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A REVIEW ON STORM WATER MANAGEMENT IN CHANDIGARH

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Abstract - *Storm water management includes the control of storm water i.e. runoff from rainfall. Due to increase in construction activities, the pervious surface is decreasing day by day and it prevents the runoff to infiltrate into soil. The surface water runoff carries many of the sediments, pollutants, bacteria, pesticides, metals and petroleum by-products by the medium of manmade drains into the natural water streams by which the drains getting flooded and harm the infrastructure. Pervious concrete pavement design is to be suggested for light traffic areas and parking lots for some sectors of Chandigarh but still the surface runoff is not manageable because it will reduce only 15.30%(maximum) of runoff from the area not more than that. Excessive runoff is an area of concern because the drains are not designed to remove sudden downpours more than what is limited by their design; this all is the major cause of flooding in the area. The solution for this problem is to decrease the time taken by runoff to reach the drain inlets, by on-site absorption of the rainwater employing the use of pervious interlocking tiles laid down over the roadside drain channel that carries water to the drain entrance. This can substantially reduce the overload on the drains and can recharge the groundwater whereas will also benefit by increasing the life of the infrastructure by reducing the flooding on the roads. This method can be economic and will be found out it the research further because it does not needs replacement of the overall paved area.*

***Keywords*: storm water management, pervious pavement, flooding.**

I. INTRODUCTION

Storm water is the flow of water that occurs when excess storm water, melt water, or other sources flows over the earth's surface. This might occurs because soil is saturated to full capacity, because rain arrives more quickly than soil can absorb it or the impervious surface is increasing and it prevents the runoff to infiltrate into soil that cause flooding in the area.

As per the design, Chandigarh had only 30 sectors which were later expanded up to 56 sectors with this expansion a city called S.A.S Nagar Mohali in the southern foots was developed which continued to lay down sectors from 56 onwards. This expansion of urban areas is the reason why the drains are not sufficient enough to handle the quantity of precipitation falling onto the surface. This all drew in more imperious cover on the land which resulted less in absorption and more in runoff. Even the road adjoining soil cover is also replaced by the impervious cycle tracks which might increase the runoff. Storm water management is to manage the storm water or surface runoff by collecting the runoff at the same time it reaches the earth's surface or drains so that it infiltrates into the soil directly and helps in recharging the ground water that can only be done by providing interlocking pervious tiles and by keeping the drains clean from silting and garbage. Also the cycle tracks can be laid on permeable pavement this could be an alternative to manage storm water.

2. LITERATURE REVIEW

Alsubih et al. (2016) investigated the hydrological properties and performance of the permeable pavement by conducting a series of experiments on a 1:1 scale prototype apparatus whose dimensions were 1m x 1m x 1.6m with one side transparent to allow visibility into the apparatus. The ratio of inflow and discharge volume was measured conforming that there was no surface runoff in any case. It was found that 40% of total rainfall from the entire rain event tested was stored in the structure with average outflow duration of 0.86 to 7.43 hours under all the tested conditions.

Antunes et al. (2018) studied the life cycle assessment of the permeable pavements where the homogeneity and heterogeneity of the various processes and factor involved in the study were carefully monitored and reviewed. The LCA life cycle assessment guide was considered essential to provide better decision making as permeable pavements studies still have many immature concepts which can mislead the designers. The study pictured that there despite having a lot if information on the topic there is still a significant heterogeneity in untis, limits and processes related to permeable pavement and green infrastructures.

Brattebo & Booth (2003) conducted series of experiments to find which one is more superior amongst traditional pavement or permeable pavement on the basis of its characteristics hydrological above impervious pavement. The experiments were conducted on 4 available parking systems where the structural impacts and durability, with its capacity to infiltrate water and the quality of infiltrated water was studied for 6 years with no specific surface runoff, it was found that more than 85% had motor oil from asphalt runoff but not a trace in any sample of the infiltrated water from the permeable pavement. It was also found that all samples had lower lead concentration as compared to zinc found. The study concluded that this type of pavement system does not have uniform performance and its performance depends upon site and soil conditions. Even the financial conditions play a major role in its consideration.

Damodaram et al. (2010) explained that increase in storm water runoff volume and flooding in the area is because of urbanization. They tried best management practices and low impact development options to control storm water runoff at the source like rain water harvesting, green roofs, permeable pavement and rainfall events has been checked to reduce the amount of runoff in the area to obtain sustainable objectives. They applied the LID's options in parking lots, watersheds so that they get the best out of it. By which they are able to reduce the storm water runoff in that particular area.

