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State of Pavement Engineering in the Philippines and Implications on the Economic Life of National Roads

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Abstract: The Department of Public Works and Highways (DPWH) is tasked with the design, construction and maintenance of national roads in the Philippines. The study presents an assessment of the current practices in design, construction and maintenance of asphalt concrete pavements (ACP) and Portland cement concrete pavements (PCCP) in the Philippines. Issues pertaining to pavement engineering were identified, and the impacts of practices and issues on pavement economic life are discussed. Based on the information obtained, the main challenge for pavement engineering in the Philippines is the propensity of contractors to deviate from pre-established specifications during construction. This has led to more frequent maintenance activities to extend serviceability of roads. To address this, the DPWH has implemented Long Term Maintenance Contracts, which has so far resulted in what the agency claims as being more reliable and efficient in terms of maintaining national roads.

Keywords: Pavement, Design, Construction, Maintenance, Life Cycle

1. INTRODUCTION

Roads in the Philippines are usually classified according to the government entities administering them. They are classified as National roads, Provincial roads, City roads, Municipal roads, and Barangay roads. A summary of the different classifications with their respective descriptions is given in Table 1.

National roads are either arterial or secondary. Arterial roads, also known as primary roads, are continuous roads that form part of the main trunk system leading to either primary centers such as major cities and airports or all roads connecting to the primary centers. National roads are classified by function into the following:

a. North-South Backbone – form the main trunkline from northernmost Luzon down to Southern Mindanao, interconnecting major islands;
b. East-West Laterals – roads traversing the backbone and across the islands (about 100 km apart);
c. Other roads of strategic importance – provide direct access to important centers and areas vital for regional development and emergencies.

Table 1. Administrative Road Classification in the Philippines

Road	Description	Administrative Responsibility
National -Arterial -Secondary	Continuous in extent, form part of the main trunk line system; all roads leading to national ports, seaports, parks or coast-to-coast roads	Design, construction, management and maintenance by national government through the Department of Public Works and Highways (DPWH)
Provincial	Those roads that connect one municipality to another municipality and to National Arterial or Secondary Roads; other road as designated by the Province through legislation	Design, construction, and maintenance under the Provincial Engineering Offices (PEOs)
City	Major streets in the city if not provincial or national road; other roads designated by City through legislation	Planning, design, construction and maintenance under city engineering offices
Municipal	Those roads/streets within the municipal town, if not provincial or national roads; other roads designated through local registration	Planning, design, construction and maintenance under municipal engineering offices
Barangay	Classified as penetration roads or farm-to-market roads connecting barangays with each other and to road network of the area; other roads designated by local council.	Routine maintenance by Barangay council through the Barangay Road Maintenance Committee (also referred to as Committee on Public Works/ Infrastructure)

(Source: Maintenance Study in the Philippines, International Labor Organization, 2006)

On the other hand, national secondary roads are those that complement national arterial roads to provide access to other main population and production centers.

This paper looks into the current practices of design, construction and maintenance of Philippine roads, focusing on the national roads, which are under the jurisdiction of the Department of Public Works and Highways (DPWH). The paper identifies issues pertaining to design, construction and maintenance as well as measures or initiatives currently being undertaken to address such issues. The study provides an assessment of the implications of current practices on the economic life of roads in the Philippines.

2. OBJECTIVES

The objectives of this paper are the following:

a. Assess the current practices in design, construction and maintenance of pavements in the Philippines
b. Identify issues pertaining to pavement engineering
c. Evaluate impacts of practices and issues on pavement economic life
d. Formulate recommendations to improve pavement engineering in the country

In the process of meeting these objectives, it was necessary to coordinate with relevant DPWH bureaus and divisions in obtaining pertinent information on national road pavement design, construction and maintenance.

3. CURRENT STATE OF NATIONAL ROADS

The current distribution by surface type and road condition of primary and secondary national roads in the Philippines as of November 2013 is shown in Table 2. As can be seen from the table, as of 2013, 83.08% of the national roads are paved. Of those paved, 19.92% are in poor or bad condition and 6.93% have not been assessed.

