



Drainage Risk Management for Flexible Pavement

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ABSTRACT

The roads play a vital role in the development of the country. The quality of the road should be perfect so that the transportation could be safe and luxurious, in actual, there are plenty of roads are not following the requirement. When roads do not match with quality measurement, then it causes the damage. Proper drainage is very concerning part in construction of road. We know that how water in pavement creates major problem in premature pavement failure. To stop or reduce premature pavement failures and to strengthen the road performance, it is imperative to provide adequate drainage. There are different ways by which water could enter the pavement that are water logging on the surface of the road and leading to seepage of water into the pavement cause road failure. Water collection in road layer causes the reduction in bearing strength of the road. Presence of water for long time on the road surface results in high maintenance difficulties. The purpose of this study is to illustrate the reason for drainage problem and also to provide proper remedial measures for the pavement road.

Keywords: Pavement road, Drainage problem, Bearing Strength, Road Safety.

Introduction

During the construction of road various kind of surface drainage is mentioned for replacing all water that is available on pavement as well as shoulder surface from which water may flow onto the pavement. If water present on surface is not systematically removed, this water can go under the pavement surface and weaken the road. Road failure is due to the construction materials, traffic load, climate and water. Problem arises when the ditch is not functioning properly to direct and carry the run off away due to improper physical condition, capacity and maintenance. It effects in weakening of the soil which accelerates the pavement cracking process. The integration of drainage and the road system is done by concerning factors that influence urban drainage system which are rainfall density, urban growth and environmental factors. Drainage plays a role in preventing the types of road of construction failures caused by puddles on the road surface or water infiltration on the pavement. To maintain a desirable level of service and traffic safety it is essential to install effective water drainage system to prevent accidents which results from hydroplaning and loss of visibility from splash and spray. When the water gets accumulated for the long term it reduces the strength of granular materials, subgrade soils and causes rapid deterioration of pavement. Heavy vehicle loads causes severe hydraulic shocks when pavement is saturated with water. Water is also responsible for a large number of non-load related distress. Water infiltration into the pavement structure cannot be effectively stopped. Therefore, it may be more cost effective to invest in a sub surface drainage system. Cedegren projects that pavement life can be extended up to three times if adequate subsurface drainage systems are installed and maintained. The benefit of a functional subsurface pavement drainage system will vary depending on climate, subgrade soils, and the design of the overall pavement system. The subsequent drainage system design decision is made by systematically considering the Influence of these factors.

The importance of drainage can be enumerated as follows:

- Drainage help in remove all the surface and sub surface water in excess from the right of way.
- The frost action caused due to accumulation of water causes the decrements in the durability.
- Mitigating the damage to the pavement due to stagnation of water.
- Preventing from the mud pumping.
- Moisture content in soil causes the lowering the stability.
- Erosion of soil is prevented.

Risk Management For Drainage

Risk management is a process to methodically analyse and estimate possible course of action, identify risks and benefits, and determine the best course for any situation. Risk is unavoidable portion in construction project. The project management of risks requires that they can be identified and allocated in well defined manner. Risk management process is nothing but a series of steps that help identify and migrate the risks for the successful closure of a project. If done correctly and sincerely, construction risk management will reduce not only the likelihood of an event occurring, but also the magnitude of its impact. In the simplest terms, Risk management process is considering pre-emptive steps to avoid and minimize any kind of jeopardy to a project in future.

Process of Risk management

1. Identity the Risk

Heavy moisture content causes minimum in strength or stability of soil mass, depending on type of soil and mode of stress application. There are some of the effects of poor drainage system in Roads and Highways:

- High moisture in sub-grade results in decreasing of stability, swell and fail under heavy load.
- Because to imperfect sub-surface drainage waves, cracks, and corrugation develop in flexible pavements.
- Sustained contact of water with bituminous pavement cause failure due to stripping of bitumen from aggregate and formation of pot holes.
- Failure in rigid pavement causes high moisture content in subgrade result in pumping (rise of slurry in cracks).
- More water on shoulder seeps and cause damage.
- Pavement road constructed on embankment slopes may damage due to slop failures the reason for which is excess moisture content which causes increase in weight and thus increases stresses and simultaneous reduction in strength of soil mass.
- In low temperature water in pores may freeze and finally damage the pavement by frost action).
- When the water flow on surface cause erosion on the hill side also result in erosion of embankment cut and hillside.

