RSPONSE SPECTRUM ANALYSIS AND DESIGN OF TRANSFER BEAM SUPPORTING SHEAR WALL OF 34 FLOORS USING STRAP

S.Nitesh Kumar[1], P.M.B. Raj Kiran Nanduri[2], S.Mahender Reddy[3].

1 M.Tech Student, Samskruti College of engineering and technology, Hyderabad, 2 Assistant Professor,Department of Civil Engineering Samskruti College of engineering and technology, Hyderabad, 3 Principal Consultant & M.D. A.S.A Consultants.

ABSTRACT

This Experimental work entitled "RSPONSE SPECTRUM ANALYSIS AND DESIGN OF TRANSFER BEAM SUPPORTING SHEAR WALL OF 34 FLOORS" is an effort made to study the behavior of Transfer Beam supporting RCC Wall of 34 floors under Response spectrum analysis.

Shear Walls in High rise buildings is a must component or a member which will be helpful in resisting lateral loads which are caused by both earthquake and wind loads. Thus shear walls occupy a large spaces in the lobbies, parking & corridors etc.. in a building making it difficult for the public to access the routes like drive ways & common areas for parking. This problem can be resolved by using deep transfer beams at ground level, which creates openings in cellars and access to the public is made easy and drive ways can be planned to perfection.

Keywords: Strap, Transfer beam, Shear wall, Response spectrum Analysis, High Rise Buildings.

1) INTRODUCTION:

About STRAP

***STRAP* flagship program, covers the entire design process from analysis to the production of drawings and schedules. The program includes:**

- Design modules for calculating structural steel, reinforced concrete and post-tensioned elements subjected to static, dynamic, wind and seismic loads.
- A bridge load and analysis module.
- Auto STRAP, a BIM (Building Information Modeling) module to create a structural model from structural drawings.

*STRAP (*Structural Analysis Programs) is a Windows based suite of finite element static and dynamic analysis programs for buildings, bridges and other structures. It also includes modules for the design of steel sections (rolled and cold formed) and reinforced concrete (beams, columns, slabs, walls, footings) in accordance with Indian, American, European, Canadian and other international codes.

2) REVIEW OF LITERATURE

2.1 Analysis and design of Shear wall Transfer Beam Structure By ONG JIUN DAR

The examination done by ONG JIUN DAR on Analysis and outline of Shear divider Transfer Beam Structure is in limited component technique. He has talked about the cooperations between the basic rcc shear divider and move shaft in tall structures.

2.2 Interaction based analysis of continuous transfer girder system supporting in-plane loaded coupled shear walls by J. S. Kuang A. I. Atanda

This Experiment conveys a procedure of investigation for an auxiliary framework contains shear dividers upheld on move support shaft into sections. It is suggested that the examination of the framework be ruined into two sections.

2.3 Analysis of Shear Wall Transfer Beam Structure LEI, KA HOUDepartment of Civil and Environmental EngineeringFaculty of Science and Technology.

This paper introduces an examination and examination of the auxiliary conduct of exchange bar shear divider frameworks in tall structures with various measure of range of shear divider and geometry, for example, range length, size of divider, pillar and segment.

3) Loads:

3.1) Dead loads:

Dead load shall include weight of all structural and Architectural components. Self-weight of the materials shall be calculated on the basis of unit weights given in IS: 875.

Floor finish of 50mm thick for Residential floors	:	100kg/sqm (1.0kN/sqm)
Ceiling plaster	:	33kg/sqm (0.33kN/sqm)
Floor finish of 100mm thick for Parking Areas	:	240kg/sqm (2.4kN/sqm

3.2) Live loads:

As per Table.1 of IS 875(Part-2)-1987.