Table 2. Current distributions by surface type and road conditions of national roads in the Philippines (DPWH, 2013)

Surface Type and Road Condition		National Primary Road Total	%	Secondary National Road Total	%	Grand Total	%
Paved	**Asphalt**	**6,298.680**	**19.54%**	**3,297.706**	**10.23%**	**9,596.386**	**29.78%**
	Good	2,669.370	8.28%	1,686.688	5.23%	4,356.058	13.52%
	Fair	1,383.932	4.29%	783.248	2.43%	2,167.180	6.72%
	Poor	825.391	2.56%	345.701	1.07%	1,171.092	3.63%
	Bad	639.900	1.99%	252.744	0.78%	892.644	2.77%
	No Assessment	780.087	2.42%	229.325	0.71%	1,009.412	3.13%
	Concrete	**8,553.561**	**26.54%**	**8,622.986**	**26.76%**	**17,176.547**	**53.30%**
	Good	2,510.279	7.79%	2,812.848	8.73%	5,323.127	16.52%
	Fair	3,122.875	9.69%	3,151.267	9.78%	6,274.142	19.47%
	Poor	1,468.112	4.56%	1,455.600	4.52%	2,923.712	9.07%
	Bad	649.677	2.02%	780.731	2.42%	1,430.408	4.44%
	No Assessment	802.618	2.49%	422.54	1.31%	1,225.158	3.80%
Total Paved Length	Good	5,179.649	16.07%	4,499.536	13.96%	9,679.185	30.03%
	Fair	4,506.807	13.98%	3,934.515	12.21%	8,441.322	26.19%
	Poor	2,293.503	7.12%	1,801.301	5.59%	4,094.804	12.71%
	Bad	1,289.577	4.00%	1,033.475	3.21%	2,323.052	7.21%
	No Assessment	1,582.705	4.91%	651.865	2.02%	2,234.570	6.93%
Paved Total		**14,852.241**	**46.09%**	**11,920.692**	**36.99%**	**26,772.933**	**83.08%**
Unpaved	**Earth**	**3.493**	**0.01%**	**54.906**	**0.17%**	**58.399**	**0.18%**
	Good	0.000	0.00%	0.000	0.00%	28.256	0.00%
	Fair	0.000	0.00%	0.451	0.00%	29.493	0.00%
	Poor	0.000	0.00%	0.199	0.00%	0.199	0.00%
	Bad	0.093	0.00%	29.400	0.09%	29.493	0.09%
	No Assessment	3.400	0.01%	24.856	0.08%	28.256	0.09%
	Gravel	**1,222.983**	**3.79%**	**4,172.618**	**12.95%**	**5,395.601**	**16.74%**
	Good	75.052	0.22%	386.772	1.20%	458.824	1.42%
	Fair	298.048	0.92%	1,476.298	4.58%	1,774.346	5.51%
	Poor	185.227	0.57%	1,276.595	3.96%	1,461.822	4.54%
	Bad	268.916	0.83%	506.541	1.57%	775.457	2.41%
	No Assessment	398.740	1.24%	526.412	1.63%	925.152	2.87%
Total Unpaved Length	Good	72.052	0.22%	386.772	1.20%	458.824	1.42%
	Fair	298.048	0.92%	1,476.749	4.58%	1,774.797	5.51%
	Poor	185.227	0.57%	1,276.794	3.96%	1,462.021	4.54%
	Bad	269.009	0.83%	535.941	1.66%	804.950	2.50%
	No Assessment	402.140	1.25%	551.268	1.71%	953.408	2.96%
Unpaved Total		**1,226.476**	**3.81%**	**4,227.524**	**13.12%**	**5,454.000**	**16.92%**
TOTAL		**16,078.717**	**49.89%**	**16,148.216**	**50.11%**	**32,226.933**	**100.00%**

4. PAVEMENT DESIGN IN THE PHILIPPINES

4.1 Design guidelines

Discussion with the DPWH-Bureau of Design (BOD) revealed that the agency uses the following references:

- American Association of State Highway and Transportation Officials (1993) Guide for the Design of Pavement Structures.
- Transport Research Laboratory (1993) Overseas Road Note 31.
- Asphalt Institute, Asphalt Overlays for Highway and Street Rehabilitation, Manual Series No. 17 (MS-17).
- Japan Road Association (1989) Manual for Asphalt Pavements.

