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Design and Construction of Hume Pipe

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ABSTRACT: -

Hume pipes are essential for facilitating the passage of watercourses such as streams and nallas under earth embankments, ensuring that road embankments do not obstruct natural waterways. These pipes, also known as culverts, serve to balance floodwater levels on both sides of the embankment, thereby mitigating flood risks. The design of reinforced concrete pipes like Hume pipes typically follows the indirect design method, which simplifies the process based on performance specifications verified through manufacturing plant testing. This method ensures the pipes meet required strength standards. Following the construction of Hume pipes, thorough analysis is conducted to assess any potential issues. Each scenario undergoes comprehensive engineering simulations, considering factors like material properties, contact behavior between components, and loading conditions. Simulations yield insights into performance and potential design enhancements, allowing for comparisons between different scenarios. Various properties of the construction ingredients of Hume pipes are studied, and multiple tests, including cube tests, hydraulic tests, and load tests, are conducted to validate their integrity and performance. All tests have yielded satisfactory results, ensuring the reliability of the Hume pipe construction.

Key Word:- Embankment, flood.

Introduction:-

It's a well-established fact that roads are typically built on embankments, which can impede the natural flow of stormwater from existing drainage channels. To ensure unobstructed water flow, cross drainage structures must be provided to allow water to pass through the embankment. These structures, such as Hume pipes (culverts), small bridges, or major bridges, vary based on their span, which, in turn, depends on the discharge of water. Culverts are designed to cover waterways up to 6 meters (IRC:5-1981).

The pipes manufactured by us play a crucial role in providing stability to concrete structures. They are crafted using high-quality materials in various dimensions and weights. Adhering to international quality standards, our pipes can be customized to meet specific client requirements. Clients can choose from our extensive range of pipes, known for their durability, strength, and reliability. These pipes are constructed using materials such as cement, sand, aggregates, and steel.

These pipes are used as following:

• Road culvert

• Railway culvert

• Drainage system

• Agriculture water pipe

With first commitment to quality, we are manufactured comprehensive range of concrete culvert. Used for drainage work, culverts. Water supply scheme and other purposes. All our pipes comply with IS458:2003, which is tested on various parameters.

Objective:-

A. At first we learn and supervise the construction of hume pipe which is manufactured in company.

B. After that we prepare a design of hume pipe as per IS 458-2003 and also 2D&3D model using AUTOCAD.

Literature Review:-

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)

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)

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)

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)

Construction and Field Testing:-

The design of a concrete pipeline assumes that certain minimum conditions of installation will be met. Acceptance criteria are established to ensure that the quality of workmanship and material provided during construction meet the design requirements, and that the pipeline will perform satisfactorily. Installation and field testing are the final steps in a process that also includes research, surface and sub- surface investigations, design, specification preparation, pipe manufacturing and material testing.

Installation procedures are presented in this chapter, together with some of the problems that might be encountered. These procedures include:

• Pre-construction planning

• Site preparation

• Ordering, receiving and handling

• Excavation

• Foundation and bedding preparation

• Jointing

• Backfilling

• Construction testing

Conclusions:-

1. Hume pipe for cross drainage works across high embankments has many advantages compared to a slab culvert.

2. It is easy to add length in the event of widening of the road.

3. Hume pipe is structurally very strong, rigid and safe.

4. Hume pipe does not need any elaborate foundation and can easily be placed over soft foundation by increasing

8. Easy to construct, practically no maintenance, can have multi-cell to match discharge within smaller height of embankment.

9. Small variation in co-effcient of earth pressure has through walls or through flls effective width loses its applicability.

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