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Impact of Traffic Vibration on Structural Analysis and Design of Structural Member

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Abstract-—*It is our common observation that many civil engineering structures are now a day's constructed near to highways and railway structure. It is also found that many structures are high rise structures and the structure which consist the basement floor required the more safe design. So, there are large possibilities that the effect of vibration due to heavy traffic loads occurs on the existing structures surrounding the highways and railway structures. Generally, during the structural design of the structures, we consider only dead load, live load and the earthquake load or wind load. But, for the safety of structures it is important to consider the effect of traffic loads also in the design of the structures having basement floor near to the highways and railways structures. Therefore, the impact of traffic vibration due to heavy traffic load on the structural analysis and design of the critical members of Hospital building with two basement floors is presented in this research paper.*

Keywords:- *Traffic Vibration, Heavy Traffic Load, Structural Analysis, Structural Design, Safe Design.*

1. INTRODUCTION

Safe and economic design of structures is the main work for a structural design engineer in the developing countries. Many structures are collapsing due to the vibration effect. Now a days traffic loads are increasing rapidly surrounding the existing structures and the large possibility of the damage of structures are coming into picture. Crack beyond the permissible limit can occur on the structural member subjected to heavy traffic loads. So It is very important for a structural design engineer to consider the impact of traffic vibration effectively during the design of all types of building structures near to heavy traffic loads. Traffic loads must be considered in the along with dead load, live load, earthquake load, wind load etc as per the location of the existing structures.

2. LITERATURE REVIEW

Villanueva et. al (2011) have described about the procedure to estimate the vibration path caused by the passing of a train.

Bogazzic et. al(2012) have discussed about the methodological approach employing a mathematical model to evaluate the vibration level transmitted by railway traffic is proposed.

Stypulab et. al (2013) presents the methodology of measurement and interpretation of the provision of the people with the necessary comfort in the buildings in a relation to the design of new or redevelopment of the existing transport route.

M. Podwornaa (2014), worked on the vibration theory and random dynamic analysis of the series-of-types (designed by the author) of composite (steel-concrete) bridges loaded by a German ICE-3 high-speed train.

Ahmed Hashed (2015), study about the relationship between additional stresses on building induced by vibrations, vibration nature and building dynamic characteristics.

Krzysztof Czech and Wojciech Gosk (2016) presents the results of research involving the measurement of vibration acceleration generated during the extraction of elements of sheet pile wall.

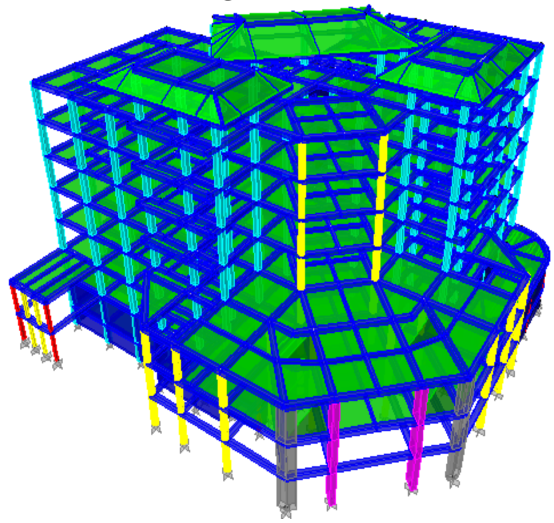
Lutz Auersch *Federal* (2017) work is limited to the structural response at frequencies near the first resonance frequency of the soil.

3. RESULTS AND DISCUSSION

The Comparison and results of Dynamic Analysis of Hospital Building (B2+G+5)

1. Concrete M-25
2. Steel Fy500,
3. Column 600X600
4. Beam 600X450
5. Slab 150mm Thick
6. RCC Wall 300/230 thick
7. Load Considered Dead Load, Live
8. Load, Earthquake Load

1. Floor to Floor Height is 3.6Meter.



Hospital Building (B2+G+5)

The figure title is mentioned above the figure in this research paper. The Increasing safety factor after discussion with experienced structural design engineer is 1.7 from 1.5.

