

EFFECTIVE TECHNIQUES FOR MAINTAINING AND REPAIRING RIGID PAVEMENTS

Chukwudi Emmanuel Nwachukwu and Miriam Adedayo Olanrewaju

Department of Building Technology, Captain Elechi Amadi Polytechnic, P.M.B 5936, Rumuola, Port Harcourt,
Nigeria

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Abstract: Change in environmental conditions and steady increase in vehicular traffic will certainly have effect on the serviceability of a pavement and ultimately result in their failures regardless of quality of pavement design. Cracking is the most common feature of the rigid pavement while fatigue cracking is considered the major cause for its failure. Rigid pavement offers a lot of benefits ranging from longer lifespan, high strength and less maintenance. The common achievement of maintenance activities of rigid pavement is to enhance serviceability of the pavement, reduce life cycle cost and improve riding performance for the road users.

Keywords: Maintenance, Repair, Rigid, Pavement, Management

1.0 Introduction

Continuous increase in vehicular traffic and varying environmental conditions will have effect on the service life of pavements and ultimately result in their failure regardless of the quality of pavement design and material used in construction. According to the continuously increasing rate of economic and development activities in several countries including Nigeria, traffic loads is on the increase and causing roads devastation. Allocated funding resources and infrastructure requirements are generally considered inappropriate and not being enough with highly growing maintenance demands which in turn caused a large deterioration in road pavements.

Repair and restoration of rigid pavements to its serviceability state depend upon the type of distress. Cracking is the most common feature of the rigid pavement while fatigue cracking is considered the major cause for its failure. The stress ratio between flexural tensile stress and modulus of rupture of concrete is the primary factor that decides the number of road repetition to cause fatigue cracking, most common causes of rigid pavement failure are pumping, faulting, spalling, shrinking, polished aggregate, pop out, deterioration of joint load transfer system, linear cracking, durability cracking, corner break, alkali aggregate reaction and blow-ups and others.

Development of rigid pavement in expressway, highways in Nigeria are greatly increasing and undertaken due to its durability, less life cycle cost of maintenance. Government focusing more on construction of rigid pavement highways for long life, durable roads, less maintenance and life cycle. Some of the rigid pavements are ongoing while others are receiving some repair and rehabilitation, examples of such are, Lagos-Ibadan expressway, Benin-Ore road etc while Enugu Abakaliki expressway is receiving dualization and repair in some sections.



Sample of Rigid Pavement Failure

Rigid pavements have relatively long service life if properly designed, constructed and maintained. Rigid pavements can serve up to its design service life and even beyond if timely repairs are undertaken. All types of pavements deteriorate with time. Rate of deterioration for a rigid pavement is comparatively much slower than that of flexible pavements.



Excavated Portion of a Failed Rigid Pavement

Rigid pavement maintenance is more than just a collective set of specific pavement maintenance techniques.

Various Defects in Rigid Pavement

1. Joint defects which includes spalling sealant failure/loss, faulting at joints separation.
2. Shrinkage cracks such as Y-cracks, alligator cracks, etc.
3. Ravelling of concrete surface or scaling of cement concrete, pop-out etc.
4. Structural cracks which ranges from medium to major cracks such as longitudinal cracks, transverse cracks, edge cracks etc.
5. Pot holes and corner damages
6. Settlement of panel or multiple cracks near expansion joints



Failure in Rigid Pavement by Faulting

Pavement Management System for Rigid Pavement

A pavement management system is a set of defined procedures for collecting, analyzing, maintaining and reporting pavement data, to assist the decision makers in finding optimum strategies for maintaining pavements in serviceable condition over a given period of time for the least cost.

A pavement management system is a set of tools or methods that assist decision makers in determining cost effective strategies for maintaining, upgrading and operating network of pavements. Pavement management system (PMS) can be used to determine the most appropriate time to rehabilitate pavement, what the most cost effective method is and how much it will cost to maintain a roadway system at a desirable condition level. The serviceability of the pavement is an indicator of how good or bad a pavement is. Pavement serviceability represents the level of services that pavement structure offer users. This indicator first appeared as rating made by users with respect to the state of the road particularly the roads surface.

For modern roads and highways to be operated efficiently and effectively for the benefit of all road users, it is expected to meet customer's defined requirements. Road drainage performance plays a vital role in ensuring the pavement performance. Pavement management comprises the following aspects.

- Budgeting analysis
- Economic analysis
- Rate collection with a specific period of time
- Maintenance standards and methods

Maintenance needs Assessment

Maintenance needs are usually carried out annually as part of planning and considering the following factors.

- Traffic
- Survey
- Visual rating



Maintenance of a Failed Pavement

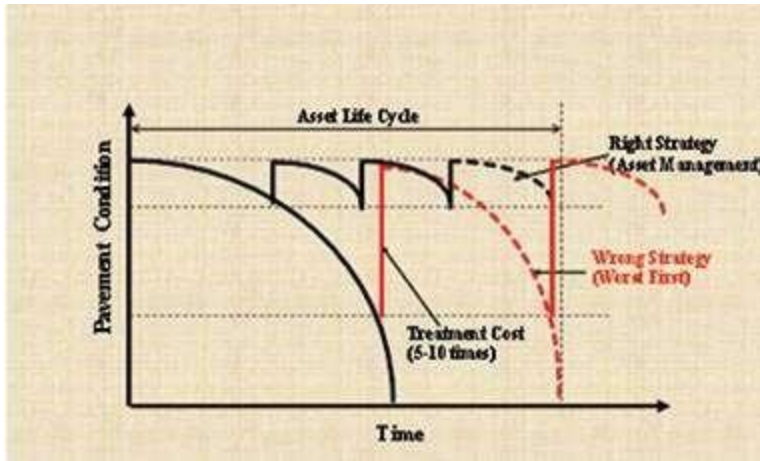
Some Maintenance and Repair techniques adopted in Rigid Pavement

- Scaling of cracks
- Dowel bar retrofit
- Joint resealing
- Repair of edge and corner
- Breaking of slabs
- Patching
- Scaling
- Re-surfacing
- Re-lecturing
- Diamond grinding
- Concrete pavement restoration
- Diamond grinding for rectification of pavement faulting etc.

