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PLANNING AND DESIGN OF MULTISTOREY BUS PARKING: A REVIEW

[1]*Chandan Sahani*, [2]*Sunil Saharan*,[3]*Rahman Wali*, [4]*Bello Safiyanu*

[1,2,3,4] *Department of Civil Engineering, Sharda University*

Abstract— ***the growing population India has created many problem, one of them is parking problem of vehicles. The population is increasing day by day which leading to increase number of vehicle. This increasing number of vehicle is creating problem of transportation system. In order to reduce parking problem construction of multistorey parking is needed. This paper presents the planning and design of multistorey parking of buses which reduce the parking problem of buses. In this paper we considered various design aspect such as planning of grid, designing, dimension, bay width, arrangement of deck and ramp, alignment paths to exits barrier, security, visibility, space allowance and lift provision. For analysing this structure all possible loading was considered to check whether the building is safe against all the possible loading. For analysing this multistorey building E-tab (2016) software is used and planning of building was done by Auto CAD (2015)***

Keywords— Concrete, Analysis, Design, Modelling, Spacing for parking, ETAB (2016), AUTO CAD(2015).

I. INTRODUCTION

Building is a space enclosed by number of wall, column, and beam with roof. Similarly multistorey building is structure which consists of number of floors. Earlier building was constructed mainly for living purpose only but as time passes technology goes on increasing and nowadays building is constructed for different purpose, one of them is parking purpose. Multistorey bus parking is structure design for parking which consists of number of floors or level with sufficient strength to withstand against the various loads of buses and passenger. In multistorey bus parking, large number of buses can be parked in small space in managed way.

Earlier there was very less population and the number vehicle was also very less. As the population of India is growing day by day with rate of 1.11% per year, with this increasing population the number of vehicle is also increasing at rate of 11.05% according ministry of statistics of 2011-2012. The increasing number of vehicles has created the problem of transportation system. To reduce the problem of transportation, government has plan to run public buses so that people can use public buses in rather than using their own vehicle. But with this increasing population the government expands these public buses in large number which has created the problem of parking. In order to reduce the problem of parking of public buses, it is necessary to construct the multistorey bus parking system which occupies less space and public buses can be parked in managed way.

Traditional way of bus parking was unmanaged and was occupying a lot of space and the cost of initial construction was also high. Current way of parking is improved and has sufficient facilities and provides easy access to public buses and passenger too.

II. LITERATURE REVIEW

Dhalwar et al.(2018) performed the analysis and design of pre engineering multilevel car parking for mitigation of traffic challenge in public area using STAAD PRO and ETAB software. It was found the pre engineering building are low rise building up to height 20m to 30m and are very economical & speedy. It can be constructed less than half of normal time especially when complimented with other engineering sub system. Pre engineering building has lower construction cost, lower maintenance and operational cost, withstand high wind speeds, dynamic loads and seismic loads. It was found that section designed by using STAAD PRO software was found efficient and economical than the conventional steel section. It can be concluded that the pre engineering building is best suited for providing end user a much more economical and the better solution for larger column free parking space.

Dr S Mahendran (2018) performed the planning and design of multilevel parking (G+5) using AUTO CAD and STAAD PRO as per IS 456-2000. The layout of building was planned with reference of codes to facilitate maximum utility and for emergency purposes, separate dog legged staircase was provided on the backside of structure. It was found from the analysis that the size of beam was 250mm x500mm, column of 300mm x300mm, slab thickness of 300mm. It was found that load on slab are considered to be uniformly distributed load. The beam is subjected to bending and develop bending stress and is design for flexural resistance and are checked for safety against deflection.

S.logeswaran (2017) studied the planning of bus terminal. The size of bus terminal was decided by analyzing its operational condition bus route, scheduled timing and basic facility requirement. They explain the design factor and design element to be considered for bus terminal planning with minimum standard such as bay width with clearance, bay width, parallel offset, turning radius of bus, road width at entrance and exit, toilet and washroom for passenger and staff, canteen for passenger and staff, ticketing booth, sewage treatment and waste management, kiss and ride parking, emergency clinic, easy access from seating room to bus parked and ticketing booth, proper sign board and marking for route, toilet, entrance, exits, maps of bus park, route and city etc.

Lavanaya et al. (2017) performed the analysis and design of multistorey (G+4) residential building with lateral loading effect of earthquake by using software ETABS. The design was carried out according to Indian code IS-1893 part 2-2002, IS 456-2000 with taking type-2 soil condition and sever seismic zone factor 0.24, response reduction factor(R) 3.0. The column size varied from bottom to top, larger to smaller and diaphragm was rigid. Analysis was done by using software E-Tabs and was successfully verified manually as per IS 1893-2002 and was found that the gradual increase in the value of lateral forces from the bottom floor to top floor in software analysis. It was found that maximum shear and maximum bending moment was acting on top floor of the building.

S.S Kudwe et al. (2017) preformed the analysis and design of multistorey parking (G+5) of floor height 3m with fixed support at base of structure on hard type soil, location in zone II. They studied seismic behaviour of multistorey car parking building with three different loading condition: (a) when all car are parked (b) when no car are parked (c) when only one floor is parked and other remain vacant and the structure is analysed according to Indian Standard (IS) code. Response spectrum system is used for analysis of building which show the behaviour changes with the lateral force of building due to the change in loading condition. Displacement of the structure and base shear of the structure increase with the increase in the mass.

