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DEVELOPMENT OF INTEGRATED ROAD DRAINAGE SYSTEMS FOR THE IMPROVEMENT OF IRRIGATION ENGINEERING PRACTICE AND ECOLOGY CASE STUDY: REVA UNIVERSITY CIRCLE JUNCTION TO NAGAWARA CIRCLE

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ABSTRACT

The contributed runoff water thus need to be safely disposed to the rivers/outlet channels so that the functional utility of the road infrastructure maintained and thereby avoid the damages which otherwise occurred to the road and property. Adequate drainage is very essential in the design of highways since it affects the highway's serviceability and usable life. If ponding on the traveled way occurs, hydroplaning becomes an important safety concern. Drainage design involves providing facilities that collect, transport and remove storm water from the highway. Storm water in urban areas was traditionally managed by designed sewer systems for the prevention of the collection of excess water on urban surfaces and the reduction of risk to people, health, property, society and the natural and built environment. The objectives of this study was to study of road network geometry, Rainfall data, Drainage system network, collection point for drainage water & used same for ecology development and irrigation engineering practice purpose. Case study was conducted for the road network from REVA University circle junction to Nagawara circle from June 2016 to march 2017. Data collected was then be analyzed qualitatively and quantitatively. Analyzed data is presented in tables. it was found that the existing road drainage network is not effectively enough to collect effectively for the aimed purposes. It was also found that an integrated drainage network section of 2m x 3m is required. This will help us to come out of water crisis.

Key words: Road Network Geometry, Integrated Road Drainage System, Urban Road Surface, Rainfall, Ecology, Irrigation Engineering.

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1. INTRODUCTION

Indian road network is consisting of expressways length is 1000km, National highway length is 100,087.00km, and state highway length is 1, 54,522km length. Bangalore urban itself we have 950km road length. During normal, medium & high rain fall periods, 85% of runoff water which is collected by road drainage/storm water drain is getting wasted because of improper integrated road drainage systems. From well-planned integrated road drainage systems, we can use Approximately 5 TMC of runoff water in Bangalore city itself. It is most feasible solution for water scarcity in urban & surrounded districts. The contributed runoff water thus need to be safely disposed to the rivers/outlet channels so that the functional utility of the road infrastructure maintained and thereby avoid the damages which otherwise occurred to the road and property. Adequate drainage is very essential in the design of highways since it affects the highway's serviceability and usable life. If ponding on the traveled way occurs, hydroplaning becomes an important safety concern. Drainage design involves providing facilities that collect, transport and remove storm water from the highway. Storm water in urban areas was traditionally managed by designed sewer systems for the prevention of the collection of excess water on urban surfaces and the reduction of risk to people, health, property, society and the natural and built environment.

1. Problem statement

Bangalore city is having 950 km road length among which SH104 from REVA University circle junction to Nagawara circle is 4 lane divided road with median with cross slope of 2.5% and at curve locations emax 5% is adopted. Basically because of improper integrated drainage system most of the runoff water which is getting wasted, during one rainy season approximately 5TMC of runoff is getting wasted in overall Bangalore city. Because of over flooding of roads resulting to accumulation of silt on the road leads to reduction of skid resistance.

B. Objectives of the study

- Study of road network geometry, road condition, category of road, road inventory.
- Study on rain fall data for the selected road network area.
- Study on road drainage & storm water drainage network
- Study of lowest point location to collect rain off water received from road integrated road network drainage system
- Study on road side tree / plants can be grown.

C. Significance of research study

- The collected runoff the road surface used for irrigation practice and ecology development by scientific methods or techniques to quantify the same.
- The runoff collected from the road surface will be helpful to overcome the water crisis for irrigation

D. Scope of the study

This research study was carried to SH104 from REVA University circle junction to Nagawara circle in Bangalore city. The study is to analyse the Existing Road surface drainage, integration between Road drainage Network and Storm water, Road geometry study and present serviceability. These study addressed Problems related to road surface drainage and integration between storm water drain networking.

The exact study is focused to study of Existing road drainage network, Existing Condition, maintenance of road and drainage infrastructures, impacts of integrated road drainage network. Collection of runoff water from the network and using same runoff water for ecology improvement.

E. The Study Area Description

Study area is located in Bangalore city which is so called Silicon Valley and Information and technology hub of India. The study area which is SH104 from REVA University circle junction to Nagawara circle in Bangalore city length of 21km. Road network which connects to Proposed Information and technology park which having 4-lane divided carriage and longitudinal drain of size 1.5mX1.2m RCC Box drain.

2. LITERATURE REVIEW

The following research materials published by different authors who have been engaged to reinforce the research work.