The AASHTO Guide has been the reference of highway engineers around the world for pavement design and is still the preferred guide despite its publication in 1993. There have been supplements to the guide, particularly the one in 1998, but there have been no new editions of this manual. The guide emphasizes the need for the development of local factors such as those employed to determine materials properties for concrete. A more detailed discussion on the input parameters for AASHTO is provided in a succeeding section of this paper.

The TRL Road Note 31 is another old publication (1993) but is simpler than AASHTO. For one, the TRL method does not employ complicated nomographs or equations. According to the DPWH, it is usually employed for the proverbial second opinion to determine if pavement thicknesses, for example, that were derived using AASHTO are reasonable. It is important to note that this reference is applicable only for bitumen-surfaced roads (i.e., ACP). This is different from the Road Note 29 published by the same institution when it was still known as the Road Research Laboratory (RRL) in 1970. The latter provides a guide for both PCCP and ACP design.

The basic difference in design philosophies between the TRL and AASHTO methods may be seen from the approaches. The procedure for the TRL method determines the thicknesses of the layers from the bottom to the top following the reasoning that the sub-base and base layers form the foundations for the surface or slab layer. Thus, the logic here is that weak sub-base and base layers will eventually lead to deterioration of the surface/slab. Meanwhile, the AASHTO method determines the design thicknesses from the top to the bottom. The logic here is that the layer on top is designed to protect the layer beneath it while already incorporating the subgrade, sub-base and base characteristics in each step of the design process.

The Asphalt Institute manual is obviously intended for ACP applications only and so with the one from the Japan Road Association. According to the DPWH-BOD, the former is only used occasionally while the latter is more a “relic” from previous training programs sponsored by the Japan International Cooperation Agency (JICA) as part of their technical assistance to the DPWH.

There are no extant official issuances pertaining to the use of any manual though there are heavy references (and an apparent dependence) on AASHTO in the DPWH design manual (i.e., red book). When asked whether the DPWH has been developing or has developed local factors such as structural layer coefficients for use in the AASHTO procedures, the BOD stated that the values of coefficients (i.e., structural layer coefficients) from AASHTO were reduced for the Philippine setting. This reduction was a way of adapting the coefficients to local conditions and the reductions have generally resulted in thicker pavements.

The DPWH-BOD also revealed that they employed average designs where thicknesses of pavement layers are the same for at least every one-kilometer of road section. This practice is more economical according to the BOD but the trade-off is that it is inevitable that certain sections will either be over-designed or under-designed depending on the actual conditions for that section.

In 2011, the DPWH issued Department Order No. 22 prescribing the minimum thickness and widths of national roads for both ACP and PCCP. The order also specifies the procedure for computing the cumulative equivalent single axle load for heavy vehicles considered in the estimation of the design load. This issuance is currently used by the DPWH for all roads under its jurisdiction, especially for new projects and roads being rehabilitated.

4.2 Design reviews

The DPWH-BOD, as the responsible division for design is also in-charge of the review of highway and street designs of national roads. These include designs submitted by contractors or design firms for local and foreign assisted projects, which are evaluated based on the guidelines used by the Department.

At the regional and district levels, the District Engineering Offices (DEO) are in-charge of reviewing road designs, particularly for projects funded by the government through the General Appropriations Act (GAA) or the Priority Development Assistance Fund (PDAF) of senators and congressmen, which are also coursed through the DPWH if road projects are identified for use of the fund.

4.3 Issues in design

Perhaps the most significant issue in pavement design is one related to the estimation of pavement loads. The DPWH Department Order 22 provides sample calculations of the heavy vehicle factors used in estimating the load for the corresponding design periods of ACP and PCCP. The factors used are based on the maximum gross vehicle weights prescribed under law (Republic Act 8794) rather than on empirical data such as the actual measured weights of heavy vehicles along highways. There is also the use of lane distribution factors where local factors are twice that prescribed by AASHTO or any Highway Engineering textbook.

When coupled with the prevalent truck overloading practices in the Philippines, the implications of the first issue (vehicle factors) is a tendency for possible underestimation of loads over the design life of a road, thereby shortening the economic life of the facility. Meanwhile, the implication of the second issue is a tendency to overestimate the load for the design lane. This leads to thicker but more expensive pavements. Other parameters used in design are basically adopted from AASHTO with the exception of the structural layer coefficients that the DPWH has already adjusted for Philippine conditions.

