Analyze, Design and Estimation of Multistoried Building Parking System for a Specified City

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Abstract— within a future city it is essential to organize daily traffic for best efficiency and optimize parking management. By implementing Multistoried Building Parking System it is possible to manage quickly and easily parking systems, vehicle transit, automatic traffic lights control and supervise emergency situations such as accidents, roadwork's or traffic jams. The use of all of the above solutions improves significantly traffic flow and, in general, enhance living standard. In this project, a Vita city (Dist. Sangli, Maharashtra) is selected for improving the parking system. Firstly, the traffic volume counting is done by manual method. The traffic volume is done for the area which is most congested and belongs to high traffic jam problem. The manual counting is done for the two and four wheeler vehicles coming in the city and going out the city. It is been seen that the during 3rd slot (Evening slot) the traffic volume count is more. The site selection is done and the area for the construction of the Multistoried Building is been finalized. Accordingly, the plan, design and estimation of building with basement and (G+2) are done.

Key words: Design, Traffic Volume, Estimation

I. INTRODUCTION

Transportation is the key infrastructure of country. A countries economy status depends upon the how well the country is served by its road, railway air ports, ports pipelines and shipping. The rate at which a country economy grows is very closely linked to the rate at which transport sector grows. As a road transport gives personal mobility to person, the vehicle ownership rate has been increasing at a fast rate round the world. Due to increasing a car ownership, the problem of parking is becoming more and more day by day.

Studies have shown that by reducing congestion by just but also can create sizeable number of jobs. Cities can easily achieve these benefits by optimizing their parking management using data and analytics with Street line's smart parking solutions. As a result, everyone wins. Both the city and merchants win through increased revenue. And more importantly, motorists enjoy less congested streets and ample parking once they reach their destination.

A. Traffic Studies

Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help identify critical flow time periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends. The length of the sampling period depends on the type of count being taken and the intended use of the data recorded. For example, an intersection count may be conducted during the peak flow period. If so, manual count with 15- minute intervals could be used to obtain the traffic volume data. Two methods are available for conducting traffic volume counts: (1) Manual and (2) Automatic.

1) Manual Count Recording Methods

Manual counts are recorded using one method: tally sheets. The most common method of collecting traffic flow data is the manual method, which consists of assigning a person to record traffic as it passes. This method of data collection can be expensive in terms of man power, but it is nonetheless necessary in most cases where vehicles are to be classified with a number of movements recorded separately, such as at intersections. Tally Sheets: Recording data onto tally sheets is the simplest means of conducting manual counts. The data can be recorded with a tick mark on a pre-prepared field form. A watch or stopwatch is necessary to measure the desired count interval.

B. Volume Study

Volume/flow: The total number of vehicles that pass over a given point or section of a lane or roadway during a given time interval. It is the actual number of vehicle observed or predicted to passing a point during a given interval. From the details collected regarding the vehicle category it can be noticed that the number of cars maximum which needs to be provided with suitable parking facility. Vehicles are counted manually. There are two methods of manual counting, I) Direct Method ii) Indirect Method.

1) Direct Method

Data is counted by using hand tally and manual counters/ enumerators.

a) Advantages

- By this method traffic volume as well as vehicle classification and turning proportions can be obtained.
- Data can be used immediately after collection

b) Disadvantages

- This method is not practicable for long duration count and when flow is high. Error is common especially when volume is high.

2) Indirect Method

In this method, data is collected using video camera. Video is captured for long time and data is collected later by rewinding.

a) Advantages

- Besides traffic volume, several traffic parameters can be obtained from recorded film.
- Data can be cross checked and quality can be ensured. This method is applicable when volume is high. It is suitable for non-lane based traffic operation.

b) Disadvantages

– A suitable elevated place is required for filming operation. Data cannot be used immediately after collection.
– Data must be manually transcript of recorded film. This process is time consuming and tedious.

