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# Analysis of Parking Planning System for Smart City

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**ABSTRACT:** To being discussion on parking Now-a-day there is an increase in the number of vehicles on road. It is very easy to park vehicle on road or when vehicle is moving. But, when the vehicle stops, we cannot leave vehicle on road or unsafe place. For proper storage of vehicle when not in use parking space is needed.

Many cars and two -wheeler are seen parked on either side of the roads. Both angular as well as parallel type of parking was noticed on almost all the stretches of the roads. This has reduced the capacity of the carriageway and endangering pedestrians and motorists alike the frontage of almost all the roads in this area has been converted into commercial land use without taking into account the demand for parking of the vehicles. Nowadays smart city project is gaining a lot of attention. A novel method of effectively parking system required.

**KEYWORDS:** Smart City, Parking Problem, Parking Systems, on street parking, off street parking.

## I. INTRODUCTION

In Aurangabad the number of vehicles is increasing at the same rate as the population of the city is increasing rapidly. The number of vehicles in Aurangabad district has crossed 14 lakh. The number of four-wheeler is increasing every day. According to the RTO, the number of four-wheeler has gone up to 88,076 till 31 November 2021. The vehicle purchase process has become easy and affordable for all.

As a result, four-wheeler purchases are on the rise; but after purchasing a vehicle, there is no parking arrangement in many parts of the city. The problem of traffic congestion and pollution in the city has gone out of hand due to vehicles, and now the problem of vehicle parking is also taking a serious turn. There are two types of parking arrangements for vehicles in public places and in residential areas. Due to the lack of the planning corporation, the parking of public places has been disrupted.

The news article was published in lokmat news-paper on 16, 2022 November shown in figure number 1.1, 2.1 A&B. The total no of vehicle in Aurangabad is 15, 97,749 and because of lack of parking policy and poor execution of current traffic rules has led to haphazard parking on city roads and casing inconvenience to the commuters.

The scene is common in most part of city as space for vehicular traffic and pedestrian moment is turning from bad to woes.



Fig No.1 Article on parking problem in Aurangabad City

## II. RELATED WORK

B Vamsi 3 March 2017 in his paper model of multi-stored building is done. The design is done based on the requirements, terms and conditions. The design, civil software like auto cad, staad pro etc. The design of multi storey parking system is done by using code IS 456-2000. The traffic congestion problem can be regulated by providing multi storey parking at jagdamba centre. The problem is controlled up to one decade. This project will serve as solution to various traffic congestion problem and can be used as a model in the development of multi storey car parking.

Dr. S. Mahendran, K. Sivasubramanian 11 November 2018 in his papers his automatic car parking system enables the parking of vehicles floor after floor and thus, reducing the space used. These makes the system modernized. The plan for this building was prepared using Auto cad software. The analysis of the frame was carried out for vertical and horizontal loads using Staad Pro software. The design has been done according to Indian standard code IS 456:2000. Structural elements like slab, beam, columns, footing, staircase and ramp has been designed and detailed

Anil S. Savadi April 2019 In This Paper To fulfil. The Requirements And Need Of High Rise Buildings For Commercial Purpose. Composite Structure Is Best For Infrastructural Growth And Economic Structure Other Than RCC and Steel Structures. Cost Comparison For (G + 2) Commercial Building Is Carried Out Then Results Are Composite Beam Is 1.7 % Less Than Steel Structure And 13.7% Less Than The Rc Structure Because Main Advantage Is In Composite Frame Structure Bar Bending And Form Work Is Not Required. The Main Parameter In Composite Structures Is More Economical Than RCC and Steel Structures. In The Erection Work Like Beam, Column, Etc. Labour Requirement Is Very Less In Composite Structure Compared To RCC structure. In Composite Structure Deflection Criteria Is Less Compare To Steel Structure And More In Rc Structure.

## III. METHODOLOGY

The before execution of work we have to do case study about that structure with the reference of review of the research paper can analyse the tentative outline work of the project with the help of background studies case of different type of parking which is already executed on site.

### Car/ two-wheeler park planning

At first, theoretical information was collected about the subject of the research; a field survey was conducted to estimate parking demand and supply. For planning of the location study Outline planning considerations are mainly related to the configuration of parking bays and traffic flow patterns into and around the car park. The dimensions of large, standard and small size cars are well established and are given by the Institution of Structural Engineers. These dimensions form the basis of the geometry required for stalls, aisles and ramps.

