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PLANNING AND DESIGN OF THE MAIN BUILDING OF FIVE STAR HOTEL USING STAAD PRO

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ABSTRACT

The commercial enterprise and visitor place prospering in Hyderabad city, we organized and deliberate the improvement of the fundamental structure of a multi famous person caravansary of supported Indian standards to satisfy the requirements of the ongoing condition. In our venture, Park Hyatt, Banjara Hills, we've meant to fulfill the fundamental necessities of a multi megastar caravansary. Assigning the on hand space for numerous capacities the whole layout was created. The production become then dissected and planned in STAADPRO. Park Hyatt, BanjaraHills,A lavish accommodations that joins business with pride, first influence with something greater massive, shape with paintings. Halfway situated in the upscale Banjara Hills, our 5-superstarlavish lodging gives customized administrations and super encounters to enterprise voyagers and understanding close by visitors. With 209 significantly targeted rooms,3 honor triumphing arteries ,innovation nicely disposed accumulating spaces and Nizamithemed Spa, extravagance at its nice anticipates to make constant encounters for you. Leave Hyatt Hyderabad offers unfastened close by leaving places of work for up to 500 automobiles. Worked throughout on a place of 32,256 square meters (347,200 sq.ft) the improvement of the hotel commenced in2006. Claimed by Gayatri Hi-tech Hotels and oversaw by Hyatt, the lodge turned into brought on29 April 2012 costing Rs 7 billion round. The Hotel has 185 rooms, 24 suites at the initial six tales and forty two geared up assist condos referred to as The Residence on the 2 maximum flooring. Every one of the lodging's guestrooms is amongst the largest in Hyderabad, estimating somewhere round 463 rectangular toes. The entryway is planned with shining water issue and flora that encompass a 35-foot tall white particular determine. Park Hyatt Hyderabad is the first accommodations in quite some time to highlight Hyatt's private fashion meeting idea named TheManor.Theabsolutegatheringsandoccasionsplacesofworkdegreeinexcessof1, 600rectangular meters (17,000 sq.Feet). Obliging a scope of consuming the motel has a Lobby Lounge - The Living Room, The Dining Room - All Day Dining Restaurant, Tre-Forni Bar and Restaurant - Northern Italian Cuisine, Oriental Bar and Kitchen - South East Asian Cuisine. The Hotel is likewise geared up with Spaand Fitness Facilities.

1. INTRODUCTION

Hyderabad City progressing at a very quick pace within the commercial sector, major comes are undertaken to quench the forth returning wants.

Technology soaring heights, its impact is clearly visible during this tiny, beautiful city. Hyderabad

City, a blend of beauty and technology, has become a major attraction for both tourists and business entrepreneurs. Though, towards the core, that is heavily charged with which means and activity, the suburbs of this city are within the Rajiv Gandhi International airport at shamshabad, India's second largest, the requirement for hotels of approved standards and hospitality arose in its proximity. Since accessibility is that the key for not only practical but also psychological reasons, the choice of site should suite the acceptable wants. Our project, the planning and design of the main building of a 5 star hotel, has aimed toward filling this void. The project was developed so as to include the analysis and design a part of civil engineering. Our project is that the accomplishment of the structural design of the main building of the hotel, Park Hyatt, Banjara Hills.

2.Structural Analysis LOAD CALCULATIONS

The different loads on the structure are

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taken based on the relevant Indian Standard Specifications BIS 1987. The following loads were considered for the design.

LIVE LOAD

- Banquet hall $5\frac{KN}{mm^2}$
- Other areas $3\frac{KN}{mm^2}$

DEAD LOAD

- Dead load for concrete $\frac{KN}{m^3}5$
- Dead load for brick wall 22

STRUCTURAL DESIGN

The design of the structural members is done using the limit state method of design. This method is selected for doing the design, mainly due to the fact that it considers a factor of safety for the design with which the members are designed. The design of members by this method is commonly practiced now-a-days mainly due to its reliability over the working stress method. All designs are done according to the provisions of the Bureau of Indian Standards.

