Review of Maintenance Program Implementation for Roads at the Local (District) Level

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Abstract: Maintenance of national roads in the Philippines is conducted by the Department of Public Works and Highways (DPWH) following a maintenance manual published in 2014. The implementability of the DPWH manual at district level was examined. Also, the current practice of maintenance at the local level was documented and was compared to a good management practice through gap analysis. Results show that the implementability of the manual was rated 88.23%. The gap analysis comparing the DPWH manual to the suggested maintenance practice scored 71.25%. This rating could be further improved following some recommendations as follows: improving and maintaining an organized database, putting more attention on heavy-traffic zones for urban districts, and continually going for Long Term Performance Based Contracts.

Keywords: Road Maintenance, Road Deterioration, Maintenance Procedures

1. INTRODUCTION

1.1 Background of the Study

The Philippines is comprised of more than 250,000 kilometer of road section, and about 15% of which are national roads.

From the reports of World Economic Forum on Global Competitiveness Index (GCI), the Philippines ranked from 86th in 2012 to 97th in 2015 out of 140 countries in terms of road quality. The decreasing trend should alarm the government to take actions in improving the quality not only of roads, but of all transport infrastructures. Poorly maintained roads impede mobilization of goods, communication, and information. Also, a focus on maintenance would lessen the cost of repetitive repairs

In 2012 Asian Development Bank published a report entitled "Philippines: Transport sector assessment, strategy, and road map" containing 66 argument points, they have mentioned that road maintenance has not been carried out fully in our country. In fact, it was stated in the report that the poor quality of road networks contributes to the rising number of road accidents. According to DPWH Traffic Accident Recording and Analysis System, about 1,513 died due to road accidents. World Health Organization said that the reported fatalities only comprise about 10% of the total road accident deaths, meaning an estimated 10,379 road traffic deaths happened in 2013.

1.2 The Problem and the Objective of the Study

Improved road maintenance would result to a more efficient transportation, thus ladd our country's economic development.

The main objective of this study is to fully understand and to assess the management of the maintenance of national roads in the Philippines. In the process of attaining the main objective, the following procedures are to be undertaken:

1. to document maintenance practices for paved roads;
2. to identify issues pertaining to maintenance management of roads;
3. to assess implementability of maintenance manual at a district level; and
4. to recommend applicable practices from neighboring countries for the improvement of national road maintenance management in the Philippines.

1.3 Significance of the Study

Millions of pesos are spent to construct roads and bridges. However, if it is not well maintained, the structure will deteriorate more easily and reversing the defects would cost the government more. DPWH promises premium and efficient roads for the user through providing and managing quality infrastructure facilities and services responsive to the needs of the Filipino people in the pursuit of national development objectives.

The documentation produced in this study showed the present condition of maintenance of roads in the Philippines. The status quo is important to know since all of the improvements that could be done will be rooted from here. Without the knowledge of the present condition, pinpointing strong and weak points of the system would not be attainable

The gap analysis that was conducted between the proposed criteria for good maintenance management practice for highways published in the United Kingdom and the actual condition of DPWH maintenance management of national roads was a great tool in planning development in improving the state of maintenance in the Philippines.

1.4 Scope and Limitation

The study focused on the implementation of local maintenance procedures in national roads in the Philippines, whether asphalt or concrete. The researchers limited the study on the implementation of Department of Public Works and Highways at the District Offices. This research was intended to gain knowledge on how District Offices take action on maintenance problems encountered in different places, since they are the frontliners. The inspection, information, implementation are undertaken by the District Offices.

National roads, the scope of this study, are under the jurisdiction of Department of Public Works and Highways (DPWH). The maintenance sections of district offices of three regions, including National Capital Region, were surveyed, targeting MPP's and District Maintenance Engineers. The regions that were surveyed are Regions III, IV-A, and NCR.

The results of the survey and information from supporting interviews with Bureau of Maintenance were used in coming up with the rating of actual state of maintenance management in district level. On the other hand, the provisions of the Philippine Highway Maintenance Manual 2014 and Department Orders No. 41 s. 2016, No. 245 s. 2003, No. 54 s. 2004 No. 42 s. 2008, No. 67 s. 2014, No. 20 s. 2016 and No. 98 s. 2016 were used to describe the standards of maintenance management in the country and was rated using the suggested Good Maintenance Management Practices from UK. This was also used in performing the gap analysis between the actual state and local standards, and local standards to international standards since it is a general tool for the analysis of maintenance management. The United

Kingdom has a clear vision and a detailed procedure to improve its asset maintenance management. Additional literature from the experiences in Singapore, New Zealand, and United Kingdom were used also used as basis in drawing up additional recommendations. These countries were members of First Delegates on World Road Association.

