

Structural Design for Effective Load Balancing of the Iron Frame in Manhole Lid

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Abstract : Manhole refers to facilities that are accessible to the people cleaning and inspection of sewer, and its covering is called manhole lid. Manhole lid is typically made of a cast iron material. Due to the heavy weight of the cast iron manhole lids their installation and maintenance are not easy, and an electrical shock and corrosion aging of them can cause critical problems. The manhole body and the lid manufacturing using the fiber-reinforced composite material can reduce the weight considerably compared to the cast iron manhole. But only the fiber reinforcing is hard to maintain the heavy load, and the method of the iron frame with double injection molding of the composite material has been proposed widely. In this study reflecting the situation of this market, the structural design of the iron frame for the composite manhole lid was carried out. Structural analysis with the computer simulation for the effectively distributed load on the iron frame was conducted. In addition, we want to assess manufacturing costs through the comparing of weights and number of welding spots of the frames. Despite the cross-sectional area is up to 38% compared with the basic solid form the maximum von Mises stress is increased at least about 7 times locally near the rim and the maximum strain in the central part of the lid is about 5.5 times. The number of welding points related to the manufacturing cost was increased gradually with the more complicated shape. Also, the higher the height of the arch in the center of the lid the better result might be obtained. But considering the economic aspect of the composite fabrication we determined the same thickness as the frame for the height of the arch at the center of the lid. Additionally in consideration of the number of the welding points we selected the hexagonal as the optimal shape. Acknowledgment: These are results of a study on the 'Leaders Industry-university Cooperation' Project, supported by the Ministry of Education (MOE).

Keywords : manhole lid, iron frame, structural design, computer simulation

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