Seismic Examination and Retrofit of India Multistory Existing Building

Zainuddin Alam
M.Tech Scholar (Structure Design)
SSSUTMS, India

Abstract— In the ongoing past, India has seen mass decimation because of disappointment of structures hit by seismic tremors also, therefore, lost a ton of lives. Thus, it is of most extreme significance that consideration be given to the assessment of the sufficiency of strength in surrounded RC structures to oppose solid ground movements. In this endeavor an old four story strengthened solid structure has been viewed as which lies in zone iii according to is 1893 2000 portrayal of seismic zones in India. For nonstructural individuals stone work infill has been expected. In the Equivalent Static Method of examination, the seismic burden following up on the structure is expected to be a proportionate static level power applied to singular frames. The all out force applied will be equivalent to the result of product of the acceleration response spectrum and the seismic weight. It is utilized just for low to tall structures without huge coupled torsional modes. The structure is planned in software, considering M15 cement and Fe250 steel reinforcement for with and without seismic tremor loading conditions. The interest moments and shear have been noted down from the product investigation and contrasted with the limits of the given area. FRP jacketing is the most proper technique for retrofitting the failing members in the given 4- story RC structure. The standards expressed in ACI 440-2R.02 have been followed to compute and recommend the technique and plan of utilization of FRPs to the part and furthermore the quantity of employs to be utilized. Starting there an examination has been done on the proportion of profitability achieved in making do with the deficiency in the individuals. The FRP strengthening framework has been checked for functionality just as creep-crack points of confinement since the whole displaying, examination and plan for the structure has been finished utilizing limit state plan.

Keywords: Seismic Examination, Retrofit of India

I. INTRODUCTION

Quakes the world over are without any assistance answerable for the demolition to life and property in huge numbers. So as to alleviate such risks, it is essential to join standards that will improve the seismic exhibition of structures.

As indicated by the Seismic Zoning Map of IS 1893:2002, India is isolated into five seismic zones, in climbing request of a specific zone factor which is doled out to them based on their seismic force. The 4-story RC Structure being investigated in this specific venture , which is situated at all helpless zone for example zone III. In any case, taking into account that the essential basic arrangement of the structure is in any event 50 years of age, it was not planned by the plan arrangements given in IS 1893:2002. Thus, it might fall flat in case of any respectably solid structural movement in its region. Contemplating the presentation of the structure and recommending appropriate retrofit measures for the structure would subsequently be a need.

A. Proposed Work and Objective

My research project aims at doing seismic evaluation for building and suggesting how to retrofit the failing members, using FRP jacketing.

II. LITERATURE REVIEW

Yen-Po Wang [11] presented the basics of seismic base disengagement as a compelling system for seismic plan of structures. Spring-like seclusion orientation diminish tremor powers by changing the crucial timeframe of the structure to stay away from reverberation. Notwithstanding, sliding-type detachment heading sift through the seismic tremor forces by means of discontinuous sliding interfaces and forces are kept from getting transmitted to the superstructure in view of the friction. The structure of the base detachment framework incorporates discovering the base shear, bearing displacement and so forth as per site-explicit conditions.

M C Griffith And A V Pinto [4] have examined the particular subtleties of a 4-story, 3-cove fortified solid casing test structure with unreinforced block stone work (URM) infill dividers are described alongside appraisals of its imaginable shortcomings concerning seismic loading. The solid casing is demonstrated to be basically a "frail segment solid pillar outline" which is probably going to display poor post yield hysteretic conduct. In view of the aftereffects of a broad writing audit, the structure is relied upon to have greatest sidelong misshapening limits relating to about 2% horizontal float. The unreinforced workmanship infill dividers are probably going to start splitting at a lot littler sidelong floats, of the request for 0.3%, and to totally lose their load conveying capacity by floats of somewhere in the range of 1% and 2%.

Durgesh C. Rai [7] gave the rules for seismic assessment and fortifying of structures. This report is created as a major aspect of venture entitled ―Review of Building Codes and Preparation of Commentary and Handbooks‖ granted to Indian Institute of Technology Kanpur by the Gujarat State Disaster Management Authority (GSDMA), Gandhinagar through World Bank funds. This archive is especially worried about the seismic assessment and reinforcing of existing structures and it is planned to be utilized as a guide.