- Assessment of the Effect of Urban Road Surface Drainage: A Case Study at Ginjo Guduru Kebele of Jimma Town
- Best Practice Handbook on Road Side Vegetation Management
- Trees, people and the built environment Proceedings of the Urban Trees Research Conference 13–14 April 2011Using
- Highway Surface Drainage System & Problems of Water Logging In Road Section Management
- The Urban Forest in the Roadside: Public Values and Transportation design

3. RESEARCH METHODOLOGY

A. Study setting\Area

Descriptive and exploratory types of research methods are adopted in which Descriptive method adopted to describe the existing condition of network and exploratory type adopted for physical measurements, same can be compared with standards. Study area is located in Bangalore city which is so called Silicon Valley and Information and technology hub of India. The study area which is SH104 from REVA University circle junction to Nagawara circle in Bangalore city length of 21km. Road network which connects to Proposed Information and technology park which having 4-lane divided carriage and longitudinal drain of size 1.5mX1.2m RCC Box drain.

B. Study Design\Data types

Data collection has been carried by adopting both Quantitative as well as qualitative data types. 80% of research data was collected from field surveying physical measurement and 20% of data was collected from secondary data sources in order to strengthen the data sources.

C. Data Collection Methods

Data collection has been carried out by two systems or methods for the present case study. Those are by field measurement of surveying operation was done by using survey equipment's like measuring tape, Dumpy level, Total station and hand GPS. Secondary data collection like Topographical sheets, Rain fall data, hydrographs etc.

D. Data Processing and analysis

The collected had been checked and analyzed by using software's like Auto cad, Civil3D and Microsoft office software

4. RESULT AND DISCUSSION

A. Existing Road Geometry, pavement structure and drainage network

Urban roads are classified into four categories. These are arterial, sub arterial, collector streets and local road. Present case study comes under arterial roads and pavement cross section given in figure 1. Recently overlay of 110DBM and 40BC were constructed to strengthen the existing surface.

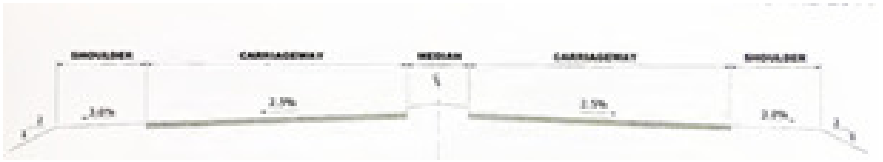

Figure 1 Typical Pavement Cross Section

Most of the locations side drains silted up and no inter connectivity. Following Table:1 shows condition of study area.

Table 1 Chainage wise Cross slope along the road

Chainage		Cross slope in %	Longitudinal Drains	Remarks
From	To			
0+000	3+575	2.5	1.5X1.2 RCC Drain available	REVA University circle junction
3+575	4+350	3%	No Median drain but Longitudinal Drain of 1.5X1.2 RCC Drain available	Super elevated Section
4+350	6+500	2.5%	1.5X1.2 RCC Drain available	Normal
6+500	7+100	5%	No Median drain	Super elevated Section
7+100	8+350	2.5%	1.5X1.2 RCC Drain available	No interconnectivity of Drain network
8+350	9+000	3%	1.5X1.2 RCC Drain available	No interconnectivity of Drain network
9+000	15+000	2.5%	1.5X1.2 RCC Drain available	
15+000	18+350	3%	No Median drain but Longitudinal Drain of 1.5X1.2 RCC Drain available	No interconnectivity of Drain network
18+350	21+000	2.5%	1.5X1.2 RCC Drain available	

B. Runoff calculation and hydraulic capacity

Present case study, the runoff water generated from the road surface was determined by IRC SP 42-2014 and IRC SP 50 2013. Hydraulic capacities of the open channels were determined by using manning's Equation. Peak hour rate of runoff and hydraulic capacity of channels were calculated and presented in the below.

5. CONCLUSION AND RECOMMENDATIONS.

After research study and critical analysis it was found that geometry of the road is good and present road surface serviceability is good. Longitudinal road side drains are insufficient to carry runoff water if at all average of 600mm rainfall happens. Road side drains are silted up everywhere because of improper maintenance. There is no integration between side drain and storm water drain.

- Rain water harvesting from Road surface can be implemented as effective method for the improvement of ecology, irrigation engineering practice, crop pattern & formers economy.
- Road drainage /storm water drainage- integrated road drainage systems can be helped to come out from water scarcity issues.
- Ground water table will be increased drastically.
- No Flooding's will happen if any zone if connected with integrated road drainage systems

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