Use of FRP Grating Mesh on Manhole Cover to Avoiding Accidents

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***Abstract* - Manhole recognition and monitoring is one of the essential needs for modern society, particularly smart City plan urban growth is an ongoing trends and one of its Direct consequences is the development of buried utility network. locating these network is becoming a challenging task while labeling of the large object in aerial images is extensively studied. Nowadays Road accidents in India are increasing day by day getting into road accidents can lead to several unwanted consequences, including permanent injuries or even death. the cause of these accidents are due to human error, over speeding, due to weather faulty road fixture and pit untitled, uneven Position of manhole is break of manhole cover. It is very important to focus on such a problem that daily it can harm to our life because of road construction and it shrinks the quality of the city. The major challenge in this research is to investigate a method in recognition of manholes and future investigate on the condition of manholes on roads. The manhole allow traffic to pass over them and prevent people from falling into the pit and most manhole cover are placed over the traffic lanes. the distance between the road level and manhole is increased due to adding road layer during making new road Because of that hole can create and many of bike riders, bicycle car etc are get into accidents. The surrounding of manhole cover is disturb hole, pits, gabs are created for avoiding these such a problem we are used FRP grating material. This material have High strength to weight ratio easy to remove for maintainers which will provide road safety and prevent accidents. Manhole is any of the Shape like Rectangular, Circular And any size these materials cut in any shape.**

***Keywords*- FRP (fiber reinforced polymer) material, Manhole, Bitumen.**

I. Introduction

A manhole is a large hole in a road or path, covered by a metal/Concrete plate that can be removed. Workers climb down through manholes when they want to examine or clean the drains. The purpose of a manhole is to provide a junction for several underground pipes, and/or to provide a maintenance location for whatever the pipes are supplying. Manholes allow traffic to pass over them and prevent people from falling into drainage and most manhole covers are placed over the road. The gap between road level and manhole level is increased due to the addition of a new road layer. Addition of a new road layer generates a big pothole on the road and many bike riders, bicycle, car etc get into accidents. In this project we are developing FRP grating mesh material as a cover of the manhole which has high compressive strength and is easy to remove for the maintainer which will also provide road safety and prevent accidents.

II. LITERATURE REVIEW

FRP materials were developed primarily for aerospace and defense industries in the 1940s and are widely used in many industries including construction industry today. The very basis of strengthening existing structures using bonding technique are polymer adhesives such as epoxies and polyesters, known as synthetic adhesives. These adhesives are widely used for structural bonding today, and were first used in Germany at the beginning of 1930s. Natural adhesives such as starch, animal glues and plant resins have been used for centuries and are still used widely today for packing and for joining wood. However, these adhesives are not very good for structural bonding. The method of strengthening existing concrete structures with the use of epoxy adhesives originated in France in the 1960s, where tests on concrete beams with epoxy bonded steel plates were conducted. There is also reported use of this strengthening method in South Africa in 1964. Since then, the application of epoxy bonded steel plates has been used to strengthen bridges and building in several countries over the world. The first ideas on strengthening of concrete with epoxy bonded steel plates were presented in the 1960's by L'Hermite et al and Bresson. The first applications on a highway bridge and in a building followed in 1966-67.Within 20 years since 1967, when L'Hermite and Bresson proposed the external bonding of steel plates with epoxy resins for the post-strengthening of structures, the partial substitution of steel plates (as there are many disadvantages associated with retrofitting using steel plates) with carbon fiber reinforced polymer (CFRP) strips was discussed at EMPA laboratories, Switzerland in 1982; and in 1987 it was shown that this is feasible.FRP products were first used to RC structures in the mid 1950s. Experimental work using FRP for retrofitting concrete structures was reported as early as 1978 in Germany. The first known use of FRPs as reinforcement occurred in 1975 in Russia. There, glass fiber reinforced polymer (GFRP) prestressing tendons were used to reinforce a 30 ft. (9 m) long, glued timber bridge.In Switzerland, one of the first applications with the use of carbon FRP (CFRP) was carried out at the end of the 1980s, and since then several thousand applications have been carried out worldwide. FRP reinforcements gained significant support during the 1990s from research of magnetically levitated (maglev) train support structures in Japan. The Japanese in 1996 were the first to introduce design guidelines for FRP reinforced concrete. Since then, the use of FRP as structural reinforcement has increased exponentially and design guidance has been authored by organizations from around the world. Nowadays, the strengthening of concrete by Fiber Reinforced Polymer is a state-of-the art technique.