E. Senthil Kumar, A.Murugesan and G.S.Thirugnanam [5] did an experimental investigation of the behavior of retrofitted FRP (fiber reinforced polymer) wrapped exterior beam-column joint of a G+4 building in Salem, which lies in seismic zone III. The test specimen was taken to be one fifth model of beam column joint from the prototype specimen and was evaluated in terms of load displacement relation, ductility, stiffness, load ratio and cracking pattern. On comparing the test results with the analytical modeling of the joint on ANSYS and STAAD

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Pro, it was found that such external confinement of concrete increased the load carrying capacity of the control specimen by 60% and energy absorption capacity by 30-60%.

III. THEORY AND FORMULATION

The figuring of Demand Capacity Ratio to recognize the deterioration individuals, is the piece of Equivalent Static Analysis.

Demand is the measure of force or twisting forced on a component or segment (for this situation, concerning seismic tremor stacking). Limit is the allowable quality or misshapening of a basic part or framework (from the current casing of the structure).

DCR= Demand/Capacity

In the event that DCR is lesser than 1, the part passes, else it passes. It is a significant device used to decide if a specific individual from the structure is passing or flopping because of moment or shear. The check for DCR surpassing 1 was performed for both flexural and shear limits of the beams just as segments of the structure.

To maintain a strategic distance from disappointment, the accompanying strategies can be embraced

- Reducing the heaps following up on the part
- Increasing the cross section area of the segment
- Replacing with a material of higher quality

The third technique has been utilized to manage the failing member individuals for example reinforcing the failing member individuals with FRP.

A. Methodology

The technique for examination utilized in the undertaking is Equivalent Static Method. The underlying piece of investigation to decide the individuals that flop under seismic tremor stacking is finished by computing the Demand-Capacity Ratio (DCR) for every part independently. Figuring out which individuals will come up short is fundamental since it gives a harsh thought regarding which retrofit system to continue with-worldwide or nearby. The point by point assessment of the structure includes equal static horizontal force system, load with reaction decrease factors and Demand Capacity Ratio (DCR) for pliability as in IS 13920:1993.

Checks done:

1) moments of resistance in sagging and hogging for beams
2) shear capacity in beams
3) moment of resistance in columns
4) shear capacity in columns

IV. RESULTS

A. Moment Capacity of Beam

BeamNo.	Demand(kNm)	CapacitySagging (kNm)	DCR Sagging	ResultSagging	Capacity Hogging(kNm)	DCRHogging	ResultHogging
1	44.184	34.011	1.299109	FAIL	34.011	1.299109	FAIL
2	42.166	34.012	1.239739	FAIL	34.012	1.239739	FAIL
3	42.105	34.012	1.237945	FAIL	34.012	1.237945	FAIL
4	41.664	34.012	1.224979	FAIL	34.012	1.224979	FAIL
5	41.785	34.012	1.228537	FAIL	34.012	1.228537	FAIL
6	42.158	34.012	1.239504	FAIL	34.012	1.239504	FAIL
7	41.522	34.012	1.220804	FAIL	34.012	1.220804	FAIL
8	44.431	34.01	1.30641	FAIL	34.01	1.30641	FAIL
11	44.328	35.622	1.2444	FAIL	58.201	0.761636	PASS
13	101.59	58.086	1.748958	FAIL	125.645	0.808548	PASS
14	102.405	50.328	2.034752	FAIL	123.639	0.828258	PASS
15	99.518	50.329	1.977349	FAIL	112.7	0.883035	PASS
16	92.931	40.971	2.268214	FAIL	108.49	0.856586	PASS
17	92.767	40.971	2.264211	FAIL	108.49	0.855074	PASS
18	98.034	50.328	1.947902	FAIL	123.639	0.792905	PASS
19	100.109	50.329	1.989092	FAIL	110.541	0.905628	PASS
20	92.615	44.856	2.064718	FAIL	93.613	0.989339	PASS

