CLAY PAVERS-AN EXTERNAL FLOORING MATERIAL – A CASE STUDY

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Abstract:

External flooring using the Interlocking blocks, Paving blocks and Paving tiles are aesthetically pleasing, easy maintenance and ready to use within an hour. Interlocking Pavers are modern day solution to the outdoor flooring versatility in applications. They are high strength concrete and clay mouldings in various shapes, sizes & colors to suit the imagination of landscape architects & nature's essence. Clay bricks used as pavers have been around a lot longer than their concrete cousins. Here a Case study is done to know the technical details manufacturing and laying of the clay pavers. The material constituents for the clay pavers are Laterite soil (collected from Naubad area of Bidar district Karnataka), cement (Birla super cement -43 grade) and quarry dust which is then mixed in the ratio 1:4 (1 part of cement,2 part of laterite soil and 2 part of quarry dust) and then moulded into suitable shapes .They are then tested for their index properties and the investigation revealed that these pavers are economical and easy to install product and of sufficient strength.

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1.0 Introduction:

Interlocking Pavers are modern day solution to the outdoor flooring versatility in applications. They are high strength concrete mouldings in various shapes, sizes & colors to suit the imagination of landscape architects & nature's essence. Interlocking pavers are manufactured concrete product that is individually placed in variety of patterns. Pavers do not use mortar or grout the sharp angle bedding sand that they are placed on provide the interlocking feature of pavers which allow them to shift slightly with the earth without cracking or breaking. Paving stones are three times stronger than poured in place concrete. There are many advantages of choosing outdoor paving tile to finish off a patio design or to tidy up your garden. The obvious aesthetic effect goes without saying, but it can also be used to aid drainage and level out a specific area. Non-porous paving tiles are therefore perhaps better.

They do not absorb water and can be placed so that excess water is taken away from the garden and patio area rather than over-saturating it. Non-porous materials include stone, concrete and other treated materials. An added bonus of non-porous tiles is that they will not expand and crack over a period of time. This is largely because they don't absorb water nor succumb to the elements. Outdoor paving tiles come in various shapes and sizes and can even be custom-made to suit your needs.

1.1Types of Interlocking pavers

1) Concrete Pavers ,2) Clay Pavers ,3) Fly ash Pavers

Newly completed clay pavers to private driveway


1.2 Thickness:-

There are 2 common thicknesses for clay pavers.

- 50mm – for residential driveways and patios
- 60/65mm – the BS pavers as used for footways and carriageways

There are exceptions; some manufacturers offer thicker or thinner pavers.

1.3 Colours:-

The final colour of clay pavers is determined by the clay used in the manufacture and the firing process. As naturally-occurring clays are so variable, so the range of colours available as pavers is extensive, but they can be lumped together into 4 main groups.

(1). Reds, (2).Browns, (3).Blues, (4).Buffs

1.4 Edges:-

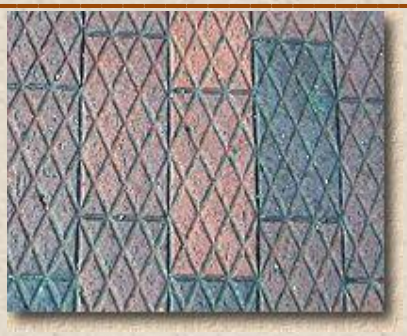
Clay pavers have two types of edges – chamfered and square-edged. Chamfered pavers can be used on footways and carriageways, while square-edged pavers are typically used only on footways where a smoother surface is required, such as in shopping areas, where the absence of chamfered joints makes pushing loaded trolleys considerably easier.

1.5 Texture

There are five common textures to clay pavers – smooth, sand-moulded, patterned and drag-face are machine made, plus the hand-made texture.

Drag Wire Sand Moulded Smooth Choclate Brown





Hand Made Red – Multi | Tumbled Red | Diamond Patterned

1.6 Technical notes –Strengths and Tolerences

Flexible pavers are classified as either type PA or PB, depending on intended usage and transverse breaking strength. The classification also dictates the size tolerances, with class PB being much more tightly controlled than type PA.