In 2008, the AASHTO released a new design guide for pavement design using the Mechanistic-Empirical approach. This approach represents the state-of-the-practice in pavement design and enables designers to accurately predict performance of roadways under various loading. However, this approach is s not yet adopted by the DPWH. According to the BOD, it is not urgent for them to adopt the procedure and such will require capacity building for the Bureau as well as the for their district and regional offices. Currently, there are no engineers with the DPWH who are knowledgeable or experienced with the new design procedure.

5. PAVEMENT CONSTRUCTION IN THE PHILIPPINES

5.1 Construction practices

The Bureau of Construction (BOC) is tasked with the review, evaluation, cost estimation, contracting of projects under the DPWH. The BOC is also charged with the inspection and monitoring of construction projects of DPWH implementing offices and other agencies.

Projects are now bidded out using an online system for prospective contractors to download bid forms and pertinent information on projects. Actual construction is carried out under the Project Management Office (PMO) and the District Engineering Offices spread across the different provinces and cities in the country. Figures 1 and 2 show typical construction practices in rural and urban areas.

a. Manual laying out of sub-base material

b. Compaction of sub-base layer

Figure 1. Typical construction practices for national roads in rural areas

a. Rehabilitation along urban highway

b. Typical road works along urban highway

Figure 2. Typical construction practices for national roads in urban areas

The DPWH Blue Book is a manual that provides the details of items considered for road construction. These include the material requirements, tests, and methods that are used as basis for progress payments of road construction projects. The checklists for both ACP and PCCP are shown in Table 3.

Table 3. Checklists of items under road construction in DPWH manual

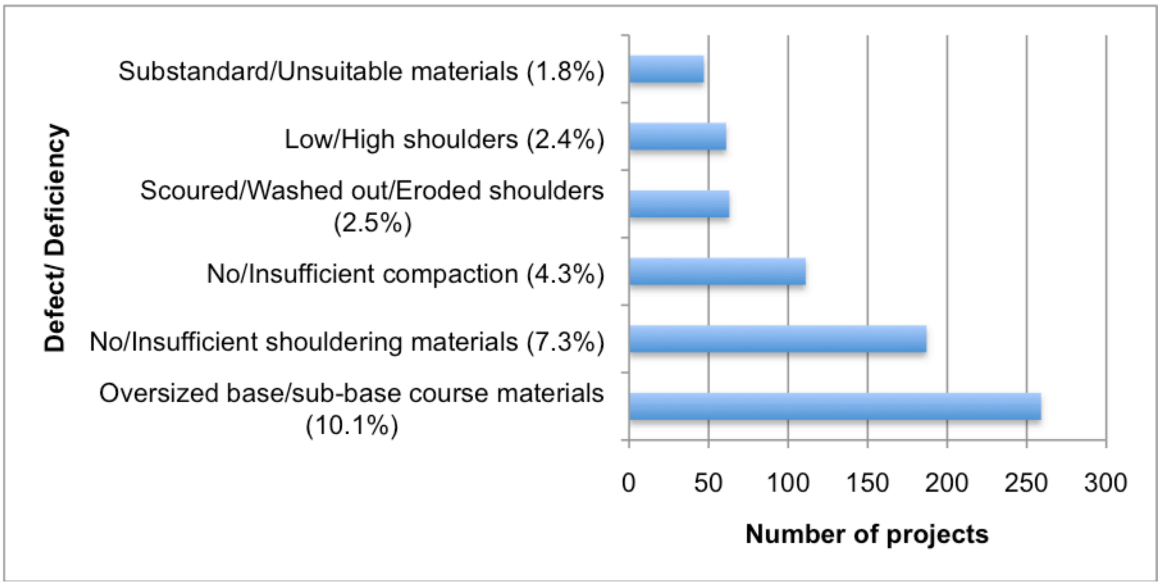
ACP	PCCP
▪ Material requirements (aggregates) ▪ Weather limitations ▪ Preparation of area to be paved ▪ Preparation of mixture ▪ Placing ▪ Construction equipment ▪ Sampling (AASHTO and ASTM) ▪ Testing (AASHTO and ASTM) ▪ Method of measurement ▪ Basis of payment	▪ Material requirements ▪ Construction requirements ▪ Equipment ▪ Preparation of grade ▪ Setting forms ▪ Conditioning of subgrade or base course ▪ Handling, measuring and batching materials ▪ Mixing concrete ▪ Limitation of mixing ▪ Placing concrete ▪ Test specimens ▪ Strike-off of concrete and placement of reinforcement ▪ Joints ▪ Final Strike-off (consolidating and finishing) ▪ Surface Test ▪ Curing ▪ Removal of forms ▪ Sealing of joints ▪ Protection of pavement ▪ Concrete pavement – slip form method ▪ Acceptance of concrete ▪ Opening to traffic ▪ Tolerance and pavement thickness ▪ Method of measurement ▪ Basis of payment

