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Analysis of a Tall Structure Considering Three Different Filler System using ETABS

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Abstract

A reinforced concrete building with masonry infill is most common type of construction in India. Traditionally, conventional clay bricks or concrete blocks which are heavy rigid materials have been used as Infill wall. Though, AAC (aerated light weight concrete) blocks which are lightweight, flexible building materials that provides insulation and fire resistance and have lower impact on environment, can be used as masonry infill (MI) material in buildings. AAC blocks are now also available in India. A number of researchers have studied the behavior of AAC in-filled reinforced concrete (R/C) frames experimentally. Interlocking Bricks are even introduced further which adds an advantage over AAC bricks.

IN THIS PAPER presenting review of literatures

Index Terms: Interlocking Blocks, AAC block, Infill frame, Equivalent strut model.

I. INTRODUCTION

Reinforced concrete building with masonry infill is the most common type of construction in India. Masonry walls are provided for functional and architectural point of view and thus they are generally considered as nonstructural elements. Hence interaction of infill with bonding frame is neglected in the design. Though an irifill panel interacts with the bonding frame and may induce a load resistance mechanism when subjected to lateral loads. Influence of infill is ignored in modeling of the RC structure which leads to inaccuracy in guessing the actual seismic behavior of framed structures.

Infilled frame shows a composite structure which is made by the combination of both RC frame and Infill walls. The lrifill walls in infilled frame may be of conventional clay brick, concrete block or AAC block. The study of the influence of types of infill materials on the seismic response of infilled RC frames is still limited.

Thus, in present study focus is given on the effect of type of material on wind performance. AAC blocks, Interlocking Blocks and clay bricks are used as irifill in RC frame. AAC blocks are light-weight building materials that provide insulation and fire resistance and have lower impact on environment. Ashish Patil and Dr. Ajay G. Dhake (2021) research paper examined the layout notion of the interconnecting.

structure block airs its application as a wall. The ›. as have their strength characteristics tested using ansys software. Similarly, the use of the particular interconnecting construction block below does not raise electricity more handy, but further minimises the amount of human effort. Such blocks may transfer from one location to another without any problem. The concrete grade M50 has been used for

block instruction in the software application.
When comparing the RCC wall with the concrete wall triggered, the strain on the precast wall is significantly less than the RCC wall. The simplified building cycle reduces time, boosts productivity, reliability and efficiency and reduces costs. Precast Construction provides an extended lifetime and reduced maintenance costs. Precast concrete is more densely resistant to chemical attack, erosion, shock, ground suction and is dust-resistant.

II. LITERATURE REVIEW

Irfan Khan et.al (2021) research paper tested the computational modeling of Dry-Stack Block Masonry (DSM) walls subjected to cyclic monotonic loading. The analytical results were compared with experimental test results of the unreinforced and unconfined DSM cantilever walls subjected to lateral loading along with a constant axial load. ABAO_US has been used for Finite Element Modelling and analysis of the wall. Various material properties are defined for the wall in the software and modelled as a homogeneous material.
The results obtained from experimental work and numerical analysis using ABA US, of DSM walls showed a well-defined similarity in behaviour in the elastic range. The damage patterns of experimental and numerical model for monotonic lateral displacement are closely matching, which shows the authenticity of the Finite Element Package. The monotonic response of multi-story DSM can be predicted accurately based on the results of the ABAQUb soitware. Though the pattern of Hysteresis loop, obtained from ABAQUS does not accurately match with the experimental plot, yet the cyclic behaviour of DSM can be predicted. The plastic strains match with the corresponding experimental diagonal cracks for cyclic loading.

Manoj U. Deosarkar et.al (2021) The purpose of this project was to develop an interlocking block system which does not require mortar for construction of masonry walls and to reduce the cost by using recycled aggregate and time of the construction. The blocks developed by us where provided with projection and depression to interlock them horizontally and vertically and to prevent them from sliding. The blocks are efficient in resisting the sliding horizontally and vertically. The grooves and keys are strong enough to resist shear and deterioration due to minor impacts while handling.

Ho Choi and Kang-Seok Lee (2020) research paper presented experimental tests of two types of new concrete block walls as well as a typical block wall and investigated their in-plane behavior, loading bearing capacity, energy dissipation capacity and reuse ratio.
Results stated that the in-plane seismic performances of Specimens PS and DS were much higher than that of Specimen CB. In particular, the deformability of the proposed system has improved remarkably due to the interlocking mechanism between the main blocks and the key blocks. The calculated lateral loads based on the simple rocking mechanism agreed well with the experimental results. The energy dissipation capacities of the proposed systems were considerably superior to that of Specimen CB. Furthermore, the remarkable deterioration of the ratios of the proposed systems were not found until the final loading. The proposed seismic block systems can reuse more than 70% after the final loading. This result implies that the proposed concrete block wall systems are economical and eco-friendly.

