

Review Analysis and Performance evaluation of Height Adjustable Manhole

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ABSTRACT

We often see that when the roads are to be repaired or re-tarred the man holes get covered up due to increase in height of the road and hence they have to be reconstructed to adapt to the height of the road else misaligned manhole frames in streets often cause driving hazards, failure of pavement around the frames, cause poor access to manholes, may be responsible for inflow and infiltration and can also result in other problems. Because manhole frames are not manufactured to be adjustable, efforts to make repairs is time consuming and often ineffective. Thus there is a need to develop an height adjustable manhole system where in man hole system be constructed by casting the manhole by suitable method according to the Indian Standard so as to make the system flexible enough to adjust the height of the manhole as per requirement. The scaled model of the height adjustable manhole will be made and solid modelling using Unigraphics software will be done to determine optimal dimension of gear-shaped parts through bending stress formulas and application Ansys work bench software to validate the strength of the manhole analytically.

Fabrication of the scaled model will be done after appropriate selection of the nodular cast iron frame work for nut and screw parts where as the holder elements will be developed by casting concrete. Testing will be done by suitable methods to determine and experimentally validate the strength of the developed part.

Keyword : - Manhole , Height Adjustment, Gear shape parts

1. Introduction

Manhole covers are often made out of cast iron, concrete or a combination of the two. This makes them inexpensive, strong, and heavy, usually weighing more than 113 kilograms (249 lb). The weight helps to keep them in place when traffic passes over them, and makes it difficult for unauthorized people without suitable tools to remove them. It is decorative plaster. It is obvious that requirement of sand size and texture are different at different stages hence the sand that is available at the site is needed to be screened. Presently it is observed that the sand screening activity is done manually or in some cases with the aid of some machine. But these machines are single screen machines and thus only one size will be separated at a time hence it takes a lot of time and labor.

Taking this into consideration a variety of researches and developers have developed a spectrum of machines to solve this problem a few of them have been discussed in the section below.

2. Literature review :

1) Development of a height-adjustable manhole Ch.H. Kim a,*, J.H. Park b

Purpose of project was to determine optimal dimension of gear-shaped parts through bending stress formulas and Taguchi orthogonal array table. Design/methodology approach was that whole parts of real manhole were manufactured experimentally by casting nodular graphite cast iron according to the Korean Standard. It can be used as water supply and drainage, sewage, telecommunication cable, traffic sign, electricity supply, etc. with better performance. The findings of project were that this manhole consists of cover, outer cylinder and inner cylinder. The gear-shaped stairs are extruded on the outer wall of inner cylinder, and on the inner wall of outer

cylinder. The outer cylinder has three columns of 4~5 receptacles, and the inner cylinder has three columns of 6~7 protrusions. The inner cylinder shall be slid into the outer cylinder and then be rotated within the outer cylinder in order to lock the protrusions into the receptacles. The stairs on outer cylinder and inner cylinder allow workers to control the height of manhole because the height is controlled by adequate locking them on sidewall in installation or rehabilitation of manholes. It is designed for the perfect lock. Practical implications of project were to use of this manhole must be drastically economical because it requires only 1-2 workers and simple adjustment of the height comparing with that the existing manholes is required 4-5 workers and reconstruction because conventional should be entirely excavated to reinstall or repair. This entire excavation of a manhole causes too much time-consuming work, waste of resources, and obstruction of traffic. The optimal design of manhole, which deals with design elements of manhole which has gear-shaped stairs on the road to adjust its height.

- 2) Optimization of the circular manhole cover made of ductile cast iron using finite element method Lovrenić-Jugović et al, International scientific journal "machines. Technologies. Materials."

