

# DESIGN OF PERMEABLE PAVERS FOR STORM WATER RUNOFF SOLUTIONS

Yogita Asawale, Krushna Borhade, Niteen Chavan, Suraj Hadawale

*Yogita Asawale, Department, VPSCOE Lonavala, Maharashtra, India*

*Krushna Borhade, Civil Department, VPSCOE Lonavala, Maharashtra, India.*

*Niteen Chavan, Civil Department, VPSCOE Lonavala, Maharashtra, India.*

*Suraj Hadawale, Civil Department, VPSCOE Lonavala, Maharashtra, India.*

## ABSTRACT

*The purpose of this project is to provide permeable pavers for smooth storm water runoff. In this project we intend to design permeable pavers for run off storm water and tackle the flooding situation specially in urban areas where there are not many impermeable surfaces available. In our country during rainy season the main problem occur is to get rid of surface running water, but due to urbanization the rain water could not percolate through the hard and impermeable surface and various problems like sewers get choked and all the rain water flow on the surface and causes problem to traffic and daily activities so we are developing such type of pavers , after installing can help to get over these problems without any difficulties called permeable pavers.*

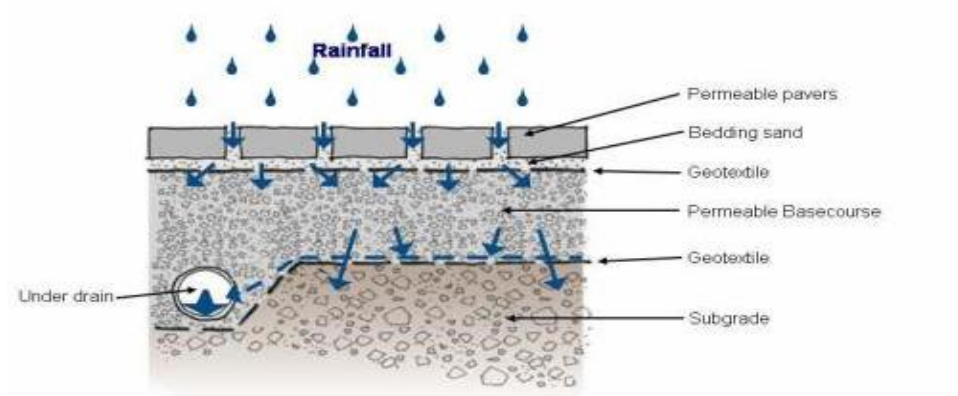
**Keyword-** *Permeable paver, conventional paver, compressive strength, infiltration rate, cost*

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## 1. INTRODUCTION

Permeable pavers are very good alternative for pedestrian pathways and parking lots than conventional pavers since these allow rainwater to percolate through it. In pavement design the base is the top portion of the roadway that pedestrians or vehicles come into contact with. The media used for the base of permeable paving may be porous to allow for fluids to flow through it or nonporous media that are spaced so that fluid may flow in between the crack may be used. In addition to reducing surface runoff, permeable paving can trap suspended solids therefore filtering pollutants from storm water. Examples include roads, paths, and parking lots that are subject to light vehicular traffic, such as cycle-paths, service or emergency access lanes, road and airport shoulders, and residential sidewalks. Even though some porous paving materials look nearly indistinguishable from nonporous materials, their environmental effects are qualitatively different. Whether it is pervious concrete porous asphalt porous asphalt, paving stones or concrete or plastic-based pavers, all these permeable materials allow storm water to percolate and infiltrate the surface areas, traditionally impervious to the soil below. The goal is to control storm water at the source, reduce runoff and improve water quality by filtering pollutants in the substrata layers.