Parimal Borkar et.al (2020) research paper presented an analytical study of Precast retaining wall made up of precast structural blocks, and it was compared with precast RCC wall. The blocks were designed and analysed using ANSYS software and further interlocked to form a retaining wall.
Results stated that the deformation of the retaining wall produced less than 3mm which was quiet safe enough. When the RCC wall was compared with the precast wall, stresses induced in the precast wall was very less as compared to the RCC wall. These blocks are easy to transport and they are easy to construct The key factors which regulate the quality of construction such as curing, temperature, mix design, formwork, etc. can be monitored for Precast Concrete for improved quality construction. The simplified construction process reduces the time, increases the productivity, quality and safety and thus the cost is reduced. Precast Concrete structure has a longer service time period and minimal maintenance. The high-density Precast Concrete is more durable to acid attack, corrosion, impact, reduces surface voids and resists the accumulation of dust.

Aiko Furukawa et aI (2020) the research paper investigated the use and shape of the interlocking blocks instead of the regular rectangular blocks to increase the strength of masonry buildings without using expensive reinforcing materials. Diagonal compression tests were performed to investigate the effects of the interlocking block shape and the support conditions on the load-displacement relationship and failure behavior of the masonry wall. Four types of interlocking blocks were prepared namely I-shaped block (right angle type), I-shaped block (obtuse angle type), hourglass-shaped block (linear type), and hourglass-shape block (wavy type).

2-dimensional finite element analysis of the diagonal compression test was also conducted.
Results stated that walls made of I-shaped blocks with a right angle have less strength than the I-shaped block walls with an obtuse angle and the two hourglass-shaped block walls. It was also found that the support condition has a slight effect on the results of the I-shaped block wall with a right angle but large effect on the results of the other three block walls where the wall under the contact condition has larger strength than the wall under the glued condition. The strain was locally concentrated where the adjacent blocks interlock with each other or the block interlocks with the jig, and failure occurred at the area where the strain was concentrated. Strength can be increased by changing the block shape with less interlocking effect such as the 1-shaped block walls with an obtuse angle or hourglass-shaped block walls. However, the displacement increases due to the dislocation and rotation of blocks as the interlocking effect decreases.

C. Neeladharan et.al (2019) in the research paper, the AAC block was shaped into a size of 25cm*15cm*15cm. It was drilled using a 12mm drill bit at an regular interval of 12.5cm at the top and 5.5cm at the sides. The rods of grade 415 are cut into a regular length of lm and 1.25m.These rods are threaded at both the ends for a distance of 0.65cm.
The Earthquake resistant wall has the greater strength comparatively with the conventional wall. Wall fails due Earthquake resistant walls doesn't have the bond between them, it has a greater strength. The cracks doesn't tend to develop all along the structure , thus avoiding the sudden collapse of the structure .Provision of these type of walls at corners can reduce the maximum drift to the structure, by withstanding the heavy Loads. The results of this Project indicates that it could be Economical & Faster way of construction in seismic zones.

Gulam Rizwan Gulam r iroz et.aI (2U19) in this research paper presented analysis, design and estimates of structure, comparing between autoclave aerated concrete and conventional brick in the form of steel consumptions. Autoclaved Aerated Concrete (AAC) is a lightweight concrete building material cut into masonry blocks or formed larger planks and panels. Multi-storeyed residential building was analyzed designed with lateral loading effect of earthquake using ETABS as per INDIAN CODES- IS 1893- part2:2002, IS 456:2000.
Results stated that the base shear, lateral forces and story shear for a structure with AAC blocks is significantly less as compared with the structure in- filled with brick masonry due to low weight density of AAC blocks. Lesser base shear will result in lesser lateral forces and as the weight density of AAC blocks is less as compare with brick masonry the dead load of AAC block masonry is less as compared brick masonry and hence economy in design can be achieved by replacing brick masonry with AAC block masonry. The bending moments for members of structure with AAC block in all cases were less as compared with corresponding cases of structure with brick masonry.

Lohith M S et.al (2019) research paper aimed to review the development of interlocking bricks and its structural behaviour and experimental investigation was conducted on parameters of compressive strength, water absorption, acid resistance test, carbonation.
Results stated that acid resistance strength was less for

1st class table mould burnt bricks compared to CSEB. Depth of carbonation is also more for 1st class table mould burnt bricks compared to CSEB. CSEB absorbs less water due to the absence of pores and voids. Hence the percentage of water absorption is less in CSEB compared to 1st class table mould burnt bricks.