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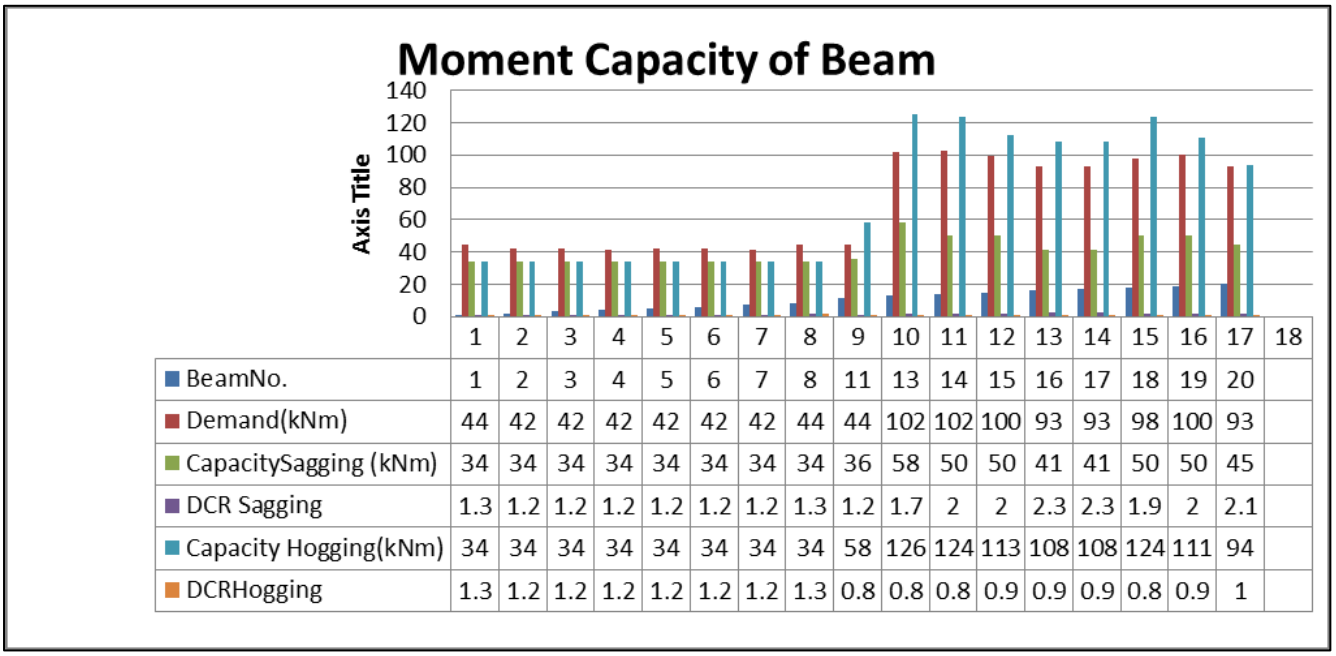
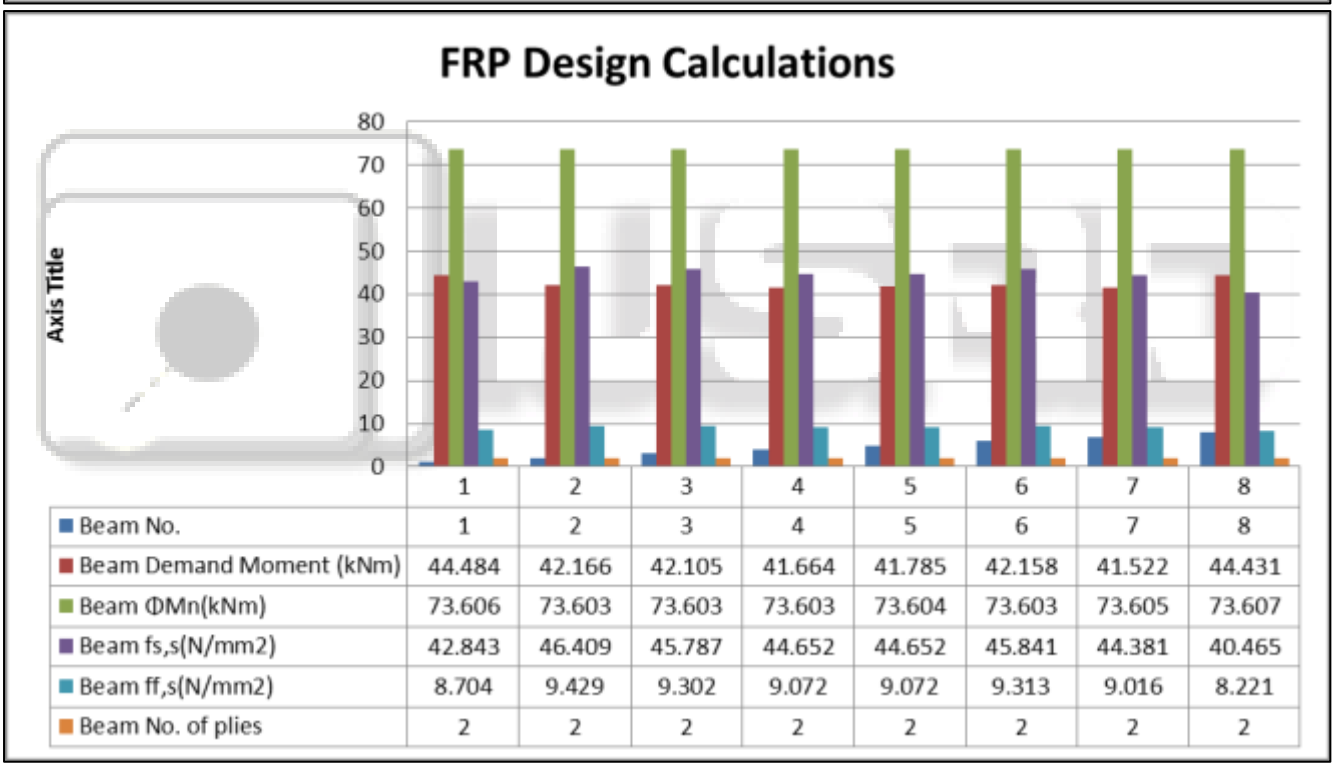


