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SEISMIC ANALYSIS & FRP JACKETING OF 4-STOREY BUILDING

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ABSTRACT

In the recent past, India has seen mass destruction due o failure of structures hit by earthquakes and consequently, lost a lot of lives. Hence, it is of utmost importance hat attention be given o he evaluation of the adequacy of strength in framed RC structures o resist strong ground motions. In his project, a 50-year old four storey reinforced concrete structure has been considered, which lies in Zone IV according o IS 1893:2000 classification of seismic zones in India. For non-structural members masonry infill has been assumed. In he Equivalent Static Method of analysis, the seismic load acting on the structure is assumed o be an equivalent static horizontal force applied o individual frames. he otal force applied shall be equal o he product of the acceleration response spectrum and he seismic weight. It is used only for low o high rise buildings without significant coupled lateral-torsional modes. the structure is designed in STAAD.Pro v8i, considering M15 concrete and Fe415 steel reinforcement for with and without earthquake loading conditions. he demands moments and shear have been noted down from the software analysis and compared o he capacities of he given section. FRP jacketing is he most appropriate method of retrofitting he failing members in he given 4-storey RC structure. the norms stated in ACI 440-2R.02 have been followed o calculate and suggest he method and scheme of application of FRPs o he member and also, he number of plies o be used. Hereafter, an analysis has been done on he amounts of efficiency achieved in dealing with the deficiency in he members. He FRP strengthening system has been checked for serviceability as well as creep-rupture limits since he entire modelling, analysis and design for the structure has been done using limit state design.

INTRODUCTION

1.1. General

Numerous urban multi-story structures in India today have open first story as an unavoidable element. This is essentially being received to suit stopping or gathering halls in the principal story. Though the complete seismic base shear as experienced by a structure during a quake is reliant on its normal period, the seismic power dispersion is subject to the circulation of firmness and mass along the tallness.

The conduct of a structure during seismic tremors depends basically on its general shape, size and geometry, notwithstanding how the quake powers are conveyed to the ground. The tremor powers created at various floor levels in a structure should be brought down along the tallness to the ground by the most limited way; any deviation or intermittence in this heap move way results in horrible showing of the structure. Structures with vertical mishaps (like the inn structures with a couple of stories more extensive than the rest) cause an abrupt hop in quake powers at the dimension of intermittence. Structures that have less segments or dividers in a specific story or with abnormally tall story will in general harm or breakdown which is started in that story. Numerous structures with an open ground story proposed for stopping crumbled or were seriously harmed in Gujarat during the 2001 Bhuj quake. Structures with segments that hang or buoy on pillars at a middle of the road story and don't go right to the establishment, have discontinuities in the heap move way.

1.2 Proposed Work and Objective

My exploration task goes for doing seismic assessment for the structure.

The organization principle building is as of now the most unmistakable structure in the foundation region. Be that as it may, since it was built somewhere in the range of 50 years sooner, it wasn't intended to withstand tremors. A postulation done before uncovers that the structure will constantly bomb when exposed to quake loads. A proposition done before utilizing Equivalent Static Method uncovers that the structure will constantly bomb when exposed to seismic tremor loads. The Demand Capacity Ratio (DCR) was determined for bars and sections, just in the main story. An enormous number of shafts and segments were found to flop under flexural limit. In any case, the majority of these individuals were found to go in shear.
Thinking about the above outcomes, my goal is to-
i. Analyse the seismic presentation of the structure as per the plan created by STAAD.Pro v8i

LITERATURE REVIEW

Current writing study incorporates tremor reaction of multi story building outlines with common segments. A portion of the written works stressed on reinforcing of the current structures in seismic inclined districts. To assemble different sorts of work on seismic investigation of skyscraper structures and expanding parallel solidness of the framework different papers, postulation and research articles were considered altogether and alluded.

Maison and Neuss [15], (1984), Individuals from ASCE have played out the PC investigation of a current forty-four story steel outline tall structure to examine the impact of different demonstrating angles on the anticipated unique properties and registered seismic reaction practices. The anticipated powerful properties are contrasted with the structure's actual properties as recently decided from exploratory testing. The seismic reaction practices are figured utilizing the reaction range (New imprint and ATC spectra) and proportionate static burden techniques.

Also, Maison and Ventura [16], (1991), Individuals from ASCE have played out the PC investigation of a current forty-four story steel outline tall structure to examine the impact of different demonstrating angles on the anticipated unique properties and registered seismic reaction practices. The anticipated powerful properties are contrasted with the structure's actual properties as recently decided from exploratory testing. The seismic reaction practices are figured utilizing the reaction range (New imprint and ATC spectra) and proportionate static burden techniques.

