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Permeable Pavement – Innovative solution for Recharge Groundwater

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ABSTRACT: It is solution for the impervious surface which didn't allow to pass the water through ground surface, which is in infiltrate condition. It should recharge the ground water table which also increase the water storage. The improper drainage system which cause the soil loose its properties, strength and erosion. The dust particles which affects the impervious surface from rain water to produce pollution and harmful for aquatic life. The excess of water stored should be discharged into streams and drainages. The drainages should be design and laid as per standard recommendations. It is used in low traffic areas pedestrian roads, parking areas and cycle path. This helps to recharge water usage and increase the soil properties as well as strength. This paper deals to give effective design method and innovative solution in terms of permeable pavement for ground water replenishment and on the certain experiments conducted. This is application of most efficient and sustainable construction. It is cost effective and better solution in terms of life long achievement. It is easy to repair and less maintenance cost. By using various material in design like cement, sand, soil, stone, gravel, etc.

KEYWORDS: impervious, permeable pavements, drainage, sustainable, economical.

I. INTRODUCTION

Environmental issues on surface water management is minimized by providing layers of pavement surface and outlet discharge in streams or usage in it as a portable water. It is best method for preservation and reuse of storm or rain water by storing underground by making proper drainage system. It is alternative process in approach towards paving surface that capture and temporarily stored pavement surface into the surface underlying stone reservoir by filtering runoff through voids. It is best option for impervious surface convert into pervious surface by providing a layer of it which is help to reduce pollution of water and soil properties. It is used as manual process, where several pavements are allowed to use as permeable pavements. It is used in lower speed and pedestrian areas. It is design as per geotechnical reference take into consideration i.e. soil properties, ground water table, drainage systems etc. As per references and various considerations the sediment-laden soil runoff could clog the system (e.g. near loose material storage areas). The point at which affects designing of permeable pavements take into consideration is when the runoff of flooding, peak flow, ground water or stream velocities and stream bank erosion, increased temperature and reduced water quality. There are types of permeable pavements are porous asphalt, interlocking concrete pavers and plastic grid pavers. To discharge excess rain or storm water by providing perforated pipes can be added near the top of stone reservoir. It could also help when only cleaned washed stones that meets quality of municipal roadway standards should be used to reduce clogging. It is a cost effective and solution for water management system.

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Figure 1. Permeable pavement (upper portion of figure) has large void spaces to allow water to infiltrate, unlike traditional asphalt (lower portion of figure).

II. OBJECTIVES

Factors considered in Permeable Pavements: There are four key elements to the structural design of permeable pavements:

- Total Traffic
- In-Situ Soil Strength
- Environmental Elements
- Actual Layer Design

The first three elements are inputs into the fourth, Layer Design.

A. Total Traffic:

Determining total traffic, or expected vehicle load placed on the pavements, is a five steps process.

- a) Estimate Vehicle Weight
- b) Number of Vehicle passes (Average Daily Traffic)
- c) Converting Vehicle Weight to Established Factor
- d) Decide Design Life
- e) Calculate Total Expected Load

For cases examined for permeable pavements, it can be expected that either only cars and other passenger vehicle would be used or, for the case of a fire lane vehicle, such as a fire truck would use the pavement occasionally. It should be noted as Design Weight, DW.

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B. In-Situ Soil Strength:

In-Situ soil strength varies by soil type. Fortunately, soil that are highly permeable (such as sands, loamy sands and sandy loams) also have the best bearing capacity (ability to carry loads).

There are three step process:

- Determine soil type
- Estimate Base Strength
- Convert to Soil Support Value

C. Environmental Factors:

There are two environmental dependant variables that influence pavement design.

- The amount and frequency of rainfall, and
- The ability of the underlying soil to infiltrate water

D. Determining Layer Thickness:

To determining layer thickness, the total strength of the pavement must be calculated.

This strength is called the Structural Number. The structural number must be matched or exceeded by the strength of the pavement. The strength of the pavement is determined by materials used (such as concrete block, plastic grid, sand and stone) and the thickness of each layer.

There are two steps:

- Determining Necessary Strength (Structural Number)
- Setting Layer Thickness so that Structural Number is Met or Exceeded.

III. CONCLUSION

Permeable pavements can be a major contributor to the effective management of stormwater. They provide the opportunity of transforming a traditional source of stormwater runoff into a best management practice for capturing, storing and infiltrating stormwater into the natural surroundings. Benefits achieved include reduced stormwater discharges as well improvements to water quality including reduced suspended solids and reduction of chemical contaminants. While they can be an effective tool, their design and construction should carefully consider structural and hydrological concerns to ensure that they provide cost-effective solutions over their design life.

REFERENCES

- [1] A.M. Admure, A.V.Gandhi et.al, "Permeable Pavements: New Technique for Construction of Road Pavements in India", IRJET, Vol 4, (2017).
- [2] David whiting, Adrain Card, "Estimating Soil Texture", Colorado State University, Dec 2011.
- [3] Ruben A. Garcia-Gaines and Susan Frankenstein, "USCS and USDA Soil Classification System", US Army Corps of Engineer, March 2015.
- [4] Carmen T. Agouridis, Jonathan A. Villines, and Joe D. Luck "Permeable Pavement for stormwater management", (UK) University of Kentucky College of Agriculture, AEN-108.
- [5] Urban Drainage and Flood Control District, "Permeable pavement System", Urban Storm Drainage Criteria manual, Volume 3, March 2018.
- [6] Yail J. Kim, Adel Gaddafi, Isamu Yoshitake, "Permeable concrete mixed with various admixtures", Materials & Design, Vol. 100, pp 110- 119, 2016.
- [7] Pankaj R. Teware, Shrikant M. Harle, "Mix proportion of cementitious material in pervious concrete", Journal of Recent Activities in Architectural Sciences, Vol. 1, pp 1-13, 2016.
- [8] Alalea Kia, Hong S. Wong, Christopher R. Cheeseman, "Clogging in permeable concrete: A review", Journal of Environmental Management, Vol. 193, pp 221-233, 2017.
- [9] Kharat P. V. and Shetkar, R.V. "Evaluation of Evaporation Models Using Climate Based Models", International Journal of Civil Engineering and Technology, Vol.7, Issue 4, 2016, pp 111-120.