Design of drainage and retaining wall for shukursagar, Osman nagar

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Abstract: The South-west zone of Hyderabad that is shukursagar, venkatapuram, balapur, Telangana. Is one of the low-lying area of rajendranagar mandal which have been experiencing water logging for the last few years even a little rainfall now causes a serious problem. The area suffers from drainage congestion and water-logging especially during rainy season. Dumping of garbage on roads, uncleared or blockage of free flow of water and increased urban development's not providing sufficient drainage results in water logging leaving the area inundated for several days. No exit point to drain-out the water have created an unhealthy environmental situation and causes inconvenience to the residents of area including damages to the infrastructure, loss of business, no transportation and spreading of diseases. The frequency of these problems have been increasing day by day creating adverse effects on people of Shukursagar. It is observed that there is a lack of planned and adequate drainage network system. This area have a distinct slope, so standard draining by gravity may not always be possible. This problem have created major challenges of development and to keep balance between environment and development. It have been identified that improvement of the drainage system is one of the highest priority needs of the area for better living environment. This work is trying to analyze and portray the main water-logged zone, to fetch the proper drainage planning to overcome this problem while reviewing the status of existing drain of the area, Construction of retaining wall around the effected area , Recognizing the problems of drainage and storm water stagnate, we are providing circular pipes connected to household then to roads, and from there to main pipe of venkatapuram .These are the solutions we came up with for development of the area.

Keywords: Drainage, waterlogging, retaining wall, water pipes, slopes

I. INTRODUCTION

The city has a natural drainage pattern due to gently rolling terrain with sufficient gradients to drain off water easily into the main drainage channels that is lakes and rivers in Hyderabad. The main lakes in which drain water flows are Hussain Sagar, Durgam Cheruvu, Osman Sagar, HimayatSagar, Shukur Sagar, Mir Aalam Tank, etc .Due to the faster growth of population and rapid increase in the land prices habitation has extended to the low lying areas which do not have proper drainage Outlets.

Fig 1 - Open Drainage and dumped garbage

Fig 2 - Submerged houses of shukursagar

Dumping of garbage, particularly plastics, causes serious reduction in waterways of main drainage channels. In the old city areas, space for construction of road side drains is a major problem. Even 60% to 70% of the houses which do not have sewer connection are discharging their waste into the existing drains, causing serious environmental problems due to which results overflow and backflow of water in residential and commercial areas. The Proposed drainage system should comprise of 3 components :

(1)Main drains along main roads.
(2)Area drainage, where problems have been identified.
(3)Branches and Lateral Drains.

Rectangular drains are proposed in the town because in most of the areas land availability is the constraint up to 1.05 meter depth, there are two alternatives -

(a) Stone masonry drains (b) RCC drains

We have interacted with the people and came to no that the water overflows during the rainy season. Which causes the houses to submerge and weaken the foundation Also when the rainy season beings people vacant their houses and leave the area.

FIG 3 - PUBLIC INTERACTION (1)

FIG 4 - PUBLIC INTERACTION (2)

• Retaining wall is a rigid one which supports the soil mass at the different levels and also soils with different sloped profiles, reinforced retaining walls uses reinforcing steel to take care of the tension forces and stresses being developed in the concrete mass. Retaining walls are supported by a wide base to stabilize the structure against the sliding, overturning etc. Common types are listed gravity walls, cantilever retaining walls, counterfort retaining walls, counterfort retaining walls with relieving platforms, buttress walls. Loads acting on the retaining walls can be classified based on load categories such as self weight of the wall, lateral loads from the soil, water table effect, the superimposed load with the provision of vehicles transportation and the earthquake loads originating from the vibrations of the ground.

1- Dead load 2- Live load 3- Surcharge load 4- Seismic load

• When a soil mass is retained at a higher level by a retaining wall, the retained mass of the soil tends to slide and assume a flat slope for equilibrium, which is resisted by the retaining wall.

1. Active earth pressure 2. Passive earth pressure 3. earth pressure at rest

The proposed retaining wall consist of (a) 6.0 meter height with spacing of 3.5 meter and for total length of 728.64 meters.

