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Design of Novel Parking Shed

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Abstract: This project's essential reason is to produce Novel Parking Shade. A graph that is both budget-friendly and visually appealing. Changing the structural appear of a everyday parking facility with a creative format approach. Make certain there are no misunderstandings and that the whole thing is visible. Pedestrians and vehicles are both safe. It need to be aligned with parking rows that run parallel to the pedestrian crossing and supply handy parking (parking region orientation).
The shape carries solely one column, which is supported with the aid of cable and enables for a extra cost effective construction by lowering the variety of columns.
Keywords: Novel Parking Shad, New design, Safety, Economical

I. INTRODUCTION

A allotted parking space is referred to as "parking." The parking spaces are marked on the floor with white or yellow strains forming squares that can each keep one car. Parking loads are familiar close to retail malls, universities, restaurants, and other public facilities the place parking is necessary. A Parking Shad would protect automobiles from the sun's rays, dust, bird droppings, and the elements. Design of a unique parking shade that is each practical and appealing.Parking is the act of stopping, disengaging, and leaving an unattended vehicle. In terms of mobility, architectural design, excellent of life, and environmental issues, parking is critical.

II. GENERAL WORK INFORMATION

A. Parking Studies

Before any measures to beautify occasions are made, information on the availability of parking spaces, the extent to which they are used, and parking demand are required. All of this facts comes from parking surveys. Because the time it takes to park a car varies, a range of information are used to verify how plenty parking is needed.

B. Parking Statistics

1) Excess parking It is the number of parked automobiles at any particular time. The accumulation curve is commonly used to express this. The accumulation curve is constructed by charting the number of bays occupied against time.
2) Parking volume is the total number of vehicles parked at a given duration of time. This does not account for the repetition of vehicles.
3) The area under the accumulation curve is determined by the parking load. It can also be found by multiplying the number of vehicles in the parking lot at each time interval by the time interval. It is calculated in vehicle hours.
4) The average parking time It's the proportion of total vehicle hours to the number of parked automobiles.

III. LITERATURE REVIEW

Design of Parking Shads Author Virginia Asphalt Association, fahed@vaasphalt.com Detailed examination of parking aspects (markings, drainage) about their supposed use. Consideration in the design of an asphalt parking lot surface.
Capital City Development Corporation's Parking Structure Design," Author Kimley Horn lives in Boise, Idaho. Implementation of the format study requirements for parking, Investigation of prefabricated members, Parking layout that is environmentally friendly, Drainage and lightning
"An Investigation of Parking Patterns for Various Parking Facilities"
Vol. 2, Issue 2 (October 2014 - March 2015) of the International Journal of Civil and Structural Engineering Research
Sitesh Kumar Singh is the author of this article. He is working on a methodology to examine PCU on the LPU campus, as properly as specific parking patterns for distinct purposes.
Variations in the passenger unit across time
Kolkata's Perennial Problem of Car Parking" The International Journal of Science is a peer-reviewed journal that publishes

IV. DATA COLLECTION AND ANALYSIS

Many common structures are being redesigned more imaginatively to boost their significance and qualities.
Because columns can't be installed in the ground's center, a circular roof with a vast span is supported by cables.
A long-span parking roof can also be added to create a major building.

A. Montreal Olympic Stadium and the Montreal Tower, Canada

1) Steel cables anchored to the Montreal Tower support the roof of the stadium in this arrangement. The 175-meter-long cables anchored to the Montreal Tower can open and close this roof.
2) Built in 1987 and designed by Roger Taillibert.
3) The stadium measures 59309 square meters in size.

The Montréal Tower is the world's tallest inclined tower, standing at 165 meters and angled at 45 degrees.

B. The Power Wing

1) B Grimm Power tasked OPENBOX with raising public awareness about the benefits of renewable energy. The goal was to construct an iconic piece of landmark for their headquarters that will send a strong message.
2) The OPENBOX design team examined the arrangement of the headquarters and proposed the creation of two multi-function objects in the office parking lots, which are the most visible from the main road. We'll build a parking deck with solar panels shaped like a sculpture.
3) The architecture and nature are fused in the design. Each solar panel was positioned at various angles according to energy waves to form "The Power wing" to produce a more dynamic form.