Freni et al. (2010) Involves the analysis to compare the mitigation techniques so that the pollutant from runoff can be reduced by comparing different water quality mitigation plan in order to reduce the amount of polluted discharge. The study was based on the homemade model conforming to previous studies where combined sewer systems and infiltration trenches and other ancillary structures were stimulated to determine the quantity and quality of the discharge. The overall model was stimulated to reduce the infiltration in structure by volume and to reduce the clogging using different mitigation techniques like BMP'S, LID's and SUDS.

Gavric et al. (2019) Explained the utilization of GF&GFS (Grass swales & Grass filter strips) in improving the hydraulics and hydrology of storm water runoff. Urban grass soil systems are strong interest between impervious surfaces by removing pollutant immobilization by infiltration and by runoff. The methods adopted are lab field and mathematical modeling with secondary examining to study agricultural runoff, pollutant uptake for various plants. Flow studies with respect to transported solids, chemicals and bacteria is synthesized is calculated by strokes law and other mathematical expressions. Results of the empirical studies on GF&GFS amplified various factors of quality parameters and detailed the focus mostly on settling biological and chemical particles by adsorption or absorption. The observations of other pollutants other than solids is limited and not quantified to feed developing a dynamic model.

Gilbert & Clausen (2006) compared the runoff on the behalf of the quality and quantity of the storm water runoff from the models which were made to replicate entirely the behavior of asphalt, paver stone and crushed stone driveway. The runoff samples were weekly taken as flow-weighted composite samples to find the concentration of TSS- total suspended solids, metals and oil infiltrated on driveway. By analyzing the samples it was clearly understood that the runoff was decreasing from asphalt having the most, then pavers and crushed stone having the least in same order. It was also see that the average infiltration rates were 0, 11.2, 9.0 cm/hr respectively. In the longer duration of the same study it was found that the infiltration rates from the paver and the crushed stone substantially decreased due to the clogging of pores from the fine particles whereas the asphalt had no changes in the infiltration rates,

Gogate et al. (2015) The research involved, during 1900 the only option for storm water management was to remove it. They studied the constraints and problem of storm water in urbanized cities of India. They found the major issue is urban expansion coupled with climate change. By studying and analyzing the problem they improved the shortcomings in the existed plan of area. Best management practices came in the study to fulfill the aim of the researcher.

Illigen (2008) illustrated physical phenomenon and modeling of pavements systematically evaluated by field measurements, lab scale experiments and application of HYDRUS-2D to compute infiltration performance. The database lead to identify boundary conditions and major constraints such as rain intensity, rain duration, grade of clogging and base layer characteristics in four different types of pavements at the centre and at the tyre track which resulted in developing advanced bi-directional layer model, recommendation for common planning tasks and Monograms of recommended runoff coefficients for pavement types.

Singh et al. (2018) proposed a method to decrease the surface runoff by providing permeable pavement in various areas such as driveways, parking lots etc. in the city of Chandigarh. The design of pervious concrete pavements depends upon the infiltration capacity and the native soil properties. Capacity of storing showers was more than 42.16% and it was observed

that there was subsequent decrease in the runoff by 7.54% to 15.30%. impacts such as decreased groundwater recharge, concentration of flow on adjacent properties and damage to transportation and utility infrastructure was consider to develop a method for potential effectiveness of sustainable urban drainage system (SuDS). This method of storm water management is designed to deal with runoff at the source.

3. METHODOLOGY

Step 1: Description and study of the site.

1.1 Landscape characteristics and assessment

Step 2: Developing a plan based upon the BMP (best management practices)

Step 3: Physical Analysis

3.1 Field measurements

3.2 Drainage network representation and scale

3.3 Hydrological analysis

3.4 Calculating runoff generation

3.5 Flow quantity

3.6 Flow quality

Step 4: Framework and design for permeable interlocking tiles

Step 5: Monitoring and collection of data

5.1 Data collection

Step 6: Analyses and representation of data in table and graphics

Step 7: Experimentation

Step 8: Results in optimization of the model

4. CONCLUSIONS

According to the literature review, the use of pervious pavements can potentially decrease the surface runoff and can improve the problem of storm water logging in the urban areas. The permeable pavements have various distinct affects on the quality and quantity of the stored storm water and it depends upon various factors such as soil profile, gradient, type of permeable pavement chosen etc. Hence the utilization of a improved version of permeable pavement tiles can diminish the challenges faced by the conventional permeable pavement and concrete.

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