The Study of Highway Maintenance Works In Selangor

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ABSTRACT: The major towns are accessible by roads in the state of Selangor. The road networks are expanding at a slow rate. Hence, the maintenance of existing roads is of utmost importance. But it was found that some of the roads are badly deteriorated due to poor maintenance of the roads. A study was carried out with the objective to identify the main types of defects that frequently occur, the factors that cause the defect of roads and also to identify the methods used for road repair. This study was carried out in the district of Bangi, Selangor and involved the roads. Under the care of Public Work Department and maintained by Road care(M) Sdn. Bhd. A total of 40 questionnaires were distributed and 37 of the questionnaires were received. The study was also carried out by interview. The data is analysed using average index method and statistics. From the study the main types of defects that frequently occur are potholes, block cracks, revelling and rutting. The factors that cause the defects of roads are heavy traffic and excessive environmental condition.

KEYWORDS: Improve highway maintenance works, Rutting.

I. INTRODUCTION

Malaysia is formed by the Malay Peninsular and the East Malaysian states of Sabah and Sarawak on the northern coast of Borneo in 1963. The peninsular which is located at the southern Asia bordering by Thailand while northern one-third of the island of Borneo, bordering Indonesia and Brunei make the Federation of Malaysia accessible from other countries by sea, air and road. An estimation in year 2001 shows that the road network in Malaysia covers 65,877km with 51,318km paved roads and, 14,559km left unpaved. In addition to these national and main regional roads, Malaysia has thousands of kilometres of local roads that are maintained by local jurisdictions. The requirement of road begins since the invention of wheel in Samaria in 3000Bc. Since then, the road construction has slowly evolved over a very long period from the barely earth or soil surface roads to the highway with both flexible and rigid surfaces. Federal roads used are to connect between main cities and the enrance throughout the country. This kind of roads system is constructed and being maintain to the initial condition using the direct allocation from federal government under the federal Public Works Department. [1]. The basic objective of road maintenance is implicit in the word itself. It is done to ensure that the road that has been constructed, or improved, is maintained in its original condition. It is accepted that over the life of the road it will deteriorate due to factors with which maintenance activities cannot deal. Nevertheless maintenance is intended to begin on the first day after the road improvement works are completed. [2]. Even governments have learnt to do more with less. Privatization offers a solution to improve quality and save money. Cities, districts, states, and the federal governments privatize road and highway maintenance to achieve the common advantages of privatization, as summarized with reference to Segal et al. [3]. The current available prove of aging is by measuring the bitumen viscosity. However, Januszke et-al (1992) caution that single point measurement of bitumen property to justify aging is limited unless backed up by considerable empirical experience and knowledge of the bitumen types involved. [4]. Research in crack sealing advances into finding the cheapest and most effective type of sealant and finding the best ways of sealing cracks. Research undertaken by the Strategic Highway Research Group (SHRP, 1992), in the U.S.A. is currently undergoing in using robotics for crack sealing operations. [5]. Surface dressing has...
been commonly used as a wearing course on lowvolume roads. It is a suitable resurfacing technique on most surface failure onthese roads. The potential use of surface dressing is not limited to improvesurface distress. High bitumen film thicknesses improve resistance against agehardening. The layer of bitumen may seal cracks. [6]
Thin hot mix asphalt is a minimum thickness of asphalt normally less than25 mm thick laid using customary equipment. Any type of hot asphalt mix ormodified mix can be used. The thin asphalt layer provides for non-structuralpurposes mainly to correct surface deficiency.
Thin hot mix can be applied at areas subjected to low traffic loading and deflection level. It is not meant to correct structural failures such as cracking andsevere rutting. Surfacing that suffers from polishing, stripping, bleeding can beoverlayed with thin asphalt.
Porosethin hot mix can also be used. High voids in the mix allow water to drain laterally. Removal of water through this mix is rapid. Water splash andspray are substantially reduced when driving in wet conditions on this surface. Improved surface friction characteristic makes this mix suitable for wet roads.

II. METHODOLOGY OF SUTDY
The methodology flowchart as shown in briefly explains the methodologyof this study. The most important part Of this study is the datacollection. The data are divided into two categories; there are primary and secondary data.

