IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"ANALYSIS AND DESIGN SINGLE PIER (2 LANE) FLYOVER BY USING STAAD PRO CONNECT"

[1]Ketan S. Kumbhar, [2]Manoj U. Deosarkar

[1]PG Student, M.E (Structural Engineering), Department of Civil Engineering, Dr. D. Y. Patil School of Engineering and Technology, Lohegaon, Charoli (Bk), Pune – 412105

[2]Assistant Professor, Department of Civil Engineering, Dr. D. Y. Patil School of Engineering and Technology, Lohegaon, Charoli (Bk), Pune – 412105

Abstract: As the population is growing, urbanization is caused which result in increasing of traffic with usage is more no. of vehicles for different means of transport. As stated that above the growth of population and usages of vehicles for their different means will automatically result in increase in flow of vehicles which is called as traffic to overcome the issue of traffic getting jammed. When coming to highway one of the efficient ways of overcoming it is construction of flyover. The Principle objective of this project is to design and analysis of two lane flyover using Staad. Pro Connect. The completion of the flyover work is expected to ease of traffic movement on solapur road. The flyover is a part of the 2 Km from new vijapur road. The project is initiated with the collection of information from existing journals, papers called literature review. After collecting the relevant information the project is started. Dead load, live load, wind load, vehicle load which are taken from Indian standard codes IS – 456, IS -800 and IRC:6 - 2016. The safe loads are found from the design results against various loading cases. Axial forces, bending moment, shear forces, plate stress on span to be designed by using STAAD. Pro Connect

Index Terms **– Fly over, design parameters, bending moment, shear force, plate stress, displacement, staad pro**

1. INTRODUCTION

The difference between Flyover and Flyover is based on the purpose of its usage and the location where it is built. Flyovers are built to connect two points separated by a naturally occurring region like valley, river, sea or any other water bodies, etc. Flyover is built to connect two points in congested areas or roads and intersection of roads. Flyover and flyovers are structures providing passage over an obstacle without closing the way beneath. The required passage may be for a road, railway or a valley. Flyover design is a complex problem, calling a creativity and practicability, while satisfying the basic requirement of safety and economy. The basic design philosophy governing the design is that a structure should be designed to sustain, with a defined probability, all action likely to occur within its intended life span. In addition, the structure should maintain stability during unprecedented action and should have the adequate durability during its life span.

In India due to high population density, most of the cities are saturated and traffic congestion is one of the major problems faced by these cities. Construction of flyovers is a solution to this problem. But construction of flyovers using R.C.C is time consuming, and will affect existing traffic and it has low seismic resistance. Construction of flyovers using steel sections can overcome these disadvantages, even though its initial cost is high. A flyover and Flyover has three main elements. First, the substructure (foundation) transfers the loaded weight of the Flyover and flyover to the ground; it consists of components such as columns (also called piers) and abutments. An abutment is the connection between the end of the Flyover and road carried by earth; it provides support for the end sections of the Flyover and flyover. A flyover consists of number of number of columns, spans, bridge deck and foundation etc. To construct a flyover all of these elements are design properly. For large construction process the design manually is complicated and it consumes lot of time and lead to commencement error. The Requirement of purposed construction and complete the task without any problems, software are used efficient work.

2. METHODOLGY

- Study of literature review survey
- Problem identification and research gap
- Structural study of existing structure by research papers, books, some field works
- Study of structure and all parameters
    1. Nodal Displacement
    2. Shear Force
    3. Bending moment
    4. Effect on plate stress
    5. Principal stress due to IRC loading
- Analysis Result
- Result and discussion
- Conclusion

3. DESIGN AND MODELING

- Length of Flyover 400M
- Width of Flyover 8M
- Material Properties
    1. M40 Concrete
    2. Fe415 Steel
- Beam Size 1.5M X 1.5M (Longitudinal Beam Along X-Axis)
- Beam Size 1.2M X 2M (longitudinal Beam Along Z-Axis)
- Pier 2.5M Diameter
- Deck Slab Thickness 400mm
- Loading
    1. Dead Load
    2. Live Load
    3. Wind Load
    4. IRC Class 70R and IRC Class A Loading
- Live Combination – IRC Class 70R+ Class A