1.5 Conceptual Framework

For this study the current practice of maintenance that is considered were from DPWH District Offices and Bureau of Maintenance (BOM). This was compared to the good management practice as suggested by UK through gap analysis. A set of criteria was used and discussed further in the methodology. From the deviations encountered the implementation plan were developed for the improvement of the current maintenance practice. The method for developing an implementation plan was suggested but the delivery and monitoring would not be possible for this study.
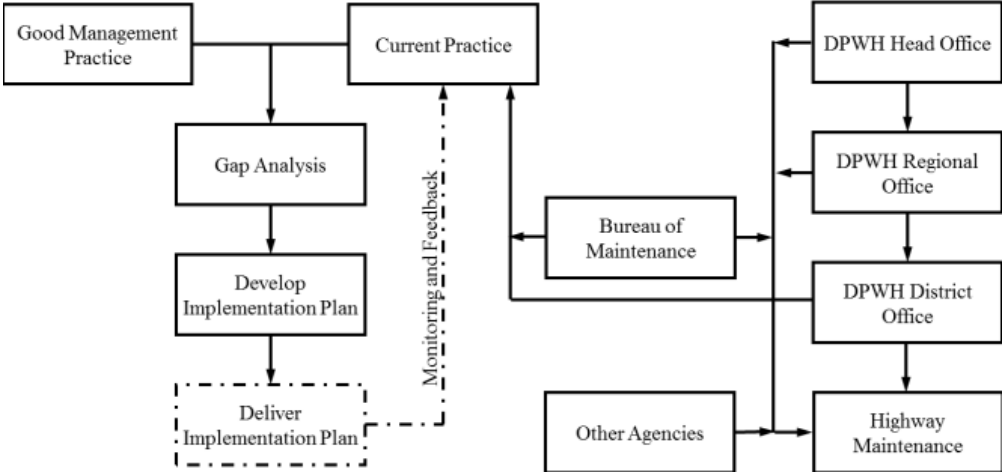
Figure 1. Conceptual Framework

2. LITERATURE REVIEW

Maintenance of roads, which includes painting and cleaning of road surfaces, routine visual inspection of pavements, and early involvement of maintenance agencies is important to preserve the quality of roads.

Napalang, S., et al. studied about the state of practices in design, construction and management of asphalt and concrete roads, giving emphasis on the impact of the quality to the economic life of roads. It was concluded that the DPWH is working hand in hand with private sectors to create and maintain the design performance of the road, but a quality work of frontliners, which are the District Engineering Offices and Regional Offices, should be encouraged and implemented.

Biscocho, M. (2013) analyzed different factors that affect the quality of the pavements. The assessment relates the defects on the design, construction and maintenance practice. Results show that an effective maintenance procedure should be implemented in order to prevent the roads from deteriorating. Also, the lifespan of pavements is affected by quality of construction.

The Chartered Institution of Highways and Transportation conducted a review on

road maintenance in several countries. There were 12 countries who participated in the review. This review has looked in the best practices of these countries. Countries were leading to long term plans and resulted in better management. Each country stated their strategies in attaining quality maintenance of highways.

The International Labour Organization studied about the rural road maintenance in the Philippines.. The study showed that preventive maintenance is not widespread in concerned local government units and is the reason why substandard roads were observed and cost a lot due to rehabilitation. Issues concerning the budget for roads, technical capacity, distribution of jurisdiction, among others were identified in the study. Even in rural roads, road maintenance should be valued.

3 METHODOLOGY

3.1 Data Collection

The guidelines for maintenance management were gathered from DPWH Bureau of Maintenance. Researchers conducted interviews to engineers from the DPWH Bureau of Maintenance Inspectors to get insights on the scope of work of Maintenance Section of District Offices. The information were used to formulate a survey that was given to Maintenance Point Persons in the District Offices.

This method was inspired from a study of Abat-Bangasan, (2006) who pinpointed the current maintenance management system in New Zealand. The survey questions were guided by the Philippine Highway Maintenance Management Manual, and Department Orders.

3.2 Method of Analysis

The implementation of maintenance was analyzed by gap analysis. The answers to the survey were tallied to see if there were gaps in the actual knowledge and performance of the personnel to the guidelines and manuals of the department.

The data that were analyzed are as follows:
- Organization of district
- Scope of work of personnel
- Common defects that are encountered
- Guidelines or standards used
- Inspection procedure
- Identification and scheduling of repair
- Common maintenance methodologies

Deviation from the manual were considered and analyzed more thoroughly through follow-up questions and interview with the DPWH Bureau of Maintenance.

