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Health Monitoring of An Existing RC Structure Considering Seismic Analysis Using Analysis Tools Staad

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ABSTRACT

Seismic retrofitting is for the most part done to meet the seismic wellbeing prerequisites. The arranging of changes to existing structures contrasts from new arranging through a significant condition; the current development must be taken as the premise of all arranging and building activities. India is one of the most seismic tremor inclined nations on the planet and has encountered a few significant or moderate quakes during the most recent 15 years.

Around 50-60 % of the absolute region of the nation is helpless against seismic movement of changing powers. Many existing structures don't meet the seismic quality prerequisite.

In this study we are performing health monitoring on existing old structure G+2, using rebound hammer to evaluate its present strength and analyze the structure using analysis tool staad.pro.

In this study we are performing time history analysis (el-centrino) with retrofitting over weak members.

Keywords : Time history, staad.pro, Non destructive test, rebound hammer, existing structure, retrofitting, analysis.

I. INTRODUCTION

Retrofitting of constructions susceptible to earthquakes is a problem of great political and social significance. Prevention of disasters due to earthquake has become more and more important in recent years. There has been much research on the topic of retrofitting of structures in modern years. Considerations has been focused on both building and bridge structures and with the extensive damage to older structures, owners are increasingly taking action to avert similar damage to existing structures in future earthquakes. Disaster avoidance includes the reduction of seismic risk through retrofitting present buildings in order to meet seismic safety necessities. Though, no such thing as fully earthquake proof structure can exist in real, proper retrofitting method can remarkably improve the seismic performance of a structure. Mostly column failures, which include shear failure and shear cracking, have

been detected in a RC structure during the recent earthquakes.

This study shows comparative study of high-rise G+02 building R.C. frame considering seismic zone II with medium soil type Under the seismic effect (TIME HISTORY ELCENTRO) as per IS 1893(part I) - 2016analysis. A comparison of analysis of results in terms of forces, moment, displacement and cost is presented in this study

Retrofitting of the Structure

The requirement for seismic retrofitting of a current structure can emerge because of a few reasons like: building not intended to code, ensuing refreshing of code and configuration practice, resulting overhauling of seismic zone, weakening of solidarity and maturing, adjustment of existing structure, change being used of the structure, and so forth. Seismic retrofit is fundamentally applied to accomplish open wellbeing, with different degrees of structure and material survivability controlled by monetary contemplations. As of late, an expanded criticalness has been felt to reinforce the inadequate structures, as a feature of dynamic fiasco moderation, and to work out the changes that might be made to a current structure to improve the basic execution during a tremor.

The need for retrofitting in existing building can arise due to any of the following reasons:

Building not designed to code

Subsequent updating of code and design practice

Subsequent upgrading of seismic zone

Deterioration of strength and aging

Modification of existing structure

Additional loads

Change in use of the building, etc.

Rebound Hammer test is a Non-dangerous testing strategy for solid which give a helpful and fast sign of the compressive quality of the solid. The bounce back sledge is likewise called as Schmidt hammer that comprise of a spring controlled mass that slides on an unclogger inside a cylindrical lodging.

According to the Indian code Seems to be: 13311(2)-1992, the bounce back sledge decide the compressive quality of the solid by relating the bounce back list and the compressive quality with a rule that the hardness of cement and bounce back mallet perusing can be corresponded with compressive quality of cement.

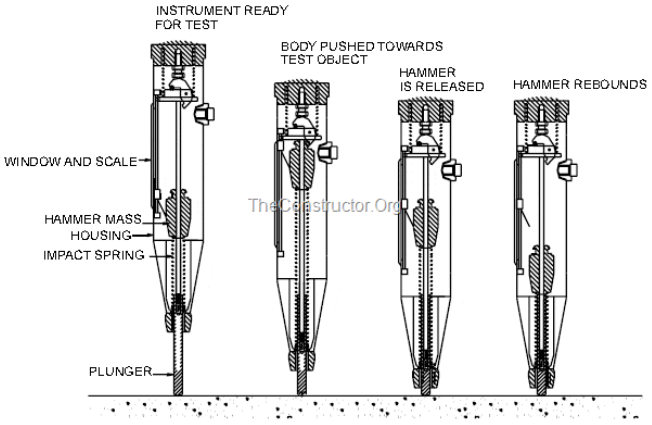

Fig 1: Rebound Hammer

II. Literature Survey

Premalatha & Lakshmipriya (2018) A diagnostic investigation on seismic retrofitting of a strengthened solid Beam-section joint was performed utilizing FEM demonstrating . The primary goal of this investigation is to expand the shear limit and burden conveying limit of the structures utilizing retrofitting procedures. In this investigation, the retrofitting was finished by jacketing techniques like carbon fiber strengthened polymer sheets (CFRP), Glass fiber fortified polymer work, Sisal filaments alongside crossed bars are completed utilizing the ANSYS Workbench. The wrapping of bar segment joint was finished by single, twofold, triple layer of CFRP, GFRP and Sisal strands with various thickness. During the examination one

