A THOROUGH INVESTIGATION AND DESIGN APPROACH FOR DRAINAGE AT DIU PREMISES

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A Thesis submitted to Daffodil International University's Department of Civil Engineering in Partial Fulfillment of the Requirements for the Degree Issuance of a **Bachelor of Science in Civil Engineering**

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CERTIFICATION

This is to certify that this project and thesis entitled **"A thorough investigation and design approach for drainage at DIU premises."** was done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Civil Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Civil Engineering. The presentation of the work was held in June 2024.

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ABSTRACT

The currently installed roadside drainage system does not regulate the quality of runoff; it only attempts to restrict its quantity. Rainwater and objects from the road surface contain hazardous elements. Two potential drainage structures are infiltration trenches, which appear on both the left and right sides of the road. The existing drainage channel on the road may be modified to produce it. Providing a road drainage design model based on the notion of a sustainable urban drainage system is the aim of this work. The bottom of the rectangular channel was completed with several holes to promote porosity. The purpose of the aggregate-filled canal was to filter runoff from the roads before it reached the reservoir below. The water is then let go into the infiltration well. Data on rainfall and other physical features from the DIU smart city's Civil to EEE department were used to construct the model. Based on runoff volume, the aggregate filter's depth and channel's dimensions were constructed. Rainfall, runoff volume, area ratio, and drainage dimension are shown to be related. When the amount and quality of precipitation are taken into consideration, the notion of sustainable road drainage is achieved.

Keywords: Road drainage system, Runoff management, Hazardous materials, Infiltration trenches, Retrofitting, Porous bottom, Aggregate-filled canal, Reservoir, Infiltration well, DIU smart city, Rainfall data, Physical features, Runoff volume, Area ratio, Drainage dimension, Sustainable Road drainage, Water quality, Precipitation management, Environmental sustainability.

CHAPTER 1 INTRODUCTION

1.1General

The goal of this project, carried out by Daffodil International University's Civil Engineering Department, is to develop and execute an effective roadside drainage system between the Departments of Civil and EEE. To preserve the structural integrity of road surfaces and provide safe driving conditions, the major objective is to manage and minimize concerns linked to waterlogging and erosion.

1.1.1 About Drainage

The process of intercepting and removing water from beneath and above the area around the road surface is known as drainage. Drainage is the act of collecting and eliminating water from both below and above the region around the road surface. Transporting water across a road's surface and into drainage ditches is known as surface drainage; subsurface drainage involves moving water beneath the pavement construction. When designing and building new roads, surface and subsurface drainage has a significant impact on the roadways' structural integrity, user safety, and quality of life. The purpose of the road drainage system is to efficiently collect and redirect all of the water that collects around the road. To shield the road from damage caused by surface and subsurface water, drainage systems are necessary. A pavement's lifespan and structural integrity may also be jeopardized by inadequate drainage. To properly transport this water, drainage systems include a variety of natural and artificial features, including ditches, pipelines, culverts, and curbs.

1.1.2 Types of Drainage

Surface Drainage:

The first step in managing water accumulation on a road's surface is surface drainage. There are channels, ditches, and slopes designed to deflect water away from the road. It is safer to drive when there is proper surface drainage since it reduces the possibility of hydroplaning, puddles, and waterlogging.

Subsurface Drainage:

Water that goes through below the surface of the road and gathers in the base or sub-base layers is addressed by subsurface drainage. A system of perforated pipes, drains, and other devices is usually used in order to capture and redirect groundwater away from the road foundation. Preserving the road's structural integrity lowers the possibility of pavement collapse or deformation.

1.2 Importance of Drainage

- **Structural Integrity**: Maintaining the strength and stability of road infrastructure depends on proper drainage. A buildup of water can cause erosion, which weakens the roadbed and results in potholes, fractures, and other structural problems.
- **Safety**: Water can pool on roadways due to poor drainage, creating hazardous driving situations including hydroplaning and decreased traction. The chance of accidents is decreased by efficient drainage.

  Durability: Well-drained roads last longer since water doesn't cause early damage and repairs aren't needed as frequently.

  Maintenance Costs: By reducing water-induced damage, effective drainage systems contribute to a reduction in long-term maintenance costs.

1.3 Components of Drainage Systems

- **Channels and Ditch**: These are open systems intended to gather surface water and divert it away from roadways. Usually, they are found at low locations or beside roadways.

- **Culverts:** These are the buildings that let water flow beneath railroads and roadways. They are necessary to keep roads connected and to stop water accumulation that might weaken the foundations of roads.

- **Curbs and Gutters**: Raised borders on roadways assist in collecting water by guiding it into gutters, which subsequently send the water to specified drainage locations.

- **Manholes and storm drains**: These are made to gather surface runoff and channel it into the drainage system. Manholes offer access for upkeep and examination.

1.4 Considerations for Effective Drainage

- **Appropriate Design and Planning**: Careful planning and design are necessary for efficient drainage systems. When building drainage systems, engineers have to take into account things like topography, soil type, climate, and road traffic.

- **Regular Maintenance**: Inspection and maintenance are necessary regularly to guarantee the efficacy of drainage systems. This includes clearing debris from culverts, cleaning ditches, and making sure storm drains are operating properly.

1.5 Objectives of the Study:

The following goals might be included in the research if its main focus is evaluating and creating a drainage system for Daffodil International University's Road between the Electrical and Electronics Engineering (EEE) department and Civil departments:

1. Calculate the amount of surface runoff from precipitation data.
2. Asses available options gathered on similar drainage systems.
3. To design roadside drains considering historical precipitation data.
4. To provide necessary detailing for construction.

1.6 Outline of Thesis

In our thesis paper, the first chapter is the introduction. In this introduction chapter we described why our thesis is important and why we have selected this topic. The second chapter of this book is about project site details there we are discussing our project and its place, diagram & visual elements in the site. The name of chapter three is a literature review. We researched several thesis papers that were relevant to our thesis topic, and we have summarized those thesis papers here. The introduction and literature review are these. An extensive literature study is essential fora thesis paper. The methodology used for the study is covered in our fourth chapter. This chapter includes the introduction, sample and survey, and methods. Here, we spoke about how we went about gathering data, how we analyzed it, what tools we utilized, etc. The fifth chapter is titled "Analysis and Results." The model of drainage design and its problem is followed by the introduction, analysis, and analysis techniques. Here, wediscussed both the steps involved in data analysis and the results. Finally, we developeda model of drain in roadside area between two departments of Daffodil International University. Our number sixth and last chapter is the conclusion and recommendation. We described here our thesis conclusion and recommendation for future study.

CHAPTER 2 PROJECT DETAILS

2.1.Introduction

The project's goal at Daffodil International University is to build an efficient roadside drainage system connecting the EEE and Civil departments. The effort uses cutting-edge technical methods and sustainable materials to lessen erosion, decrease waterlogging, and improve road safety. A thorough study of rainfall data, field surveys, and applying environmental, structural, and civil engineering concepts are important tasks that guarantee the drainage system's longevity and effectiveness. This project will act as a standard for further campus infrastructure upgrades.

2.2.Location Details

Google map navigation: 23°52'54.7"N 90°19'15.6"E

Daffodil Smart City, Birulia 1216, (Changa Village), Ashulia, Saver, Dhaka. [Figure 1]

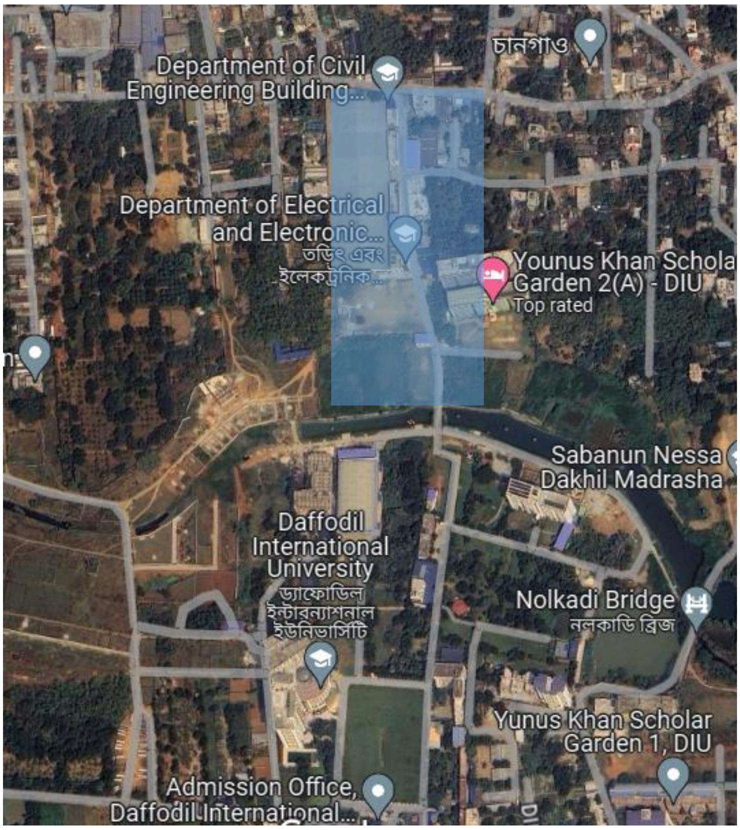


Figure 1 Total DIU smart city location.

Our project is being carried out at a 180-meter distance from the Civil Engineering Department to the EEE Engineering Department. To link departments inside Daffodil International University, a road passed across the campus. We may observe those road areas and drainage areas in [Figure 2] & [Figure 3]

Figure 2 Project area drainage path

Figure 3 Marked surface drainage area

2.3.Project Site Characteristics:

Every building, apartment, and other structure that we are viewing on our site is labeled and visible to others. Ones in [Figure 4] have been shown as measurements of those in [Figure 5]

