

Analysis of multistorey building under Fire Loading

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ABSTRACT

Under the implementation of the normal and parametric temperature-time fire curves, much of the new understanding of construction time fire curves activity in fire is run. Project fires are based on experiments on a small scale and uniformly idealize the thermal environment. So, their applicability to wide enclosures has major limitations. This research examines the structural-thermal response of a 10-story RCC. RCC is a mixture of reinforcement and concrete and is used in different kinds of construction work. Reinforcement concrete structure widely used around the world. In this study 10 story RCC structure is modelled in the 3D AutoCAD and thermal analysis done in Finite element software ANSYS. In this findings show that, depending on the fire, the structural response uses different materials and does not spread and does not as long as the fire is concentrated on a single floor, it changes dramatically due to the location of the fire. This paper illustrates the comparison and study of structural behavior changes using the AAC Block and Brick Wall of Flames.

Keywords

Thermal Analysis, AAC Block, Brick wall, ANSYS, RCC.

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Introduction

There are essentially two concepts to selecting and designing for structural elements of fire resistance:

- 1) A perspective method, and
- 2) A performance based method. [13]

The most prevalent type of construction in India is reinforced concrete construction with masonry infill. Masonry walls are supported from a practical and architectural point of view and are therefore typically regarded as non-structural components. AAC blocks and clay bricks are used in the RC frame as infill. Lightweight construction materials that provide insulation and fire resistance are AAC blocks and have lower impact on environment. [11]

The issue of how to describe the fire environment to be used in the building's design stage is faced by structure fire engineers. In the 3D AutoCAD and thermal analysis carried out in the Finite Element program ANSYS, a 10 story RCC structure is modelled. The effect is a rise in temperature during a fire or heat transfer from the fire to structural components. This rise in temperature leads to a substantial loss of strength of the material and the consequent thermal expansions in the system compared to the cold behavior.

A. Heat Transfer Analysis

- Heat transmits by three ways, as it is quite widely known; namely, conduction, convection, and radiation.
- Concrete is difficult to describe by a single numerical value for all of its properties, because of its versatility and diversity.
- If the temperature of a warm body is not in equilibrium (steady state), the body's temperature profile changes over time. The transient heat analysis method is used when time is a factor for heat conduction analysis.

B. Thermal Analysis

- Thermal analysis is used in order to determine the distribution of temperature, thermal gradient, heat flow, and other thermal quantities in a system.
- Steady-state or transient may be a thermal analysis
- On the entire structure, thermal load is applied.

Material Used in Structure

A. AAC Block

This type of structure is manufactured in Sweden in 1994. The AAC block referred as Autoclave Aerated Concrete. This becomes the most useful constructions in Europe and there is increment in rising in many countries. AAC is made of lime, sand, cement, water, and a limited number of common materials that are rising agents. It is autoclaved under heat and pressure when mixed and molded to develop its properties.

AAC has exceptional thermal insulation and acoustic absorption properties. AAC block is free resistant and pests is as well as is economically preferred for traditional materials such as stone, timber, brick and concrete. AAC is thermally insulation material which may built on concrete i.e., used for exterior as well as interior construction. For high-rise buildings as well as those with high temperature fluctuations, AAC is greatly suited. High-rise structures built using AAC need decrement in concrete and steel for structural members and concrete for structural members due to their lower density. Due to its less cost than brick masonry, easy construction, light weight, high thermal insulation, good fire protection, high sound insulation, lower water absorption, eco-friendly, a large number of buildings are now being constructed using the AAC block.

B. Brick Wall

The world's most widely used R.C. Brick-masonry construction is used, even in the earthquake zone. In order to ignore the contribution of strength and rigidity of the infill as a bare frame, construction of reinforced concrete with brick infill walls is studied and designed. In addition, the infill works along with the reaction of the infill activity of the structures differs from the expected infill-free construction. [11]

A brick is a type of block used in masonry construction to build walls, pavements and other features. Brickwork, using bricks and mortar, is masonry created by a bricklayer. Usually, to create a building such as a brick wall, rows of bricks called courses are laid on top of each other.

