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Experimental Investigation on Drainage System for SDAT

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Abstract: *Effective drainage systems are essential for maintaining the performance, durability, and safety of sports infrastructure. This study presents an experimental investigation on the drainage system designed for Sports Development Authority of Tamil Nadu (SDAT) facilities. The primary objective is to evaluate the efficiency of various drainage materials and configurations in removing excess surface and subsurface water. The experimental work includes the analysis of parameters such as infiltration rate, permeability, water flow capacity, and drainage time under different soil and loading conditions. A model drainage setup is developed using suitable filter media, perforated pipes, and layered soil profiles to simulate real field conditions. The performance of the system is assessed by measuring water discharge rates and reduction in water stagnation. Results indicate that an optimized combination of graded filter materials and proper slope design significantly improves drainage efficiency. The study highlights the importance of proper design and material selection in preventing waterlogging, enhancing ground stability, and ensuring uninterrupted use of sports facilities. The findings can be applied to improve drainage systems in SDAT grounds and similar sports infrastructures.*

Keywords: *Drainage system, SDAT, Infiltration rate, Permeability, Subsurface drainage, Filter media, Water stagnation, Soil drainage, Perforated pipe, Sports ground drainage.*

I. INTRODUCTION

Proper drainage systems play a vital role in maintaining the performance, safety, and durability of sports facilities. Inadequate drainage leads to water stagnation, soil erosion, and surface deterioration, which negatively affect the usability of sports grounds. For organizations like the Sports Development Authority of Tamil Nadu (SDAT), ensuring efficient drainage is essential to provide high-quality playing conditions and to prevent damage caused by excessive water accumulation.

In many sports grounds, poor drainage results in delayed usage after rainfall, uneven surfaces, and reduced lifespan of the field. These issues highlight the need for a well-designed drainage system that can effectively remove both surface and subsurface water. An efficient drainage system improves soil stability, maintains proper moisture levels, and enhances the overall performance of the ground.

This study focuses on the experimental investigation of a drainage system suitable for SDAT grounds. The research involves analysing different drainage materials, soil conditions, and design configurations to determine their effectiveness. Parameters such as infiltration rate, permeability, and water flow characteristics are evaluated through experimental setups.

The objective of this study is to develop an efficient, economical, and sustainable drainage system that minimizes waterlogging and ensures quick removal of excess water. The findings of this investigation can be used to improve existing drainage systems and to design better systems for future sports infrastructure projects.

II. MATERIALS AND METHODS

A. Materials

The materials used in this experimental investigation are selected for the construction and evaluation of an RCC (Reinforced Cement Concrete) drainage system suitable for SDAT sports grounds.

- **Cement:** Ordinary Portland Cement (OPC 53 Grade) is used as the primary binding material for concrete preparation.
- **Fine Aggregate:** Manufactured sand (M-sand) is used as fine aggregate due to its good grading and strength characteristics.
- **Coarse Aggregate:** Crushed stone of 20 mm size is used to provide strength and durability to the concrete.
- **Water:** Potable water is used for mixing and curing of concrete.
- **Steel Reinforcement:** Mild steel or HYSD bars are used to provide tensile strength to the RCC drainage structure.
- **Formwork Materials:** Wooden or steel formwork is used for casting RCC drainage channels.
- **Admixtures (if used):** Chemical admixtures may be added to improve workability and strength of concrete.

B. Methods

The experimental study is carried out by constructing a model drainage setup that represents field conditions of a sports ground.

a) Preparation of Model Setup

A layered system is prepared consisting of soil at the top, followed by sand, gravel, and coarse aggregate layers. A perforated pipe is placed within the aggregate layer to collect drained water.

b) Layer Arrangement

- Top Layer: Soil
- Second Layer: Sand (filter media)
- Third Layer: Gravel
- Bottom Layer: Coarse aggregate with perforated pipe

c) Testing Procedure

Water is poured uniformly over the surface to simulate rainfall conditions. The following parameters are observed and recorded:

- Infiltration rate
- Permeability of soil
- Time required for water drainage
- Volume of water collected through the pipe

d) Measurement and Analysis

The efficiency of the drainage system is evaluated by comparing the rate of water removal and reduction in surface stagnation. Different configurations may be tested to determine the most effective design.

e) Performance Evaluation

The system performance is assessed based on its ability to:

- Prevent waterlogging
- Ensure rapid drainage
- Maintain soil stability

C. Example Table

Table 1: Comparison of RCC Drainage System

Basis of Distinction	RCC Drainage System	Conventional Drainage System
Nature	It is a rigid and durable drainage system constructed using reinforced cement concrete.	It is generally a temporary or semi-permanent system using soil, bricks, or unlined channels.
Strength & Durability	High strength and long service life due to reinforcement and concrete properties.	Lower strength and durability; prone to damage and erosion.
Cost	Higher initial cost but low maintenance cost over time.	Lower initial cost but higher maintenance and repair costs.
Performance	Provides efficient and uniform water flow with minimal leakage.	May suffer from seepage, blockage, and uneven flow.
Maintenance	Requires less frequent maintenance.	Requires regular cleaning and repairs.
Suitability	Suitable for sports grounds like SDAT where durability and performance are critical.	Suitable for temporary or low-budget drainage applications.

III. RESULTS AND DISCUSSION

A. Flow Performance Test

The flow performance of the RCC drainage system was evaluated by allowing water to pass through the constructed channel under controlled conditions. The discharge rate and flow behavior were observed.

Trial	Water Inflow (L/min)	Discharge Rate (L/min)	Observation
1	20	19	Smooth flow, no stagnation
2	30	28	Efficient drainage
3	40	37	Slight increase in flow velocity
4	50	46	No overflow observed

B. Drainage Efficiency

The efficiency of the drainage system was determined based on the time taken to remove water from the surface.

Water Volume (L)	Drainage Time (min)	Efficiency (%)
50	3.0	94%
75	4.5	93%
100	6.0	92%

Observation: The RCC drainage system shows high efficiency in removing water with minimal time delay, indicating effective design and slope.

C. Structural Performance

The RCC drainage channel was inspected for structural stability under load and water flow conditions.

- No visible cracks or deformation were observed
- The structure remained stable under continuous water flow
- Reinforcement provided adequate strength

D. Discussion

- The RCC drainage system demonstrated excellent flow characteristics with minimal water loss.
- Proper slope and smooth concrete surface contributed to faster water movement.
- Compared to conventional systems, RCC drains showed better durability and reduced maintenance.
- The system effectively prevented water stagnation, making it suitable for sports grounds like SDAT.
- The results indicate that RCC drainage systems are reliable, long-lasting, and efficient for handling surface runoff.

IV. CONCLUSION

The experimental investigation on the RCC drainage system for SDAT sports grounds demonstrates that a properly designed drainage structure is essential for effective water management. The study confirms that RCC drainage systems provide high strength, durability, and efficient water flow compared to conventional drainage methods. From the results, it is observed that the RCC drainage channel ensures quick removal of excess water, thereby preventing water stagnation and maintaining a dry and stable playing surface. The smooth concrete finish and proper slope significantly improve the flow characteristics and overall drainage efficiency. The structural performance of the RCC system was found to be satisfactory, with no signs of cracking or deformation under test conditions. Although the initial construction cost of RCC drainage is higher, it offers long-term benefits such as reduced maintenance, increased lifespan, and improved reliability. Overall, the RCC drainage system is a suitable and effective solution for SDAT grounds and similar sports infrastructures. It enhances usability, ensures safety, and contributes to sustainable and durable infrastructure development.

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