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# Investigation of Ferrocement Plate Affected by Flexural Filling up

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***Abstract: In spite of the fact that terrorist attacks are exceptional instances caused by human dynamic loads, such as blast loads, which must be carefully calculated like wind and seismic loads, the increased number of terrorist attacks in the last few years has largely shown that the impact of blast loads on structures is a real concern that we should take into account during the configuration procedure of structures. This article also introduces the behavior of ferrocement composites under blast loading, which are used as long-lasting formwork in traditional reinforced concrete constructions. Specimens of single ferro cement panels are subjected to blast load testing both analytically and experimentally, and the behavior of load deflection is then examined.***
***Keywords: Ferrocement, Finite Element Method, Explosive Effect, Blast Resistant Design, Blast Waves.***

## I. INTRODUCTION

Concrete is a multicolored material composed of molten cement paste and finely and coarsely ground aggregate that settles over time. The majority of commonly used concretes are composed of lime, such as Portland cement or cements derived from other water-powered concretes, such as calcium aluminates cement. In any case, bitumen-based concrete, such as asphalt concrete, is another type of concrete that is utilized for road surfaces; polymer cements are occasionally employed in situations where a polymer is used as the bonding ingredient.

There are various varieties of concrete that vary depending on the ratios of the primary components. The final product can be implemented by substituting the aggregate and cementation steps. Density, tolerance to chemicals and heat, and strength are unique characteristics.

Large chunks of material mixed with finer elements like sand to form aggregate are typically found in coarse gravel or crushed stones like granite or limestone. The primary goals of this project are to examine how ferrocement concrete behaves under blast loading and how resistant it is to blasts compared to regular concrete.

First, a quick explanation of blasts and their various varieties has been provided. In addition, the standard components of the blast process were demonstrated to clarify how blasts affect structures. Gaining a deeper understanding of blasts and their characteristics will enable us to plan blast-safe structures much more efficiently. Basic techniques for extending a structure's perimeter to provide protection from hazardous impacts are discussed using both a planning and designing methodology.

If the threat posed by bomber action cannot be eliminated, then social fury, harm to the populace, and fatalities must all be reduced. It is undeniably not a feasible or cost- effective alternative to plan and design structures to be entirely safe, but modern engineering knowledge and design can enhance both new and existing buildings to lessen the impacts of a blast.

### *A. Ferrocement*

A potential solution to material problems is ferrocement, a material that is thin and slender but yet substantial and exquisite. It has a long history of use in structural hovels, where quills are used to stiffen dried mud. Committee ACI 549-R97. The development component known as ferrocement is thin, measuring between 10 and 25 mm in thickness. It is made of pure concrete mortar, devoid of any coarse fragments of broken or crushed stone. At least one layer of steel with a smaller diameter serves as reinforcement meshing of wire and welding.

Skilled labor is not needed for either the casting or the formwork. Because wire mesh support swiftly absorbs breaking powers beneath the surface, the concrete network in ferrocement remains intact. The Husain Doshi Gufa is a ferrocement shell construction located beneath the surface of Ahmedabad, India. It was constructed in 1993 and has withstood earthquakes and other natural disasters without breaking. It is still intact today.

With the help of ferrocement innovation, a structure with intricate curvatures may be built in a reliable manner, allowing compositional articulation free reign. Around the world, countries including New Zealand, Canada, the United Kingdom, Brazil, the USA, Australia, Mexico, the former USSR, India, Thailand, China, and Indonesia are leading the way in innovative ferrocement growth. Nowadays, research is being done on using cement as a structural material in place of RCC, blocks, steel, prestressed concrete, stone, and wood. It is also being studied as an auxiliary material for walls, floors, roofs, beams, columns, and components, as well as for holding or retaining soil and water in structures.

Various applications include doors, windows, shutters, and jambs. In contrast to typical brick work, RCC, or steel, ferrocement can be made into any perfect shape or auxiliary arrangement.

There are numerous types of meshes available almost anywhere in the world. Two important reinforcing parameters—the volume part of support or the total volume of reinforcement per unit volume of ferrocement—are typically used to depict ferrocement. The primary varieties of wire mesh now in use are listed below.