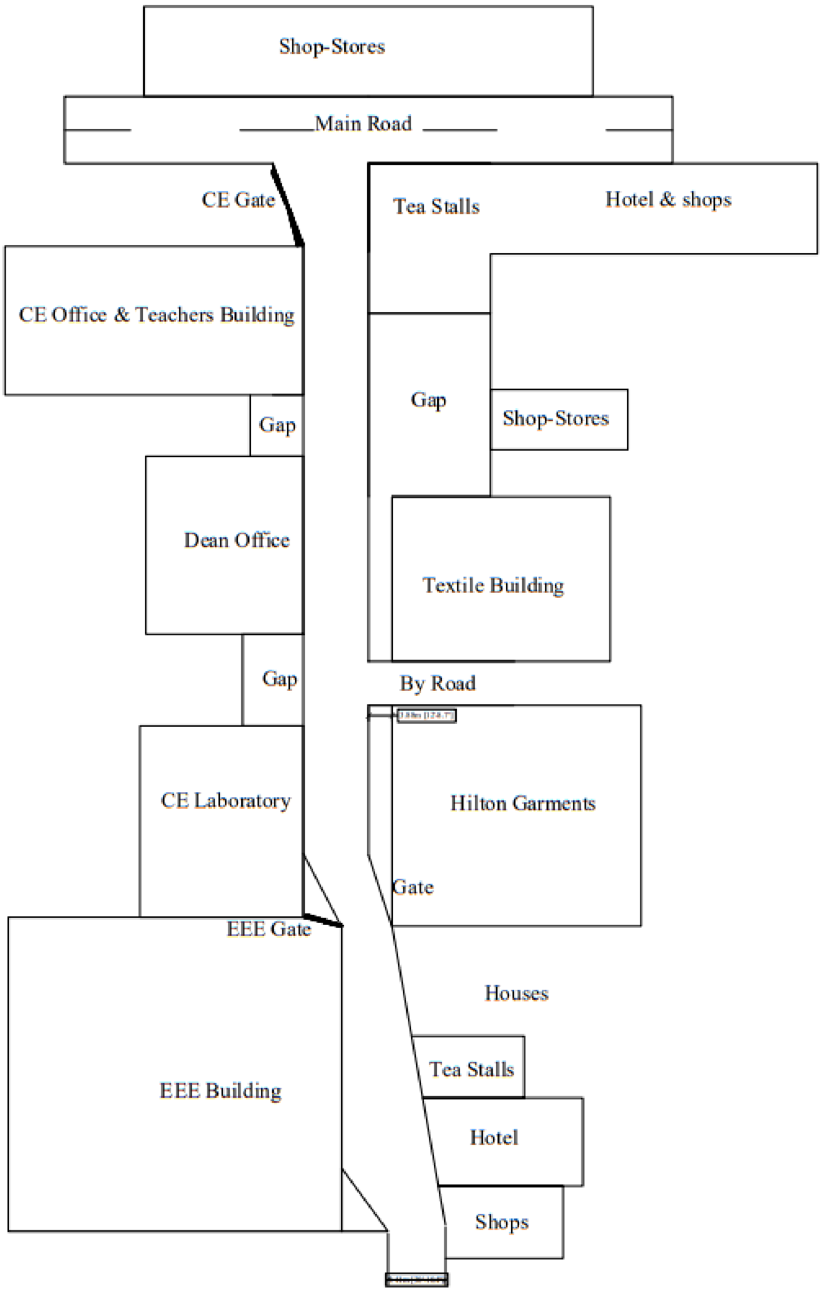


Figure 4 Project visual fixed elements name & Details

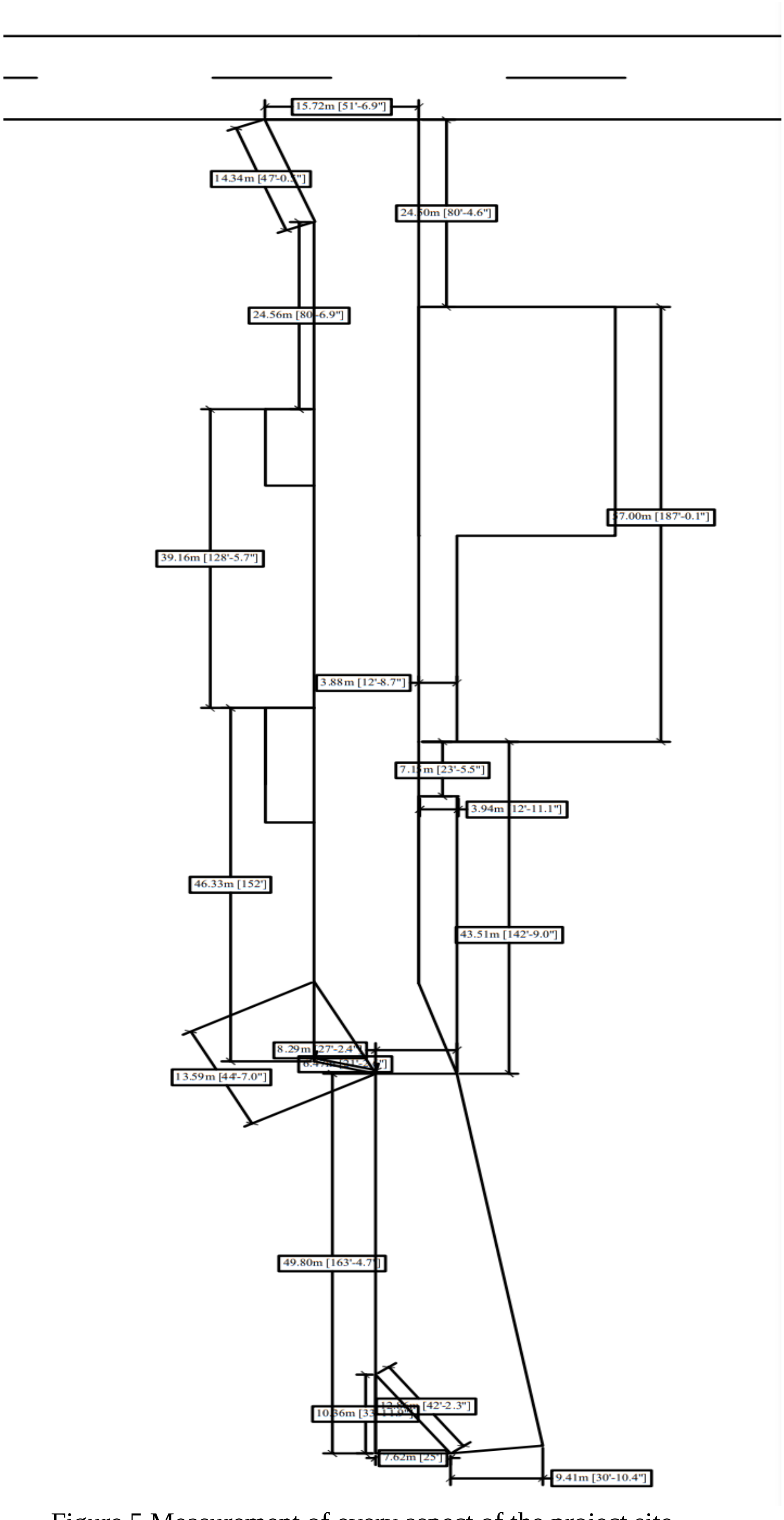


Figure 5 Measurement of every aspect of the project site.

CHAPTER 3 LITERATURE REVIEW

3.1.Introduction

A review of the literature analyses and summarizes the state of the area as it stands without contributing any new knowledge. Because they are predicated on existing data, they said the researchers even initiated the study issue. The assessment of the literature makes recommendations for the effective direction of future research. The significance of a literature review in a scientific publication can be reduced to an analytical feature that allows for its flexible application. It improves the research's legitimacy in several ways.

- Thus, highlighting the contradictions between various perspectives within the problem, it establishes facts.
- When displaying their increased knowledge, it helps gauge the effect of new information on the subject.
- Indicates where research is now in the field's schema.
- It serves as a foundation for further research as it not only illustrates the continuity of knowledge but also identifies areas that need greater examination.
- Cutting the study subject may be achieved by evaluating, summarizing, and synthesizing the important ideas in the author's own words.
- Gives the audience the chance to appropriately credit fact-checking and fact-finding in scientific papers.

3.2.Literature Review

For at least fifty years, academics and pavement designers have given the issue of draining surplus water from beneath roadway pavements a great deal of attention. The Federal Highway Administration (FHWA) released one of the first sets of design guidelines for subsurface drainage for roads in the early 1950s. Many attempts have been made since then to create subsurface drainage for highways, and new materials and products for drainage have been accessible to designers and contractors so they may include subsurface drainage into roadway systems (Canelon and Nieber, 2009). To achieve proper drainage, drains (also known as ditches) alongside the road are essential to collect water from the road surface and surrounding areas and lead it to an exit point where it can be safely discharged, according to Cedergreen et al.'s (1972) evaluation of field tests involving both drained and undrained pavement sections. Drainage is a crucial component of pavement design, according to the AASHTO Guide for Design of Pavement Structures (1986). Some of the techniques for drainage include free draining bases, French drains, pipe and aggregate sub drains, and most recently, prefabricated "composite" edge drains. The economic impact of subsurface drainage systems was addressed by Forsyth (1987). The economic impact of subsurface drainage systems was addressed by Forsyth (1987). Considering many case studies about pavement drainage, the investigator verified that the implementation of edge drains often enhances pavement longevity. Tart and Rupter (2000) looked at how rain events affected the functionality of pavements. Mallela et al. (2000) took into account the planning and building of the drainage system. Lytton et al. (1989) dealt with the statistical and numerical modeling of pavement drainage systems. A detailed performance study of principal interstate pavement sub-drains was carried out by Ceylan et al. (2013). A detailed performance study of principal interstate pavement sub-drains was carried out by Ceylan et al. (2013). Subgrade Pavement with edge drain Sub-base, or granular base Armor Table of Water trench made with gravel The impact of inadequate sub-drain performance resulting from faulty design, construction, and maintenance on pavement surface distresses was examined in Figure 1 of the Iowan roadway subsurface drainage system, which uses edge drains. Design guidelines were proposed to help highway engineers design proper drainage to increase the service life of the pavement. Zumrawi (2013) studied the various impacts of inadequate drainage on road pavement conditions and found that most roads in Khartoum State suffered from poor drainage, which causes severe distress and damage to pavement. As a result, the soil's porosity exceeds its volumetric water content. Negative pressures, also known as suction pressures, arise because water in this zone is retained in the soil pores by surface tension forces (Ariza, 2002). Mulvaney (1850) was the first to propose this process; Kuichling (1889) developed it; and Lloyd Davies (1906) made more modifications. The Rational Method was suggested in the 1977 Institution of Engineers Australia publication Rainfall and Runoff for the planning of urban and small (less than 25 km) rural catchments. The Rational Formula can be interpreted in two ways. The deterministic interpretation comes first, followed by the statistical interpretation. Understanding flow across unsaturated soils is challenging since the permeability coefficient is directly proportional to both negative pore water pressure and water content, and it is a function of both (Freeze and Cherry, 1979). Rainfall that falls on pavement percolates through the subgrade, sub-base, and base soils. Any layer's ability to infiltrate is dependent on its porosity, thickness, and water content. Permeable layers allow water that has seeped into the pavement to be transported to edge drains, where it is subsequently removed via outlet pipes. To withstand the compressive load transferred from the surface, a certain thickness of treated or untreated aggregates is put as base or sub-base beneath the pavement surface. These top layers are supported by the soil underneath the sub-base. As a result, the components of pavement can be anything from coarse gravel to fine clay soil to cohesive materials like Portland cement concrete and asphalt. A version of the Richards Equation is used to address the water flow problem in the unsaturated zone. By replacing the unsaturated continuity equation with Darcy's Law, the Richards Equation is obtained. According to Puller (2003), the substructure construction approach (cut-and-cover or top-down) is influenced by peripheral sheeting/walling, ground and groundwater conditions, geographical location, talents, and preferences of local contractors. Top-down construction is expected to reduce settlements, soil deformation, and wall motions. As excavation depth grows, it gets more difficult, which leads to top-down procedures that enable the building of the superstructure and substructure at the same time. Finite-element analysis is crucial for top-down modeling building to produce consistent and dependable predictions of soil deformations, as shown by Whittle et al. (1993). However, highlights the necessity of accurately characterizing engineering qualities over the whole soil profile. According to Marchant et al. (1994), the principal contractors' perspective on economics was the driving force behind the top-down building style. According to experts, using the top-down approach can also have site-specific ramifications that might have a significant influence on the design. Emphasized that the design-build process is more effective the earlier the contractor is involved. For the majority of urban development scenarios, the top-down method works effectively. But to be included in the design and analysis, it needs strict adherence to quality standards, careful planning, management skills, and a comprehensive grasp of building processes. (2010) Basarkar et al. The efficiency of the top-down building strategy in Malaysia was investigated by Wong et al. (2019). They came to the conclusion that places with heavy traffic and metropolitan regions are the most suited and most efficient for using the top-down building technique. The study emphasized that in order to carry out top-down construction, specialized equipment and highly skilled contractors are required. The study also found that this strategy has drawbacks in terms of constrained working areas and machine idle.

