

Retrofitting of RCC Building for strong column weak Beam Design Criterion



Adil Bashir, Manish Kaushal, Sandeep Singla

Abstract— Reconstruction is a technical intervention in building structural systems that improves shock resistance by optimizing strength, ductility and seismic loading. The strength of a building results from the size of the structure, the material, the shape and the number of structural elements. The ductility of the building comes from good details, materials used, earthquake resistance, etc. The seismic load is generated by the seismic activity of the site, the quality of the building, the importance of the building, and the degree of earthquake resistance. In India, high rise structures are often built because of huge amount of cost and insufficiency of land. In order to take advantage of the largest land area, builders and architects usually propose high-rise building planning configurations. These buildings were built in earthquake-prone areas and may be get fail during the earthquake. Earthquakes occur naturally and can produce the forces which can cause damage in the structure. With proper design and structural component details, the building should be safe for life in order to have a malleable failure form. The knowledge of seismic forces is that the structure should be analyzed and designed to resist the seismic forces, with minimum damage and forces due to maximum consideration of the seismic forces, with some recognized structural damage but no collapse. This thesis involves Srinagar location survey which is in earthquake zone V. This exploration shows how easy an assignment for analysis that can be used to estimate the seismic resistance of existing or modified systems. The thesis analysis a detailed non-linear analysis of part of the structure for.

Keywords: retrofitting, existing buildings, construction, shear wall, beams and columns.

I. INTRODUCTION

Retrofitting is a change to an existing structure to reduce or eliminate the possibility of damage to the structure from flooding, erosion, wind, earthquakes and other hazards. The focus of this manual is on the renovation of buildings affected by floods. The following sections describe the purpose of the manual, audience, and the organization.

A. GOALS AND INTENDED USERS

This manual has been produced by the Federal Emergency Management Agency (FEMA) with the support of other groups to assist local authorities, engineers, architects and owners in planning and carrying out residential flood restoration projects.

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The goal is to provide engineers, architects, and local code with engineering design and economic guidance to help them understand the technical feasibility and cost-effective renovation measure of flood-prone housing structures. The focus of this manual to renovate one to four houses affected by floods without being affected without wave section. This manual describes various active and passive changes for dry and wet flood protection. These include the height of existing structures, relocation of structures, barrier construction (flood walls and levees), dry flood protection (sealants, enclosures, sump pumps and backflow valves), and wet flood protection (flood protection damage-materials and protection of used contents). The goal of this manual is to capture the latest information and present it systematically. As a basis for this document, existing data and current standards are used to the cornerstone of this the evaluation of corrective actions, details of planning and design, and case studies of the completed renovation work. Methods have been performing for economic analysis of the various alternatives are presented.

The architects, engineers, or code officials must be aware altering the structure of a house can affect the structure impact those associated with floodwaters, as wind hazards. A holistic approach should be taken to address the hazard. Impacts of ice and debris flow on the water surface, flood related hazards such as erosion forces, and debris flow impacts, and non-flood related hazards such as earthquakes and wind also need to be considered in the renovation process. Restructuring the structure to withstand only the forces generated by the flood can compromise the ability of the structure to withstand the various hazards described above. Therefore, in terms of multi-hazards, the selection of improved methods and the design process

II. METHODS OF RETROFITTING

- Renovation measures against for flood disasters hazards include there are as follows.
- Elevation: The elevation of the existing structures on fill or foundation elements such as solid perimeter walls, piers, columns, columns, or pilings.
- Relocation: The relocate existing structures outside the identified floodplain.
- Dry Flood proofing: The strengthen existing of foundations, floors and walls to withstand the forces of flooding while keeping the structure watertight.
- Wet Flood proofing: The utilities, making structural parts, and contents are protected from flood during flooding in the structure are waterproof.
- Floodwalls/Levees: The Place floodwalls and dams' levees around the structure.

In terms of necessary human intervention, the conversion means can be passive or active. Active or urgent remedial action is effective only if there is sufficient warning time to mobilize the labor and equipment needed to implement the action.

III. TECHNIQUES

This may be accomplished, for example, by removal of one to two floors. In this case it is obvious that the elimination of the mass will lead to a reduction in the period which will lead to a rise in the desired strength.