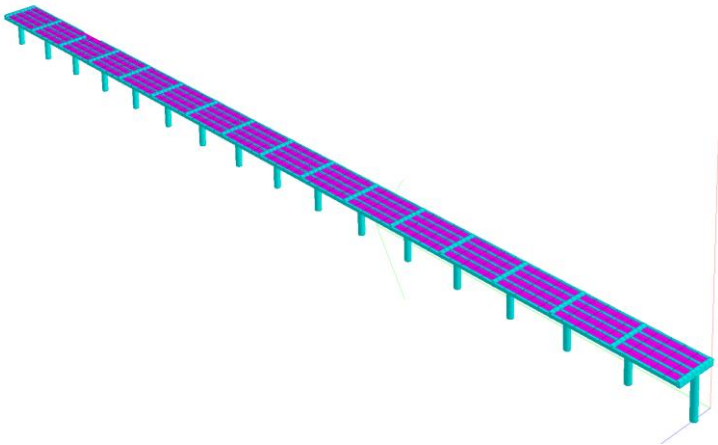


Fig 3.1 3D View of Model

4. RESULT AND DISCUSSION

4.1 Displacement Due To Load Combination

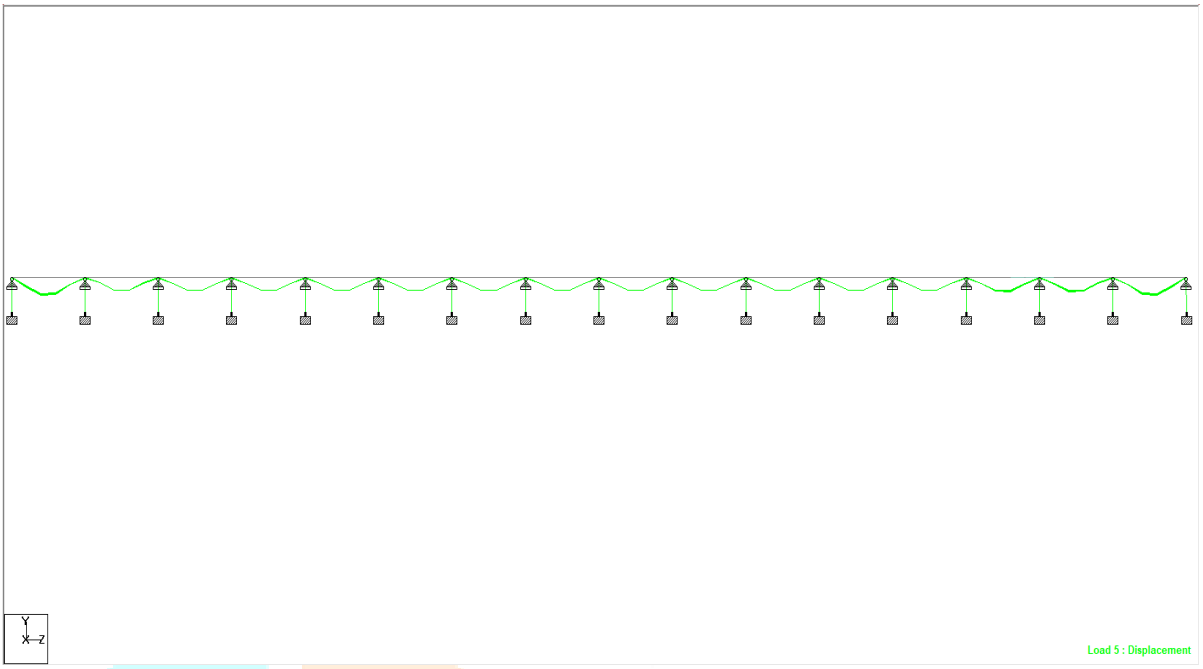
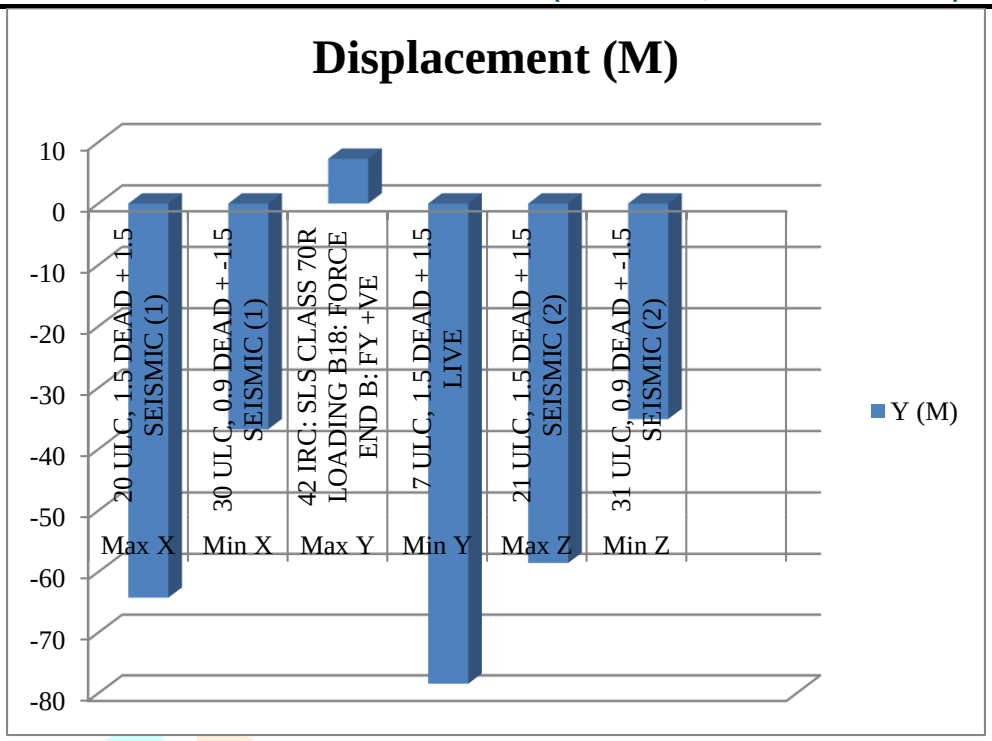


