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# AN OVERVIEW OF WATER LOGGING PROBLEMS IN AN URBAN AREA OF NADIAD CITY AND PROBABLE ANALYTICAL SOLUTIONS

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**Abstract:** Water logging is a fundamental problem during moderate and extreme rain weather for low laying areas. Except low laying areas some of the structures which have depression included itself within the structure below the ground level and are exposed or in open condition are also very much affected by water logging problem. Due to this problem not even structure but surround structures, environment, transportation facilities associated with it are also damaged to moderate to severe level. Maintenance of such kind of structure and associated structure is costly. In these review paper we have provided an overview of water logging problems of a railway underpass situated at urban area of Nadiad city, which is located in Gujarat state of India. We have also provided possible solutions to remove this problem for above mention region.

**Keywords:** Water Logging, Heavy Rain Condition, Low Lying Area, Railway Underpass, Urban Area

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## INTRODUCTION

Nadiad city is located at in kheda district of Gujarat, having total area of 45.16 sq/km and it is considered as the administrative centre of kheda district. Nadiad has population and population Density of 225139 and 5000 persons/sq.km respectively. This city has an elevation of 35m (114ft.) above mean sea level. For overview problem of water logging and its solution we have selected the railway underpass which is situated at the southern end of Nadiad Railway station. (Sensus 2011)

**Figure 1: Google map view of Nadiad city**

The site is located near Nadiad railway station. The underpass Lies at the southern end of Nadiad Railway station. This is a main underpass of Nadiad connecting ST Bus depot, Administrative building & other important business centre of Nadiad.

The underpass gets water logged every year in monsoon due to which the whole traffic system gets blocked for many hours. This is the major problem for Local, official public & other road users. As every year in Rainy season Nadiad Railway underpass comes in the main list of water logged area. Hence we define the problem as above of Nadiad railway underpass.

**Figure 2: Location Of Underpass**

As per newspaper articles (local newspapers) due to this waterlogging the whole traffic systems gets blocked for some hours or diverted to some other routes and this directly affects the local/professional public. As earlier we mentioned that Nadiad railway underpass comes under water logging area due to which the whole traffic systems gets blocked for some hours. This underpass is one of the major underpass of Nadiad. The gravity of the land, slope and drainage issue compounds the problems during heavy rains in the city. Rain water flows down and gets accumulated at one place in the underpass. Also, some waste materials like plastics ,rags etc which floats with water gets accumulated in the catch pit openings due to which drainage of storm water is affected which increases the water level of surrounding areas.

**Figure 3: A flooded street near underpass after heavy rains**

**PROBLEM SUMMARY**

As Nadiad railway underpass is water logging prone area due to which the following problems are raise in front of public and systems.

(1) Traffic systems may get block/divert.
(2) The local areas are also comes under this situation.
(3) Due to this people get affected by dengue/malaria.

**(1) TRAFFIC SYSTEMS MAY GET BLOCK/DIVERT**

During rainy season generally the underpass is submerged and holds the whole traffic systems of this route. And as it is near railway station and bus stand which is most important part for connecting Nadiad to other places and also official work area and many schools, residential area comes near it. Due to which sometimes the local/official public are stuck in this underpass and it can directly affect the whole traffic systems.

**(2) WATER LOGGING AT RAILWAY UNDERPASS AFFECT THE LOCAL AREAS:**

As the areas near the Nadiad railway underpass is also submerged with underpass in the rainy season. There is some gravity inland difference and sloping between surrounding areas and

underpass due to which it can create the waterlogging condition in directly/indirectly manner. There is also some gravity difference in the drainage provisions in underpass and nearby areas.

**(3) PUBLIC HEALTH IS BADLY AFFCTED BY WATER LOGGING:**

Due to heavy water logging in underpass and in surrounding areas this area is also act as breeding places of mosquitoes and every year there are numbers of people in nearby areas who suffer with diseases like malaria and dengue.

**LITERATURE REVIEW**

1) WATER LEVEL INDICATOR

The invention of "water level indicator" was done by MARKOSE ELDOSE of Kerala (INDIA) In this we studied to insert the device the calibrated cable with the sensor by rotating the handle connected to the wheel into the bore well. When the tip of the sensor touches the water level the led glows and the buzzer makes a beep sound after getting audio and video signal for detection of water stop the rotation of the wheel and measure the water level looking at the calibrated cable.