3.3 An example case study

We used this approach at Jijel, Algeria's UDS. Algeria's northeastern coast is home to Jijel. It has 135,000 residents and a 6238-hectare surface area. 94% of the city's population is served by the public drainage system. Private systems provide services to the remainder of the city. Eight percent is a distinct network and the remaining ninety-two percent is a unified public drainage network. The network is around 113 kilometers long overall. The WWTP's (wastewater treatment plants) capacity.

Management of urban drainage systems that is sustainable The National Sanitation Office (ONA) in Algeria is faced with the difficult task of incorporating sustainable development—the government's current strategic focus—into UDS (Loi n° 05-12 du 04 août, 2005). It must pinpoint the specific steps that will lead to sustainable management. This work is particularly challenging because of the many requirements of a sustainable development strategy (economy, society, and environment), as well as the absence of organized methodology and information at different levels of the hierarchy (Ugwu and Haupt, 2007). For a nation like Algeria, which must expand its urban infrastructure to boost economic growth, this challenge is much more challenging. Enhancing the ONA's management capabilities is essential before aiming for sustainable management.

3.4 Statement of the Problem

The specific issues and challenges that the project seeks to solve are outlined in the problem statement. The description of the problem can cover several possible problems when the Civil Department and the EEE Department at Daffodil International University undertake a drainage system analysis and design. The following are some typical issues statements that you may encounter in this situation:
The main issue is the regular occurrence of floods and waterlogging along the route between the EEE Department and the Civil Department, particularly during periods of intense precipitation. This endangers people's safety and impedes pedestrian and vehicular movement.

Erosion and Infrastructure Damage: The stability and structural integrity of the road or route have been compromised by soil erosion brought on by insufficient drainage. This causes surface deterioration and needs regular upkeep and repairs. Safety Risks: Vehicles and people are put in danger by poor drainage. Hydroplaning can be caused by standing water on the road, and accidents are more likely to occur on slick roads.

Water Flow Inefficiency: If there is a drainage system in place, it is not managing water runoff well enough, which causes bottlenecks and sluggish water drainage. The performance of the drainage system as a whole is affected by this inefficiency. Impact on the Environment: Poor drainage practices can lead to pollution, soil erosion, and the disturbance of nearby ecosystems. This necessitates designing drainage systems with sustainability in mind.

Restricted Accessibility: Erosion and water buildup can make places less accessible, especially for those who have trouble moving about. This makes it more difficult for the campus infrastructure to be inclusive and functional.

Regulation Compliance: There might be legal ramifications and even fines if the existing drainage system doesn't adhere to industry standards or local laws.

Maintenance Difficulties: Because of accessibility concerns or the need for regular repairs brought on by persistent faults, maintaining the current drainage system, if any, may be difficult.

These particular problems should be included in the problem statement, along with an explanation of how they affect the university campus. By directing the solutions toward resolving these issues and delivering a more efficient and long-lasting drainage system, this will set the scene for the analysis and design process.

CHAPTER 4 METHODOLOGY OF THE STUDY

4.1 Introduction

This study makes us more knowledgeable to work in any kind of drainage work in the future. The process used by Daffodil International University's Civil and EEE departments to analyze and design the drainage system includes several crucial elements that guarantee a thorough and efficient procedure. To evaluate the current drainage conditions, the process starts with a detailed site assessment that concentrates on locations where water gathers, erosion happens, and safety issues exist. The fundamental information needed to create a well-informed drainage system design is provided by this survey. A hydrological study is carried out after the site assessment to comprehend rainfall patterns and anticipated water discharge. This research is essential for figuring out the drainage system's capacity and designing it to efficiently control water flow in a variety of weather scenarios. To guarantee effective water drainage, the design process entails developing conceptual and comprehensive designs for the drainage system that include features like trenches, culverts, and slopes. To lessen its influence on the campus environment, the design approach integrates environmentally friendly methods with a focus on sustainability. To guarantee that there is as little disturbance as possible during construction, implementation planning entails creating a construction schedule, implementing safety procedures, and coordinating with campus stakeholders. Throughout the implementation phase, steps are made to ensure the integrity of the design through quality assurance. The drainage system that has been put in place is thoroughly analyzed and evaluated at the end of the approach to make sure it is sustainable and functional. To ensure the drainage system's continued performance, suggestions are also given for routine upkeep and potential advancements

This methodical approach guarantees a comprehensive process for developing a dependable and sustainable drainage system between the Civil Department and the EEE Department. It includes site surveys, hydrological analysis, detailed design, implementation planning, and quality assurance.

4.2 Sampling and Survey

We need to investigate drainage design for this project thesis to learn more about it. Additionally, our respected supervisor sir, provided us with other alternatives to finish this book. Here, we are discussing our project surveying process. We initially got every component from our civil laboratory. Next, we use a measuring tape to determine the whole project area. Recommending the location of the station where we may place our leveling machine and where we must survey to obtain the up-and-rise value. Additionally, we determine the region of the station from which we obtain all the values required for the places we are examining in [Figure *6*] & [Figure *7*]

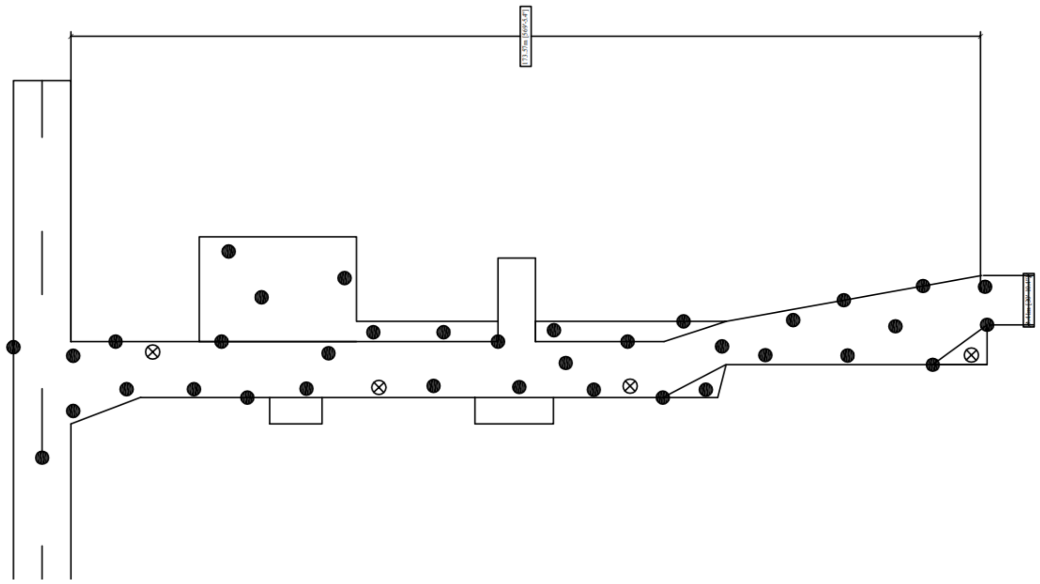


Figure 6 Pointing with the leveling machine.

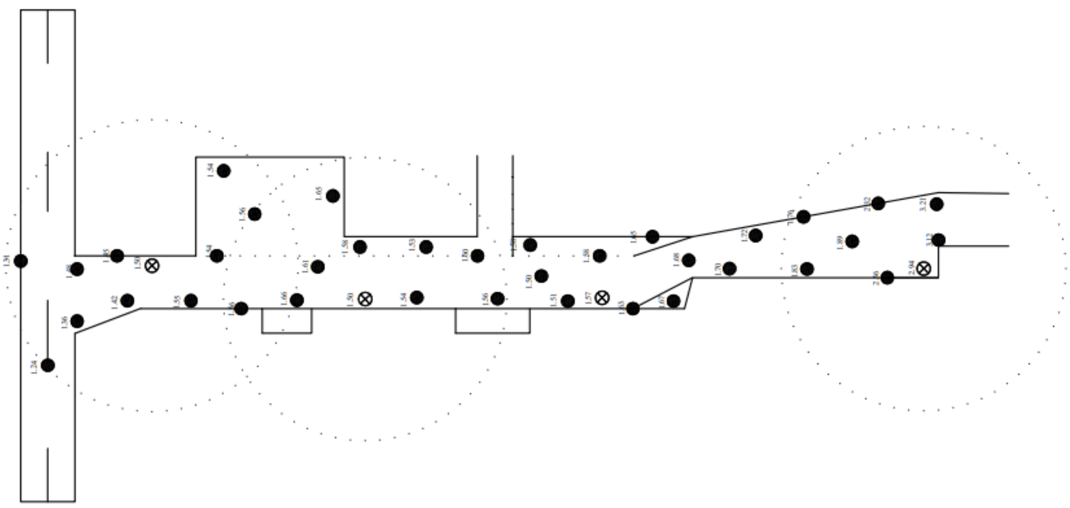


Figure 7 Pointing height with stand-on leveling machines.

After all, we complete our all-pointing work, we are going to make a note of our points on a note page to memorize them properly. Then completing the survey in the field, we shall give it a proper shape it what we are showing on [Figure 8] is that four stations helped us to make a proper shape on the survey field in the case we made a proper diagram on it. So, we can easily count that zoon that is up & rising and where water will go after rain.

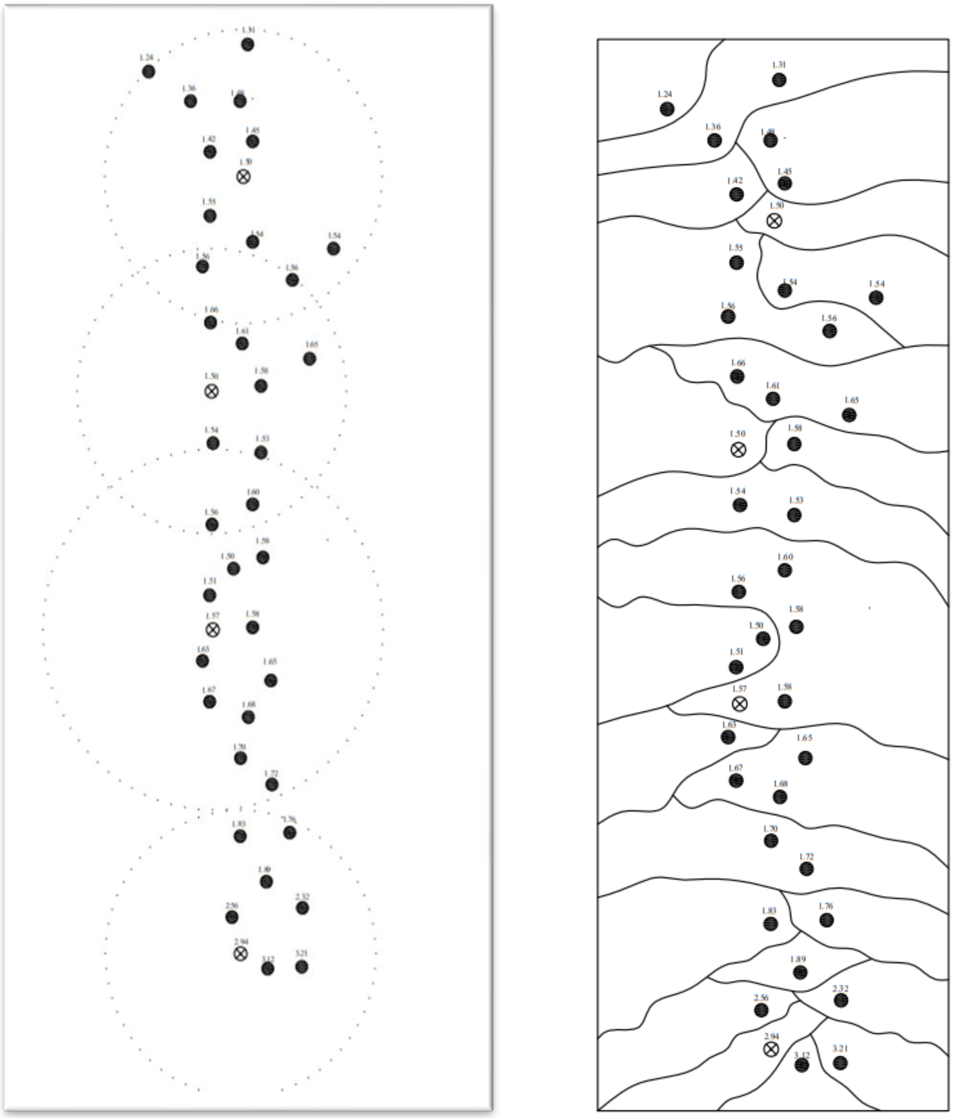


Figure 8 All Level points are set on the page to get the actual layout.