finish of the segment were fixed. Cyclic stacking was applied at the free finish of the cantilever shaft in Beam-section joint and Fixed burden was applied at the highest point of the segment. The heap is applied up to a definitive burden to get the weakness disappointment. This report examines about the exhibition of the retrofitted shaft section joint; and was contrasted and the ordinary example.

Tsige and Zekaria (2018) dissected an office medium ascent working for seismic tremor power by thinking about three kind of auxiliary framework. for example Exposed Frame framework, in part infilled and completely Infilled outline framework. Viability of workmanship divider has been was examined with the assistance of five unique models. Infills were displayed utilizing the identical swagger methodology. Nonlinear static examinations for sidelong loads were performed by utilizing standard bundle ETABS, 2015 programming. The examination of these models for various quake reaction parameters like base shear versus rooftop removal, Story uprooting, Story shear and part powers are completed, discovered that the seismic interest in the exposed casing is significantly more when infill solidness isn't taken with bigger relocations. It has been inferred that completely infilled outline is around 15% more contrasted with uncovered edge model; outline with 25% brick work divider diminished is almost 10% more contrasted with the exposed edge; outline with half of the workmanship divider diminished is about 8% more contrasted with the exposed casing and casing with 75% of the stone work divider diminished is about 5% more contrasted with the exposed casing. This is on the grounds that the exposed casing models don't account the firmness rendered by the infill board, it gives essentially longer timeframe.

Tarek et. al. (2017) have reinforced and tried the 3 pillars with GFRP and two with CFRP composites utilizing epoxy tars and results were contrasted and a control shaft. 1 and 2 layers of 1mm CFRP and 1, 2 and 4 quantities of layers of 1.3mm GFRP were utilized for fortifying pillars remotely. All bars were strengthened with 3-10mm width bars at pressure zone and 1-6mm breadth bar at pressure zone and 2 legged 8mm distance across stirrups at 100mm c/c. The conditions created depend on ACI code for minute limit of reinforced bars, thickness of FRP is hypothetically confirmed with test esteems. Two point loads with separating 200mm were applied for the test. All pillars bombed by solid smashing at pressure zone. It was resolved that the flexural quality of reinforced pillars utilizing FRP covers at strain zone, more than that of control shaft.

Problem Identification:

Authors in past perform analysis of a old RCC structure but none of them describe its present strength and after retrofitting strength using analysis tool. The numerous analysis was done on experimental setup but here we are going to perform analysis of a case study which is approx. 35 year old RCC structure.

For modelling and designing we are considering staad.pro analysis tool also considering seismic load as per I.S. 1893-I:2016.

Aim of the study:

The primary aim of the study is to perform health monitoring of an old structure and increase its design life using retrofitting technique.

Structural and their connections shall be demonstrated by analysis or by a combination of analysis and testing to provide a reliability not less than that expected for similar components designed in accordance with the Strength Procedures when subject to the influence of dead, live, environmental and other loads. Consideration shall be given to uncertainties in loading and resistance.

III. Objectives

These following are the primary objective of our research work:

- 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 perform Non-linear (Time history analysis) over an strengthened old structure.
- To determine the cost of retrofitting as per SOR (CPWD).

IV. Methodology

Analysis of building with given dimensions has been considered for the parametric analysis of critical load position as per superimposed loading standard which are analyses with the help of staad pro software. Proposed steps are as followings:

Step 1: Selection of the geometry of superstructure by using coordinate system in STAAD Pro or plot over the AUTO CAD, which can be import in Staad-Pro as per dimension of beams, c/c distance of columns, expansion to expansion distance and no. of diaphragm etc. Schematicsketch of the superstructure.

Step 2: building as per existing strength is modelled and one model with retrofitting is prepared of same dimension and same loadings as per Indian standards. finite element modeling of the model considering the above parameters.

