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Envirokerb – A Linear and Combined Drainage System

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Abstract: *Poor subsurface drainage is one of the factors that causes pavement distress and reduces pavement service life. The evaluation of roadway subsurface drainage system required good knowledge in groundwater flow especially the unsaturated water flow through pavement layers and related properties that affect the ability of drainage system to remove moisture held in base, sub base and sub grade layers, so that the kerbs are provided in the road pavement. Kerb is a line of stone or concrete forming an edge between a pavement and a roadway, so that the pavement is some 15 cm above the level of the road. For most purposes, the top of the kerb should be 100 mm above the road surface. If kerbs are placed too high it can induce 'kerb shyness' which is where the width of carriageway. Over the past few years, the use of Combined Kerb Drainage has grown rapidly, with engineers appreciating the advantages offered over the traditional gully and pipe drainage systems, for car parks and carriageways. Envirokerb is a revolutionary combined kerb drainage system. Envirokerb is made from recycled plastic composite material. The system has excellent surface drainage efficiency which coupled with its large flow capacity, makes it superior to and much less expensive than conventional kerb and point drainage on many highway and non-highway schemes. Envirokerb is made entirely from recycled materials. It is widely acknowledged that the construction industry has a major impact on the earth's already dwindling resource. Existing combined kerb drainage systems manufactured in traditional materials rely heavily on natural resources. There are additional logistical concerns on the transportation of these materials through the smaller countryside communities in the UK.*

Keywords: *Envirokerb, Real-time Control, Optimal Control, Combined Sewer Networks,Flood Prevention.*

I. INTRODUCTION

Roads will affect the natural surface and subsurface drainage pattern of a watershed or individual hillslope. Road drainage design has as its basic objective the reduction and/or elimination of energy generated by flowing water. Highway pavement is carried out to make travelling convenient. Road construction requires the creation of an engineered continuous right-of-way or roadbed, overcoming geographic obstacles that will make the foundation stable and having grades low enough to permit vehicle or foot travel and may be required to meet standards set by law or official guidelines. After pavement, Storm drainage is designed to drain excess rain and ground water from impervious surfaces of the road to

fix defects and preserve the pavement's structure and serviceability. After road pavement, erosion and sediment controls are constructed to prevent detrimental effects. Drainage lines are laid with sealed joints in the road easement with runoff coefficients and characteristics adequate for the land zoning and storm water system. Drainage systems must be capable of carrying the ultimate design flow from the upstream catchment with approval for the outfall from the appropriate authority to a watercourse, creek, river or the sea for drainage discharge Drainage quality is an important parameter which affects the highway pavement performance.

The excessive water content in the pavement base, sub-base, and sub-grade soils can cause early distress and lead to a structural or functional failure of pavement. Drainage is the most important aspect of road design. Proper design of drainage is necessary for the satisfactory and prolonged performance of the pavement. In designing drainage, the primary objective is to properly accommodate water flow along and across the road and conveniently transport and deposit the water o the downstream without any obstruction in the flow. A typical road construction is multi layered in form, comprising of unbound materials.

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Essentially, the lower indigenous subgrade layer is covered by a bound or unbound sub base, providing drainage and frost protection for the subgrade, and the road base layer upon which the asphalt layers are laid as a final surface coating. Poor drainage in pavement can lead to early pavement distresses lead to driving problems and structural failures of the road. The primary source of water in pavements is atmospheric precipitation. This water can enter the pavement through several ways (e.g., cracks, infiltration, through shoulders and ditches, high groundwater) and is moved by an energy Department of Civil Engineering, Guru Gobind Singh Polytechnic, Nashik 4 gradient, such as gravity, capillary forces, osmotic forces, and temperature or pressure differences.

The drainage designer is primarily concerned with saturated gravity flow, which can be determined by application of Darcy's law. To understand and analyse the conditions under which the pavement must function, the designer needs information on highway geometrics, surface drainage, and non-paved subsurface drainage, climate, and soilproperties. These data enable the designer to predict the amount of free water that will enter the pavement structure, to predict the free water surface, and to establish the design subgrade moisture content.

