

# Applicability of Porous Pavement at Khokhra Circle of Ahmedabad City

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## ABSTRACT

This study represents the experimental work related to porous pavement feasibility at Khokhra circle. Nowadays porous pavement is a new concept introduced worldwide. In India and other countries research is going in positive direction. There are many advantages of porous pavement. Porous pavements allow storm water runoff to filter through surface voids into an underlying stone reservoir where it is temporarily stored and/or infiltrated. For this study khokhra area of Ahmedabad city has been selected with the specific road network from the Laxminarayan society to Khokhra circle, Madrasi mandir to Anupam cinema and Haripur housing to Hatkeshwar circle. The above road network has the history of the accumulation of water in the area during the monsoon season for long duration. To study the above objective, the rainfall data for the area during the different day, month is collected. The volume data is the other important aspect for identifying the low volume road. The quality of soil sub grade is the other data, which is collected for determining the thickness of porous asphalt concrete at this road network. The soil quality is also useful in order to identify suitability of disposal of the seepage ground water nearby to the stream/artificial drainage link.

**Keywords:** Porous pavement, soil sub grade, Rainfall data, soil quality, surface voids, Stone reservoir, Infiltration, low volume road, porous asphalt concrete.

## I. INTRODUCTION

Increased urbanization causes pervious green fields to be converted to impervious areas increasing storm water runoff. Engineers and scientists have combined their knowledge to introduce innovative thinking to manage the quality of urban runoff and harvest storm water for productive purposes. With increased population and climate change water shortage problems are troubling mankind all over the world. How to harvest the water during rainfall events for use at times of need is of major interest subject to civil engineers, environmentalists and to the community. On the other hand, with urbanization, more impervious road and roof surfaces appear resulting in increased runoff from rainfall. Most of the floods occur because existing drainage systems are unable to handle peak flows during rainfall events. During a storm event, flood runoff will carry contaminants to receiving waters such as rivers and Creeks. There is increased interest in protecting river water quality and as a result, improving the quality of storm water. A porous asphalt pavement differs from traditional asphalt pavement

designs in that the structure permits fluids to pass freely through it, reducing or controlling the amount of run-off from the surrounding area. By allowing precipitation and run-off to flow through the structure, this pavement type functions as an additional storm water management technique. The overall benefits of porous asphalt pavements may include both environmental and safety benefits including improved storm water management, improved skid resistance, reduction of spray to drivers and pedestrians, as well as a potential for noise reduction. Applying permeable pavements as an alternative to traditional drainage systems should be extended, especially in dry regions in order to recharging groundwater.

## Objective and Scope of Study

### Objectives

- To study the existing pavement conditions study area.
- To carry out traffic volume counts in study area at peak hours.

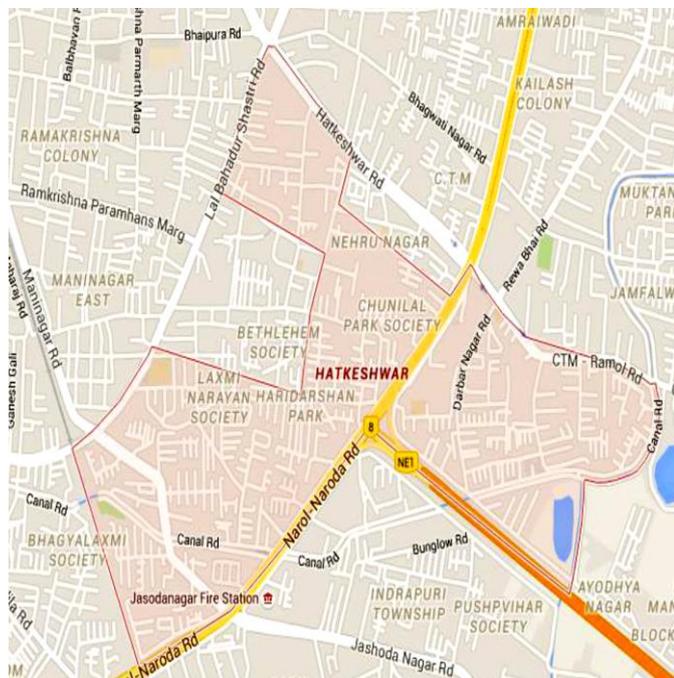
- To propose the solution of better pavement.
- To evaluate the performance of porous pavement.