Fig 4.1 Displacement due to load combination

Table 4.1 Max displacement for load combination

Max/Min	Node	Load combination	Vertically Y Diection (mm)
Max x	929	20 Ulc, 1.5 Dead + 1.5 Seismic (1)	-64.240
Min x	929	30 Ulc, 0.9 Dead + -1.5 Seismic (1)	-36.744
Max y	160	42 IRC: Sls Class 70r Loading + Class Aa Loading B18: Force End B: Fy +Ve	7.289
Min y	151	7 Ulc, 1.5 Dead + 1.5 Live	-78.422
Max z	843	21 Ulc, 1.5 Dead + 1.5 Seismic (2)	-58.518
Min z	843	31 Ulc, 0.9 Dead + -1.5 Seismic (2)	-35.111
Max rx	409	7 Ulc, 1.5 Dead + 1.5 Live	-36.151
Min rx	488	7 Ulc, 1.5 Dead + 1.5 Live	-36.105
Max ry	840	22 Ulc, 1.5 Dead + -1.5 Seismic (1)	-26.777
Min ry	840	28 Ulc, 0.9 Dead + 1.5 Seismic (1)	-16.066
Max rz	926	43 IRC: Sls Class 70r Loading + Class Aa Loading B1294: Force End A: Fy -Ve	-38.165
Min rz	288	7 Ulc, 1.5 Dead + 1.5 Live	-78.405
Max rst	151	7 Ulc, 1.5 Dead + 1.5 Live	-78.422



Graph. Displacement Due to Load combination

Displacement of node is due to load combination 1.5Dead load + 1.5Live load is -78.422 mm maximum as compare to load combination IRC Class 70R + Class A loading is 38.165 mm.