A. Wall Thickening Technique of Retrofitting

The existing walls of the building are provided more thickness by using bricks and concrete to increase the horizontal and vertical load strength.

B. Design Steps

- *Adding New Shear Walls:* Often used for retrofitting of non-elastic RCC structures. The added elements can be either cast or precast concrete elements. The new shear wall elements should be constructed at the exterior of the structure to avoid the interior changes of the building.
- *Jacketing on existing Beams and Columns:* Placement of new designed reinforcement in columns and beams. Adding of new clear cover. Placement of Concrete.

IV. METHODOLOGY

A. Introduction

In this chapter, building modeling is done with E-tabs and staad-pro building analysis completes the design of the Reinforcement is done. Considering that the buildings are too old and more than 60 years old, construction by leakage and environmental behavior is not very good. A structural audit of the building takes place. Although the slabs and foundations are safe, audit reports have confirmed that the reinforced beams and columns are cracked and have low strength due to corrosion. Various changes are applied to increase the method Retrofitting building is applied to.

B. Preliminary Data

The building is located in Srinagar and is a G + 5 Building with a 60-year history. Other basic data is as follows.

- | | | |
|---------------------------|---|--------------------------------|
| ▪ Type of structure | = | RCC Building |
| ▪ Earthquake Zone | = | V |
| Layout | = | as shown in fig. |
| ▪ Number of stories | = | G+5 |
| ▪ Ground storey height | = | 4 m |
| ▪ Floor to floor height | = | 4 m |
| ▪ Parapet wall | = | 250 mm thick including plaster |
| ▪ Wall thickness | = | 250 mm thick Including plaster |
| ▪ Total depth of the slab | = | 125 mm |

Size of columns and beams

- Ground floor
Column size 600 mm circular

- Beam size 400 x 350 mm
- Ist and 2nd floor
Column size 500 x 350 mm
Beam size 400 x 300 mm
- 3rd 4th and 5th floor
Column size 450 x 300
Beam size 350 x 230 mm

Density of RCC concrete	=	25kN/m ³
Unit weight of brick masonry is	=	20kN/m ³
Weight of floor finish (FF)	=	1kN/m ²
Live load on floor	=	2kN/m ²

C. Load Combination

- Comb. 1 – 1.5 (DL+LL)
- Comb. 2 – 1.2 (DL+LL+EL)
- Comb. 3 – 1.2 (DL+LL-EL)
- Comb. 4 – 1.5 (DL+EL)
- Comb. 5 – 1.5 (DL-EL)
- Comb. 6 – 0.9DL+1.5EL
- Comb. 7 – 0.9DL-1.5EL

D. Application of Codes and Standards

- IS 15988:2013
- IS 456:2000
- IS 1893-2002
- IS 13311 (Part- I): 1992
- IS: 1331 (Part 2): 1992

E. Load Calculation

The building is considered to be located in the Srinagar district and is a public building.

- *Dead load data*

Roof load	=	25 × 0.125
Self-weight of the slab	=	3.125 kN/m ²
Weight of floor finish	=	1k N/m ²
Weight of terrace water proofing	=	1.5 kN/m ²
Total slab weight on roof	=	5.625 kN/m ²
▪ <i>Floor load</i>		
Self-weight of the slab	=	25 × 0.15
	=	3.125 kN/m ²
Weight of floor finish	=	1 k N/m ²
Weight of furniture	=	1 kNm ²
Total slab weight on floor	=	5.125 kN/m ²
▪ <i>Wall load including plaster</i>		
Parapet weight of wall	=	1.5 × 0.250 x 19
	=	7.125 kN/m
Weight of wall	=	19 × 0.23 x 4
	=	19 kN/m

- *Live Load Data*

Live load on roof	=	3 k N/m ²
Live load on floor	=	3 kN/m ²

Fig. 1. Loads on Building.