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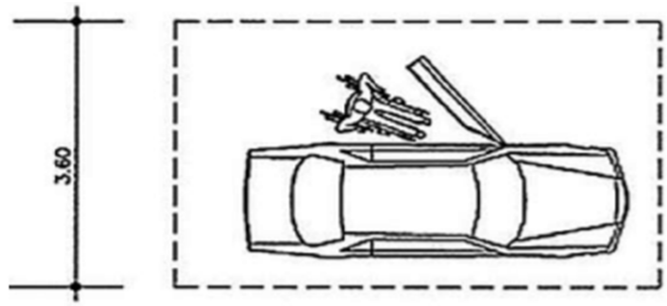
V. DESIGN AND VARIOUS UNITS

Parking index = parking load divided by parking capacity divided by 100

PARKING SPACE DESIGN (IRC: SP:12-2015)

The standard measurements are 2.5m in width and 5m in length.

Parking area for different aided people (disabled) is increased to access the car.



1.2 m access should be provided for such cases so the total width is increased to 3.7m

Table 6.1 Parking Space Requirement

Vehicle	Space Required (in m^2)
Car	20-36 sq. m.
Buses	55-60 sq. m
Trucks	55-60 sq. m
Three Wheelers	10-15 sq. m

As parking norms are generally prescribed in terms of ECS, following factors shall be used to convert other vehicles into equivalent car units **Table 6.2:**

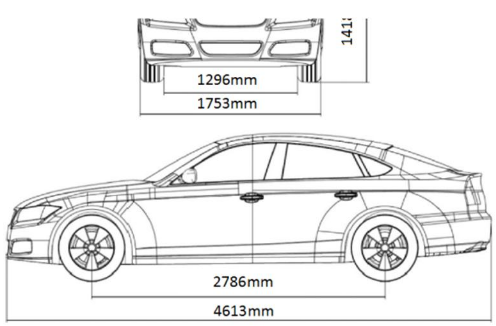
Table 6.2 Equivalent Car Spaces (ECS)

Vehicle Type	ECS
Car/taxi	1.00
Two Wheeler	0.25
Auto Rickshaw	0.50
Bicycle	0.10
Two wheelers	0.25
Trucks/Buses	2.50
Emergency Vehicles	2.50
Rickshaw	0.8

Source: URDPFI Guidelines, MoUD 2014.

A. *Dimensions Of A Vehicle*

TOTAL width:1.7m



Total length:4.6m

Height:1.4 to 2.2m in case of SUV

RULE REQUIREMENTS FOR PARKING SLOTS (IRC: SP:12-2015)

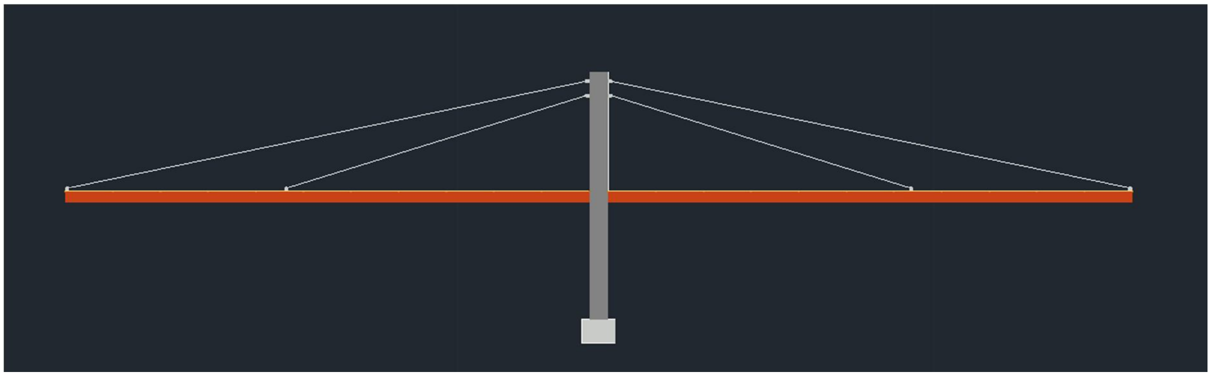
A minimum of one accessible parking space shall be supplied in every parking facility with fewer than 50 automobiles.

Accessible parking spots shall be provided in a ratio of 1:50 for parking facilities with a maximum capacity of 400 spaces.

At least 8 accessible parking spots should be provided for parking facilities with more than 400 spaces, and 1 place for every additional 100 automobiles over 400.

B. Design Explanation

1) A PVC sheet will be used to cover this parking structure.
2) The sheet will be resting and anchored on a lightweight frame for stiffness and longevity.
3) The frame will be supported by beams.
4) One end of the beams will be hung by cables, while the other will be fastened to an RCC column.
5) The column will be a member of the RCC.



C. Material Used For Parking Shed

1) *ROOF - Fiberglass sheet*

- This design depicts the top and front views of a parking garage.
- The column is composed of RCC and has a steel metal anchoring cap on top. It stands 4 meters tall.
- There are 14 parking spaces in the shed, which is 28 meters long.
- To control deflection, steel beam members with lengths greater than 5m will be held by a cable at the cantilever end.