C. Parking System

It provides significant opportunities for design and development of next generation traffic management solutions. As an important component of traffic system, parking management system is playing an important role and affecting people's daily life. By detecting and processing the information from parking lots, smart parking system allows drivers to obtain real-time parking information and alleviates parking contentions, in these densely populated Urban areas, a certain amount of traffic congestion and delay are due to parking. In this case, detailed information associated with parking availability would allow drivers to make better decisions on use of parking lots and road-side parking. Finding a vacant parking space nowadays is time and fuel consuming. This problem may causes drivers to get frustrated and eventually improper parking will appears. This will at the end causing traffic jam in the parking space and accident might occur.

Some important terms associated with parking are explained below:

1) Parking Accumulation- Total number of vehicles parked in an area at a particular time period.
2) Parking Duration- Length of time a vehicle spent in a parking space
3) Parking Occupancy- Number of spaces occupied as a percent of total available spaces.

II. METHODOLOGY

A. Planning and Design

1) Survey

For planning and designing of a multistoried building, following site surveys were carried out for the finalization of the structure:

– Location Survey
– Topographic Survey
– Traffic surveys

a) Location Survey

This survey is one of the important surveys which need to be done for the construction of multistoried parking building. Those areas was surveyed which is most congested and belongs to high traffic jam problem.

b) Topographical Survey

The basic objective of the topographical survey was to collect the essential ground features of the area using Total Station so as to develop a Digital Terrain Model to take care of design requirements. The data collected will result in the final design and is also used for the computation of earthwork and other quantities required like hard strata available at meter depth.

c) Traffic surveys

The manual counting is done for the traffic volume study. The data analyse during this survey is as follows-

Time	Incoming vehicles Sangli to Vita		Outgoing vehicles Vita to Sangli	
	Two wheeler	Four wheeler	Two wheeler	Four wheeler
8am-12pm	1809	693	1935	756
1pm-4pm	1902	712	2005	816
5pm-9pm	1989	796	2050	950

Table 1: Survey

B. Design

In order to prepare the plan of the Multistoried parking building the following technical factors were taken into consideration:

– Land use requirement for various activities
– Planning norms and regulations
– Topographical and geotechnical factors such as ground features and slope, type of soil, ground water level etc.
– Standards for provision of parking requirement
– Traffic growth trend and future demand
– Seismic zone and wind direction
– Safety and security

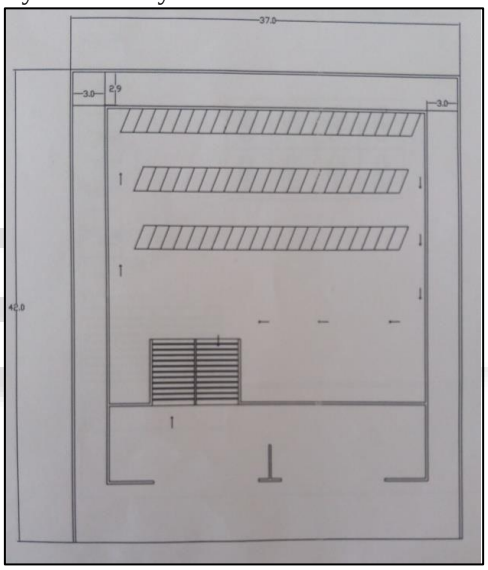

Fig. 1: Basement Plan

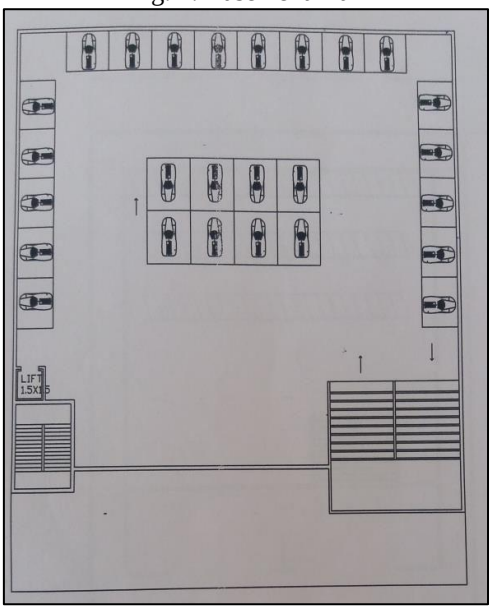

Fig. 2: Ground and First Floor Plan

C. Sizes

The following sizes were considered from the design calculations-

- Beam Size: 230mm X 500mm
- Column Size: 230mm X 400mm
- Slab: 230mm
- Ram Angle: 8°
- Staircase Measurement: 3500mm
- Inclined Slab: 300mm
- Footing (Isolated Stepped Footing): 2m X 2m
- F.S.I: 1

