

OUTDOOR PARKING PROTECTION EQUIPMENT WITH A CONVERTIBLE DESIGN

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ABSTRACT

There is always a scarcity of parking spots in heavily populated locations, such as cities, because there are fewer vehicles than there are spaces. Paved or unpaved, a parking area is just a spot where cars are allowed to park. A parking lot is a collection of parking places, and when a car finds a spot and pulls into it, that's called parking. Protected outdoor space for parking vehicles also arises as a result of increased population and traffic on the roads. You may safeguard your vehicle from thievery and extreme weather using a variety of accessible technologies and pieces of equipment. Vehicle protection equipment was designed and developed according to past patents. This equipment protects automobiles from weather conditions and includes foldable attachments and cloth coverings. The components are designed to be fastened to car bumpers.

Keywords- *outdoor parking, solid work, designed and developed outdoor parking protection equipment*

INTRODUCTION

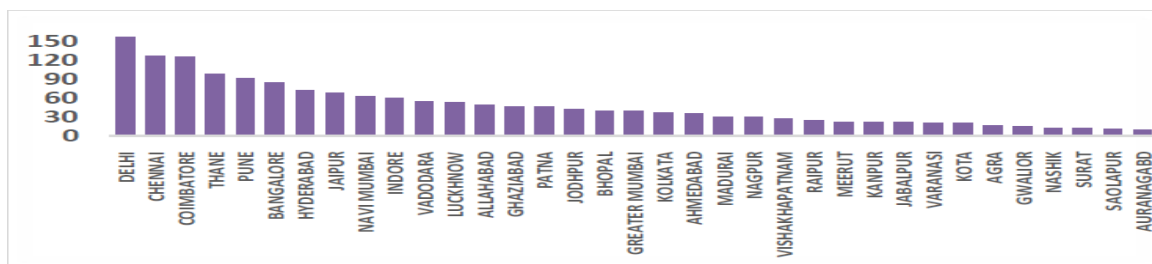
As part of another project, we're looking at parking equipment that makes efficient use of space. A lot of parking equipment has hydraulic attachments that raise the base using hydraulic cylinders. A solid base and an open space to raise the automobiles are necessities for this parking equipment. Due to the usage of hydraulic cylinders and a hydraulic pump, the car lifting system contained within this parking equipment is expensive, and it also requires frequent maintenance to keep it clean and in good operating order. Because the vehicle is being lifted, there is a weight restriction for the vehicle that is meant to be parked.

Previous inventions have shown that attachments meant to be fastened to vehicle bumpers aren't strong enough to prevent blind collisions. On the other hand, the hydraulic lifter parking arrangement offers better protection for vehicles, but it's usually not used because of its heavy weight and expensive production costs. There is a clear need to upgrade the current outdoor parking protection equipment with stronger linkages, more affordable options, and more simply convertible and serviceable attachments.

Due to the large number of people in India who own cars, many find the parking issue to be complicated and perplexing. Issues with parking can have a negative impact on local businesses and inhabitants' quality of life, whether it's at an airport, bus station, or retail mall. Considering that most private automobiles sit in one place for the most of their time, the issue of space for parked vehicles is far more pressing than that of space for moving cars on the road. Our cities' infrastructure isn't expanding fast enough to meet the rising demand for parking spots. The subsequent parking space shortage has started to affect other parts of daily life as well. Thus, the issue will be exacerbated since private vehicle usage would rise in response to affordable parking. It is a result of progress in transportation. Accordingly, parking studies acknowledge the significance of allocating enough space to provide a "cushion" beyond what is actually required. When it comes to parking, the methods currently used for planning are both wasteful and frequently fail to resolve issues. In places with