4.2 Max Support Reaction at Bottom

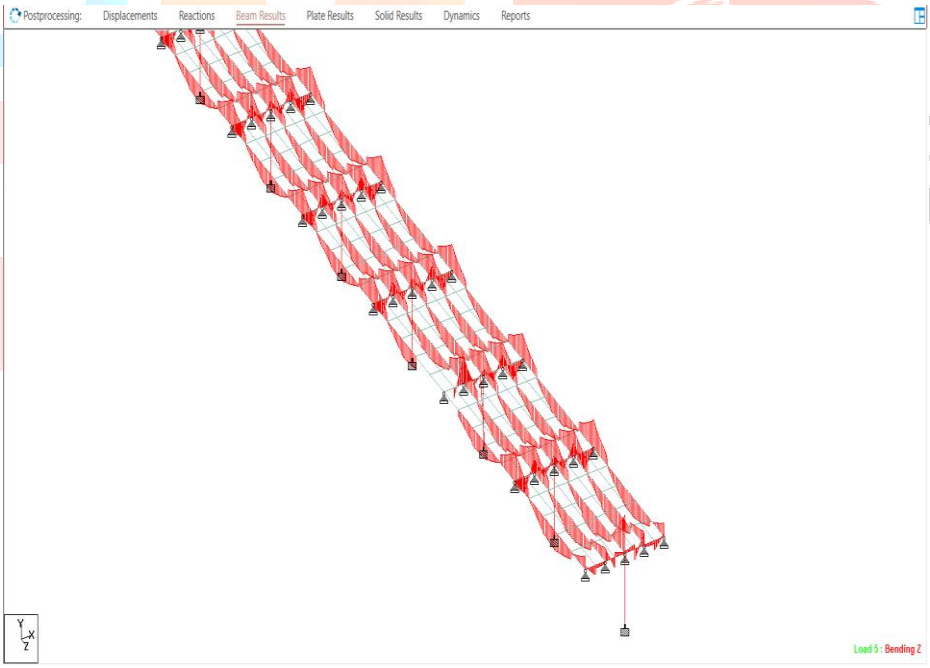


Fig 4.2 Bending Moment

Table 4.2 Force and Max Support Reaction At bottom

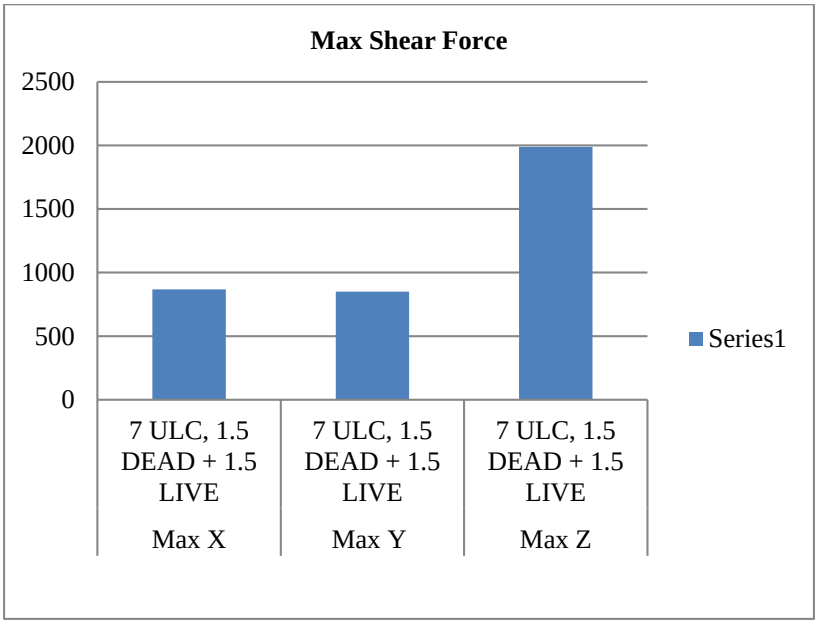
MAX	Node	LOAD COMBINATION	FX	FY	FZ	MX	MY	MZ
Max Fx	13	22 ULC, 1.5 DEAD + -1.5 SEISMIC (1)	**86.701**	2980.38	217.398	0	0	0
Max Fy	100	7 ULC, 1.5 DEAD + 1.5 LIVE	0	**3246.42**	-0.001	0	0	0
Max Fz	118	23 ULC, 1.5 DEAD + -1.5 SEISMIC (2)	-0.039	2875.25	**2042.93**	0	0	0
Max Mx	952	7 ULC, 1.5 DEAD + 1.5 LIVE	0	867.435	1991.34	**6228.79**	0	0
Max My	952	22 ULC, 1.5 DEAD + -1.5 SEISMIC (1)	0	867.435	1991.34	6228.79	**0.566**	0
Max Mz	966	44 IRC: SLS CLASS 70R LOADING B1294: FORCE END B: FY -VE	-17.294	-0.022	-213.534	-667.92	0.01	**54.09**