In those surveys we were able to know the place layout perfectly and also Daffodil International University can position itself as a leader in interdisciplinary research and education focused on advancing state-of-the-art drainage system analysis and design, contributing to sustainable development goals and societal resilience in the face of climate change and urbanization.

4.3 Methodology

Here, we'll talk about how we work on surveys and other projects to create and analyze effective drainage systems. We begin these projects by leveling the ground. To ensure proper leveling in the project field, we begin leveling using a spirit level set in our level machine. We precisely align each station with the spirit level. Our first station photo, which wonderfully highlights its work, is shown in [Figure 9]. Additionally, each time we swap out a machine, we record the machine stand height information.

(a) (b)

Figure 9 Level Measurement Machine Fixed with Sprit Level
(a) Side view & (b) Top view.

Next, we began repairing the machine that was the navigation angel with the triangular stand. We placed a bubble in the middle. After the bubble has been set up, we may declare that our machine is ready for operation. Our device operates correctly to provide us with an ideal value for the survey. In that instance, we placed the water bubble center on the line that you are viewing by fixing it on three rolling dials [Figure *10*]. With a level measurement system, we can now precisely measure the level of our project.

Figure 10 Fixed full Setup Perfectly on level measurement machine.

When we get data from the leveling point into the level machine, we begin to point bubbles in the scale after the level measurement machine has been corrected. Once more, in order to determine the value of the machine glass to be watched, we check the water bubble point on the scale. To do this, we refer to [Figure 11], which explains why incorrect leveling values result from improperly placed water bubbles on our scale.

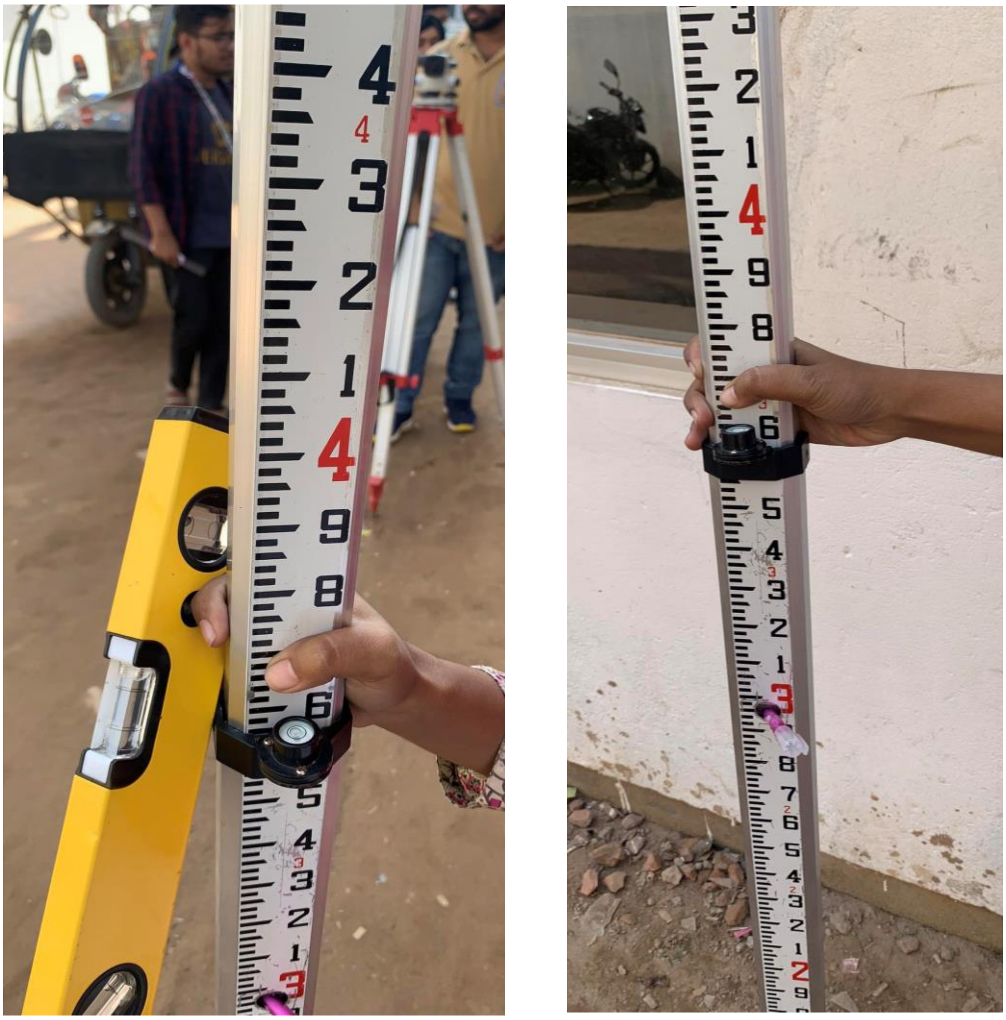


Figure 11 Scale which we are set up with bubble for perfect values.

After completing the equipment setup, we may begin the fieldwork for the project, which involves leveling the ground. In such task, an individual positions themselves close to the leveling machine, tends to the glass, and then observes the front side scale. To display the scale reading effectively, it must be sharply focused before being placed on a pad. As seen in the image [Figure *12*], a guy observes the leveling machine to obtain the scale reading.

Figure 12 Survey work is going on with 3rd leveling station.

After finishing the survey, we worked to redraw the project site in AutoCAD and added all of the survey data. This allowed us to have an excellent view of our site. We will now begin to focus on defining the data that will be visualized for others. After that, configure the drain and redesign it to fit this particular drain. Following the conclusion, we polish our book with advice from our esteemed supervisor, sir.

CHAPTER 5 ANALYSIS & RESULT

5.1 Introduction

Managing water buildup and erosion difficulties along the passage between the EEE Department and the Civil Department is the main goal of the project. To do this, the project must evaluate the drainage system's present condition and pinpoint the precise locations that require repair. The following actions are included in the analysis stage:

Site study: To comprehend the topography and the current drainage system, a thorough site study is carried out. This entails locating areas that are prone to erosion, water buildup, and possible safety risks. Baseline data from the survey are provided for additional research.

Understanding rainfall patterns, water runoff amounts, and drainage capacity are all part of hydrological analysis. This stage is essential for creating a drainage system that is capable of withstanding a range of weather, particularly during periods of intense precipitation.

5.2 Project Site

We use the leveling equipment on that site to determine the actual level on our site when leveling the survey for our project. To provide a flawless survey report, we use four leveling stations to stand our leveling machine in projects that are [Figure 13]

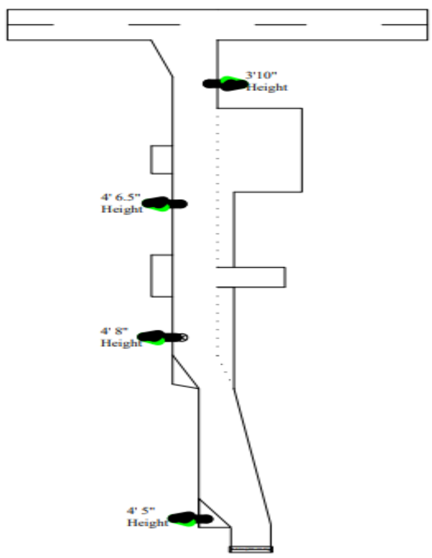


Figure 13 leveling machine position in project site

However, while we worked on the project site, we discovered that the leveling machine was installed on a stand of the same size is not possible as the leveling machine [Figure 14]. For this reason, I set a constant height of five feet [Figure 15].

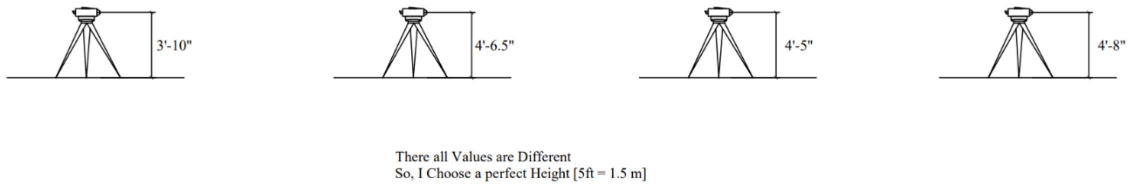


Figure 14 The heights of the machine are different

Figure 15 Assumed it in a fixed height.

We also have further issues with the earth's level being different at our stat station, which is upside down. where the water from the rains also descends to the last station. Although the station simulation diagram differs from the project, the measurements are accurate. [Figure 16]

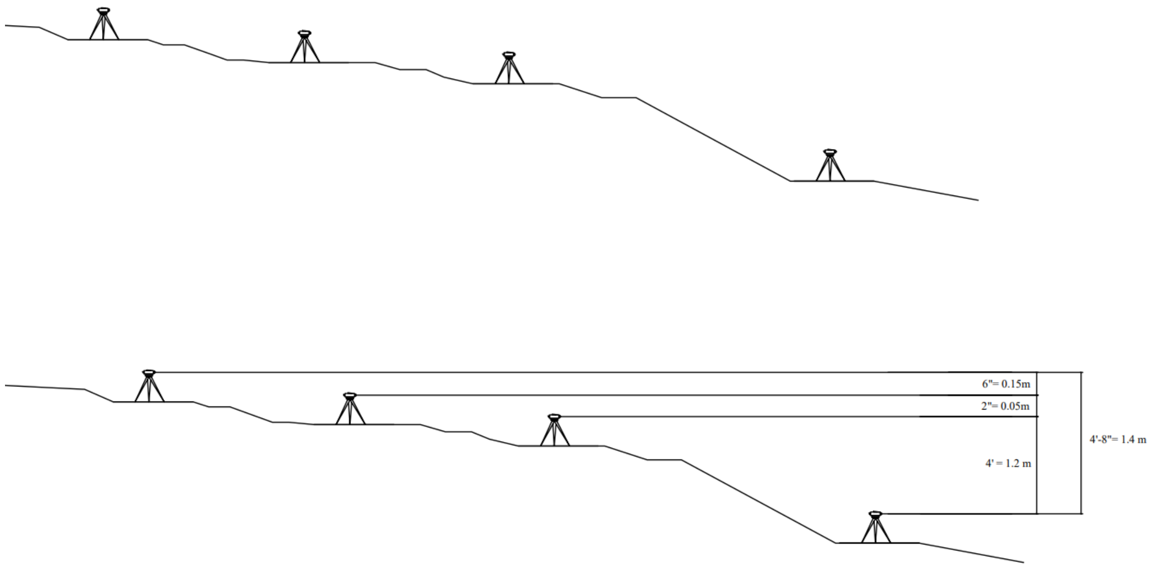


Figure 16 Leveling machine standing in different positions upside to down.