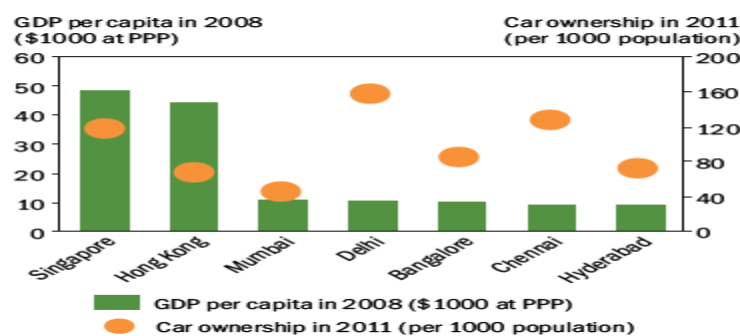
accessible land use, good mobility options, or transportation and parking management systems, the minimum parking needs are often too high because they are based on demand surveys conducted in locales dependent on automobiles. Spaces are frequently inaccessible or reserved for priority applications, so even with an excess of supply, parking remains an issue. Inadequate supply is not the main issue; rather, ineffective management.

In Indian culture, purchasing an automobile is seen more as a status symbol than a basic need. The wealthier and more powerful a person is, the fancier and more expensive their car is. Today, there are more than 450 automobiles per 1000 people in countries like the United States, Japan, and Europe. India, on the other hand, has thirteen vehicles for every thousand people. Even though there are so few automobiles relative to the population, we are still having a major problem with where to park them, which is totally unwarranted. See Figure 1.1 below for a visual representation of car ownership in over one million Indian cities.



Graph 1.1: - The percentage of Indians who own an automobile in the country's one million+ cities

When compared to Indian cities like Delhi and Chennai, the percentage of people who own cars is lower, or even half, in Singapore and Hong Kong, two of the world's cities with the highest per capita income. Although car ownership is low in both Singapore and Hong Kong, the low rate may be attributable to the governments' policies that prioritise public transportation over private autos. Figure 1.2 shows the relationship between car ownership and GDP.



Graph 1.2: - Vehicle ownership as a percentage of GDP

An automotive manufacturing industry has played a significant role in India's economic development. The automotive sector contributed around 5% to GDP in the years 2010 and 2011. A total of 13.1 million people

found gainful employment as a result [2]. The year 2012 was mentioned by MoHIPE. As a result of inadequate public transit options, people are more reliant on their own cars.

LITERATURE REVIEW

There may not have been as many parking garages in the past, but with the proliferation of personal automobiles, the demand for such facilities became increasingly great. As a result of the enormous parking problem caused by the 23 million vehicles on American highways by 1929, communities sought ways to accommodate as many cars as possible in as little space as feasible. A parking garage such as Dock Square Parking Garage was born out of this. A national boom in the development of parking garages occurred thirty years later, in the 1950s. Three distinct varieties of parking garages have emerged during the course of the century beginning in the 1910s. In 1918, the earliest multi-story parking garage that came to light was constructed. Holabird and Roche designed the hotel La Salle's parking garage, which was constructed by them. The hotel was located a few blocks from the parking garage. The parking structure remained intact throughout the 1975 demolition of the hotel. The parking garage was unfortunately torn down in 2005. Regarding automobiles, two distinct perspectives emerged. One was that it was merely a machine, and the other was about the liberating sensation of being mobile and driving one's own car. There are two distinct varieties of parking garages that originated from these two concepts: the automated garage and the ramp garage.

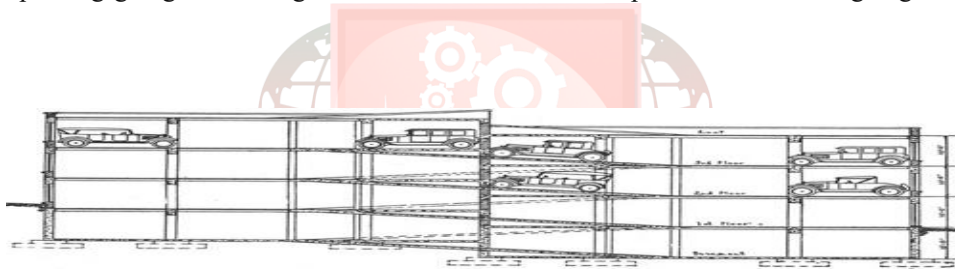


Figure 2.1:- The first multi-story parking garage was built in 1918.