D. Parking Area

The details of area is as given below for vita city,
Plot area = 37m x 42m = 1554 Sq.m

Sr. No.	Name	Area (in Sq.m)
1	Basement- for two wheeler	500
2	Ground Floor- For Cars	200
3	1st Floor- For Cars	200
4	2rd Floor- For Cars	200
	Total Built up area in Sq.m	1100
	Total Plot area in Sq.m	1554

Table 2: Parking area detail

The proposed building is 31m long and 37m wide with a plinth area of 1554 Sq.m for each floor. The floor height shall be 2.5m. A combination of column beam arrangement is proposed for the building. Large column spacing of 6.4m is adopted along the breadth and 8.4m is given lengthwise to facilitate easy vehicle movement. Considering the larger size of slab panels, grid beam arrangement is proposed for floors and roof. Ordinary beam slab arrangement is adopted for ramps. Mild condition of exposure is considered in design. Isolated, combined and foundations are the different types of foundations adopted. The minimum depth of foundation shall generally be 2.2 m below ground.

Salient features of the building are:

- Length 31m
- Breadth 37m
- Column spacing (along the length): varies from 6.4m to 2.96m.
- Column spacing (along the breadth): 8.8m
- Column spacing for ramp (along the length): 3.345m
- Column spacing for ramp (along the breadth): varies from 6.36m to 3.46m.

E. Design Criterion

- Exposure Condition - Mild (as per IS 456 – Table Clause 8.2.2.1 & 5.3.2)
- Grade of Concrete – M30 (as per IS 456 – Table 5 Clause 6.1.2, 8.2.4.1 & 9.1.2)
- Reinforcing Steel - Fe 415 conforming to IS 1786.
- Safe Bearing Capacity of the soil considered – 225 KN/m2
- Depth of foundation – 2.5m below ground

F. Design codes and standards

The structural design is carried out as per the latest versions of Indian Standard codes published by Bureau of Indian Standards. Various design codes and standards referred are:

- IS 456 for Plain and Reinforced Concrete.
- IS 875 Part 1, 2, 3 & 5 for dead load, live load, wind load and combinations
- SP 34 for detailing of reinforcement

The codes followed are:

- IS 1893 Part I for earthquake resistant design and
- IS 13920 for ductile detailing of reinforced concrete subjected to seismic forces.

G. Loads Considered

- Self-Weight of members
- Wall Load
- Slab Live Load (3kN/m2 as per IS 875 Part II)
- Stair/Lift/Ramp Load
- Load due to Wind

Following densities and load values are considered for design:

- Density of Reinforced concrete: 24 kN/m3
- Density of brick masonry: 18.85 kN/m3
- Density of earth: 18 KN/ m3
- Superimposed Live Load: 4 kN/m2
- Floor Finishes: 1 kN/m2

In the limit state design of reinforced concrete structures, the following load combinations are to be accounted for:

- 1.5(DL+IL)
- 1.2(DL+IL±EL)
- 1.5(DL±EL)
- 0.9DL±1.5EL

Factors Considered for Earthquake Analysis.

- Vita City is Located in Zone IV
- Zone Factor: 0.24
- Importance Factor: 1.5
- Response Reduction Factor: 3.0
- Rock & Soil Site Factor: 1.0
- Damping Ratio: 0.5
- Suitable increase in SBC is considered as per IS 1893-2002

Ref: [Table1 Percentage of Permissible Increase in Allowable Bearing Pressure or Resistance of Soils (clause 6.3.5.2)]

For Medium soil - Percentage of Permissible Increase is 25% for isolated RCC footing without tie beams, or unreinforced strip foundations.

1) Clear cover to reinforcement

The following clear cover to the outer reinforcement shall be adopted:

- For Foundation: 50 mm.
- For Beams: 30 mm.
- For Slabs: 20mm.
- For columns: 40 mm.

