e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
( Peer-Reviewed, Open Access, Fully Refereed International Journal )
Volume:05/Issue:10/October-2023 Impact Factor- 7.868 www.irjmets.com

# A CASE STUDY ON RETROFITTING OF AN OLD STRUCTURE USING NDT AND ANALYSIS TOOL

**Ankit Prakash*1, Hitesh Kodwani*2**

*1Research Scholar, Civil Engineering Dept., Sam Global University, Raisen, Madhya Pradesh, India.

*2Assistant Professor, Civil Engineering Dept., Sam Global University, Raisen, Madhya Pradesh, India.

DOI : https://www.doi.org/10.56726/IRJMETS45053

## ABSTRACT

A live project (Hamidia Hospital old building) of G+2 existing old structure, structure is modelled and analyzed in Staad.Pro with existing strength determine from NDT and then providing extra columns, thickness and struts at places where strength is at failure. Comparative analysis is done in between the existing structure and the proposed structure which can easily overcome the failures seen by existing structure proven in the results of NDT.

It is seen that with the procedure of retrofitting, the soundness of a structure can be recovered without disassembling the structure utilizing fortifying steady individuals. It is even seen that the retrofitting method can be 88.64% cost effective than destroying and developing another structure.

Product examination and site test work can be joined for the advancement of the framework, as done in this investigation where we decided the quality of the structure utilizing NDT (Non-destructive testing) though displaying and checking quality improvement should be possible utilizing investigation apparatus staad.pro.

**Keywords:** Retrofitting, NDT, Staad.Pro, Axial Force, Storey Displacement, Shear Force, Bending Moment.

## I. INTRODUCTION

Seismic retrofitting is mainly done to meet the seismic safety requirements. The planning of modifications to existing buildings contrasts from new planning through a significant condition; the existing development must be taken as the premise of all planning and building activities. India is one of the most earthquake inclined nations on the planet and has encountered a few significant or moderate earthquakes during the most recent 15 years. Around 50-60 % of the absolute zone of the nation is defenseless against seismic movement of shifting powers. Many existing buildings don't meet the seismic quality necessity. The requirement for seismic retrofitting of an existing building can emerge because of a few reasons like: building not intended to code, consequent refreshing of code and configuration practice, resulting overhauling of seismic zone, crumbling of solidarity and maturing, alteration of existing structure, change being used of the building, and so on. Seismic retrofit is essentially applied to accomplish open wellbeing, with different degrees of structure and material survivability dictated by financial contemplations. Lately, an expanded direness has been felt to fortify the insufficient buildings, as a feature of dynamic debacle relief, and to work out the adjustments that might be made to an existing structure to improve the auxiliary execution during an earthquake.

In this proposed work we are considering a live project of G+2 existing old structure, structure is modelled in staad with existing strength determine from NDT and than providing extra columns, thickness and struts at places where strength is at failure.

### Retrofitting

Chiefly retrofitting depicts the measures taken in the assembling business to permit new or refreshed parts to be fitted to old or obsolete congregations (like edges to wind turbines). The generation of retrofit parts is fundamental in make when the plan of a huge get together is changed or overhauled. In the event that, after the progressions have been actualized, a client (with an old adaptation of the item) wishes to buy a new part at that point retrofit parts and gathering procedures should be utilized so the reexamined parts will fit appropriately onto the more seasoned get together. Retrofitting is a significant procedure utilized for valves and actuators to guarantee ideal activity of a mechanical plant.

**Objectives**

- To determine the strength of an existing old structure using NDT (rebound hammer).
- To determine the effect of composite member on an old structure strengthening.
- To evaluate the present condition of Hamidia hospital block 2 using rebound hammer.
- To evaluate seismic assessment impact on hospital building for Zone II using analysis tool.
- To determine the weakest portion of the structure and propose suitable retrofitting Technique.