The demand for parking spaces increased in direct proportion to the number of cars on the road. Cities sought ways to accommodate the increasing number of vehicles while making optimal use of limited parking spaces. Modern automobiles are much more robust to the elements than their forebears. Their sensitivity, open-top design, and leather seats transport us to a bygone era. Consequently, it was necessary to keep them sheltered from the elements by parking them within. Parking garages originally resembled other types of storage facilities. Contrary to modern perceptions, most people back then saw cars only as machines, with no inherent value beyond that. You wouldn't know they were there because the parking garages blended in with the surroundings. Parking garages would occasionally double as horse stables, with prices that were identical for both parking cars and stalling horses.



Figure 2.2:- Around the year 1907, in the 2000 block of M Street NW, stands the DuPont Garage.

A management solution for Rajkot's maps parking issues with public transport in cities Gain knowledge of k The majority of automobiles are parked for extremely short durations during peak hours, according to research by Hingrajia and Pratik D Vagadia (September 2015), as a result of the trade. The region is also connected to numerous prominent retail malls and destinations, which causes traffic congestion due to the presence of the car park on the street. For lengthy journeys, this means lost time and potential delays. Possible solutions to this problem include parking on the roof or making better use of the space in the majority of parking lots. Jaydipsinh P. Chudasama and Dr. L.B. Zala (2013) The author, who has experience with parking laws and volumes, chose the AmulAnand Dairy Road case study because it is in the heart of Anand's business district. There were two kind of studies carried out: one measuring the amount of video recordings made and another looking into land use and parking patterns as they pertained to enrolment recording methods. Based on his analysis, he concluded that Amul Dairy road makes use of mixed-use land. Thirty meters is the right-of-way. Compared to other types of traffic, this one has the largest ratio of two wheels. According to the numbers, long-term Parker parking is extremely low while short-term Parker parking is at a high. Throughout this survey section, street parking is quite common.

PROBLEM STATEMENT

1. The environmental, aesthetic, and economic effects of parking garages. Companies end up paying for undervalued parking either out of their own pockets or by passing the expense on to consumers in the form of taxes. Businesses may face additional constraints as a result of enough parking.
2. Businesses may struggle to hold on to consumers and residents may have trouble obtaining parking near their houses if parking places are inconvenient for those in the area.
3. Parkers with disabilities are in high demand. The ideal locations for these spots, whether in garages or on surface lots, are those that are near curb cuts and access ramps.
4. The effect on traffic and locals of the region of extra parking places.
5. Serious issues that have already leaked out. When there is insufficient on-street parking or adequate parking on-site to meet the parking demand of a given use.
6. Parking outside of the city. Travellers from out of town typically make up the bulk of a residential area's car traffic.
7. Areas designated for loading and unloading. Commercial trucks will obstruct traffic lanes since there is nowhere for them to park while they load or unload.
8. Parking possibilities that are inconvenient. During some times of the day, it is difficult to find parking that is within a decent walking distance.
9. The site does not have enough parking. Crowd control and traffic flow disruptions are possible outcomes of special events.
10. People are begging for parking spots. The rising reliance on motorised vehicles, particularly cars, is a direct outcome of the unregulated parking supply. There are more essential and less aggressive uses for the limited urban area that cars are aggressively pushing into.
11. The road and footpaths are being swallowed for car parking as a result of unanticipated provisions of on-street planning. Poor parking management is causing problems for pedestrians. Unauthorised parking on roadways completely blocks pedestrian walkways.

12. A greater number of automobiles are used by car owners because parking spaces meant for pedestrians are made available for motorised vehicles. A wrong method exists for determining the prices of the parked cars.
13. Other social difficulties have been exacerbated by the illegal parking of automobiles on undesignated places in relation to urban land.
14. You'll need 23 square meters to park an automobile. However, no city can ever afford to dedicate so much space to parking.
15. Parking for a small number of people requires a significant amount of land.
16. Parking, when done right, minimises both the need for parking and the amount of time people spend in their cars.

PROJECT OBJECTIVE

The objectives of this project:

- a. Make a model of the demand for parking.
- b. Determine what is needed for parking and then compare it with what is available.
- c. The primary goal of this innovation is to use outdoor parking protection devices to make parking vehicles outside safer and more efficient.
- d. Making it space-saving and convertible via the use of connecting members or hinge joints is another goal of the current invention.
- e. The use of pneumatic cylinders for opening and folding it after usage further streamlines the process and reduces the amount of manual labour required.