4.3 Max Shear Force at Column

Table 4.3 Max Shear Force at Column

Max/Min	Beam	L/C	Node	Fx kN	Fy kN	Fz kN
Max Fx	1512	7 ULC, 1.5 DEAD + 1.5 LIVE	952	**867.435**	0	-1991.35
Min Fx	1512	7 ULC, 1.5 DEAD + 1.5 LIVE	6	-867.435	0	-1991.35
Max Fy	18	7 ULC, 1.5 DEAD + 1.5 LIVE	11	0	**849.734**	0
Min Fy	1294	7 ULC, 1.5 DEAD + 1.5 LIVE	100	0	-1125.76	0
Max Fz	1528	7 ULC, 1.5 DEAD + 1.5 LIVE	118	-867.435	-0.039	**1988.114**
Min Fz	1512	7 ULC, 1.5 DEAD + 1.5 LIVE	6	-867.435	0	-1991.35

Graph 4.3 Max Shear Force Due to Load Combination



The maximum shear force occurred in Z-direction is 2042.93KN Due to load combination 1.5Dead load + 1.5Live Load is higher as compared to X and Z direction.

4.4 Max Principal stress Due to IRC Loading Class 70R

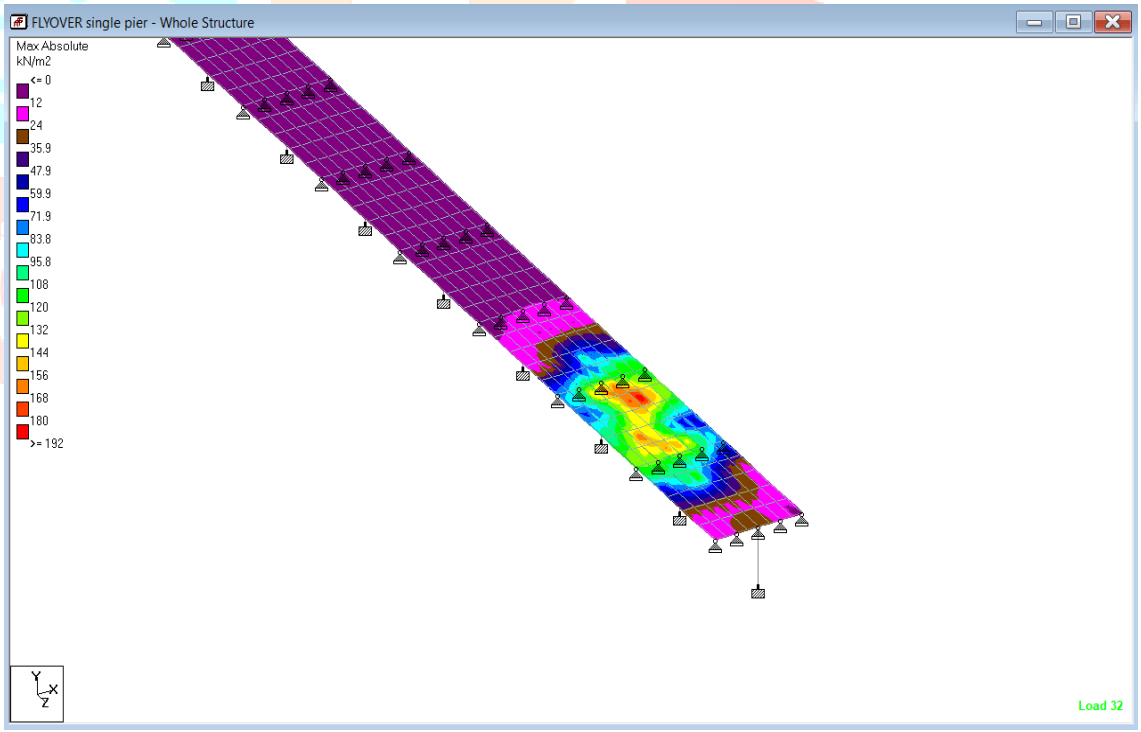


Fig.4.4 Principle stress Due to IRC loading

Table 4.4 Max Principal Stress Due to IRC Loading

Max/Min	Plate	L/C	Top kN/m2	Bottom kN/m2
Max Principal (top)	735	35 IRC: SLS CLASS 70R LOADING P735: STRESS MAX ABSOLUTE +VE	4370.462	-2473.029
Min Principal (top)	994	43 IRC: SLS CLASS 70R LOADING B1294: FORCE END A: FY -VE	-3684.433	636.165
Max Principal (bottom)	994	43 IRC: SLS CLASS 70R LOADING B1294: FORCE END A: FY -VE	-636.165	3684.433
Min Principal (bottom)	735	35 IRC: SLS CLASS 70R LOADING P735: STRESS MAX ABSOLUTE +VE	2473.029	-4370.462