5.2 Issues in road construction

Based on interviews with the DPWH, most issues pertaining to road construction are associated with the variation or deviations from plans by of contractors. These variations are supposed to be approved and incorporated in the design stage but shortcomings in monitoring of road projects often produce results that tend to lead to early deterioration of the pavement. Figure 3 shows statistics on the results of the assessment of 2,559 roads during the maintenance stage where problems attributed to the construction stage are manifested.

The most common problem is over-sized base and sub-base materials used in the projects. Significant, too, are substandard/unsuitable materials. These items are supposed to have been evaluated during the construction of the highway and could easily be identified by inspectors monitoring the progress of a project and whose assessment would be the basis for payments.

In the construction of roads, there are also issues pertaining to the proper handling of materials, preparation of base and sub-base layers, mixing of the concrete and curing. In urban areas, there are also issues pertaining to traffic management and the impacts of vibrations due to heavy vehicles passing along the construction site.



Explanatory note: Out of a total of 2,559 roads, 10.1% (259 roads) were found to have oversized base/sub-base course materials.

Figure 3. Frequency distribution of defects/deficiencies of base, sub-base and shoulders for 2,559 roads in 2012 (DPWH, 2013)

6. PAVEMENT MAINTENANCE IN THE PHILIPPINES

6.1 DPWH Guidelines and Procedures

The DPWH implements a regimen according to three types of maintenance:

- Routine
- Periodic
- Preventive

Routine maintenance is applied to minor defects using what are usually labor-intensive methods and equipment. Such minor defects include minor failures for PCCP such as scaling, depressions and cracks (longitudinal, transverse and shrinkage). For ACP, these include potholes, rutting, corrugation and cracks (alligator and reflective).

Periodic maintenance is more intensive and refers to works undertaken in longer intervals, say every 5 years. These are usually implemented on project basis with funding from the GAA and employ more sophisticated equipment such as graders. Activities under periodic maintenance that are related to PCCP and ACP include:

- Resurfacing unpaved roads
- Bituminous surface treatment
- Resurfacing unpaved shoulders
- Selected replacement of concrete pavement

Preventive maintenance is also defined by the DPWH as works that are more extensive than routine maintenance work. The only difference mentioned is that preventive maintenance is conducted only after routine and periodic maintenance needs have been satisfied subject to the availability of funds. Activities under preventive maintenance include:

- Asphalt overlays
- Asphalt resealing
- Selective replacement of deteriorated concrete pavement, and bituminous penetration macadam pavement.

6.2 DPWH Road Condition Assessment

The DPWH developed the current Highway Planning Process under the Road Information Management Support System (RIMSS) project (2004-2006) supported by the World Bank (WB) and Asian Development Bank (ADB). The process involves data collection and monitoring of the national roads and bridges. Such data are utilized to formulate work programs based on needs that in time will result to better choice of maintenance treatments, effective utilization of funds, and ultimately effective management of the existing road network.

The Road and Bridge Information Application (RBIA) was established as repository of data used for analysis, reporting and information dissemination. The RBIA together with the data collection and management for the new highway planning process was institutionalized in the DPWH in 2004 through Department Order No. 54.