II. LITERATURE REVIEW

• **Mu'azu Mohammed Abdullahi** made "Evaluation of Causes of Retaining Wall Failure Retaining structures are vital geotechnical structure, because the topography of the earth surface is a combination of plain, sloppy and undulating terrain. The retaining wall resists thrust of a **bank** of earth as well as providing soil stability of a change of ground elevation. Earth pressures on retaining wall are designed from theories of Soil Mechanics, but unfortunately the engineers using them do not always realize the significance of the assumption in their development. and concluded that A design of retaining wall should be thorough and at least the engineer should appreciate the assumption in the derivation of these formulas used. A good backfill material should be used with good drainage characteristics to prevent hydrostatic pressure build – up. A situation where it is not available, water should be prevented from getting into the backfill material to prevent a build – up hydrostatic pressure". The word failure does not necessarily imply catastrophic failure some like a slight sliding of retaining wall should be more aptly described as unsatisfactory performance than a seriously failure.

• **Aranda J.A June 2021**.Excess surface water on roadways due to storm events can cause hazardous scenarios for traffic. The design of efficient road and transportation facility drainage systems is a major challenge. Different approaches to limit excess surface water can be found in the drainage design standards of different countries. This document presents a method based on hydraulic numerical simulation and the assessment of grate inlet efficiency using the Iber model. The method is suitable for application to design criteria according to the regulations of different countries. The presented method facilitates sensitivity analyses of the performance of different scupper dispositions through the total control of the hydraulic behavior of each of the grate inlets considered in each scenario.

• **Ritabrata Sengupta February 2015 "Drainage system".**A survey on the surface water drainage system in West Bengal and the pollution. This work had been conducted under the guidance of Dr A. K. Ghosh. Most of this work was done in 2005 and was supposed to come up as a part of environmental report on West Bengal, which was never published. Data used in this works are taken from various government agencies. I am adding the file, unedited, as it was at the last time I looked at the work.

• **Punde Gayatri V.1, Auti Akanksha S.2, Yendhe Rutuja R.3, Yendhe Aishwarya A.4 ,Shelar Trijeta** made Design of Retaining Wall, "Retaining walls are usually built to hold back soil mass to retail soil which is unable to stand vertically by themselves. However, retaining walls can also be constructed for aesthetic landscaping purposes. They are also provided to maintain the grounds at two different levels. Retaining walls shall be designed to withstand lateral earth and water pressures, the effects of surcharge loads, the self-weight of the wall. All analysis and design are based on the ACI code. The existing shear stack was of great help in a designing the two models . both where set up as full scale model or prototype with accordingly adapted dimension to avoid the breakage of reinforcement during testing , the quantity of geogrids was a deliberately increase this way from the two limit state of internal stability ,only the pull out failure was allowed.

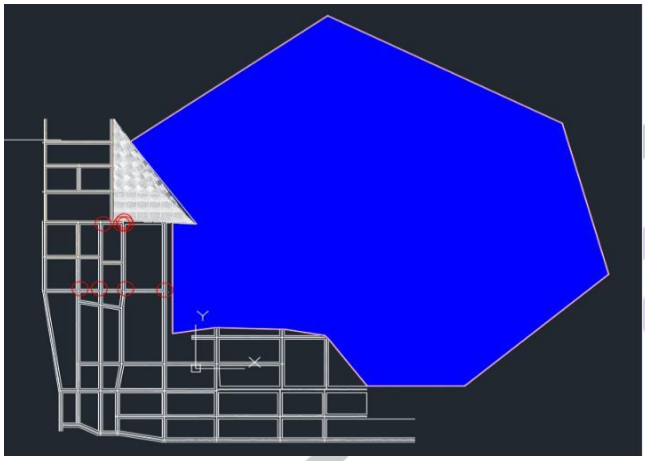
• **B.S. Tasildar investigated Stability of Retaining Wall under Seismic Load:** A Review, A wall designed to maintain a difference in the elevations of the ground surfaces on either side of the wall is called a retaining wall. It is a very common civil engineering structure and is extensively used in railways, bridges, canals and other engineering works, Provision of a horizontal relief

shelf projecting from the stem of retaining wall into backfill is known to reduce the total active earth pressure acting on the wall .This results in a reduction in the overturning moment and consequent economy in the design of the stem and slab base.. It is observed stability of retaining wall is a very crucial matter. There are number of failure modes for the retaining walls. Horizontal shelves on the vertical wall (stem) of retaining wall can be proved to be useful parameter for stability of wall. By offering number of changes stability of retaining wall can be enhanced.