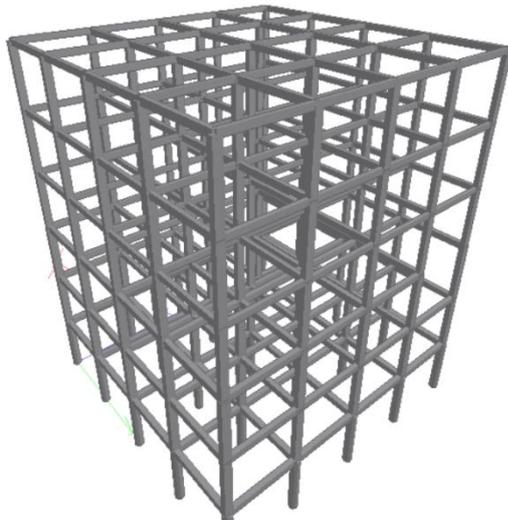
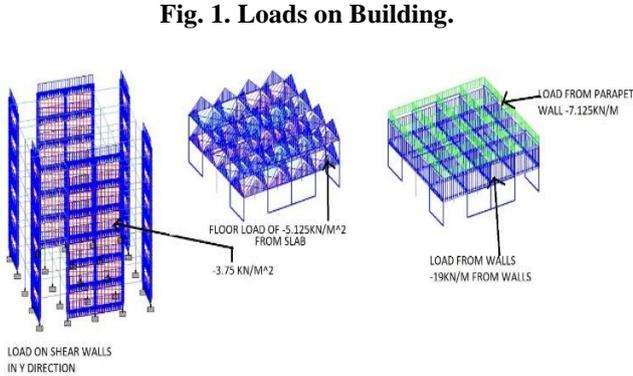


Fig. 2 Building Frame Model.

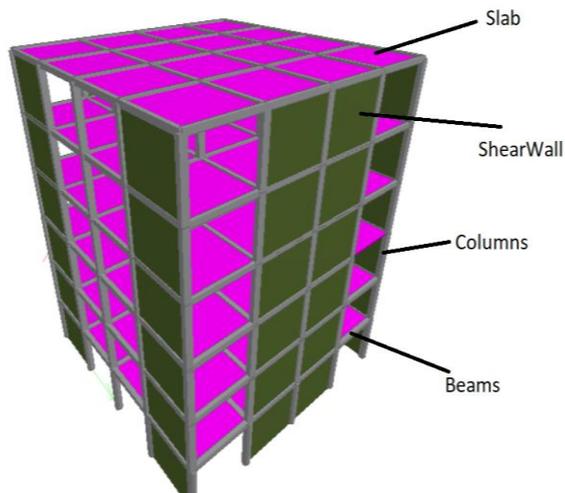


Fig. 3. 3D-view of building.

V. RESULTS AND ANALYSIS

It can be observed from the graph that node displacements are reduced to large extent for seismic load in X direction and Z direction respectively the drift of the building has reduced to 75-80% by using shearwalls.

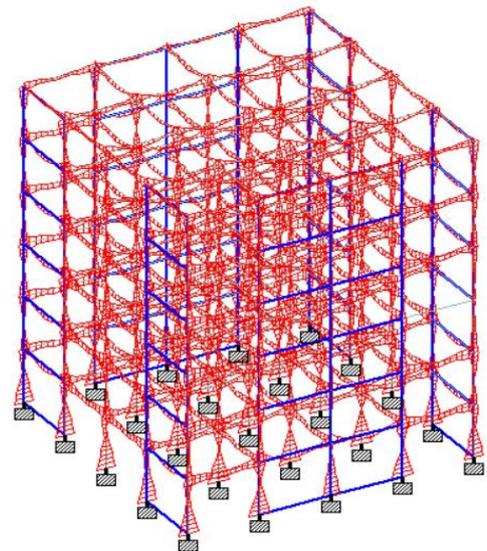
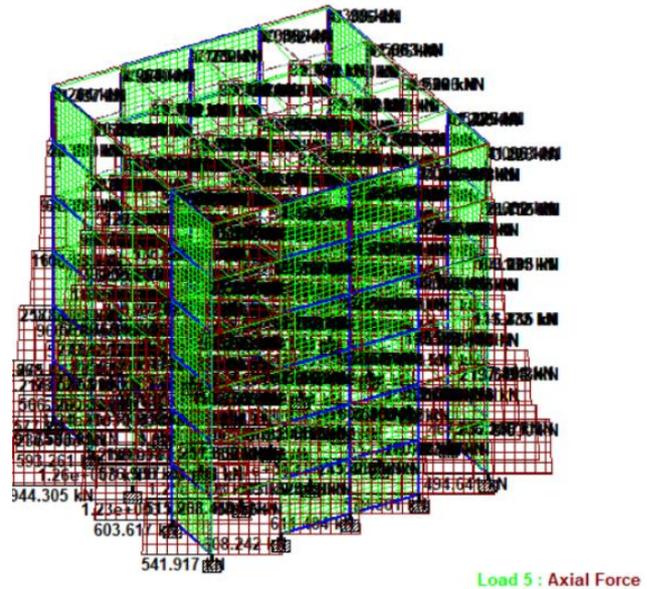