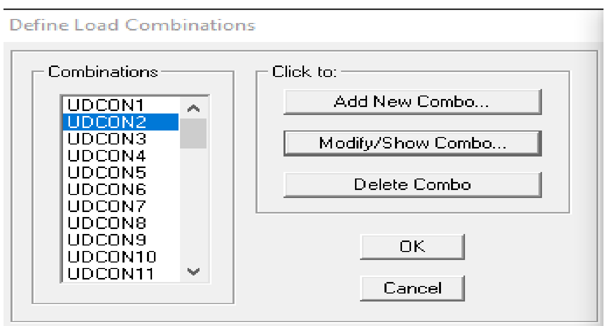


Fig. 1 Design Consideration without Traffic Vibration

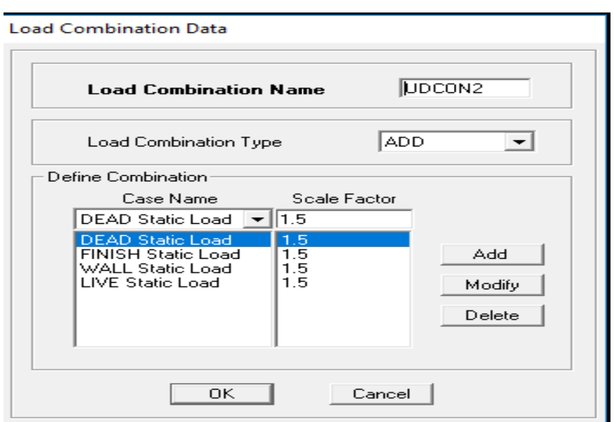


Fig. 2: Factored Load Combination

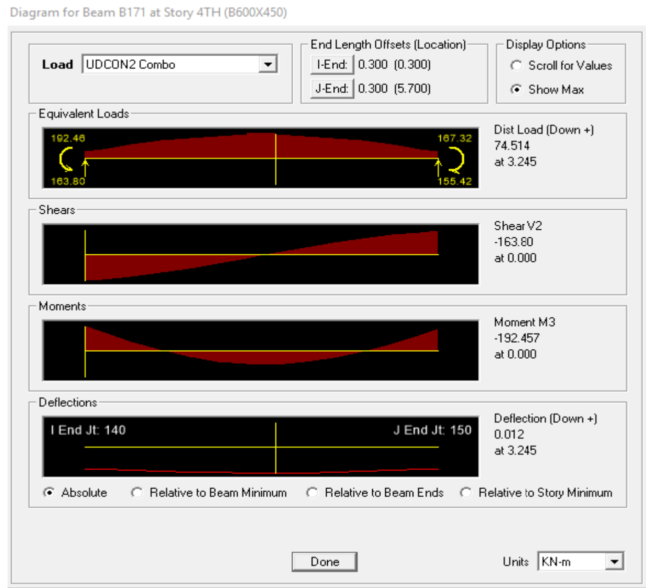


Fig. 3: Showing Uniformely Distributed Load,Bending Moment, Shear Force,& Deflection Diagrams.

Design Consideration with Traffic Vibration

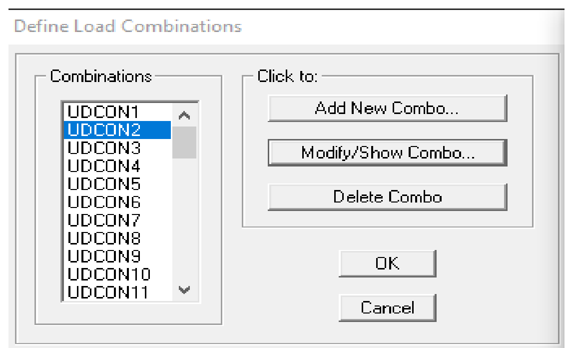


Fig. 4: Load Combination

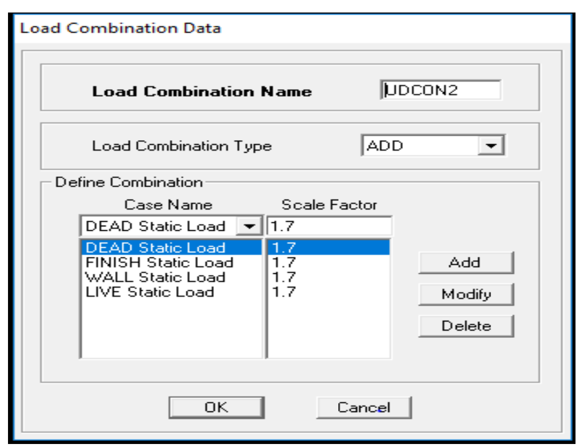


Fig. 5 Factored Load Combination

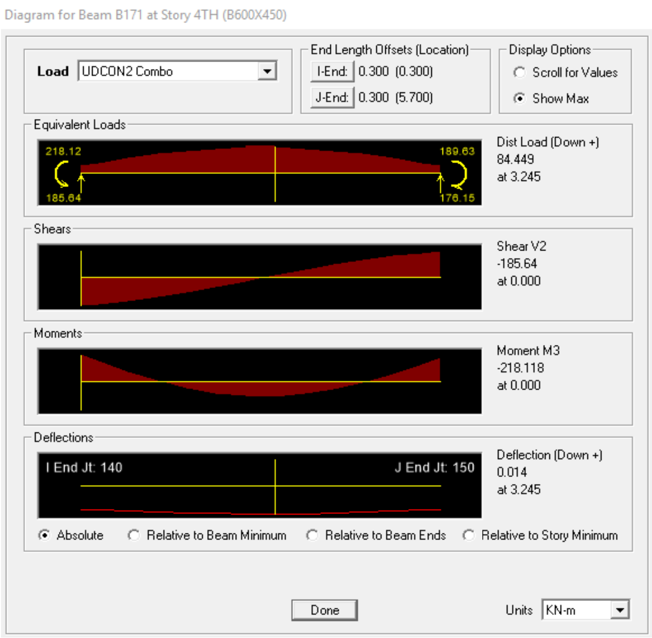


Fig. 6 Showing Uniformly Distributed Load,Bending Moment, Shear Force,& Deflection Diagrams.

Reinforcement comparison between structures

TABLE: 1 Analysis result without traffic vibration

Beam No	Load Combination	Bending Moment (KNm)	Shear Force (KN)	Deflection (m)	Max R/f Beam Vertical (t&b)	Max R/f Column
171	1.5 DL+LL	163.80	192.45	0.012	22/13, 26/19	91 (2.52%)
468	1.5 DL+LL	136.84	154.24	0.017	25/19, 24/17	47 (1.30%)

TABLE-2Analysis result with traffic vibration

Beam no	Load Combination	Bending Moment (KNm)	Shear Force (KN)	Deflection (m)	Max R/f Beam Vertical (t&b)	Max R/f Column
171	1.7 DL+LL	185.64	218.12	0.014	22/14, 26/23	116 (3.22%)
468	1.7 DL+LL	155.08	174.80	0.020	25/23, 24/19	66 (1.83%)

4. CONCLUSION

Analysis of two structures with traffic load vibration & without traffic load vibration we can see the differences in table-1 & table-2. Traffic load will affect the structure & increase the r/f. ratio up to 0.50% to 0.70%. So it is important to consider the traffic load in design of the structures having basement floor subjected to heavy vibration loads during the design period.5. Acknowledgements

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