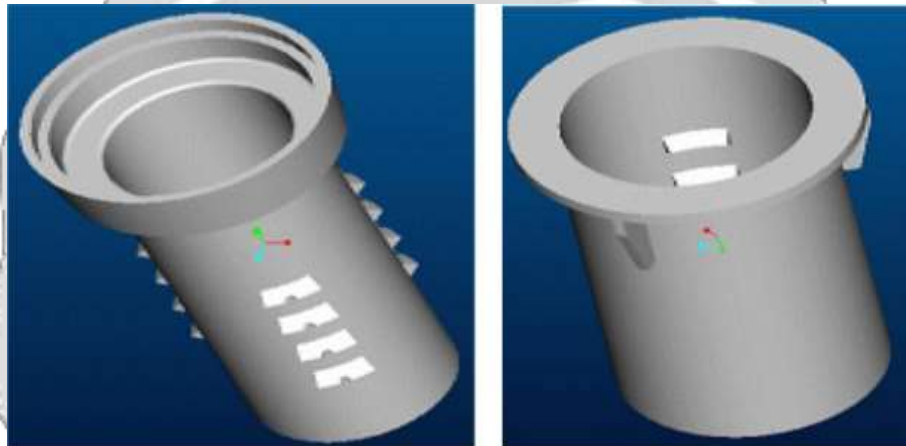
In this paper, in order to dimension the position and the number of vertical reinforcement, several numerical linear static simulations of bending circular manhole cover of ductile cast iron (grade EN-GJS-500-7) with 600 mm diameter are performed. The analysis of displacement and stress using the finite element method in the software package Autodesk Simulation Mechanical were conducted. Verification of numerical results for the solution of thin circular plate was performed with analytical bending solutions. After checking the numerical procedure on the thin circular plate, two circular vertical reinforcements were added on the underside: internal and external. Numerical simulations investigated the influence of the inner circular reinforcement position on the strength of the circular manhole cover, while equivalent stresses followed by energy theory of strength (von Mises) were monitored. Since maximal equivalent stresses remain on the plate by varying the position of the inner circular reinforcement, simulations with added radial reinforcements are performed. Finally, by optimizing the number of radial reinforcements, the optimum plate design is chosen to describe the sieving process using a rectangular mesh with slight inclination as laborious. Authors note that there are different machines that are being used for sand sieving and cement mixing processes and in their concept both the process will take place simultaneously thereby eliminating the time consumed during the whole process of preparing the concrete is reduced.

2.1 Literature Gap

From careful study of the literature pertaining to the problem of manhole in fixed constructed form requires a lot of labor and time for reinstallation in reconstruction of roads, thus to save , time money and effort it is required to fabricate an height adjustable manhole

3. Proposal of Height adjustable manhole

Concept of height adjustable Manhole :



This height-adjustable manhole is consisted with the cover, inner cylinder, and outer cylinder