The results of the survey were used as supporting details to rate the adherence of the district offices to the international standards. This is supported by the rating of the current status of maintenance manuals and standards. The standard that was used for the gap analysis was based from the suggested Good Maintenance Management Practices for Highways. The sections of the said set of standards were assessed and qualified based on the applicability of the content to the setting in the Philippines.

The following figures shows the categories and the rating standard used in the gap analysis.

1. **Processes and Systems** – the processes, procedures, tools and systems required for highway structures management.

2. **Data** – the data/information required to support highway structures management.

3. **People** – the number and competence of staff responsible for highway structures management.

Figure 2. Definition of Categories

4. RESULTS AND DISCUSSION

4.1. External Management
4.1.1. Relationship of DPWH District Offices to LGU
        By law, the local government units were allowed to enforce their own traffic rules. Highways are utilized by road users, and that the local government controls the traffic on their area. So, the DPWH coordinates with the LGU involved to notify stakeholders about the activities and to manage the road network that was interrupted. In this way, both units create an alternative route for the materialization of public works and for preventing any huge economic losses due to repair work.

4.1.2. Relationship of DPWH District Office and Road Board
        The Road Board ensures that the collected moneys from Motor Vehicles User's Charge (MVUC) serve its purposes - to provide road maintenance and improvement of drainage; installation of traffic lights and road safety; and air pollution control. They get advice from the DPWH regarding the road sections that need to be maintained and select projects to be funded over a list of projects. Road Board still conducts further maintenance on roads even if District Offices do their parts. The Road Board coordinates with DPWH District Offices whenever they conduct maintenance in their district.

4.2 Internal Management
4.2.1. Relationship of DPWH District Office and DPWH Bureau of Maintenance
        The DPWH- Bureau of Maintenance has engineers who inspect the sections at least twice a year and at least four times in district offices in National Capital Region. They check whether the repair works were properly done and response times were followed by the DPWH District Offices. The said bureau is also responsible for issuing sanctions, penalties, and rewards to District Engineers, District Maintenance Engineers, and Maintenance Point Persons.

4.2.2. Relationship of DPWH District Office and DPWH Regional Office
        A Regional Office is the direct office above district offices. It monitors on-going maintenance activities and physical conditions of roads within its jurisdiction were of prescribed quality. Activity Data Summary and Activity Performance Summary Worksheet were passed from District Offices to Regional Offices. Large projects were also transferred to the management of Regional Offices.

Rating	Processes and Systems	Data	People
1	**Not in place** – the need has not been recognised or the need has been recognised but no action has been taken.	**Poor** – data quality and quantity are below the level required to undertake basic management activities.	**Unsatisfactory** – competence below minimum requirements in many areas and/or severe staff shortages.
2	**Implementation** – the need has been recognised and a plan for implementation is currently being developed or is already being implemented.	**Basic** – inventory is adequate but condition and performance data is poor and incomplete.	**Needs Improvement** – staff competence below minimum requirements in some areas and/or some staff shortages.
3	**Recently implemented** – has been recently implemented and the authority is in the early stages of training and usage.	**Fair** – inventory is complete and there is sufficient condition and performance data to support basic asset management.	**Satisfactory** – meet minimum competence and resources requirements, but skills and capacity for innovation may be insufficient.
4	**Established** – has been in place for a number of years and as such is documented and associated training is in place, but it may not be fully integrated with other processes.	**Good** – inventory is complete and quantity and quality of condition and performance data is improving	**Competent** – competence and/or resource above minimum requirements, and skills and capacity available to promote innovation and improve efficiency.
5	**Fully embedded** – mature and fully documented, associated training is in place and it is integrated with other processes.	**Comprehensive** – all data is accurate, up-to-date and complete and sufficient to support advanced asset management.	**Excellent** – competence and resources above minimum requirements with suitable skills and capacity to actively innovate and improve efficiency.

Figure 1. Equivalent Ratings for each Category

4.3. Management in the District Office

4.3.1. Data and Storage

The organization and storage of information is important in road maintenance as information tend to be repetitive through history, and so data had to be organized well. MP-1 and MP-2 forms were filled out by the Maintenance Point Persons as they inspect the roads. Forms were encoded to electronic spreadsheets by Maintenance Section Encoder. The storage of which, however, was left to District Offices' strategy.