Fiberglass sheets in various colors

<u>1. Size: 8*4 ft. 1. Price: Rs 25-120 per sq.ft (custom size option available)</u>
<u>2. Thicknesses: 2 mm, 5 mm, and 10 mm</u>
<u>3. The product isn't fire-resistant.</u>

2) *Roof Structure Stiffening*

Hollow square tube made of aluminum
12 m, 6 m in length
Polished surface
Forging technique
Size: 0.5 inch, 1 inch, 2 inch Thickness: 0.5-150 mm
Price per kg: Rs.200

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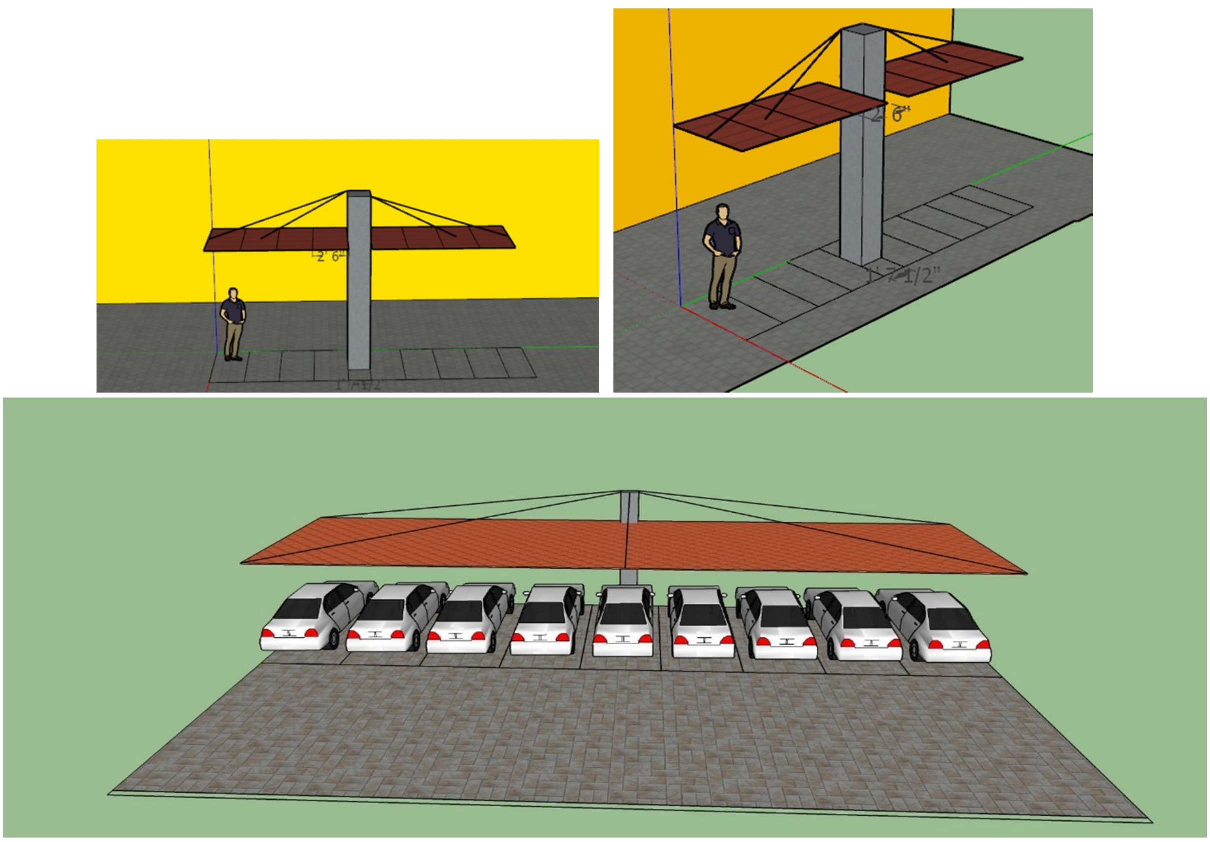
3) Steel Beam

70 Rupees per kilogram
TATA Steel is a well-known brand.
Rectangular in section
Cold finish

"HANDBOOK OF STRUCTURAL STEELWORK" is a good source of information. Steel parameters in the TATA Structura brochure

4) Steel Cables

Diameter: 10-40mm
Length: 200-1000 mtr
Material: Galvanised Steel
Construction: 1x7, 1x19, 7x7, 6x19, 6x36, 6x37
Rate: Rs 10-3000 per m.



