



AN EXPERIENCE ON STREET PAVEMENT MAINTENANCE PROGRAM IN SMALL REGION- (BAFQ CITY)

Khability Mehdi and Gorbian Nader

Faculty of Engineering, Bafq Branch, Islamic Azad University, Bafq, Iran

E-Mail: Khabirim@yahoo.com

ABSTRACT

This paper reports an experience on Pavement Maintenance plan of the Research Team of the Islamic Azad University- Bafq Branch. The City of Bafq streets are failing at a growing rate, despite all the efforts of Pavement Management, improved efficiencies in street maintenance operations, contracted work and sharing equipment with other agencies. Pavements in this range show some form of distress or wear that requires more than a life extending achievement. In this group, a well-designed pavement will have served at least 75% of its life and the authority of the pavement has dropped by about 40%.

Keywords: pavement, maintenance, flexible, small urban, regional conditions, distress.

INTRODUCTION

Paved streets not only provide an all season route for traveling to and from home, work and company, they are also relied on for import and transport of nearly everything we use in our daily lives. They clearly are the life-blood of a healthy community. Unfortunately at and beneath the surface of Bafq's streets, many distresses are quietly accumulating. Without arranged attention many more distresses will sooner or later surface. The expenditure of applying preventive maintenance before the pavement fails has always established to be cost effective. On the other hand, the cost for treatment of botched pavement escalates exponentially. To better understand the cost savings an explanation of how pavements behave might be helpful.

The focus of roadway activity in the early to mid 20th Century was on the construction of new pavements. In the latter part of the 20th Century continuing into the 21st Century, this focus has shifted to the maintenance and rehabilitation (M and R) of pavement infrastructures. Maintenance includes actions that retard or correct the deterioration of infrastructure facilities. These actions include crack sealing as well as resurfacing etc. [1]. Pavements must be selected for maintenance when they are still effective. In most cases, the proper time to apply maintenance is before the need is apparent to the casual observer. This is because once pavements start to deteriorate; they deteriorate rapidly beyond the point where maintenance is effective. With the increasing use and awareness of pavement management systems and the growing emphasis on asset management of pavement infrastructure, it is important to strengthen the maintenance components of these systems and particularly the preventive maintenance part [2, 3].

Current Pavement Condition/Pavement Maintenance Program Basics the City of Bafq is responsible for the maintenance of 15 centerline kilometers of asphalt pavement roadway totaling approximately 10/000 square meter of pavement. As noted above, annual visual inspections are performed to assess the street conditions. The inspections cover the entire City's

street network over a five year period (the entire City is not inspected each year). The PMP categorizes pavement condition by assigning a number, the pavement condition index (PCI), based on the visual inspections. A newly constructed street has a PCI of 100, while a street with severe alligator cracking (much reduced condition) has a PCI of 25 or less.

The most recent definition of preventive maintenance by AASHTO Standing Committee on Highway states that preventive maintenance is "a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional conditions of the system (without increasing structural capacity)" [2].

Agencies have found that applying a series of low-cost preventive treatments can effectively extend the service lives of their pavements. Preventive maintenance techniques should be scheduled to maximize safety, maintainability, and the cost-effectiveness of pavement preservation efforts. However, it is difficult for most users to establish the level of distress at which a particular maintenance treatment should be applied. Selection of the most appropriate maintenance treatment for a given distress type should consider several factors including type and extent of distress, climate, existing pavement type, cost of treatment, traffic type and volume, expected life, availability of qualified contractors, availability of quality materials, time of year, pavement noise, facility downtime (user delays), surface friction, anticipated level of service, and other project-specific condition.

Several types of treatments are used as preventive maintenance of flexible pavements. All of them, if placed in a timely fashion, will extend the life of the pavement. The most common are crack treatment, patch repairs, thin hot mix overlays, etc. Most of these are widely used by highway agencies and they are treated separately in this study.



