

Experimental Study Between Standard Concrete Blocks and Bituminous Concrete (Hybrid) Block


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• ABSTRACT

The continuous demand for improved construction materials has encouraged the exploration of alternatives capable of enhancing the performance of conventional concrete. In the present study, an experimental investigation was carried out to compare the behavior of bitumen–hybrid concrete blocks with that of standard M30 grade concrete blocks. The study focuses on evaluating the influence of incorporating bitumen as a partial replacement for cement on key mechanical properties. Concrete specimens were prepared using standard materials, while the hybrid mix was developed by introducing a controlled proportion of bitumen to modify the binding characteristics. The performance of both types of blocks was assessed through a series of laboratory tests, including compressive strength, load-bearing capacity, and shear strength tests conducted under controlled conditions.

The study suggests that bitumen–hybrid concrete can be considered a promising alternative for construction applications where improved durability and resistance to cracking are required.

Keywords- Bitumen–Hybrid Concrete, M30 Concrete, Compressive Strength, Load Bearing Capacity, Shear Strength, Sustainable Construction, Modified Concrete

1. Introduction-

• Concrete remains one of the most widely used construction materials due to its availability, versatility, and satisfactory compressive strength. It forms the backbone of modern infrastructure, ranging from residential buildings to large-scale civil engineering projects. However, despite its extensive use, conventional concrete exhibits certain inherent limitations such as brittleness, low tensile strength, and susceptibility to cracking under varying load and environmental conditions. These drawbacks often lead to durability concerns and increased maintenance over the service life of structures. Bitumen, a viscoelastic material commonly used in flexible pavements, possesses characteristics such as improved adhesion, water resistance, and flexibility. These properties make it a potential candidate for partial replacement of cement in concrete, particularly in applications where resistance to cracking and deformation is critical.

2. Objectives-

- To Compare the standard concrete blocks and Bituminous- Concrete (Hybrid) Blocks.
- To Compare the Compressive Strength Test of Standard Concrete Blocks and Bituminous -Concrete (Hybrid) Blocks.
- To Compare and clear the thing that which block is better between standard concrete blocks and bituminous concrete block.

3. Material collection-

1.Cement –

Ordinary Portland Cement (OPC) was used as the primary binding material. The cement was fresh, free from lumps, and stored in dry conditions to maintain its quality. It plays a key role in strength development through the hydration process.

2.Fine Aggregate–

Natural river sand was used as fine aggregate. It was clean, well-graded, and free from impurities such as silt, clay, and organic matter. The sand helps in filling voids and improving the workability of the concrete mix.

3.Coarse Aggregate–

Crushed stone aggregates of suitable size were used as coarse aggregate. These aggregates were strong, durable, and properly graded to ensure good interlocking and load transfer within the concrete matrix.

4. Testing –

A. Compressive Strength Test

- The compressive strength test was conducted to determine the maximum load that the concrete blocks could withstand under axial compression. For this purpose, the specimens were first cast and cured for specified periods of 7 days and 28 days. After curing, the surfaces of the specimens were cleaned to remove any loose particles.
- Each specimen was then placed centrally in a Compression Testing Machine (CTM), ensuring proper alignment to avoid eccentric loading. The load was applied gradually and continuously until the specimen failed. The maximum load at the point of failure was recorded, and the compressive strength was calculated based on the cross-sectional area of the specimen.
- This test provides a direct indication of the load-carrying capacity and overall strength of the material.

B. Load Bearing Test

- The load bearing test was performed to evaluate the actual load-carrying capacity of the blocks under conditions similar to practical applications. The specimen was positioned in the Compression Testing Machine in a stable and aligned manner.
- Load was applied gradually, and observations were made throughout the loading process. The load at which the first visible crack appeared was noted as the initial cracking load. The loading was continued further until the specimen reached ultimate failure, and the corresponding load was recorded as the ultimate load.
- This test helps in understanding how the material behaves under real structural loading conditions and provides insight into its practical performance.

C. Shear Strength Test

- The shear strength test was carried out to determine the resistance of the concrete blocks against shear forces, which are responsible for sliding or diagonal failure. The specimen was placed in a suitable shear testing arrangement using a Universal Testing Machine (UTM).

- Load was applied parallel to the cross-section of the specimen in a controlled manner. The load was gradually increased until shear failure occurred. The maximum load at failure was recorded, and the shear strength was calculated based on the area subjected to shear.
- This test is important for evaluating the internal resistance of the material and its ability to withstand forces that may cause cracking or separation within the structure.