## II. LITERATURE REVIEW

According to **Harshitha and Vasudev (2018)** earthquake is the one of the serious calamity in the world since numerous years, there has been an extensive commitment from earthquake engineers for the wellbeing of the structure. One of the choices to decrease the harm caused because of the earthquake is embracing auxiliary steel bracings in the structure. These individuals can be used in the building as an even burden opposing framework to improve the firmness of the edge for seismic powers. This examination depends on analysis of RC confined structure through auxiliary steel props utilizing ETABS programming and means to comprehend the conduct of the diverse supporting framework for different courses of action. G+10 structure in zone IV is chosen and broke down with various supports. The viability of props is examined by methods for 16 models out of which one is the uncovered edge model. The presentation of the structure is contemplated as far as base shear, horizontal dislodging and timespan. The results of the analysis are thought about and it was seen that the seismic conduct of propped encircled building is upgraded when contrasted with unbraced surrounded building. It was additionally seen that the different courses of action of propping frameworks have extraordinary ineffect on seismic execution of the structure.

**Patilet. al. (2018)**studied the effective bracing system for G+20 building by using STAAD.pro v8i. The purpose of this study is to analysis and design different parameter in high rise steel structure. In this research G+20 structure is taken with eccentric bracing system under different types of lateral loading.

**Krishna et. al. (2017)**contemplated that with the upsurge in the stature of the structure floods the force and impacts of Lateral burdens containing seismic and wind loads. Wind load obstruction turns into an administering factor once the structure accomplishes the depiction of tall structure because of the wastefulness of unbending or semi inflexible casings to control the uprooting and avoidance. In this manner, lessening the quality and solidness of the structure. Supported casing framework is a profoundly able and savvy technique to control the avoidances emerging because of the fluctuating breeze loads. In the present examination three unique kinds of concentric supported casing frameworks were broke down in wording Shear power, twisting minute, nodal relocation and responses by utilizing STAAD.Pro V8i programming according to Equivalent static analysis strategy. A (G+11) sporadic skyscraper structure was thought to be arranged in Bhuj with Basic breeze speed 50m/s.

Numerical analysis of a skyscraper stone work infill RC building so as to assess seismic performance has been done by**Hasan (2017)**. In such manner, outline is structured by direct bar and section components. A 8-story RC outline structure with various measure of brick work infill dividers and uncovered casing were considered. Demonstrating of stone work infill dividers had been finished by askew swagger methodology. Infill boards are demonstrated by bracket components and the limit condition at the help is viewed as controlled toward all path and straight material properties are utilized. The perception of the reaction of building structures shows that there is critical commitment of infill in the portrayal of their seismic conduct. During demonstrating of a structure the impact of infills are commonly disregarded as a rule those are delegated non-basic components. Subsequently, it gets unattainable to compute the real seismic reaction of encircled structures. In his investigation, story relocation bends and story float bends were found from static analysis, reaction range analysis and time history analysis which are utilized in contrasting the impacts of various setup of stone work infill divider in structure. As to the analysis results, the impacts of infill were resolved in the auxiliary conduct under earthquake.

**Paudel (2017)** examined that in open ground story buildings, abrupt difference in solidness happens along the building stature which makes the story more adaptable than the adjoining story. Henceforth sections and bars in those accounts got vigorously pushed. Nearness of infill dividers in the edge modifies the conduct of the building under sidelong loads. Notwithstanding, it is a typical industry practice to disregard the solidness of