DESIGN OF SLABS

DATA: Two way slab Suitable span: 12.2m
Limiting criterion: DeflectionRebar: 2.94Kg/m^2
PT; 3.87Kg/m^2

MATERIAL PROPERTIES:

Concrete:

Fc_{28} = Compressive strength on concrete 28 days

F_{cd} = Design value for compressive strength on concrete

= $0.6\times Fc_{28}$ = $21N/mm^2$

Pre-stressing steel:

A_p = cross sectional area of pj steel $146mm^2$

F_{py} = yield strength of PT steel $1570N/mm^2$

F_{pu} = characteristics strength of PT steel $1770N/mm^2$

Pre-tensioning steel:

E_p = modulus of elasticity of pre stressing steel $1.95\times10^5N/m$

(Very low relaxation 3%)

Admissible stressing 0.75 f_{pu}

Reinforcing steel:

F_{sy} = yield strength of reinforcing steel is $460N/mm^2$

Long-term losses (assumed to be 10%)

DESIGN:

Determination of slab thickness:

Assumption l/h = 35

Self weight of slab g = yc×h

L = length of slab 8.4

h = 0.24m

Yc = volumetric weight of concrete = $2.5KN/m^3$

g = $6\ KN/m^3$

q = $5\ KN/m^3$

(g+q)/g = 6+5/6 =1.83

(l/h as a function (g+q)/g)

For value of 1.83 on y-axis l/h is coming to 36

0.233 Which is approximately 0.24

Determination of pre-stress:

μ = it is transfer component from pre stressing/ unit length (g+q)/g =1.8

Pre stress in longitudinal direction:

For 1.83 the u/g value is 1.3

u = $8.34KN/m^2$

K = woober's coefficient = $(0.24\times10^3) / (8.4^2\times25) = 0.136$

h = 0.274

Length of slab =8.4

DESIGN OF BEAMS

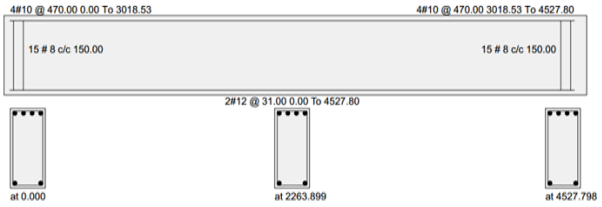

Fig.8.2a Design Load

Table.8.2a Design Parameter

Fy(Mpa)	415.000000
Fc(Mpa)	25.000000
Depth(m)	0.500000
Width(m)	0.230000
Length(m)	4.527800

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Table.8.2b Bending along Z in EQX

Mz(Kn Met)	Dist.et	Load
18.969999	1.500000	10
-32.950001	0.000000	11
-46.360001	4.500000	10

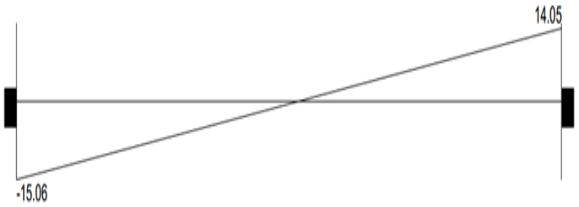


Fig.8.2b Bending along Z in EQX

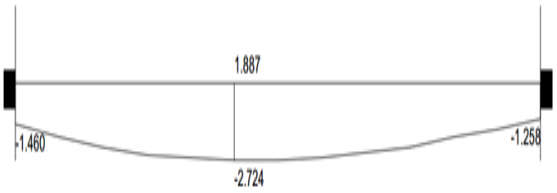


Fig.8.2c Shear along Z in EQX

Fig.8.2d Deflection along Z in EQX

Table.8.2c Shear along Z in EQX

Dist.m	Fy(kN)	Mz(kNm)
0.000000	-6.4309	-15.0630
0.377317	-6.4309	-12.6365
0.754633	-6.4309	-10.2100
1.131950	-6.4309	-7.7835
1.509267	-6.4309	-5.3571
1.886583	-6.4309	-2.9306
2.263900	-6.4309	-0.5041
2.641216	-6.4309	1.9224
3.018533	-6.4309	4.3489
3.395850	-6.4309	6.7754
3.773166	-6.4309	9.2018
4.150483	-6.4309	11.6283
4.527800	-6.4309	14.0548