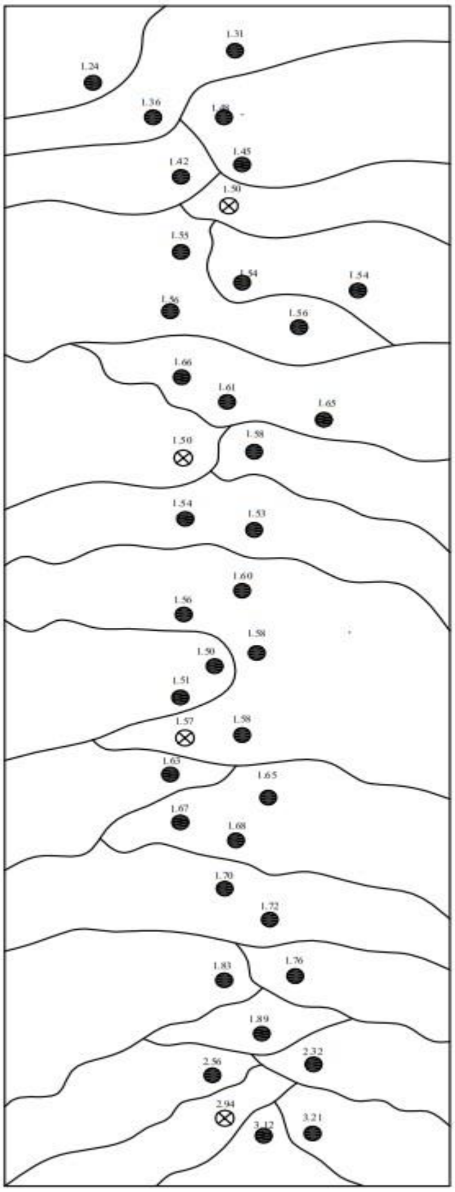


Figure 17 Survey calculation by layout

DATA ANALYSIS

- 1.26-1.42 = 1st Zone
- 1.31-1.45 = 2nd Zone
- 1.42-1.56 = 3rd Zone
- 1.50-1.56 = 4th Zone
- 1.56-1.65 = 5th Zone
- 1.50-1.53 = 6th Zone
- 1.54-1.58 = 7th Zone
- 1.50-1.65 = 8th Zone
- 1.63-1.68 = 9th Zone
- 1.68-1.76 = 10th Zone
- 1.68-1.89 = 11th Zone
- 1.89-2.94 = 12th Zone
- 1.89-3.21 = 13th Zone

Slope

Various rainfall water-flowing routes exist, such as

- 1.26 – 1.54
- 1.55 – 1.65
- 1.50 – 1.68
- 1.50 – 3.21 [In case of excess rainfall]
- 1.63 – 1.72
- 1.72 – 2.94
- 1.72 – 3.21

But I got this route because maximum rainfall water came from this way 1.50 – 3.21

Slop Calculation:

- 1.54 – 1.26 = 0.28 m Distance = 53.70 m
- 1.65 – 1.55 = 0.10 m Distance = 35.72 m
- 1.68 – 1.50 = 0.18 m Distance = 48.24 m
- 3.21 – 1.50 = 1.71 m Distance = 71.52 m
- 1.72 – 1.63 = 0.09 m Distance = 28.92 m
- 2.94 – 1.72 = 1.22 m Distance = 42.76 m
- 3.21 – 1.72 = 1.49 m Distance = 37.00 m

Average Height = (0.28 + 0.10 + 0.18 + 1.71 + 0.09 + 1.22 + 1.49) / 7 = 0.724 m

Average distance = (53.70 + 35.72 + 48.24 + 71.52 + 28.92 + 42.76 + 37) /7= 45.41 m

$\tan n = (0.724/45.41)$

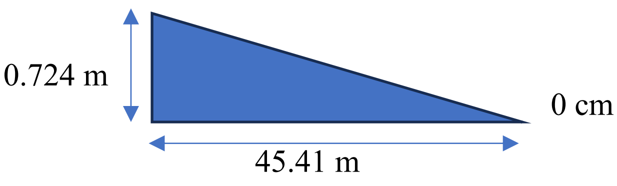
$\emptyset = \tan^{-1} (0.724/45.41)$

$\emptyset = 0.016^{o}$

% slope = 100 tan n

$= 100 * \tan 0.016^{o}$

$= 0.028\ \%$



Highest slop

$\tan n = (1.71/71.52)$

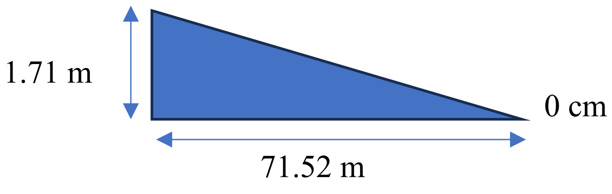
$\emptyset = \tan^{-1} (1.71/71.52)$

$\emptyset = 0.0239^{o}$

% slope = 100 tan n

$= 100 * \tan 0.0239^{o}$

$= 0.042\ \%$



30 Years (2003-2023) Rainfall Date 3 hours (mm):

Full data is in the drive link simple table is below:
https://docs.google.com/spreadsheets/d/1VBq0D5njQ-AUJ5yC90ir3ObM9qE5Y1aRQCadKSIEaS0/edit?usp=sharing
We buy this data from the Bangladesh Meteorological Department, Dhaka

MAXIMUM MONTHLY RAINFALL

Table 1 Monthly rainfall data analysis in millimeters

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	21	21	25.6	44	36.8	64.6	21	33.6	35.5	21	21	36
2004	21	21	21	53	39.2	70	36	44	80	68	21	21
2005	21	21	41	45	62	54	58	67	86	48.4	21	21
2006	21	21	21	96	38	38	45	22	87	26	21	21
2007	21	21	21	48	129.6	63.6	63	118.4	33	53	42	21
2008	21	21	21	33	39.6	74	50	25	41.2	23.6	21	21
2009	21	21	37	21	31	36.4	210	66.8	55.4	21	21	21
2010	21	31.2	22.4	21	34.2	45.4	21	76	23.6	50	21	34
2011	21	21	21	49.4	45.6	33.6	32	36.4	25.6	38.5	21	21
2012	21	21	36.2	50	38	34	35.6	23	21	21	21	21
2013	21	21	21	21	64	45	72	35.4	23.2	25.2	21	21
2014	21	21	21	33.6	23	39.9	51.4	40	22	25	21	21
2015	21	21	21	22.4	35.2	66	42	36	43	21	21	21
2016	21	21	21	21	26.2	38.2	40.2	29	21	25.6	21	21
2017	21	21	32	33.2	49	44	54	121	66	61	21	21
2018	21	21	21	50.4	81	54	52	21	21	22.4	21	21
2019	21	21	21	48.4	23	46	75	35.4	40.4	45.3	21	21
2020	21	21	21	43.4	62	55	63	24.8	25.8	54	21	21
2021	21	21	21	24	44	85	38	35.6	52	24	21	28.2
2022	21	21	21	44.2	42	53	21	31.2	25.8	86	21	21
2023	21	21	27	21	36.8	81.2	72	60.4				

Table 2 Maximum Rainfall Data Table

Year	Monthly maximum rainfall (mm)
2003	64.6
2004	80
2005	86
2006	96
2007	129.6
2008	74
2009*	210
2010	76
2011	49.4
2012	50
2013	72
2014	51.4
2015	66
2016	40.2
2017	121
2018	81
2019	75
2020	63
2021	85
2022	86
2023	81.2

Top Rainfall Data (30 years) 100% = 210 mm

95% = 199.5 mm (3 hours)

Top Rainfall Data (per Hour) = 66.5 mm/hr.

Top Rainfall Data (per sec) = 0.018472222 mm/s

Table 3 Notebook of sheet reading of leveling

BS	IS	FS	RISE	FALL	RL	REMARKS
1.50					1	BM 0.080
	1.24		0.26		1.26	0+000
	1.31			0.07	1.19	0+030
	1.36			0.05	1.14	0+060
	1.48			0.12	1.02	0+090
	1.42		0.06		1.08	0+120
	1.45			0.03	1.05	0+120
	1.55			0.10	0.95	0+150
	1.54		0.01		0.96	0+180
1.35		1.65	0.09		1.05	0+210
	1.54			0.19	0.86	0+210
	1.56			0.02	0.84	0+240
	1.66			0.10	0.74	0+270
	1.58		0.02		0.76	0+300
	1.53		0.05		0.81	0+330
1.30		1.70		0.17	0.64	0+330
	1.60			0.30	0.34	0+360
	1.58			0.02	0.32	0+360
	1.68			0.10	0.22	0+390
	1.70		0.02		0.24	0+420
	1.73			0.03	0.27	0+420
	1.83			0.10	0.37	0+450
	1.76		0.07		0.44	0+480
0.1		2.94		1.18	- 0.74	0+480
	1.76			1.66	- 2.40	0+510
	1.83			0.07	- 2.46	0+540
	1.89			0.06	- 2.52	0+570
	2.32			0.43	- 2.95	0+600
	2.56			0.24	- 3.19	0+600
	3.12			0.56	- 3.75	0+600
	3.21			0.09	- 3.84	

Reason for choosing Surface Drainage:

There are some considerations when selecting surface drainage over subsurface drainage, and they include the project's budget, environment, context, and maintenance requirements. The following are some reasons why surface drainage may be preferable to subsurface drainage:

1) Cost-effectiveness: Because surface drainage involves less complicated construction and fewer resources, it is typically more affordable than subsurface drainage. This can be quite important for initiatives that have little funding.
2) Construction Ease: Swales, ditches, and gutters are examples of surface drainage systems that are generally simpler to build than subsurface systems, which need excavation and subterranean installation. This ease of use can shorten the duration and complexity of building.
3) Erosion Control: Surface runoff that is not managed can cause soil erosion near transportation infrastructure, affecting the integrity of nearby land, embankments, and slopes. Surface drainage systems reduce erosion and save the environment by guiding runoff in a controlled manner.
4) The Flow of Water Naturally: Surface drainage facilitates easier water management by following the natural flow of water. By directing water to specific locations, it imitates natural processes and lowers the chance of erosion and waterlogging.
5) Effect on the Environment: Because surface drainage depends less on artificial systems and causes less disturbance to the land than subsurface drainage, it may have a less environmental effect. This method can be more environmentally friendly if it includes elements like bioswales or rain gardens.
6) Minimizing Maintenance Requirements: The quantity of water penetrating the subgrade and road base is decreased by well-designed surface drainage. As a result, the transportation infrastructure requires fewer maintenance interventions and pays less over its lifetime.
7) Preventing Structural Damage: Surface drainage systems help prevent water damage to culverts, bridges, and other traffic infrastructure. These systems help prevent undermining and other types of structural damage that might arise from extended exposure to water by effectively diverting water away.
8) Design Flexibility: Flexibility in surface drainage enables a range of designs and combinations to meet the project's unique needs. This adaptability comes in handy when managing unusual terrain or site limitations.
9) Prevention of Pavement Deterioration: Effective surface drainage keeps water from building up on the surface of the road and seeping into the structure of the pavement. Potholes, cracking, and other types of pavement distress can result from

water weakening the elements that make up the pavement. Surface drainage prolongs the life of the pavement and preserves its structural integrity by effectively eliminating water.