II. METHODOLOGY

Methods of Envirokerb Drainage: There are two methods of Evnirokerb drainage systems. (i) Surface drainage (ii) Sub surface drainage

(i) Surface Drainage: Simplest and most common in India by digging open drainage at suitable intervals and depth (A) Drainage of flat areas – < 2 per cent land slope (i) Random system (ii) Parallel system – ideal both in irrigated and rainfed areas, also known Field ditch system (iii) Parallel ditch system – also known as Diversion ditch system (iv) Bedding system – dead furrow formed, adopted when slope up to 0.5 per cent. v) Interception system – slope > 2 per cent, also known as Slope ditch system. (vi) Broad bed & furrow system (BBF) – bed width 120-150 cm, furrow width 45 cm and 15 cm raised widely practiced in groundnut crop in clay soil.

a. Minimum recommended size of tile is between 10 to 15 cm. b. Surface drainage is generally carried out by – Land shaping. The flow rate from soil to drains depends on: (i) Hydraulic conductivity of the soil (HC)Department of Civil Engineering, Guru Gobind Singh Polytechnic, Nashik 16 (ii) Depth of the drains (iii) Horizontal spacing between drains

(ii) Sub-Surface Drainage: (A) Tile drains- < 2 per cent slope, it includes perforated pipes (i) Gridiron system – Laterals are provided only on one side of mains (ii) Herringbone system (iii) Double main system (iv) Cut off or interceptor – adopted when main source of drainage is from a hilly land. (B) Mole drains: Suitable for clay soils, made with the help of mole plough. (C) Vertical drainage: Drainage by wells. Wells collect water through seepage and collected water is pumped out.

(D) Deep open drainage: Water collected by seepage.

(E) Buried drainage: Draining channel is made below the ground surface and thus filled with tiles, fibres or plastics.

III. LITERATURE REVIEW

The Effects of Poor Drainage System on Road Pavement Author: Tiza& Michael Toryila (2016) carried out to review various research works carried out byresearchers on the effects of poor drainage on road pavement. Poor drainage causes early pavement distresses leading to driving problems and structural failures of road as pointed out by researchers. To prevent or minimize premature pavement failures and to enhance the road performance, it is imperative to provide adequate drainage. The review covered: importance of highway drainage system in road construction, requirements of highway drainage system, and effects of bad drainage system on roads.

The research pointed out areas of concern for drainage designers and road engineers that are of great importance during road construction to ensure that, the constructed road is put to use without failure before the actual design life. The review concluded that effect of poor drainage condition on a road is very adverse. It causes the failure of road in different ways and as well economic hardship on inhabitants of affected communities with devastating effect of sicknesses as a result of breeding of mosquito especially on streets in towns with poor drainage capacity.Proper drainage system provided to the road increases the life of roads. But the improper drainage system causes the failure of the road at its early edge.

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Therefore, effective engineering practices should be considered necessary during design, construction and management of roads and drainagechannels.

A Review of Sustainable Urban Drainage Systems Considering the Climate Change and Urbanization Impacts (2014) Author: Qianqian Zhou Has done climate change and urbanization are converging to challenge city drainage infrastructure due to their adverse impacts on precipitation extremes and the environment of urban areas. Sustainable drainage systems have gained growing public interest in recent years, as a result of its positive effects on water quality and quantity issues and additional recreational amenities perceived in the urban landscape. This Department of Civil Engineering, Guru Gobind Singh Polytechnic, Nashik 8 paper reviews recent progress in sustainable drainage development based on literature across different disciplinary fields. After presenting the key elements and criteria of sustainable drainage design, various devices and examples of sustainable drainage systems are introduced. The state ofthe-art model approaches and decision aid tools for assessing the sustainable alternatives are discussed and compared. The paper further explores some limitations and difficulties in the application of the innovative solutions and suggests an integrated and transdisciplinary approach forsustainable drain.