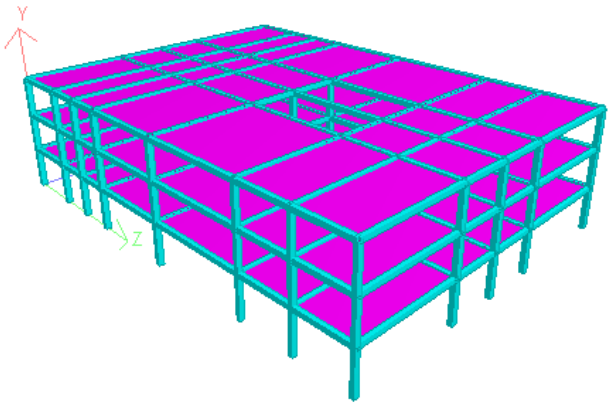

Fig 2: Existing Structure

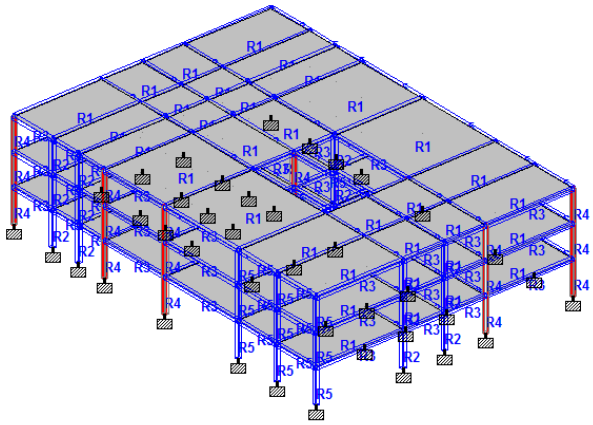

Fig 3: Building after Retrofitting (Steel Casing)

Step 3: Computation of existing culvert strength by N.D.T. rebound hammer method to determine its present condition.

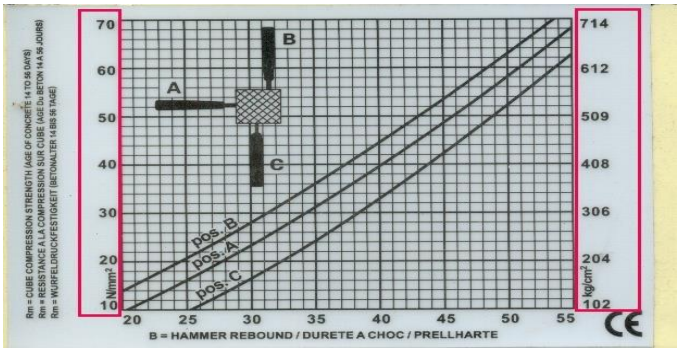

Fig 4: NDT Strength Graph

Step 5: After apply the support condition, now the next step to be considered for the Dead Load of the superstructure i.e. “self weight”.

Step 6: After apply the Dead Load, now the next step to be considered for the **Superimposed load**.

Step-7 Selection of Seismic zones (Zone II) and medium type soil as per IS- 1893(part I) -2016.

Step-8 load combination as per 875-part-V

Step-9 Analysis of building frames considering Time history Analysis (ELCENTRO CASE) method for seismic forces in X & Z direction and gravity load as shown in figure below.

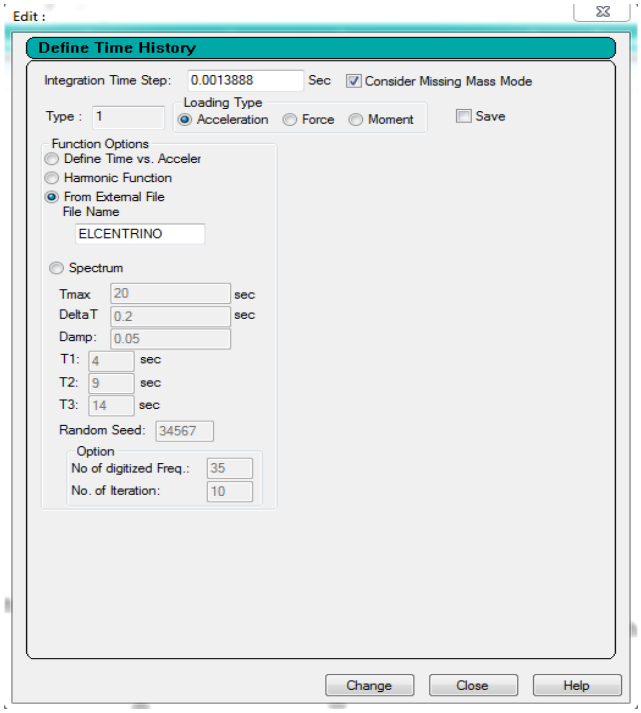

Fig 5: Assigning El-centrino (time history)

Step-10 Designing structures as per I.S.456:2000 to determine the amount of reinforcement required in both the cases.