Advantages /Benefits

According to study of parameters which will discussed in the research papers the following are the benefits of the composite structure Collecting information from the literary sources related to the research topic

- Speed of construction
- Safe method of construction
- Structural stability
- Sustainability
- Easy installation services
- Light in weight

With this reference the proposed project having the more benefits it will be useful for the public places and the municipal corporation also after successive execution of the project work on multiple storey composite parking for the public places is as follows:-

- The traffic congestion problem can be regulated by providing multi storey parking
- The composite frames are best suited among all the constructions in terms of material cost and benefit added with better structural behaviour.
- An attempt has been made to improve the car parking facility.

This policy may be effective for the Aurangabad city and it is also effective for the city having a same population growth rate.

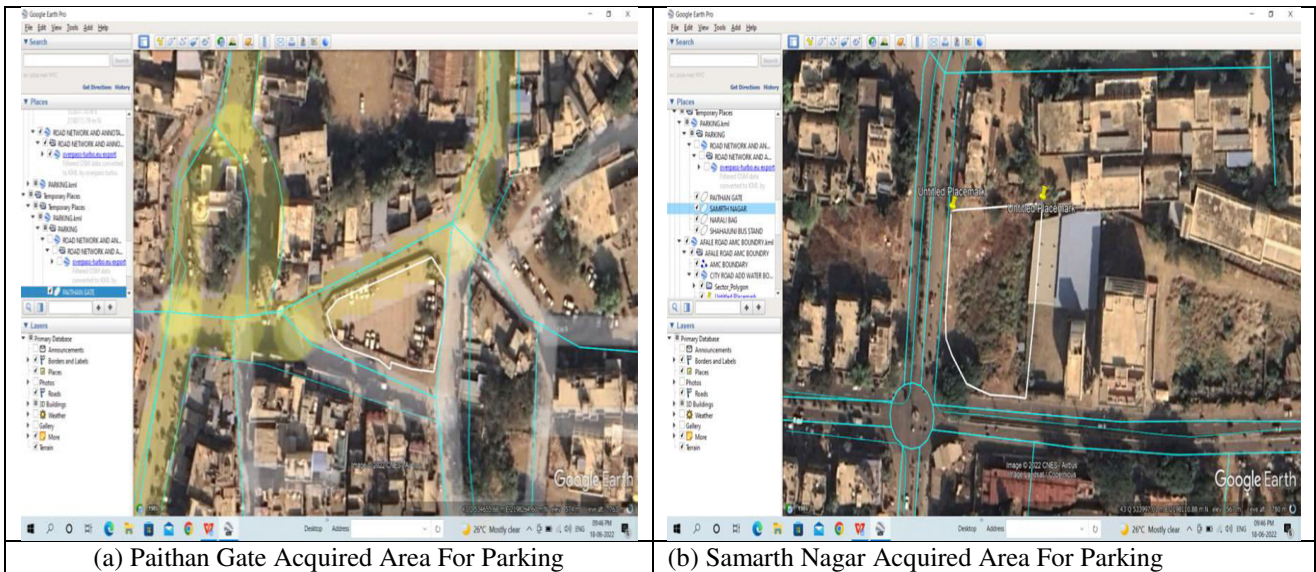


Fig. 2. Column Positions

In structural engineering, determining the sizes of structural members such as beams, columns, and slabs is a critical step in the design process. These sizes directly impact the strength, stability, and overall performance of the structure. Manual calculations play a fundamental role in arriving at initial member sizes before the software modelling takes place. Manual calculations involve using engineering principles, codes, and standards to analyse the loads and forces acting on the structure. Engineers consider factors like dead loads DL (self-weight of the structure), live loads LL and other relevant forces. The goal is to guarantee that the structure can securely support all anticipated loads for the duration of its life. Based on the manual calculations, engineers determine the required sizes of individual structural members like beams and columns. The size of a member directly relates to its cross-sectional dimensions, such as the width, depth, and thickness.

**IV. ANALYSIS OF STRUCTURE**

This structure consist of G+7 floors, having the head room top as open parking with roof .each floor of the multilevel parking carried 16 cars park conveniently and the 15 motorized two wheeler can park. The total 112 cars & 105 two wheeler can be able to park at time. The corner of the floor lift also provided for vertical moment of vehicle for backup point of view.as well as the ramps are provided for the moment of the vehicle from floor to floor. We can use this as per the flexibility of parking requirement.