The DPWH extended their efforts to provide a formalized system in collecting data, and it is the Road and Bridge Information Application, as fed by the Road Condition

(ROCOND) Rating Surveys. Although site inspections and ROCOND look into the defects and condition of roads, both were fully independent of each other as the former thoroughly examine and measure every defect in the road while the MPP inspections rely their data to visual observations only. Access to RBIA was limited to a few numbers of staffs.

4.3.2. Constraints Encountered in Maintenance

The Maintenance Point Persons conduct road inspection daily. The constraints that they encounter were identified, and that the most answered was weather condition. During heavy rains, they would stop inspecting and reschedule the activity. Traffic volume is one of the concerns of the MPP's, especially under district offices on the urban area. The most common area that were treated as critical and needs more attention were highways that are passed on by large traffic volume and load because they were more subjected to defects. Another constraint was lack of equipment, although there were available equipment controlled by the Bureau of Equipment or similar, the mobility of these are inconvenient for everyday use. Large and heavy equipment, mostly were not suited in maintenance because of mobility reasons. There are multipurpose, medium-sized equipment that are available in the market that could be used in the district office maintenance section.

4.3.3. Maintenance Practices

The District Maintenance Section was in-charge in maintaining safety and comfort of road users by keeping further deterioration of roads. The preventive maintenance undertaken by the district offices were cleaning of unwanted debris and painting of surfaces.

Selected districts on the urban area implemented Anti-truck Overloading Mobile Enforcement (ATOME) by capturing overloaded trucks. Another operation conducted by the maintenance section of the district offices is the "Operation Zero Pothole". This operation usually was called before rainy season, so that the existing potholes would be rectified to avoid multiplication of damage severity when rainwater penetrates in the holes.

The prescribed repair methodologies for different defects were in Department Order 41, s. 2016. The table below shows the percentages of responses that answered the suggested measures. Not all measures got a rating over 80 percent because they adapt to what was in the District to avoid delays in schedules.

Table 1. Summary of Percentage of Respondents Who Answered the Prescribed Repair Work

Defect	Suggested Measure (DO 41 s. 2016)	Actual
Potholes	Bituminous premix	77.14%
	Penetration patching	51.43%
Alligator Cracks	Bituminous premix	24.29%
	Penetration patching	34.29%
Major Scaling	Reblocking of slabs	45.71%
Shoving and Corrugation	Reblocking of slabs	30.00%
Pumping and Depression	Reblocking of slabs	74.29%

No/Faded Road Markings	Painting	97.14%
Low/Inverted Shoulders	Resurfacing	74.29%
	Vegetation Control	2.86%
Lush Vegetation	Vegetation Control	100.00%
Clogged Drains	Cleaning	91.43%
Open Manhole	Replacement	81.43%
No/Inadequate Sealant in Joints	Crack and Joints sealing	92.86%
Cracks	Crack and Joints sealing	92.86%
Ravelling	Crack and Joints sealing	10.00%
Unmaintained Road Signages	Cleaning	67.14%
Unmaintained Bridges	Cleaning	61.43%

4.4. Milestones of Maintenance Management of National Roads

The following criteria were used to rate the road maintenance management of DPWH. These are based on Management of Highways: A Code of Practice by United Kingdom, which was updated in 2013:

- Structure Management Context
- Structures Asset Management Framework
- Maintenance Planning and Management
- Inspection, Testing and Monitoring
- Assessment of Structures
- Asset Information Management

The first milestone generally described the workmanship and organization of the agency in maintenance management. The ratings given to the adherence of the manuals and actual performance of district offices were tabulated below. These processes and systems were already established for a long time, and were effective because it's adapted until now. The people under DPWH were trained and sent to seminars for further improvement. They satisfied minimum requirements or qualities for the job.

The second milestone would like to show how deep the agency works on to provide quality maintenance. This contains information on additional processes and innovations of the implementing body in ensuring that the structures are fit for its intended purpose and performance. The data for this milestone is complete, but basic since the data that the district. An innovation in the system has been implemented recently, like supersession of department orders and creation of Performance-based maintenance.