Ferhi and Truman (1996) decided seismic reaction of structure frameworks with the nearness of firmness and quality whimsy. Both flexible and inelastic seismic conducts were examined. From logical investigation of the structure frameworks it was seen that the seismic reaction indicated more noteworthy reliance on solidness unpredictability in versatile range. Notwithstanding, the impact of solidarity erraticism on seismic reaction was seen to be in the inelastic range.

Awkar and Lui [3], (1997) considered reactions of multi-story adaptably associated edges exposed to quake excitations utilizing a PC model. The model joins association adaptability just as geometrical and material nonlinearities in the investigations and reasoned that the examination shows that association adaptability will in general increment upper stories between story floats however diminish base shears and base upsetting minutes for multi-story outlines.

De-La-Colina (1999) studied the effects of torsion on simple torsionally unbalanced building systems considering the earthquake components in two perpendicular directions. The effects of following parameters were studied,
(a) Seismic force reduction factor,
(b) Design eccentricity,
(c) Natural time period.
The basic model utilized for the expository investigation is appeared in Figure 1.28. In view of the aftereffects of diagnostic examination it was inferred that, with increment in the power decrease factor, the pliability request diminished for adaptable component. As to impact of timespan it was

discovered that for torsionally unequal hardened components the pliability request expanded with timeframe and the other way around for torsionally lopsided adaptable components. The expansion in estimation of solidness erraticisms diminished the standardized pliability request. In light of these outcomes it was inferred that qualityterraticism had more noteworthy impact on seismic reaction when contrasted with firmness unusualness.

2.3.STAAD.Pro

STAAD.Pro is the auxiliary building proficient's decision for steel, solid, timber, aluminum, and cold-framed steel structure of for all intents and purposes any structure including ducts, petrochemical plants, burrows, scaffolds, heaps, and considerably more through its adaptable displaying condition, propelled highlights, and familiar information coordinated effort.

STAAD.Pro enables auxiliary architects to break down and plan for all intents and purposes any sort of structure through its adaptable demonstrating condition, propelled highlights and familiar information coordinated effort [9].
Adaptable demonstrating is given by a best in class graphical condition and the structure underpins more than 70 worldwide codes and more than 20 U.S. codes in 7 dialects.

A variety of cutting-edge auxiliary examination and configuration highlights are incorporated, for example, atomic accreditation for 10CFR Part 50, 10CFR 21, ASME NQA-1-2000, time history and push over investigation and link (straight and non-direct) investigation.

3.THEORY AND FORMULATION

3.1 Theory

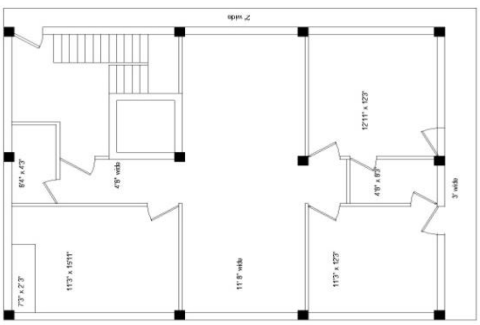
3.2. Methodology

3.2.1. Geometry and Section specification

The structure is an under-development building situated in Roorkee. This is to be utilized for private reason as it were. There the estimation has been taken from structure. At that point the arrangement is drawn utilizing AutoCAD Software. This is a G+3 structure. The size of structure is 42' x 31'. The stature of the structure is 40 ft and each floor is of 10 ft. Figure 1 demonstrates the Plan of the structure at Ground Floor. Figure 2 demonstrates the Plan of the structure at first floor. Figure 3 demonstrates the Plan of the structure at second floor. Figure 4 demonstrates the Plan of the structure at third floor. There are 3 room on each on second and third floor.

Figure 1- Plan of building on ground floor

Figure 2 - Plan of building at 1st floor



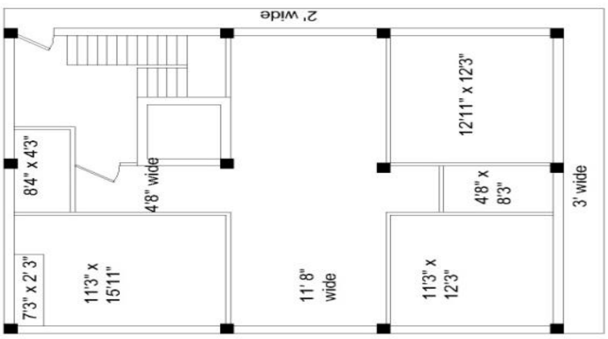
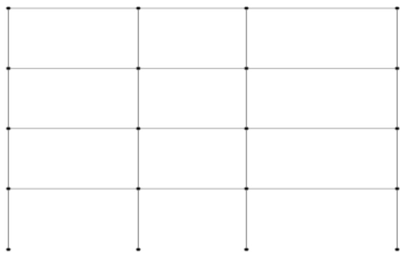


