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Study on Behavior of Beam Which is Acting on Moving Load

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Abstract - *In this study the simply supported RCC beam with total length of 10m modeled and analyzed in STAAD PRO software is based on finite element method. The study has been executed to find the effect of moving loads on the beam using IRC 6:2016. The parameters that are mainly examined are bending moment and shear force variation for the moving loads.*

Key Words: Moving Loads, Beam, STAAD PRO.

1. INTRODUCTION

Now a days various software are used for analysis and design purpose for RCC, STEEL and composite structures. However use of software can minimize time required for analysis compared to manual calculation or also ensures that accuracy for the expected results. Analytical study have carried out using single beam per meter width. Purpose of this is to understand the modeling and moving load analysis at critical position in STAD Pro. At first we assumed the basic data which is close to real life scenarios. Using this data we analyzed the beam element using STAAD PRO software and also referred to various IRC codes. This beam element is subjected to loads at various points in order to get the maximum loading results like bending moment, shear forces at different loading point. However these collected results data are useful to understand the actual behavior of beam at different load points.

1.1 PART A- SOFTWARE CALCULATION

Fig 1 is a simply supported beam acting two point loads 40kN and 60kN rolls on per meter width of beam at different positions. Moving load of length 5m of front wheel of 60kN and rear wheel of 40kN.

i) RCC simply supported beam

ii) Length of beam 10m per meter width

iii) Reinforcement – Fe 415 and Concrete – M30

iv) Beam Size – 150mm x 150mm

v) Vehicle 40 KN, 60 KN of length 5m

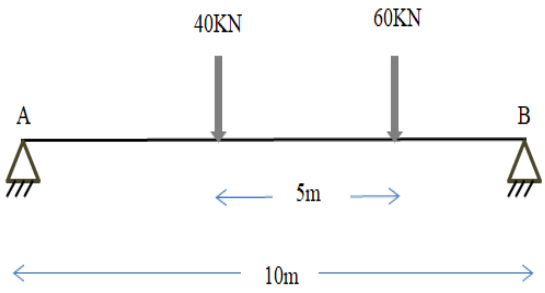


Fig. 1: Beam acting two moving point loads

1.2 Modeling of frame

Following is the model of beam that was developed in STAD PRO. The properties are assigned for simply supported beam 150*150mm of concrete grade M30 and Fe415 steel. The model was then analyzed using moving point loads.

Fig. 2: Model of beam in STAAD Pro

Fig. 3: Moving load assigned on beam

1.3 Analysis and results

In analysis of beam was carried out for three different cases

a) Case 1: Maximum moment under 40 kN load position at a distance 3.5m from left

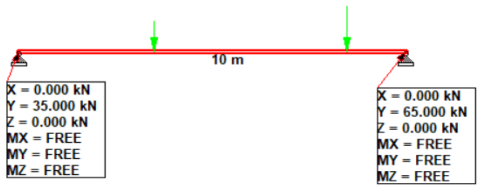
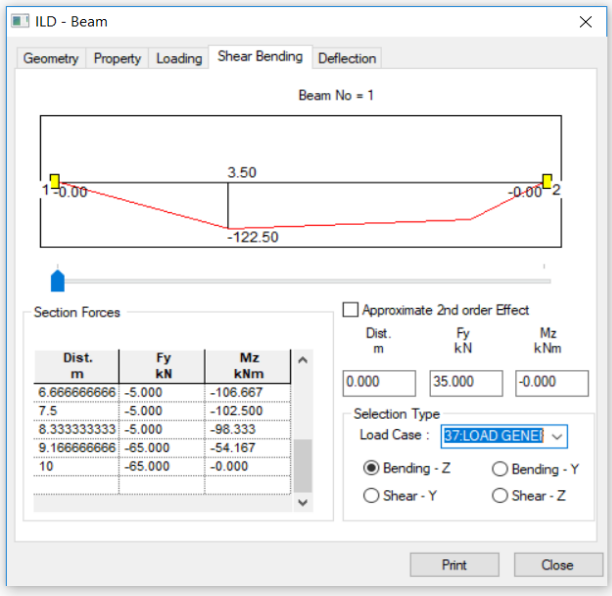


Fig 4: Maximum reaction under 40KN load



Dist. m	Fy kN	Mz kNm
6.666666666	-5.000	-106.667
7.5	-5.000	-102.500
8.333333333	-5.000	-98.333
9.166666666	-65.000	-54.167
10	-65.000	-0.000