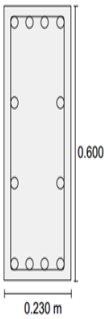
Table8.2d Deflection along Z in

Dist.m	X(mm)	Y(mm)	Z(mm)
0.000000	22.3242	-0.4279	-1.4604
0.377317	22.3242	-0.4609	-1.9193
0.754633	22.3242	-0.4594	-2.2680
1.131950	22.3242	-0.4299	-2.5135
1.509267	22.3242	-0.3792	-2.6631
1.886583	22.3242	-0.3138	-2.7238
2.263900	22.3242	-0.2403	-2.7027
2.641216	22.3242	-0.1655	-2.6069
3.018533	22.3242	-0.0959	-2.4436
3.395850	22.3242	-0.0383	-2.2199
3.773166	22.3242	0.0008	-1.9430
4.150483	22.3242	0.0148	-1.6198
4.527800	22.3242	-0.0031	-1.2575

Table.8.2c Shear along Z in EQX EQX

Dist.m	Fz(kN)	My(kNm)
0.000000	-1.4587	-9.0752
0.377317	-1.4587	-8.5248
0.754633	-1.4587	-7.9745
1.131950	-1.4587	-7.4241
1.509267	-1.4587	-6.8737
1.886583	-1.4587	-6.3233
2.263900	-1.4587	-5.7729
2.641216	-1.4587	-5.2226
3.018533	-1.4587	-4.6722
3.395850	-1.4587	-4.1218
3.773166	-1.4587	-3.5714
4.150483	-1.4587	-3.0211
4.527800	-1.4587	-2.4707

3.DESIGN OF COLUMNS



Load	5
Location	End 1
Pu(Kns)	-0.130000
Mz(Kns-Mt)	0.250000
My(Kns-Mt)	0.090000

Fy(Mpa)	415
Fc(Mpa)	25
As Reqd(mm²)	1104.000000
As (%)	0.983000
Bar Size	12
Bar No	12

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Fig.8.3b Bending along Z in EQX

Fig.8.3c Shear along Z in EQX

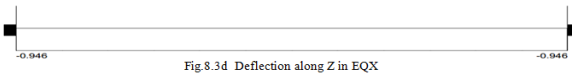


Fig.8.3d Deflection along Z in EQX

Table.8.3b Bending along Z in EQX

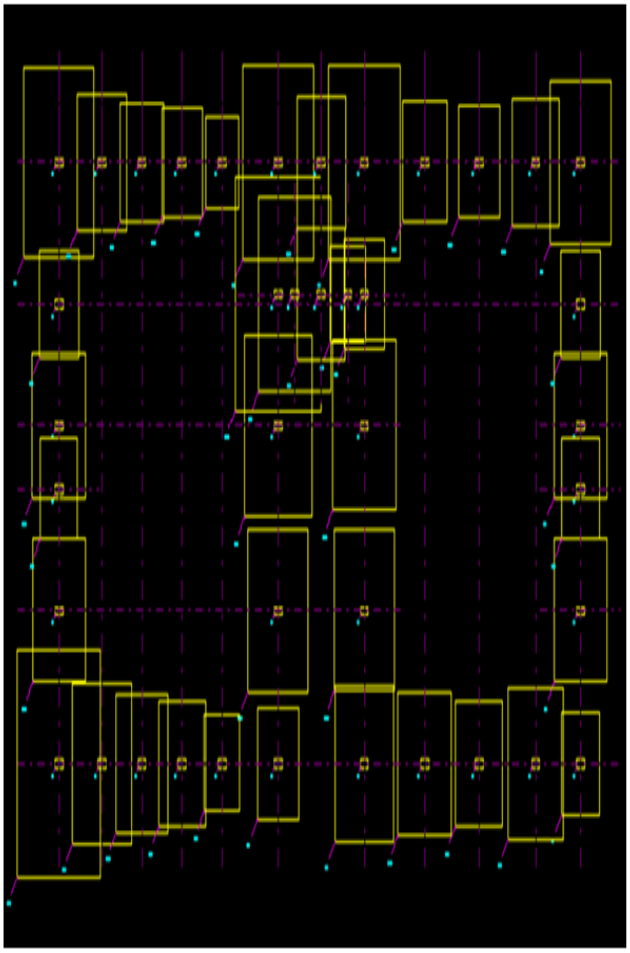
Dist.m	Fy(kN)	Mz(kNm)
0.000000	-0.3210	-3.9159
0.275000	-0.3210	-3.8276
0.550000	-0.3210	-3.7393
0.825000	-0.3210	-3.6511
1.100000	-0.3210	-3.5628
1.375000	-0.3210	-3.4745
1.650000	-0.3210	-3.3862
1.925000	-0.3210	-3.2980
2.199999	-0.3210	-3.2097
2.474999	-0.3210	-3.1214
2.749999	-0.3210	-3.0332
3.024999	-0.3210	-2.9449
3.299999	-0.3210	-2.8566

