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REVIEW PAPER ON THE EFFECT OF POOR DRAINAGE ON ROAD PAVEMENT

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ABSTRACT

This study is carried out to review various research works carried out by researchers 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. Therefore effective engineering practices should be considered necessary during design, construction and management of roads and drainage channels.

Key Words: *Poor, Drainage, Road, Pavement, Construction, Accident, Highway, Geometry.*

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 o the downstream without any obstruction in the flow.

II.LITERATURE REVIEW ON ROAD DRAINAGE SYSTEM:

Highway Drainage System

Highway drainage is the process of removing and controlling excess surface and sub-surface water and within the right way. This includes interception and diversion of water from the road surface and sub-grade. The installation of suitable surface and sub-surface drainage system is an essential part of highway design and construction. Highway drainage is used to clear surface water from the highway. Good highway drainage is important for road safety. Roads need to be well drained to stop flooding; even surface water can cause problems with ice in the winter. Water left standing on roads can also cause maintenance problems, as it can soften the ground under a road making the road surface break up and as well lead to an accident from the road users **(Amit, 2016)**. **Dipnoan, (2014)** studied highway surface drainage system and problems of water logging and concluded that adverse roadway elements contributing to highway accidents were substandard roadway alignment or geometry, lack of shoulders and shoulder defects, absent or inappropriate pedestrian facilities, narrow and defective lanes and bridges/bridge approaches, roadside hazards, undefined pavement center and edge lines, poor sight distances and visibility, unmarked and inappropriate design of intersections, serious allocation deficiencies along the route, haphazard bus shelters/stops, and others are causes of water logging problem in highway. This research traced that Proper drainage is a very important consideration in design of a highway. Inadequate drainage facilities can lead to premature deterioration of the highway and the development of adverse safety conditions such as hydroplaning. It is common, therefore, for a sizable portion of highway construction budgets to be devoted to drainage facilities. **Muhammad, (2014)** studied highway drainage system and started that highway is importance for removing water from the road surface, preventing ingress of water into the pavement, passing water across the road, either under or over and preventing scour and/ or washout of the pavement, shoulder, batter slopes, water courses and drainage structures. He identified types of drainage on the highway to include kerb and gullies, surface water channel, combined filter drain (French drain), over-the-edge drainage, drainage channel locks, combined kerb and drainage units, linear drainage channels, fin and narrow filter drain (sub-surface drainage) and edge drainage for porous asphalt. Streams crossing bordering that right of way. This is important because of water damage highway structure in many ways. The water which are dangerous for highways are: Rainwater: Cause erosion on surface or may seep downward and damage pavement (surface drains), Groundwater: May rise by capillary action and damage pavement (sub-surface damage) and water body: May cross a road(river/stream) and may damage road (cross drainage words). In a research on drainage on roads by **Singh, Navpreet and Nitin (2014),** a well-designed and well maintained road drainage is important in order to: minimize the environmental impact of road runoff on the receiving water environment,