2) Lanjun Zou, Zhi Wang and Yinming Yang study on the topic assessing the Urban Waterlogging Risk under Rainfall Condition in Shanghai china in 2012

Their paper focuses on the effect of weather and drainage conditions on urban waterlogging risk. The main objective is to examination whether or not weather rain condition impacts urban area and road in Shanghai. This general examination is a contribution that allows policy makers to assess the appropriateness of local traffic management strategies. To achieve this goal, the paper analyses urban accumulated water and drainage data of over 260 different parts in shanghai with a historical series of ten years to find out the relationship between rainfall and ponding depth at the different traffic locations with the heterogeneity of the weather effects. Thus, six levels of urban waterlogging risk are set up with six different colours. With the statistical relationship between rainfall and ponding depth, AWS rain gauge data, radar QPE and NWP rainfall data are engaged in to predict urban waterlogging risk condition in Shanghai. The results indicate that rainfall increases the traffic intensity, and the perdition or warning information of urban water logging risk is useful to diminish traffic intensity. Further findings might be possibly achieved by studying rainfall impacts on local roads and by shifting the focus of research toward local human travel behaviour. (Aili Pyhälä et al. 2016)

3) Delhi government civil planning and water management department carried out a detailed study on dwarka underpass water logging and published a report on 31/07/2009.

According to this report Dwarka Underpass has been in the news for the sheer visual shock of seeing 6m (20ft) high column of water on a road after a more than average rainfall in a single day. Actually, the water was standing not just in the underpass but also on the road leading into the underpass from both sides. Approximately, 1.5 km stretch of road including the underpass had water logging. The water logging was so bad that, even today, 4 days after the downpour, and hectic efforts to pump out the water, the road is still blocked for traffic.

4) Neel opal Adri and Ishrat Islam from Dept. of Urban and Regional Planning, University of Engineering and Technology (BUET), Dhaka, Bangladesh carried out a study on Water Logging in Keshabpur:

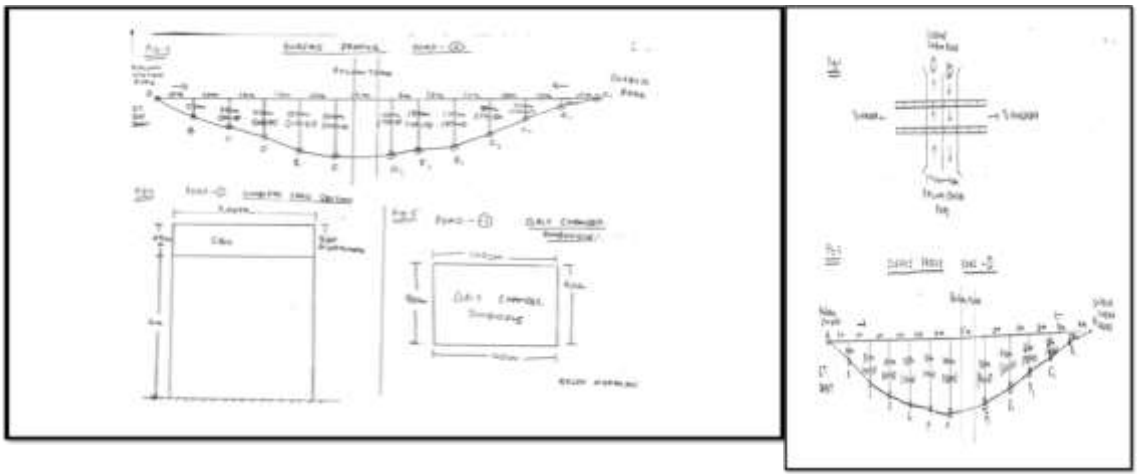
In this they focused to the Coping Strategies of the People and observed that Water logging has been disrupting livelihoods of about one million people in Bangladesh during past two decades. South-west Bangladesh is prone to water logging due to the vulnerable geographical setting and climate change. The worst hydro-geophysical vulnerability has been found in Keshabpur Thana of Jessore District where most of the land is waterlogged for over seven years. The researchers tried to identify people's unique coping strategies under such adverse environmental condition. Necessary data were collected through questionnaire survey, Focus Group Discussions (FGD) and Participatory Vulnerability Assessment (PVA) tools. About 270 households of the study area were surveyed. Major findings revealed the constraints towards reducing people's vulnerability such as climate change, poor coordination among stakeholders, limited institutional initiative of coping etc. Accordingly researchers tried to put some necessary recommendation such as promoting agricultural and institutional coping immediately in the study area. (Neelopal Adri and Ishrat Islam, 2012)

5) A report was published in Intelligent System Design and Engineering Applications (ISDEA), 2013 Third International Conference on 16-18 Jan. 2013

