STORM WATER DRAINAGE EFFECTIVE DESIGN AND USAGE

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Abstract : Storm water drains during rainy season and storms due to heavy down pour get undated leading to water logging and flooding. This is a common problem seen in urban areas. Narrow drains, desilting , illegal acquiring of areas related to the drains add to unmanageable situations.

Infiltration galleries in these areas of excessive water or in region of flooded area can add to the solution of the problem. The water through these infiltration galleries can be stored and can be out to use for various purposes. This diversion minimize the water logging in downstream side . If this concept being introduced under SWD, sole burden on such SWD will be drastically deduced. SWD cum infiltration galleries perform on dual mode can be used to handle instant heavy rain water.

IndexTerms: **Strom water, Slot/Screen pipes, woven Geotextiles.**

I. INTRODUCTION

Water logging is the major issue during monsoon season in urban India. Roads are blocked leading to traffic jams, pedestrians have to wade through flooded streets , urban poor living in slums or quarters have their home often damaged by water and also the water becomes polluted when it mixes with the garbage and waste i.e. littered everywhere and apart front disrupting traffic it also becomes a risk to health. Road drainage design has its basic objective as the reduction & elimination of energy generated by flowing water, therefore water must not be allowed to develop in sufficient volume or velocity so as to cause excessive wear along ditches, below the culvert or along exposed running surfaces.Presence of excess water or moisture within the roadway will adversely affect the engineering properties of the materials with which it was constructed.

Spray from rainwater being thrown up by car tires can reduce visibility which can lead to delays in reacting to events on thecarriageway. Drag on car tires from local rainwater ponding can alter the balance of vehicles travelling at speed which can be alarming or cause skidding. It is incompressible therefore standing water effectively acts as jackhammer on the wearing course right through to the sub-base when vehicles pass over head. In extreme storms, rainwater can simply wash away roads.

Surface Drainage System is the removal of water that collects on the land and surface. Provision must be made for removal of water, from rain or melting snow, or both that falls directly on a road or comes from the adjacent terrain.

The channels should be located and shaped to minimize the potential for traffic hazards and accommodate the anticipated storm-water flows. Drainage inlets should be provided as needed to prevent ponding and limit the spread of water into traffic lanes.

Use of slotted pipes in a drainage system with a perforated pipe at the base is one of the solutions to the problem. Runoff flows slowly through the granular material, trapping sediments& providing attenuation.

II. MATERIALS

Coarse aggregates: The Aggregates used in the slotted pipe installation passed through 16mm & retained on 12mm sieve this aggregate medium act as previous concrete, which allows the water to percolate easily & enters the pipe.

Gravel: is extremely effective filter media because of its ability to hold back precipitates containing impurities. The primary role of the gravel is to prevent clogging of the PVC Pipes with sand.

Effective sizes	1/8'' to 2 ½"
Uniform coefficient	1.2 to 1.7
Specific gravity	2.7
Moh's hardness	6
Density	100lbs per cubic foot

Table 1: Properties of materials to be used

Table 1

Slotted or screen pipes: used for casing in ground water section to allow water to enter the ground. These pipes are also used to provide soak ways for storm water or rain water to infiltrate back into surrounding ground.

These percolation pipes also used in roof top water harvesting in the form of percolation pit to recharge the ground water.

Slotted pipes also used for controlling and reducing volumes of discharge into existing main sewer systems and water courses.

Size	No of rows	Slot width	Distance b/w slot	Slot width	Distance b/w slot	Slot length
35	3	0.5	6	1.5	9.5	25
40	3	0.5	6	1.5	9.5	28
50	3	0.5	6	1.5	9.5	36
80	3	0.5	6	1.5	9.5	56
100	5	0.5	6	1.5	9.5	43
115	5	0.5	5.5	1.5	8.5	48
125	5	0.5	5.5	1.5	8.5	48
150	5	0.5	5.5	1.5	8.5	57