### Scope

- Identification of better alternative as a solution.
- To analyse rainfall data, traffic volume counts, CBR test, proctor test.
- To review and improve upon the existing road condition under study.

### Study Area

Ahmedabad city is the major city of Gujarat, which attracts people from the different place of Gujarat for different activities. This leads to very high traffic to and from Ahmedabad. Khokhra area of the Ahmedabad is one of the prime locations. The total population of this area is about 96000 people (source: **Hatkeshwar zonal office**). In this area the local bus depot is situated and it is a main place for different business activities. It is also the area from where the road leading to different cities passes from the Ahmedabad city. It is the most waterlogged area in Ahmedabad city during the high rainfall.



**Figure 1:** Study area

## II. METHODS AND MATERIAL

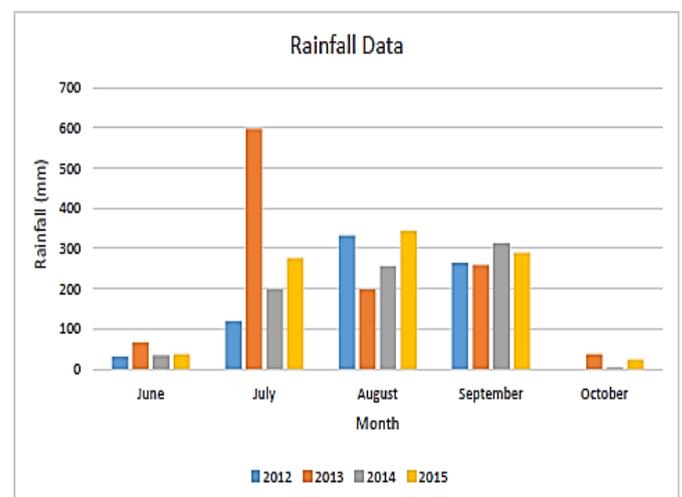
### Rainfall Data

TABLE 1  
ZONE WISE RAINFALL DATA

Year	Zone wise rain (in mm)						Average	Inch	Days
	Central	West	North	East	South	New west			
2005	1199.00	1301.71	1363.00	1251.43	1085.50	-	1033.44	49.61	54
2006	1064.70	1177.15	1328.50	1203.48	1315.42	-	1014.88	48.71	52
2007	847.00	1015.50	1181.50	997.99	905.15	973.72	986.81	39.47	66
2008	770.30	769.62	569.60	635.35	562.35	699.37	667.77	26.71	60
2009	449.00	427.94	492.50	628.19	429.75	374.66	467.01	18.68	31
2010	1030.50	1197.30	1099.00	1219.91	1112.90	1455.6	1185.87	47.44	76
2011	551.00	794.00	968.83	654.96	639.55	631.19	706.59	28.26	66
2012	642.50	708.21	743.83	707.62	676.35	538.83	669.56	26.36	61
2013	1089.57	1259.33	1138.74	1028.12	809.17	1112.9	1072.98	42.24	74
2014	823.23	1101.50	308.50	938.60	722.10	803.30	782.87	30.82	61
2015	789.30	985.50	632.70	987.00	813.00	967.00	862.42	35.85	63

The total rainfall data of the Ahmedabad city of west zone, new west zone, south zone, central zone, north zone and east zone is collected from the Ahmedabad municipal corporation office. Khokhra area is situated in the east zone of Ahmedabad city. There are three places Odhav, Nikol and Chakudia at which the rain gauges are provided to record the daily rainfall of east zone. The daily rainfall of Khokhra area is recorded at chakudia. Day to day Rainfall data is collected from the Ahmedabad municipal corporation office from the year 2010 to year 2013.

### Rainfall



**Figure 2:** Rainfall data

## Traffic Data

The traffic volume count survey was carried out for the purpose of identifying the area having low traffic volume. The traffic survey is conducted in the internal street road of the Laxminarayan society to Khokhra circle. Traffic volume details in PCU/hr are tabulated as below:

TABLE 2  
TRAFFIC VOLUME COUNT

No.	Peak	Stretches	No. of Vehicles	PCU/h(V)
1	Morning	Laxminarayan to khokhra circle	346	392.3
		Laxminarayan to khokhra circle opp.	344	380.35
	Evening	Laxminarayan to khokhra circle	334	378.3
		Laxminarayan to khokhra circle opp.	353	389
2	Morning	Madrasi mandir to Anupam cinema	264	311.35
		Madrasi mandir to Anupam cinema opp.	276	321.3
	Evening	Madrasi mandir to Anupam cinema	332	377.6
		Madrasi mandir to Anupam cinema opp.	339	382.9
3	Morning	Haripur housing to Hatkeshwar circle	246	284.35
		Haripur housing to Hatkeshwar circle opp.	255	298.5
	Evening	Haripur housing to Hatkeshwar circle	264	305.8
		Haripur housing to Hatkeshwar circle opp.	251	318.55
Total average of PCU/h (veh.)				376.39

