



REVIEW ON ANALYSIS AND DESIGN OF G+4 RESIDENTIAL BUILDING

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Abstract: Today, in our environment, it can be seen that land has become scarce and the demand for building renovation by builders and land developers is increasing sharply. As with real estate, there is a shortage of open land and it has become very expensive to build a home on open land. So, in the current scenario, builders are renovating old houses by modifying them according to customer requirements. This document has attempted to analyze and design the existing structure for the change proposed by Architect according to the client's requirements. The analysis and design are carried out according to I.S. 456:2000 with STAAD Pro. Two existing buildings with floors G+1 and G+4 is analyzed and planned. Among these, the first structure is an existing structure and the second is a continuous structure. After analyzing and designing the building, the techniques needed to strengthen the structure were proposed.

Keywords—*Seismic Retrofitting; Seismic Force; Flexibility; Stiffness; Ductility; Unity of Structure; Critical Point*

Introduction

Generally, withinside the seismic layout of everyday middle/high-upward push buildings, structural traits are saved uniform in a constructing with a view to keep away from harm attention to sure stories. However, it's far extraordinarily hard to include a structural layout suitable for the traits of every feature correctly in widespread for the multifunctional constructing. For a base-remoted shape able to decreasing seismic pressure to a constructing, the diploma of freedom withinside the structural layout of a top constructing receives really high. For the base-remoted shape, however, a seismic isolation device is frequently mounted on the lowest tale to save you seismic enter from getting into a constructing directly. This is likewise due to the fact movable components aside from base-isolation substances are minimized with the aid of using decreasing plumbing crossing the seismic isolation tale and stopping the elevator shaft from passing throughout the seismic isolation tale deformed in large part withinside the horizontal direction. For an everyday base remoted shape, therefore, the clearance required among the constructing and its peripheral floor constitutes a remarkable limit at the concord and continuity among the environment and the constructing at the floor level. This has a primary effect on constructing plans below the existing condition.

This paper describes an instance of the layout of a multifunctional 4-storied constructing which include apartments, workplace rooms, stores and parking masses in which a seismic isolation device is mounted at the middle-tale. Structure evaluation involves figuring out inner forces which includes axial, bending moment, shear pressure, and so forth withinside the aspect member for which the member is to be built below load action. The manner of figuring out the safe, durable, and less expensive specs of a shape, which include substances, geometry, and the scale of structural individuals ok to guide the burden of the shape over its existence time, is referred to as layout. The intention of layout is to set up an appropriate threat that the constructing below attention will function correctly over its deliberate existence.

Hueste. M. et. al. tested the seismic overall performance of a five-tale bolstered concrete body shape. The number one structural reactions had been anticipated utilizing artificial floor motion facts together with nonlinear static and dynamic evaluation. The seismic overall performance of the case observe shape turned into assessed the use of the FEMA 356 criteria. A flat slab and perimeter moment-resisting frames with spandrel beams make up the shape's ground gadget. ACI 318-83, the American Concrete Institute (ACI) Building Code Requirements for Reinforced Concrete, is used to layout the structural members. ZEUS-NL, a finite detail structural evaluation device designed for nonlinear dynamic, traditional and adaptive push-over, and eigenvalue evaluation, turned into used withinside the observe. A -dimensional analytical version turned into used, that is suitable for the case observe constructing's common ground plan. Since the contextual evaluation constructing would not fulfill the FEMA 356 essential safety targets for the Memphis developments, 3 seismic retrofit processes had been applied to paintings on seismic execution: shear dividers, RC phase coats, and remotely bonded metal plates to restrict the plastic hinge regions. The retrofits growth universal seismic overall performance, in keeping with the observe. Further change of the retrofit schemes is needed to absolutely meet the FEMA 356 member-stage criteria.

Polak.M. offers an experimental and analytical observe on a way to supply bolstered concrete slab column connectors appropriate ductility and rotational ability. The have an effect on of transverse reinforcement at the rotational ability of slab-column connections is the focal point of this paper. To hit upon both punching or flexural failure modes of slabs without or with shear reinforcement, a finite detail technique primarily based totally on layered shell factors is used. Punching shear or well-known longitudinal reinforcement yielding are approaches for a bolstered concrete slab-column connection to attain its height load. After accomplishing a height load similar to well-known yielding of in-aircraft reinforcement, a flat slab in loss of a shear reinforcement failing in flexure will nonetheless be ductile. However, after the reinforcement on the slab column connection has yielded, the connection's rotations and flexural cracks decrease the concrete's shear ability, that can in the end cause a punching failure. The aim of the test turned into to look how powerful shear reinforcement is at strengthening slab-column connections, with a focal point on shear bolt overall performance for retrofitting present slabs. All of the specimens had been full-scale and represented elements of a slab-column non-stop gadget, which turned into described through the contraflexure strains surrounding the column. The factors have to account for shear deformations on the way to deal with transverse shear issues of the shape, and this observe makes use of shell finite factors primarily based totally on principles much like Mindlin idea for plates to do so. Finally, the overall performance of shear bolts, a singular kind of shear reinforcement evolved for retrofitting present slabs in homes, turned into highlighted. Shear bolt shear reinforcement in flat RC slabs can drastically enhance the connections' power and ductility.

