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Envirokerb Drainage System for Highway

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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. 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, Drainage, Industry

I. INTRODUCTION

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 on the downstream without any obstruction in the flow. A typical road construction is multi-layered in form, comprising of unbound materials. 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., 9 | Page cracks, infiltration, through shoulders and ditches, high

groundwater) and is moved by an energy 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 soil properties. 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

Drainage is a basic consideration in the establishment of road geometry and in general this means that:

(a) Cross falls should be a minimum of 2.5% on carriageways, with increased cross falls of up to 5.0% on hard shoulders draining to filter drains; (b) Longitudinal gradients should not be less than 0.5% on kerbed roads; (c) Flat areas should be avoided and consideration of surface water drainage is particularly important at rollovers, roundabouts and junctions; (d) Outfall levels must be achievable; (e) The spacing of road gullies should be sufficient to remove surface water whilst achieving an acceptable width of channel flow. One gully for every 200sq. m of paved surface is generally found to be satisfactory, however, reference should be made to U.K. Highways Agency Advice Note HA 102/00 for more detailed information on the spacing of road gullies.

Kerbs and Gullies

Road surface drainage by kerbs and gullies is commonly used in urban areas and in rural embankment conditions. Surface water flows over the pavement to a kerb at the edge of the road and is collected in gullies which are connected to longitudinal carrier drains set within the road verge. The carrier drain may be a sealed pipe for the collection of surface water only (separate system), or a perforated or open jointed pipe may be used in order to convey both surface water and subsoil water to the outfall (combined system). The gully can be located at the edge of the road pavement, or can be inset into the verge.



Fig 1: Kerbs & Gully (inset into verge)



Fig 2: Side Entry Gully

Combined Kerb and Drainage Block:

These are precast concrete units either in one piece or comprised of a top and bottom section. A continuous closed internal channel section is formed when contiguous blocks are laid. The part of the unit projecting above the road surface looks like a wide kerb and contains a preformed hole on its front face which admits water into the internal cavity. These units are especially useful where kerbs are necessary at locations with little or no longitudinal gradient. They can also be useful where there are a number of public utility services in the road verge, particularly in urban areas.



Fig 3: Combined Kerb and Drainage Block

Linear Drainage Channels

Linear drainage channels can be precast or formed in situ. They are set flush with the surface and contain a drainage conduit beneath the surface into which the surface water enters through slots or gratings. When used on shallow gradients they are prone to maintenance difficulties.



Fig 4: Linear Drainage Channel

Surface Water Channels

Surface water channels are normally of rounded or triangular concrete section, either slipformed, cast or precast and set at the edge of the road pavement and flush with the road surface. Significant benefits can include ease of maintenance and the fact that long lengths can be constructed quickly and relatively inexpensively. Channel outlets can be located at appreciable spacing's and possibly coincident with existing watercourses. However, roads with flat longitudinal gradients may necessitate discharge of channels fairly frequently into outfalls or parallel longitudinal carrier pipes in order to minimize the size of the channels.



Fig 5: Surface Water Channel

Combined Surface and Ground Water Filter Drains (French Drains)

Open jointed, porous or perforated pipes are laid in a trench which is backfilled with a porous media. These trenches are situated in verges adjacent to the low edge of the road pavement. Surface water runs off the carriageway and enters the top surface of the trench, passing through the filter material and into the pipe at the base of the trench. Pavement and capping layers must be contiguous with the side of the trench so that any water within these layers is also collected by the drain. The subsurface water drains through the porous media in the trench and into the open joints or perforated top surface of the pipe. The grading of the filter material is important and must be specified correctly to prevent silting-up of the drain. The filter drain may be enclosed by a geotextile sock to further limit the silting-up of the drain.



Fig 6: French Drain



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III. CONCLUSION

Combined kerb and drainage offers 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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