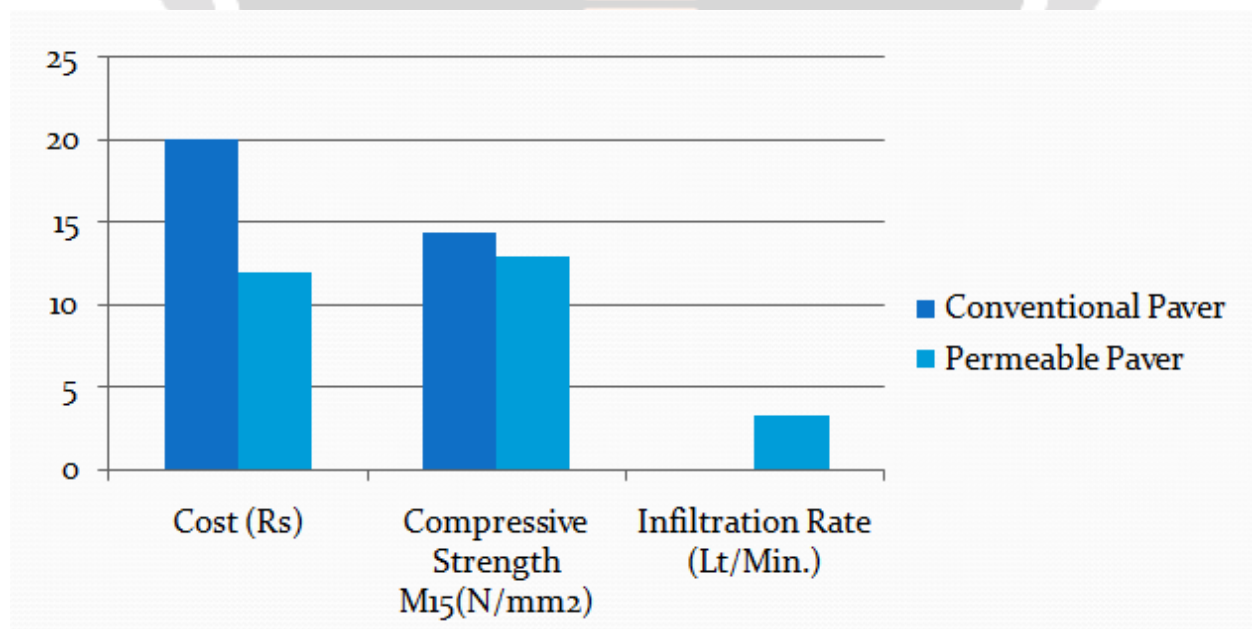
Fig-1 Permeable pavers in action



## 2. ANALYSIS REPORT

We done all necessary tests on permeable pavers and eventually we could compare our permeable pavers with conventional pavers. From the tests we conclude the following data given in bar chart. Given bar chart shows three parameters of permeable pavers against conventional pavers, which are cost, compressive strength and infiltration rate. By comparing these we find that permeable pavers are better than conventional pavers in almost every aspect. The cost for production of permeable pavers is much less than conventional pavers. The compressive strength is also moderate and infiltration rate is also good. The following bar chart shows the detailed information about permeable nad conventional pavers.

Chart-1 Analysis Report



### 3. ESTIMATION OF QUANTITY OF MATERIALS

We cast three different strengths of permeable pavers, all different pavers needed different quantity of materials like cement, sand, aggregate, water so first we calculated the quantity of materials needed for casting of pavers for different strengths. The proportion for material used is given below in table and total quantity is also given in table.

**Table-1** Estimation of quantity of materials

Grade Of concrete	No.s of blocks	Volume of concrete (m <sup>3</sup> )	Cement (Kg)	Sand (m <sup>3</sup> )	Aggregate (m <sup>3</sup> )	Water (lit)
M20 [1:1.5:3]	10	0.021	8.63	0.0089	0.0179	3
M15 [1:2:4]	10	0.021	6.78	0.00942	0.0181	2
M10 [1:3:6]	10	0.021	4.74	0.0098	0.0195	1
<b>TOTAL QUANTITY OF MATERIAL</b>	<b>30</b>	<b>0.063</b>	<b>20.15</b>	<b>0.0281</b>	<b>0.0549</b>	<b>6</b>

### 4. ESTIMATION OF COST OF MATERIALS

we calculated the cost required for production of one paver block by the materials we used before. We calculated the cost of each item will used in paver block then by adding all the materials cost we found the total cost of manufacturing of single permeable paver which is mentioned in given table.

**Table-2** Estimation of cost of material

Sr.No	Materials	Quantity	unit	Rate	Amount
1	Cement	20.15	Kg	320Rs/50Kg	128.96
2	Sand (crushed sand with fly ash)	0.0281	m <sup>3</sup>	3000Rs/ Brass	30Rs (1 cu.ft)
3	Aggregate	0.0549	m <sup>3</sup>	2200Rs/Brass	44Rs (22Rs for 1 cu.ft)
4	Water	6	liter	10Rs/Liter	60Rs
<b>Total cost:-263Rs</b>					

## 5. COMPRESSIVE STRENGTH (28 DAYS)

We tested our pavers after 28 days for compressive strength and we got the following results. The given table shows the compressive strengths of 3 categories of permeable pavers after the test.

28 DAYS COMPRESSIVE STRENGTH					
GRADE OF CONCRETE	DATE OF CASTING	DATE OF TESTING	WT OF CUBE	LOAD N	COMP STRENGTH N/mm <sup>2</sup>
M10	20/02/2018	20/03/2018	6.52	418.9	8.9
	20/02/2018	20/03/2018	6.62	417.8	8.8
	20/02/2018	20/03/2018	6.55	422.6	9.0
M15	20/02/2018	20/03/2018	6.88	451.3	12.9
	20/02/2018	20/03/2018	7.01	454.9	12.7
	20/02/2018	20/03/2018	6.96	461.8	13.0
M20	20/02/2018	20/03/2018	7.10	490.1	16.0
	20/02/2018	20/03/2018	7.05	488.7	16.1
	20/02/2018	20/03/2018	7.07	483.9	16.3

## 6. CONCLUSION

1. The permeable concrete allows water to pass through it.
2. Compressive strength is slightly lower than conventional concrete paver.
3. Permeable concrete pavers are economical than conventional one in terms of cost.
4. Infiltration rate is high in permeable concrete pavers.

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