Silva. M. A. L et. al. investigated using CFRP (Carbon fiber bolstered polymer) outside strengthening as a non-negative technique to enhance the punched shear ability of considerably broken slab column connections. The impact of making use of multi-layered CFRP with trade bond preparations on the shear vital region, in addition to using quit anchorage at the outside CFRP strengthening scheme, had been investigated to similarly broaden the punching shear ability. For this observe, a complete of twenty-six fairly broken flat slab-column connections had been prepared. The Rebound Hammer technique turned into used to decide compressive power. The specimens had been sincerely supported through 4 I phase and subjected to a temporary factor load thru the center stub column till they failed. An in-situ chip mixture concrete aggregate turned into used to repair the previous, broken concrete. After 28 days of cure, the repaired specimens had been reinforced making use of the CFRP outside strengthening approach. Using a hydraulic jack with a 500 kN ability, a factor loads of 0.5 kN/mm turned into carried out thru the stub column specimen. End anchoring on CFRP can assist save you CFRP fortifying plans from flopping upfront because of debonding. There are forms of quit anchorage structures depending on how the anchor is carried out to the web website hosting body: negative quit anchorage and nondamaging quit anchorage. ABAQUS, a commercially to be had software program, turned into used to create a numerical version. The Concrete Damage Plasticity Model (CDPM) turned into used to assign fabric functions in view that it could outline harm traits in anxiety and compression in addition to complete inelastic behavior. The use of unidirectional externally bonded CFRP to reinforce the flexural reinforcement ratio turned into determined to be an green approach to enhance the punched shear ability even

as enhancing the flexural ability of flat slabs. End anchors growth pressure distribution even as reducing pressure localization. The radial placement of CFRP at the anxiety face of a slab's shear vital place should enhance the flat slab's punched shear ability.

Das. S et al. have mentioned as architects grow to be extra willing to create beamless systems for classy reasons, the prevention of lateral loading and seismic strengthening of flat slab, ribbed slab, and waffle slab systems has grown to be an crucial need. This research technique turned into applied to steer constructing reliability exams withinside the United States, and the observe determined that flat slab homes constructed earlier than the Sixties may maintain excessive harm at some stage in moderate-depth earthquakes. For concrete body layout in Bangladesh, flat slab layout follows ACI code 318-99. Article 6.5 of the National Building Code specifies the unified layout of flat slabs, flat plates, and area supported slabs. The hazard of punched failure of connections and the opportunity for crumble have to be investigated first on the way to set up cost-green and a success retrofit opportunities for ameliorating the protection of seismically insufficient flat slab homes. Actual earthquake data, possibility evaluation, and engineering judgement can all be used to generate fragility data. To enhance lateral stiffness, shear walls, masonry infills, or a bracing gadget may be used. Pushover evaluation (a static, nonlinear method for figuring out seismic structural deformations) turned into finished on some of eight, ten, and twelve-tale homes with varieties of slabs: flat slab and beam supported slab, each of which had been constructed in keeping with BNBC 1993 and lateral loading in keeping with UBC 97. The pushover studies proved past a shadow of a doubt that beam-supported homes are pretty powerful at dealing with seismic masses on flat slabs.

Pravin S Waghmare, in this paper, one-of-a-kind jacketing strategies are mentioned. Jacketing strategies defined for strengthening of column to enhance the overall performance of R.C.C constructing. Jacketing is the maximum popularly used technique for strengthening of constructing columns. The maximum not unusual place varieties of jackets are metal jacket, bolstered concrete jacket, fiber bolstered polymer, composite jacket, jacket with excessive anxiety substances carbon fiber, glass fiber. Construction approach for metal jacketing, R.C.C jacketing, FRP jacketing are studied. Construction approach element for every jacketing is proven withinside the paper.