Club House	: 400 kg/ sqm (4 kN/sqm)
Parking Area	: 250 kg/ sqm (2.5 kN/sqm) + 25% Impact load
Internal driveway	: 500 kg/sqm (5.0 kN/sqm)

Residential Floors

Residential areas	: 200 kg/sqm (2.0 kN/sqm)
Stairs	: 300 kg/sqm (3.0 kN/sqm)
Corridors / Balcony/Utility	: 300 kg/sqm (3.0 kN/sqm)
Toilets	: 200 kg/sqm (2.0 kN/sqm)
Lift Machine room	: 1000 kg/ sqm or as per actual.

3.3 Wind Loads

The Wind pressure shall be calculated in accordance with IS: 875 (Part-3). Hyderabad is located in the Telangana with a high wind speed of 44m/sec. Basic Wind Speed V_b: 44 m/sec

Risk Coefficient k_1	: 1.00 (k_1)
Terrain, height, structure size factor k_2	: 1.1
Topography factor k_3	: 1.00

The external and internal pressure co-efficient shall be as per respective clauses of IS: 875 (Part 3) Design wind speed V_z : V_b x k1 x k2 x k3

: 44 x 1.00 x 1.10 x 1.00

: 48.4 m/sec

Design wind pressure P_z : $0.6 \times V_z^2$

: 0.6×48.40^2

: 1405.54 N/m²

: 1.406kN/m

3.4 Seismic Forces

Hyderabad falls under seismic zone II as per IS 1893-2002 (Part 1) (Fifth Revision) and has the following factors to be considered for designs. Ductile detailing is not required. (Please refer attached map)

Seismic Zone : II

Seismic Zone factor, Z : 0.10 (As per Table 2, IS: 1893-2002)

Design horizontal seismic coefficient (A_h) : $(Z/2)*(S_a/g)*(I/R)$

I -Importance factor : 1.0 (Ref Table 6, IS: 1893-2002)

R-Response reduction Factor : 3 (OMRF)

4) STRUCTURAL CONCEPT

- The Structural System comprises of RC walls and slabs construction using aluminum formwork, supported by RC structural columns and core walls. Ground floor podium slab & basement slabs is of conventional beam and slab system. Floor slabs are considered to act as a rigid diaphragm to transfer the lateral forces through to the basements.

- The transfer floor is planned at ground floor level with provision of RC girders to support the RC wall elements.