10) Improved User Experience: A smoother, more dependable driving experience is enhanced by good surface drainage, which reduces water-related disturbances like flooding and water collecting on the pavement. This improves the transportation network's overall dependability and usability.

In summary, although subsurface drainage has benefits like controlling massive water volumes and maintaining aesthetics, surface drainage is frequently preferred due to its affordability, ease of use, accessibility, and sustainability. In the end, the choice is based on the project's background, financial constraints, environmental factors, and adherence to local laws. Selecting surface drainage can help you achieve your goals of improved safety, less environmental impact, and an efficient, long-lasting solution.

Calculating Surface Runoff

1. The distance between the furthest point in the turf-covered drainage area and the point of entry to the side drain is 13.75 meters, with an average slope of 1.7% in the direction of the drain.
2. The kind of surface and its slope are the main factors that affect the run-off coefficient C's value. The C-value for bituminous pavements and cement concrete is between 0.80 and 0.90. Consequently, 0.85
3. The run-off coefficient has a weighted average value of 0.85.
4. In sandy clay soil, the longitudinal open drain is 180 meters long from the inflow point to the cross drainage.
5. An unlined channel's velocity needs to be high enough to avoid silting, but not so high as to encourage erosion.
6. The kind of soil determines the permitted flow velocity. The rates for sand and silt are 0.3 to 0.5 m/sec, loam is 0.6 to 0.9 m/sec, clay is 0.9 to 1.5 m/sec, and gravel is 1.2 to 1.5 m/sec. 1.5 to 1.8 m/sec for suitable soil covered in well-established grass.
7. To avoid silting and erosion, a flow velocity of 1.6 m/sec can be assumed in the side drain.
8. Over 30 years (2003–2023), estimate the side drain's design quantity of flow based on how frequently storms occur.
9. The pea run-off water for roadway drainage is commonly estimated using the rational formula.

The simplest version of the rational formula is given by:

$$Q = C * I * Ad$$

Where, Q = Run-off, m^3/sec

C = run-off coefficient, which is the ratio of run-off to rainfall rate.

The run-off coefficient's value C mostly relies on the kind of surface and its inclination. In the case of cement concrete and bituminous pavements, the C-value ranges from 0.80 to 0.90. Thus, it is 0.85

I = Rainfall Intensity, which is 0.018472222 mm/sec

Drainage area, $A_d = (180*13.75)\ m^2$

$= 2475\ m^2$

Total Drainage Catchment Area

$A = \{(a + b)/2\} *h$ where, a = 173 m, b = 180 m & h = 13.75 m

Now, Total area, $A = \{(a + b)/2\} *h$

$= \{(173 + 180)/2\} *13.75\ m^2 = 2426.87\ m^2$

Summary design flow

This is the highest rate at which a flood wave may pass a location in a stream. The wave's flow maximizes and then decreases as it reaches the point. It is a crucial component of culvert designs, and the amount of the return period determines how big it is.

Areas of catchment (Area data)

- The gravel road surface and shoulders are not paved.
  The area's length is 0.685 km.
  The area's width is 0.008 km.
  The Area is equal to [Length * Width], or 0.685 * 0.008 km^2.

- The build-up area (the area of land on the other side of the drain) is equal to 0.021*0.8, or 0.02 km.

- The area covered with grass is equal to 0.0234*0.35, or 0.005 km.

- Area of all catchments = 0.03 km.

Coefficient of surface runoff (C)

The gravel surface coefficient is 0.35, the accumulation coefficient is 0.8, and the soil covered with grass has a coefficient of 0.1.

$C_1 = 0.45$, $C_2 = 0.85$, and $C_3 = 0.1$ as a result.

Weighted runoff coefficient value:

$$C = \frac{C_1A_1 + C_2A_2 + C_3A_3}{A_1 + A_2 + A_3}$$

$$C = \frac{0.45*0.0055 + 0.85*0.022 + 0.1*0.005}{0.0055 + 0.022 + 0.005}$$

$$C = 0.615$$

Thus, the runoff coefficient (C) is equal to 0.615.

Peak flow (Q)

Peak flow (Q) by using the following formula;

Q is equal to 0.3*C*I*A.

Where;

Q = the amount of surface runoff from rainwater in m^3/sec.
C = the coefficient of surface runoff.
I = Maximum amount of rainfall in millimeters per hour.
A = Surface area to be drained in square kilometers.

C = 0.615
I = 320 mm/hour
A = 0.025 km^2

$$Q = \frac{0.3*0.55*320*30m}{60*60}$$

Q = 0.45 m^3/sec

Thus, Q = 0.9 m^3/sec is the quantity of rainwater surface runoff.

Calculation

Determination of runoff

Here, Q = C * I *Ad
C = 0.85
I = 0.018472222 mm/sec
A_d = 2426.87 m^2
Run-off, Q = C * I *A_d = 0.85 * 0.018472222 * 2426.87 = 38.86 m^3/sec

The Design of the hydraulic channel section

To design a side drainage system and other structures, the design runoff Q must first be determined. The design runoff Q determines the quantity of surface water (m^3/sec) a side drainage system must remove, and V indicates the maximum flow velocity (m/s) the system may have. This relation may be used to get the area of the channel's cross-section A (m^2):

Q=A*V

An unlined channel's velocity needs to be high enough to avoid silting, but not so high as to encourage erosion. For the lined channel, the permitted velocity should be more than one (1 m/sec).
The design value of flow velocity V, roughness coefficient n, and hydraulic radius R may be found using Manning's formula for the longitudinal drain with known or assumed cross-section and depth of flow, to get the slope S.

The Manning’s Formula:

$$V = 1/n * R^{2/3} * S^{1/2}$$

Here,

V=Average velocity in meters per second;

N is Manning's roughness coefficient

R is the hydraulic radius.

S is the channel's longitudinal slope.

The roughness coefficient for Manning's is

N = 0.0125 for typical unlined ditches; 0.045 to 0.1 for unlined ditches with dense vegetation; 0.01 for rough rubble; 0.045 for stone riprap; and 0.015 for pipe culverts respectively

Cross-sectional area by Wetted perimeter equals hydraulic radius.

Concentration period (t)

Water must travel a total distance from the catchment area to the designated element within the period of concentration.

A watercourse or the closest cross drainage, the length of the longitudinal drain L, and the maximum flow velocity V in the drain are used to calculate how long it takes for water to travel down the drain.

$$V/L = T.$$

Rainfall duration design value or time of concentration is determined by adding together all the intake and drain flow times.

The overland flow duration in minutes is denoted by T_1- in this case.

$T_c = T_1 + T_2$

T_1 - is the time in minutes for overland flow.

T_2 - is the minute-by-minute channel flow time.

* T_1 = [0.95 L^3/H] ^ 0.45

Here,

L = the amount of overland flow measured in kilometers between the drain's mouth and the critical point.

H = the total drop in level measured in meters from the drain's mouth to the critical point.

Note: - The rainfall I is determined in millimeters per second (mm/sec) using the rainfall intensity, duration, and frequency curves. By time T and return period frequency. The practical bottom width and side slope of the drain are taken into account when calculating the necessary depth of flow. To provide a free body, the open channel drain's true depth may be somewhat increased. One finds the hydraulic mean radius of flow, or R. Using the Manning formula and an acceptable value for the roughness coefficient, the needed longitudinal slope S of the drain is computed.

Examine the following rectangular section:

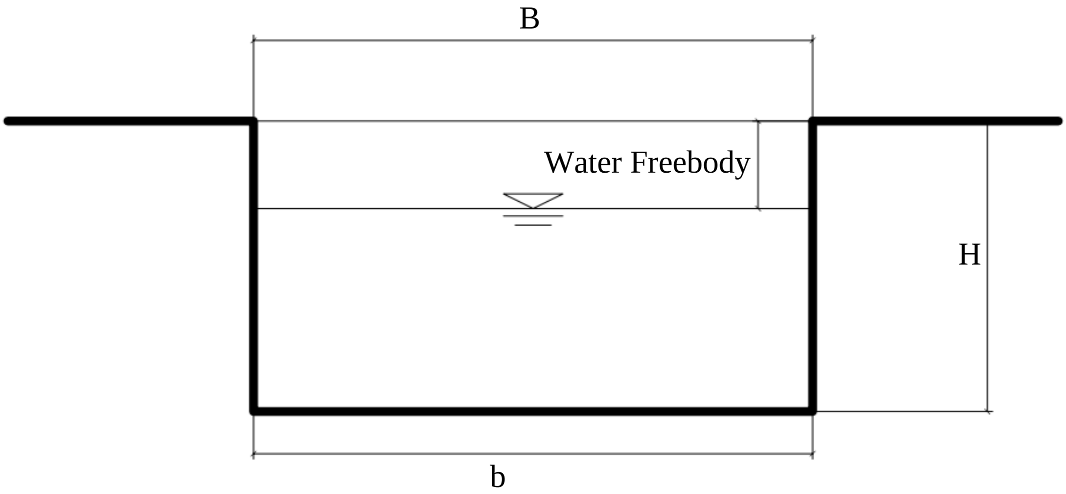


Figure 18 Rectangular section of drain.

Flow area (A) is b*h; Wetted Perimeter (P) is B+2h; Top wide (B) is B = b;

Hydraulic radius (R) is A/P;

For discharge to be maximum or for the best hydraulic cross-section in a rectangular channel.

b = 2h; R = h/2;

Cross-sectional area of drain (A) = b*h; Substituting b = 2h into the area formula;

The cross-sectional area of the drain (A) = 2h*h =$2h^2$;

Catchment Area is 2426.87 m^3/s;

Q = V*A;

$Q = 1/n * R^{2/3} * S^{1/2} * A$

Manning's roughness Co-efficient, (n) = 0.014

Bed Slop, (S) = 0.042

Substituting, Q, n, R, S, and A in Q

$1.35 = 1/0.014*(h/2)^{2/3}*0.042^{1/2}*2h^2$; h = 0.289 m ~ 0.3 m

The cross-sectional area of the drain (A) = $2h^2$;

So, $A = 2*(0.3)^2$; A = 0.18 m^2

Width of drain b = 2h;

So, b = 2*(0.3); b = 0.6 m

It is necessary to provide a freeboard of at least one foot (0.3 m);

Drain depth = (0.3 + 0.3) m; = 0.6 m

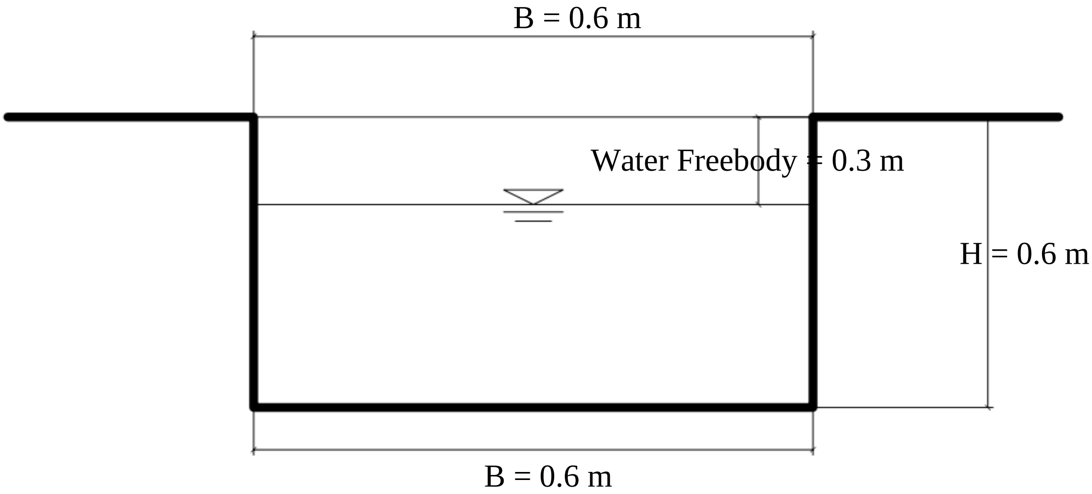


Figure 19 Drain Rectangular shape size.