CONSTRUCTION

Brief Description of the Drawings:

Figure 5.1 is a perspective view of outdoor parking protection equipment for automobiles in accordance with the present invention; when read with the disclosure, the following figures will make the objects and benefits of the present invention clear.

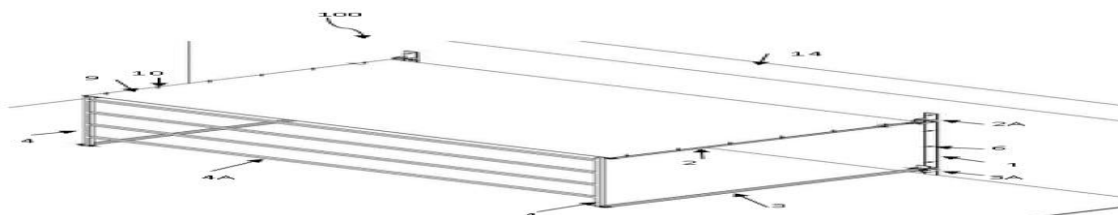


Figure 5.1:- View of outdoor parking protection devices from a different angle

Outdoor parking protection equipment for automobiles according to the present invention is shown in Figure 5.2 as a perspective view of the upper link;

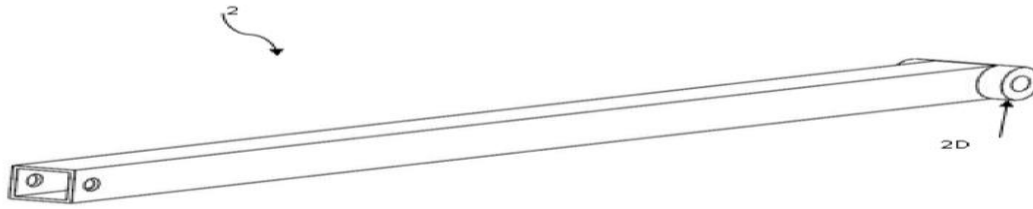


Figure 5.2:- Outdoor parking protection equipment's upper link, viewed from a perspective

The present invention's outdoor parking protection equipment for vehicles is shown in Figure 5.3, which is a perspective view of the lower link;

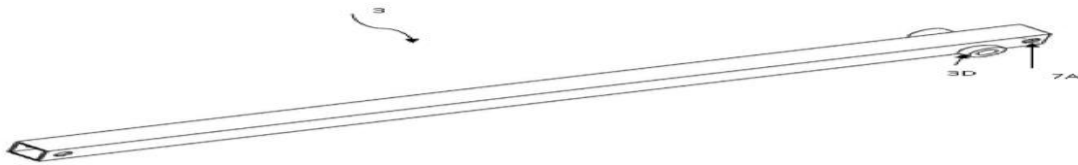


Figure 5.3:- View from below of the outdoor parking protection equipment's lower link

A side view of the outdoor vehicle parking protection equipment that complies with the current invention is depicted in Figure 5.4.

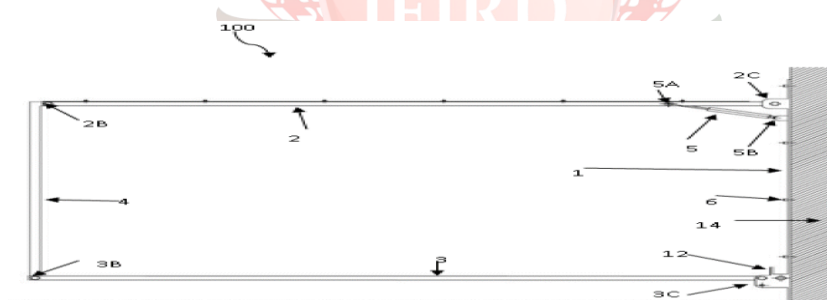


Figure 5.4:- Outdoor parking protection equipment, viewed from the side

Presented in Figure 5.5 is a side view of the outdoor parking protection equipment that the present invention employs for automobiles in an elevated position;