DESIGN

INPUT DATA

ELECTRIC MOTOR DETAILS

POWER= 100 WATT

SPEED = Variable(0-9000)rpm

Design Torque (T_{design}) = 1.28 N.m

3.1 DESIGN OF MAIN BODY

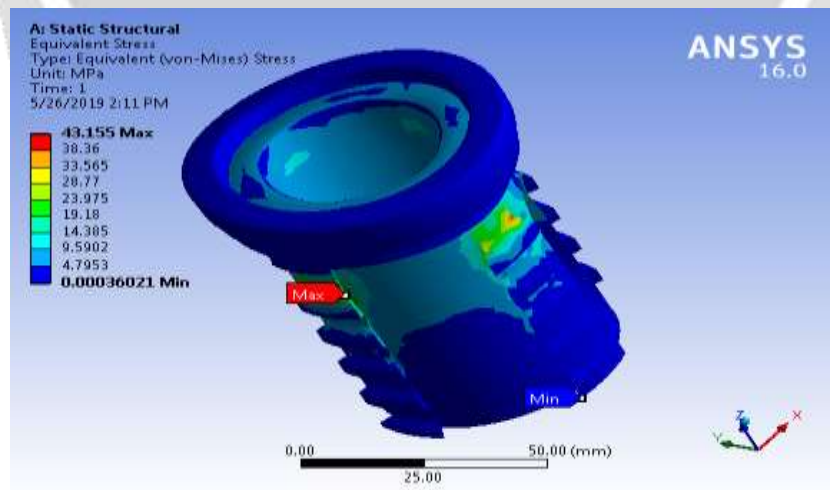


Direct Tensile or Compressive stress due to an axial load :-

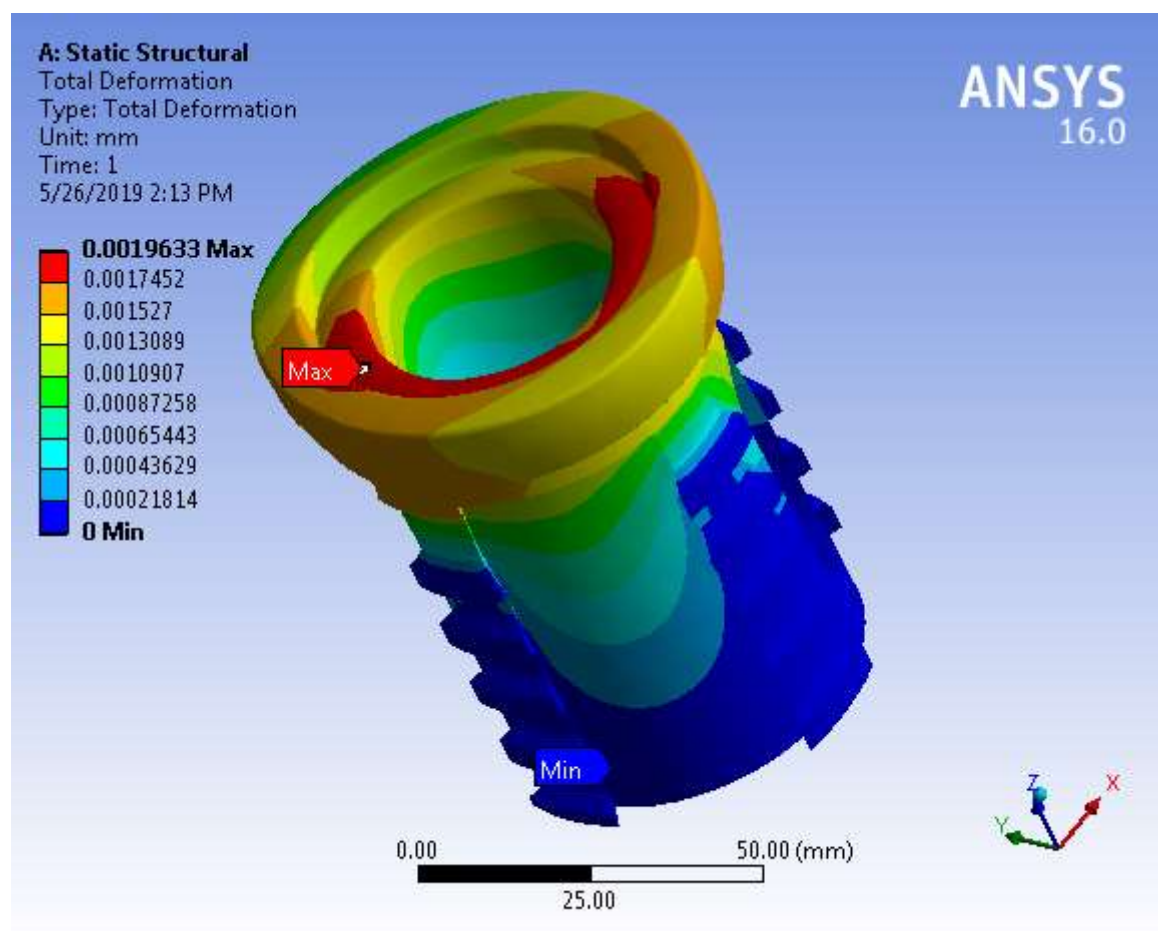
Design load = 9810 N

$$\Rightarrow f_{c_{act}} = 75.6 \text{ N/mm}^2$$

As $f_{c_{act}} < f_{c_{all}}$; Body is safe in compression



The maximum stress induced in the part material is 43.155 MPa which is far below the allowable stress of 320 Mpa hence the body is safe,



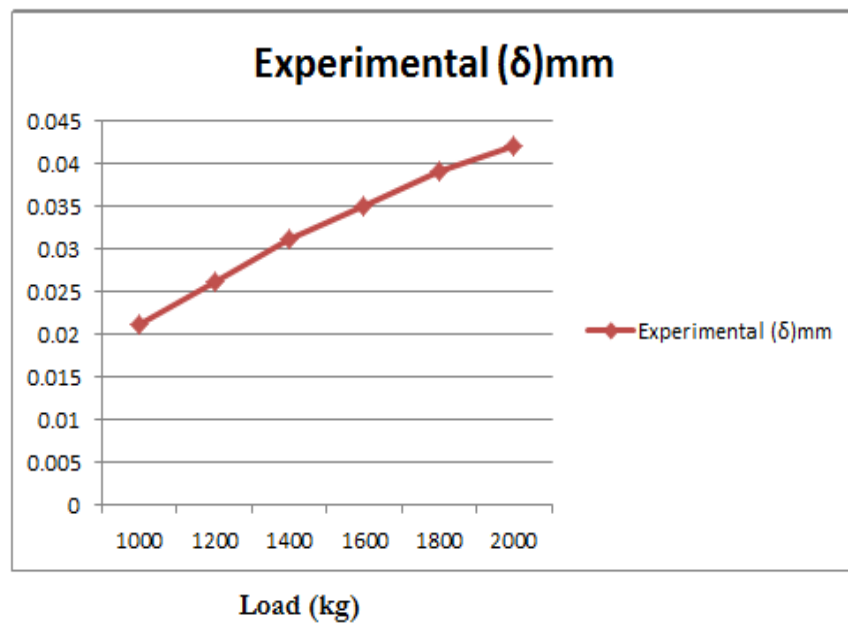
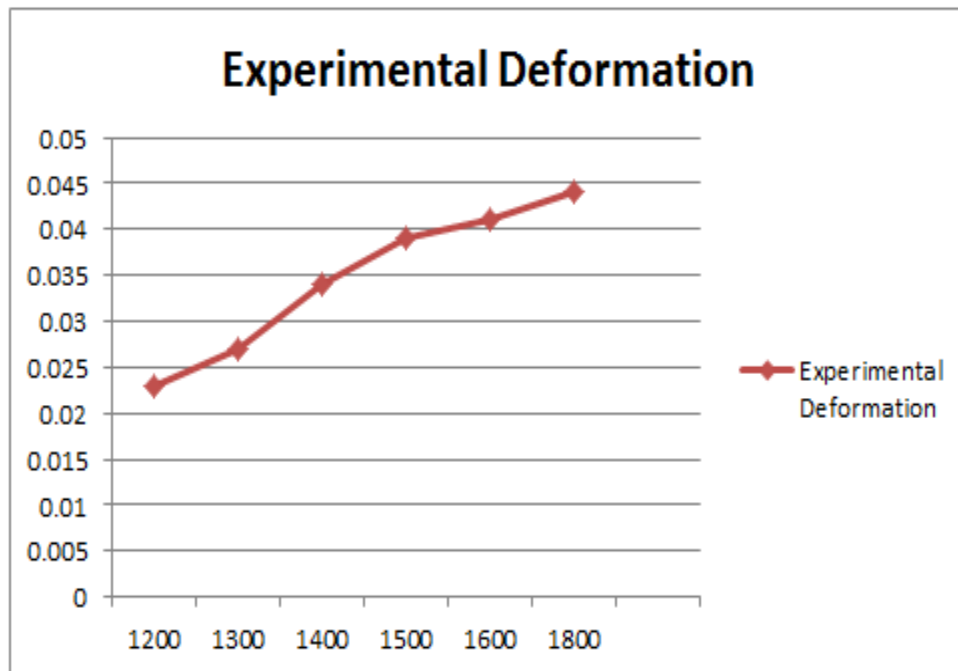
As the maximum deformation is 0.0019 mm which is negligible hence the body is safe