If only four wheeler parked-15(per floor)

If only two wheeler parked-60(per floor)

Comparative analysis study of composite structure and RCC structure

In this moderate era of innovation. Most of the reinforced concrete structures are greater demands in India.as compared to another types of structure. But as per the current development needs advanced construction methodology like and steel concrete composite structure is widely used in to the industrial area but the ratio is low as compared to other countries because of the unawareness about the analysis and design of complexity. In this paper the two different types of material elements use that is steel concrete composite material and RCC material application use for the analysis for G+ 7 multilevel parking structure.

Study the comparative multilevel parking analysis of steel concrete composite structure element like composite column steel beam deck slab and the analysis of multilevel RCC multilevel parking. Parking structure is modelled by using ETABS-2017 software. For earthquake IS 1893:2002 is considered for the analysis. The seismic parameters for zone II. For the analysis of the parking structure considering the load for G+7 and study the analysis between the two different types of structural parameters like maximum displacement, maximum storey drift, modal load Participation Ratios, fundamental time period.

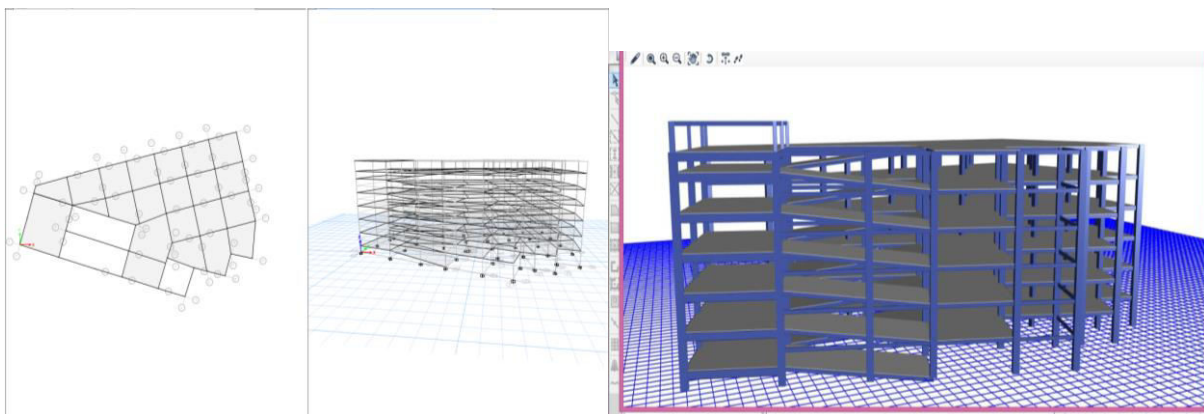
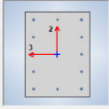
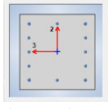
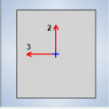


Figure 3:- Plan view of building model in ETABS-2015

**Table no 1. Parameters Considered For RCC Modelling**

Sr.no	Particulars	Dimension/Value
1	Area dimension	1010.40Sq.m
2	Total height of structure	18.2 m
3	Height of each story	2.7 m
	Height of head room	2 m
4	Thickness of RCC slab	150mm

5	Grade-of Longitudinal bar Grade of Lateral ties Grade of concrete column Grade of concrete beam Grade of concrete slab Density of Concrete	Fe500 FE415 M25 M20 M20 25 Kn/m
6	Size of Column C1  C2	 450X600mm   450X450mm
7	Size of beam B1	 400X450mm
8	Semitic zone Importance factor Zone factor Damping ratio	II 10 0.5 5%
9	Floor finish Live load Vehicle load	1kN/m 4kN/m 5kN/m

#### 4.1 Maximum storey displacement

The results are obtained after the analysis is carried out, the storey displacement is shown in this section, the maximum storey displacement in X and Y direction are given in the table number 9 along with the allowable limits as per IS code as shown below. The bar charts direction for displacement is shown in the figure number 4.1 respectively.