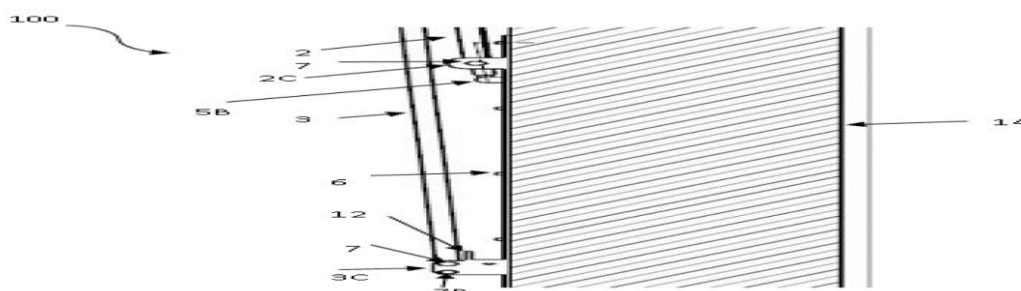


Figure 5.5:- Outdoor car parking protection equipment in a raised posture, seen from the side

The lower hinge plate of the vehicle protective equipment for outdoor parking according to the current invention is shown in Figure 5.5 in a side view;

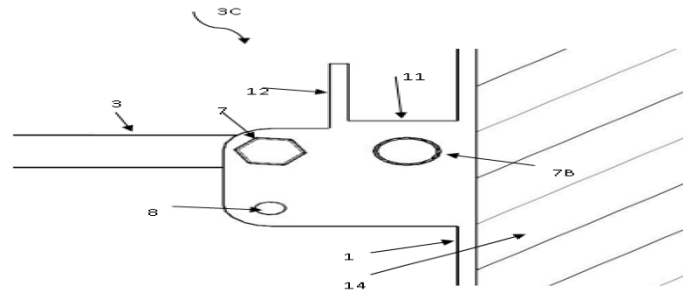


Figure 5.5:- Panorama of the underside of the parking safety equipment's hinge plate

Detailed Description of the Embodiments:

The accompanying illustrations serve as examples of the current invention. The components of the invention are identified throughout the description by the numbers provided in brackets. You may find the invention's components and their corresponding reference numbers in the table below.

Table 5.1:- Detailed description of the embodiments

Ref. No.	Components Name	Ref. No.	Components Name
1	Base column	5	Pneumatic cylinder
2	Upper arms	5A	Upper mounting point
2A	Upper hinge point	5B	Lower mounting point
2B	Upper front hinge point	5	Anchor bolts
2C	Upper hinge plate	7	Bolt
2D	Bush	7A	Locking hole on lower link
3	Lower arms		
3A	Lower hinge point	7B	Pin
3B	Lower front hinge point	9	Roof top
3C	Lower hinge plate	10	Rivets
3D	Bush	11	Horizontal stopper
4	Front links	12	Vertical stopper
4A	Cross bracing members	13	Concrete wall or column

Referring to Figures 5.1 to 5.5, Outdoor parking protection equipment for vehicles (100) (hereinafter “parking protection equipment (100)”) in accordance with the present invention is shown.

Referring fig. 5.1, 5.2 and 5.3, in an embodiment, the parking protection equipment (100) comprises of, Minimum two base columns (1) having minimum two upper arms (2) linked with the upper hinge joint (2A) which is positioned near top of the base column (1), similarly two lower arms (3) separated by desirable distance in between are linked with the lower hinge joint (3A) which is positioned at the bottom side of the base column (1). The upper hinge joint (2A) consists of upper extended plate (2C) containing hole mounted on base column (1) and bush (2D) containing hole joined with the end of upper link (2). Similarly, the lower

hinge point(3A) consists of lower hinge plate(3C) containing hole mounted on base column(1) and bush(3D) containing hole joined with the end of lower link(3). The lower hinge plate (3C) is extended more from the base column (1) in comparison with the upper extended plate (2C). The difference in length of the upper extended plate(2C) and lower extended plate(3C) is similar as that of the size of tube used in upper(2) and lower arm(3). Bolts(7) are inserted inside the holes of plates(2C,3C) and bush(2D,3D) to complete the upper(2A) and lower hinge joint(3A) and nut is provided at inserted end of bolt(7) which protects the bolt(7) from falling off.