TESTING & TRIAL

OBJECTIVES OF TESTING:

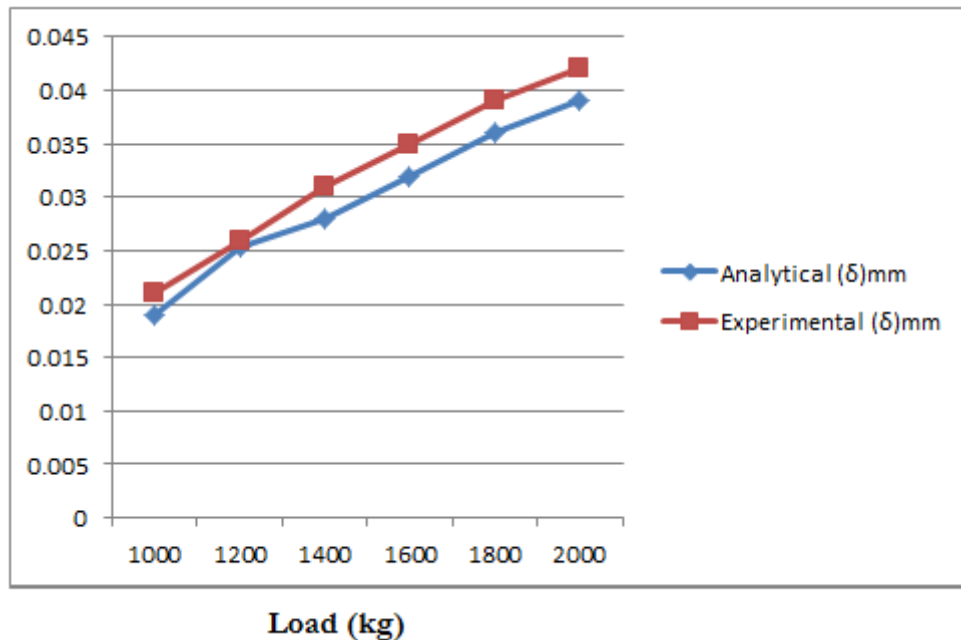
1. **Determination of Maximum deformation at different loads**
2. **Maximum load carrying capacity**

sr no	Load (KG)	Experimental Deformation
1	1200	.023
2	1300	.027
3	1400	.034
4	1500	.039
5	1600	.041
6	1800	.044

Graph of Experimental Deformation Vs Load

The experimental deformation is seen to increase with the increase in load

Comparison Graph of Analytical and Experimental Deformation Vs Load



The comparison graph doesnot show any significant difference in the values or trend of deformation and as the values are in close agreement it can be safely concluded that the experimental results are validated.

Conclusion :

1. The design of the Body shows that the maximum stress induced calculated using theoretical method as well as the analytical method is well below the allowable stress in the material of the part hence it is safe , so also deformation is negligible.
2. The experimental deformation is seen to increase with the increase in load
3. A new method to reconstruct manhole without masonry work is successfully developed.

4. REFERENCES

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