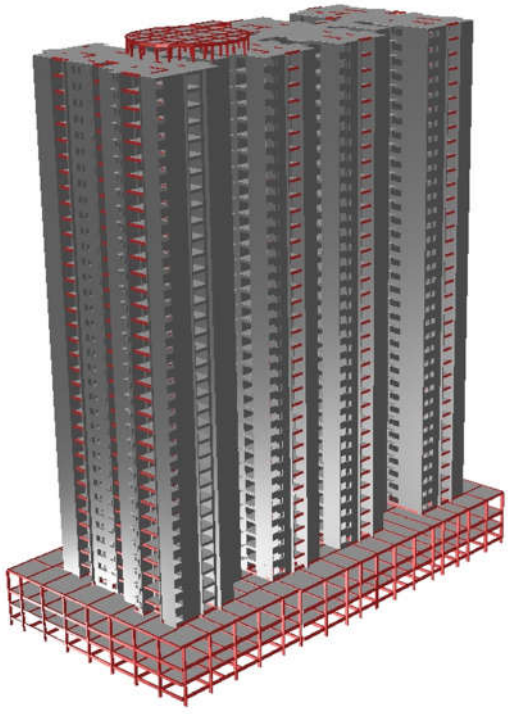


Fig:1 3D model

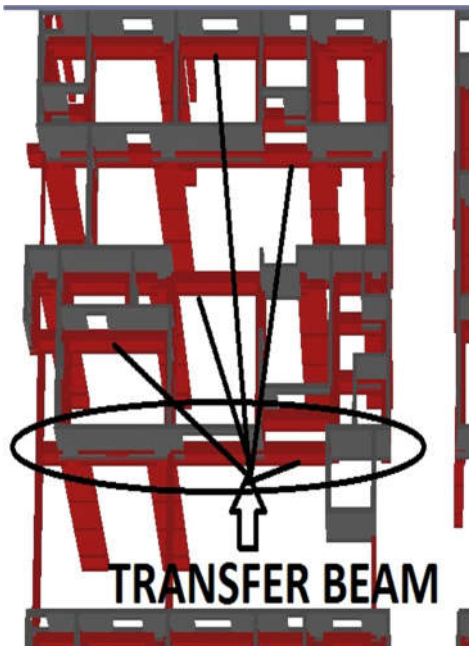
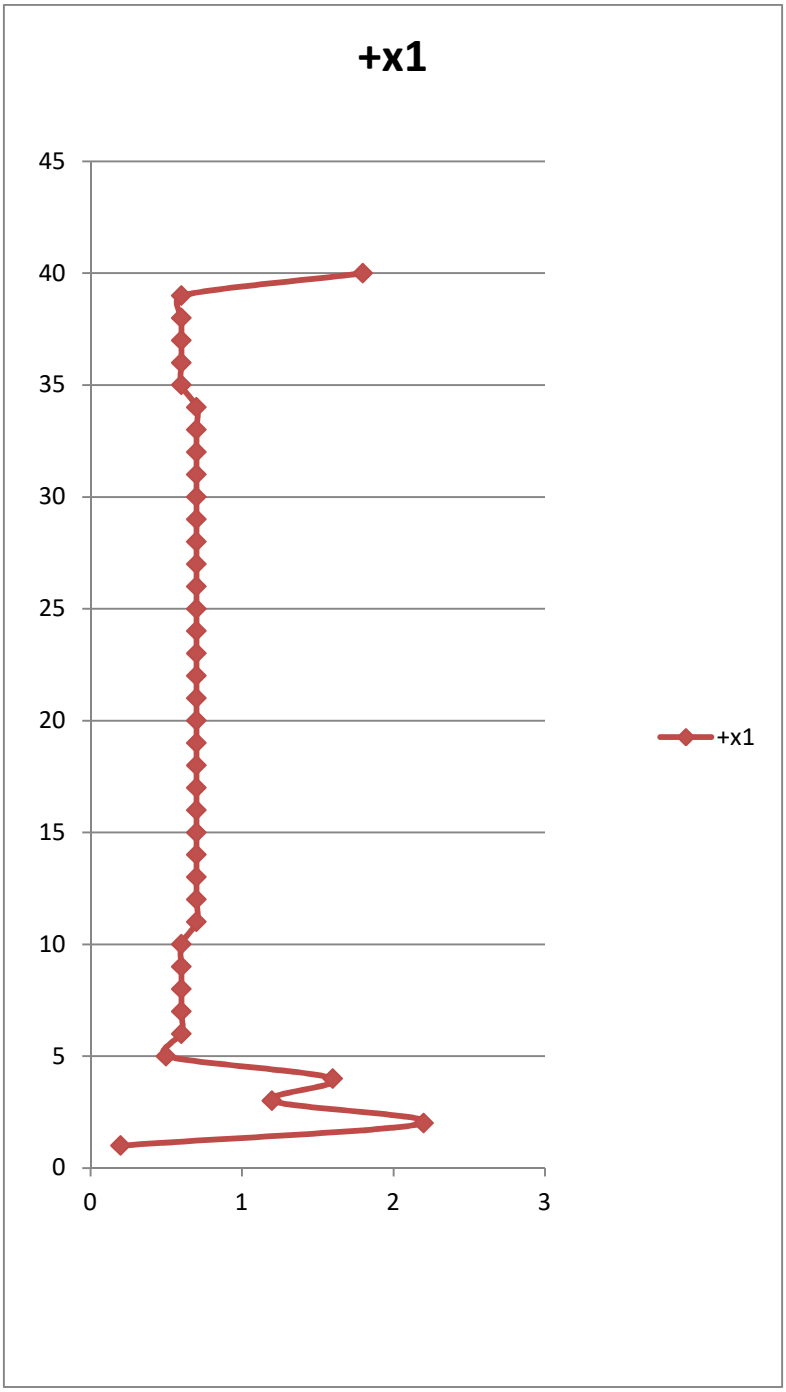