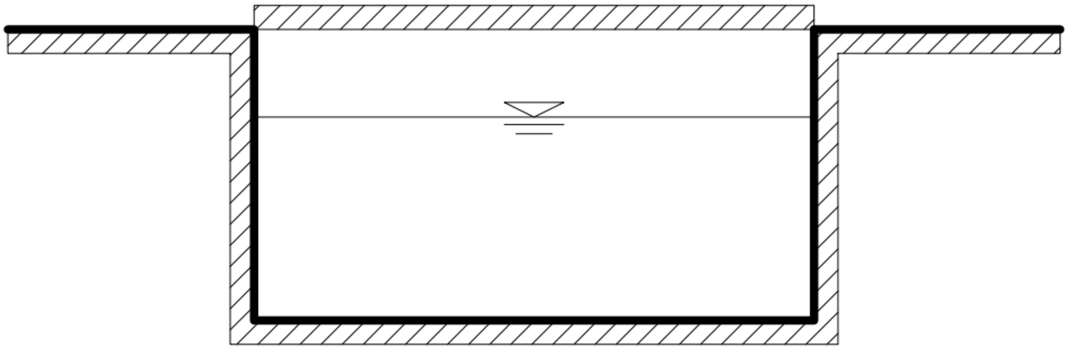


Figure 20 Cross-section design of our drain.

DIAGRAM

The slope along a longitudinal path.

The amount is additionally computed using Manning's formula.

V = 1/n * R^2/3* S^1/2

R = Area / Wetted perimeter

The wetted perimeter is equal to (1.2*2) + (0.25*2), which is 2.9 in

R = (0.298/2.9) = 0.103

n = 0.045; V = 1.25 m/sec

S = 1.5*0.045/0.103^2/3 S = 0.54

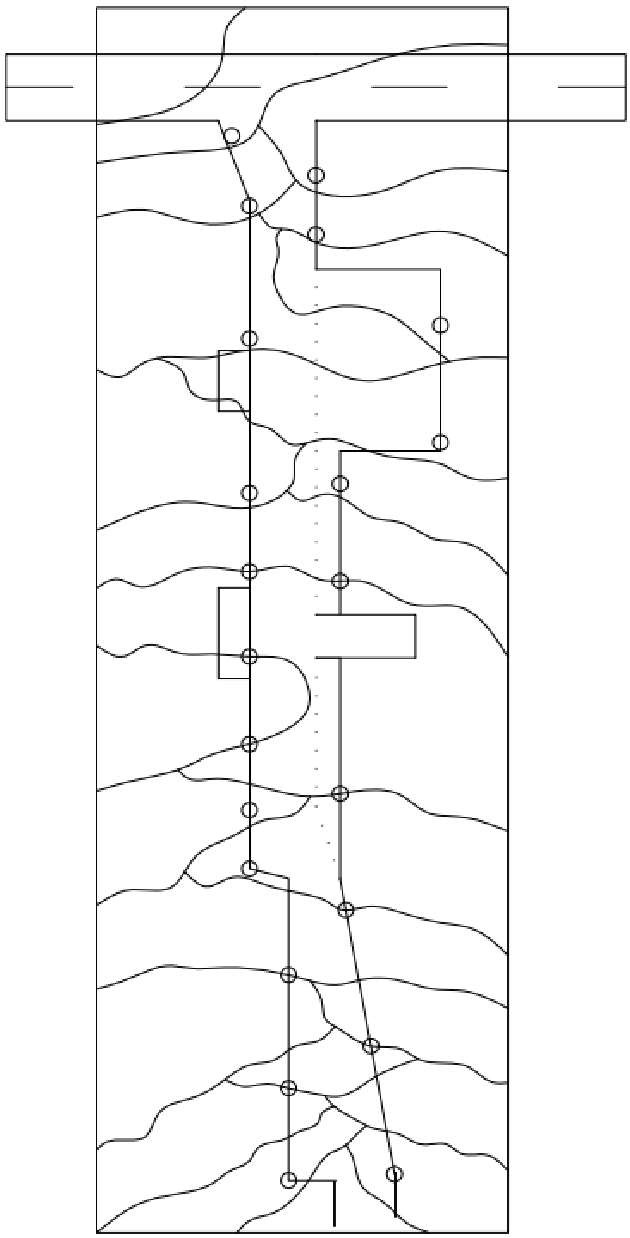


Figure 21 Possible drain point drawing with leveling

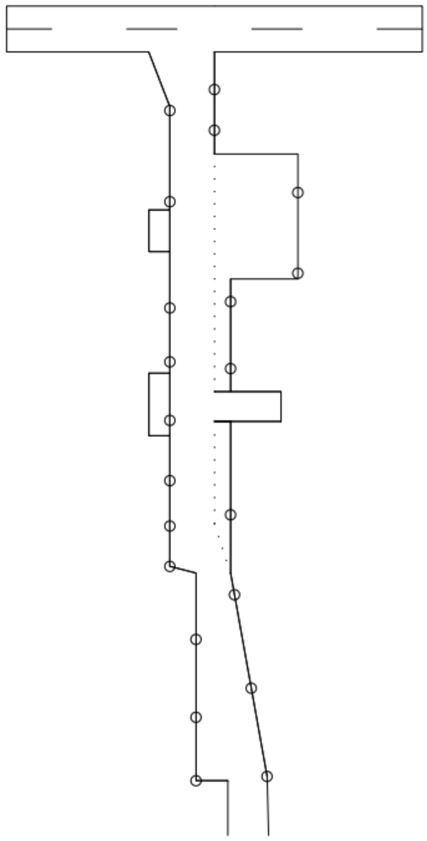


Figure 22 Possible drain point where water passes away

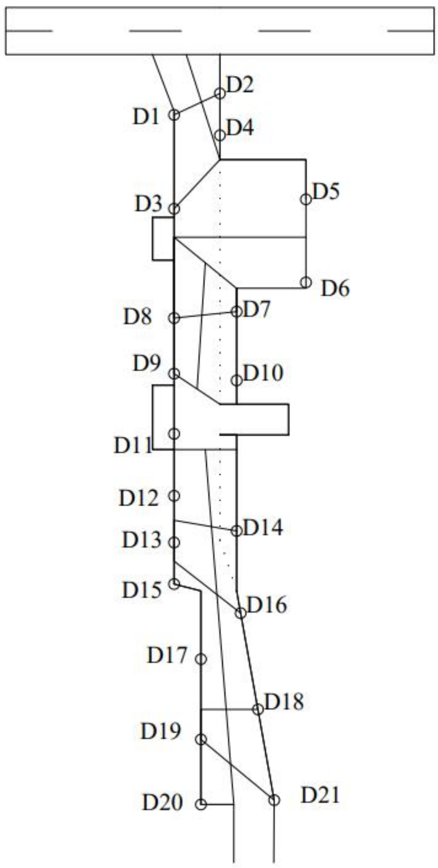


Figure 23 Water catchment area of every drain point

We join our current drain to the department drain of EEE. [Figure 24] makes it easy to notice that drain, which has been occurring next to the EEE department drain system. Following that work, Diu Lake will be traversed by our water. Our drain construction is limited to the area between the Civil and EEE departments. This is the cross-section of our drain, where the upper slab cover is constructed of concrete and the sides are built up with bricks. We can observe the drain on both sides of the soil pressure in

Figure 25].

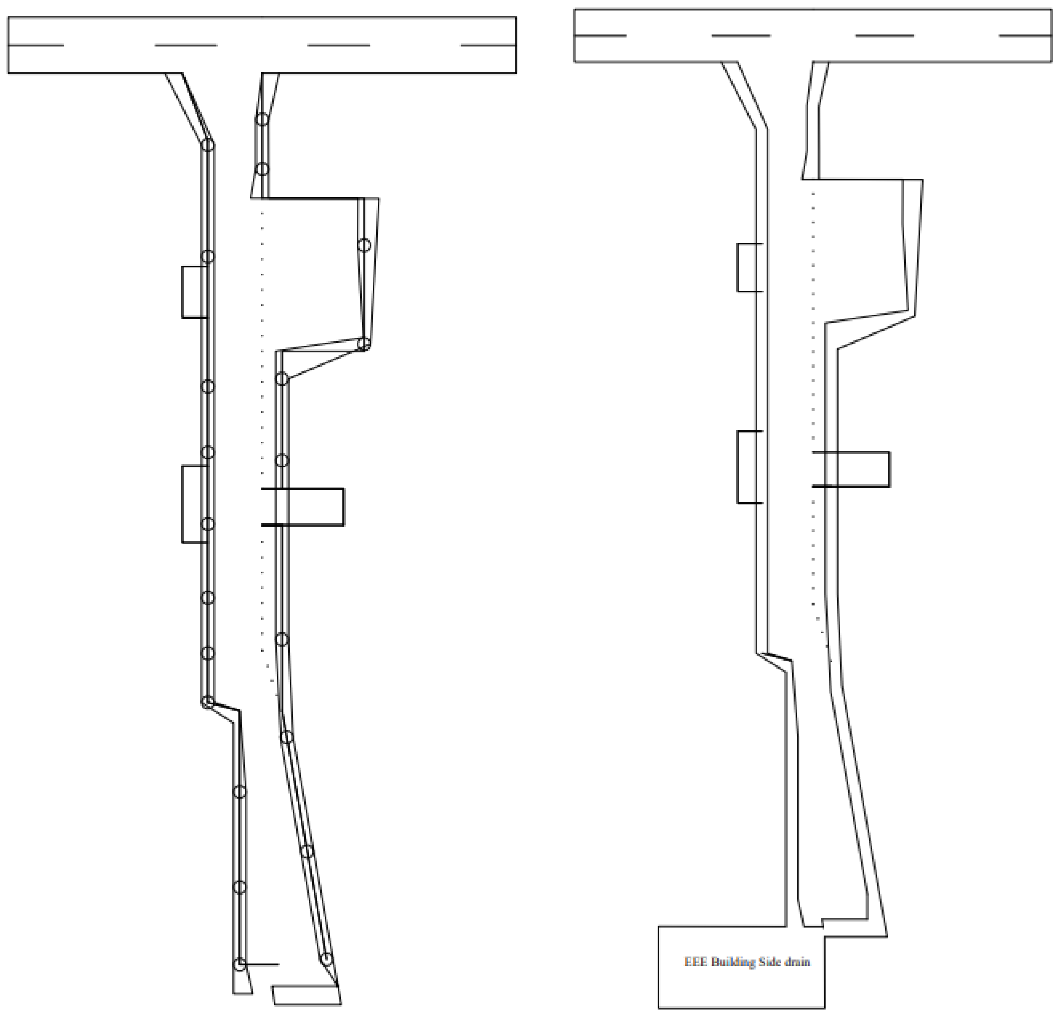


Figure 24 Drain connection with EEE building side drain.