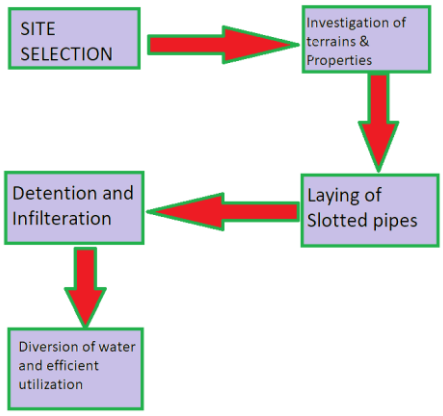
175	5	0.5	5.5	1.5	8.5	56
200	6	0.5	5.5	1.5	8.5	65

Table 2 : Dimension details of screen/Slot of casing pipes confirming IS12818:1992

Geotextile

These are permeable fabrics which used in association with soil, have ability to separate filter reinforce, protect or drain.
One of the most popular option for drainage filtration stabilization is the nonwoven geotextile fabric.
These are used in ditches, round pipes, underneath drain or in other areas dealing with high levels of sub surface drainage or site run off.
It is a planar, permeable, polymeric textile material, which may be woven or nonwoven. Geo textile used in slotted pipes for infiltration process by 10 hr/day having durability of about 10 years or more

III. METHODOLOGY



Site selection:In urban cities there may be potential water logging zones. Water logging generally takes place due to terrain properties i.e in down-stream sites. GIS mapping should be enabled for Such potential water logging zones to be selected.
Investigation of terrain properties to determine the terrain conditions of the water logging site, gradient, direction of flow of run-off water possibility to deviate water for effective utilization.
Laying of slotted pipes
After proper inspection & investigation of its terrain properties laying of slotted pipes is carried out in primary drains. Initially 4" aggregate bed will be laid before pipes are installed ,once the pipes are installed longitudinally in the primary drains over & above again a 4" thick aggregate layer shall be provided. Aggregate medium in a macro level to prevent the waste entering the circumference of the slotted pipes.
Geo-textile cloth will be wrapped all round to prevent the micro sand particles entering or getting settled in the slots of the pipes. On top of the aggregate layer, a gunny bag cloth layer is laid for preventing macro plastics or leaves etc. which is very economical and avoids this process getting inundated very soon.

IV. DURABILITY

Slotted pipe is a very durable material requiring a little maintenance. These pipes are highly durable with a fifty year life under severe loading conditions. If water percolation is slow then the aggregate layer is removed & replaced with new aggregates.
PVC Pipe its offers resistance to conventional corrosion &
abrasion & it shows better result compared to the reinforced concrete pipes in laboratory testing
These pipes are highly durable of 50 years life under severe loading conditions. PVC pipes shows better performance than HDPE drainage pipe,& are more susceptible to UV radiation

Quality control

Visual checks may be done before installation where to assess form, resistance, sizes regularity & quantity of perforation & brittleness
If a proper factory test has been carried out on the pipes, the quality control during the installation process can be confined by checking weather the pipes

- Have been produced, transported & stored according to the norms & contract specifications
- Have been produced longer than 3 months before delivery
- have been stored in the shade & have not been damaged during transport.

Quality control can be active or passive

Active : the inspectors carry out regular quality checks at all points of the installation process.
Passive: the passive system is least complicated, provided that contractors have the adequate motivation & capacity to carry out the work.

V.RESULTS

During an experiment found the difference between the rate of flow of tap water as well as water containing macro material such as leaves, plastics, papers, sand particles, mud particles & other waste materials through this model was found very less

- Rate of flow of tap water =0.098l/s
- Rate of flow of water containing macro materials 5%=0.086l/s

- Rate of flow of water containing macro materials 10%=0.083l/s
- Rate of flow of water macro materials 55%=0.080l/s

VI. DISCUSSION

- This technology can remove the water logging from many urban areas if installed in various areas prone to water logging during monsoon season
- Using slotted pipes for detention & infiltration can effectively resist the large undesirable materials such as garbage etc from entraining the drain & thus making the flow of rain water smooth ,a rapid clearance of rain water from the pavement surface.
- this technology can also help in a better maintenance of the rain water as it can be diverted or stored for better use such for irrigation of nearby gardens or farms, sending to nearby water plants etc.
- lots of money can be then saved which is being utilized for the reconstruction, maintenance of pavements subjected to water logging.
- This method is also very economical as it doesn't require installation of any highly expensive materials.

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