STUDY PROBLEM

Bafq City has a great value for its economical role in Iran. In Bafq City, there are several universities, mining centers and other institutions. Consequently, it attracts intense traffic volumes as well as different types of transportation way. Bafq City is also facing a great challenge in dealing with an aging infrastructure. For pavements in particular, it is sought that many streets were built 15 or 25 years ago and they are near the end of their financial life [4]. As a developing city, Bafq City pavements have the following current threats:

- Increase rate of deterioration. (Pavements deteriorate fast);
- Overloading of vehicles. (No commitment with the legal loading);
- Rapid traffic growth. (High increase of vehicle ownership);
- Poor repairs. (Indecent materials, incorrect completion, etc.);
- Insufficient income (geometry, funds, tools, materials, etc.);
- Insufficient information for managerial; and
- Incompetent current usual management system.

In addition, a future challenge will face the pavements in the city.

Building of Bafq's new mining center requires a good maintained street arrangement for rapid, safe and eases movements of people and supplies. It is expected that weighty axis loading production will increase causing more weakening of Bafq pavements. The traditional maintenance system that is currently in use in Bafq town reveals that:

- There isn't any record;
- There is no use of record programs in accumulate and giving out the system data in the Street Maintenance plan;
- The organization is not flexible enough to adjust work plans and schedules to reflect changing conditions; and
- The system is poor to assist in making decisions.

From the above mentioned points, there is a strong need for a complete PMMS that involves:

Data: Facilitate the physical data of the system to be managed and allow data storing, retrieving, displaying, updating and getting queries.

Assessment System: Assists in making timely cost effective decisions related to the maintenance and rehabilitation of pavements.

Pavement Maintenance Program: Provides information about maintenance needs, costs, priorities, etc.

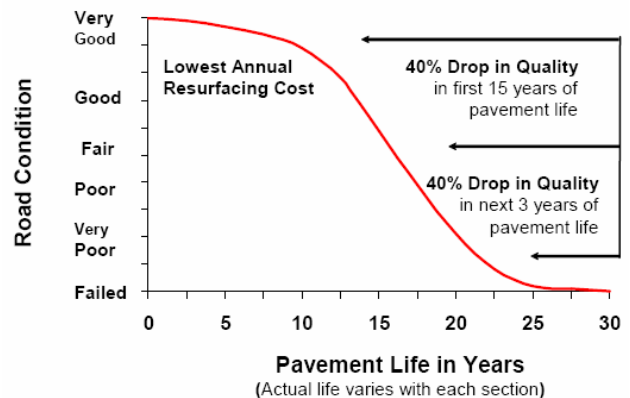


Figure-1. Relation between pavement life and pavement condition [2]

REPAIR METHODS FOR SMALL CITY

There are many methods for asphalt pavement repair, but for a small city that has little financial plan, appropriate method is as under:

Crack action

It is a successful technique to seal the surface of the pavement to treat any cracks in a timely and effective manner. It includes crack sealing and crack filling. Crack Sealing consists of an application of a sealing material directly into the cracks of the pavement surface. It is normally used to prevent water and incompressible materials from entering into the pavement [5].



Figure-2. Longitude crack repair by crack sealing and crack filling [5].

Patch preservation

Space repairs are typically used to address contained pavement distress and prevent moisture penetration. If the distress is a result of a structural shortage, it may be necessary to do away with and replaces some or all of the granular base/subbase and subgrade to mitigate the distress from reoccurring.



Figure-3. Pothole distress repair by replaces some or the entire granular layer.

Lean Hot-Mix Overlays

Treatments by lean hot-mix overlays are alike to usual overlays, but the thickness is less than 37.5 mm. They are used to correct surface irregularities which cannot be addressed with the other maintenance treatments. They include dense-, open-and gap-graded mixes and often hold modified binders such as polymers or bit rubber. Dense-and gap-graded mixes seal the pavement surface, improve ride quality, and slide resistance. Open-graded mixes improve travel quality, surface resistance, and enhance the ability of water to drain off the pavement. The act of thin dense-graded overlays has been mixed, with lives of 2 to 10 years.