Max Tresca (top)	735	35 IRC: SLS CLASS 70R LOADING P735: STRESS MAX ABSOLUTE +VE	4370.462	-2473.029
Min Tresca (top)	230	33 IRC: SLS CLASS 70R LOADING N489: DISP Y +VE	0	0
Max Tresca (bottom)	735	35 IRC: SLS CLASS 70R LOADING P735: STRESS MAX ABSOLUTE +VE	4370.462	-2473.029
Min Tresca (bottom)	230	33 IRC: SLS CLASS 70R LOADING N489: DISP Y +VE	0	0

4.5 Max Principal Centre Stress Due to Load Combination

			Shear		Membrane			Bending	
	Plate	L/C	SQX (local) kN/m2	SQY (local) kN/m2	SX (local) kN/m2	SY (local) kN/m2	SXY (local) kN/m2	Mx kN-m/m	My kN-m/m
Max Qx	911	7 ULC, 1.5 DEAD + 1.5 LIVE	568.839	359.106	0	0	0	-274.852	-115.717
Max Qy	1032	7 ULC, 1.5 DEAD + 1.5 LIVE	225.64	442.63	0	0	0	-182.94	-34.346
Max Sx	1457	28 ULC, 0.9 DEAD + 1.5 SEISMIC (1)	-211.906	-27.821	11.666	3.377	7.876	-186.2	6.719
Max Sy	1457	28 ULC, 0.9 DEAD + 1.5 SEISMIC (1)	-211.906	-27.821	11.666	3.377	7.876	-186.2	6.719
Max Sxy	1000	20 ULC, 1.5 DEAD + 1.5 SEISMIC (1)	-330.105	-92.058	-0.443	-0.595	13.739	-280.383	-43.628
Max Mx	735	7 ULC, 1.5 DEAD + 1.5 LIVE	-20.784	-13.94	0	0	0	314.481	27.737
Max My	735	35 IRC: SLS CLASS 70R LOADING P735: STRESS MAX ABSOLUTE +VE	-3.109	11.199	0	0	0	147.502	83.465
Max Mxy	731	7 ULC, 1.5 DEAD + 1.5 LIVE	568.839	-359.105	0	0	0	-274.852	-115.717