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
BeamNo.	1	2	3	4	5	6	7	8	11	13	14	15	16	17	18	19	20	
Demand(kNm)	44	42	42	42	42	42	42	44	44	102	102	100	93	93	98	100	93	
CapacitySagging (kNm)	34	34	34	34	34	34	34	34	36	58	50	50	41	41	50	50	45	
DCR Sagging	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.2	1.7	2	2	2.3	2.3	1.9	2	2.1	
Capacity Hogging(kNm)	34	34	34	34	34	34	34	34	58	126	124	113	108	108	124	111	94	
DCRHogging	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.3	0.8	0.8	0.8	0.9	0.9	0.9	0.8	0.9	1	



	1	2	3	4	5	6	7	8
Beam No.	1	2	3	4	5	6	7	8
Beam Demand Moment (kNm)	44.484	42.166	42.105	41.664	41.785	42.158	41.522	44.431
Beam ΦMn(kNm)	73.606	73.603	73.603	73.603	73.604	73.603	73.605	73.607
Beam fs,s(N/mm2)	42.843	46.409	45.787	44.652	44.652	45.841	44.381	40.465
Beam ff,s(N/mm2)	8.704	9.429	9.302	9.072	9.072	9.313	9.016	8.221
Beam No. of plies	2	2	2	2	2	2	2	2

V. CONCLUSIONS

The examination of pillars by Equivalent Static Method uncovered that the majority of the bars collapse in flexural limit. The quantity of collapse bars diminished with expanding stories. Be that as it may, the quantity of beams collapsing in shear limit were less for example beam 23, 36, 40 in first story; 112, 116, 118 in second story; 188, 192 in third story.

For segments as well, the investigation uncovered that the greater part of them collapsed in flexural limit however were protected in shear.

In view of the above perceptions, the quick need to counter lack in flexural limit was distinguished and the FRP jacketing plan was proposed uniquely for beams, collapsing in flexure. Because of the high elasticity and firmness, soundness under high temperatures and protection from acidic/salt/natural conditions, carbon fiber was picked as the FRP material to be utilized.

FRP strips that are industrially accessible are not made to a widespread standard yet a limited standard as set by the assembling organization. Hence, the measurements considered for the strips were carefully according to a plan model in ACI 440.2R-02. The code states however, that more extensive and more slender FRP strips have lower bond stresses and consequently, give more elevated level of solidarity. Additionally, the utilizes were thought to be clung to the soffit of the beams utilizing wet layup strategy. An all the more keeping wrapping plan would have

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expanded the quality further and henceforth, diminished the measure of FRP required.

The FRP structure technique utilized in this undertaking is basically experimentation where the estimation of the depth of neutral axis must be expected and contrasted and the worth acquired. In this way, endeavors were made so the quantity of employs to be applied to a constant arrangement of shafts, state the longitudinal or transverse direction, would continue as before. This would guarantee achievability of use of the FRP framework to the beams.

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