Table.8.3c Shear along Z in EQX

Dist.m	X(mm)	Y(mm)	Z(mm)
0.000000	29.9703	-0.9457	0.0884
0.275000	30.1052	-0.9457	0.1081
0.550000	30.2369	-0.9457	0.1177
0.825000	30.3655	-0.9457	0.1192
1.100000	30.4910	-0.9457	0.1149
1.375000	30.6135	-0.9457	0.1069
1.650000	30.7331	-0.9457	0.0975
1.925000	30.8499	-0.9457	0.0888
2.199999	30.9638	-0.9457	0.0831
2.474999	31.0751	-0.9457	0.0825
2.749999	31.1837	-0.9457	0.0892
3.024999	31.2898	-0.9457	0.1054
3.299999	31.3934	-0.9457	0.1333

Table.8.3d Deflection along Z in EQ

Dist.m	Fz(kN)	My(kNm)
0.000000	1.3925	2.1682
0.275000	1.3925	1.7852
0.550000	1.3925	1.4023
0.825000	1.3925	1.0194
1.100000	1.3925	0.6365
1.375000	1.3925	0.2535
1.650000	1.3925	-0.1294
1.925000	1.3925	-0.5123
2.199999	1.3925	-0.8952
2.474999	1.3925	-1.2782
2.749999	1.3925	-1.6611
3.024999	1.3925	-2.0440
3.299999	1.3925	-2.4269



DESIGN OF FOOOTINGS

Footing No.	Group ID	Foundation Geometry		
-	-	Length	Width	Thickness
41	1	5.250 m	5.250 m	0.305 m
42	2	5.350 m	5.350 m	0.355 m
43	3	5.400 m	5.400 m	0.356 m
44	4	4.550 m	4.550 m	0.355 m
45	5	4.000 m	4.000 m	0.606 m
46	6	3.950 m	3.950 m	0.656 m
47	7	2.850 m	2.850 m	0.505 m
48	8	4.350 m	4.350 m	0.506 m

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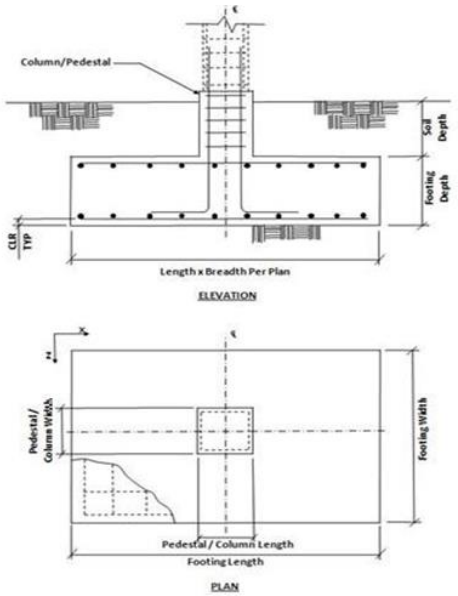
49	9	3.100 m	3.100 m	0.655 m
50	10	6.250 m	6.250 m	0.355 m
51	11	3.950 m	3.950 m	0.656 m
52	12	4.000 m	4.000 m	0.656 m
53	13	5.050 m	5.050 m	0.657 m
54	14	4.500 m	4.500 m	0.756 m
55	15	4.700 m	4.700 m	0.757 m
56	16	4.450 m	4.450 m	0.756 m
57	17	6.450 m	6.450 m	0.356 m
58	18	3.000 m	3.000 m	0.555 m
59	19	3.750 m	3.750 m	0.305 m
60	20	3.300 m	3.300 m	0.305 m
61	21	3.050 m	3.050 m	0.305 m
62	22	2.500 m	2.500 m	0.455 m
63	23	3.650 m	3.650 m	0.305 m
64	24	5.400 m	5.400 m	0.305 m
65	25	3.600 m	3.600 m	0.305 m
66	26	2.650 m	2.650 m	0.455 m
67	27	2.950 m	2.950 m	0.505 m
68	28	2.950 m	2.950 m	0.505 m
69	29	2.800 m	2.800 m	0.555 m
70	30	2.800 m	2.800 m	0.555 m
71	31	3.350 m	3.350 m	0.355 m
72	32	3.100 m	3.100 m	0.405 m
73	33	3.550 m	3.550 m	0.355 m
74	34	4.450 m	4.450 m	0.305 m
75	35	3.850 m	3.850 m	0.305 m
76	36	3.500 m	3.500 m	0.305 m
77	37	2.650 m	2.650 m	0.455 m
78	38	4.000 m	4.000 m	0.355 m
79	39	3.500 m	3.500 m	0.355 m
80	40	4.150 m	4.150 m	0.355 m

