Research Study of Ferrocement Plate Under Impact of Flexural Loading

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Abstract— The expanded count of terrorist attacks for the most part over the most recent couple of time has demonstrated that impact of Blast loads on structures is a genuine issue which we ought to be considered during configuration procedure of structures in spite of the fact that these sorts of terrorist strikes are extraordinary cases made by man dynamic loads i.e. Blast loads are really needed to calculate with great attention just like wind and seismic loads. Also, the investigation of behavior of ferrocement composites under Blast loading that are utilized as lasting formwork in conventional reinforced concrete structures is introduced in this report. Single ferrocement panel specimens are tested experimentally and analytically under Blast load and also the load deflection behavior is then studied.

Keyword: Ferrocement, Blast Resistant Design, Blast Waves, Explosive Effect, Finite Element Method.

I. INTRODUCTION

Concrete is a variegated substance made out of coarsed and fined aggregate insured together with the liquefied cement paste that settles down over time. Regularly used concretes are mostly made up of lime i.e. lime-based, like Portland cement or cements made from the other water powered concretes, like a calcium aluminate cement. Anyway, asphalt concrete that is now used for road surfaces is additionally a sort of concrete where the cement stuff is bitumen and polymer cements are sometimes used where the bonding material used is a polymer.

There are different kinds of concrete are available, differed by the proportions of the main ingredients. The final product can be used for its implementation by replacing the cementations and aggregate stages. There are distinct features of density, chemical and thermal resistance as well as strength.

Aggregate is a composite of big pieces of material in a mixture of concrete, predominantly coarse gravel or crushed stones such as calcareous or granite, together with fine components such as sand. The main aim of this project is to study the behavior of the ferrocement concrete under Blast loading and study of Blast resistance of ferrocement concrete in comparison with normal concrete. Blasts and types of Blasts have been explained in brief firstly. Furthermore, the normal parts of Blast procedure had displayed to explain the impacts of Blasts on structures. To obtain a superior comprehension of Blasts and attributes of Blasts will empower us to make Blast safe structure planning and considerably extra productively. Fundamental methods for expanding the limit of a structure to give protection from the dangerous impacts is talked about both with a planning and designing methodology. Harm to the peoples, deaths and social frenzy are aspects that must be limited if the danger of bomber activity can't be ceased. Planning and design of the structures to be completely bang safe is certifiably not a reasonable and affordable alternative, anyway present-time designing and engineering learning can improve the new as well as old edifices to reduce the effects of an Blast.

A. Ferrocement

Ferrocement is such a material that is thin and slender but, in the meantime, solid and exquisite which gives a potential answer for material issues, with a history of ancient and all-inclusive method for structural hovels using quills to fortify dried mud. (ACI Committee 549-R97). Ferrocement is a flimsy development component with thickness ranging from a 10-25 mm and utilizes pure concrete mortar and no coarse pieces of broken or crushed stone is utilized; and the reinforcement comprises of at least one layers of less diametered steel wire/weld meshing. It doesn't require skilled labour for the casting, and also for a formwork. In ferrocement, concrete network doesn't split since breaking powers are taken by wire mesh support quickly beneath the surface. Husain Doshi Gufa, ferrocement shell structure which is beneath the surface of the ground which was worked in 1993 year at Ahmedabad, India has remained uncracked in the year of 2001 quake as well as has stayed crack free till down today. Such a structure including complex curvatures can be developed in a dependable way utilizing ferrocement innovation, giving free rule to compositional articulation. Innovation in the growth of ferrocement is being advanced all through the world in nations like New Zealand, Canada, United Kingdom, Brazil, USA, Australia, Mexico, the previous USSR, India, Thailand, China, Indonesia. Ferrocement is currently investigated as structure materials substituting RCC, block, steel, prestressed concrete, stone and wood and furthermore as auxiliary segments—walls, floors, rooftops, beams, columns and pieces, water and soil holding or retaining structures. Different applications incorporate window, shutters door and jambs. Ferrocement may be manufactured into any ideal shape or auxiliary arrangement which is commonly impractical with standard brick work, RCC or steel.

