

# Composite Materials Concrete and Bituminous Paver Block

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**Abstract-** Solid unreinforced pre-cast blocks is a versatile, aesthetically attractive, functional, cost effective and requires little or no maintenance if correctly manufactured and placed. Paver blocks can be used for different traffic categories i.e. Non-traffic, Light-traffic, Medium-traffic, Heavy-traffic and Very heavy traffic. Paving block is a very common and popular method of hard landscaping that is suitable for various applications including: driveways, paths, public utility areas, garage, forecourts and roads etc. After the useful life of paver blocks, demolished ones can be used as recycle aggregate conveniently. In routine life we also shows a bituminous and concrete roads. Both roads are now seen everywhere. Some problems in both these roads are also found. Both of these roads are expensive too. It's Construction time duration also more than the paver block pavements. But Paver Block Roads are not fully succeed. It's not more suitable for high speed roads and less frictional surface. Some benefits paver block pavements are easily repairable, Less maintenance required, and also economical. So we try to composite materials bituminous and concrete in shape of paver block. In this report shows that the composition design of paver block and its benefits to use as pavement with replace with concrete and bituminous roads. This study investigated the design of composite pavement structures composed of a flexible layer (top-most layer) over a rigid base. Composite pavements, when compared to traditional flexible or rigid pavements, have the potential to become a cost effective alternative because they may provide better levels of performance, both structurally and functionally, than the traditional flexible and rigid pavement designs.

**Index Terms-** Concrete, Paver Block, Bituminous, Pavement

## I. INTRODUCTION

We want to do something in our project that will make the road or other pavement surface very good. This can help solve all road problems. At present, Concrete Roads, bituminous Roads, and Paver blocks are found on road surface. There are a problem in this three roads. As like maintenance, Repair, Settlement of ground surface. So we tried to create a new composite materials road. It's easily repairable, less maintenance, economical. It's cost of construction is also less as compare to all of above three roads. We have assembled two materials Bituminous and Concrete, one of the paver block.

A composite pavement structure is defined as a structure comprising two or more layers that combine different characteristics and that act as one composite material . The two most commonly used materials that compose this composite structure are a flexible layer (e.g., HMA hot mix asphalt) and a rigid layer (e.g., PCC, cement-treated base [CTB], cement stabilized base [CSB], rolled-compact concrete [RCC], or lean mix concrete). There is no single definition applicable to composite pavements because an HMA overlay on a CTB can be considered a composite pavement; likewise, a thin PCC overlay on an HMA layer, known as white topping, has also been considered a composite pavement. Furthermore, a PCC surface layer applied on top of another PCC layer before the bottom layer has set may be considered a composite "wet on wet" pavement. In this study, the composite pavement system investigated was a rigid base overlaid with a flexible layer as shown in example cross-sections in Figure 1.1.

Composite pavements, when compared to traditional flexible or rigid pavements, have the potential to

provide better levels of performance both structurally and functionally (technical aspects) while being an economically viable alternative to the traditional flexible and rigid pavement designs (economic aspect).

We composite both the materials in paver block shape.

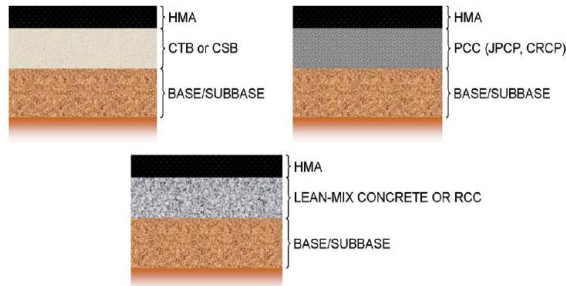


Fig. 1.1 Typical Cross-Sections of Composite Pavements



Concrete Block +Bituminous layer = Composite Materials

Fig. 1.2 Composite both the materials in paver block shape.

## II. MATERIALS

### Cement

In this work, Ordinary Portland cement (OPC) of (53 grade) brand obtained from a single batch was used. The cement satisfies the requirement of IS: 8112-1989. The specific gravity was 3.15 and fineness was 2800 cm<sup>2</sup>/g. The cement grade 53 is known for its rich quality and is highly durable.