The process was adopted by the RIMMS from the ROCOND 90 manual of the Road Traffic Authority of the New South Wales, Australia. It was further developed in 2006 by the DPWH through the RIMSS consultant. They have made changes to the ROCOND methodology to suite the Philippine condition and were utilized in the 2007 ROCOND surveys. After intensive monitoring of the 2007 ROCOND surveys, review and field validation of the data, and issues and concerns brought by the raters, further improvements have been made in 2008. Currently, the DPWH is again updating its ROCOND manual and is conducting training for their engineers.

6.3 Road Condition Assessment Implementation

The determination of the pavement road condition by visual inspection is termed “visual road condition assessments” (ROCOND) survey. The objectives of the ROCOND survey are as follows:

a. to measure and record the road condition throughout the system
b. to describe the road condition at the time of survey
c. to provide a sequence of recorded condition that can be analyzed to indicate performance trends
d. to provide condition data for the analysis in the Pavement Management System (PMS), Routine Maintenance Management Systems (RMMS), and eventually for budgeting in the Multi-Year Programming System (MYPS)

The assessment and measurement of road conditions follows different formats; some items like side drains and shoulders are rated on a scale of 1 to 5 while other items for gravel and earth are rated on a scale of 1 to 4 with accompanying condition descriptions with some simple dimensions, others that are particularly for concrete and asphalt are rated by severity of distress and extent of distress exhibited both of which are measured in terms of percentage of area affected by the particular distress, others are evaluated by sampling. Roads that are inspected should generally be of the same surface type of at least 50 m in length for paved road or even less for gravel road. The rating ascribed to each item is deemed to report the average condition of the whole segment at the time of inspection.

The Road and Bridge Information Application (RBIA) Regional Coordinators supervise, monitor and validate the condition data submitted by the *raters*. They are the overall responsible for the road condition data collection and management. The quality control checking must cover at least 5% of each district for each surface type. If there is discrepancy of greater than 15 VCI on more than 10% of the segments for any surface types, then all segments for that survey must be resurveyed.

6.4 Road Condition Assessment Criteria

The *rater* will select a segment of the road based on the procedures prescribed in the ROCOND manual. After selection of the segment, the rating process can begin and with the corresponding rating method. Road segments are sometimes rated on a representative gauging lengths: a 50 m gauging length for flexible pavements, and first 10 slabs for rigid pavement. Both are measured from the beginning of the segment to be rated. Assessment procedures for the different kinds of distress vary depending on the type of pavement in the segment of the road to be surveyed.

6.5 HDM-4

The DPWH uses the Highway Development and Management Ver. 4 (HDM-4) for evaluating national roads and bridges. The objectives in relation to HDM-4 include the following:

- Provide objective basis for prioritizing pavement management spending
- Prioritization based on RBIA data on road quality derived from the District Engineering Offices
- Insulate the road budget from political interventions to favor pet projects of politicians
- Require Program of Work for projects where those without were not given funds.

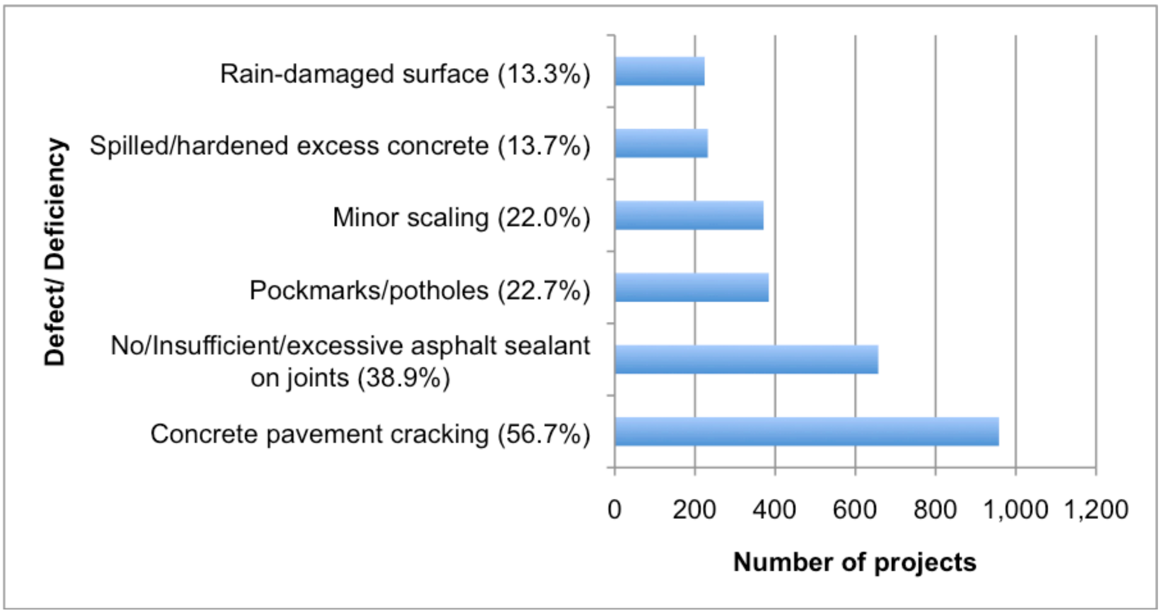
Data collected at the district level are used as inputs to the HDM-4 tool. The HDM-4 tool is operated under the DPWH Planning Service where the tool is employed for prioritization of maintenance works. Data inputs for the tool, however, present some concerns as well as the availability of funds for maintenance works. The DPWH-BOM provided some insights into practices pertaining to pavement maintenance in relation with the use of HDM-4 and those for foreign-funded projects.