TYPE	USES	Transverse Break Load		Tolerances					
				Length		Width		Depth	
		Mean	Individual	Max	Min	Max	Min	Max	Min
PA	Driveways, public footpaths, patios, light-use roads	3kN	2kN	24.35	23.65	24.44	23.56	24.69	23.30
PB	Public Highways Freight Yards Fuel stations Docks, ports	7kN	4kN	24.26	23.74	24.33	23.67	24.52	23.48

1.7 Construction

For flexible construction, clay pavers are laid in exactly the same way as concrete blocks – a screeded bed of grit sand is prepared, the blocks are laid by hand, cut-in and compacted. On the subject of jointing, clay pavers usually require slightly more sand bedding per square metre than concrete pavers of a comparable size. This is because of the imperfect nature of the pavers, which results in the joints being slightly wider than would be found with concrete blocks. The difference is usually around 15-25%.

1.8 Shapes and Sizes:-

The vast majority of clay pavers are rectangular in plan. The dimensions and proportions of the rectangles are varied, but there are 4 distinct classes of clay pavers:

- Cobbles – usually square and 100x100mm or less in plan
- Bricks – rectangular, most often 2:1 or 3:1 in plan
- Oversize – rectangular, but not 2:1 or 3:1, often less than 2:1 May be known as Pamments, Barn Pavers, or other local terms of affection.

50mm and 75mm Clay Cobbles

2:1 and 3:1 Clay Pavers

Oversize Clay Pavers

Special Fittings

CASE STUDY:

2.0 Introduction

The case study is done on clay pavers which is manufactured in the company, M/s Laterite blocks Industry, Bidar, Karnataka. Bidar is a district headquarter in northern Karnataka where laterite soil is abundantly available. Established with most modern machinery and equipment, M/s Laterite blocks industries products are well known for quality because they are test certified at every stage of production.. The products are beautifully designed crafted and textured and distinctive colours.

2.1 Technical details of clay pavers:-

1) Thickness : 50mm, 55mm, 60mm & 80mm.
2) Size of the block : 3.5 Blocks/sft(Approx).
3) Designs available in colours
   : Terra Cotta, Grey, Dholpur, Nut Brown.
4) Crushing Strength: As per clients requirements.
5) Weight per Sq.ft : 11.5kgs (Average).

2.2 Usage area

A) Light Duty:- Residential,,Driveways,Porticos,Pool Decks,Parking Lots (Light Traffic),Walkways

B) Medium Duty:- Shopping Malls,Residential Streets,Parking Lots (Heavy Traffic),Safety Zones,Service Roads,Railway Platforms,Parks,Canal Lining,Bus Stops,Ware Houses,

C) Heavy Duty:-Public Roads,Petrol Bunks,Container Yards,Industrial Floors,Loading Docks.Ports

2.3 Advantages

Cost Effective,Aesthetically Pleasing,Excellent Surface,Easy Maintenance,Ready to Use within an Hour,Easily Replaceable,Time Saving,Choice of Patterns,Durable,Latest Technology

2.4 Materials

1. Cement 43 grade

Physical properties

(All the tests were done as per IS 8112-1989)

Sl No	Physical properties	Values
1	Fineness	2270 sqm/kg
2	Intial setting time =85min,	Final setting time -540min
3	Cpmpressive strength	44.2 MPa under 28days curing
4	Soundness	8mm

2. Laterite soil

Physical properties

Sl No	Charecteristics	Description
1	Natural moisture content (%) **(IS 2720(Pt 2):1973)**	21.57
2	Liquid Limit (%) **(IS 2720(Pt 5):1970)**	52.5
3	Plastic Limit (%) **(IS 2720(Pt 5):1970)**	25.6
4	Plasticity Index (%) **(IS 2720(Pt 5):1970)**	26.9
5	Maximum Dry Density (KN/m^3) **(IS 2720(Pt 7):1980)**	15.82
6	Optimum Moisture Content(%) **(IS 2720(Pt 7):1980)**	18.42
7	Unconfined Compressive Strength (KN/m^2) **(IS 2720(Pt 10):1991)**	275

8	California Bearing Ratio (%) **(IS 2720(Pt 16):1969)**	28.5
9	Specific Gravity **(IS 2720(Pt 3):1980)**	2.69
10	Colour	Reddish-brown

Particle size distribution (IS 2720(Pt 4):1985)