III. DESIGN

A. Design of Footing

Design Parameters,

- Maximum factored axial load coming on footing = 320 KN.
- Safe Bearing capacity of the soil = 200KN/ m2.

- Characteristic compressive strength of concrete, fck = 20 N/mm2.
- Characteristic yield strength of steel, fy = 415 N/mm^2.
- Unit weight of concrete, γc = 25 kN/m3.
- Partial safety factor for concrete = 1.5
- Nominal Cover to exposure condition = 50mm
- Diameter of bars = 20mm.
- Column Dimensions:
  - Breadth of the column B = 230mm
  - Depth of the column D = 450mm

1) Design

- Maximum axial load coming on footing = 2000 KN
- Add 10% toward the self-weight of footing=200KN
- Total load = 2200.00 KN
- SBC of Soil: 200KN/m^2 is considered in the design of foundations.
- Area of footing required = 2200 /225 = 9.778 m^2
  L = 3.39 m, B = 2.89 m

2) Provide footing of size 3.4 m x 2.9 m

- Projection beyond Column Faces = 1.29 m
- Net Upward Pressure on the foundation = 306.812 KN/ m2.
- B.M @ Section XX = M x 306.812 X 3.39 X (1.29^2/2) = 865.40 kN/m
- Factored Moment = Mux =1303.95 kN/m
- Equating Mulim to Mux = 0.138fckbd2 = Mux
- Mulim= 3312 d2
- d = 627mm
- B.M @ Section YY = My306.812 X 2.89 X (1.29^2/2) = 741 kNm
- Factored Moment = Muy = 1111 kNm
- Equating Mu, lim to Muy = 0.138fckbd2 = Muy
- Mulim= 1242 d2 d=946 mm
- Effective cover to lower layer of steel = 50 mm + 10 mm = 60 mm
- Effective cover to upper layer of steel = 60 mm + 20 mm = 80 mm
- Overall depth required = 946 mm + 80 mm = 1026mm
- The overall depth may be increased by 30% to limit the shear stress
- Overall depth reqd = 1340mm
- Effective depth for short span = 1340 mm - 60 mm = 1280 mm
- Effective depth for long span = 1340 mm - 80 mm = 1260 mm

3) Steel Required for Longer Direction

- Muy / bd2= 2.42
- % of steel = 0.718 %
- Area of steel required= 0.718/100 x 300x 126= 2714 mm^2
- Provide 9 bars of 20 mm dia
- Spacing of 20 mm dia bars 115 mm c/c

4) Steel Required for Shorter Direction

- Mux / bd2= 0.995
- % of steel = 0.287%
- Area of steel required = 2940 mm^2
- Reinforcement required for central band of 3.19 m= 2183 mm^2
- Provide 9 bars of 20 mm dia
- Spacing of 20 mm dia bars 143 mm c/c

5) Check for Shear

Critical section X1 X1 is considered at a distance equal to the effective depth from the face of the column, i.e. at a distance of 1280 mm from the face of the column Shear force at this critical section X1 X1.

- V = 14 KN
- Factored Shear Vu = 21 KN
- Overall depth of the critical section D'= 608 mm
- Effective depth of the critical section d' 608 - 60 = 548 mm
- Breadth of the footing @ tp @this critical section b' = 3360mm
- Nominal shear stress = τυ = 0.01 N/mm2
- Percentage of steel provided = 0.15 %
- Permissible punching shear stress = 0.25 x sqrt (fck)
- 1.37 N/mm2 > 0.01 N/mm2

Provided Section is adequate.

B. Design of Columns

Rectangular Short Column

1) Column NO C1

- Load Case 1.5*(DL - EQX)
- Characteristic compressive strength of concrete, fck = 30 (N/mm2)
- Characteristic yield strength of steel, fy = 415 (N/mm2)
- Unit weight of concrete, γc = 25 (kN/m3)
- Partial safety factor for concrete 1.5
- Exposure condition Mild
- Nominal Cover to exposure condition 40mm
- Assumed effective cover all around, d' 50mm
- Dimensions of the Column
  - Least lateral dimension = 230 mm
  - Breadth of the column B (mm) = 230
  - Depth of the Column D (mm) =450
  - Thickness of floor slab = 230
- Effective length of the column, (m) =0.65 x 2.5 = 1175 mm
- Check for Slenderness ratio, L/D:
  - Slenderness ratio, λex = 10.17 <12 column is Short.