Fig:2 Transfer beam

5) ANALYSIS DRIFT RESULTS

Drift

No.	*X1-Drift mm*	*X2-Drift mm*
1	0.2	0.1
2	2.2	0.3
3	1.2	0.4
4	1.6	0.5
5	0.5	0.1
6	0.6	0.1
7	0.6	0.1
8	0.6	0.1
9	0.6	0.1
10	0.6	0.1
11	0.7	0.1
12	0.7	0.1
13	0.7	0.1
14	0.7	0.1
15	0.7	0.1
16	0.7	0.1
17	0.7	0.1
18	0.7	0.1
19	0.7	0.1
20	0.7	0.1
21	0.7	0.1
22	0.7	0.1
23	0.7	0.1
24	0.7	0.1
25	0.7	0.1
26	0.7	0.1
27	0.7	0.1
28	0.7	0.1
29	0.7	0.1
30	0.7	0.1
31	0.7	0.1
32	0.7	0.1
33	0.7	0.1
34	0.7	0.1
35	0.6	0.1
36	0.6	0.1
37	0.6	0.1
38	0.6	0.1
39	0.6	0.1
40	1.8	0.6

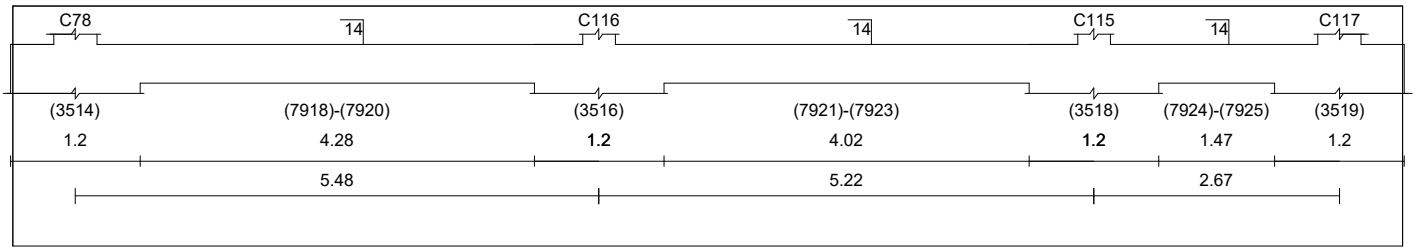


GRAPH-1 +X1 STOREY DRIFT VS STORIES

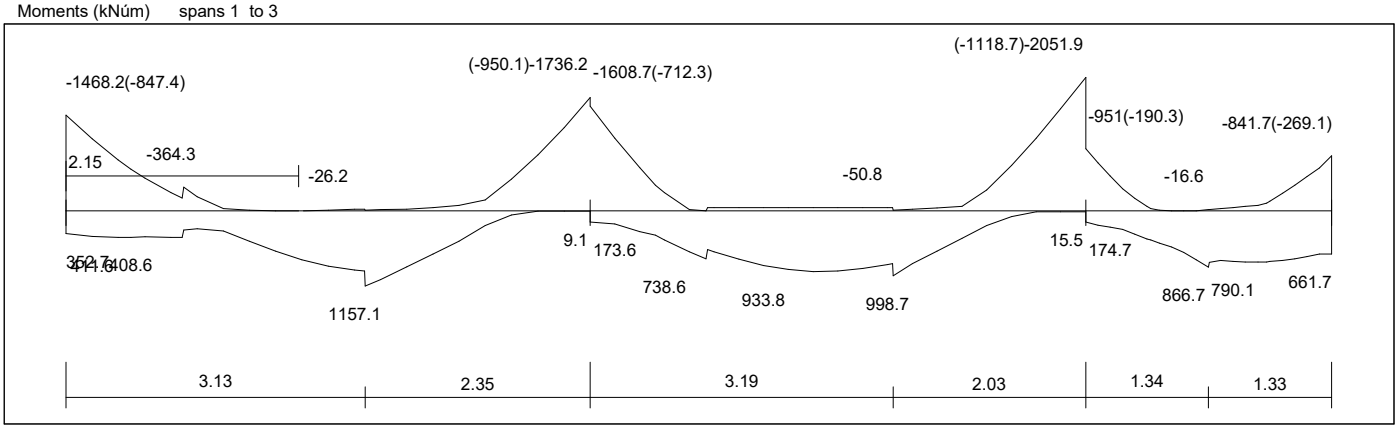
6) DESIGN TRANSFER BEAM & SUPPORT SHEAR WALL DETAILS

TRANSFER BEAM 766: RESULTS

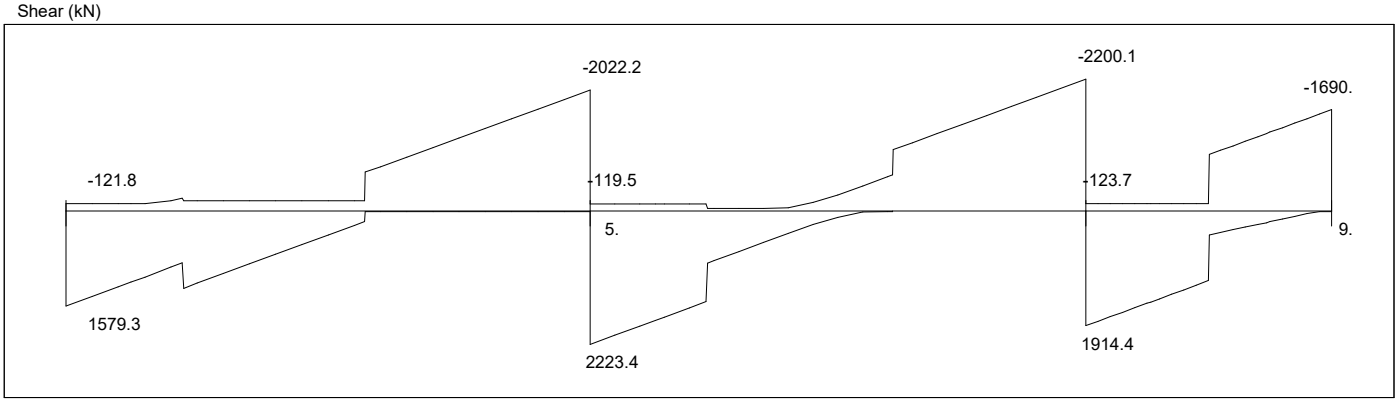
Geometry



Moments (kNúm) spans 1 to 3



Shear (kN)



Stirrups for spans: 1 to 3

Diam: min = 8 : max = 16 Max. no. of groups = 5 fy = 500

No. of Legs =2 Alt no. =2

Spacing: min =100 by =50

Wall no. 107 Design unit 1

Design combination = 7

Conc= M60 fy = 500 MPa Cover (gross) = 30 mm

le = β * lo h le/h

Asv/sv-req'd			1.76	0.37		2.62	3.01		0.37		2.95	2.38		1.37		2.06
prov.			2.01	1.34		2.68	4.02		1.34		4.02	2.68		2.01		2.68
	Mx:	2.90 =		1.00 *		2.90		18.75		0.2						
	My:	2.90 =		1.00 *		2.90		3.50		0.8						
	Gap = 116						Gap = 60.0					Gap = 135				
	7ϕ16@200						6ϕ16@100					2ϕ16@150				
	5ϕ16@300						4ϕ16@300					2ϕ16@200				
	4ϕ16@200						4ϕ16@200					4ϕ16@150				
	4ϕ16@150						4ϕ16@150					Gap = 135				
	Gap = 116						6ϕ16@100					Legs = 2				
	Legs = 2						Gap = 60.0									
							Legs = 2									