Various sorts of meshes are accessible nearly in each nation in the world. Two significant reinforcing parameters are ordinarily utilized in portraying ferrocement and are characterized as Volume part of support; it is the all-out volume of reinforcement per unit volume of ferrocement. The main types of wire mesh at present being utilized are given beneath

B. Phenomenon of Blast

A Blast can be explained as a quick release of stored potential energy with a bright flash released as an audible Blast. Some portion of energy is discharged as warm radiation streak and a section is coupled in the air as air Blast and into the soil earth as ground shocks both as radially.

The material should have the following features to be an explosive,

- This reaction must yield gases with volume under typical weight yet at the high temperature coming about because of a Blast is a lot more noteworthy than that of the first
- It should be composite of a substance or blend of substances that remaining parts unaltered under normal conditions however experiences a quick chemical change after stimulation.
- The change should be exothermic so as to warm the products generated from the reaction and therefore to build their pressure. Basic sorts of Blasts incorporate development impacting to separate shake or to annihilate structures and their foundations, and coincidental Blasts

II. PROBLEM STATEMENT

Ferrocement can be used for the construction of the low-cost housing, making boats some residential as well as industrial buildings also. These structures are may be attacked by the suicide bombers. A bomb explosion inside or in the immediate vicinity of a building can cause disastrous harm to the external and inner structural frames of the building, collapse of walls, knocking out big window spaces, and shutting down critical life-safety mechanisms. Loss of life and injury to occupants can lead from numerous causes, including direct blasting, structural collapse, effect of debris, fire. So Ferrocement panels may undergoes against blast explosion. So, this can be a challenge for structural designers to design blast resistant buildings using ferrocement composite panels

III. METHODOLOGY

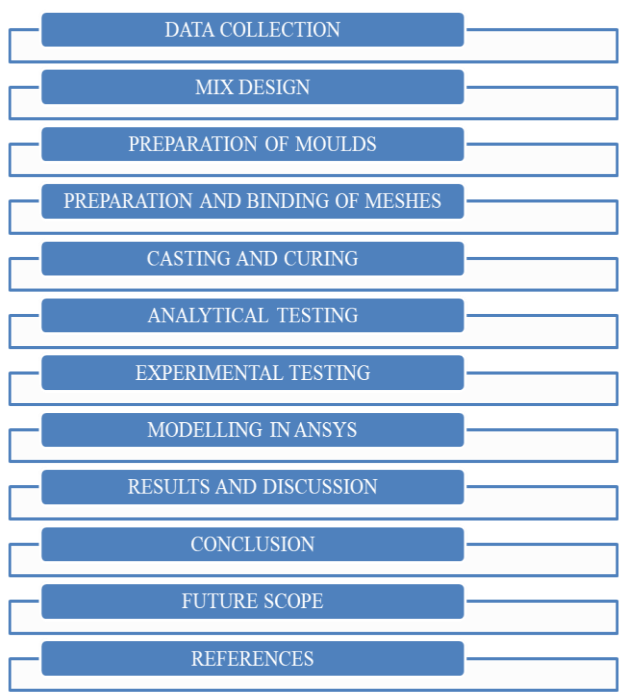


Table 1 Material quantity for design mix

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
For total 3 Panels with 25 mm thickness	14	42	4.2	167