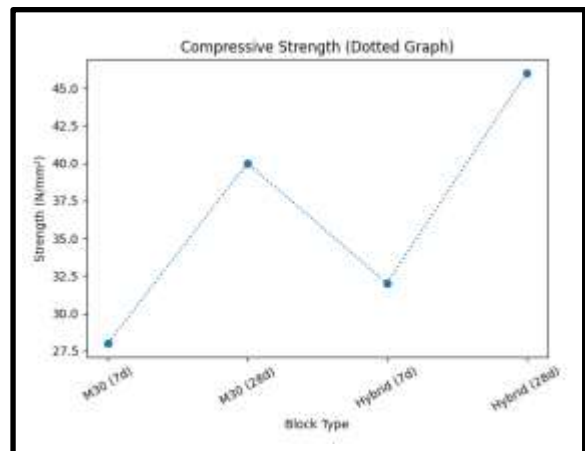


Material	Quantity
1)Cement	320kg
2) water	140 liters
3) Bitumen	80kg
4) Fine Aggregate	650 kg
5) Coarse Aggregate	1200 kg
6) Admixture	1-5% of Cement weight

Material	Quantity
1)Cement	400kg
2) Fine Aggregate	650kg
3)Coarse Aggregate	1200kg
4) Water	180 Liters
5) Admixture	1-2% of Cement Weight

6. Result –

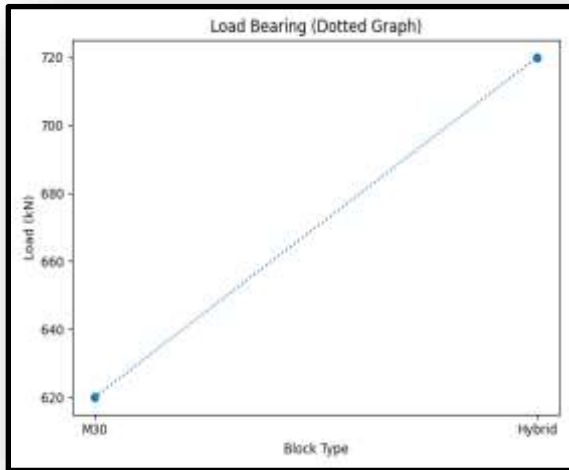
a. Compressive Strength Test



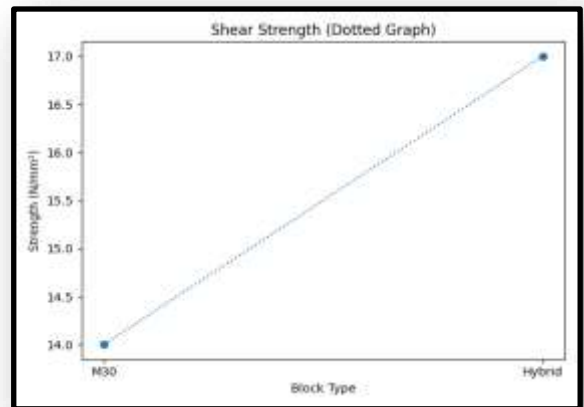
Type of Block	Readings (7 days)	Readings (28days)
Concrete Block	28.0	40.0
Hybrid Block	32.0.00	46.0

Type of Block	Readings
Concrete Block	14.0
Hybrid Block	17.0

b. Load Bearing Test



b. Shear Strength Test



Type of Block	Readings	Readings (28days)
Concrete Block	620	40.0
Hybrid Block	720	46.0

8. Conclusion

- The experimental investigation demonstrates that the incorporation of bitumen into the concrete matrix leads to a noticeable improvement in compressive strength when compared to conventional M30 concrete. This indicates that the hybrid material is capable of sustaining higher loads under compressive conditions.
- The results obtained from the load-bearing and shear strength tests reveal that the bitumen–hybrid blocks exhibit better resistance to applied loads and internal stresses. The improved performance can be attributed to the enhanced bonding characteristics and flexibility introduced by the presence of bitumen.
- Overall, the study highlights that the use of bitumen as a partial replacement for cement contributes to improved mechanical behavior and reduced brittleness of concrete. This makes bitumen–hybrid concrete a suitable and promising alternative for applications where strength, durability, and resistance to cracking are of significant importance.



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