### *B. Phenomenon of Blast*

A blast is defined as a brief release of potential energy that is accompanied by an auditory blast and a brilliant flash. A component of the energy is released as a streak of heated radiation, while another portion is coupled as air blasts and ground shocks that travel both radially through the soil.

For a material to be explosive, it needs to possess the following characteristics:

1) This reaction has to produce gases with a volume smaller than usual weight, but the high temperature that results from a blast is much more remarkable than what the first reaction produced.
2) It should consist of a composite material or mixture of materials with the remaining portions remaining unchanged under normal circumstances; however, stimulation causes a brief chemical shift.
3) The alteration ought to be exothermic in order to warm the reaction products and subsequently increase their pressure. Common types of blasts include development that causes structures and their foundations to tremble or collapse, as well as accidental blasts.

### *C. Problem Statement*

The low-cost housing market, as well as certain residential and commercial buildings, can be built using cement. The suicide bombers might target these buildings. A bomb explosion within or close to a structure can seriously damage the building's exterior and interior structural framework, force walls to crumble, destroy large windows, and disable vital life-safety systems. Several factors can result in occupant injuries and fatalities, such as direct blasting, structural collapse, debris impact, and fire. Thus, cement panels are susceptible to blast explosions. Therefore, using ferrocement composite panels to develop blast-resistant buildings might be difficult for structural designers

## II. METHODOLOGY

1) DATA COLLECTION
2) MIX DESIGN
3) PREPARATION OF MOULDS
4) PREPARATION AND BINDING OF MESHES
5) CASTING AND CURING
6) ANALYTICAL TESTING
7) EXPERIMENTAL TESTING
8) MODELLING IN ANSYS
9) RESULTS IN ANSYS
10) RESULT AND DISCUSSION
11) CONCLUSION
12) FUTURE SCOPE
13) REFERENCES

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Table 1 Material quantity for design mix

| Material | Cement (Kg) | Sand (Kg) | Water (liter) | Admixtures (gm) |
|---|---|---|---|---|
| For total 6 Panels | 24 | 72 | 7.2 | 288 |
| For total 3 Panels with 18mm thickness | 10 | 30 | 3 | 121 |
| or total 3 Panels with 25 mm thickness | 14 | 42 | 4.2 | 167 |