EFFECT OF VARYING MAINTENANCE APPROACHES

Some pavement designs involve a combination of two or more performance periods. A pavement is constructed at an initial serviceability level and is rehabilitated to an acceptable level at certain time during its design life. This process of rehabilitation may be repeated severally depending on

the rate at which the existing pavement deteriorate with time.



Pavement Condition Index (PCI)

Pavement condition index is a numerical indicator of overall state of a pavement condition which takes into account the roughness and distress of a pavement.

Pavement condition index is widely adopted as follows.

- ✦ Policy for minimum service level for various roads pavement maintenance system (pms).
- ✦ Rating of road for maintenance and repair
- ✦ As a factor to plan maintenance and rehabilitating activities
- ✦ A tool in identifying of immediate pavement maintenance and rehabilitation needs. ✦ Plan development for short and long term and budget for road maintenance needs.

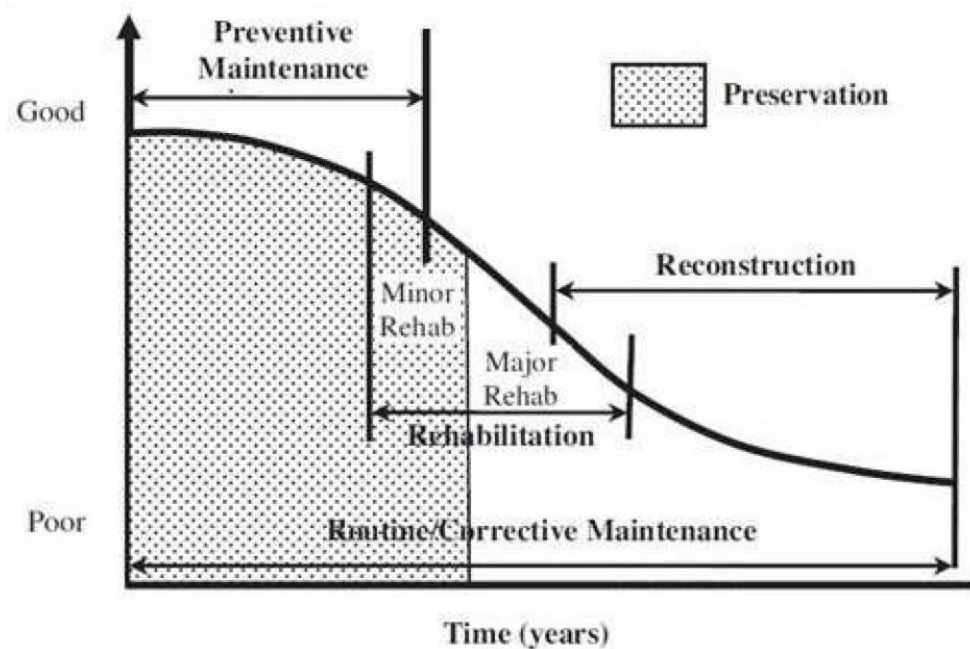
Benefits of Rigid Pavement

1. **Longer lifespan:** Rigid pavements can last up to 30 years or more with proper maintenance approach and timely assessment.
2. **Loss Maintenance:** Rigid pavements require minimal maintenance compared to other pavement types, reducing maintenance and operational cost when properly constructed.
3. **More environment:** Friendly than flexible pavement.
4. **High Strength:** The stiffness and strength of rigid pavements can withstand heavy traffic loads and reduce the needs for frequent repairs hence saving cost and serviceability period.
5. **Reduced Noise:** The smooth surface of rigid pavements produces less noise pollution compared to other types of pavements
6. **Rigid Pavements:** Distribute loads in the broader area and can bear a larger load due to slab action.
7. **A rigid Pavement:** Has high flexural strength and has a good resistance to oils and chemicals

Different Categories of Pavement

Maintenance such as routine, preventive and corrective (rehabilitation and re-construction of

parent) maintenance.



Preventive repair treatment based on distress, defect identification, timely inspection will reduce life cycle, costs and increase pavement serviceability.

Proper rigid pavement design, regular inspection and maintenance of drainage system is of utmost importance.

Effort is required to integrate various systems related to highway management to be carried out.

The main disadvantage in rigid concrete pavement is its initial construction cost and the consumption of resources is very high.

Establishment of an efficient and effective road and highway planning and management system is very pavement. This is to meet the growing demand optimally and to ensure rigid economic progress of the country.

Conclusion

- The common achievement of maintenance activities is to improve serviceability of the pavement, bring down life cycle cost and enhance riding performance.
- Timely maintenance approach at the right moment, a lot of benefits will be achieved. This solely depends on the pavement's condition and its position in the life cycle.

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