2. Analyse the Risk

When talking about roads water has a high tendency to deteriorate the roads .Though we have drainage system to drain out water but the question is are they sufficient with the current way of making them ? And how we can improve them. The poor drainage system not only deteriorates the top surface of the road but also penetrates below it and makes the underlying sections of highway unstable. It can cause damage to the safe sloping angle , form cracks, reduce friction , etc. The deterioration of pavement not only increases the cost of maintenance but also sometimes is cause of many accidents which can even lead to death. Also it also consumes time for maintenance which not only causes trouble for people but also hinders the various economic activities. The components to be used for the design of pavements are needed to be chosen strictly with their suitability to use.

3. Evaluates The Risk

To forecast the potential outcome you need to evaluate the risk of any action .Any action which which had a possible outcome that was intolerable , risk averse approach would reject it .one might consider an action that had an potentially unacceptable outcome for so long as the probability was sufficiently low with slightly more risk tolerance . To judge whether the risk are worth taking or not , we have to see if one is more risk tolerant than the other , one could consider the potentially favourable.. In case of pavement drainage, it is necessary to estimate what risks could be happened during construction or post construction of road. If any kind of Risks are coming so this is need to be cured by implementing proper treatment.

4. Treat the Risk

- **Cement** – This kind of cement can be used to construct the drainages in the areas where there is heavy rainfall, low temperature areas and also in the areas where the monsoon like condition persists throughout the year. As when the rainfall occurs then there is a tendency of water to accumulate in the drainage system layers both in cross drainage as well as parallel drainage structures and this would deteriorate the drainage system and can be a cause of failure of the pavement as a whole. In case of cross drainage system if the drainage system fails then the water can seep down in the beneath layers and cause various malfunctioning such as- swelling, cracking, loss of friction, etc which will ultimately lead to the failure of pavement. In case of the parallel drainage layer it becomes easy for water to seep in lower layers of pavement such as base and sub grade since they are generally constructed at a lower level than the cross drainage structures. Now in order to prevent the accumulation of water and cracks due to freezing and thawing caused due to the changes in the surrounding temperature we can use the AIR ENTRAINING CEMENT of suitable quality and strength so that excess water is trapped in the air pockets formed by it. This would not only improve the life span of the pavement but also would help to prevent undesired settlements in the pavement.

- **Using the screens-** It is many times observed that people throw a lot of waste materials on the road . Apart from this due to action of winds also a lot of waste material gets deposited on the roads. If the size of the material is big and the material is in more concentration then it can choke the drainage system . So in order to avoid this kind of situation we can put the grills with suitable opening sizes so that it does not get deposited in drains and choke them. The screens should be made of such materials that it should not get easily corroded and should also have sufficient strength to bear loads. It should mostly permit dust through it. These screens would also prevent the entry of the ripped off or separated aggregates from the road to get deposited and choke the road drainage system.
- **Constructing a parallel pipe system-** This kind of system would not only act as an additional water disposing system in case of emergency but during the periods of heavy rainfall this would help to eliminate the excessive discharge. The discharge carrying capacity of the system gets increased when they are connected in parallel. The pipe could be of thick plastic as they are cheap, long lasting and also easy to transport , place and repair.
- **Providing proper markings –** The proper marking signs should be used so that they clearly denote the underlying drainage system so that in case there is repair work carried out suitable measures can be taken to ensure that the drainage system is not harmed. Also it would easily help them to locate the pipes for cleaning and repair.
- **Timely inspection -** The drainage system should be checked on regular intervals and the deposited materials should be cleaned . The connection between the pipes should be checked and try to make it free of leakage.

5. Monitor And Review The Risk

With the passage of time every structure needs to be monitored and reviewed and so in the case of drainage system also. After the road is inaugurated and is brought in service there is continuous deposition of various materials such as - dust, waste(plastic bottles, wrappers of edible items,etc), wooden pieces,etc. So to prevent the choking of drains due to the accumulation of these materials it needs to be checked and monitored. The various points which could be considered in monitoring the drainage system are - 1-checking that outflow>=inflow. 2 the slope 3. the surface condition 4.the fitting and the joints in pipe 5-the opening of drainage .

Conclusion

we know that the highways play a major role in running a country. They not only provide economic support but also social , cultural and political support. They play a key role to help us to get our daily services such as reaching hospitals, schools, offices, etc. They also help the government to keep the administration on track . So we must ensure the long live of highways, so in order to do this the above suggested measures will prove a boon for them. The proper drainage not only drains out water but also many harmful diseases along with it . The accumulation of water on road sides not only deteriorates the highway but also forms birthplace to many diseases, insects and foul odour. A good drainage system would help in not only the reduction of maintenance cost but also will lessen the need to repair it which would reduce inconvenience to the traffic and waste of resources. This would further contribute to speedy and smooth functioning of our economy . The money saved in repair and maintenance works could be used in some other sectors. These remedies could be extremely helpful in the areas of heavy rainfall and which have wet climate most of the time.

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