Isolated Footing 41



Design Parameters

Concrete and Rebar Properties

Unit Weight of Concrete: 30.000 KN/m^3

Strength of Concrete: 30.000 N/mm^2

Yield Strength of Steel: 415.000 N/mm^2

Minimum Bar Size: Ø8
Maximum Bar Size: Ø16
Minimum Bar Spacing: 50.000 mm
Maximum Bar Spacing: 300.000 mm
Pedestal Clear Cover (P, CL): 50.000 mm
Footing Clear Cover (F, CL): 50.000 mm

Soil Properties

Soil Type :	Drained
Unit Weight :	22.000 kN/m^3
Soil Bearing Capacity :	200.000 kN/m^2

Sliding and Overturning

Coefficient of Friction: 0.500
Factor of Safety against Sliding: 1.500
Factor of Safety against Overturning: 1.500

Design Calculations Footing Size

Initial Length (L_0) = 1.000 m

Initial Width (W_0) = 1.000 m

Uplift force due to buoyancy = 0.000 KN

Effect due to adhesion = 0.000 KN

Area from initial length and width, $A_0 = L_0 \times W_0 = 1.000$ m^2

Min. area required from bearing pressure, $A_{min} = P / q_{max} = 3.470$ m^2

Note: A_{min} is an initial estimation.

P = Critical Factored Axial Load (without self weight/buoyancy/soil).

q_{max} = Respective Factored Bearing Capacity.

Final Footing Size				
Length (L_2) =	5.250	m	Governing Load Case :	#1
Width (W_2) =	5.250	m	Governing Load Case :	#1
Depth (D_2) =	0.305	m	Governing Load Case :	#1
Area (A_2) = 27.563m^2				

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4.ANALYSIS AND DESIGN USING STAAD

DETAILS OF THE ANALYSIS SOFTWARE

STAAD for windows is comprehensive structural engineering software that addresses all aspects of engineering-model development, analysis, design, verification and visualization. Staad for windows is based on the principles of finite element analysis and is available in a "concurrent engineering" profile. It is capable of analyzing and designing structures consisting of both frames and shell elements. Following are the main options available from the concurrent graphics environment.

STAAD Analysis and design

STAAD PRE Graphical input generator

STAAD POST Graphical post processing STAAD INTDES Interactive design of structural components

STAAD uses a command language based input format which can be created through a text editor or throughSTAAD PRE, graphical or through CAD, based formats.

Analysis facilities available in STAAD are:

1. Stiffness Analysis-based on the matrix displacement method.
2. Second Order Analysis

i. P-Delta Analysis-incorporates secondary loading.

ii. Non Linear Analysis-incorporates both secondary loading and geometric stiffnesscorrection.

3. Dynamic Analysis-solution of free vibration problems response spectrum analysis and fixed vibrationanalysis.

IDEALIZATION OF STRUCTURE

All the beams and columns of the main building of our hotel were included as prismatic members with six degrees of freedom (3D beam elements). The columns at the foundation level were assumed to be pinned.

LOAD COMBINATION

The load on beams from slabs from slabs has been considered as uniformly distributed on the entire span. This loading was arrived at by considering equivalent uniformly distributed load from the triangular or trapezoidal pattern in the case of one-way slabs. In this case dead load, live load, wind load and their combination has been considered. The load cases 1, 2 and 3 correspond to dead load, live load and wind load respectively. Load cases 4 and 5 correspond to combination of dead load and live load, dead load and wind load. The intensities of wind load are calculated from the IS: 875(Part-3). The whole structure was analyzed for these 6 different loading conditions and the design was carried out based on the most critical loading condition.

