

Flood Management & Rainwater Harvesting on Road

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Abstract - Soil surface in urban areas becomes covered by impervious materials, such as asphalt and concrete, the natural water cycle is disrupted due to rapid urbanization. When landscape architects finish landscaping wetlands, they can no longer allow water to seep into the soil. This causes surface runoff, flooding in urban areas, traffic disturbances, and low groundwater levels. The current project about flood control includes system and roadside rain water harvesting. The rainwater is collected and filtered through drain and sand filter mechanisms and is stored in a tank. The experiment was carried out to analyze the flow rate, filtration efficiency and backwash performance. It can be concluded from the results that the model is useful for surface runoff, groundwater recharge and sustainable stormwater management in urban areas.

Key Words:Urban Flood Control, Rainwater Harvesting, Surface Runoff, Sand Filtration, Groundwater Recharge, Stormwater Management.

1.INTRODUCTION

Cities are growing fast, and with them, we're seeing way more roads, buildings, and concrete everywhere. It's good for getting around, but it's messing with the environment big time. One of the biggest problems? Flooding when it rains hard.

Rain used to soak into the ground naturally, thanks to open spaces and plants. But now, with all the concrete and blacktop, the water can't get through. Instead, it just rushes over the roads, causing:

- Flooded streets
- Traffic jams and crashes
- Damaged roads and stuff
- Less water going back into the ground
- More chances of flooding

The thing is, a lot of cities don't have enough water because the groundwater is drying up. So, we're dealing with too much rainwater causing floods, but also losing water that we could actually use.

2. METHODOLOGY

This project tackled road waterlogging and put rainwater to good use with a simple plan. First, we checked out the site to see where water pools during rain, looking at the road's slope and any drain problems that already exist. After that, we made a shoulder filter drain with layers of : a G1 grid on top, then sand and gravel, with a perforated pipe. The road's shape directs rainwater into this setup, where it goes through the layers and gets filtered naturally. Then, it's sent to recharge pits or for storage. This gets rid of extra water and helps save water and raise groundwater levels with a solution that's easy, cheap, and good for the environment.

2.1. Need for the project.

We need to start managing stormwater in a smart way, not just let it run off. If we grab rainwater from roads, clean it, and carry it away, we can fix two things at once:

1. Stop floods
2. Save water

This project is all about building a rainwater harvesting system on the side of the road that collects and filters the water.

2.2. Objective of study.

The point of this project is to grab rainwater from roads to stop floods in the city. We want to create a drain system that gets rid of extra water and cleans it with a sand filter. This should also help raise the water levels underground through natural soaking. We're checking how the water flows, how well the filter works, and adding a way to backwash and clean dirty filters to keep it all running smoothly. This system is designed to be cheap, good for the environment, simple to keep up, and able to work in actual cities.

2.3. Scope of the project.

This project's all about making a simple system to deal with rainwater on roads and actually put it to good use. Instead of just letting it run off, we're turning regular roadside drains into rainwater collectors and filters.

The system grabs rainwater, filters it with sand to get rid of the junk, and then distributes it as per need . Plus, it's got a way to clean the filter so it keeps working well.

The point is to make something cheap and easy that can be used in cities or smaller towns without needing fancy stuff. If we use this, roads can help handle water better, stop flooding, and save water, too. It could work great in smart cities, on highways, in neighborhoods, and anywhere that floods a lot.

2.4. Materials Properties.

1. Properties of Galvanized Steel

Galvanized steel is just steel with a zinc coating, which stops it from rusting. This coating really helps since the steel is out in the weather all the time. It's strong, lasts a while, and you don't have to do much to keep it up. That's why it's good for things like covers, grates, and holding stuff up.



Galvanized Steel

2. Properties of Sand Filter

Sand filters are key to cleaning water in this system. Fine sand catches dirt and small bits of stuff as water goes through. Sand is cheap and easy to find, which makes it a good way to filter rainwater. Plus, you can easily clean or swap it out when needed.



Sands

3. Properties of Gravel

Gravel's great for filtration systems because water goes right through it while still holding up the stuff above. The gaps in the gravel help water drain well and stop the finer sand from washing away. Plus, it's tough, doesn't mess with the water, and lasts a long while without breaking down, so you can depend on it.



Gravels

4. Properties of Top Side Perforated Pipe

So, a perforated pipe is a pipe with tiny holes along it. It lets water get in the pipe easily. These pipes are usually light and don't rust or break easily. Because of this, they are good to bury without needing constant repairs.



Perforated Pipe

Layer	Thickness	Size
Road surface / shoulder top	As per design	Depends On Road Length
Top GI Grid	10-20	Depends On Road Length
Sand Filter	100	1.70mm and above
Gravel Layer	150-200	12.5mm and above
Perforated Pipe	100-150 dia	Depend On Discharge



Model

2.5. Overview of test conducted.

To evaluate the performance of the filtration and drainage system, three important tests were conducted:

- 1.Flow Test
- 2.Filtration Test
- 3.Residual Chlorine Test (Water Quality Check)
- 4.Backwashing Test

1.Flow Test

We did a flow test to see how fast water moves through the filter system. Keeping the water flowing right is key for roadside drainage.

If the water flow is too slow, things get soggy, and the filter gets blocked. If it goes too fast, the filter doesn't do its job well since the gunk doesn't have time to settle.

Observation result of flow test.

Parameter	Observation
Initial 1 Litre Flow	22 SEC 03 MS



Flow Test

2..Filtration Test

We did a filtration test to see how well the sand and gravel layers filter out stuff from water. We also looked at how easy it is to clean and reuse the system.

This test checked:

- How good sand is at catching tiny bits of junk
- If the gravel helps with filtering and holding water
- How much work the system needs to keep it running



Filtration Test

3. Residual Chlorine Test (Water Quality Check)

We did a residual chlorine test to see how good the water was before and after we filtered it. We were looking at:

- Whether there were gross things floating around
- How much stuff the water could react with chemically
- How well the cleaning process worked

Observation result of Residual Chlorine Test

Sample	Residual Chlorine
Turbid Water	1 PPM
Filtered Water	0.1 PPM



Residual Chlorine Test

4. Backwashing Test.

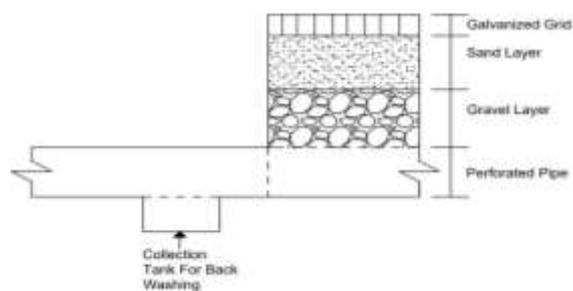
Backwashing cleans the filter by reversing the water flow, washing away the dirt, so everything runs well again.

Observation result of backwashing test.

Parameter	Value
Backwashing water required	2.9 Litres
Water Remaining After Backwashing	1.3 Litres
Time Required For Backwashing	15 Seconds



Backwashing Test



Cross-Sectional of Drain

3. CONCLUSIONS

The Sand Filter Drain System is a great way to handle rainwater runoff from roads. It collects and filters the water and helps refill groundwater supplies, which is good for the environment. The system keeps water flow under control, lowers the chance of flooding, and filters water well.

Testing shows the design does its job when things are normal. It's easy to build and doesn't take a lot to keep it running. Plus, it's cheap, so it could easily be used in big city road projects.

All in all, the Sand Filter Drain System is a good, green idea for today's drainage designs. It makes roads safer and manages water better.

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