Again referring figure 5.1, the base column (1) consists of several holes through which fasteners like anchor bolts (5) can be assembled with the rigid support generally a concrete wall or column (13). The front members(4) having cross bracing members(4A) joined in between are assembled with the upper arm(2) and lower arm(3) at upper front hinged point(2B) and lower front hinge point(3B) by inserting a bolt(7).

Referring figure 5.4, The upper front hinge point(2B) consists of plate having hole joined with the front link(4) and lower front hinge point(3B) consists of hole drilled between the lower arm(3) and bottom of front link(4). To protect the vehicles(not shown) from sunlight and rain, a roof top(9) is fastened with the upper arm(2) by using rivets or self-drilling screws(10) and also for minimizing the efforts of user, the parking protection equipment (100) is provided with multiple gas filled pneumatic cylinders(5) connected between base column(1) and upper arms(2). Top mounting point(5A) of gas filled pneumatic cylinder(5) is connected with the upper arm(2) leaving some distance from upper hinge point(2A) and bottom mounting point(5B) of gas filled pneumatic cylinder(5) is connected with the base column(1) leaving some distance from the upper hinge point(2A). The pneumatic cylinder (5) is in compressed state when the parking protection equipment (100) is lowered down and it is fully expanded as the parking protection equipment (100) is lifted up.

Referring figure 5.5 and 5.5, The base columns(1) also consists of link locking arrangement of different locking holes(8) at lower extended plate(3C) in which the vertical and horizontal position of parking protection equipment(100) is locked by inserting a pin(7B) between the locking hole(8) of extended plate(3C) and locking hole(7A) of lower link(3) provided on the extended end towards base column(1). If the parking protection equipment (100) is lifted up then the position of the equipment is supposed to be locked to avoid it from coming down accidentally, similarly it is also locked in horizontal position to restrict it from lifting up automatically. The parking protection equipment (100) is also provided with the horizontal (11) and vertical stoppers (12) to limit the movement of the linkages more than 90 degrees. The horizontal (11) and vertical stoppers (12) are mounted on the lower extended plate (3C). The parking protection equipment (100) can be easily disassembled or removed from the concrete wall or column(13) by simply removing the nuts assembled with anchor bolts(5) and thus it avoids damage cost at the time of reinstallation. All of the examples and explanations of the current project up to this point have been provided only for the sake of illustration. Many changes and adaptations are conceivable in view of the preceding teaching, and these are not meant to be all-inclusive or to restrict the current invention to the specific forms shown. The purpose of selecting and describing these embodiments was to provide the best possible explanation of the present project's principles and its practical application, so that other experts in the field could make the most of the present project and its various embodiments with appropriate modifications for the intended use.

CALCULATIONS

Design Calculations

Lifting Force

Minimum Required Lifting Force = Hanging mass $\times$ Acceleration due to gravity;

In our case, hanging mass is sum of all masses of all members which are in hanging or hinged at one point.

Hanging mass = Sum of mass of (Upper link + Lower link + Front impact member + Fasteners + Roof top).

Calculating mass of upper link

Mass (M_U) = Volume $\times$ Density of material

M_1 (for Square tube section) = Area $\times$ Length $\times$ Density

$$M_1 = [25 \times 25 - 20] \times 1688.2 \times 7.87$$

$$M_1 = 2.95 \text{ kg}$$

Adding the mass of mounting bush for pneumatic damper

M_2 = Area of bush $\times$ Length $\times$ Density of material

$$M_2 = (6548.98 - 5338) \times 7.87$$

$$M_2 = 9.530 \text{ gm}$$

As two bushes are implemented on the existing design then,

$$M_2 = 9.530 \times 2$$

$$M_2 = 19.06 \text{ gm}$$

Therefore, total weight of upper link is

$$M_U = M_1 + M_2$$

$$M_U = 2.95 \text{ kg} + 19.06 \text{ gm}$$

$$M_U = 2.969 \text{ kg}$$

Similarly,

Calculating mass of Lower link

Mass (M_L) = Volume $\times$ Density of material

M_L = Area of bush $\times$ Length $\times$ Density of material

$$M_L = 2.824 \text{ kg}$$

Similarly,

Calculating mass of front impact member

M_F = (Mass of side member $\times 2$) + (Mass of bracing members $\times 4$)

$$M_F = (1095 \times (625 - 400) \times 7.87 \times 2) + (2693.2 \times (625 - 400) \times 7.87 \times 4)$$

$$M_F = 22.95 \text{ kg}$$

Similarly,

Calculating mass of fasteners (Nuts and Bolts)