The analysis result consists of member end forces, which includes shear forces and bending moments, deflection of members, support reactions etc.

The analysis turned out well with the deflection of the structure within the permissible limits. Themember forces, support displacements and support reactions obtained are given in tables.

SEISMIC PARAMATERS FROM IS 1893 (PART-1)-2002			
Zone Factor (Z) (Seismic Zone 3 – Table-2Clause 6.4.2)	=	0.1	
Importance factor (I) (Table-6 Clause 6.4.2)	=	1.0	
Response Reduction Factor (R) (Table 7 Clause 6.4.2)	=	5.0	
Structural Soil (SS) (Fig 2 type 1 Rock or Hard soil)	=	1.0	
Structure Type (ST) (RC Frame Building)	=	1.0	
Damping Ratio (D_{mp})		=	0.05

COLLAPSE LOAD COMBINATIONS (KN/M)			
1.	1.5 (DL +LL)	2.	1.5 (DL+EQ X)
3.	1.5 (DL+EQ Z)	4.	1.2 (DL+LL+EQ X)
5.	1.2 (DL+LL+EQ Z)	6.	0.9 DL+1.5 EQ X
7.	0.9 DL + 1.5 EQ Z	8.	1.0 (DL + LL)
9.	1.5(DL + WL X)	10.	1.5 (DL + WL Z)
11.	1.2 (DL + LL + WL X)	12.	1.2 (DL + LL + WL Z)
13.	0.9 DL + 1.5 WL X	14.	0.9 DL + 1.5 WLZ

SERVICEABILITY LOAD COMBINATIONS

To examine the Sway and Drift in different columns of the building by using Serviceability load combinationsare as follows:

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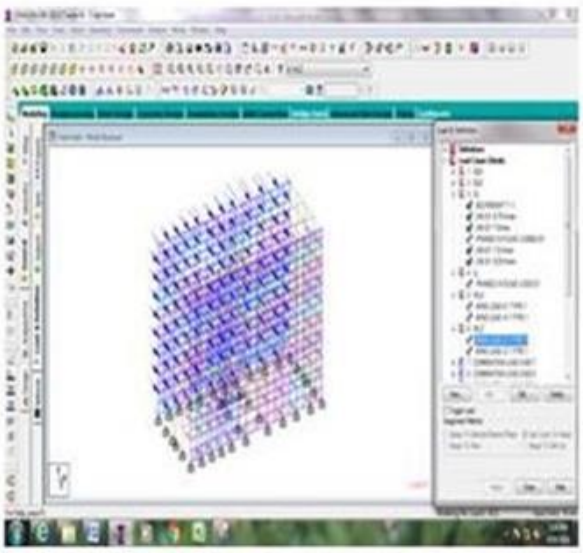
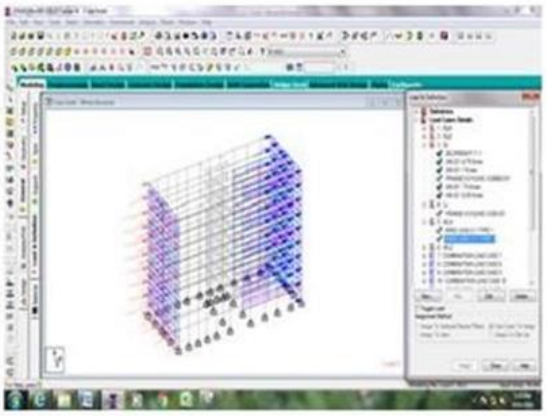
1.	1.0 (DL + EQ X)	2.	1.0 (DL – EQ X)
3.	1.0 (DL + EQ Z)	4.	1.0 (DL – EQ Z)
5.	1.0 (DL + WL X)	6.	1.0 (DL – WL X)
7.	1.0 (DL + WL Z)	8.	1.0 (DL – WL Z)
9.	DL + 0.8 (LL + EQ X)	10.	DL + 0.8 (LL – EQ X)
11.	DL + 0.8 (LL + EQ Z)	12.	DL + 0.8 (LL – EQ Z)
13.	DL + 0.8 (LL + WLX)	14.	DL + 0.8 (LL – WLX)
15.	DL + 0.8 (LL + WLZ)	16.	DL + 0.8 (LL – WLZ)