Figure 1 - Plan of building at 2nd floor

Figure 2 - Plan of building at 3rd floor



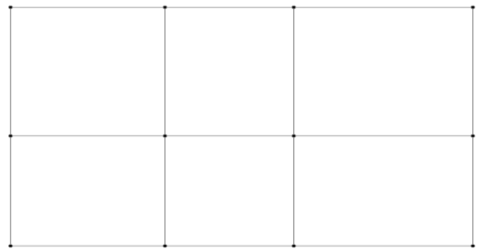


Figure 3 - Elevation view of structure in Staad.Pro **Figure 4 - Plan view of structure in in Staad.Pro**

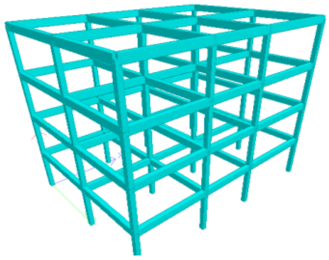


Figure 5 - 3D rendered view of the geometry

The width of the building is 30 ft which have two opposite room. Each room have the width of the 15 ft. Figure 3.4 shows the plan view of the building of beam arrangement. So length of beam in this structure is 12 ft along the length and 12 ft along the width of the structure.
Section of the beam = 0.23 m X 0.45 m
Section of column = 0.23 m X 0.23 m

3.2.2. Load Calculation

3.2.2.1. Dead load IS 875: Part 1:1987 arrangements with dead loads to be expected in the plan of structures and same is given as unit weight of materials. The unit weight of different materials that are probably going to be put away in a structure are additionally included with the end goal of burden figurings due to put away materials,

A structure needs to perform numerous capacities acceptably. Among these capacities are the utility of the structure for the expected use and inhabitance, Structural security, fire wellbeing; and consistence with clean. Sanitation, ventilation and sunlight norms. The structure of the structure is reliant upon the base necessities recommended for every one of the above capacities. The base prerequisites relating to the basic security of structures are being shrouded in this code by method for setting down least plan loads which must be accepted for dead loads, forced burdens, snow loads and other outside burdens, the structure would be required to manage.

Exacting adjustment to stacking principles suggested in this code, it is trusted won't just guarantee the auxiliary security of the structures which are being planned and built in the nation and along these lines lessen the dangers to life and property brought about by risky structures, yet in addition dispose of the wastage brought about by expecting pointlessly overwhelming loadings.

Material: Concrete
Strength: 25 N/mm^2.
Density: 14 KN/m^3
Material: Steel
Strength: 415N/mm^2.

Material: RCC
Density: 25 KN/m^3
Material: Brick
Density: 20 KN/m^3

DEAD LOAD DUE TO BEAM

There, the beam has been modelled in STAAD Pro. So there self-weight is to be used to calculate the load and reaction on structure. So no calculation is required.

DEAD LOAD DUE TO COLUMN

Same as beam, the column have been modelled in STAAD Pro. So there self-weight is to be used to calculate the load and reaction on structure. So no calculation is required.

DEAD LOAD DUE TO WALL

Load of wall = Volume x Density = Length x width x Height x Density of brick

For outer wall

Length of wall =1 m (unit length)
Width of wall =0.2286 m (outer wall)
Height of wall = 3.048 m
Load of wall =1 x 0.2286 x 3.048 x 20 = 14 KN/m

For outer wall

Length of wall =1 m (unit length)
Width of wall =0.1524 m (outer wall)
Height of wall = 3.048 m
Load of wall =1 x 0.1524 x 3.048 x 20 = 9.3 KN/m

DEAD LOAD DUE TO SLAB

Load of slab = Volume x Density
= Length x width x thickness x Density of RCC
Length =1 m (unit length)
Width = 1 m (unit length)
Thickness of slab = 0.1524 m
Load of slab = 1 x 1 x 0.1524 x 25 =3.81 KN/m^2

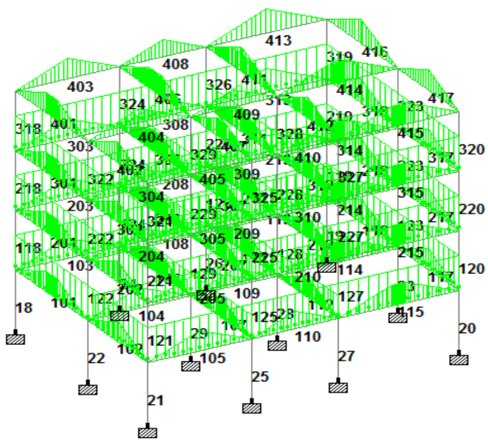


Figure 6 - Dead load on structure in Staad.Pro

3.2.2.2. **Live/Imposed load**

IS 875: Part 2:1987 arrangements with forced loads on structures delivered by the planned inhabitance or use. The structures and basic frameworks will give such basic respectability that the risks related with dynamic breakdown, for example, that because of nearby disappointment brought about by extreme over-burdens or anomalous burdens not explicitly secured in that are decreased to a dimension reliable with great building practice.