Bhavar Dadasaheb O Dhake Pravinchandra D, Ogaleramesh A This paper has centered on strengthening the prevailing R.C.C constructing. In this paper, an vintage R.C.C constructing is reinforced to conquer the destiny problems or inconvenience. A fitness constructing withinside the coronary heart of Nasik town is reinforced to conquer the destiny problems from the bodily and experimental research, it turned into concluded that the constructing both must be demolished or as a minimum must be retrofitted with appropriate strategies to growth is provider life.

A.K.Singh, Dr. R.S jangid, Dr. gopal l. rai, "Structural Retrofitting – a case observe", Municipal Corporation, Mumbai-2009. This paper describes the in depth retrofitting of an present RCC framed shape. The constructing is a RCC framed shape owned through a nationalized financial institution and is extra than 30 years vintage. The constructing turned into tested for its contemporary structural circumstance and to indicate the remedial measures. The approach followed turned into aiming to get better the unique overall performance, for which the broken or deteriorated part of the shape turned into to be repaired or changed with new factors or new fabric.

According to M. Navarro et al (2019), RCC slabs are the fundamental additives of excessive-upward thrust homes. However, failure in RCC slabs takes place in a brittle manner without notice, and has a tendency to interrupt as a result of punching shear. This shape of failure is hard to predict, takes place nearly instantly, and may have disastrous repercussions. To simulate the punching shear impact on bolstered bolt-retrofitted concrete flat slabs with bolts placed in 3 awesome positions across the support, ABAQUS software program is used to examine a hard and fast of non-linear numerical fashions. Following that, Adetifa and Polak's exploratory facts had been applied to do the preliminary calibration of a finite detail version. A parametric evaluation turned into then used to decide the effect of the retrofitting geometrical factors. During the check, the burden turned into transferred through the column studs till brittle punching shear failure occurred. The experimental format turned into modelled to be the polar contrary of an actual shape. As formerly stated, ABAQUS turned into used to calibrate a numerical version for finite detail evaluation (FEA).

It consists of the Concrete Damage Plasticity version, which has been demonstrated to be powerful. The ABAQUS FEM fashions had been applied to research the overall performance of diverse retrofitting schemes for RC slab-to-column connections that had been subjected to punching shear. Certain conclusions had been drawn from the parametric evaluation, inclusive of an growth in bolt-to-column and bolt-to-bolt spacing, in addition to an growth withinside the diameter and wide variety of bolts, should lessen the closing load notwithstanding growing the full transverse place for reinforcement. It is sincerely felt that the findings received have cleared the manner for destiny studies aimed toward methodically figuring out the pleasant layout parameters.

Marco Valente (2012) provides the effects of a numerical research at the seismic overall performance and retrofitting of an R/C flat-slab prototype shape. This turned into finished in a lab with the aim of figuring out the seismic behavior of a flat slab shape. The check shape's numerical fashions had been created, and dynamic and nonlinear static reviews had been executed. The Seism Struct laptop code turned into used to numerically version the full-scale R/C prototype shape. A fiber version turned into used to characterize the inelastic behavior of any member for the duration of its duration and interior its cross-phase. To fit experimental effects, powerful slab widths had been calculated and calibrated. The R/C square phase turned into applied to explain the cross-sections of the columns, even as the R/C T-phase turned into used to explain the cross-sections of the beams and slabs. It's really well worth noting that. Nonlinear dynamic research had been used to numerically mimic the pseudo-dynamic exams executed at the prototype shape on the JRC ELSA Laboratory. The version can decide the most glide at the second one stage primarily based totally at the glide profiles. In phrases of shear force, an appropriate settlement is confirmed. In these paintings, capacity retrofitting techniques for growing the seismic overall performance of the R/C prototype shape had been investigated. The shape's columns had a power and stiffness intervention making use of R/C jacketing. In order to permit the shape to undergo sizeable seismic activities, a 2d retrofitting technique using fiber-bolstered polymer (FRP) laminates turned into placed forward. For the seismic improve of the R/C shape, those retrofitting remedies centered at improving column power or ductility had been simulated and investigated. The R/C jackets drastically better the tension and power of the shape, as a result reducing the displacement of the shape, in keeping with the numerical modelling of the primary counseled retrofitting approach, which turned into now no longer experimentally tested on the JRC ELSA Laboratory. The FRP retrofitting of columns boosted the nearby ductility ability of column quit sections simply because the shape's universal ductility ability. The demand-to-ability ratio values for the columns of the FRP retrofitted shape had been drastically reduced. However, primarily based totally at the foregoing observations, the shape has to be included with different structural factors to offer an awful lot extra lateral stiffness, inclusive of structural walls, braces, or stiff frames, withinside the occasion of excessive seismic actions.