STUDY METHOD

The two Streets are divided into six Pavement Maintenance regions, 1 through 6. The urban schedules pavement maintenance program in each consecutive

maintenance zone on about a 5-year cycle. In other words, streets in repairs zone 1 through 4 would characteristically be given maintenance once every four years. Zones 5 and 76 are specific to the upper used streets called primary and small arterial streets. The high use of these parts of streets requires a higher go back for pavement maintenance. The City schedules pavement maintenance in district 5 each four years and Zone 6 every five years. The occupation may include projects such as Path restore, Asphalt Overlay, or Street Reconstruction. Due to budget constraints this does not mean that all street in a district will receive management each year. The kind of pavement treatment may be charge on competing pavement needs and accessible resources. The City strives to give effective pavement maintenance requirements by competent use of available resources received particularly for pavement maintenance purposes.

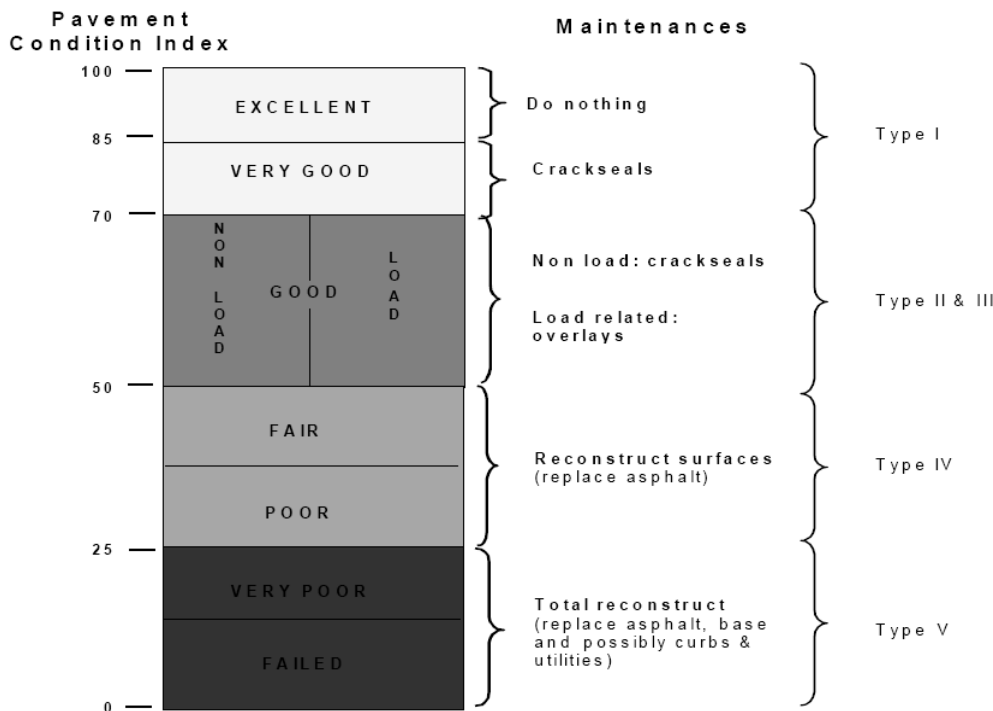


Figure-4. pavement condition and fix method alternated for small city [4].

Note that as maintenance is delayed, or when no accomplishment is taken until the street condition has extensively deteriorated, the unit fee of remediation increases spectacularly. One of the key elements of a successful pavement management repair strategy is to sustain streets in the “Good Condition” and “Fair Condition” categories by implementing low cost preventative maintenance treatments at the appropriate time. This is mainly proper for streets in the “Fair Condition” range, because they are at the point where pavement deterioration accelerates if left untreated. To demonstrate street condition and individual repairs, the photos below provide examples of pavement deficiencies from streets in the City of Bafq and the suitable repair methods. The City’s current average PCI for these streets is approximately 70. The City of Bafq’ Pavement Management Program is designed to achieve an “Optimal” network PCI of around 80, which is in the “Good Condition” category. In other words, the PMP will recommend maintenance treatments in a challenge to transport all of the streets in Bafq to a PCI of around 80 [2, 4 and 5].