The forced burdens, determined thus, are least loads which ought to be thought about with the end goal of basic security of structures. Private Buildings - These will incorporate any structure in which resting convenience is accommodated ordinary private purposes with or without cooking or eating or the two offices (aside from structures under 2.2.5). It incorporates one multi-family homes, condos (pads), cabin or living houses, cafés, inns, quarters and private inns.

IMPOSED FLOOR LOADS FOR RESIDENTIAL OCCUPANCIES

Living rooms, bed rooms and dormitories

Load = 2 kN/m^2

Imposed Loads on Roof

Flat roof Access not provided except for maintenance

Load = 0.75 kN/m^2

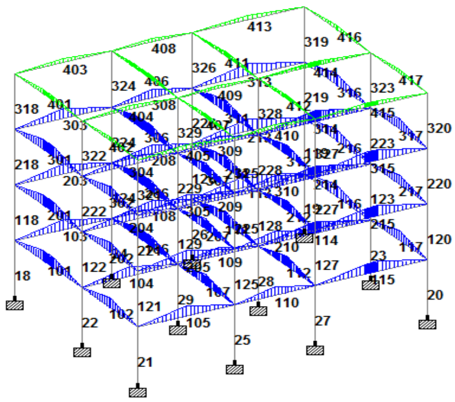


Figure 7- Live load on Structure in Staad.Pro

3.2.2.3. **SEISMIC LOAD**

IS 1893: 2002: Part 1 manages appraisal of seismic loads on different structures and tremor safe plan of structures. Its essential arrangements are appropriate to structures; raised structures; modern and stack like structures; spans; solid brick work and earth dams; banks and holding dividers and different structures.

Himalayan-Nagalushai area, Indo-GangeticPlain, Western India, Kutch and Kathiawarregions are topographically precarious pieces of the nation, and some staggering seismic tremors of the world have happened there. A noteworthy piece of the peninsular India has additionally been visited bytsolid quakes, yet these were moderately very few happening at a lot bigger time interims at any site, and had extensively lesser force.

The plan even seismic coefficient Ah for a structure will be dictated by the accompanying articulation:

$$A_h = t\frac{ZIS_a}{2Rg}$$

Z = Zone Factor is a factor to obtain the design spectrum depending on the perceived maximum seismic risk characterized by Maximum Considered Earthquake (MCE) in the zone in which the structure is located. The basic zone factors included in this standard are reasonable estimate of effective peak ground acceleration.

Location	=	Roorkee
Zone	=	IV
Seismic Intensity	=	Severe
Z	=	0.24

I =Importance factor is a factor used to obtain the design seismic force depending on the functional use of the structure, characterised by hazardous consequences of its failure, its post-earthquake functional need, historic value, or economic importance.

For General building I = 1.0

R = Response reduction factors the factor by which the actual base shear force, that would be generated if the structure were to remain elastic during its response to the Design Basis Earthquake

(DBE) shaking, shall be reduced to obtain the design lateral force.For Special RC moment-resisting frame (SMRF) R = 5

S_a/g =Average response acceleration coefficient is a factor denoting the acceleration response spectrum of the structure subjected to earthquake ground vibrations, and depends on natural period of vibration and damping of the structure.

Seismic Weight:-Seismic Weight of Floors The seismic load of each floor is its full dead burden in addition to suitable measure of forced burden. While figuring the seismic load of each floor, the heaviness of sections and dividers in any story will be similarly conveyed to the floors above and underneath the story.

Seismic Weight of Building The seismic load of the entire structure is the total of the seismic loads of the considerable number of floors. Any weight bolstered in the middle of stories will be conveyed to the floors above and beneath in backwards extent to its separation from the floors.

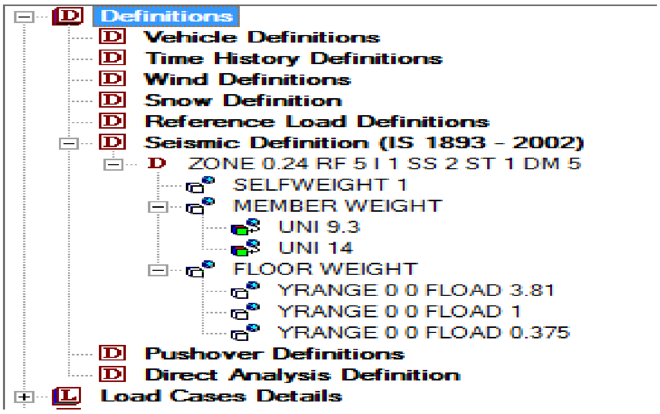
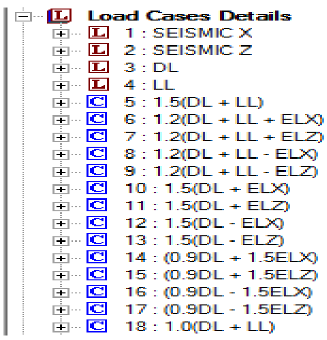