Fig. 4. Bending Moment Diagram

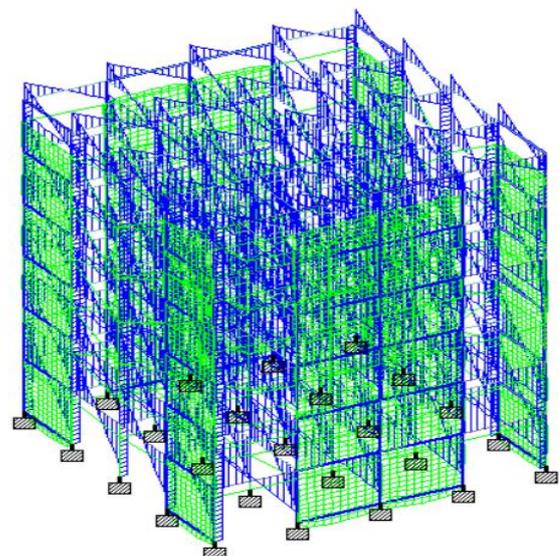


Fig. 5. Shear Force Diagram

Retrofitting of Rcc Building for Strong Column Weak Beam Design Criterion

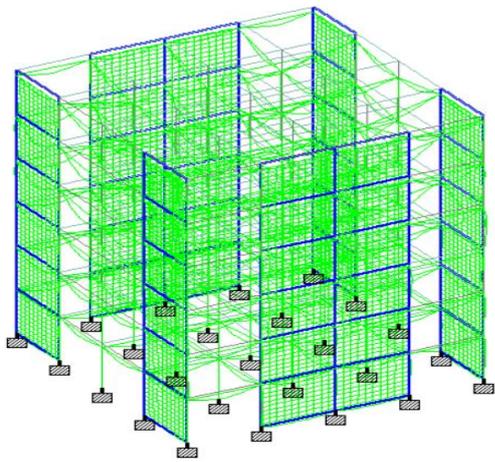
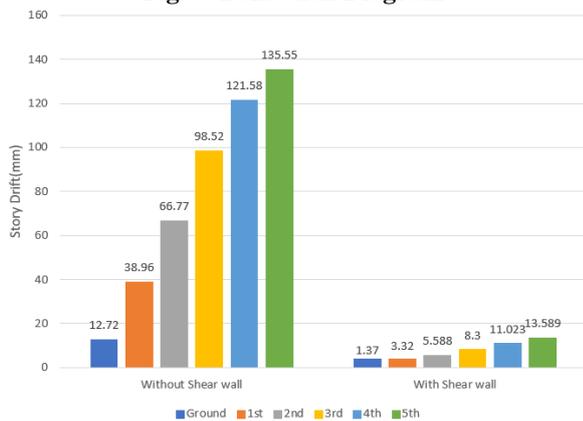
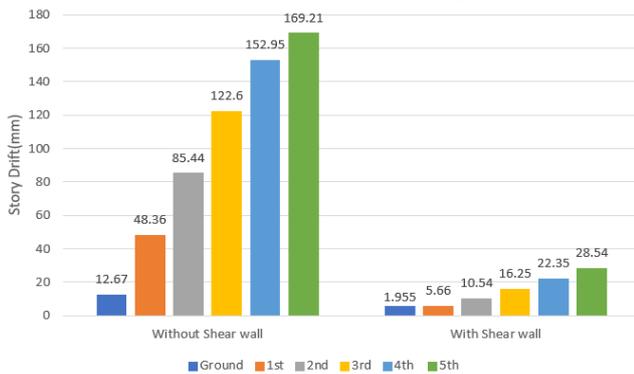


Fig. 6. Deflection Diagram



Graph. 1. Graph showing Story Drift (mm) in X direction for G+5 building.