2) Design Factors

a) Load calculation:

- B1=120.02KN
- B2=48.56KN
- Total load =168.58 kN/m
- Factored load Pu= 252.87 kN/m

b) Minimum eccentricity

- -e_{min}=20mm
- 0.05b = 0.05 x 450 = 22.5 mm e_{min} has not exceeded 0.05b = ok safe.
- Gross area of the column = Ag = 230 x 450 = 103500mm2
- Area of the steel =Ac = 103500 - Asc
- Ultimate load Pu = 0.4 x 20 (103500 - Asc) + 0.67 x 415 x Asc
- Asc = 2889 mm2
- Provide 8 bars of 22 mm diameter.
- Hence the column is safe

3) Lateral Ties
- 6mm
- (1/4)x20= 4mm

Provide 6mm tiles.

4) Pitch Distance
- Least lateral dimension = 450mm
- 16 x20 = 288mm

Provide 6mmØ ties @ 250 mm center.

C. Design of Beam B1 mid Span

1) Design Parameters
- Load Case [1.5*(DL - EQX)]
- Characteristic compressive strength of concrete, fck = 30 N/mm2
- Characteristic yield strength of steel, fy = 415 N/mm2
- Unit weight of concrete, γc = 25kN/m3
- Partial safety factor for concrete = 1.5
- Exposure condition = Mild
- Nominal Cover to exposure condition = 45mm

2) Dimensions of the beam
- C/C Span of the beam = 6.2m
- Provide a width of 450mm. For the beam span between centre of bearing = 6.2+0.45 = 6.65m
- Approximate overall depth = (Spam/10 or 12) = 665/10 =665mm
- Provide on overall depth of 670mm

3) Details of reinforcements
- Diameter of tension reinforcement = 25mm
- Diameter of compression reinforcement = 25mm
- Diameter of stirrups = 8mm

4) Effective depth

Effective depth, d (mm) (670-45) = 625mm

5) Load
- Self-weight of beam = 0.40 x 0.45 x 25 = 4.5 kN/m Factored load = 1.5x4.5 = 6.75 kN/m
- Weight of slab = 17.63kN/m
- Weight of wall = 20.7kN/m
- Total load = 45.08kN/m2
- Mu = 45.08 X 6.652 /8 = 249.19kN/m
- Mu = 0.138 x fck x bd2 =511.56mm < dpro = 670mm ok safe.
  - Section is under reinforced
  - Calculation of longitudinal reinforcement.
- Ast_x =1973.01mm
- No of bar = 5.19mm
  - 6 bar of 25mmØ as a tension and 2-12 mmØ as compression reinforcement.
- Ast_{pro} = 2280.79mm^2
- The total load on span A and B is U.D.L 45.08kN/m
- RA + RB = 45.08 X 6.2 = 279.50KN
- RA = RB = 139.75 KN

6) Design of shear reinforcement
- Vu=139.75KN
- $_{ve}$ = Vu/b.d = 0.97 N/mm2
- $\tau_{c\ max}$ = 2.8 N/mm2
- Pt% = 2260.79/625x230 = 1.58 %

Pt%	M20
1.50	0.72
1.58 τ	X
1.75	0.75
0.25	0.03
1	0.12

- X= τ_c= 0.72+0.12 (1.58-1.50) = 0.73N/mm2
- $\tau_c < \tau_{ve} < \tau_{c\ max}$ Ok safe
- Provide 6mmØ bars @ 220mm c/c spacing.