Of the three milestones, the third one got the lowest rating. This is not surprising because the second milestone should have more priority first before the third milestone. It is commendable that the DPWH improve their system by imposing a long-term development vision. The manual, specifically the Philippine Highway Maintenance Manual is still under development for provision on long-term specifications.
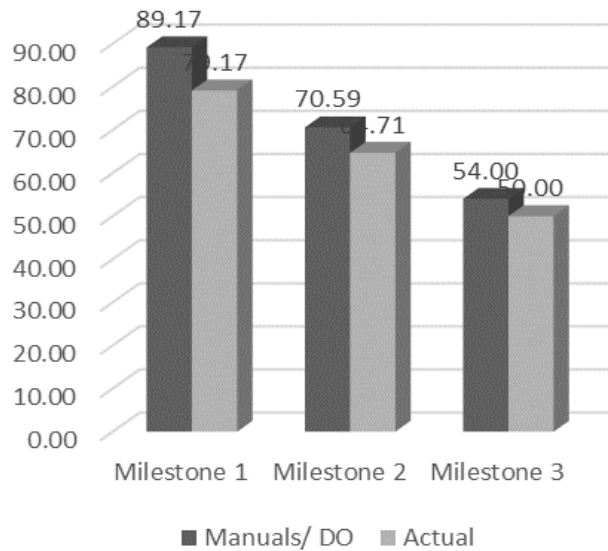
Figure 4. Variation in the Manual/ Standard and Actual Management

4.5. Implementation of Manuals

Table 2. Implementation of Manuals to Maintenance Section at District Engineering Offices

Implementation of Manuals to Maintenance Section at District Engineering Offices	
System	87.37
Data	89.81
People	87.50
Overall	88.23

Dividing the percentage of conformity of actual performance of district offices to conformity of manuals to the same criteria in the gap analysis, the implementation of manuals to district engineering offices were determined and tabulated above. These values were generated by looking at how close the rating of the actual performances were from the rating given to the manuals in the gap analysis. The closer the ratings were, the more implemented and digested the manuals were to the district offices.

The issuance of memoranda regarding Department Orders were effective to disseminate uniform information, especially about updated processes in maintenance, in all district offices. However, there were several surveyed districts that mention about superseded Department Orders. This was observed in the survey where the surveyees were asked about the guidelines and standards that they use in deciding appropriate maintenance work for different conditions. The rough trend of answers were also observed in other sections of the survey. This was because the engineers were given the leeway to strategize their works as long as the requirements were complied. Although this may not massively affect the performance of the district, the development of their performance would be stagnant. An improvement in the imposition of information to the offices that were hardly reached should

be encouraged and be brought up to the national level.

The management of people in the maintenance section was given a rating of 3.75. From time to time, seminars were conducted to raise the information quantity and quality possessed by the engineers in the district office. However, since engineers use judgment and own experience in dealing with some problems, the manuals were not one hundred percent implemented and deviations from the standards come at times due to constraints they face and a deadline or schedule to be followed.

Overall, the manual was implemented well as the actual performance reflected the notes in the manual. The revisions that would be made in the manual could easily be translated to the District Engineering Offices. The challenge now is to improve the maintenance manual towards attainment of Milestone Three.

5. SUMMARY/ CONCLUSIONS

Below are the summarized results as well as recommendations to further improve the maintenance of roads in the country:

1. The following conditions were observed in District Offices:
   - For contractual projects, DPWH was able to establish a system to properly monitor the performance of the contractors. However, DPWH needs to consider other utilities that may need excavation to ensure that quality of road is maintained. Other problems may arise from this like problems in scheduling, right of way, etc.
   - One of the major causes of road deterioration was found to be overloading. The DPWH District Offices put more attention on heavy-traffic zones for urban districts, and highways where trucks pass. Interviews and surveys had confirmed that the quality of work was compromised due to limited budget.

2. There were several constraints and issues identified that hinder smooth performance of District Offices:
   - Weather condition delays work but coordination within the section could catch up delays.
   - The Department of Public Works and Highways has to impose the importance of keeping an organized database.
   - The district offices, as the feeder of more detailed information since they are the frontliners to roads, should produce a quality set of information through uniformity and supporting documentations. The use of photographs of the condition of the road before, during, and after maintenance work was a good information to track the accomplishments of the district offices.
   - The Road and Bridge Information Application was a huge step towards centralization of databases, but contents of which that were similar with the data that other sections collect must be viewable to avoid overlapping of data.

3. The implementation rate of the manuals and department orders was 88.23%. DPWH is almost near in attaining the first milestone fully. Innovations on data, system, and improvement and qualifications of the people were on-going. Long Term Performance Based Contracts is auspicious and would be helpful in the development of maintenance in the Philippines in the long run. Innovations in maintenance would pull up the ability of our country to compete globally in terms of maintenance.

4. The following recommendations could be helpful in the development of maintenance in the country:
   - The safety of road users is important and must be the top priority of the department.

Data on road accidents may be used in reevaluation of road section. The safety of DPWH personnel on the field should also be strictly implemented.

● Involvement and participation of stakeholders would be helpful in decision-making for maintenance management as they were the primary ones affected by the roads.

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