IV. EXPERIMENTAL ANALYSIS

A. Modelling in ANSYS

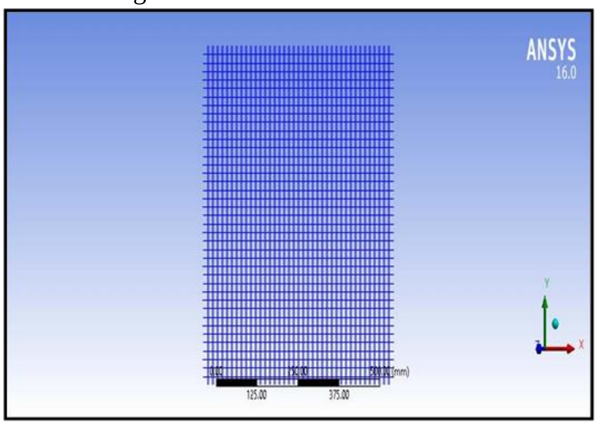


Fig 1 Wire Mesh Modelled in ANSYS

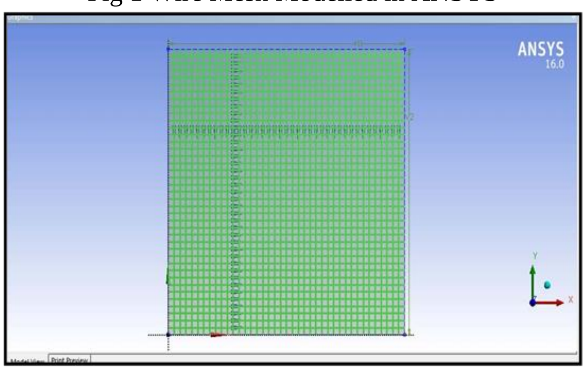


Fig 2 Modelling of ferrocement panels in ANSYS

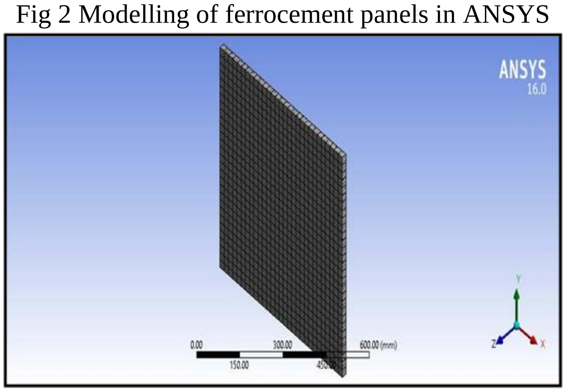


Fig 3 Meshing Ferrocement Panel

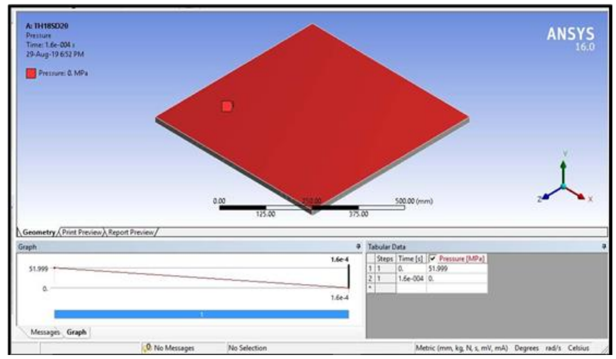
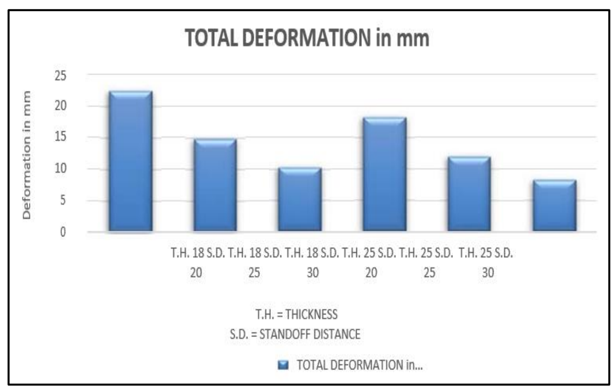