It focussed on Water logging control standard is an important basis for the determination of the distribution and scale of water logging control projects. Studying on water logging control standard is of important practical significance for both controlling water logging and ensuring food security. The research status of water logging control standard is generalized from the perspectives of the expression, control index and the calculation of drainage modulus. And its economic, environmental, ecological and social attributes are discussed in greater details here. Then the limitations of the traditional researches of water logging control standard are pointed out: the present way to determine water logging control standard emphasizes crop growth, yield and economic benefits of projects. Whereas the quantified research about the environmental, ecological and social effects of water logging control is inadequate, and the standard is lack of the corresponding evaluation system. Therefore, the necessity of research on the integrated control standard of water logging is proposed. In addition, its development direction and some problems needed further study are also demonstrated. (W. Lou et al. 2013)

CURRENT SCENARIO OF UNDERPASS

**1. Profile Levelling:**



**2. Size of underpass:**

- Width of road - 4.0 m.
- Width of underpass – 4.0 m.
- Height of underpass – 3.048 m.
- Thickness of slab – 0.9144 m.
- Total height – 3.962 m.
- Size of grit chamber_1 – 140.0 cm * 90.0 cm.
- Size of grit chamber_2 - 183.0 cm * 91.0 cm.

**Figure 4: Choked Grit chamber**

3. Water-table data:

- In Monsoon time: 55 ft.
- In Summer time: 80 ft.

(As per Nadiyad Nagarpalika)

4. Details of Drainage Pumping Station:

# Detail of Drainage Pumping Station

| Name Of Pumping Station | Depth | Wetwell Dia. ø | Drivewell Dia. Ø | Type | Inlate / Inlate Pipe Dia. ø | Screen Chamber |
|---|---|---|---|---|---|---|
| Shreyas Pumping | 27' | 4' | - | Wet. | 12' Dia | - |

5. Rainfall data:

District : KHEDA

Note : (1) The District Rainfall(mm.)(R/F) shown below are the arithmatic averages of Rainfall of Stations under the District.
(2) % Dep. are the Departures of rainfall from the long period averages of rainfall for the District.
(3) Blank Spaces show non-availability of Data.

| YEAR | JANUARY | | FEBRUARY | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUGUST | | SEPTEMBER | | OCTOBER | | NOVEMBER | | DECEMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R/F | %DEP. | R/F | %DEP. | R/F | %DEP. | R/F | %DEP. | R/F | %DEP. | R/F | %DEP. | R/F | %DEP. | R/F | %DEP. | R/F | %DEP. | R/F | %DEP. | R/F | %DEP. | R/F | %DEP. |
| 2008 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 35.9 | -65 | 207.0 | -36 | 313.5 | 21 | 201.5 | 37 | 0.0 | -100 | 0.0 | -100 | 0.2 | -86 |
| 2009 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 1.7 | -98 | 285.0 | -12 | 144.8 | -44 | 3.0 | -98 | 13.6 | -11 | 2.8 | -75 | 0.0 | -100 |
| 2010 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 21.9 | -79 | 264.8 | -18 | 408.6 | 57 | 117.3 | -20 | 0.0 | -100 | 33.8 | 196 | 0.6 | -57 |
| 2011 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 4.1 | -96 | 145.8 | -50 | 374.6 | 44 | 59.8 | -60 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 |
| 2012 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 | 25.0 | -77 | 124.9 | -57 | 222.5 | -14 | 272.0 | 81 | 0.0 | -100 | 0.0 | -100 | 0.0 | -100 |

(Source of Information Metrological Department of India)

6. Rainfall condition of Nadiad city:

- Cumulative rainfall:

- Average rainfall: 651.54mm.
- Duration of rainfall: June to December

| Year | Rainfall (mm) |
|---|---|
| **2008** | 758.1 |
| **2009** | 450.9 |
| **2010** | 847.0 |
| **2011** | 557.3 |
| **2012** | 644.4 |

8. Disposal pattern of underpass:

- For removal of water at the underpass there is a provision of grit chambers of size 140cm.* 90cm and 183cm.*91cm. In case of heavy rainfall when grit chamber is not sufficient to remove water at the underpass.
- Then pumping system is carried out in which pumped water is disposed into the sherdi river, from their water flows to gulf of Khambhat by open flow.

METHODOLOGY ADOPTED

- Based on data collected from municipality we will design the storm water drainage system with the help of various storm water design manual.
- Existing storm water design facilities will also be studied and now requirement of these facilities will be identified.
- Besides this requirement if some new techniques or remedies can be approached base on the storm water drainage system design, these can be taken into consideration thus full filling the gaps and between the existing and what should be exact design elements for minimizing the water logging problem.

PROBABLE SOLUTION

- Proper cleaning of grit chamber.
- Pump efficiency increase.
- Proper arrangement of site drains.
- Pumping water into a water chamber and then connecting the chamber with the main drainage line of the city.

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