### Fine aggregate (Sand)

In this project we are using (Natural Sand) Fine aggregate resulting from the natural disintegration of rock and which has been deposited by streams or glacial agencies. The river sand was used as natural river sand. It is distinguished from gravel only by the size of grain or particle, but is distinct from clays which contain organic minerals. Size of sand used which passing from 4.75mm IS Sieve.

Fine sand for use mix with bituminous which size vary with 1.12mm to 4.75mm IS sieve. And this aggregate in shape of angular.

### Coarse Aggregates

Coarse aggregate are the crushed stone used for making concrete. The commercial stone is quarried, crushed and graded. Much of the crushed stone used is granite, limestone and trap rock. Crushed angular granite metal of 10 mm size from a local source was used as coarse aggregate. The specific gravity of 2.6 and fineness modulus 6.05 was used. Size of aggregates used Aggregates passing through 12.5 mm size sieve and retained on 10 mm size sieve are used. Specific Gravity of aggregates used were 2.884.

### Water

The water used for mixing and curing of concrete should be free from harmful materials and objectionable strain on surface. A part of mixing water is utilized in the hydration of cement and the remaining water serves as lubricant between the fine and course aggregates and make concrete workable.

### Bituminous

Bituminous materials or asphalts are extensively used for roadway construction, primarily because of their excellent binding characteristics and water proofing properties and relatively low cost. Bituminous materials consists of bitumen which is a black or dark coloured solid or viscous cementitious substances consists chiefly high molecular weight hydrocarbons derived from distillation of petroleum or natural asphalt, has adhesive properties, and is soluble in carbon disulphide.

## III. PREPARATION OF BLOCK

### Mixing Concrete:

This signifies relative quantities of essential components that are mixed together to make concrete. Thus a concrete mix of “1:1:2” signifies three parts of sand and five parts of coarse-aggregate for one part of cement. The quality of concrete depends to a great extent on these relative quantities. Various methods have been applied to decide the proportions. In ordinary construction, arbitrary method is generally applied where the experienced mason decides the ratios of sand and coarse aggregates to be mixed with each volume of cement. There are generally two methods are adopted Hand mixing and Mechanical mixing.

#### Prepare Mould of Paver Block Shape:

As per our design first prepare mould. As like shown in fig.



Fig. 3.1 Paver Block Mould

#### Placing Concrete:

Filling of moulds Most production machines operate on one of two basic principles. In the first and more widely used system, an amount of mixture is progressively compacted under vibration until a predetermined height has been reached. In the second system, a gauged quantity of mixture is compacted for a set period. In both cases, variations in density will result if the gauged quantities are not consistent or the mixture is not uniformly distributed within the mould. These variations are over and above those due to variations in moisture content. Filling is usually facilitated by a period of previbration after which the moulds are “topped up” with a second filling of mixture. Where topping layers are used the “topping up” is done using a special topping mix. For very cohesive mixes some difficulty may be experienced when filling the moulds.

#### Compaction

The optimum period of vibration must be determined experimentally in the plant but is usually 3 to 12 seconds. Good compaction is more difficult to achieve in thicker blocks and those that have acute angles.

#### Curing

As with all concrete products, the quality of concrete pavers is improved by water curing. However, it is not practicable to apply significant amounts of water onto newly moulded pavers or subsequently to subject them to water sprays or immersion in water. Curing process occur up to 28 days.

#### Prepared Block

Most upper surface of block is must be rough so that binding with bituminous possible.



Fig.3.2 Prepared Blocks

#### Bituminous aggregate mixing

Asphalt batch mix plant is to produce HMA known as Asphalt Batching Plant and hot mix plant. It blends together aggregates and bitumen to produce the hot mix paving material. The aggregates here can be a single sized material. It can be a combination of different grades / sizes of materials. Finer aggregates are also added along with mineral filler material. The binding material also known as asphalt cement can be cutback asphalt, synthetic binders or emulsion.

#### Placing Mix bituminous on prepared Paver Block

First Clean the surface of Concrete block. Then after Mix bituminous place. Up height of 20mm or 30mm as per design of block.