Literature Review

1) Sami Kilic and Serdar Selamet(2013) there is an investment of uncoupled structural- thermal response of 50 storey building which is steel high rise. The high rise structural loads carrying mechanism with a moment that resists frame. The results show that the structural response and the progressive collapse differ depending on the spread of the fire, and as long as the fire is contained to a single floor, the location of the fire does not change drastically. The aim is to study a provide better performance of impact loading of fire that is leading to collapse of multi storey steel building mechanism. [5]

2) Jadhao and Pajgade (2013) they observed the RC frame behavior with infill of clay bricks and AAC blocks to seismic loads. They examined that the base shear of the AAC block models was substantially smaller than that of the traditional clay bricks, resulting in a decrease in the strength of the member forces, which resulted in a decrease in the amount of as needed to resist the forces of the member. So, using AAC blocks instead of traditional clay bricks, economy in building can be achieved. [4]

3) Y. Wang, Y.L. Dong, B. Li, G.C. Zhou (2013) knows more about the fire behavior of concrete floor slabs and this paper discusses the results of a fire test on continuous concrete floor slabs in a full-scale 3-story steel framed construction. The case models the reality of fire conditions more closely than previous laboratory studies, requiring four panels (two by two) and steel beams on the third floor to heat the structure of a special furnace on the second floor of the building. The experimental findings are evaluated in detail and take into account the furnace temperature, the distribution of temperature, the vertical and horizontal deflections during the heating and cooling process of the structural element failure patterns. Test results show that the number and position of the heated panels on the floor also have a significant influence on the continuous concrete floor fire behavior and, in addition to the limitation conditions set by the adjacent structural members, on the boundary limitation conditions. In addition, the steel beams show better fire-resistant performance than those found in normal fire tests, depending on their structural integrity and the interaction between the structural elements. Compared to the high-strength bolt connections and the welded-bolted connections of the structure, the steel beams subjected to fire do not cause local buckling. [3]

4) Anil Agarwal, Amit H. Varma(2014) they offers a quality evaluation for importance of gravity columns with stability behavior of 10- storey steel construction under fire loading. Two types of ten storey building with a planned composite floor systems, following construction patterns in the US. According to the lateral loads, one of these buildings had perimeter moment resistance frames (MRFs)while the other building had the inside core of the RC shear walls. The impacts of gravity loads as well as fire conditions were simulated with the use of finite element approach and numerical simulation methods. [7]

5) Shukla (2014) addressed an attempt to compare two primary building materials and provide detailed analysis to assist engineers and architects in evaluating their choice of materials. Comparative analysis reveals that in almost all of the parameters, the AAC blocks have a superior advantage over burnt clay bricks. The use of AAC blocks contributes to reductions in total building costs; decreased environmental and social impact can be reduced to speed up the construction process. She therefore concluded that it is advisable to use AAC blocks over burnt clay bricks. As its use is in the national interest, developers, contractors, and individuals are encouraged to support this product. [6]

6) Rathi and Khandve(2015) there are replacement of red bricks with the eco-friendly AAC blocks. They concluded according to their analysis which may use of AAC block decrease building costs by up to 20 percent as it renders a comparatively lighter member by reducing the dead load of wall on beam. The use of AAC blocks also reduces demand by up to 50 percent for products such as cement and sand. [10]

7) Khandve (2016) addressed different new applications of autoclave aerated concrete products in the construction industry in order to exploit most of the advantages of AAC. In order to increase AAC's share in the construction industry to contribute to the sustainable development of the nation's green initiatives, various AAC manufacturing industries should take the initiative to make these new applications more popular. He concluded on the basis of his analysis that building with AAC panels allows the final customer to reduce the overall cost of ownership. Supply of buildings made entirely of prefabricated AAC components results in cheap, easy construction and no on-site waste. [9]

8) Namboothiri(2016) was tackled by seismic assessment with AAC block infill walls of RC construction. ETABS software is used to model the bare frame model and the AAC block masonry frame design with and without openings. The infills are modelled as analogous struts in the process. A G+3-storey apartment building with medium soil strata in seismic zone III is the presumed structure. The method of measurement is adopted by the seismic coefficient. It is studying the effect of AAC blocks on multiple RC framed structure responses. To assess the effect of the infill on the structure, Base shear, story displacement and inter-story drift values are derived and compared. [11]

Conclusion

From the above literature, it is shown that researchers have widely performed studies on material activity. The fire behavior of the entire building and the contrast between the

RCC structure and the ACC block infill and brick wall are discussed in this study. In this comparative analysis of reinforcement concrete construction with the same model in which, like once with autoclaved aerated concrete block and brick wall. The author intend to expand the study by applying fire conditions to many floors in order to trigger various fire-induced collapse processes. And the fire dynamics inside the individual building are also known; the investigation of completely spread fires as well as moving fires.

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