Step-11 Cost analysis of material quantity i.e. concrete in cubic meter and reinforcement in kilo newton using S.O.R. M.P.P.W.D. 2014.

Step 12: After applied all the boundary condition and forces, now the model has to be "Analyze" for getting the results i.e. Axial force, shear force, deflection and support reactions etc.

Table 1: Description of existing structure

S. No.	Description	Value
1	Area of building	
2	Length	24 m
3	Breadth	17 m
4	Storey height	3.5 m
5	Height of the column below plinth level	1.5 m
6	Size of the column	300 mm x 300 mm
7 (a)	Size of beam for 5m span	200 mm x 500 mm
7 (b)	Size of beam for 4m span	200 mm x 500 mm
8	Thickness of slab	150 mm
9	Thickness of outer walls	200 mm
10	Thickness of inner walls	100 mm
11	Support condition	fixed

V. Analysis Result

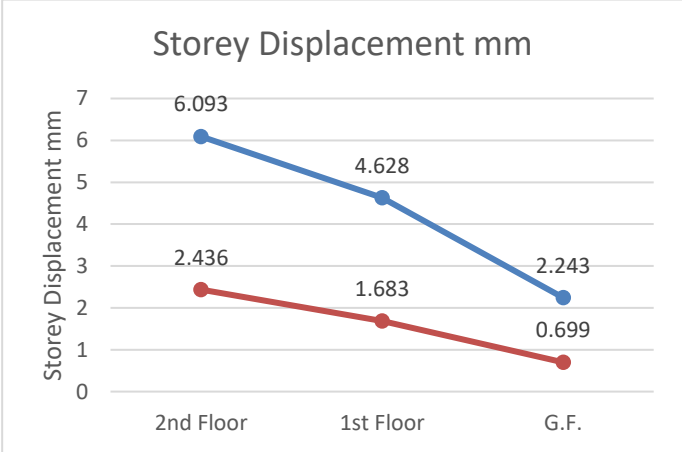

Fig 6: Displacement (mm)