Sl No	I S Sieve	% Finer
1	4.75mm	91.35
2	2.36mm	78.22
3	1.18mm	57.18
4	600µ	32.16
5	300µ	16.12
6	150µ	8.98
7	75µ	2.01
8	pan	--

3. Quarry dust

Material confirmed to the following gradation

Passing sieve	%by weight
12.5mm	100
6.3mm	82
2mm	61
425µ	32
75µ	16

2.5 Methods of Testing

The laboratory tests carried out on the natural soil include particle size distribution, Atterberg limits compaction, CBR and UCS. The geotechnical properties of the soil were determined in accordance with BIS codes. Specimens for Unconfined Compressive Strength (UCS) and California Bearing Ratio (CBR) tests were prepared at the Optimum Moisture Contents (OMC) and Maximum Dry Densities (MDD).

2.6 Manufacturing process of blocks and tiles

1. Materials used in a proportion 1:4 (i,e 1 part of cement : 2 part of laterite soil+ 2 part of quarry dust).
2. To this proportion colour is added i,e oxides of different colours like red, yellow or black and mixed using water.
3. These materials are mixed according to the proportion.
4. Materials are mixed in a Pan mixer which contains 2 roller and 2 mixing handles. Here materials are crushed slightly while mixing. This is done for 15 minutes.
5. The slurry is obtained from mix. A dry mixture of cement .laterite dust and aggregate dust is readied for making the blocks & tiles.

6. Moulds of different shapes & size are available for the requirements according to client.

   The usual sizes are mentioned below,

   a) 12”x12” & 10” x10” of 1” thickness available for paving tiles.

   b) For paving blocks different size and shape for 60mm & 80mm thickness available.

7. Oil is applied for the mould. Then Slurry is poured with the help of trowel into the mould to 10mm thickness for paving tiles and 25mm thickness for paving then the remaining portion to be filled by dry mix.

8. The upper cover is placed and locked

9. This set of mould is kept in the hydraulic machine for hydraulic press, pressurized for 30 tons to get a solid compacted tile or block.

10. This block or tile is dried for one day and then cured for 15 days.

11. The final product is obtained.

2.7 Instructions for laying interlocking blocks and tiles

1. Set the level for floor i.e,dead level or slope as specified by the Architect/Contractor.
2. This can be done just by levelling the ground with help tools and filling with soil
3. This surface can be compacted slightly.
4. The area should be laid with sand of 1 inch thickness as base material.
5. The laying of paving blocks should be done from the corner of the area.
6. As the blocks have the interlocking capacity, they should be interlocked by placing them properly.
7. Care should be taken that the sand grains do not block the interlocking of blocks.
8. All the area should be covered and no area should be left (as gap in area causes the lose in interlocking capacity).
9. Surface area should be cleaned and its ready to use.

2.8 Tests on clay pavers

Sl No	Characteristics	Description
1	Density	1200kg/cum
2	Water absorption	12%
3	Average Compressive strength	12MPa

2.9 Production

- **Output:-**

  Labour for Making :- For 8 Hours = 2 Labours = 400 No's

- **Rates**

1. For Paving Tiles:-

Size: - 1) 12"x12" = 10 Rs/No + 14.5% VAT + Transportation cost.

2) 10"x 10" = 6 Rs/No + 14.5% VAT + Transportation cost.

2. For Interlocking Blocks and Paving Blocks:-

Rate range: - 30 to 55 Rs/No + 14.5% VAT + Transportation cost.

- **For Laying of Blocks & Tiles:-**

  Rate :- 4 to 5 Rs/Sft + Materials + Taxes.

3.0 Conclusion:

Clay pavers can create a casual or formal design feature in virtually any color you require. They can be lifted and replaced without much hassle at all, unlike having to repair a concrete slab. The maintenance costs involved for this reason are very low. Not only are clay paver easy to repair, but the likelihood of them being damaged is slim. For each unit has joints that allow them movement, so the chances of them cracking is very rare. The permeable types of clay pavers are environmentally friendly where vegetation is planted between the grid systems. These

pavers allow the re-use of storm water back into the grounds, rather than back into our waterways. Meaning that they also maintain themselves with the necessary watering, without having to use our own water, for it is such a precious resource.

Hence these pavers economical and easy to install, they are widely used all over.

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