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A Review on Manufacturing Process and Techniques of Hume Concrete

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A B S T R A C T

We all see that there is a major change in construction techniques in various parts of the Civil Engineering field in the last few years. With changing construction techniques, some of the manufacturing processes and their operational techniques are also changing with time. Our major focus in this project is on Hume Concrete Pipe as it is being widely used in various agricultural, industrial, domestic and engineering field to fulfil the requirement of water supply.

Hume Concrete Pipes which are also known as RCC Concrete Pipes are Now-a-days playing a vital role in the Drainage system as all the drainage pipes are underground in Chandrapur District and are made of RCC concrete. We as engineers need to study the fundamentals of how they are manufactured and handled while construction.

Keywords: Manufacturing Process, Operational Techniques, Laying Procedure.

1. Introduction

The term “Hume Concrete Pipe” basically originated from Australia and was invented by the Hume brothers in 1910. It was introduced in India by The India Hume Pipe Co. Ltd. in 1926. It is a concrete tube which is made by pouring concrete into formwork and axially rotating it, and allowing it to compact using centrifugal force. RCC Concrete Pipes which are also known as Hume Concrete Pipes are used in various construction sites such as the laying of sewer pipes, agricultural waterways and residential construction. The other names for Hume Concrete Pipes are Precast Concrete Pipes, RCC Concrete Pipes and Spun Pipes.

As our aim of the study is about the manufacturing process and operational techniques of Hume Concrete Pipes, the below mentioned are the mains objectives:

1. To study raw materials.
2. To study operational techniques.
3. To study tests conducted.
4. To study about laying procedure of Concrete Pipes.

1.1 Reason for Selecting the Project:

As there is a major drastic change in construction techniques in the last few years and we are using Hume Concrete Pipes in various parts of construction sites. And it is a substructure material so there is a major scope in studying this. The pipe when manufactured at the manufacturing unit needs different parameters and laying under the soil strata needs different parameters.

As Engineers, we should know all the above points including the raw materials used, tests conducted, operating machines and how they are handled before and after manufacturing, how they are handled before and after the laying and installation process and. In this study, we will also get to know about the Price range of the pipes. So, we have decided to “Study the Manufacturing Process and Operational Techniques of Hume Concrete Pipes” which will cover all the data required.

1.2 Scope of the Study:

1. Getting knowledge of Previous methods.
2. Getting knowledge of Present techniques.
3. Able to differentiate the Price Range.
4. Core knowledge of the unit.

2. Literature Review

1. Cellular Concrete Pipes

This paper describes a full-scale experimental evaluation of the design, manufacturing, and performance aspects of a "cellular" concrete pipe, a precast concrete pipe in which multiple continuous conduits were incorporated within its wall. Two fully- instrumented prototype segments of the proposed cellular concrete pipe were manufactured using standard dry-cast manufacturing procedures. The pipe segments were subjected to a D-load test to evaluate their structural performance. (El Naggar et al., 2007)

Author's Conclusion:

The overall performance of the four-conduit specimen was superior to that of the six-conduit specimen and comparable to that of specimens with a solid wall. The ideal conduit material should be sufficiently stiff to resist the hydrostatic pressure of the fresh concrete while sufficiently flexible to deform with the concrete material to prevent the attraction of un proportionally high percentage of the applied load.

2. Water Conservancy

Due to the large depth of burial, if the prefabricated reinforced concrete drainage pipe is damaged during construction or use, it will have a great negative impact on the safety of the project and it will be very difficult to repair. There is no relevant basis in the Water Conservancy code and there are safety risks. Taking actual engineering as an example, the calculation results according to the design specifications and finite element analysis are compared and analyzed. (Xiaoling& Bin, 2019)

Author's Conclusion:

Construction should be backfilled by the strict requirements of the Atlas during construction; In the design, it should be noted that the finite element software check design is adopted according to the actual construction conditions; When the buried depth of the pipeline is large, the pipeline bearing capacity can be increased by increasing the height of the piping.