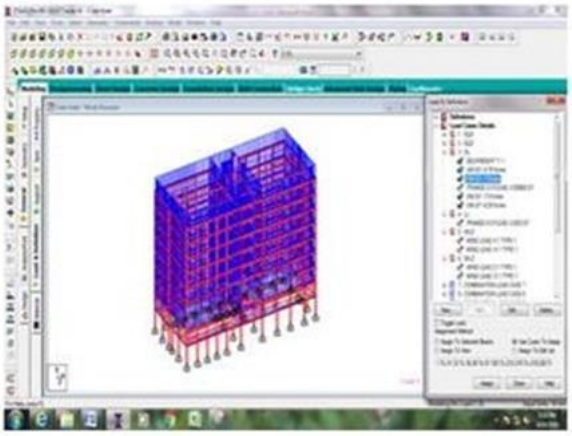


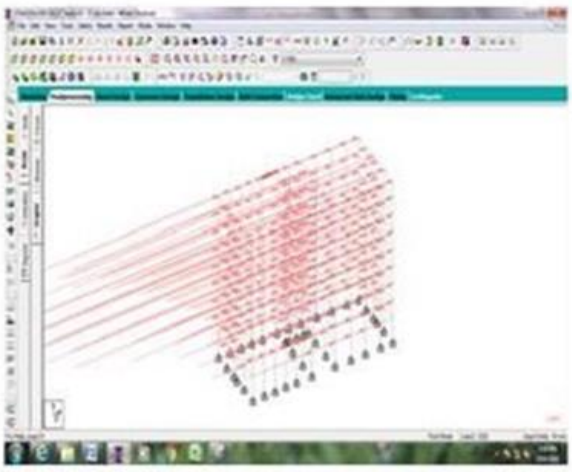
Member End Forces

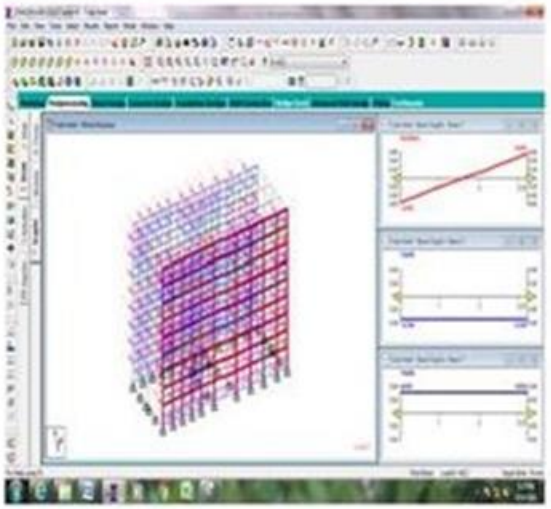
Units Force - KN ,
Length - m

Staadoutput









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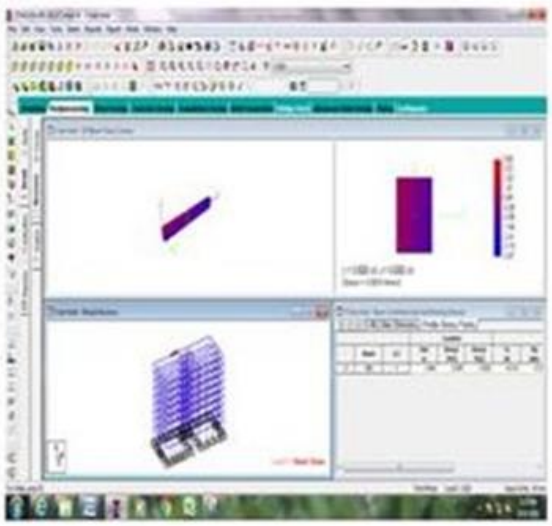

CONCLUSION

- A comparative example has been analyzed in the present research and all sustainable dimensions were
- Perceived in it. However, there's no necessity for all disciplines of sustainable development in landscape.
- The concerned design proposal here aims at creating an iconic Business hotel for Hyderabad which does not have a 5 Star property yet. The hotel design here not only concentrates on robust and efficient space planning, but also on the aesthetic values which define modern day hospitality ethos.

- The design idea revolves the concept of 'TIME' from which cues have been taken for planning as well form development of the building.

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