Fig. 3.3 Placing Mix bituminous on prepared Paver Block

#### Compaction

Compaction of bituminous with heavy weight. At height of 120 to 150 mm. Try to remove air voids as possible.

IV. RESULTS ANALYSIS

Comparison of Compressive Strength of Concrete Block

Compressive strength is the ability of material or structure to carry the loads on its surface without any crack or deflection. A material under compression tends to reduce the size, while in tension, size elongates.



Fig. 4.1 Comparison of Compressive Strength of Concrete Block

Comparison of Compressive

$$\text{Strength of Concrete} = \frac{\text{Max Load carrying by specimen}}{\text{Top surface area of specimen}}$$

Collect the result after Comprise with Concrete paver block and Composite materials paver blocks. Use M25 Grade Concrete.

Table No. 4.1: Compressive strength comprise with concrete paver block and composite materials paver block

Sr. No.	Compressive strength of concrete for M25 grade concrete (N/mm2)			Compressive strength of composite of concrete and bituminous for M25 grade concrete (N/mm2)		
	7	14	28	7	14	28
Days	16	22	24.6	17	26	30

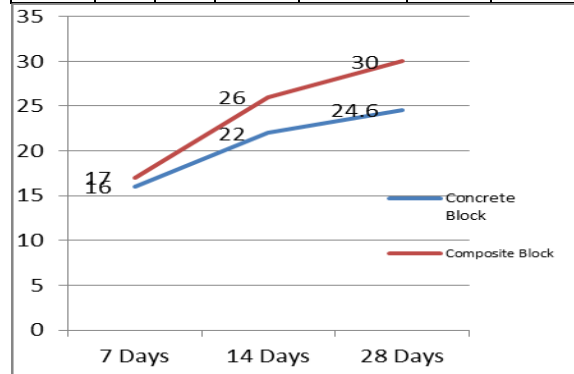


Fig. 4.2 Comparison Chart of Concrete and Composite Block strength result

Splitting Tensile Strength of Concrete

This standard covers the procedure for determining the splitting tensile strength of moulded concrete cubes and cylinders

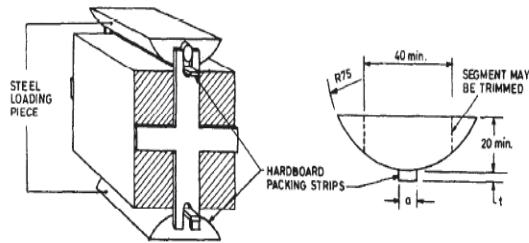


Fig. 4.3 Apparatus For Splitting Cube

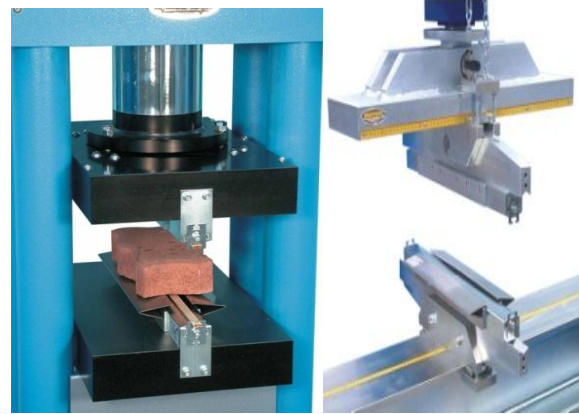


Fig. 4.4 Apparatus for Splitting Cylinder and Concrete

Block Pavers, Cubes and Prisms

Using the following formula:

$$f_{cd} = \frac{2P}{\pi ld}$$

Where

P = maximum load in Newtons applied to the specimen,

l = length of the specimen (in mm), and

d = cross sectional dimension of the specimen (in mm).

