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"Effective Strength of Porous Pavement at Global City, Virar for Reducing Water Logging"

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Abstract - Porous pavement provides the surface that passes the water through it. The purpose of providing the porous pavement is that to reduce the water logging issue and also to reduce the storm water runoff. We have chosen Rustomjee Global City Virar, (west) as our study area. We are going to construct M25 grade porous pavement using cement, 10mm coarse aggregate and water. We got the final result that is 19.5mpa compressive strength and hence we conclude the we can use porous pavement at low traffic volume roads, parking slots, complex road and airport shoulders.

Key Words: **Porous Pavement, Storm water, Water logging**

1. INTRODUCTION

Transportation plays an important role in development and growth of living standard of the human society. Road network is important for the proper co-ordinate but the material disaster like storm water affect the proper co-ordination of road network. Storm water leads to the water logging problem. Because of the growing urbanization there is shortage of the pervious lands which lead to the water logging problem. Increasing water logging problem can be solved by using the porous concrete or porous pavement. Porous concrete is a mixture of cement, coarse aggregate, water and any other additive or mixture. Porous concrete does not include sand or fine aggregate because it will fill the voids in pavement. Porous concrete contains almost 20-30% or up to 30% of the voids. The voids present in the concrete will allow the water to penetrate through it. Penetration of water through voids will lead to increase in the level of ground water table and also the storm water gets filtered through it so that the amount of the contamination is less. Filtered water can be reuse especially in the dry region it plays an important role to increase the ground water level .But as compared to the conventional concrete the strength of the porous concrete is less .So that the porous concrete should be use on low traffic volume i.e. at parking slots, shoulders, etc.

Figure 1.1Small Model of Porous pavement

Fig 1.1 shows small model of porous pavement. The user is putting water on the pavement and the water is easily passing through the pavement as it does not contains voids because of non-availability of sand which will decrease the water logging problem and storm water gets easily runoff.

1.1 Statement of problem

We have chosen porous pavement at Rustomjee Global City, Virar(west) to reduce the water logging problems in that area, to recharge the ground water and to reduce the traffic jam. In current year the rainfall intensity was very more which leads to the water logging problem in this area so to reduce this water logging problem we have chosen this study area.

1.2 Objectives of the Study

The objectives of the give study area are:

- To collect the data (detailed plan, metrological data, etc) for the given study area.
- To complete traffic survey for given study area.
- To design porous pavement for reducing water logging problem for the given study area.
- Also by designing porous pavement, reduce water shortage problem in given study area.

2. Literature Review

(2016, Pankaj Teware) had made a research that cement is replaced by fly ash and ground granulated blast furnace slag

by 10%, 20% up to 30% which helps to reduce cement consumption, environmental issue.(2017, A.V.Gandhi) had found a way to control the storm water at the source, reduce runoff, reduce cost and improve water quality by filtering the pollutants in the subtract layers and increase the subsurface water level. For this use of fly ash is also socio-economic problem. Use of fly ash upto 10-30% as a replacement of cement by fly ash. Its application to road shoulders, parking lots. (2017, Praveen Kumar) has investigated that the pervious concrete is obtained by removing the fine aggregates wholly(0%) and replacing with 6.3mm waste marble aggregate and partially as 10% replacing coarse aggregate and partially as 10-20% of waste marble aggregate of 10-12mm with water cement ratio of 0.4. Result obtained is compressive strength of 22.22N/mm^2 and strength gets increased. At Sitapura institutional area, Jaipur in 2016 Mukul Nama had use permeable pavement to reduce runoff , this effectively traps suspended solids and filter pollutants from the storm water , 80mm blocks lay on 50mm laying path. This laid on 200mm sub-base. Sub-base consist of 40mm aggregate and in open graded base 20mm aggregate are used. As per analysis 10m^3/sec discharge of storm water passing through pavement. These discharge collect in drainage pipe and further used for various application, pollutants capture during infiltration so the contaminant is also less.

(2017, A.M.Admute) he found a new techniques in permeable pavement for construction of road pavement in India. This research describes the use of permeable pavement and where it can be used, how to increase the strength by porous asphalt. In 2014 Stephen.A.Arin had made optimal mix designs for pervious concrete for an urban area. Pervious concrete is used at Columbia and finding out the strength by different mix design and conducting various test on the pavement. (2015, Rajesh Kumar) made characteristics study on pervious concrete. This journal contain the characteristic study of pervious concrete by using various mix design and to find out the compressive strength, flexural strength, void ratio so to get the best of ever mix design.(James b. Leedom) made a case study enhanced porous concrete pavement system creates advantages for all stakeholders. In this research porous pavement was used at 'west rawsonavenues's' at Framklim , the storm water was used by retail building and the cost of the pavement was lower than surface detention system.

(2016, Jaiman Solanki) had made research at Khokra circle, Ahmedabad city and also found the application of porous pavement. For the rainfall data, traffic volume and quality of soil sub-grade at that particular place and from these it has made a conclusion that porous pavements are applicable for low traffic volume and that amount of rainfall. (2013, Darshan.S.Shah) had made research and case study of pervious concrete at new era for rural road pavement. In this case study he made a comparison between conventional concrete and pervious concrete. After comparison he got a result that the pervious concrete pavement are more suitable in rural areas to increasing the ground water level. (2014, Parmar Manisha) had made a case study at Hatkeshwar, Ahemdabad city. In this journal, in karnavati society during the rainfall there is a water logging issue. They collected the traffic and rain fall data of that area and made a conclusion that porous pavement is applicable to this area

(2018, Yogita Aswale) had made a design of permeable pavement for storm water runoff solution. In this journal they have done the compare conventional pavement and permeable pavement, find the strength of permeable pavement and found that permeable pavement is more convenient paver and cost is also less. (2016, Mukul Nama) had done a case study of sitapur institutional area, Jaipur. They made the permeable pavement and use the storm water again. They also found that durability get increases due to permeable pavement depending upon the aggregate durability and strength and the life span is 8-10 years.