Figure 8- Seismic load defination in Staad.Pro

LOAD COMBINATION

At the point when seismic tremor powers are considered on a structure, these will be consolidated where the terms DL, IL and EL represents the reaction amounts because of dead burden, forced burden and assigned quake load individually. In the farthest point state plan of fortified and pre-focused on solid structures, the accompanying burden mixes will be represented:

1) 1.5(DL+lL)
2) 1.2(DL+IL+EL)
3) 1.5(DL+EL)
4) 0.9DL* 1.5EL



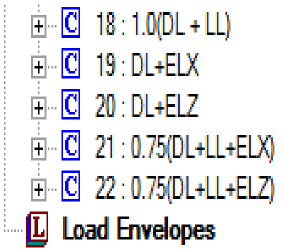


Figure 9- Load combination as per IS 1893: 2002: Part 1

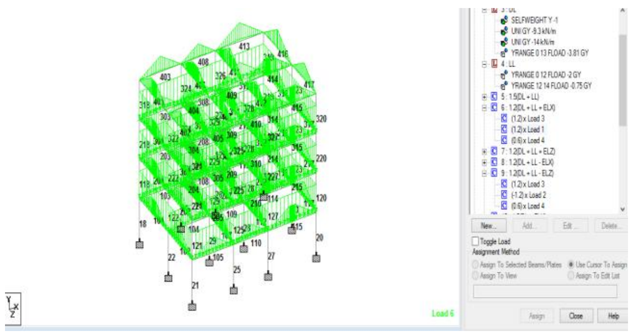


Figure 10- Load combination in Staad.Pro

RESULTS AND CONCLUSIONS

4.1 Results

4.1.1 Reinforcement for Ground Floor Column

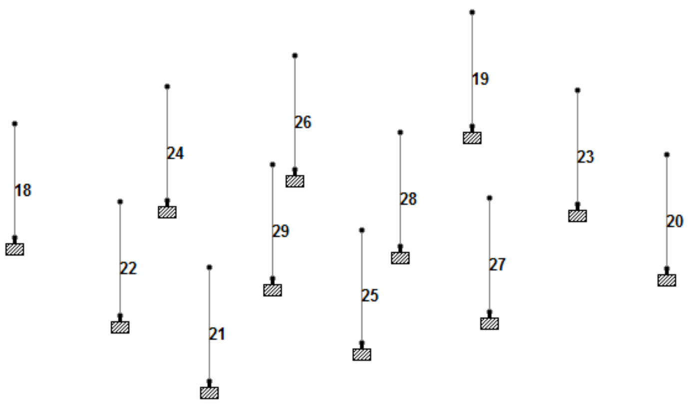


Figure 31 - Column at ground floor with Member number

Table I - Main Reinforcement in ground floor Column

Member Name	Member Number	L/C	Axial Load (KN)	Area Provided	Bar Specification
M29	18	C5	548.236	452	4T12
M30	19	C5	600.321	452	4T12
M31	20	C5	536.382	452	4T12
M32	21	C5	488.499	452	4T12
M33	22	C5	876.585	452	4T12
M34	23	C5	943.834	452	4T12

M35	24	C5	789.84	452	4T12
M36	25	C5	715.44	452	4T12
M37	26	C17	480.341	804	4T16
M38	27	C17	379.273	804	4T16
M39	28	C10	1059.466	905	4T12
M40	29	C5	1171.41	905	8T12

Table II- Shear Reinforcement in Ground Floor Column

Member Name	Member Number	L/C	Bar Size	Bar Number	Spacing
M29	18	C5	8	16	190
M30	19	C5	8	16	255
M31	20	C5	8	16	190
M32	21	C5	8	16	190
M33	22	C5	8	16	255
M34	23	C5	8	16	190
M35	24	C5	8	16	255
M36	25	C5	8	16	255
M37	26	C17	8	11	255
M38	27	C17	8	11	255
M39	28	C10	8	16	190
M40	29	C5	8	16	255