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infill divider for analysis of confined building. Draftsmen believe that assessment without considering infill strength prompts a conventionalist plan. In any case, this may not be for each situation certifiable, especially for vertically sporadic buildings with broken infill dividers. Hereafter, the showing of infill dividers in the seismic examination of circled buildings is essential. Indian Standard IS 1893: 2002 grants assessment of open ground story buildings without pondering infill strength yet with an increase think about 2.5 compensation for the immovability irregularity. Regardless, as experienced by the pros at plot work environments, the duplication factor of 2.5 isn't functional for low rising buildings. This requires an evaluation and audit of the code suggested augmentation factor for low ascent open ground story buildings. Also, presumed that Column powers at the ground story increments for the nearness of infills in upper stories, however configuration load increase factor 2.5 is seen as a lot higher, it is really seen as 1.15. Not noteworthy change in bar powers of the principal floor bars was acquired after the thought of infills as well. Timespans diminishes with the expansion of measure of infill in the buildings (most elevated for without infills and least for the completely infilled case). This outcomes in the fascination of more earthquake power for the lower timeframes. Story float is seen as most reduced for completely infilled and most noteworthy for without infills however float of first story is most elevated for the building with infills over the ground floor (for example open ground story).

**Mohabbiet. al. (2016)** described the effect of infill wall in formation of short column at military aid watchtower in Turkey has been analyzed and the analysis result compared with effect of earthquake that have been seen after earthquake. Concluded that Strength of masonry infill, even though considered non-structural, influence the lateral behavior of RC frames, Structural drift is reduced by infills, because of reduced ductility of RC edges, and segments specifically, Shear constrain in short section in RC outlines builds, inferable from the nearness of infills which prompts disappointment of the structure. A fractional infilled short segments structure pulls in bigger power and manages basic harm. Amid the horizontal burdens inappropriate shear stream due to halfway infilled structures will harm the short segment prompting auxiliary disappointment. Solution for this type of problems is isolation the infills from the surrounding frames.