1. Primary data refer to all the real data collected from the study area. There are four types of data used in this study which are :defects that occur which maintenance are required, factors cause the defects, maintenance activities treatments and budget allocation for maintenance according to types of roads, section or activities carried out. The data is collected through questionnaires, interviews and site visit.
2. Secondary data can be obtained through the literature review from the published material such as books, journal, conferences proceeding, newspaper etc.
3. After collecting arranging all the required information through questionnaires, interview, site visit, and literature review, all the data will be analyzed to generate accurate result which can represent and draw conclusion to the research objectives. The data are analyzed using the average index method and statistic.
4. The average index is counted according to the following formula[16];
\[ \text{Average Index} = \frac{\sum a_i x_i}{\sum x_i} \]
Where
\[ a_i = \text{constant expressing the weight given to } i \]
\[ x_i = \text{variable expressing the frequency of respondent, for } i: 1,2,3,4,5 \]
Average index method is used to identified deterioration of the road and to study the maintenance management system. The categories of scale are:
1= very frequent 1.00 < min index 1.50
2= frequent 1.50 < min index 2.50
3= average 2.50 < min index 3.50
4= less frequent 3.50 < min index 4.50
5= least frequent 4.50 < min index 5.0
5. Conclusion will be made out according to the research. Via the conclusion, recommendations will be given for future study.

III. DATA ANALYSIS
Raw data from Public work Department, selangor Municipal council and the Concession company Roadcare(M) Sdn. Bhd. Is analyzed and identity major periodic maintenance works that are carried out. The collected data is also used to analyze and identify the incurred costs for periodic maintenance works carried out by the concession company Roadcare(M) Sdn. Bhd. And routine maintenance by public Work Department Selangor.
1. Periodic maintenance
Table 1 explains the length involved under periodic road maintenance that the concession company undertook in 2006, 2007, and 2008. Firstly, the scattered data is grouped and categorized into 11 types of works as carried out by the company and both of the agencies. Then the length for every type of work for each state is calculated and analysed.

<table>
<thead>
<tr>
<th>Activity</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>km</td>
<td>%</td>
<td>km</td>
</tr>
<tr>
<td>Mill and Pave</td>
<td>12.81</td>
<td>6.40</td>
<td>14.5</td>
</tr>
<tr>
<td>Pave</td>
<td>5.15</td>
<td>2.74</td>
<td>0.00</td>
</tr>
<tr>
<td>Regulate</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Mill, Regulate &amp; Pave</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Reconstruct &amp; Pave</td>
<td>8.19</td>
<td>4.36</td>
<td>24.00</td>
</tr>
<tr>
<td>Scarify &amp; Pave</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Scarify, Regulate &amp; Pave</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Scarify, Raise &amp; Reconstruct</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Regulate &amp; Pave</td>
<td>22.48</td>
<td>11.96</td>
<td>4.00</td>
</tr>
<tr>
<td>Reconstruct, Scarify, Regulate</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Strengthen &amp; Pave</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total</td>
<td>48.63</td>
<td>100</td>
<td>42.5</td>
</tr>
</tbody>
</table>

Fig 1 Demonstrates the length of roads that was maintained periodically for each of the four areas within the concession area. It can be seen that periodic maintenance works was carried out the most in the area of South Selangor with a 62% total length of road maintained.

2. Incurred costs for periodic maintenance
Table 2 Costs incurred in carrying out periodic maintenance works for 2006, 2007 shows that ‘Mill and Pave’ accounts for the most incur red cost in 2006 with an amount of RM 6,450,000. This is followed by ‘Reconstruct and Regulate’ which accounts for RM 5,320,000, and ‘Regulate and Pave’ amounting RM 0,870,000.
Table 3 Costs incurred in carrying out periodic maintenance works for 2008, shows that 'Mill and Pave' costs the most in 2008 with a cost of RM5,940,000 followed by 'strengthen and Pave' with a cost of RM 7,400,000 and 'Regulate and Pave' with a cost of RM 4,600,000. These three activities account for RM 18,131,000, and the activity 'Strengthen and Pave' incurred highest cost in 2008 with an incurred cost amounting to 52.10 percent of the total costs incurred for that year.