Syed Raheel Ahmed and Aditi H. Deshmukh (2019) research paper presented comparative analysis and design of the structure using different types of infill walls. In this study, an R/C frame structure with a different type of infill walls like AAC Block, Clay Brick, was considered to investigate the effect of different types of infill walls on earthquake response of the structures. The RCC frame analyzed & designed by using STAAD-Pro software. The diagonal strut approach is adopted for modelling of irifill walls. The analytical results of the building frame were compared and analyzed to obtain are storey drift, base shear, Lateral displacement, shear force and bending moment when subjected to static earthquake loadings. Results stated that the bare frame model have the maximum shear force and bending moment in structural members, on the other hand, conventional brick infill model have the minimum shear force and bending moment as compared to all other models. The conventional brick have minimum lateral displacement then AAC block infill model because the diagonal compressive strength of conventional brick is more than AAC Block as AAC blocks are lightweight and less compressive strength. Its show presence of infill contributes to the stiffness of the building.

Mubeena Salam and S. Siva Rama Krishana (2018) research paper presented comparative analysis of a structure with bare frame and a structure with infill masonry walls. Each building model was of 21 storeys and height of each storey was 3.5m except 11th storey, height of 11th storey is 2m for all the different building models. The building was considered to be located in seismic zone V. In seismic weight calculations, 50% of floor live load was considered.

Results stated that seismic base shear considerably more for masonry infill, shear wall and Concrete bracings models as compared with bare frame model. Hence consideration of masonry infill stiffness, shear wall and Concrete bracings increases Strength of the structure. Storey drifts are found within the limit as specified by code (IS 1893-2002 Part-1). The presence of masonry infill influences the overall behaviour of structures when subjected to lateral forces.

Prajakta Dinesh Bulkade and Ganesh P. Deshmukh (2017) research paper aimed to compare the environmental impact of materials- Kiln Burst Brick and Autoclaved Aerated Concrete used for wall assemblies. Further objective was to evaluate the materials on the bases of Life Cycle Assessment Impact Categories which includes: Raw Material Index (RMI), Water consumption, Embodied Energy (EE) and Operational Energy (U-Value), Electricity, Occupational Health and Safety (OHS Index), Total Cost, CO2 Emissions.
Comparative Analysis indicates that in almost all the parameters, the AAC blocks have a superior edge over burnt clay bricks. The use of AAC blocks leads to savings in overall project cost; enables to speed up the construction process reduced environmental and social impact. Conclusion stated that use of ACC blocks over burnt clay bricks was recommended. It is advisable to developers, contractors, and individuals to encourage this product as its use is in national interest.

Ajay Patre and Laxmikant Vairagade (2016) research paper carried out the project high rise buildings effect of infill wall using light weight block and conventional bricks. Structural analysis and design in STAAD Pro by Equivalent Static Method. High rise building using infill ALC(Aerated light weight concrete block) and conventional clay brick masonry was designed for the same seismic hazard in accordance with the applicable provisions given in Indian codes. The analytical results of the high rise buildings was compared and analyzed obtained are cost, lateral displacement, storey drift, equivalent diagonal strut, axial force and shear force in beam and column when subjected to dynamic earthquake loadings and the structure properties are optimized for most economical dimensions.

Results stated that the ALC block material can basically be used to replace conventional bricks as infill material for RC frames built in the earthquake prone region. Shearwall construction will provide large stiffness to the building by reducing the damage to the structure. In the Base Shear in X and Z- direction SW lAB is more efficient than NCB and the % variation is 40 to 45. In the Base Moment in X and Z- direction SW lAB is more efficient than NCB and the % variation is 40 to 45. In the Floor Wise Displacement SW lAB is more efficient than NCB and the % variation is 70 to 75. By considering the infill wall the roof displacement of the structure reduces.

Bhavani Shankar and Anusha (2016) in the research paper, building frame, wall, foundation, soil was modeled using ANSYS CIVIL FEM software.The seismic analysis of single storey single bay frame with infill wall built using interlocking block and brick was conducted and compared.

Results stated that Structure with infill wall built using interlocking block has lowest value of displacement when compared with other two models. Overall displacement of interlocking block wall is reduced by about 47% when compared with frame without infill wall and about 21.4% when compared with brick infill wall.

III. CONCLUSION

Here authors studied the variations in effect of walls using analysis tools but none of them explained the effect of material over the wall system.

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