III. METHODOLOGY

Modeling of structures : I

Drains plays a major role in flowing of waste water from an unwanted area. Drains are used to draw off waste liquid gradually. The important uses for a drainage system as part of existing and developing urban systems or cities. This could be floodwater, rainwater, and different kinds of run off. Drainage systems are also in place to remove wastewater effectively, and this is referred to as a sewer system.



. FIG 5- DESIGN LAYOUT OF SHUKURSAGAR.

FIG 6- PIPE INSTALLATION

The design layout shows that the Streets with wider width are having major pipes of diameter 1.2 meter and length of 5 meter and streets with lesser width are having smaller diameter pipes of 0.35 meter with 1 meter length. The small pipes are connected to the households then to major pipes and through major pipe lines, sewage and runoff is passed to the venkatapuram's main drainage line. The Drainage have a gradient of 1 in 40 with adequate flow velocity.

Modeling of structures : II

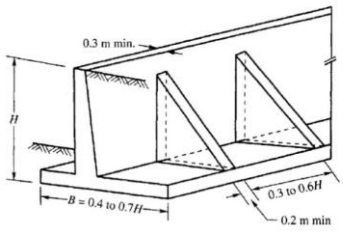


Fig 7 – Counterfort retaining wall.

Fig 8 – R.C.C. Retaining wall

The retaining wall is designed for both ultimate and service limit state the steel requirement for toe, heel and stem slab is computed form Indian standards . The counterfort are designed to resist high moments and shear forces. R.C.C counterfort retaining wall of height 6 meter including column load in line with 3.5 meter thickness of wall and spacing between them is 3.0 meter. Here Material used are M20 grade concrete and fe415 steel with mix proportions of 1:3:5 as per Indian Standards. The toe projection is of 0.875 m.

Stem or upright slab is designed as continuous slab to span between counterfort. This dimensions are carried out for the length of 1.6 kilometer across the lake And can withhold the 154444.46 cubic meter of water and more.

IV. RESULT AND DISCUSSION

The learnt area, (shukursagar) have a gradual slope where there is no Drainage and causes water stagnation. Secondly, no proper disposal of garbage and removal of stagnate water which causes harm for health of both human and cattle life. In order to over these problems,

A. For the free flow waste water

Providing drainage for every individual streets of the area with major pipes and minor pipes with respect to length and width of the streets.

The drainage have a gradient of 1 in 40 with adequate flow velocity.

Dimensions of major pipe:

Diameter of pipe = 1.2 meter

Length of pipe = 2.5 meter
Dimensions of minor pipe :
Diameter of pipe = 0.35 meter
Length of pipe = 0.85 meter
The minor pipes are connected to the households then to major and through major pipe lines – sewage and runoff is passed out to the venkatapuram's main drainage line.

B. To tackle the future floods and overflow from the lake

A R.C.C. counterfort retaining wall is design and constructed as per Indian standards code book (IS 456 2000)

Dimensions of counterfort retaining wall :

Length of retaining wall = 1.6 kilometers
Overall depth of wall = 7 meter
Depth of foundation = 1meter
Height of wall above ground level = 6 meter
Base width of wall = 4.55 meter
Thickness of wall = 3.5 meter
Heal width = 2.74 meter
Toe width = 1.52 meter
Toe projection = 0.875 meter
Thickness of base slab = 0.4 meter
Spacing of counterfort wall = 3 meter Center to Center

V. CONCLUSION

It is evident from the above study that the waterlogging and improper drainage is a major issue in the shukursagar area and the study reveals that the level of water increased over the last 2 years because of which water stagnation had occurred in shukursagar lake. It has been found out that these problem occurrence in the study area by interaction of various factors.

1. The shukursagar lake is in low lying area because of which the waste water from household is flowed in lake only.
2. To overcome these problems, we have provided RCC circular pipes in every street's which helps in freely flow of water from the household to main drains and through venkatapuram's main drainage line.
3. The free flow of water in the drainage pipes leads to pollution free and no diseases zones.
4. As it is RCC structure, life span is more than 50 years due to highly corrosion resistant.
5. A retaining wall is one of the most important types of retaining structures. It is extensively used in variety of situations such as highway engineering, railway engineering, bridge engineering and irrigation engineering.
6. This Retaining wall withhold the water entering the houses and surrounding area.
7. Wall moments in counterfort retaining walls are 76.46% lesser when compared with cantilever retaining walls which gives longer structural life and better working stability.
8. Retained water can be use for domestic purposes and for plantation purposes.
9. From the above solutions, we can conclude that the people of shukursagar lake can live a healthy and happy life.

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