Table No.2 Maximum storey displacement difference between x and y direction

Story	Elevation (m)	Composite (mm)	RCC(mm)
Story7	18.2	14.1	16
Story6	16.2	9	14
Story5	13.5	8.2	13.4
Story4	10.8	7	12.3
Story3	8.1	5.3	10.9
Story2	5.4	3.2	8.8
Story1	2.7	1.2	5.9
Base	0	0	0

#### 4.2 Maximum storey drifts

the storey wise drift is obtained from ETABS-2016 software for the building in zone II respectively which is tabulated in the table number 10 and figure number 4.2 given below along with the permissible drift according to IS 1893(part-I):2016, Clause no.7.11.1, page number 29.which states that the maximum allowable storey drift of the building should not exceed 0.004H, where H is the storey height of the building as per the

Table No. 3 Maximum storey drift difference between x and y direction

Story	Elevation	Composite(mm)	RCC(mm)
Story7	18.2	0.363	0.276
Story6	16.2	0.216	0.474
Story5	13.5	0.4	0.383
Story4	10.8		0.586
Story3	8.1		0.720
Story2	5.4		1.092
Story1	2.7		1.169
Base	0		0

### 4.3 Modal load participation ratio

Model participation mass ratio indicates the percentage of structural mass of the model participating in a given direction and mode. Tabulated in table no 2 and 3 the static and dynamic acceleration along with the figure number 4.3 and 4.4. According to IS 1893:2016, a lateral storey regular building should contribute at least 65% of mass in each direction.

Table No. 4 Static acceleration

Case	Item Type	Item	Static %(Composite)	Static %(RCC)
Modal	Acceleration	UX	98.53	99.97
Modal	Acceleration	UY	99.61	99.99

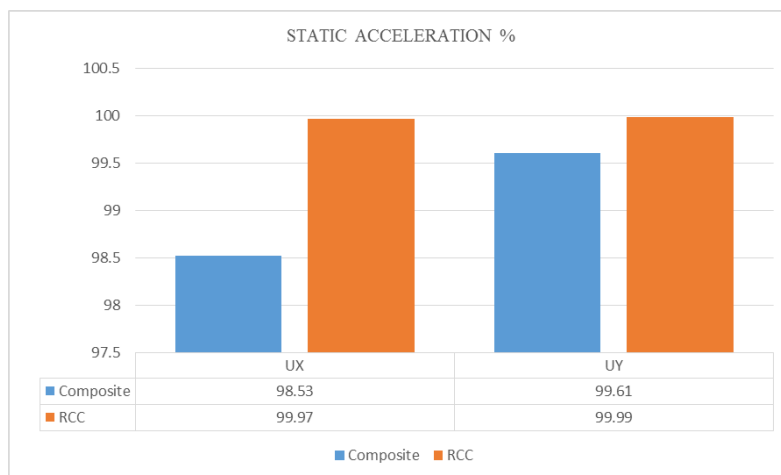


Figure no 4 :- Static acceleration

Table No.5 Dynamic acceleration

Case	Item Type	Item	Dynamic%(Composite)	Dynamic% (RCC)
Modal	Acceleration	UX	79.92	98.14
Modal	Acceleration	UY	87.03	98.86

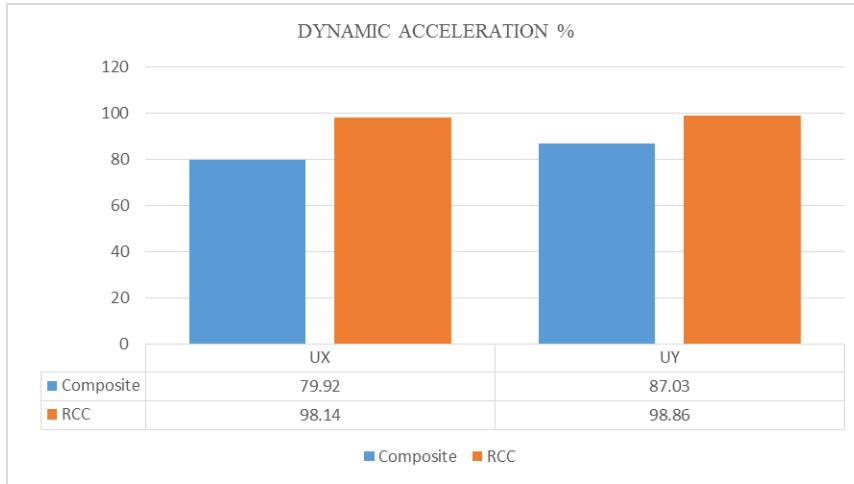


Figure No 5 Dynamic acceleration

#### 4.4 Fundamental Time Period (S)

Fundamental natural period T is an inherent property of a parking building. Any alterations made to the building will change its T. Fundamental natural periods T of normal single storey to 7 storey parking buildings tabulated table no 13 and shown graphical representation in figure number 4.5 are usually in the range 0.05-2.00 sec