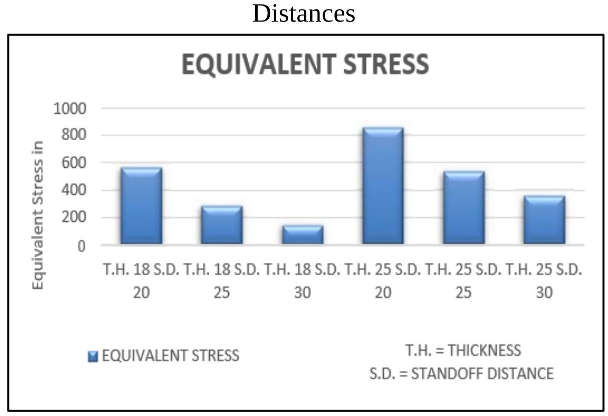
Fig 4 Providing Supports and Applying Pressure on Ferrocement Panel

Table 2 Analytical Results from ANSYS Workbench

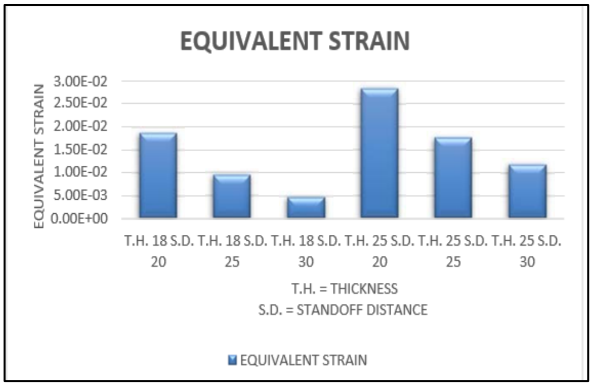
RESULTS	Ferrocement Panel					
	With 2 Layered Wire Mesh And 18mm Thickness			With 3 Layered Wire Mesh And 25mm Thickness		
	Stand Off Distance					
	20cm	25cm	30cm	20cm	25cm	30cm
TOTAL DEFORMATION in mm	22.446	14.817	10.243	18.199	11.927	8.2366
EQUIVALENT STRESS MPa	561.79	282.64	142.56	852.04	532.6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



Graph 1 Total Deformation for Various Standoff Distances



Graph 2 Equivalent Stress for Various Standoff Distances



Graph 3 Equivalent Strain for Various Standoff Distances

V. CONCLUSION

- It is observed that total deformation obtained experimentally for ferrocement panel with 18 mm thickness are 22.416 mm, 14.817 mm, 10.243 mm for standoff distances 20 cm, 25 cm, 30 cm respectively.
- It is observed that total deformation obtained experimentally for ferrocement panel with 25 mm thickness are 18.199 mm, 11.927 mm, 8.2366 mm for standoff distances 20 cm, 25 cm, 30 cm respectively.
- It is observed that total deformation obtained analytically for ferrocement panel with 18 mm thickness are 22.416 mm, 14.817 mm, 10.243 mm for standoff distances 20 cm, 25 cm, 30 cm respectively.
- It is observed that total deformation obtained analytically for ferrocement panel with 25 mm thickness are 18.199 mm, 11.927 mm, 8.2366 mm for standoff distances 20 cm, 25 cm, 30 cm respectively.
- It is observed that Equivalent Stresses obtained analytically for ferrocement panel with 18 mm thickness are 561.79MPa, 282.64 MPa, 142.56 MPa for standoff distances 20 cm, 25 cm, 30 cm respectively.
- It is observed that Equivalent Stresses obtained analytically for ferrocement panel with 25 mm thickness are 852.04MPa, 532.6 MPa, 355.57 MPa for standoff distances 20 cm, 25 cm, 30 c m respectively.
- It is observed that Equivalent Elastic Strain obtained analytically for ferrocement panel with 18 mm thickness are 0.0087, 0.00942, 0.00475 for standoff distances 20 cm, 25 cm, 30 cm respectively,
- It is observed that Equivalent Elastic Strain obtained analytically for ferrocement panel with 25 mm thickness are 0.0284, 0.0177, 0.0118 for standoff distances 20 cm, 25 cm, 30 cm respectively,

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