D. Design of Slab

1) Design Parameters
- Grade of concrete = 30N/mm2
- Grade of steel =415 N/mm2
- Unit weight of concrete = 25 kN/m3
- Live Load = 5 kN/m2
- Cover = 20 mm
- Roof Finish Load = 1 kN/m2
  - Ly = 7.4 m
  - Lx = 6.2 m
  - 7.4/6.2 = 1.19 <2

Hence, design slab as two way slab

2) Calculation of depth of slab

Assume Pt% = 0.3% ⇒Mf = 1.5 – [Fig 4 PP 38 IS 456:2000]
- L_{eff} / d_{req} x Mf = 20
- d_{req} = 200mm
- D= d_{req} + N.C
- D= 230mm
- Effective depth provided
- $d_{provided}$ = $D_{provided}$ – N.C
- $d_{provided}$ = 210 mm
- Effective span, L_{eff}= 6.41m

3) Design of the Section

a) Load Calculations
- Self-weight of Slab = 5.75 kN/m
- Floor Finish = 1kN/m
- Live Load = 5 kN/m
- Total Load =23.75 kN/m
- Factored load = 35.63 kN/m
- For given c/s 2 sides adjacent sides are discontinuous and 2 continuous sides.
- (-ve moment @ continuous edge)

Ly/Lx	αx	αy
1.2	0.060	0.047

- Mx = αx X wu X lx^2 = 13.70 KN.m
- Mx = αy X wu X lx^2 = 10.73 KN.m
- Positive moment @ mid span

Ly/Lx	αx	αy
1.2	0.045	0.035

- Mx = αx X wu X lx^2 = 65.88 KN.m
- Mx = αy X wu X lx^2 =51.24 KN.m

4) Check for effective depth
- Max B.M = KN/m
- M_x= MRU= 0.138 X fck X b.d2
- d_{req} = 162.21mm < 230mm = Ok safe

5) Reinforcement calculation:

a) Reinforcement along short span:

Ast_{req} =860.40 mm^2 > Ast_{min} = 276 mm^2 = OK

b) Spacing in short direction:

Use 20mm**Ø** @ 300mm c/c spacing along short span.
- Ast_{pro} = 1047.19 mm^2 >Ast_{req} = mm^2 = ok safe.
- Pt% = 0.46 > 0.12% Ok
- dreq = 194.24mm < dpro =230 mm ok safe.

c) Reinforcement along long span:

- Asty = 642.15 mm^2
- Ast_{req} =642.15 mm^2> Ast_{min} =276 mm^2
  Provide 18mmØ bar spacing of 205mm long ength.
- Ast_{pro} = 848 mm^2 Ast_{req} = mm^2 ok safe.
- Pt% = 0.4%
- Fs = 182.27
- Fs Mf
- 190 1.55
- X= 1.6

6) Check for depth

d_{req} =200.31 mm < d_{pro} =230 mm ok safe.

E. Design of Slab for Ramp

- Design of Slab for Ramp:
- Grade of concrete = 30 KN/m2
- Grade of steel = 415 N/mm2
- Live Load = 5 kN/m2
- Cover = 20 mm
  - Ly= 5.345 m
  - Lx= 3.6 m
- Breadth of slab = 1000 mm
- Ly/Lx = 1.48

So, Design as a two way Slab.

1) Calculation of depth of slab

- Assume Pt% = 0.3% ⇒Mf= 1.5 – [Fig 4 PP 38 IS 456:2000]
- Leff / dreq x Mf = 20
- dreq = 130mm
- D= dreq + N.C
- D= 160mm
- Effective depth provided
- $d_{provided}$ = $D_{provided}$ – N.C
- $d_{provided}$ = 130 mm
- Effective span, L_{eff}= 3.83mm

2) Design of the Section

a) Load Calculations

- Self-weight of Slab = 3.25 kN/m
- Floor Finish = 1kN/ m
- Live Load =5kN/ m
- Service Load = 8.0375 kN/m
- Design Load = 12.06kN/m
- Total Load = 29.35kN/m
- Factored Load = 44.02 kN/m
- For given c/s 2 sides adjacent sides are discontinuous and 2 continuous sides.
- (-ve moment @ continuous edge)
- Ly/Lx αx
- 1.5 0.075
- αx=0.075 αy=0.047
- Mx = αx X wu X lx^2 = 48.43KN.m
- Mx = αy X wu X lx^2 = 30.35 KN.m
- Positive moment @ mid span
- Ly/Lx αx
- 1.5 0.056
- αx=0.056 αy=0.035
- Mx = αx X wu X lx^2 = 36.16 KN.m
- My = αy x wu x lx2= 22.60KN.m