D. Design Calculations

a) Design of column

Given: Fy=415 N/mm^2
Fck=25N/mm^2

Size of Column= 230*300mm
(Ag) Gross area =100%
(Asc) Steel Area = 1%of Ag
Asc =0.01*Ag
=0.01*230*300
=690mm^2
Provide 16 mm dia. Bar

No. of bars = $\frac{Asc}{\frac{\pi}{4}*\varphi^2}$

= $\frac{690}{\frac{\pi}{4}*16^2}$

=3.43

No of bars ≈ 4 no

i) Length of bar

=Length of longitudinal bar + Development length –(2* dia. of footing+50)

=6.750+(4d+300)-(2*10+50)

=6750+(0+300)-(2*10+50)

=6980mm

=6.98m

Length of bar ≈ 7m

ii) Length of 4 bar = 7*4

=28m

iii) Calculate dia. of lateral ties

a) $^{d}T=\frac{1}{4}*$ dia. Of longitudinal bar

$=\frac{1}{4}*16$

=4

b) 6 mm

Taken dia. Of lateral ties is 8 mm

iv) No. of lateral ties required

$=\left[\frac{length\ of\ longitudinal\ bar-development\ length}{Spacing}\right]+1$

$=\left[\frac{7000-(4*0+300)}{200}\right]+1$

=34.5

≈ 35 No

v) Cutting length of 1 lateral tie

= 2(a+b)+(Hook Length)-bends

Where,

Hook Length=10d (for 135^0 bends)

Bend = 2d (for 90^0 bends)

a= 230-(2*40+2*8)

= 134 mm

b =300-(2*40+2*8)

204 mm

Cutting length of 1 lateral tie

=2(134+204)+(2*10*8)-(3*2*8)

=788 mm

=0.788m

vi) Total Length of lateral ties =35*0.788

=27.58

≈28 m

vii) Total weight of steel= Total wt of lateral ties +Total wt of longitudinal bars

a) wt of longitudinal bar=$\frac{D^2}{16^2} * L$

$=\frac{16^2}{16^2} * 28$

=44.24 kg

b) wt of lateral ties =$\frac{D^2}{16^2} * L$

$= \frac{8^2}{16^2} * 28$

11.06 kg

Total wt of steel=44.24+11.06

=55.3 kg

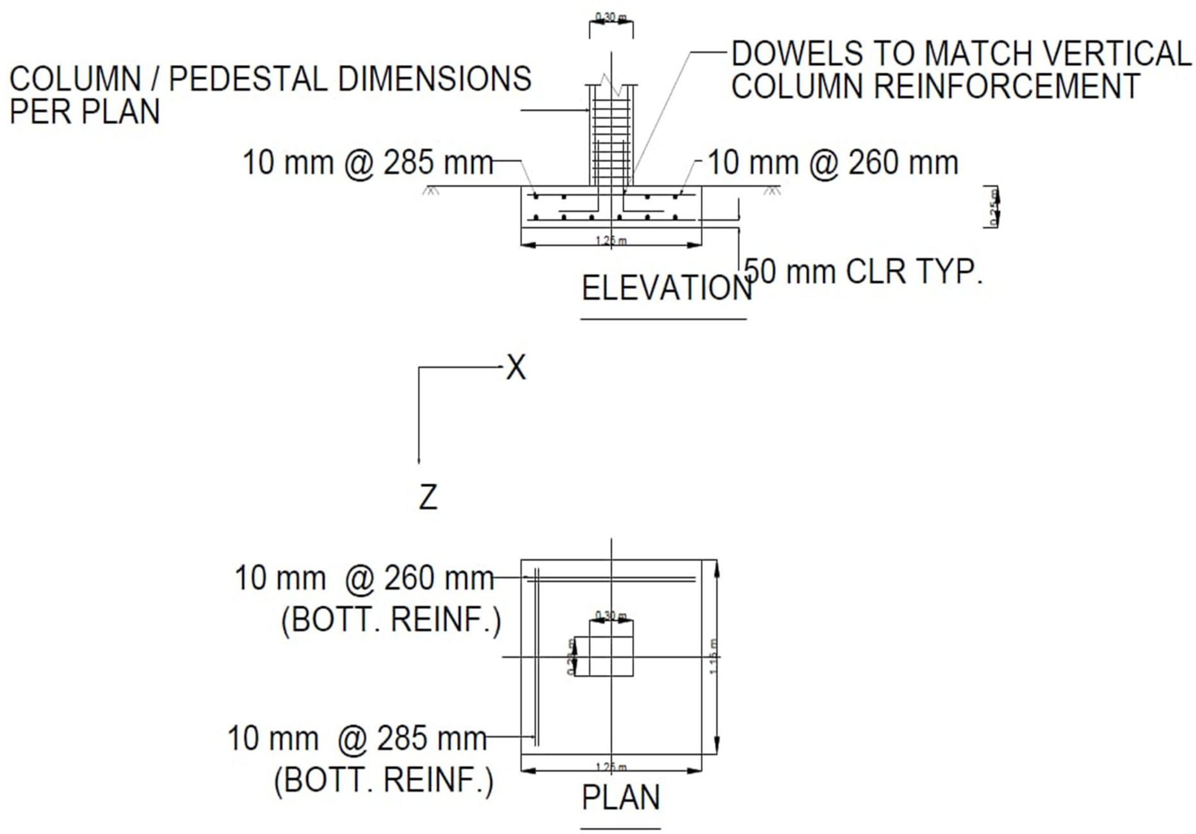
viii) Add 5% wastage of steel =$\frac{5}{100} * 55.3$