III. METHODOLOGY

3.1 Properties Of FRP (fiber reinforced polymer) FRP grating is made by combining fiberglass and resin. The fiberglass gives the finished product its strength, while the resin makes it resistant to corrosive substances.Here are the main reasons it is chosen over metal and other grating alternatives:

1. Durable: FRP grating is able to withstand harsh environments for extended periods of time without being damaged or degraded. It is low maintenance and easy to clean. And the molded-through color means it won't need to be repainted.
2. Fire resistant: while specific fire ratings will depend on the individual product, generally speaking FRP grating offers a high level of resistance to heat and fire.
3. Flexible: it is easily cut to fit particular layouts and can be adjusted as layouts change, which reduces waste and saves on extra costs.
4. Lightweight: FRP grating is easier to transport and store than other grating alternatives, which reduces costs and avoids stoppages and delays to projects.
5. Non-conductive: it doesn't conduct electricity, so it is safer in electrically hazardous environments.

3.2 Advantages

1. Light weight
2. Corrosion resistant:
3. Non- Conductive
4. Maintenance free
5. Lowest in life cycle
6. Easy to install
7. Easy to clean
8. No welding is required
9. Easy to cut
10. Durable and resistant
11. Low installation cost
12. Free retardant
13. Slip resistant high strength to weight ratio
14. Long service life
15. Impact resistant
16. Low Maintenance cost

3.3 Load Capacity and their uses

Light Duty Manhole Covers & Frames (LD 2.5/A15) : Used at pedestrian ways, cycle tracks, footways, car parking, residential complexes, institutions and places where light vehicular traffic is observed.

Medium Duty Manhole Covers & Frames (MD 10/B125) Used at roads, service lanes and places where medium vehicular traffic is observed.

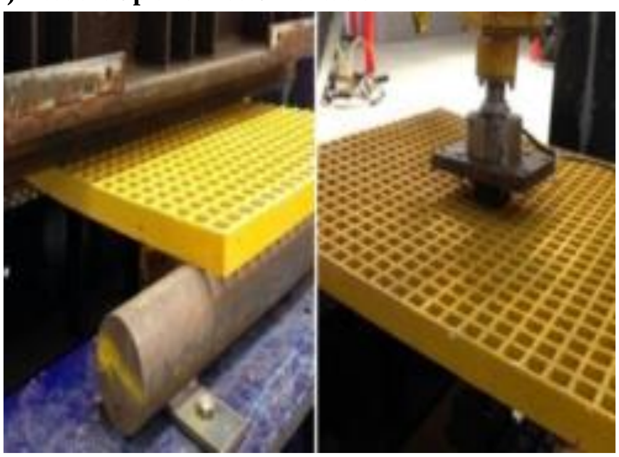
Heavy Duty Manhole Covers & Frames (HD 20/C250) Used at roads, commercial areas, bus terminals and places where heavy vehicular traffic is observed.

Extra Heavy Duty Manhole Covers & Frames (EHD 35/D400) : Used at commercial areas, industrial areas, warehouses and places where heavy vehicular traffic is observed with heavy trucks and trailers.

Grades as per IS:1726 standards	Grades as per BSEN-124 standards
Light Duty (LD 2.5) – 2.5 Ton	Light Duty (A15) – 1.5 Ton
Medium Duty (MD 10) – 10 Ton	Medium Duty (B125) – 12.5 Ton
High Duty (HD 20) – 20 Ton	High Duty (C250) – 25 Ton
Extra Heavy Duty (EHD 35) – 35 Ton	Extra Heavy Duty (D400) – 40 Ton

3.4 RESULT AND DISCUSSION

a) Test set-up and instrumentation



The behavior of full scale composite molded grating was evaluated by testing an 836 mm x 836mm grating (22 x 22 grids) under line loading and a concentrated load applied on the center and near the support following the test procedures described in AS 1657 – 2013 [12]. While the concentrated load directly represents a point load acting on the grating, the line loading was implemented instead of uniformly distributed load representing dead or live load. Three replicates were tested for each specimen type. The line loading was achieved through a rectangular hollow metal bar positioned directly in the midspan of the molded grating as shown in Figure 1. On the other hand, the concentrated load was achieved using a solid steel (100 mm x 100 mm square) welded to a base plate which is bolted to a 220 kN load cell. For the centered loading case, the load block was positioned directly in the center of the test panel, both longitudinally and transversely. However, the off-centered load was positioned at a distance of 200 mm from the support or span/4. Laser displacement transducer was positioned directly under the center of the applied load to measure the deflection. Uniaxial strain gauges were attached on the webs along the longitudinal and transverse directions. For the grating tested under point load, a uniaxial strain gauge was attached to measure the compressive strain under the load application. The load was applied using a 200kN hydraulic jack. All specimens were tested up to failure to observe the failure mechanism.

