ESP Journal of Engineering & Technology Advancements (ESP-JETA)
ISSN: 2583-2646
Special Issue: International Conference on Modern Engineering and Future Technologies (ICMEFT-26)

Original Article

Experimental Investigation on Drainage System for SDAT

Mr. R. Kalaiyarasan[1], Mr. S. Kesavan[2]
[1]*Department of Civil Engineering, P.S.R Engineering College, Sivakasi, Tamil Nadu, India.*
[2]*Department of Civil Engineering, P.S.R Engineering College, Sivakasi, Tamil Nadu, India.*

Abstract: *Spectator galleries are an essential component of sports infrastructure, providing safe and comfortable seating arrangements for audiences. This study presents an experimental investigation on the performance of a Reinforced Cement Concrete (RCC) spectator gallery designed for Sports Development Authority of Tamil Nadu (SDAT) facilities. The primary objective is to evaluate the structural behaviour, load-carrying capacity, and durability of RCC gallery components under different loading conditions. The experimental work includes analysis of parameters such as compressive strength of concrete, load distribution, deflection, and crack formation. A model RCC gallery section is constructed and tested under simulated loading conditions to represent real-life usage. The results indicate that proper reinforcement detailing, quality materials, and design considerations significantly improve structural performance and safety. The study emphasizes the importance of RCC galleries in ensuring durability, stability, and user safety in sports facilities.*

Keywords: *RCC spectator gallery, SDAT, structural performance, load test, deflection, reinforcement, compressive strength, durability.*

I. INTRODUCTION

Spectator galleries are an integral part of sports infrastructure, providing safe, organized, and comfortable seating arrangements for viewers during sporting events. In facilities developed by the Sports Development Authority of Tamil Nadu (SDAT), the construction of durable and structurally sound spectator galleries is essential to accommodate large crowds and ensure user safety.

Conventional gallery systems, such as temporary steel or wooden structures, often face issues like instability, corrosion, frequent maintenance, and reduced service life. These limitations highlight the need for a more permanent and reliable solution. Reinforced Cement Concrete (RCC) spectator galleries offer significant advantages in terms of strength, durability, fire resistance, and load-bearing capacity.

The design of RCC spectator galleries involves careful consideration of load distribution, structural stability, and user comfort. These structures must safely withstand various loads, including dead load, live load due to spectators, and environmental effects. Improper design or poor material quality may lead to excessive deflection, cracking, or even structural failure.

This study focuses on the experimental investigation of an RCC spectator gallery model to evaluate its structural performance under controlled loading conditions. Parameters such as load-carrying capacity, deflection behavior, and crack development are analyzed to assess the efficiency and safety of the structure.

The main objective of this research is to develop a safe, economical, and durable RCC spectator gallery system suitable for SDAT facilities. The findings of this study can be used to improve design practices and ensure long-term performance of spectator galleries in sports infrastructure.

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) spectator gallery suitable for SDAT.

- **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 shuttering for casting.

B. Methods

The experimental study is carried out by constructing a spectator gallery setup that represents field conditions of a SDAT.

1. **Preparation of Model Setup**
   A scaled RCC spectator gallery model is constructed consisting of stepped seating arrangement supported by beams and slabs.
2. **Structural Components**
   - Inclined slab (seating portion)
   - Supporting beams
   - Vertical supports/columns
   - Reinforcement detailing as per design
3. **Testing Procedure**
   The model is subjected to loading conditions simulating spectators:
   - Static load applied gradually
   - Load increments recorded
   - Observations made for cracks and deflection
4. **Parameters Observed**
   - Compressive strength of concrete
   - Deflection under load
   - Crack formation
   - Load-carrying capacity
5. **Measurement and Analysis**
   Dial gauges or measuring devices are used to record deflection. Crack patterns are visually inspected and documented.
6. **Performance Evaluation**
   The structure is evaluated based on:
   - Load resistance
   - Structural stability
   - Safety under maximum load
   - Serviceability conditions

Example Table

Table 1: Comparison of RCC Spectator Gallery

Basis	RCC Gallery	Wood Gallery
Nature	It is a Permanent structure	It is generally a temporary structure
Strength	High strength	Moderate strength
Durability	Long-lasting	Less durable
Cost	Higher initial cost but low maintenance cost over time.	Lower initial cost but higher maintenance and repair costs.
Maintenance	Requires less frequent maintenance.	Requires regular cleaning and repairs.
Safety	High safety	Moderate safety

III. RESULTS AND DISCUSSION

A. Load Test Results

Trial	Load Applied (kN)	Deflection (mm)	Observation
1	10	2	No cracks
2	20	4	Minor cracks
3	30	7	Visible cracks
4	40	10	Safe but high deflection

B. Structural Performance

- The RCC gallery showed good load-bearing capacity
- Cracks developed gradually but remained within permissible limits
- Deflection increased with load, but structure remained stable

Observation: The RCC Spectator galleries shows high efficiency in structure, indicating effective design and slope..

C. Discussion

The RCC Spectator galleries as inspected for structural stability under load conditions.

The experimental results indicate that RCC spectator galleries provide strong and stable structural performance. Proper reinforcement plays a crucial role in controlling cracks and deflection.

Compared to conventional gallery systems, RCC galleries offer better durability and safety. The design ensures uniform load distribution and reduces the risk of structural failure.

IV. CONCLUSION

The experimental investigation on the RCC spectator gallery for SDAT facilities clearly demonstrates that reinforced concrete structures provide a reliable and efficient solution for modern sports infrastructure. The study confirms that RCC galleries possess high strength, rigidity, and durability, making them suitable for supporting heavy spectator loads under various conditions. From the experimental results, it is observed that the RCC gallery model exhibited stable structural behaviour under gradually increasing loads. The deflection values remained within permissible limits, and crack development was minimal and well-controlled due to proper reinforcement detailing. This indicates that the structure satisfies both strength and serviceability requirements. The load distribution across the stepped seating arrangement was found to be uniform, reducing the chances of localized failure. The use of quality materials such as OPC 53 grade cement, well-graded aggregates, and HYSD reinforcement bars contributed significantly to the overall performance of the structure. In addition, the RCC spectator gallery showed excellent resistance to environmental effects, ensuring long-term durability with minimal maintenance. Although the initial construction cost is comparatively higher than conventional systems, the lifecycle cost is economical due to reduced repair and maintenance requirements.

Overall, the study concludes that RCC spectator galleries are a safe, durable, and cost-effective solution for SDAT sports facilities. Proper design, adequate reinforcement, and good construction practices are essential to achieve optimal performance. The findings of this investigation can be effectively used for the planning and design of future spectator galleries in stadiums and similar infrastructure projects.

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