Chaudhary et al. (2016) studied the problem of multilevel parking system such as the driver himself has to go different floor and search the parking space parked manually and in the same way driver himself has to search and fetch it which was unnecessary waste of time and require lot of manpower to guide the driver for parking (security guards in mall basement) which result in loss of manpower. In this paper they placed sensor in each parking space, the sensor which will report the data to controlling computer or cloud application on the internet and so that the driver can access the data in real time. And other way is that there will be huge cage for car parking which will have sensor that show whether the cage is full or empty. When the first car enters, cage will open & car will enter and it swings away and the driver will have card with barcode which will allow him to locate the vehicle, if driver want to take it out they can scan and get it.

Sonker (2016) preformed the planning and design of multilevel parking of two floors, the ground floor for car parking and first floor for motorcycle parking and discuss different type of multilevel parking such conventional type parking and automatic type parking or mechanized parking. Conventional type parking may be underground, above the ground or both and include entry and exit ramp, circulation between vehicle, car parking area etc whereas the technology used for automatic parking are puzzle type or modular type, tower type or elevator type, multi floor type and rotary type. It is found that usually 90 degree of parking is preferred but where the space is limited or does not lent itself to 90 degree parking then 30, 45, 60 degree parking may be used instead. The purpose of this paper is to provide safe, easy circulation of traffic and comfortable place for parking of vehicle.

Gajendra et al. (2016) preformed the analysis and design of C+G+5 residential & commercial building by using the software STADD Pro. The process of design involve structural planning, computation of load , method of analysis, member of design(i.e. beam column one way slab, two way slab, single reinforcement beam and double reinforcement beam, staircase etc) detail drawing and preparation of schedule. They found deflection of all horizontal members within 20mm and structural component of building are safe in shear and flexure with economical amount of steel.

Dahane (2016) preformed the design of multistorey parking for mitigation of traffic challenge in public areas using various case studies. Various design aspects were considered such as arrangement of deck and ramp, planning and structure dimension, headroom, car park layout, bay dimension, parking angle ,the bay width, slope of ramp and ramp dimension, planning grid, security, visibility, space allowance, lift provision and design information. Detailing of structure was done by software AUTO CAD and analysis and design was done by ETABS (2015). Manual calculation of building structure was done and compared with analysis of software data. They found the maximum story drift in both X direction and Y directions and maximum displacement in both X direction and Y direction (i.e. column with curtailment and without curtailment) were within permissible limit.

Pandey et al. (2016) preformed the design of multi level parking for capacity of 600 cars and 550 bikes. They have design different component of the multi level parking i.e. raft foundation, retaining wall, beam, column, and flat slab using STAAD pro and manual bases and AUTO CAD was used for making various structural drawing. It is found that the use of flat slab helps in saving building height, shorter construction time, approx saving 10% in vertical member, lower storey height reducing building weight due to lower obstruction and outer wall construction. In this paper they discuss how to use the information technology and image processing to implement a high management parking system to reduce the problem and the weakness that is already appointed in the parking system.

S.A Raji et al. (2016) preformed analysis and design of multilevel parking by using MIDAS GEN and compare the output with manual approach. The column was design according to BS 8110 code and the structural load acting on each member element were determined according to the BS 6399. They manually analyse and design the structure using limit state design (ultimate and serviceability method) according to BS 8110 and found the very small difference between the analysis through software and manual approach. From software analysis, it was found that maximum bending moment at support and then difference between maximum and minimum shear force was 26.42KN. They found the difference between manual and software tool of 61.4 KN for the maximum support bending moment of selected beam.

Dr. Panchal (2014) presents the modelling analysis and design of multilevel parking using software STAAD PRO V8i. Analysis of building was done by approximate method. It was found the composite construction of column, beam and frame were made of steel and with different type of slab such as solid slab, precast slab units and prolife sheet decking with concrete. They found the cost of construction was higher since reaction moment governing the foundation seems to be higher when ductile code is used for analysis and design .When AISC LFRD code is used for analysis and design, it consume less amount of steel in comparison when AISC ASD code is used. Hence it is desirable to follow the AISC LRFD code.

Mr. Nikhade et al. (2014) preformed the analysis and design of bridge. In this paper they studied IRC Class AA loading, Class A loading, Class B loading etc. During the analysis they have considered the intensity of wind load, centrifugal force, seismic force etc. It was found that variation of grade of concrete with load, moment decrease with the increase in the grade of concrete of RCC bridges. It was found that from excel sheet developed can provide design output for any long span box girder bridge and analysis and design of Box Girder Bridges for any span can be obtained from mathematical models without doing lengthy calculation.

III. CONCLUSIONS

Based on the study done, it can be concluded that multilevel parking can be made of steel only or concrete only or composite construction. From above study the design and the element with respect to minimum standard can be selected. It also can be concluded that multistory parking can be effectively used to reduce the problem of parking in cities. From above paper it can be conclude that multilevel parking can be constructed in two way conventional way of parking and automatic way or mechanized way of parking. In multilevel parking, large number of vehicle can be parked in managed way covering small area or space and all the facilities that are required for passengers.

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