b) Behavior of FRP gratings under line loading

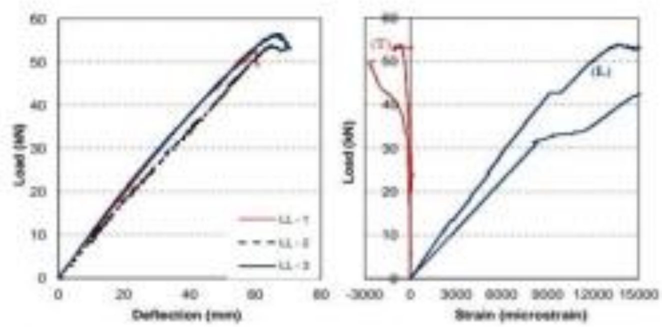
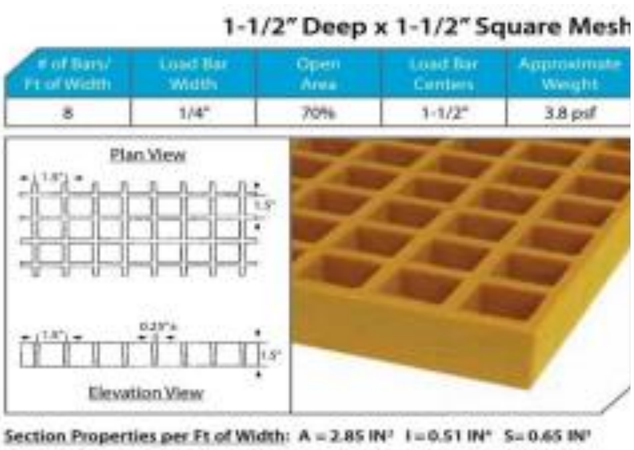


Figure shows the load and midspan deflection and the load-strain behavior of the composite gratings under line loading. An almost linear elastic load-deflection behavior up to failure was exhibited by the 3 samples. Under line loading, the gratings failed at an applied load ranging from 53 to 56 kN (stress of 350 to 370 MPa) with the midspan deflection between 60 and 64 mm. The strain measurements also indicated the almost linear elastic response of the gratings. In the graph, the strain reading in the transverse direction is designated by (T) while the strain in the longitudinal direction is designated by (L). As expected, only the grids in the longitudinal direction resisted the applied load as indicated by the high level of strain measured in this direction. This is due to the gratings simply supported only at the longitudinal direction. As an inspection observation taken during the testing, the physical failure is described as major tensile cracking and delamination on the bottom face of the grating at midspan followed by transverse shear failure. This caused the grating to lose its capacity to carry load and failed immediately. In contrast to the test of coupons, the longer length of the gratings prevented the transverse shear failure occurring first resulting in the effective utilization of the high tensile strength of the fibers. In fact, the full-scale gratings failed at an average flexural strength of 364 MPa, which is 58% stronger than the strength determined from the test of coupons. This result is encouraging as Biddah [8] reported that the full-potential of pultruded fiberglass grating is not realized due to the buckling of the compressive flange of the longitudinal I-beams as the transverse dowels connecting them have significantly lower stiffness than the I-beams. This type of failure is prevented in the molded gratings as the grid in the transverse direction provided rigidity and stabilized the longitudinal direction until reaching its maximum strength. The load strain behavior has also shown that some loads were transferred to the grid in the transverse direction when the failure was initiated as indicated by the increase in the strain levels in (T). As indicated by Meng and Lo [7], these bidirectional strength properties make molded grating a more suitable material for platform and walkways than the pultruded moldings.

3.4 Procedure

1. Initially we studied different fibers and then we found out that FRP(fiber reinforced polymers) are extremely strong,durable and non-conductive.
2. Then manhole standards are studied.
3. Due to addition of new road layer, the manhole goes down and side Portion of manhole cover get damaged and broken which causes road accidents to avoid the accidents which is occurs due to Manhole we used FRP Sheets (FRP sheet is easy to cut in any shape like rectangular or circular) while making road to bind the sides Of FRP Sheets we use the same bitumen which is used for road construction.
4. Finally we got to know that this FRP Perfectly replaces the manhole Cover.



IV. OBJECTIVE

To increase the road safety by providing FRP grating mesh as a manhole cover avoid the road accidents and to minimize the maintenance time Object of the Project:

1. Use FRP grating mesh material to avoid road accidents caused by the Manhole.
2. To minimize the maintenance time.
3. To avoid the re-leveling of manhole cover to road level.

V. CONCLUSIONS

1. FRP proves to be a wonder material as it has many advantageous properties as compared to traditional/ conventional materials. However, despite a considerable number of field applications and laboratory research on FRP.

2. This Project is very helpful to avoid accidents caused by manholes.

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