(S. Arvind) had made a construction of porous asphalt pavement using graphene. In this journal they use graphene for increase the strength of porous pavement without losing the desired strength they where manage to increase the crushing value of aggregate, stability of graphene porous is more, in short the overall properties get increased by use of graphene.

By reviewing all this literature review we conclude that we are implementing porous pavement in our Rustomjee Global City.

3. MATERIAL AND MIX DESIGN

3.1 Materials

Following are the materials we are going to use for porous concrete:

- Cement
- Coarse aggregate
- Water

3.2 Mix design

For M25 grade

- Cement = M25 (grade)
- Coarse aggregate size = 10-12mm
- Coarse aggregate shape = Angular
- Type of exposure = Mild

For the design of porous pavement we concluded IS code method:

Specific gravity

1. Cement = 3.15
2. Coarse aggregate = 2.574

Step 1: Determination of target strength
F (target) = fck + (1.65x(s))
=25 + (1.65x4) {s=4 standard deviation from IS 10262 Table 1}
= 31.6N/mm^2
Step 2: Water cement ratio
For M25
From table 5 of IS456
Maximum free w/c ratio = 0.5
Step 3: Entrapped air =2%
Step 4: Max water content = 208kg/m^3
Step 5: Water content
From IS456 table 5
Cement content =208/0.5 = 416kg/m^3
Step 6: Weight of coarse aggregate
IS 10262 table3
Size = 10mm
Zone – II
V = [w + c/sc +1/p x(ca/sac)]x(1/1000)
1-0.02 = [208 + (416/3.15) +1/0.46x (ca/2.574)]x(1/1000)
Ca=757.71042kg/m^3

Step 7: Proportion
Cement: coarse aggregate: water
416:757.7104:20
1:1.82:0.5
Step 8: Adjustment
Coarse aggregate = 1% water absorbs
= 757.7104x1.01
=765.287kg/m^3
Step 9: Final
Cement: coarse aggregate: water
1 : 1.839 : 0.5
(As per the IS code 10262:2009)

4. CUBES AND CYLINDER FORMATION

- Volume of cube = 15x15x15cm
- No of cubes = 7
- Total volume of all cubes = 23265 cubic.cm
- Volume of cylinder = 628 cubic.cm

5. RESULTS

Compressive strength

- 14 days: 15.1mpa
- 28 days: 19.5mpa

6. CONCLUSION

After getting the desire result we have concluded that we can use porous pavement at low traffic volume roads, parking slots, complex road and airport shoulders.

REFERENCES

[1] A.M.Admute. (2017). Permeable Pavements: New Technique For Construction Of road Pavements inIndia. international ResearchJournal of Engineering and Technology (IRJET) , 1810-1814.

[2] Arhin, S. A. (2014). Optimal Mix Designs For Pervious Concrete For an Urban Area. International Journal of Engineering Research & Technology , 42-50.

[3] Brief, T. (2012). Pervious concrete. ACPT , 1-8.

[4] Khan, A. A. (2017). Study on Porous Concrete with Course Aggregate and Fine Aggregate Mix Proportions. International Journal of Engineering Research & Technology(IJERT) , 531-534.

[5] Leedom, J. B. (n.d.). Case Study: Enhanced Porous Concrete Pavement System Creates Advantages For All Stakeholders.

[6] Merighi, J. V. (n.d.). Study of The Concept of Porous concrete For Use On Airport Runways. 44-53.

[7] nama, M. (2016). Research on Permeable Pavement A Case Study of Sitapura Instutional Area Jaipur. International Journal of Engineering Research & Technology , 1-3.

[8] R.M.Karthikeyan. (2017). Experimental Investigation on High Strength Pervious Concrete with Partial Replacement of Corse Aggregate by Marble Aggregate. International journal of ChemTech Research , 42-47.

[9] Rahangdale, S. (2017). STUDY OF PERVIOUS CONCRETE. international ResearchJournal of Engineering and Technology (IRJET) , 2563-2566.

[10] S.Aranvind. (n.d.). CONSTRUCTION OF POROUS ASPHALT PAVEMENT USING GRAPHENE. international Journal of Recent Trends in Engineering & Research , 482- 486.

[11] Shah, D. S. (2013). Pervious Concrete: New Era For Rural Road Pavement. International Journal of Engineering trends and Technology , 3495-3499.

[12] Teware, p. R. (n.d.). Mix Proportion of CementiousMaterial in Pervious Concrete. Journal of Recent Activities in Architectural sciences , 1-12.

[13] Tiwari, P. N. (2017). Design Of Pervious Pavement For The Light Load Bearing Parking. International Journal of Engineering Sciences & Research Technology , 792-795.

[14] X.D.Chen. (n.d.). Environmental Assessment and Economic Analysis of Porous Pavement at Sidewalk.