4.1.2. Reinforcement for 1st Floor Column

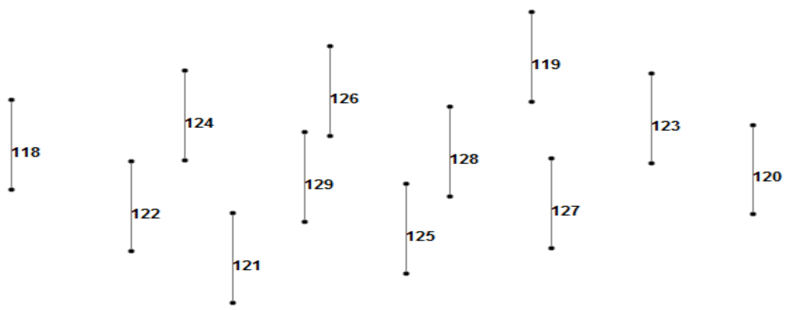


Figure 42- Column at 1st floor with Member number in Staad.Pro

Table III - Main Reinforcement in 1st floor column

Member Name	Member Number	L/C	Axial Load (KN)	Area Provided	Bar Specification
M41	118	C5	385.761	905	8T12
M42	119	C5	422.899	905	8T12
M43	120	C5	378.124	905	4T12
M44	121	C5	344.059	905	4T12
M45	122	C5	613.7	905	4T12
M46	123	C5	662.233	905	4T12
M47	124	C18	371.716	1257	4T20
M48	125	C5	504.647	1257	4T20
M49	126	C5	608.423	1257	4T20
M50	127	C5	552.303	1257	4T20

M51	128	C19	502.491	1257	4T20
M52	129	C5	830.821	1257	4T20

Table IV - Shear Reinforcement in 1st floor column

Member Name	Member Number	L/C	Bar Size	Bar Number	Spacing
M41	118	C5	8	16	255
M42	119	C5	8	16	255
M43	120	C5	8	16	255
M44	121	C5	8	16	255
M45	122	C5	8	16	255
M46	123	C5	8	16	190
M47	124	C18	8	10	190
M48	125	C5	8	10	190
M49	126	C5	8	10	255
M50	127	C5	8	10	255
M51	128	C19	8	10	255
M52	129	C5	8	10	255

4.1.3. Reinforcement for 2nd Floor Column

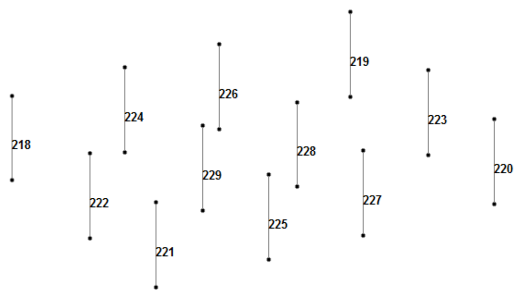


Figure 53- Column at 2nd floor in with Staad.Pro in with member number

Table V - Main Reinforcement in 2nd floor Column

Member Name	Member Number	L/C	Axial Load (KN)	Area Provided	Bar Specification
M53	218	C5	219.714	1257	4T20
M54	219	C5	241.738	1257	12T20
M55	220	C5	215.312	1257	4T20
M56	221	C5	195.253	1257	4T20
M57	222	C5	354.235	1257	4T20
M58	223	C5	384.051	1257	4T20
M59	224	C7	237.058	1257	4T20
M60	225	C5	291.026	1257	4T20
M61	226	C5	353.564	1257	4T20
M62	227	C9	233.009	1257	4T20

M63	228	C5	537.899	1257	4T20
M64	229	C5	496.699	1257	4T20

Table VI - Shear Reinforcement in in 2nd floor Column

Member Name	Member Number	L/C	Bar Size	Bar Number	Spacing
M53	218	C5	8	10	255
M54	219	C5	8	10	255
M55	220	C5	8	10	255
M56	221	C5	8	10	255
M57	222	C5	8	10	255
M58	223	C5	8	10	255
M59	224	C7	8	10	255
M60	225	C5	8	10	255
M61	226	C5	8	10	295
M62	227	C9	8	10	255
M63	228	C5	8	10	190
M64	229	C5	8	10	190

4.1.4. Reinforcement for 3rd Floor Column

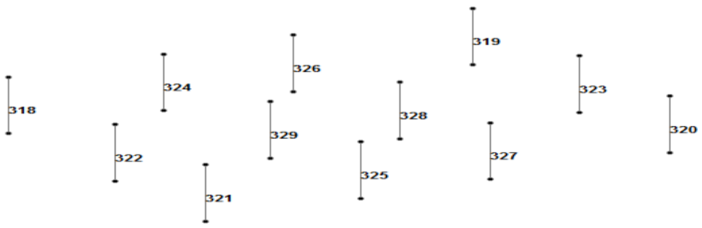


Figure 64- Column at 3rd floor in Staad.Pro with member number

Table VII - Main Reinforcement in 3rd floor column

Member Name	Member Number	L/C	Axial Load (KN)	Area Provided	Bar Specification
M65	318	C5	53.626	1257	4T20
M66	319	C5	60.414	1257	4T20
M67	320	C5	52.58	1257	4T20
M68	321	C5	46.659	1257	8T20
M69	322	C5	94.454	1257	4T20
M70	323	C5	105.579	1257	4T20
M71	324	C5	88.898	1257	4T20
M72	325	C5	76.931	1257	4T20
M73	326	C10	86.161	1257	4T20
M74	327	C5	85.19	1257	4T20
M75	328	C21	90.203	1257	4T20
M76	329	C5	163.798	1257	4T20