The rate to maintain and repair pavement depends on its present PCI. In the “Good Category,” it costs relatively little to apply a preventive maintenance treatment such as a Patch Repair which can extend the life of a pavement by correcting minor faults and reducing further deterioration. Treatments of this sort are applied before pavement weakening has become severe, and usually cost more or less \$3 per square meter. Over 65% of the city’s street network would do well to from these relatively low-cost, life-extending treatments. Almost 25% of the city’s street network falls into the “Fair Condition”

category. Pavements in this range show some form of distress or wear that requires more than a life extending treatment. In this group, a well-designed pavement will have served at least 75% of its life and the quality of the pavement has dropped by about 40%. Maintenance treatments for pavement in this category usually have need of an asphalt cover, which typically expenses about \$11 to \$25 per square meter.

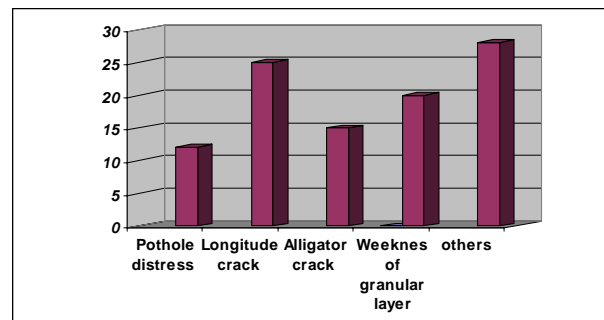


Figure-5. Pavement distress for two street of Bafq like a small city [5].

CONCLUSIONS AND RESULTS

The City of Bafq has a large asset in its street arrangement. General, 70% of the City’s network is in the “Good Condition” group (PCI > 70). However, the remaining 30% of the streets require a significant amount of money to bring them into the “Good Condition” category. The higher maintenance accumulation will consequence in greater than before future expenses because expensive treatments (reconstruction) will unfortunately be necessary if less expensive treatments



(seals or covers) aren't utilized in a timely manner. Currently the City has been spending very little money on preventative maintenance [5].

The City of Bafq streets are deteriorating at an increasing rate, despite all the efforts of Pavement Management, improved efficiencies in street maintenance operations, contracted work and sharing equipment with other agencies. By far, the biggest problem we face nowadays is lack of sufficient financial support to preserve our vital transportation road and rail network. Construction costs have risen over the last twelve years. The end result is not enough money to properly maintain the City owned streets. The general public is starting to notice the progressively more failing condition of our streets. We are receiving more calls asking for street repairs, overlays, slurry seals, etc. than at any other time. Some calls have resulted in damage claims for vehicle restore. Regrettably for many, the answer is that we do not have the finances to retain their streets. This is a trouble that not including extra funding will only rise of poorer quality more than time.

ACKNOWLEDGMENTS

I am especially grateful for the given support (during the several research steps) by Mr. Payam Bavali (engineer) and Mr. Akbar Safarinejad (engineering student). Many thanks to Dr. Gourabian (Department of Engineering) for the patient revision of this paper. This document supported by Research Deputy of Bafq Branch, Islamic Azad University.

REFERENCES

- [1] Paul Navazio. 2008. Assistant City Manager, STAFF REPORT City Council Budget Workshop. May 27.
- [2] Shafik Jendia and Maher Al Hallaq. 2005. DEVELOPMENT OF A PAVEMENT MAINTENANCE MANAGEMENT SYSTEM (PMMS) FOR GAZA CITY. Journal of the Islamic University of Gaza. 13(1): 119-138.
- [3] Shahin M.Y. 1994. Pavement Management for Airport, Roads and Parking. Lost Chapman and Hall.
- [4] John Harris and Dennis Hughes. 2007. STATE OF THE ROADS City of Gresham, Pavement Condition Overview for 2007, January.
- [5] Khabiry Mehdi, Gourbrian Nader and Payam Bavali. 2008. 11th Report of Development Best Possible Method for Street Pavement Maintenance in Small Urban (Case Study Bafq) Bafq Branch, Islamic Azad University, Bafq, Iran.