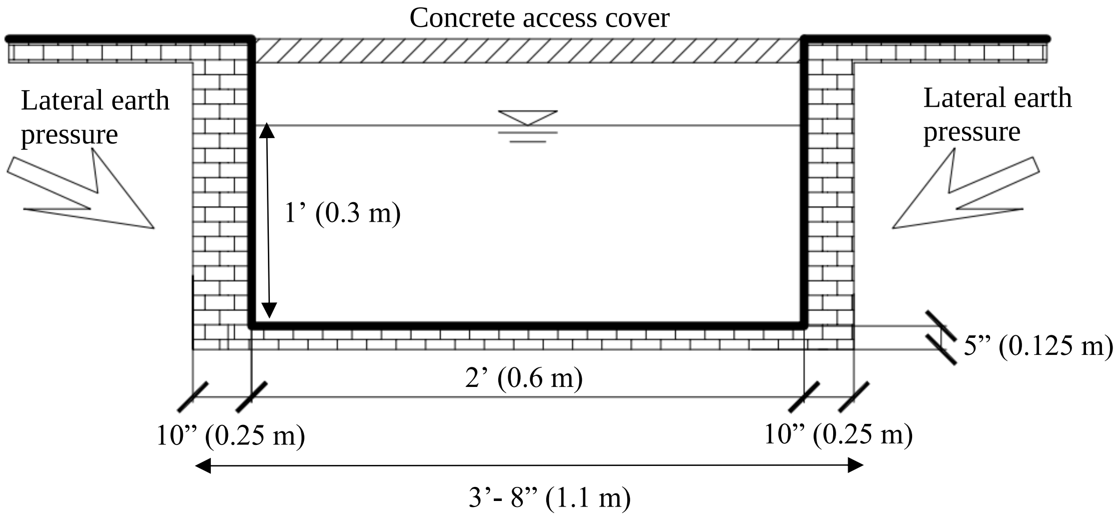


Figure 25 Complete drain with earth lateral support protection with bricks.

Details in the drain section are calculated as follows:

For 10" wall:

L = 2*180m = 2*590.551=1181.102 ft

Area, A = 1181.102*1.97 = 2325 ft^2 [0.6m =1.97 ft]

So, Quantity of work = 2325*10/12 = 1938.98 ft^3

For 5" wall:

L = 180m = 590.551ft

Area, A = 590.55*1.97 = 1163.385 ft^2

So, Quantity of work = 1163.385 *5/12 = 484.74 ft^3

Now, the total quantity of work = 1938.98 + 484.74

= 2423.723 ft^3

Required the number of bricks = x

So, 2423.723 = x (10/12 + 5/12 + 3/12)

=> x = 27921.29 ~ 27922 Bricks

If we figure out that brick loss is 5% Sources by Google

Then, we determined that the accurate value is 27922 * 5%

= 29318 Bricks ~ 29500 Bricks

Volume with mortar = 27922 * (10/12 + 5/12 + 3/12) = 2423. 78 ft^3

Volume without mortar = 27922 * (9.5/12 + 4.5/12 + 2.75/12) = 1899.65 ft^3

The volume of Mortar required = (2423. 78 - 1899.65) ft^3

= 524.143 ft^3

The volume of Mortar (Dry) = (524.143 * 1.5) [Shrinkage factor 1.5]

=786.21 ft^3

Materials required: (mix ratio) = 1:4

Fine Aggregate = 4/5 * 786.21 = 628.968 cft ~ 700 Cft

Cement = 1/5*786.21 = 157.24 cft

Here, we know 1 bag of cement = 1.22 cft

So, we need (157.24/1.22) = 128.88 ~ 130 bag of Cement.

5.3Result and Discussion

The drain catchment area is 2426.87 m^2. So, if we assume, four hours during the rainy season, and up to seven hours during the day.

Then our total water volume is = 7 * 60 * 60 * (0.018472222 mm/sec)

= 465.49 mm/hr. * A_d = 465.49 * 2426.87 = 1129706.62 ml = 1129.706 l

So, we have to design a minimum of 1130* 5% = 1190 ~ 1200 liter

There are twenty-one drain stations, but the last ones require a big case since water from all the side areas spills over into the last path. As a result, we have to increase its volume.

The Ashulia, Diu city campus drainage system's current state is examined through field visits and the compilation of data from several sources, including LGED and CTEIP. In hydrological analysis, the data is used to determine the yearly maximum rainfall for each year. Gumbel's extreme value distribution is then used to do frequency analysis of the peak rainfall data to determine the likely rainfall magnitude for return periods of five and ten years. severity-duration Frequency (IDF) curves are created using rainfall data for long-duration rainfall, ranging from one day to seven days of annual maximum rainfall for various return times, to assess the severity of the rainfall. To construct IDF curves for short-duration rainfall ranging from 10 minutes to 120 minutes in length, Bernard's (1932) equation is used to compute short-duration rainfall intensity for the same return periods. This is because short-duration rainfall is necessary in urban drainage systems.

So, the total volume of water in 7 days is,

V = 7 days *120 minutes * 60 seconds * (0.018472222 mm/sec)

= 930.99 * A_d = 931 * 2426.87 = 2259415.97 ml = 22,594.15 l

The findings section at Daffodil International University shows that a thorough drainage system is required to solve the problems found along the route between the EEE and Civil departments. The suggested design prioritizes sustainability and regulatory compliance while addressing important issues including waterlogging, erosion, and safety hazards.

These results offer a strong basis for putting in place an efficient drainage system, which will increase safety, save maintenance costs, and create a more sustainable campus environment. The suggestions made in this part are meant to direct future efforts and guarantee the drainage system's continuous effectiveness.

In the metropolitan region of Dhaka, we see rectangular drain patterns. Rectangular drains are ideal because they make it simple to release water. Additionally, we discovered particular problems with them, so we were ready to prepare our drain without those issues. The first Ashulia Bazaar roadside drain is full of rubbish because it lacks a drain cover slab or block [Figure *26*].

Figure 26 Ashulia Bazaar side drain

Next, we discovered that the identical rectangular drain building project was underway in the Gulshan region of Dhaka city as of November of last year. We took some pictures of the project and made the decision to create our own drain in accordance with their design. [Figure 27] will show us.

Figure 27 Rectangular drain construction work in Gulshan.

We also discovered another type of drain construction, which is shaped like a rectangle and allows water to enter while passing through a pipe. Additionally, that method is the subsurface drain, although it is also visible in Dhaka. We discovered that the drain project, depicted in [Figure 28], is now being built at Naya Bazaar, Dhaka. In [Figure 29], we can also observe the process of water passing via a pipe.

Figure 28 Subsurface drain in Naya Bazaar, Dhaka

Figure 29 Subsurface drain passing water through the pipe.

This kind of drain is full of rubbish without any water, and the plastic waste endangers the future usage of our river. Additionally, such trash puts our ecology and environment in danger. The river will perish, along with the river life and its fish. This type of garbage, as we can see in [Figure 30], is already endangering the Turag River. A net that is placed into the pipe's mouth where the waste exits can be used to solve those issues; [

Figure *31*] illustrates this. Constructing the long-line drain seen in [Figure 34], we may allow our drain water to flow via the Diu campus waterway.

By the way, if we ever want to clean our drain, we can see from [Figure 32] & [Figure 33] that the final drain is simple to clean inside, while the first one is difficult to clean and may cause injuries to workers.
Therefore, even though selecting option number two would be more expensive, we did so since it would require a longer cleaning procedure, as seen in [Figure 33].

Figure 30 Pass through the waste drain into the Turag River

Figure 31 Safe our environment and rivers from drain waste by using net

Figure 32 Putting hassle to clean waste in the pipe drain

Figure 33 Easy to clean out waste in surface drain

Figure 34 Pass through the rainfall water in the campus lake by constructing a drain.

Here, we are free to select any drainage design, such as the trapezoidal or rectangular forms that were discussed in the previous lesson. However, we decided to design our project site in a rectangular shape. We guarantee the reasons listed below;

Benefits of Rectangular Drain Design:

- Space Efficiency: Rectangular designs have the potential to be more space-efficient, which makes them perfect for confined or urban settings where optimizing usable space is essential.
- Simplicity and Ease of Construction: Because rectangular drains are consistent and require less complex formwork, they are frequently simpler and less expensive to construct.
- Maintenance: Because there are fewer curves and crevices for dirt to collect, the straight sides and flat bottom of rectangular drains make them easier to clean and maintain.
- Consistent Flow Characteristics: The homogeneous cross-section that rectangular drains offer results in consistent flow characteristics. When consistent flow rates are necessary, this is helpful.

Restrictions:

- Flow Capacity: Because of its vertical sides, rectangular drains may have a lower flow capacity than trapezoidal drains of the same width.

- Erosion Resistance: Rectangular drains' flat bottoms may be more prone to erosion, particularly in situations with high flow rates.

Generally speaking, rectangular drains are easier to install, need less upkeep, and fit into tight locations. On the other hand, bigger capacity, resistance to erosion, and natural environments are more suited for trapezoidal drains. The optimal option ultimately depends on variables including anticipated flow rates, environmental concerns, building costs, and maintenance schedules. We will be able to choose the best drain design for our project by carefully examining these criteria.

Other roadside drains in our city and the interior drains at our university likewise have a rectangular form with a side design. Its cost-effectiveness and ease of repair at any moment are our primary reasons. Furthermore, our entire drain is a surface drain that has been symbolized by the road. In the drain, we installed a concrete block cover slab.

CHAPTER 6 CONCLUSION

6.1 Conclusion

In the Diu Campus situation, we used drains because they effectively remove surplus water from roadways, drains decrease waterlogging, lessen soil erosion, and increase road lifetime. By lowering the possibility of hydroplaning, they also increase safety. Effective drainage systems also control runoff to shield the environment from contaminants, guaranteeing long-lasting road infrastructure and safer driving circumstances. Surface runoff calculations are essential for designing drainage systems, managing flood risks planning urban infrastructure by understanding and applying the rational method and estimating runoff from precipitation data. Planning urban infrastructure by understanding and using the rational approach, estimating runoff from precipitation data, and constructing drainage systems all depend on surface runoff estimates. As per our study, the rate of rainfall is 0.018472222 mm/sec. The amount of surface runoff from precipitation is 0.9 m^3/sec. In this drain, we found a 0.042% slope. The drain has the same 0.6 m width and height. When we build our whole roadside drain, several 29,500 no's brick pieces will be needed for the drain. We require 700 cubic feet of fine aggregates and 130 bags of cement. This roadside drainage system improves public safety while protecting the road infrastructure. This approach not only addresses immediate drainage needs but also contributes to the long-term sustainability and resilience of urban and rural landscapes.

6.2 Limitations of Our Study

We studied the development of the drainage system analysis to additional campus areas, the implementation of a comprehensive maintenance plan, and the ongoing performance monitoring of the drainage system for our thesis paper.

1) We focus on correctly planning the drain in this project, although wastewater management is not used. Therefore, to utilize this drain effluent, others must work on it.

2) Improve the sustainability of this drain to save the environment. so that society is not harmed.

3) Prepare ahead of time before working in the field to avoid harassment while taking a stand.

4) It is recommended to conduct surveys on non-peak days on university campuses, as high crowds on normal days might disrupt the process and lead to inaccurate findings.

5) According to the field survey, there are no more justifications reasons for new road development projects.

6.3 The problem faced during the project:

There are specific challenges in doing a thesis on drainage system analysis because of the mathematical, approach, and external influences involved. The following are some typical issues that we may run across when writing a thesis of this kind:

1) Since every level machine has been ruined, we must inspect them to use our work.
2) The measuring scale was damaged before to our job; therefore, we marked it with a marker.
3) Due to rain, a pause is required on the day of the survey. Then, we are unable to collect data using the level machine.

References

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