Fig 2 indicates the rapid decline of the incurred costs for periodic maintenance since the privatization from RM2.2 million in year 2006 to RM 3.1 million in year 2007, to RM 2.5 million in year 2008. The 20 percent decrease in the annual periodic maintenance cost for the year 2006 and a further 31 percent decrease in year 2007 are within the government control.
3. Type of defects occur on the roads in Selangor.
Table 4, Fig 3 the defects occur on the roads will greatly affect the quality of the road. To identify the frequency of the occurring and severity of each type of defects on the roads will surely help to increase the effectiveness of maintenance work.

IV. FACTORS CONTRIBUTE TO THE DEFECT OF THE ROADS

From the literature review, there are nine factors contribute to the defect of the roads; a questionnaire study on this purpose had been distributed. The respondents are required to fill up the questionnaire and arrange the factors according to the frequency of occur. The most frequently contribution factor will be rank as five [5].
Table 5 shows that heavy traffic and act of god such as heavy rain, flood is the factors that most frequently affect the road condition. Improper maintenance, imperfection in construction and design of the road is also frequently contributed to the defects of the road. Low quality in materials used in road construction and inefficiency of controlling and monitoring are in the category of average.

![Table 5](image)

Table 6 The defects of the road should be repair to ensure that the road reach the serviceability level. There are methods which can be used for the repair purposes.

![Table 6](image)
The defects of the road should be repair to ensure that the road reach the serviceability level. There are many types of methods which can be used for the repair purposes. However, the application of the methods are limited by several factors such as the cost required, man power, the available machinery, technique required etc.

Analysis from the collected questionnaire had been done and the frequency of the methods being used to repair the defects of the roads by Public Work Department district of Bangi show in Table 6 and Figure 4 it can be seen that patching is the most frequently used method in Public Work Department in the district of Bangi.

6. Factors causes patching as the most frequently used methods to repair the road defect.
Table 7 Five factors had been identified to determine why patching had been used most widely in repairing of the road defects. The staffs from the Public Work Department: Selangor had been asked to fill a questionnaire by giving ranking to the factors.

<table>
<thead>
<tr>
<th>Why patching has been used most frequently</th>
<th>frequency of respondents</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>The cheapest</td>
<td>✓</td>
<td>3</td>
</tr>
<tr>
<td>Most effective</td>
<td>✓</td>
<td>4</td>
</tr>
<tr>
<td>Require the shortest time</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td>Easiest to carry out</td>
<td>✓</td>
<td>2</td>
</tr>
<tr>
<td>Require the least resources</td>
<td>✓</td>
<td>5</td>
</tr>
</tbody>
</table>

1 = very frequent 2 = frequent 3 = average 4 = less frequent 5 = least frequent
IV. CONCLUSION AND RECOMMENDATION

From the data analysis, it is concluded that the study that being executed was successful and the achievement of the study can be itemize as following as Road’s maintenance, road defect and level of Satisfaction of road using.

A. Road maintenance management

From the study it can be concluded there are advantages and disadvantages of road maintenance management carried out by each of the agencies involved. The study also shows that the road users are more prefer on the road maintenance by the internal workers rather than contracting out the maintenance work.

B. Road defect.

The types of defects identified from this study are:
- Crocodile cracks
- Surface deformations
- Rutting
- Corrugation
- Depression

C. Level of satisfaction of road users

The average index of 3.53 compared to 3.73 resemble that the road user belief that MPK’s internal workers are more skilled than contactors in carrying out road maintenance work.

In terms of monitoring, an average index for the client beliefs that the maintenance activities by the contractor or internal workers are neither sufficiently nor unsufficiently monitored shows that the average index 3.43 compared to 3.43 where the road use preferred maintenance by MPK’s internal workers (Reference).

D. Recommendation for future study

1) To study the deference of the maintenance system'
2) The major improvements that was experienced after privatization as compared to before privatization.
3) The challenges of implementing successful privatization project ‘normally used in developed nations.
4) The quality of road network before and after the privatization.
5) Road user satisfaction throughout urban and rural area’
6) Centralization of appointment of maintenance contractor from State Government.
7) Standardization of schedule of rate for road maintenance.
8) Loose materials (usually aggregate) that 'ravel’ from the surface or edges of the pavement, resulting in depressions which may fill with moisture and loose aggregate which may pose problems’

Solutions – Prevention

- Timely preventive maintenance with one of the cures listed.
- Polymer modified asphalt binder
- Clean aggregates
- Material transfer devices
- Good compaction

REFERENCES


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