## III. METHODOLOGY

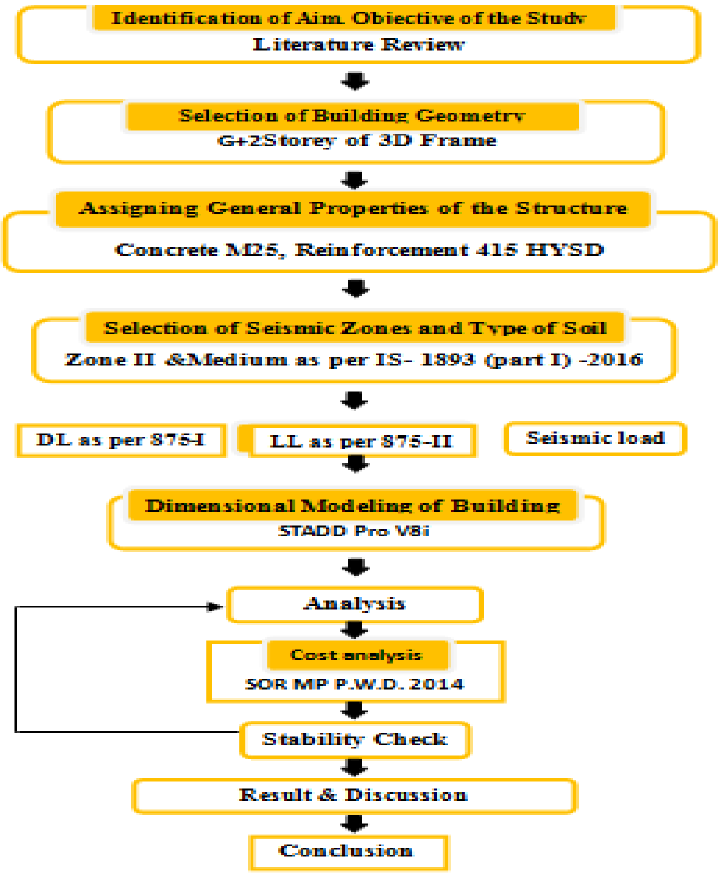


**Figure 1:**

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## IV. ANALYSIS RESULTS

**Table 1:** Bending Moment KN-m

| | Bending moment Mz ( KN-m ) | | Increase |
|---|---|---|---|
| | Case 1 | Case 2 | |
| | Existing Structure | Proposed Structure | |
| 41 | 60.567 | 178.293 | 117.726 |
| 42 | 60.567 | 177.954 | 117.387 |
| 43 | 59.481 | 175.619 | 116.138 |
| 47 | 59.481 | 174.038 | 114.557 |
| 48 | 57.8 | 157.366 | 99.566 |
| 49 | 57.8 | 155.381 | 97.581 |
| 53 | 57.348 | 154.918 | 97.57 |
| 54 | 57.348 | 149.755 | 92.407 |
| 55 | 56.391 | 149.752 | 93.361 |
| 59 | 56.391 | 146.266 | 89.875 |
| 60 | 56.327 | 141.877 | 85.55 |
| 63 | 56.327 | 137.989 | 81.662 |
| 64 | 56.125 | 136.598 | 80.473 |
| 67 | 56.125 | 136.316 | 80.191 |
| 68 | 55.946 | 133.821 | 77.875 |
| 69 | 55.945 | 132.503 | 76.558 |