5. CONCLUSION

- The maximum flow of traffic is along national highway nh65 which includes transportation of agricultural goods and industrial goods, so path chosen for the execution of flyover is along at national highway nh65.
- Construction of this structure at that junction Results in the traffic control and enhances safe driving.
- The structure is designed basing codes Wind IS 875 Part III - 1987 and seismic Code 1893 Part 1- 2002.
- The structure is designed basing codes IRC Class 70R and IRC Class A Loading, IRC 6-2016 for designing.
- It has been observed that the maximum support reactions 3246.42 KN and Moment 6228.79 KNm is which is safe limit
- The maximum displacement is occurred on column -78.422mm in Y direction is safe.
- The maximum plate stress due to moving vehicle 4370.462 KN/m^2 at top and 3684.433 KN/m^2 at bottom.
- The maximum shear force acting in 867.435KN in X Direction and 1988.114 KN in Z direction.
- Designed structure by using software result in obtaining details of each and every member, reduce time of design work, and improved the accuracy of the work.

6. REFRENCES

[1] REVIEW OF ANNUAL PROGRESS OF FLYOVER ENGINEERING IN 2019, RENDA ZHAO, YUAN YUAN,

[2] SEISMIC PERFORMANCE OF PRECAST FLYOVER COLUMNS CONNECTED WITH GROUTED CORRUGATED-METAL DUCT THROUGH BIAXIAL QUASI-STATIC EXPERIMENT AND MODELING, XIA ZHANGHUA, LIN SHANGSHUN, 16 JULY 2021

[3] Girder Longitudinal Movement and Its Factors of Suspension Flyover under Vehicle Load Guoping Huang, Research Article, 1 October 2021

[4] DYNAMIC BEHAVIOUR OF FLYOVER GIRDERS WITH TRAPEZOIDAL PROFILED WEBS SUBJECTED TO MOVING LOADS, ZHIYU WANG, YUNZHONG SHI, MDPI 2021

[5] ANALYSIS FOR EARTHQUAKE-RESISTANT OF FLYOVER STRUCTURE SUBJECTED TWO EARTHQUAKES, LIU Chunguang, MDPI 2021

[6] Comparative Analysis and Design of Steel Foot Flyover using Conventional and Hollow Section Anushka M. Pachpute, Nikita J. Patil, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Elsevier 2020

[7] Numerical Examination of Reinforced Concrete Skew Slabs Boobalan S C, Abirami P, Indhu K, International Journal of Innovative Technology and Exploring Engineering (IJITEE), March 2021

[8] Design and Analysis of Flyover, Bismi M Buhari International Journal of Engineering Research & Technology (IJERT), July-2021

[9] Comparative Study of Grillage Analogy and Finite Element Method for Flyover Heavy Load Assessment, Shojaeddin Jamal, Tommy H.T. Chan

[10] Analysis and Design of Foot Flyover Connecting (2nd Floors) of Block A and Block B of MIET, Jammu Akhil Sharma, Ashwani Kumar, Sunil Sharma, Arun Singh Chib, International Journal of Engineering Research & Technology (IJERT), May-2020

[11] Behavior of Composite Steel Flyover Beams Subjected to Various Posttensioning Schemes WILLIAM E. WILEY, TRANSPORTATION RESEARCH RECORD

[12] COMPARATIVE ANALYSIS OF T-BEAM FLYOVER BY RATIONAL METHOD AND STAAD PRO Praful N K , Balaso Hanumant, INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

[13] A Computational Approach of Pre-stressed Concrete Flyover Deck Slab Analysis for various IRC Classes of loadings using Pigeaud Charts Dr. M. Siva