=2.76 kg

Gross weight of steel=55.3+2.76

=58.06 kg

Isolated Footing



Design an isolated Footing

Given:

Vertical load =57.2 kN

size of column = 230*300 mm

SBC = 120kN/m^2

fck = 25N/mm^2 fy=415 N/mm^2

Step 1 – Size of footing

load on column =57.2 kN

10% of column ariel

$= \frac{10}{100} * 57.2$

=5.72 kN

Total Load = 57.2 +5.72

=62.92 kN

Area of footing = $\frac{Load\ on\ footing}{SBC}$

$= \frac{62.92}{120}$

=0.524 m^2

$= \sqrt{0.524}$

=0.723

≈1*1

Area Provide =1*1 = 1

Step 2- Net upward Pr.

$\delta = \frac{Force}{Area}$

$= \frac{1.5 * total\ load\ on\ footing}{area\ of\ the\ footing}$

$= \frac{1.5*62.92}{1*1}$

δ = 94.38 KN/m^2

Step 3 – Bending moment

the critical section of the footing

Critical section at face of column from the edge of footing

$= \frac{1000}{2} - \frac{300}{2}$

= 350 mm

Load on critical section=δ*bf

=94.38*1

=94.38kN/m

$BM = \frac{wl^2}{2}$

$= \frac{94.38*0.35^2}{2}$

=5.78 KN.m

Step 4 – Depth of footing

for Fe415 - Mu=0.138 fck b d^2

5.78*10^6= 0.138*25*1000 d^2

d= 40.93 mm

take 2 to 2.5 times higher value

take d = 2.5*40.93

= 102.32

effective depth ≈ 110 mm

= d + eff. cover +φ +$\frac{\varphi}{2}$

= 110+50+10+$\frac{10}{2}$

D =175 mm

Due to shear consideration adopt a higher effective depth

Adopt 200 mm as effective depth & provide a 50 mm cover

defective =200 mm

D=200+50

=250 mm

Step 5- reinforcement of main bars

Length of main bar after bending = short span – (2* side cover)=2* span(depth-(2*cover)

=1000-(2*50)+2(200-(2*50))

=1100 mm

cutting length of main bar =1100-(2*2* dia. of main bar)

= 1100-(2*2*10)

= 1060 mm

No. of main bars= [$\frac{Long\ span-(2*cover)}{spacing}$] + 1

=6.04

$\approx 6\ nos$

Step 6 – Reinforcement of distribution bar

Length of bar after bending = Long span – (2* side cover)+2* span(depth-(2*cover)

=1000-(2*50)+2(200-(2*50))

=1100 mm

Cutting length of main bar = 1100-(2*2*dia of distribution bar)

=1100-(2*2*10)

=1060mm

No. of main bar =[$\frac{short\ span-(2*cover)}{spacing}$]+1

=$\left[\frac{1000-(2*50)}{178}\right] + 1$

=6.04

≈6 nos

10 mm φ @ 178 mm c/c on main & distribution bar

Step 7- Length of Bar (m)

=$\frac{1060}{1000}$

=1.06 m

wt (kg/m) = $\frac{D^2}{16^2}$

$=\frac{10^2}{16^2}$

= 0.6172

Total weight= $\frac{Length\ of\ bar*wt*no.of\ bar*sets}{1000}$

$=\frac{1.060*0.6172*12*1}{1000}$

=7.85 kg

VI. CONCLUSION

The Open Space Parking Shade, a novel Parking Shade, should be constructed differently, with a hybrid design in which the structure has only one column and the beam structure is supported on it with the help of cable to reduce the number of columns and the structure can be constructed more economically by reducing the cost of more columns. It should also be serviceable

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