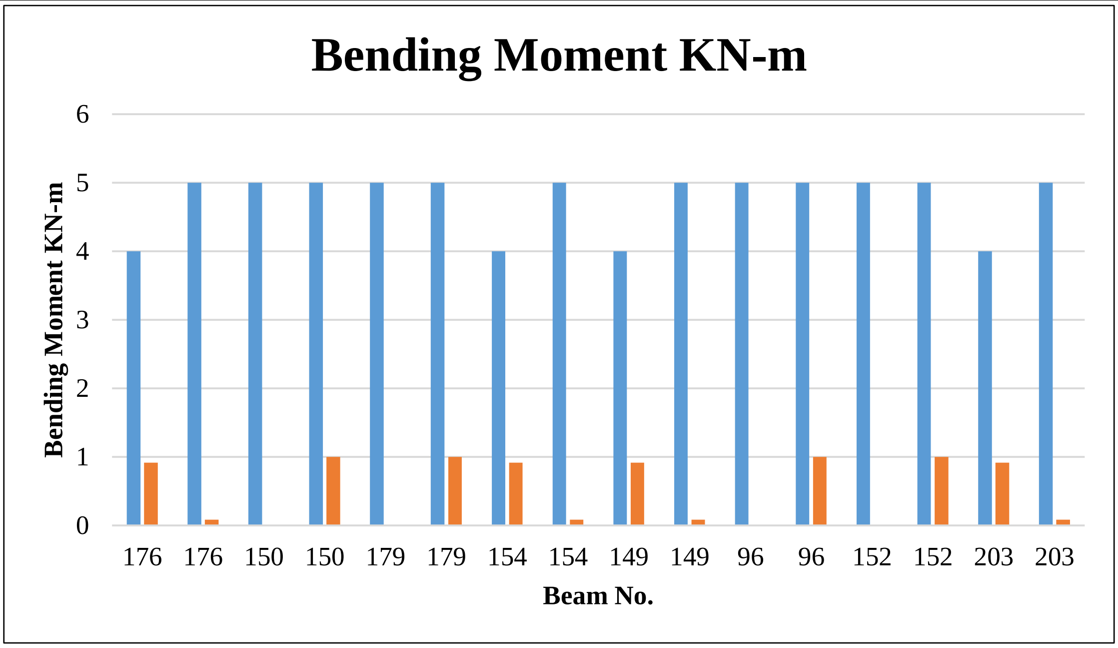


**Figure 2:** Bending Moment KN-m

**Maximum Shear Force KN**

**Table 2:** Shear Force KN

| Beam No. | Shear force Fy (KN ) | | Increase |
|---|---|---|---|
| | Case 1 | Case 2 | |
| | Existing Structure | Proposed Structure | |
| 41 | 33.639 | 85.844 | 52.205 |
| 42 | 33.329 | 84.234 | 50.905 |
| 43 | 32.893 | 80.173 | 47.28 |
| 47 | 32.871 | 79.602 | 46.731 |
| 48 | 32.658 | 78.167 | 45.509 |
| 49 | 32.624 | 74.229 | 41.605 |
| 53 | 32.564 | 72.297 | 39.733 |
| 54 | 32.491 | 72.083 | 39.592 |
| 55 | 32.343 | 71.785 | 39.442 |
| 59 | 32.238 | 71.563 | 39.325 |
| 60 | 32.226 | 71.38 | 39.154 |
| 63 | 32.189 | 71.101 | 38.912 |
| 64 | 32.182 | 70.989 | 38.807 |

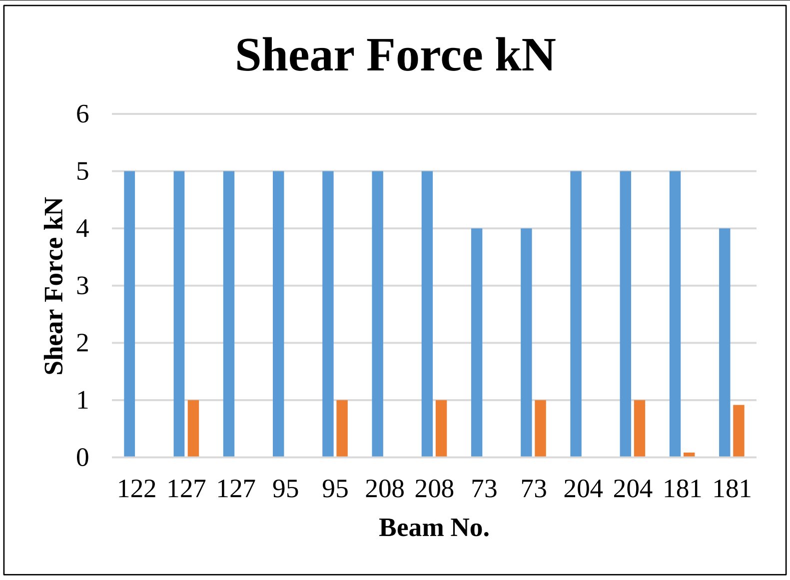


**Figure 3:** Shear Force KN

**Axial Force KN**

**Table 3:** Axial Force KN

| Column No. | Axial force Fx ( KN ) | | Increase |
|---|---|---|---|
| | Case 1 (Existing Structure) | Case 2 (Proposed Structure) | |
| 1 | 884.941 | 1159.076 | 274.135 |
| 2 | 884.939 | 1154.774 | 269.835 |

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| | | | |
|---|---|---|---|
| 3 | 883.621 | 1150.472 | 266.851 |
| 4 | 883.62 | 1146.17 | 262.55 |
| 8 | 882.302 | 1141.869 | 259.567 |
| 9 | 882.3 | 1137.567 | 255.267 |
| 10 | 880.982 | 1133.265 | 252.283 |
| 11 | 880.981 | 1128.963 | 247.982 |
| 15 | 879.663 | 1124.661 | 244.998 |
| 16 | 879.661 | 1120.359 | 240.698 |
| 17 | 878.344 | 1116.057 | 237.713 |
| 18 | 878.342 | 1111.755 | 233.413 |
| 22 | 877.024 | 1107.453 | 230.429 |
| 23 | 877.023 | 1008.184 | 131.161 |
| 24 | 875.705 | 1005.219 | 129.514 |
| 25 | 875.703 | 1003.882 | 128.179 |
| 30 | 874.385 | 1000.918 | 126.533 |
| 31 | 874.384 | 999.58 | 125.196 |