Methodology



1:100 PLAN SHOWING COLUMN POSITIONS

APPLICATION OF LOADS:

The various load applied on the geometric model in STAAD Pro is illustrated in table no:1

LOAD CALCULATION:

Table No: 1 various load applied on the geometric model in STAAD Pro

Load calculation**1.DEAD LOAD****WALL LOAD**

Wall Thickness	Floor Ht. (m)	Density kN/cum	Load Intensity (kN/m)	Applied Load Intensity in StaadModel kN/m	Wall Type	Reference
B/D(m)	H	Y				
0.15	2.7	18	7.29	7.5	Main Wall	IS 875 Part I - 1987
0.12	2.7	18	5.832	6	Internal Wall	IS 875 Part I - 1987
0.115	1	18	2.07	2.1	Parapet Wall	IS 875 Part I - 1987

FLOOR LOAD DUE TO SLAB and ROOF

Loading Type	Thickness (m)	Density kN/cum	Actual Load	Applied Load Intensity in Staad	Reference
Slab Load	0.125	25	3.125		IS 875 Part - I - 1987
Floor Finish			0.5	3.7	
			3.625		

2. LIVE LOAD**LIVE LOAD AT ROOF LEVEL**

Loading Type	Slab Type	Load Intensity (kN/sqm)	Applied Load Intensity in Staad Model	Reference
Live Load	Roof	2.5	2.5	IS 875 Part - II - 1987

3. STAIRCASE LOAD

Riser(m)	Tread(m)	Depth(m)	Density (KN/cum)	Dead Load(KN/m)	Live Load (KN/m)	Floor Finish (KN/m)
0.15	0.3	0.125	25	3.49385	3	0.48
					Wt. of steps	Total Applied Load
					1.875	9

DEAD LOAD:

Dead load consists of the permanent construction material loads compressing the roof, floor, wall, and foundation system including claddings, finishes, fixed equipment. Dead load is the total load of the component of the building that generally does not change over time. In STAAD Pro assignment of load is automatically done by giving the property of member. The dead load of different floors.