3. Design Method

This report presents the findings of a year-long research project, where an in-depth review of the available concrete pipe design methods and the Nebraska Department of Roads (NDOR) pipe design policy is conducted. In this chapter, the project's significance, objectives, and tasks are presented. Currently, two methods are available for the design of reinforced concrete pipes: **the indirect design method** and **the direct design method**. Both of the available design methods are proven to be reliable, yet as a result of recent advancements in manufacturing and construction, practical questions about the economy and state-of-the-art of the existing methods have developed.(Erdogmus&Tadros, 2006)

Author's Conclusion:

The findings from this study suggest that the NDOR policies can be updated as follows: The existing fill height tables can be updated and then expanded to include more design options for the pipe designer and manufacturer. All proposed changes would be validated through laboratory experiments. The research team also envisions substantial contributions that can be made to the current pipe design practice at a more fundamental and nationwide level. This research could develop a unified, efficient design method that eliminates the confusion and discrepancies between the current design methods. The research team's review of existing procedures indicates that based on the current standard inventory of concrete pipe available from the Industry, NDOR is appropriately using the Direct Design to determine fill heights.

4. Analysis of Precast pipe

Comparisons were made in terms of product and material requirements, structural load testing, hydrostatic performance, and durability requirements. It is shown that the RCP sector lags behind modern developments in concrete technology, standard code advances and materials innovations. The analysis also revealed various knowledge gaps in terms of the mechanical, hydrostatic and durability performance of RCP. Recommendations emanating from this critical analysis aim at tailoring performance-based guidelines that can better capture current market needs and user expectations. (Wong &Nehdi, 2018)

Author's Conclusion:

Recommendations emanating from this critical analysis include the necessity to review and update concrete pipe standards to capture modern developments in concrete technology, advances in standard concrete codes and test methods, and to tailor performance-based guidelines that can better capture the pipe's structural, hydrostatic and durability performance. These guidelines will set a new platform for technological advancement in RCP. Such an effort is particularly needed to enhance the RCP competitiveness considering the current market reality and the advent of many contenders for concrete pipe replacement using various flexible material formulations.

5. Numerical Study of Precast Concrete Pipe

This study explores the structural behaviour of full-scale 1050 mm and 1200 mm diameter RCP reinforced with SE cold-drawn steel wire cage under the Three-Edge Bearing Test. Results indicate that RCP with SE reinforcement designed per current standards did not meet the specified 0.3-mm crack and ultimate load capacity. Hence, pertinent provisions in CSA A257.2 and ASTM C76 for RCP need to be updated with specific and more suitable guidance for SE cage RCP. The study also investigates the effect of the SE cage rotation on the structural capacity of the pipe through finite element modelling. (Ramadan, 2020)

Author's Conclusion:

A single elliptical pipe reinforcing cage can be fabricated. However, restraining the rotation of the cage during the pipe-casting process is important. Rotational mis- orientation may substantially compromise the pipe's flexural capacity due to a reduction in the distance between the steel cage and the neutral axis. Although the true elliptical shape of the reinforcing cage can be made, the shape may need to be transitioned into circular at both ends of the pipe to account for the joint design. This may affect the effectiveness of the elliptical shape.

Filters are used in rainwater harvesting systems when the water is stored in tanks for direct consumption, to remove suspended pollutants from collected rainwater. Filtration and disinfection of water are necessary before human consumption.(Chalkhure et al., 2020)

Material Testing

The property of any composite material is highly influenced by the characteristics of its component. Thus the properties of the component are tested for various parameters such as Durability, Hardness, Porosity, Water absorption capacity, Impact resistance, gradual load resistance, Gradation and other such parameters. The basic elements of construction and testing of the cubes for specific readings can be obtained only if the results of quality checks are nearby the standard range.(Bhashakhetre et al., 2017)

Conclusion:

In the first paper, the project deals with the experimental study of a new class of precast concrete pipe, we can conclude that this helps us while studying of the manufacturing process of Hume Concrete Pipe.

In the second paper, Author has studied about the repair and maintenance of the concrete pipes when used in Water Conservation. So it can be helpful to us while studying about the laying and installation of the Pipes.

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Fourth paper is very helpful and will be useful while study of various tests and implementing it in standard guidelines in comparison with our Indian Standard Codes.

Fifth paper can be helpful in studying the structural design of the Hume Concrete Pipe at the Site. Moreover we can solve numerical based on structural designs.

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