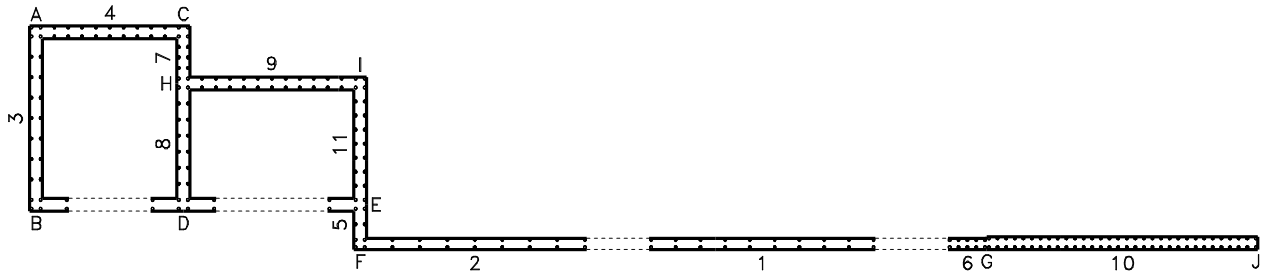
Total As in wall = 28507 mm² (rounded spacing)

252ϕ12

	P	Mx	My
Input :	-10267.	11999.8	-192.5
Design :	-10267.	11999.8	-192.5

Capacity Factor = 1.01

As = 26917 mm²



Design loads (kNúm) :

Location	Pu	Mu(y)	Mu	Mt(y)	Mt	(*=design case)
Bottom	-10267.5	-192.5	-11999.8	-192.5	-11999.8	*
Middle_	-10267.5	-419.8	-13195.2	-419.8	-13195.2	
Top	-10267.5	-647.2	-14390.7	-647.2	-14390.7	

7) CONCLUSION

This model deals with high rise buildings as well as transfer girder of beams acts as transferring agent between for stress between the columns and shear walls carrying stress from floors. This study helps in improving the Drive ways in the bottom floors ie cellars(below transfer girder) so that the vehicle movement is free without obstructions and the effective cost of construction will also be less and more economical and time saving. The following are the results absorbed in this research process and the parameters taken for the design process and the results obtained are shown above.

1. The least size of the sections has been chosen as 400 X1200 MM After the plan of the whole structures.
2. The Minimum size of the pillar is 400x1200.
3. The least grade of cement utilized for Transfer Beam and sections is chosen as M60 (for high obstruction of shear).
4. Some of the shear dividers are stretched out up to storm cellar ie @ balance level at lift center and staircases with the goal that the limit increments.
5. The least size of shear divider laying on exchange support bar is 175 mm thick at external edges and 150 mm thick at inward edges.
6. The igross esteems for segment can be taken as 0.7I
7. The igross esteems for pillars can be taken as 0.35I
8. The igross esteems for dividers can be taken as 0.7I
9. The powerful investigation is done according to the realistic in IS1893:2016 RESPONSE SPECTRUM Plot which indicates the quickening per day and age
10. The safe bearing limit is considered as 150 tons/sqm according to the site conditions which has an exceptionally colossal sheet shake beneath the ground level.
11. The modular mass support for +x1 bearing is accomplished for 9 modes.
12. The modular mass support for - x1 bearing is accomplished for 9 modes.
13. The modular mass support for +x2 bearing is accomplished for 6 modes.
14. The modular mass support for - x2 bearing is accomplished for 6 modes.

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