

Ferro cement is the Best Material for Disaster Resistance

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Abstract - India has been traditionally vulnerable to natural disasters on account of its unique geo-climatic conditions. Floods, droughts, cyclones, earthquakes and landslides have been recurrent phenomena. About 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought. In the decade 1990-2000, an average of about 4344 people lost their lives and about 30 million people were affected by disasters every year. The loss in terms of private, community and public assets has been astronomical.

Key Words: India, Disaster, Management, Methodology, Ferro cement technology.

1. INTRODUCTION

Disaster of any kind is menace to society causing havoc, destruction of property, loss of life, injury to living beings and loss of large amount of money. It causes disturbances in future life of people affected with no other alternative but to accept it. To come out of it, it takes years irrespective of help and support they get from the Government and social organizations. Disasters in the form of earth- quake, cyclones, floods and fire are quite frequent. Disaster Management groups are established to prepare themselves to face the same and manage efficiently after its occurrence. Earthquake disasters are generally sudden and cannot be redirected. Floods and cyclones are predicted and action is taken to shift people to safe areas. However loss of life, injury to living beings, and damage to properties do take place and these have to be accepted. Occurrence of fires is accidental, may be due to lapse in precautions or sometimes natural as forest fires.

Loss of life is difficult to prevent in the case of earthquakes though rescue takes place after the occurrence of disaster. In the case of floods lives are saved when there is prediction and in the case of fire lives are saved where rescue operations are successful.

However in all types of disasters the damage to properties, losses in communications and services such as power supply, roads, railways, telecom lines are inevitable

1.1. Earthquakes

Disasters Ferro cement is highly elastic material. As such under severe earthquakes, it gets deformed but regains its initial shape and position as before. Thus it has high energy absorbing capacity. In most of the cases the damage to Ferro cement structures can be repaired successfully. Very severe earthquake forces may deform Ferro cement structures beyond repairs which has not happened up till now. But such structures shall never collapse. In such cases there is no loss of human life and people can be evacuated with least injuries. Even

moveable properties in such structure can be extricated with least damages.

Ferro cement structures are cage structures with sufficient reinforcement to take the required loads and can be most appropriate even for sky rise structures. The self-weight of such structures is almost 50% of similar R.C.C. Structures. As such the earthquake forces are very much less to that extent. The Ferro cement sky rise under earthquake loads will swing by about a meter or so and come back to its original position.

The cost of Ferro cement structures should be less than that of similar structures particularly R.C.C., Steel or prestressed concrete. At the same time efficiency of Ferro cement structures shall have no parallel vis-à-vis R.C.C., steel. Under severe earthquake conditions conventional structures collapse whereas Ferro cement structures do not but deform. In the case of conventional structures there has to be total reconstruction with heavy costs whereas such costs can be eliminated if Ferro cement structures are adopted and thereby huge reconstruction costs as well as loss of life can be averted.

1.2. Cyclone

Cyclones cause damages to wooden houses as well as roofs of masonry houses. Generally wooden houses get totally destroyed causing loss of life. Cyclones are generally predictable and people can be evacuated, the property loss can be saved to a large extent. With the use of Ferro cement houses, the loss of life is mitigated to the maximum. Ferro cement houses are strong box structures with bottom, sides, top and floors all well connected with each other and monolith and shall resist effectively severe cyclonic condition. These Ferro cement box houses can get toppled worst come to worst. If they are anchored to the ground then even this may not be possible.

Even large industrial structures with Ferro cement framework and roof shall perform far better as compared to conventional R.C.C. or steel industrial structures with metal roof or cement roof which are fixed to the trusses and purlins framework with nut bolt arrangement. In the case of Ferro cement industrial structures the connections are monolith and no nut bolt system is adopted. At the same time, Ferro cement roofs are comparatively heavy and therefore the chances of being blown off are the least in case of mild cyclones.

Ferro cement high rise buildings, bridges etc. shall have far superior performance as compared to conventional. The wind forces are considered less severe as compared to earthquake force. Such Ferro cement structures will get deformed temporarily. Hence there is no question of repairs of Ferro cement structures as a result of forces due to cyclones. Ferro cement high rise buildings can swing like a palm tree and regain its position after the cyclone is over.

1.3. Floods

Ferro cement structures are constructed as box consisting of footings, floorings, walls, roofs as a one single unit with efficient interconnection with floors, walls and roof. There is no collapse as it takes place in the case of other structures during floods particularly walls are single piece from corner to corner and top and bottom. Ferro cement structures take the impact due to floods very efficiently since Ferro cement is basically energy absorbing material. Since there is no collapse mechanism in the case of Ferro cement structures, loss of human life and other damages is the least. Ferro cement structures can be constructed on hollow box foundation. In such case a structure will float during floods. It may get drifted somewhere but the occupants shall be safe. Thus there is no question of sinking.

People can take shelter and survive and be safe, if shifted to Community structures with hollow foundation.

1.4. Fire

Ferro cement is highly fire resistant material up to 750° C resisting for a period of 48 hours or so. Even afterwards there will not be total collapse of Ferro cement structures. Such behavior is accepted by UNIDO (United Nations Industrial Development Organization) many years before in 1972. Such Ferro cement structures are most appropriate for construction of important structures like hospitals, schools, hotels, government buildings, slums etc. With use of ceramics, the Ferro cement structures can be made to resist even higher temperatures and longer periods with increase in cost.