In many cases, certain roads are prioritized for maintenance such as overlays or re-blocking due to a set of criteria used by the tool that includes the volume of traffic using a particular road. There is also the long-standing perception that most roads have to be severely deteriorated before maintenance works are undertaken. As such, if there are only minor defects or distresses, the tendency is for the layman to assume that such road pavement conditions do not yet merit maintenance works.

6.6 Issues in maintenance of roads

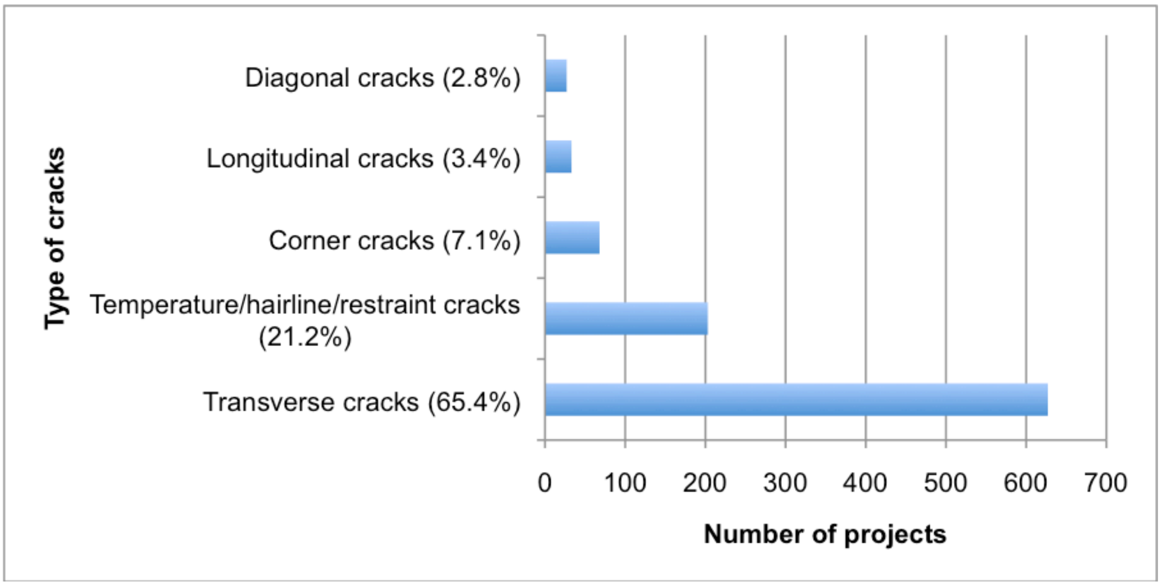
Based on the data provided by the DPWH, the following Figures 4 to 6 show the most common defects or deficiencies found in PCCP and ACP in 2012. Figures 4 and 5 are related in that both pertain to PCCP and the data for the graph in Figure 5.4 is a subset of the data for the preceding graph. That is, Figure 5.4 shows a more detailed breakdown of cracks found in

958 roads throughout the country. These statistics from monitoring reports that serve as inputs for maintenance using HDM-4 can also be used for improving the design and construction of roads.