3) Check for effective depth:

Max B.M = 48.43KN/m

Mx= MRU= 0.138 x fck x b.d2

d_{req} =108.16 mm

4) Reinforcement calculation

a) Reinforcement along short span:

- Astx = 1180.66mm^2
- Ast_{req} =1180.66 mm^2> Ast_{min} = 156mm^2
- Spacing in short direction:
- Sv = 260mm
- Provide 20mmØ bar spacing of 260mm short length.
- Astpro = 1208.30 mm^2 >Ast_{req} =1180.66 mm2 Ok safe.

b) Reinforcement along long span

- Asty =698.92 mm^2
- Ast_{req} =698.92 mm^2 < Ast_{min}= 156mm2
- Spacing in short direction
- Sv =300mm
- Provide 18mmØ bar spacing of 300mm long length.
- Ast_{pro} = 848.23mm^2 >Ast_{req} = 698.92mm^2 ok safe.

F. Estimation

The unit rates shall be arrived by considering the basic rates, lead distances, man power, machinery, and materials.

Total item wise quantities are calculated as per the detailed drawings. Separate heads for all different items of work is included in the BOQ. The major work items considered are:

- Earth work excavation
- Concrete:
  - PCC levelling Course
  - Reinforced Cement concrete- M30, Foundation, for walls, columns, beams, slab etc
- Steel - Reinforcement-Foundation, For Walls, columns, beams, slab etc
- Electrical cost
- Miscellaneous Items:
  - Caution/warning Signs, expansion joints, and etc.
  - Painting, white washing, finishes etc.

Total cost as per Abstract Sheet	Rs. 3952487.69/-
Add 3% contingencies	Rs. 118574.63/-
Add 2% water charged establishment	Rs. 395244.77/-
Net Total (Rs.)	44,66,307.09/-
Total in Words: Forty-Four Lakh Sixty-Six Thousand Three hundred and Seven only.	

Table 3: Total cost

IV. RESULT

A. Design of Concrete and Steel

1) Footing

Sr. No.	Footing Size	Main r/f	Distribution r/f
1	3.39m x 2.89m	9 bars of 20 mm dia @ 20 mm dia bars 115 mm c/c	9 bars of 20 mm dia @ 20 mm dia bars 143 mm c/c

Table 4: Footing

2) Column

Sr. No.	Column Size	Longitudinal r/f	Lateral ties
1	230 x 450mm	8 mm dia of 25 mm	6mm dia ties @ 250 mm c/c.

Table 5: Column

3) Beams

Sr. No.	Beams Size	Top r/f	Bottom r/f	Stirrups
1	230x670	2-12mm dia	6-25mm dia	6mm dia bars @ 220mm c/c

Table 6: Beams

4) Slab

Sr. No.	Slab Size	r/f along short span	r/f along long span
1	6.2m x 7.4m	20mm dia @300mm c/c	18mm dia @205mm c/c

Table 7: Slabs

B. Total Estimation

The cost of the multistoried parking building is,

Net Total (Rs.) = 44,66,307.09/-

1) Total in Words:

Forty-Four Lakh Sixty-Six Thousand Three hundred and Seven only.

V. CONCLUSION

- This system of parking can help the economy, well-liked and safekeeping based aspects of the society.
- As a conclusion from the survey, here we can add that, the paid nature of the most of the parking places creates relatively good condition for parking.
- In this research, we have also proposed a method for determining the parking capacity of an area.
- The methods of collecting and processing data introduced in this study could help to improve knowledge in the field of transport in general and especially parking.
- This research may be applied in many types of scenarios such as university parking lots, street parking, airport parking, commercial car parks, etc.

A. Scope for Further Study

The following works can be conducted in future:-

- Analyze, design and estimation for basement ground floor and more than two floors can be done for any type of city.
- Analyze of traffic volume by any other method.
- Designing by using different design software's.

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