## III. EXPERIMENTAL ANALYSIS

### *A. Modelling in ANSYS*

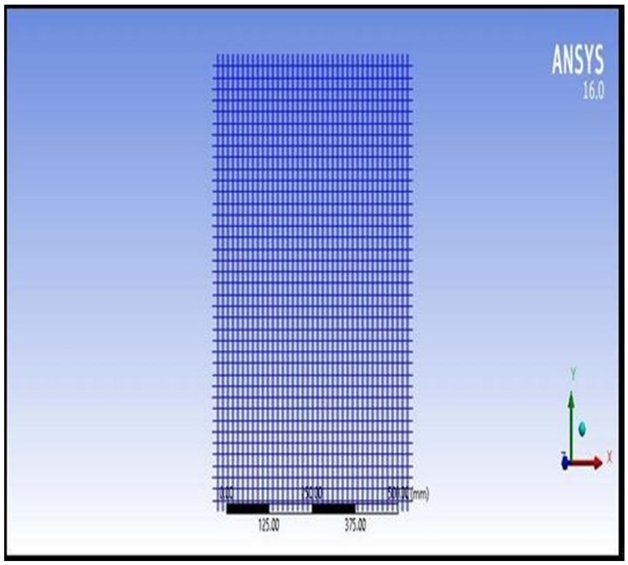



Fig 1 Wire Mesh Modelled in ANSYS

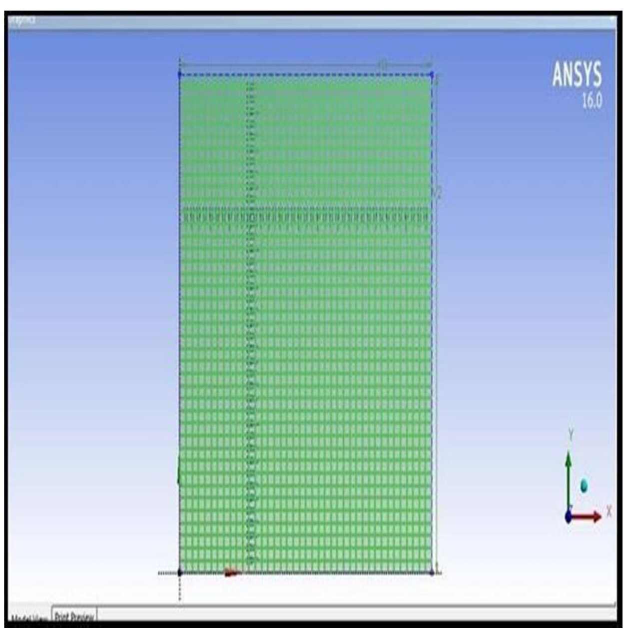



Fig 2 Modelling of ferrocement panels in ANSYS

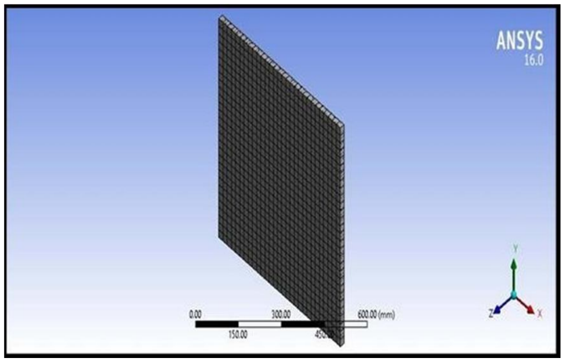



Fig 3 Meshing Ferrocement Panel

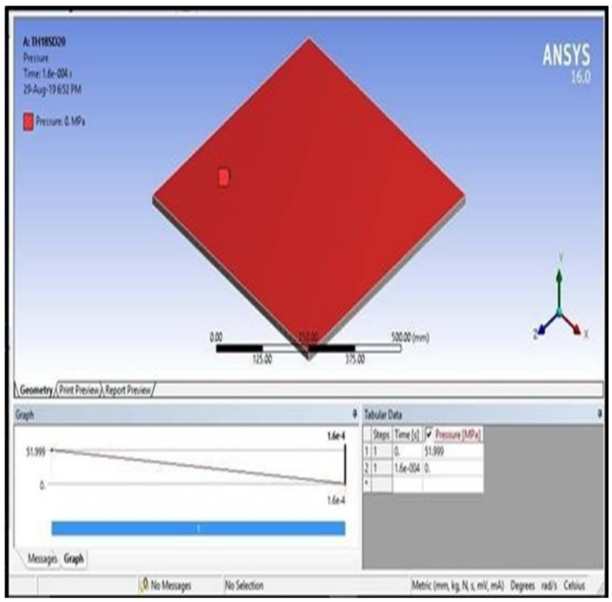
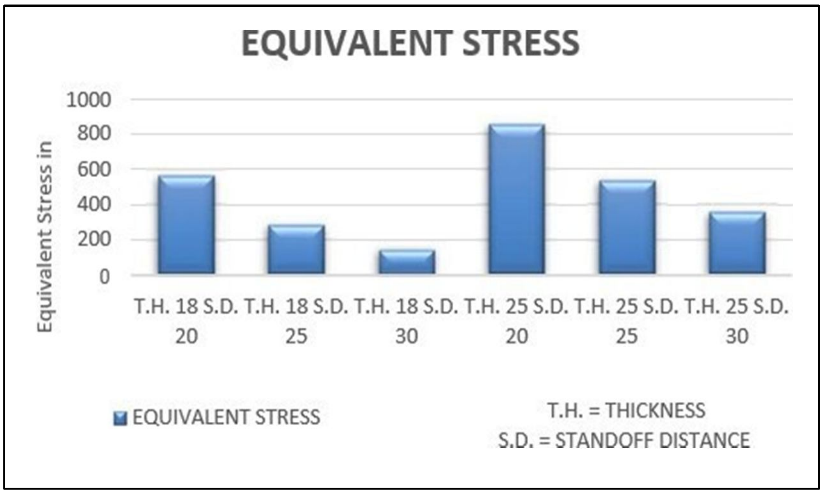