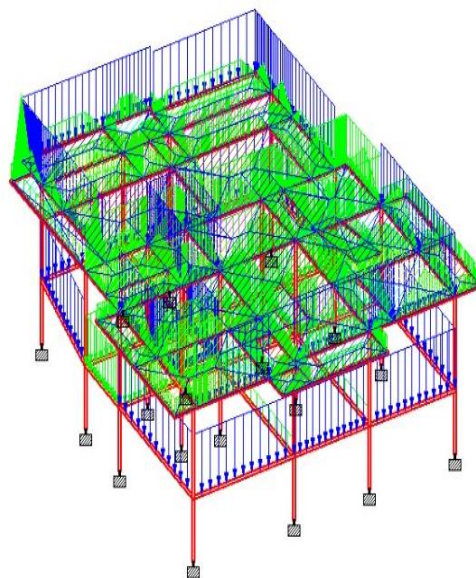


Fig. Dead load (G+1) of ongoing building

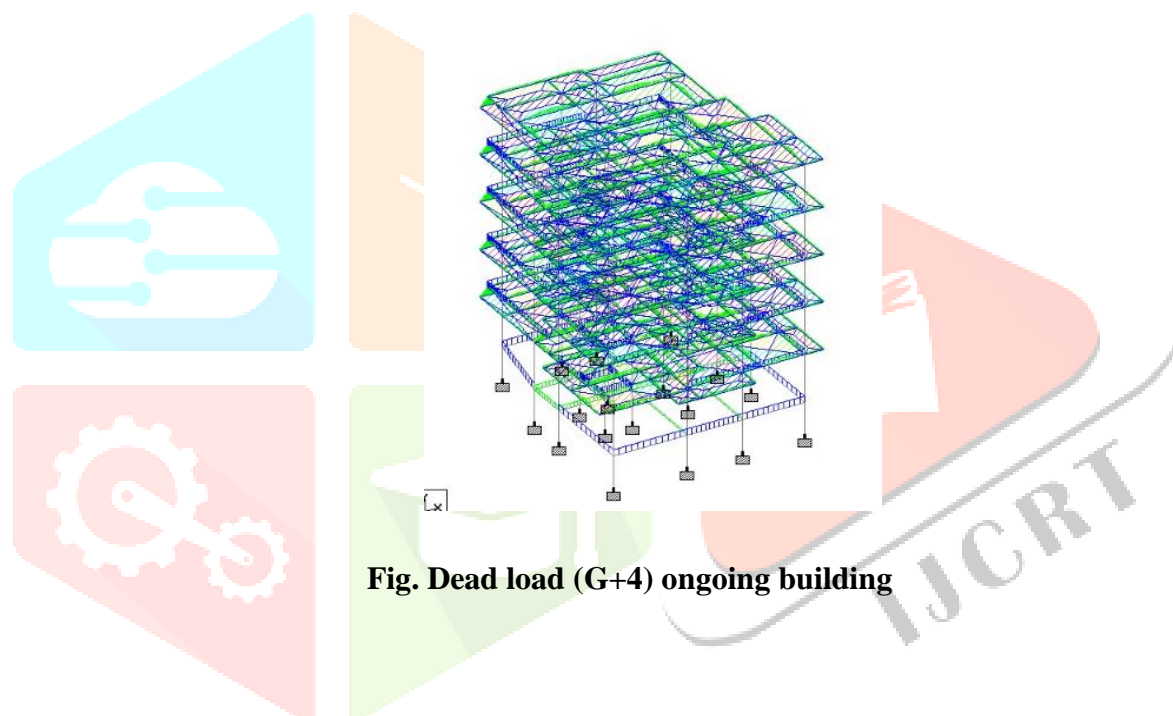


Fig. Dead load (G+4) ongoing building

Conclusion

From the existing building it could be concluded that right evaluation and layout must be executed as in keeping with IS-code provision. It is obvious that we must have extra statistics from the web page due to the fact withinside the absence of statistics the precise evaluation of shape could be difficult. The structural elements of building are safe in flexure and shear. Quantity of steel provided for building is economical and adequate. Proposed sizes of structural elements can be used in building as it is. The design of beam, slab, column, footing and stair case are safe in deflection, bending, shear and other aspects. On comparison of the manual design and geometrical model using STAAD Pro, the area of steel required for beam, column, footing, slab, staircase is comparatively similar to that of the requirement.

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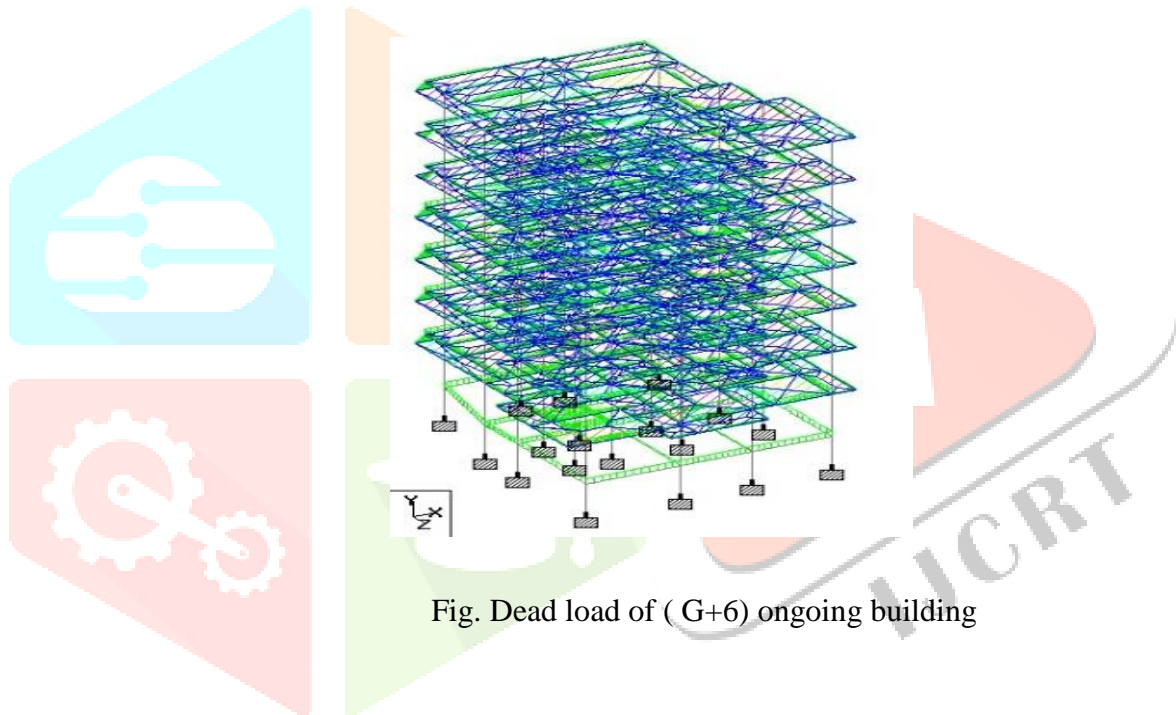


Fig. Dead load of (G+6) ongoing building