Table No. 4.2 Splitting tensile strength comprise with concrete paver block and composite materials paver block

Sr. No.	Splitting tensile strength of concrete for M25 grade concrete(N/mm2)			Splitting tensile strength of composite of concrete and bituminous for M25 grade concrete (N/mm2)		
	7	14	28	7	14	28
Days	2.13	2.68	3.39	3	3.4	4

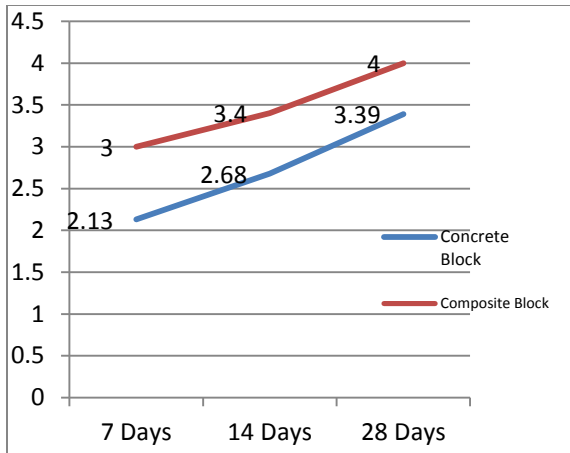


Fig. 4.5 Comparison Chart of Concrete and Composite Block Splitting Tensile Strength result

### V. CONSTRUCTION (LAYING BLOCKS)

The construction of block pavement involves preparation of subgrade, sub-base and base course layers, bedding sand and finally the laying of blocks. The block paving can be done entirely by manual labour. However, for efficient construction work, the work force has to be properly trained for this specialised job.

Blocks can be laid generally by manual labour but mechanical aids like hand-pushed trolleys can expedite the work. Normally, laying should commence from the edge strip and proceed towards the inner side. When dentated blocks are used, the laying done at two fronts will create problem for matching joints in the middle. Hence, as far as possible, laying should proceed in one direction only.

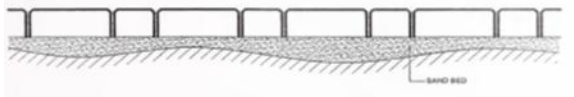


Fig. 5.1 Cross Section Of Paver Block Pavement

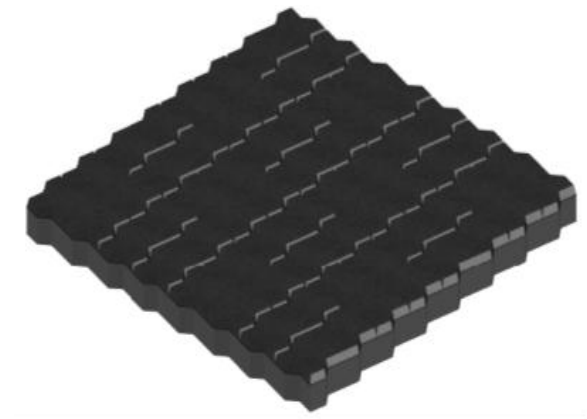
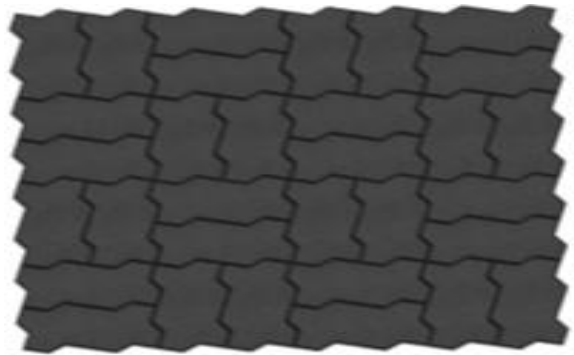


Fig. 5.2 The Laying Pattern

### VI. CONCLUSION

- The cost of maintenance is much lower than a bituminous surface.
- Block pavement does not need in-situ curing and so can be opened to traffic soon after completion of construction.
- Construction of block pavement is simple and labour-intensive, and can be done using simple compaction equipment.
- Structurally round blocks can be recycled many times over.
- Unlike block pavement does not exhibit very deterioratory effect due to thermal expansion and contraction, and are free from the cracking phenomenon.
- Composite upper layer bituminous good frictional surface for vehicles
- The noise generated is higher than bituminous surfaces.
- A very good attention to pavement drainage is needed because the water can seep through the joints.

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