Fig 5 : Maximum BM under 40KN load

b) Case 2: Maximum moment under 60 kN load 4m from right side

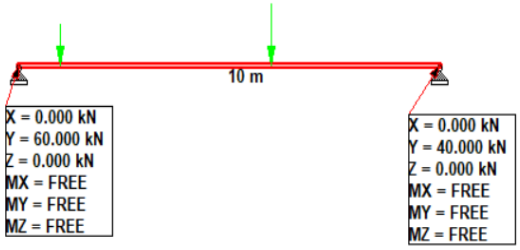
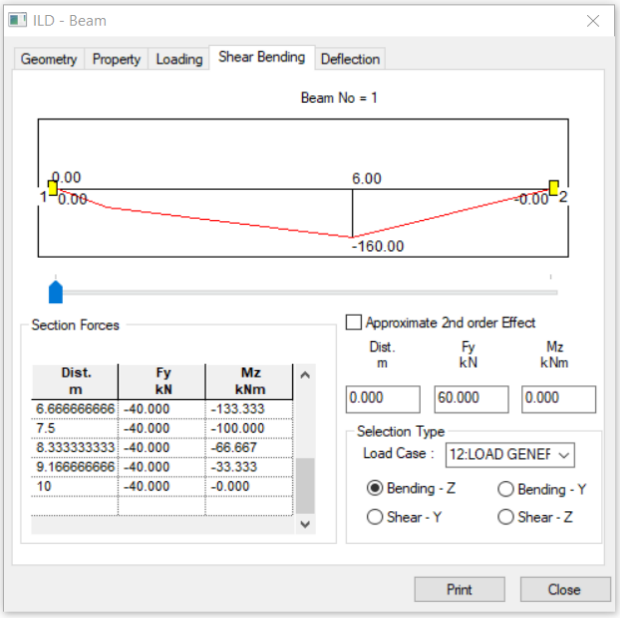


Fig. 6: Maximum reaction under 60 kN load



Dist. m	Fy kN	Mz kNm
6.666666666	-40.000	-133.333
7.5	-40.000	-100.000
8.333333333	-40.000	-66.667
9.166666666	-40.000	-33.333
10	-40.000	-0.000

Fig. 7: Maximum BM under 60 kN load

C) Case 3: Maximum shear will occur when 60 kN load is over a support

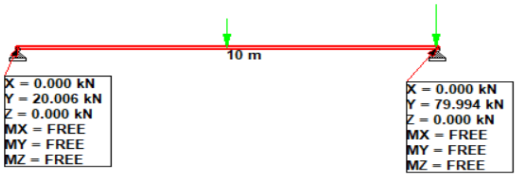
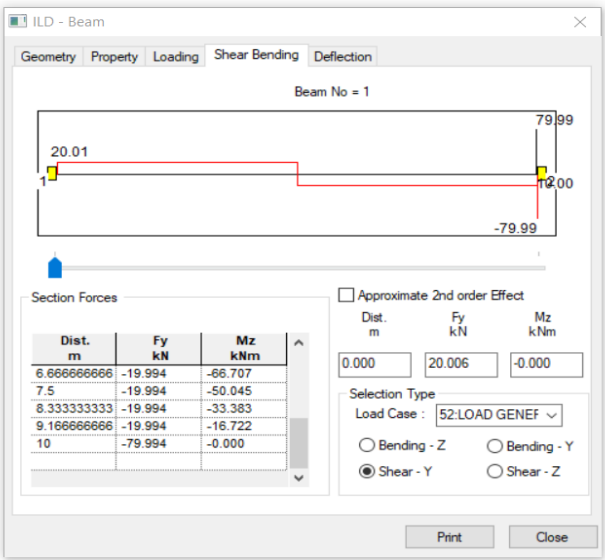


Fig. 8: Maximum reaction when 60 kN load is over support



Dist. m	Fy kN	Mz kNm
6.666666666	-19.994	-66.707
7.5	-19.994	-50.045
8.333333333	-19.994	-33.383
9.166666666	-19.994	-16.722
10	-79.994	-0.000

Fig. 9: Maximum shear force under 60 kN load

1.4 PART B- MANUAL CALCULATIONS

A truck with axle load of 40 kN and 60 kN on a wheel base of 5m roll across a 10m span compute the maximum bending moment and shear force as shown in fig4.10. Analysis of beam has been done by using Influence line diagram method. Consider the above three condition for finding out bending moment and shear force.

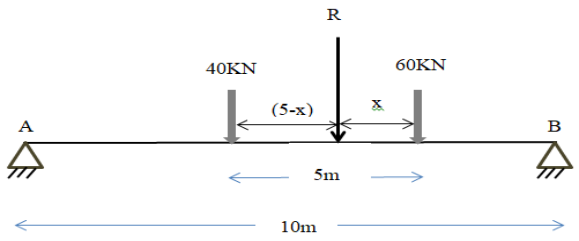


Fig. 10: Simply supported beam acting axle load

Above fig. 10 shows a load acting on it and resultant R of this acting at x from left side of 60 kN load and (5-x) from right side of 40 kN load.

R_A+R_B =100 kN

i.e. R = 100 kN

$$\sum M@60\ KN =$$

x*R = 40*5 => x = 2m

Case1: Maximum bending moment under 40KN load
Calculation for above case:

M@ left of 40 KN load = 3.5 R_A

= 122.5kNm

Case2: Maximum bending moment under 60 kN load

Calculations for 60 kN

M@ right of 60 KN load = 4* R_B

= 160 kNm

Case3: Maximum shear will occur when 60 kN load is over support

V_{max} = 80kN

1.5 Conclusion

Analysis results have good agreement with manually results. By observing above obtained results it can be concluded that numerical tool STAAD PRO software gives exact results for the given analysis.

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