Table no 6. Fundamental Time Period

Mode	Composite	RCC
1	0.836	0.84
2	0.603	0.604
3	0.53	0.554
4	0.248	0.485
5	0.212	0.3
6	0.177	0.3
7	0.174	0.3
8	0.148	0.3
9	0.129	0.3
10	0.126	0.299
11	0.119	0.241
12	0.107	0.228



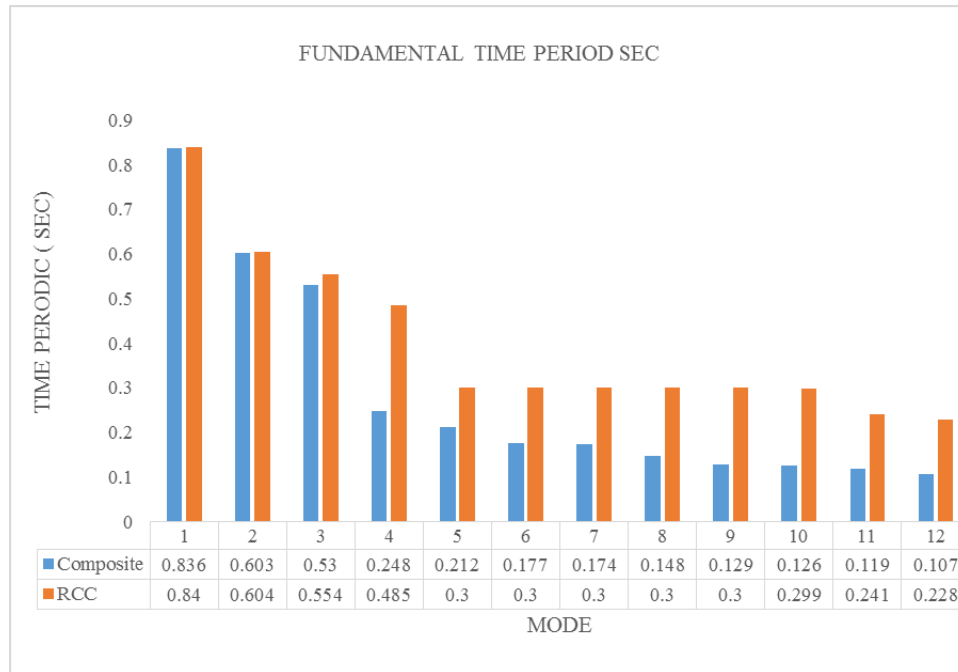


Figure 6. Fundamental time period

### V. CONCLUSION

- 1.The precious time of citizens is wasted due to traffic jams and this problem solved at this stage, by proposed G+7 multilevel parking at strategic place like Paithan gate in Aurangabad city.
- 2.The maximum displacement values are less in steel concrete composite structure compared to RCC hence it concludes that stiffness of composite structure is high compared to other parking structure
- 3.The maximum storey displacement as per IS 456:2000 is  $H/250$  (72.8 mm) for the height of the building i.e. 18.2 m. The maximum storey displacement from the analysis obtained is 14.1 mm for composite parking structure & 16 mm in RCC structure which is well within limit, hence the both parking structure is considered safe.
- 4.As the stiffness of composite members is high, the storey drifts of composite structure are comparatively less than the RCC parking structure within permissible limits.
- 5.The maximum allowable storey drift as per IS 1893(part 1) cl. 7.11.3 is  $0.004H, 0.7$  to  $0.25\%$  of height, therefore the value so obtained for 18.2 m is (0.12 m to 0.0455 m) and the result obtained 0.781 mm for composite parking structure & 1.092 mm which is well within the range of the building.
- 6.The static acceleration and dynamic acceleration is also less of composite parking structure than the RCC parking structure.
- 7.The displacement values are less for steel concrete composite parking structure so that the time period required is also less for composite structure as compared to RCC parking structure
- 8.So as per the above analysis result the steel concrete composite parking structure is better than the RCC parking structure.

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