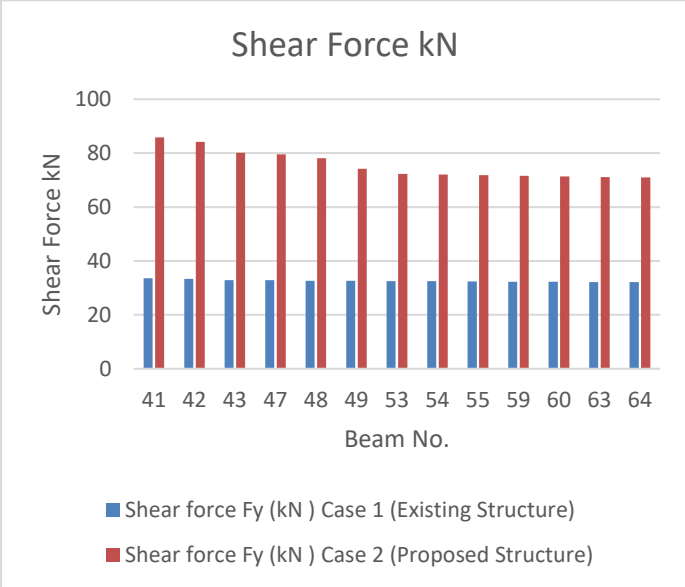

Fig 7 : Shear Force KN

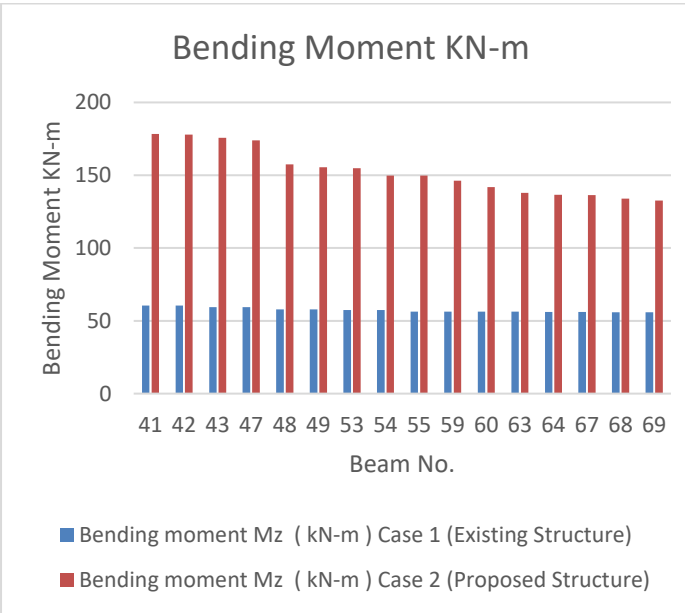

Fig 8 : Bending Moment kN-m

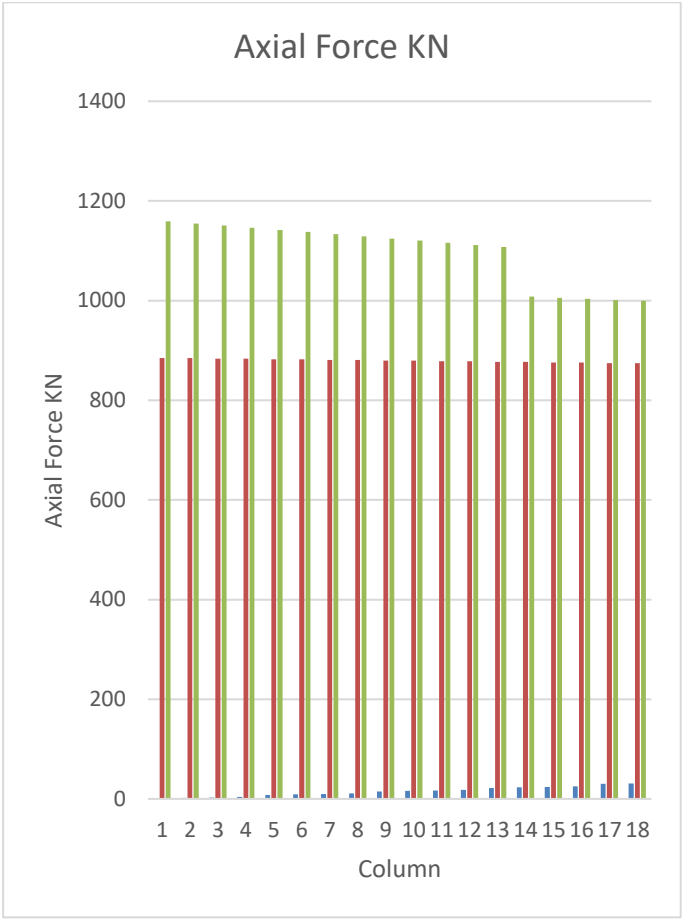

Fig 9: Axial Force kN

Table 2: Cost Analysis

Material	S.O.R. Rate	Quantity kg	Total Rate
Steel Casing	40 / kg	35953	14,38,120/-
Concrete	5091 / cu. M.	30.08	1,53,137.28/-

VI. 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 84% 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.

Maximum bending moment

It is seen in section 5 that with retrofitting method bending moment in bar and segments are increased by 33.9%.

Maximum shear force.

It is seen in chapter 5 that with retrofitting method shear force in bar and segments are increased by 39.186%.

Maximum axial force

An axial force constrain is any power that explicitly follows up on the centre turn of an inquiry. These powers are regularly expanding power or weight compel, dependent upon heading. Additionally, when the power stack is even over the edge's geometric centre, it is concentric, and when it is uneven, it is strange. Here outcomes demonstrate that pivotal powers are dispersing equitably.

Maximum Storey displacement.

It is observed that after retrofitting of the sectional members with steel casing, storey displacemet has been reduced to 39.98 % which is in its permissible limit. Hence structure is now stable and stiff to bear and distribute load.

VII. CONCLUSION

Researchers determine the use of project management software in construction work but none of them analyzed or compare the project with past scheduled project of same aspect. • Authors determine the use of project management software in resource allocation but none of them determine the levelling of resources. • In past researches author's determine that risk analysis is possible but none of them shows any factors to minimize risk analysis and not even determine the losses occurs due to it.

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