ensure the speedy removal of surface water to enhance safety and minimize disruption to road users and to maximize the longevity of the road surface and associated infrastructures. Water in the pavement system can lead to moisture damage, modulus reduction and loss of strength. In order to prevent such damages to the pavement, it is essential to provide proper drainage To the roads. They maintained that the presence of water in a highway layer reduces the bearing capacity of the road, and in doing so it also reduces the structure's lifetime. Highway drainage is used to clear surface water from the highway. Roads need to be well drained to stop flooding; even surface water can cause problems with ice in the winter. Water left standing on roads can also cause maintenance problems, as it can soften the ground under a road making the road surface break up. Requirements of Highway Drainage System: **Ger Finn, et al (2004)** designed the guidelines for road drainage which stressed that drainage is a basic consideration in the establishment of road geometry and in general this means that the drainage should meet the following: cross falls should be a minimum of 2.5% on carriageways, with increased cross falls of up to5.0% on hard shoulders draining to filter drains; longitudinal gradients should not be less than 0.5% on kerbed roads; flat areas should be avoided and consideration of surface water drainage is particularly important at rollovers, roundabouts, and junctions; outfall levels must be acheivable. **According to Bath & North East Somerset Council (2016),** Highway drainage should fulfil the following objectives: prevent flooding, ponding and seepage, and keep the carriageway, cycleway and footway as free of standing water as possible; ensure surface water falling on the highway enters the drainage system or natural watercourse as speedily as possible; keep the underlying road structure as dry as possible; prevent injury or damage caused by hazardous surface water; prevent highway surface water flooding adjacent properties and prevent blockages in associated highway drainage systems with consequential flooding. The council maintained that highway drainage requires routine maintenance to ensure its continued efficiency. From time to time, additional maintenance is essential to ensure the system continues to function properly. Gullies and their immediate pipe connection are emptied and cleaned as part of an annual proactive maintenance programme. Drainage is cleaned as followed: rural areas - once per year, urban areas- once per year, and high-speed dual carriageways twice per year. However, where persistent problems are identified with gully cleansing, for example, being blocked by silt and detritus on a regular basis, the gullies are specifically identified and programmed for a greater cleaning frequency. **According to NCHRP (1998),** a drainable pavement contains the integral components as shown in Figure 1 below. The primary components include the asphalt or concrete surface pavement, a permeable base, a separator/filter layer, the subgrade, and edge drains Table 1 shows the optional elements that can be selected for the design of each component. If any of these system components do not function properly, the system will not perform (e.g., a drainable pavement that does not drain will be a liability to the pavement system) **Magdi, (2014)** studied the impacts of poor drainage on road performance in Khartoum, a city in Sudan with two case studies; attempts were made to find out the reasons for road failure within the first five years as a result of poor drainage. In this quest, it was discovered that four basic reasons lead to early deterioration of road pavements in the study, these factors according to the research includes, Poor drainage design and construction, poor maintenance structure, use of low-quality materials and no local standard of practice .It was concluded that if these factors are put into consideration in planning and execution and if improved on pavement structures would

serve within its expected design life. **Patil and Jalinder (2011)** studied the effects of bad drainage on roads with precision on some roads in India. It was found that increase in moisture content increases the chances of road failure before the stipulated or expected design life. It was observed that on Service road to Mumbai Pune Expressway the blockage of drainage channels lead to accumulation of water on pavement thus, leading to the stripping of bitumen. On walhekarwadichowk road, poor drainage leads to formation of waves and corrugations which as well leads to increase in weight and thus increases the stress causing the simultaneous reduction in strength of soil mass. On Nehru Nagar Road, Pimpri Akurdi Railway Station Road, and Holkar Bridge Chowk, Khadaki it was found that water penetrated into the subgrade thus making it weak and subsequently development of potholes as a result of water logging. The Approach road torailway tunnel near Akurdi Railway Station was observed to be bad condition due to flood in rainy seasons.

Getachew **and Tamene (2015)** made a study on Assessment of the Effect of Urban Road Surface Drainage using GinjoGuduruKebele of Jimma Town in Ethiopia as a case study. It was found that road surface drainage of the study area was found to be inadequate due insufficient road profile, insufficient drainage structures provision, improper maintenance and lack of proper interconnection between the road and drainage infrastructures thereby resulting damages to road surfacing material and flooding problems in the area.

III.CONCLUSION:

From the review, it has been concluded that poor drainage facilities on highway structures has many devastating effects on the economy of users, as both functional and structural failures due to poor drainage leads to increase in travel time, thus reducing productivity of a community or nation, it leads to sicknesses such as Malaria fever due to breeding of mosquitoes in stagnant water around poorly drained pavements in residential areas, there is increased number of accidents thus leading to the death of many. etc. The effect of poor drainage condition on road is very adverse. It causes the failure of road in different ways. 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. Therefore effective road drainage should be taking into consideration during construction of roads. Thus, proper design, construction and maintenance practices should be adopted to keep roads drained.

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