Table VIII - Shear Reinforcement in 3rd floor column

Member Name	Member Number	L/C	Bar Size	Bar Number	Spacing
M65	318	C5	8	10	295
M66	319	C5	8	10	295
M67	320	C5	8	10	295
M68	321	C5	8	10	190
M69	322	C5	8	10	255
M70	323	C5	8	10	255
M71	324	C5	8	10	255
M72	325	C5	8	10	190
M73	326	C10	8	10	190
M74	327	C5	8	10	255
M75	328	C21	8	10	190
M76	329	C5	8	10	190

4.1.5. Reinforcement for first floor beam

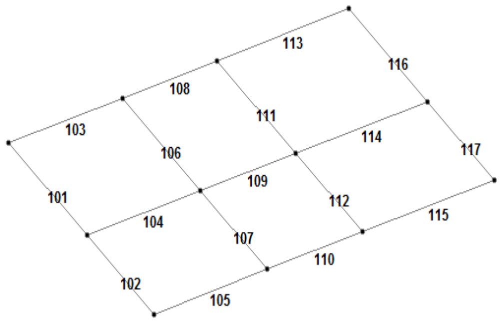


Figure 75– Beam at first floor in Staad.Pro with member number

Table IX - Main Reinforcement in 1st floor beam

Member number	Top Layer		Bottom Layer	
	Area Provided	Bar Specification	Area Provided	Bar Specification
101	603	3T16	942	3T20
102	603	3T16	942	3T20
103	603	3T16	942	3T20
104	603	3T16	942	3T20
105	603	3T16	942	3T20
106	603	3T16	942	3T20
107	603	3T16	942	3T20

108	603	3T16	942	3T20
109	402	2T16	942	3T20
110	402	2T16	942	3T20
111	402	2T16	942	3T20
112	603	3T16	942	3T20
113	603	3T16	942	3T20
114	603	3T16	942	3T20
115	603	3T16	942	3T20
116	603	3T16	942	3T20
117	603	3T16	942	3T20

Table X- Shear Reinforcement in 1st floor beam

Member Number	No of bar	Size of bar	Spacing
101	2	8	140
102	2	8	140
103	2	8	155
104	2	8	140
105	2	8	140
106	2	8	140
107	2	8	140
108	2	8	140
109	2	8	150
110	2	8	140
111	2	8	140
112	2	8	140
113	2	8	140
114	2	8	155
115	2	8	140
116	2	8	140
117	2	8	140

4.1.6. Reinforcement for 2nd Floor Beam

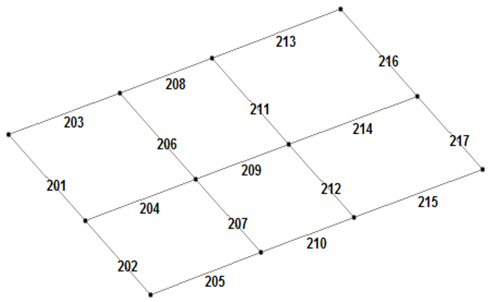


Figure 86- Beam at 2nd floor in Staad,Pro with Member number

Table XI - Main Reinforcement in 2nd floor beam

Table XII - Shear Reinforcement in 2nd floor beam

Member Number	No of bar	Size of bar	Spacing
201	2	8	140
202	2	8	140
203	2	8	140
204	2	8	140
205	2	8	160
206	2	8	140
207	2	8	140
208	2	8	140
209	2	8	150
210	2	8	140
211	2	8	140
212	2	8	140
213	2	8	140
214	2	8	145
215	2	8	140
216	2	8	140
217	2	8	190

4.1.7. Reinforcement for 3rd floor beam

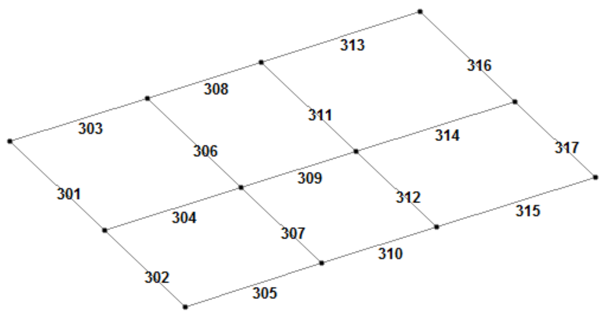


Figure 97- Beam at 3rd floor in Staad.Pro with member number

Table XIII - Main Reinforcement in 3rd floor beam

Member number	Top Layer		Bottom Layer	
	Area Provided	Bar Specification	Area Provided	Bar Specification
301	402	2T16	942	3T20
302	402	2T16	942	3T20
303	402	2T16	603	3T16
304	402	2T16	603	3T16