Fig 4 Providing Supports and Applying Pressure on Ferrocement Panel

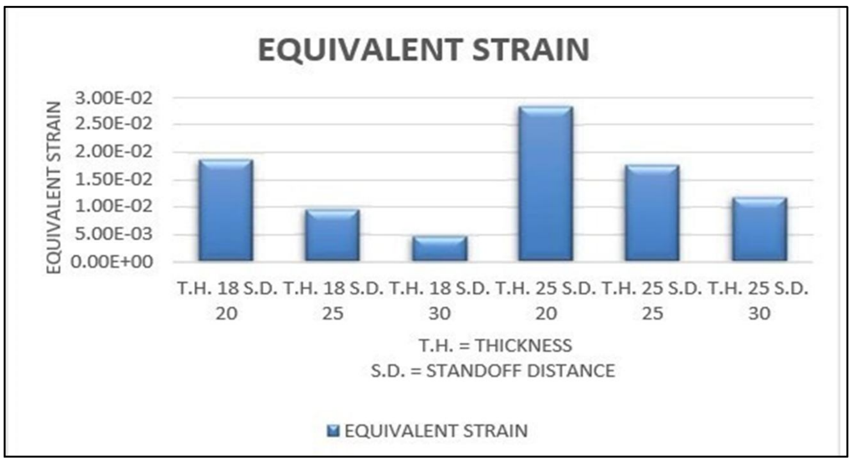
Table2 Analytical Results from ANSYS Workbench

| RESULTS | Ferrocement Panel | | | | | |
|---|---|---|---|---|---|---|
| | With 2 Layered Wire Mesh And 18mm Thickness | | | With 3 Layered Wire Mesh And 25mm Thickness | | |
| | Stand Off Distance | | | | | |
| | 20cm | 25cm | 30cm | 20cm | 25cm | 30cm |
| TOTAL DEFORMATION in mm | 22.446 | 14.817 | 10.243 | 18.199 | 11.927 | 8.2366 |
| EQUIVALENT STRESS MPa | 561.79 | 282.64 | 142.56 | 852.04 | 532.6 | 355.57 |
| EQUIVALENT ELASTIC STRAIN | 0.0087 | 0.00942 | 0.00475 | 0.0284 | 0.0177 | 0.0118 |

Graph 1 Equivalent Stress for Various Standoff Distance




Graph 2 Equivalent Strains for Various Standoff Distances.




## IV. CONCLUSION

1) Overall deformation measured experimentally for an 18 mm thick ferrocement panel is found to be 22.416 mm, 14.817 mm, and 10.243 mm for standoff distances of 20 cm, 25 cm, and 30 cm, in that order.
2) The total deformation measured experimentally for a 25 mm thick ferrocement panel is 18.199 mm, 11.927 mm, and 8.2366 mm at standoff distances of 20, 25, and 30 cm, respectively.
3) At ferrocement panels with a thickness of 18 mm, it is seen that the total deformation obtained analytically is 22.416 mm, 14.817 mm, and 10.243 mm at standoff distances of 20 cm, 25 cm, and 30 cm, respectively.
4) At a 25 mm thick ferrocement panel, the total deformation measured analytically is 18.199 mm, 11.927 mm, and 8.2366 mm at standoff lengths of 20, 25, and 30 cm, respectively.
5) It is noted that the analytically determined equivalent stresses for an 18 mm thick ferrocement panel are 561.79 MPa, 282.64 MPa, and 142.56 MPa at standoff lengths of 20, 25, and 30 cm, respectively.
6) Equivalent Stresses for ferrocement panels with a thickness of 25 mm are found to be 852.04 MPa, 532.6 MPa, and 355.57 MPa at standoff distances of 20 cm, 25 cm, and 30 cm, respectively.

## V. ACKNOWLEDGEMENT.

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