Traffic data is analysis for the PCU/h as per the PCU factors given in IRC: 106-1990. Vehicle composition is useful in selection PCU factors to convert in PCU/h. In IRC: 106-1990 5% and 10% vehicle composition factors are given.

## III. RESULTS AND DISCUSSION

### A. Graphical representation

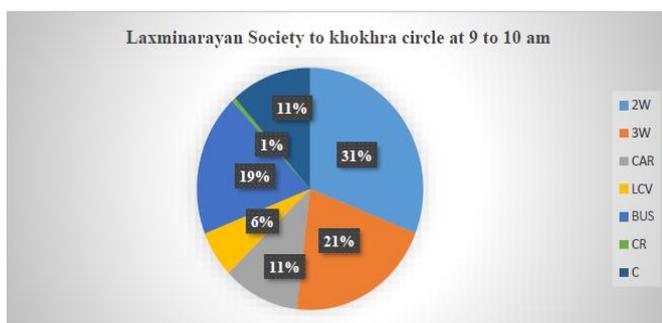


Figure 3: Laxminarayan society to khokhra circle

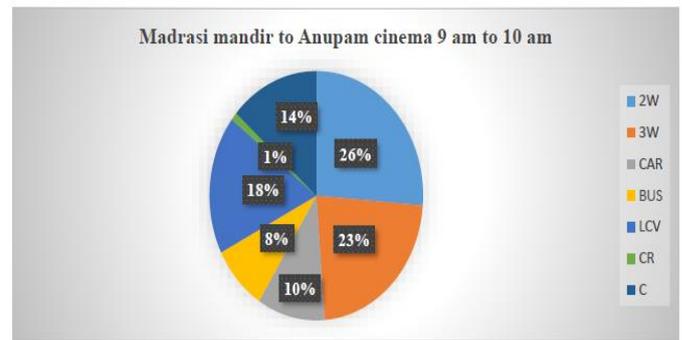


Figure 4: Madrasi mandir to Anupam cinema

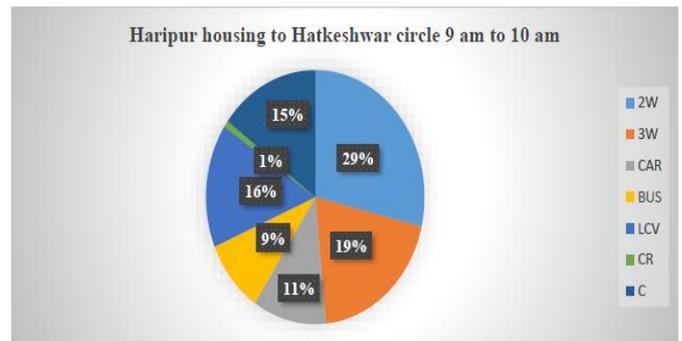


Figure 5: Haripur housing to hatkeshwar circle

### B. Analysis of Data

According to the data rainfall for the month of June, July, August, September and October are 1.61, 13.61, 13.84, 7.54, 1.18 inches respectively. Which indicates Hatkeshwar area is highly waterlogged zone. The graphical representation of traffic composition shows above which indicates that the road used by the local public for light motor vehicle. In all survey it is found that majority of users are using two-wheeler on an average of 79 %. All these analysis is done for a selected street road which is located at the Khokhra circle, so for light motor vehicle and an average rainfall the selected area is suitable for the applicability of porous pavement. For this type of waterlogged condition, using the porous pavement it is possible to reduce water logging on the site. According to the volume count data the road of study area is considered as a low volume road which is suitable for the porous pavement study. The depth of water logging in the study area is about 40-50cm during high rainfall.

#### **IV. CONCLUSION**

The rainfall data are collected for this study and also volume count survey is to be carried out. From the data it is concluded that the concept of the porous pavement is applicable for the low volume water logged area. Porous concrete, porous asphalt and interlocking concrete paver block are the best solutions in that type of area.

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