305	402	2T16	603	3T16
306	603	3T16	628	2T20
307	603	3T16	628	2T20
308	603	3T16	628	2T20
309	402	2T16	603	3T16
310	402	2T16	603	3T16
311	402	2T16	603	3T16
312	603	3T16	942	3T20
313	603	3T16	942	3T20
314	603	3T16	942	3T20
315	603	3T16	942	3T20
316	603	3T16	942	3T20
317	603	3T16	942	3T20

Table XIV - Shear Reinforcement in 3rd floor beam

Member Number	No of bar	Size of bar	Spacing
301	2	8	140
302	2	8	140
303	2	8	140
304	2	8	140
305	2	8	165
306	2	8	140
307	2	8	140
308	2	8	190
309	2	8	140
310	2	8	140
311	2	8	140
312	2	8	180
313	2	8	140
314	2	8	140
315	2	8	140
316	2	8	140
317	2	8	165

4.1.8. **Reinforcement for roof beam**

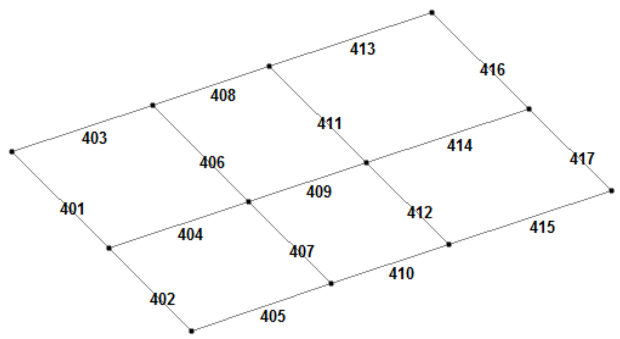


Figure 1810- Beam at Roof in Staad.Pro with member number

Table XV-Main Reinforcement in roof beam

Member number	Top Layer		Bottom Layer	
	Area Provided	Bar Specification	Area Provided	Bar Specification
401	201	4T8	201	4T8
402	201	4T8	201	4T8
403	201	4T8	201	4T8
404	201	4T8	201	4T8
405	201	4T8	201	4T8
406	314	4T10	314	4T10
407	314	4T10	314	4T10
408	314	4T10	314	4T10
409	201	4T8	201	4T8
410	201	4T8	201	4T8
411	314	4T10	402	2T16
412	314	4T10	402	2T16
413	314	4T10	402	2T16
414	314	4T10	402	2T16
415	201	4T8	226	2T12
416	201	4T8	226	2T12
417	201	4T8	226	2T12

Table XVI - Shear Reinforcement in roof beam

Member Number	No of bar	Size of bar	Spacing
401	2	8	140
402	2	8	140
403	2	8	140
404	2	8	140
405	2	8	165
406	2	8	140
407	2	8	140

408	2	8	140
409	2	8	140
410	2	8	190
411	2	8	140
412	2	8	140
413	2	8	140
414	2	8	190
415	2	8	140
416	2	8	140
417	2	8	140

CONCLUSIONS

STAAD PRO has the capacity to compute the support required for any solid area. The program contains various parameters which are planned according to May be: 456(2000). Pillars are intended for flexure, shear and torsion.

Structure for Flexure:

Most extreme drooping (making tractable worry at the base essence of the pillar) and hoarding (making malleable worry at the top face) minutes are determined for all dynamic burden cases at every one of the previously mentioned segments. Every one of these segments are intended to oppose both of these basic listing and hoarding minutes. Any place the rectangular area is deficient as independently fortified segment, doubly strengthened segment is attempted.

Structure for Shear:

Shear fortification is determined to oppose both shear powers and torsional minutes. Shear limit estimation at various areas without the shear support depends on the genuine malleable fortification given by STAAD program. Two-legged stirrups are given to deal with the parity shear powers following up on these areas.

Bar Design Output:

The default configuration yield of the bar contains flexural and shear fortification gave along the length of the shaft.

Segment Design:

Segments are intended for hub powers and biaxial minutes at the closures. All dynamic burden cases are tried to ascertain support. The stacking which yield most extreme support is known as the basic burden. Segment configuration is accomplished for square area. Square segments are structured with support disseminated on each side similarly for the segments under biaxial minutes and with fortification appropriated similarly in two countenances for areas under uni-hub minute. Every significant foundation for choosing longitudinaltand transverse support as stipulated by Seems to be: 456 have been dealt with in the segment structure of STAAD.

Scope of Future Work

In these cutting edge day's dominant part of structures are included to a compositional noteworthiness and it is beyond the realm of imagination to expect to design the normal type of structure. The contextual investigation in this postulation is determined on reaction range examination and identical static. Examination as it will be inadequate to pick up the information of direct conduct of the structure and thus to a lot of research in non-straight static investigation for example push over examination and non-direct powerful investigation is engaged.

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