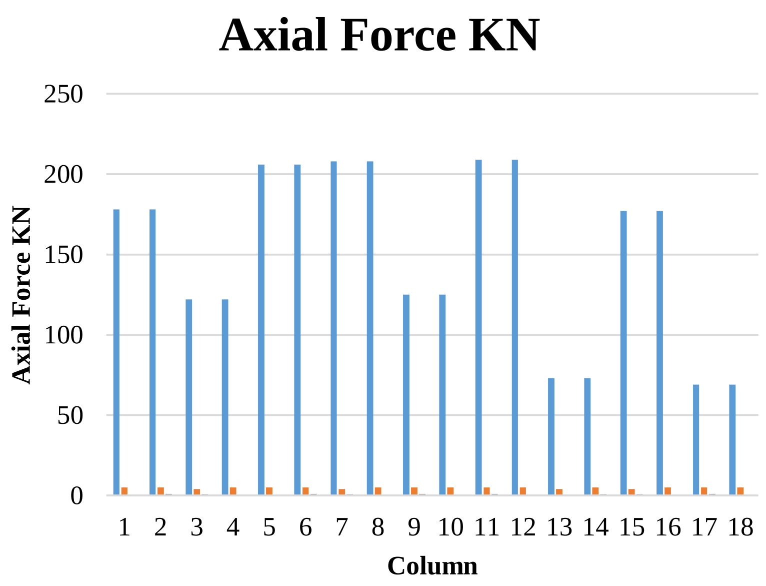


**Figure 4:** Axial Force KN

**Storey Displacement mm**

**Table 4:** Storey Displacement

| **Storey Displacement** | | |
|---|---|---|
| **Storey** | **(Existing Structure)** | **(Proposed Structure)** |
| 2nd Floor | 6.093 | 2.436 |
| 1st Floor | 4.628 | 1.683 |
| G.F. | 2.243 | 0.699 |

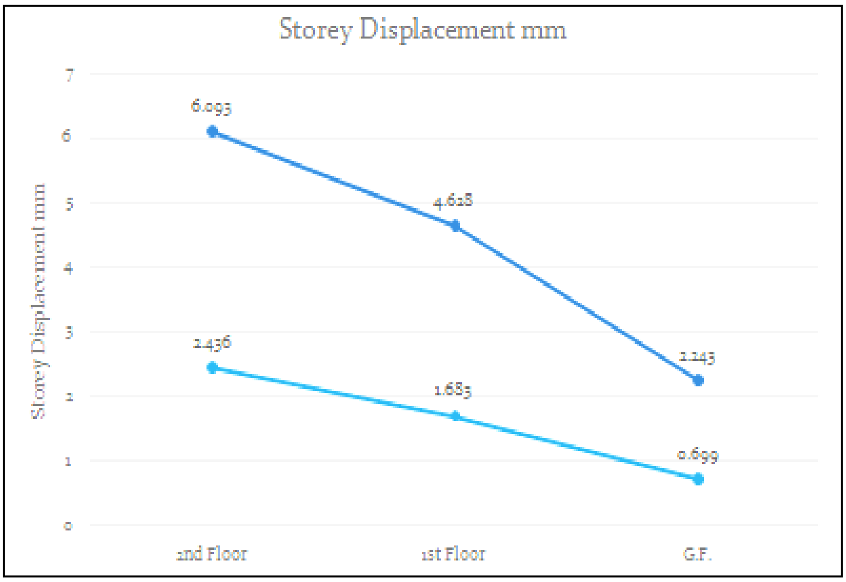


**Figure 5:** Storey Displacement mm

## V. CONCLUSION

Following are the ends according to the examination

- In this investigation, it is seen that with the procedure of retrofitting, the soundness of a structure can be recovered without disassembling the structure utilizing fortifying steady individuals.
- It is seen that the retrofitting method can be 88.64% cost effective than destroying and developing another structure.
- It can be reasoned that product examination and site test work can be joined for the advancement of the framework, As we did in this investigation where we decided the quality of the structure utilizing NDT (Non-destructive testing) though displaying and checking quality improvement should be possible utilizing investigation apparatus staad.pro.

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