M_{FS} = (Volume of shaft of bolt + Volume of hex head bolt + Volume of hex nut) $\times 7.87$

$$M_{FS} = ((3.14 \times 36 \times 65)(3\sqrt{3} \times 64 \times 82 \div 2) ((3\sqrt{3} \times 64 \times 82 \div 2 - 3.14 \times 64 \times 8))$$

$$M_{FS} = 7347.6 + 1330.215 + 425.89$$

$$= 71.646 \text{ gm} \times 4 \text{ qty}$$

$$M_{FS} = 286.58 \text{ gm}$$

Similarly,

Calculating mass of roof top sheet

$$M_R = \text{Volume of sheet} \times \text{Density}$$

$$M_R = 3 \times 3 \times 12 \times 25.4 \times 1.8 \times 3 \times 12 \times 25.4 \times 1.22$$

$$M_R = 13545263.23 \times 1.22$$

$$M_R = 16.52\text{kg}$$

$$\text{Total Hanging mass (M)} = M_U + M_L + M_F + M_{FS} + M_R$$

$$M = 2.969 + 2.824 + 22.95 + 0.286 + 16.52 + 2\text{kg (Miscellaneous)}$$

$$M = 47.549\text{kg}$$

Therefore, Lifting force at outer end will be

$$L_o = M \times 9.81\text{N}$$

$$M_L = [25 \times 25 - 20 \times 20] \times 1595.12 \times 7.87$$

$$M_L = 2.82\text{kg}$$

Therefore, Lifting force at outer end will be

$$L_o = M \times 9.81\text{N}$$

$$L_o = 47.549 \times 9.81$$

$$L_o = 466.65\text{N}$$

Considered working leverage ratio is 6.88

Therefore maximum lifting force required by pneumatic damper to lift the overall assembly at 245mm from hinge point will be

$$L_{\max} = 466.45 \div 245 \times 1.8 \times 3 \times 12 \times 25.4$$

$$L_{\max} = 3133.6\text{N}$$

Force acting on one side of assembly will be

$$F_1 \text{ or } F_2 = 3133.62 \div 2$$

$$F_1 \text{ or } F_2 = 1566.8\text{N i.e. } 159.71\text{kg}$$

Selection of Pneumatic Damper

$$\text{Force} = \text{Pressure} \times \text{Area}$$

Selection according to the bore size i.e., area of cylinder

$$F = 1566.8\text{N}$$

P = Pressure to be filled inside the cylinder

$$\text{Area} = 3.14 \times r^2$$

Where r = radius of the bore of cylinder = 10mm (Considered value)

$$\text{Therefore, } A = 3.14 \times 100$$

$$A = 314\text{mm}^2$$

$$\text{Hence, } P = 1566.8314 \div 314$$

$$P = 4.98\text{N/mm}^2$$

CONCLUSION

It is clear from a review of global case studies that prohibiting the use of private automobiles is not only a feasible choice, but also impossible to implement. No nation can reasonably expect its citizens to rely solely

on public transport, and this is particularly true in a country like India, where a small number of cities are home to a population larger than several European nations.

In cases where there is insufficient room to construct a garage or when it would be more efficient not to build one at all, the aforementioned research suggests that we can manufacture convertible parking protection equipment. Because it is convertible, you may fold it along the wall to make more room. This accessory shields the car from the elements and provides shade when driving in the rain or sunshine. Conventional parking is becoming unfeasible because to the scarcity and rising cost of land in urban areas and other higher-order cities, as well as the shrinking size of individual plots. Outdoor convertible parking protection equipment is another option for meeting parking needs.

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