Multi-objective robust rehabilitation of urban drainage systems under uncertainties UNESCO IHE, Institute for Water Education, Delft, The Netherlands Centre for Water Systems, University of Exeter, UK UNESCO-IHE, Institute for Water Education, Delft, The Netherlands Centre for Water Systems, University of Exeter, UK Arlex Sanchez Torres &Selam Sahlu(2006): Author: Arlex Sanchez Torres &Selam Sahlu Have presented paper upon Urban drainage systems are subject to many drivers which can affect their performance and functioning.Typically, climate change, urbanization and population growth along with ageing of pipes may lead to uncontrollable discharges and surface flooding. So far, many researchers and practitioners concerned with optimal design and rehabilitation of urban drainage systems have applied deterministic approaches which treat input parameters as fixed values. However, due to the variety of uncertainties associated with input parameters such approaches can easily lead to either over-dimensioning or under dimensioning of drainage networks.

The present paper deals with such issues and describes a methodology that has been developed to accommodate the effects of uncertainties into the design and rehabilitation of drainage systems. The paper presents a methodology that can take into account uncertainties from climate change, urbanization, population growth and aging of pipes. The methodology is applied and tested on a case study of Dhaka, Bangladesh.

The urban drainage network optimization problem is posed as a multi objective problem for which the objective functions are formulated to minimise damages costs and intervention costs. Two approaches were evaluated and the results show that both approaches are capable of identifying robust Pareto fronts. Department of Civil Engineering, Guru Gobind Singh Polytechnic, Nashik 9 2.4 Design of Storm Water Drainage System to Enhance Ground Water Level A Case Study on Hosur Inner Ring Road (IRR).

IV. PROBLEM STATEMENT

Commercial, industrial and residential development increases the amount of impervious areas, which in turn increases the frequency and volume of runoff generated from rainfall. This can adversely impact on the natural environment, resulting in increased flooding of land, increased waterwayerosion, transport of sediment and pollutants, and detrimental impacts on aquatic and riparian life. Furthermore, in relation to the built environment, any increase in the frequency and intensity of flooding may impact on property and recreational uses. To minimize the impact on Melbourne's waterways from changes to natural flow regimes, including flood frequency, runoff volume, runoff frequency and flow velocity resulting from urban development.

V. OBJECTIVES

It is essential that adequate provision is made for road drainage to ensure that a road pavement performs satisfactorily. The main functions of a road drainage system are:

- To prevent flooding of the road and ponding on the road surface
- To encourage measures to reuse storm water as part of urban development.
- To ensure piped drains have sufficient capacity to convey minor storm events and guarantee flooding isn't a regular nuisance.

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- To protect the bearing capacity of the pavement and the subgrade material and to avoid the erosion of side slopes.

VI. CONCLUSION

The EVIROKERB Linear andCombined Drainage System offers a sustainable, eco-friendly, and versatile solution to drainage needs in construction projects. This book has explored the design, installation, maintenance, environmental impact, and various applications of the EVIROKERB system, providing readers with a comprehensive understanding of this innovative technology. The benefits of the EVIROKERB system are numerous, including its ability to manage water more efficiently, its versatility in different construction scenarios, and its Eco friendliness. Additionally, the system is relatively easy to install and maintain, making it a cost-effective and practical choice for construction projects of all sizes. While the EVIROKERB system has several advantages over traditional drainage systems, it is important to consider its limitations and challenges. These include the need for proper design and installation, the potential for clogging and blockages, and the need for regular cleaning and maintenance. Despite these challenges, the future of linear and combined drainage systems looks promising, with ongoing research and development aimed at improving their design, efficiency, and sustainability.

As constructionprojects continue to demand more eco-friendly and sustainable solutions, the EVIROKERB system is sure to play a significant role in meeting those needs. Combined kerb and drainage offer a cost-effective approach to water management, providing an efficient high flow channel system within the structure of a kerb. For low to medium capacity road drainage, combined kerb and drainage system delivers excellent surface water removal, minimizing damage during installation with its simple design. Both offer a choice of finishes suitable for urban and rural developments. Single piece Envirokerb provides another low to medium capacity solution, with high strength M-Tech concrete and a recycled inner plastic core construction. The flexible Envirokerb, one-piece kerb and drainage system offers compatibility with the various drainage systems to provide a total water management solution for highways and carriageways.

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