Fig -1: As experimented above by UNIDO of UNO Figure

1.5. Explosion

Ferro cement is highly energy absorbing material far better than wood and steel. Wood and steel can get torn off in explosions whereas Ferro cement structures can be constructed economically and will resist explosions and punctures.

1.6. Enemy Bombardment

Ferro cement is highly absorbing material far better than wood & stronger than steel. Therefore it can efficiently sustain impact and blast forces. During bombardment Ferro cement structure will get punctured but shall not collapse as RCC, masonry or any other structure. It will be very easy to repair these structures faster and at lesser cost.

1.7. Land Slide in Hilly Sloping Area

Sometimes RCC brick masonry housing slide along slope of hills due to landside earthquake. Ferro cement being light will not slide easily. They can be better anchored to main ground. If at all Ferro cement houses slide it will be almost intact and if slide, they are easily repairable damage and can be used again.

2. FERRO CEMENT TECHNOLOGY

A highly varsity form of reinforced concrete mode of wire mesh sand, cement & water in which closely spaced wire meshes are impregnated with high strength cement sand mortar.

The meaning of the word Ferro cement can easily be understood by breaking it in two parts. The prefix 'Ferro' means iron or steel & the suffix cement obviously completes the meaning that it is combination of cement & steel in some form. In fact, it is versatile form of concrete which use well grade sand as aggregate & closely spaced woven or welded thin steel wire meshes in place of large diameter steel reinforcement bars. To be more specific, Ferro cement may be defined

“A highly varsity form of reinforced concrete mode of wire mesh sand, cement & water in which closely spaced wire meshes are impregnated with high strength cement sand mortar.”

The ingredients required for Ferro cement are easily available in every part of our country and as such it can be very easily molded or cast in any thinkable shape or form. It has been used as construction material by architects and engineers for seeing their dreams coming true, where ever the other materials deceived. It can provide shelters which can be quickly assembled or constructed economically in the wake of floods, hurricanes war it is possible to cast thin aliments with thickness as small as 10mm to 3mm cover and provided

2.1. Material Used:

Cement: ordinary Portland cement proves to be adequate sand: The tensile strength of Ferro cement is independent of the quality of sand but the compressive strength is greatly influenced by the quality of sand. It is recommended to use only sieved sand conforming to grading zone II of IS 383: 1970 shall be used, but the maximum particle size shall be less than 1-18 mm. The sand shall be clean, inert and free from organic matter. Silt and clay content shall be less than 3.0 percent.

Water: Generally the water used should be fresh. Water used shall conform to the requirements specified in IS 456: 1978.

Skeletal Steel: Mild steel bars conforming to IS 432 (Part 1) : 1982 or hard-drawn steel wire conforming to IS 432 (Part 2) : 1982 or hard-drawn steel wire fabric conforming to IS 1566 : 1982 shall be used as skeletal steel to provide framework of the structure for laying the mesh layers. Normally the diameter of skeletal steel should be from 3 mm

to 10 mm. All reinforcement shall be free from loose mill scales, loose rust and coats of paints, oil, mud or other coatings which may destroy or reduce bond. A slight film of rust shall not be regarded as harmful but the steel shall not be visibly pitted by rust.

Reinforcement: Mild steel wire conforming to IS 280: 1978 shall be used in the manufacture of wire mesh. The mesh shall have hexagonal, rectangular or square openings. It shall be woven or welded. The wires shall be galvanized before weaving. Aperture size of 6 mm to 20 mm and wire diameter of 0.56 mm to 1.25 mm are recommended. In case of welded wire mesh the diameter of wire shall be not less than 1 mm. In case galvanized wire mesh is used with mild steel bars/wires, chromium trioxide at the rate of 200 to 300 ppm of water should be added to the water used for mortar preparation.

Admixture: Admixtures may be used in Ferro cement for reducing water-cement ratio without affecting the workability and for gaining in strength and durability. Such admixture shall conform to IS 9103: 1979. Admixtures shall be used with the approval of the engineer-in-charge. Integral cement waterproofing compound, when used, shall conform to IS 2645: 1975.

Mortar: The mortar used is usually of high compressive strength verifying from 35-60 N/mm². The cement sand ratio is 1:3. The minimum compressive strength of cement mortar cubes having area of face equal to 50 cm² shall be 25 N/mm². The recommended mix proportion is 1 part of cement to 1.5 to 2.5 parts of sand by mass. Water-cement ratio should be 0.35 to 0.45.

2.2. Advantages:

The most notes worthy properties are:

1. **Strength:** High compressive and tensile strength.
2. **Durability:** Ferro cement will last for a long time as it does not rust corrode or crack easily.

3. CONCLUSIONS

Due to Ferro cement technology cost of disaster reduces and makes management of disaster easy also it saves human lives during disasters Ferro cement takes care of disaster before its occurrence. Disaster Management comes after that which makes Ferro cement a best Disaster Resistance material than normal concrete.

Ferro cement structures gets least affected by any disasters that reduces the cost of repair and reconstruction after disaster. Contribution of Ferro cement Technology before disaster is extensive. Therefore Ferro cement is the need of the day.

ACKNOWLEDGEMENT

This Study gives us a wide view on topic of Ferro cement. As a working on repairs and rehabilitation field for more than 15

years we have seen a many damages on structures which can be very tedious to repair.

REFERENCES

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BIOGRAPHIES



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