Graph. 2. Graph showing Story Drift (mm) in Z direction for G+5 building.

VI. REINFORCEMENT DETAILS

Floor No.	Beam No	Width	Depth	Top Steel	Bottom Steel
Ground Floor	B1 to B40	350 mm	400 mm	12-Mar	16-Jun
First Floor	B40 to B80	300 mm	400 mm	12-Mar	16-Jun
Second Floor	B80 to B120	300 mm	400 mm	12-Mar	16-Jun
Third Floor	B120 to B160	230 mm	350 mm	12-Mar	16-Jun
Fourth Floor	B160 to B200	230 mm	350 mm	12-Mar	16-Jun
Fifth floor	B200 to B240	230 mm	350 mm	12-Mar	16-Jun

Table 1. Steel Details of Building for jacketing of Existing beams.

Column No.	Ground storey	1st storey	2nd storey	3rd storey	4th storey	5th storey
C 1 to C 25	C 600	C 500	C 500	C 450	C 450	C 450
		X 350	X 350	X 300	X 300	X 300
	6-16	6-16	6-16	6-16	6-16	6-16

Table 2. Column Schedule.

SHEARWALL		DESIGN PER IS 456-2000			
WIDTH :	5.00 M	FC :	25.00 MPA		
HEIGHT :	4.00 M	FY :	415.00 MPA		
THICKNESS :	150.00 MM	CONC. COVER :	25.000 MM		
REINFORCING SUMMARY (REBAR SPACING/AREA UNITS: MM/MM ²)					
LEVEL (M)	GOV. LOAD NO. FOR L. E. R. HOR. VER. R. E. R. LINE	LEFT EDGE AREA	HORIZONTAL RATIO (MIN. RATIO) HOR. LINK	VERTICAL RATIO (MIN. RATIO) VER. LINK	RIGHT EDGE AREA (MIN. RATIO)
-3.60	2	1 - DIA 22	DIA 8@ 167.00	DIA 10@ 450.00	1 - DIA 22
	1	380.285			380.285
	1	0.00063	0.00201	0.00122	0.00066
	1	(0.00000)	(0.00200)	(0.00120)	(0.00000)
			NOT REQUIRED	NOT REQUIRED	
-3.20	2	1 - DIA 22	DIA 8@ 167.00	DIA 10@ 450.00	1 - DIA 22
	1	380.285			380.285
	1	0.00063	0.00201	0.00122	0.00066
	1	(0.00000)	(0.00200)	(0.00120)	(0.00000)
			NOT REQUIRED	NOT REQUIRED	

Shear Wall Design.

VII. CONCLUSION

The above approach the steel details of building. Considering that the buildings are too old and more than 60 years old, construction by leakage and environmental behavior is not very good. A structural audit of the building takes place. The structure should be designed in such a way that it can resist the seismic forces during an earthquake, with minimum damage and forces due to maximum consideration of the earthquake with some recognized damage but no collapse. This research involves Srinagar city survey. This exploration shows how easy an assignment for analysis that can be used to estimate the seismic resistance of existing or modified systems in general, structural modernization has improved the seismic resistance of the building. And could be considered the modernization of the structures at the present time to avoid the risk of structural collapse. Under design load with much greater confidence. This study shows how easy an assignment for analysis can be used to estimate the seismic resistance of existing or modified systems. Structures, as well as the way linear analysis can be followed by a detailed non-linear analysis of part of the structure. One of the most important advantages of a nonlinear payment function. Analysis outside linear analyzes is an opportunity to assess damage. Easy task Analysis can provide valuable information on expected construction performance in the future seismic events. The multi-story buildings are often built because of the huge amount of cost and shortage of land. In order to take advantage of the maximum amount of land developers,

architects generally propose construction plans from height to medium. It is likely that these buildings built in earthquake-prone areas will be damaged during the earthquakes occur naturally and can produce the forces which can cause damage to the structure. The buildings must be safe for life through the proper design and structural details of the members to obtain a form of prolonged failure.

1. It is the process through which we can modify the existing structures to increase their strength.
2. The methods should be adopted carefully
3. The main aim is to strengthen the structure with minimum cost by doing the detailed analysis of the building
4. Optimization techniques are required to know the efficient Retrofitting.

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