Explanatory note: Out of a total of 1,689 roads that were evaluated in 2012. 958 roads (56.7%) of were found to have concrete pavement cracking. Observations are not mutually exclusive.

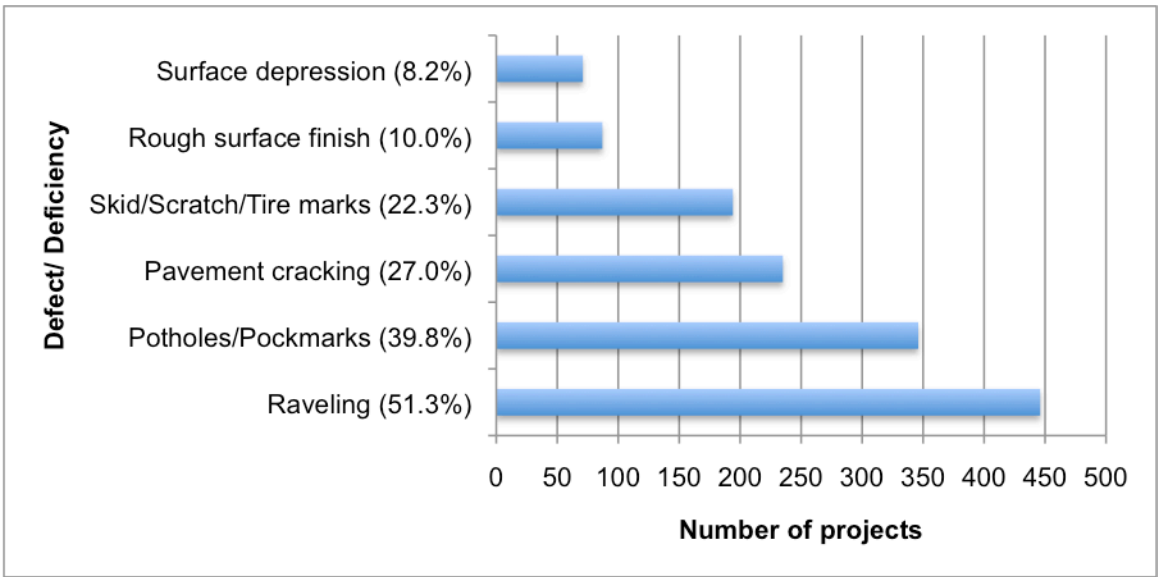
Figure 4. Frequency distribution of defects/deficiencies found in concrete pavements for 1,689 roads in 2012 (DPWH, 2013)



Explanatory note: Out of a total of 958 projects, 627 roads (65.4%) were found to have transverse cracks. Observations are not mutually exclusive.

Figure 5. Frequency distribution of defects/deficiencies pertaining to concrete pavement cracking for 958 roads in 2012 (DPWH, 2013)

Figure 6 shows the most common defects or deficiencies for ACP along 870 roads evaluated by the DPWH in 2012.



Explanatory note: Out of a total of 870 roads, 446 roads (51.3%) were found to have oversized base/sub-base course materials. Observations are not mutually exclusive.

Figure 6. Frequency distribution of defects/deficiencies found in asphalt pavements for 870 roads in 2012 (DPWH, 2013)

The World Bank (WB) identified issues in road maintenance particularly with the HDM-4 implementation. These include:

- Problems of synchronizing with budget calendar
- Data quality and timeliness have become concerns considering frequent changes in road conditions

It cited that data collected at the district level are about 10 months old by the time the HDM reports are generated. The HDM-4 list of priority projects comes out 6 months after the budget has been submitted to Congress.

The DPWH itself accepts these problems and has exerted efforts to address the timeliness of reports and their implications on project prioritization (i.e., given limited resources) and the budget process. The original and revised schedules followed by the DPWH for HDM-4 are shown in Table 4. Note the significant reduction in the total time it takes for the generation of reports from 9 months (February to October) to 6 months (February to July). Such reduction would allow for more time available for the preparation of budgets to be proposed for succeeding year.

Table 4. Original and revised schedules for the HDM-4 process

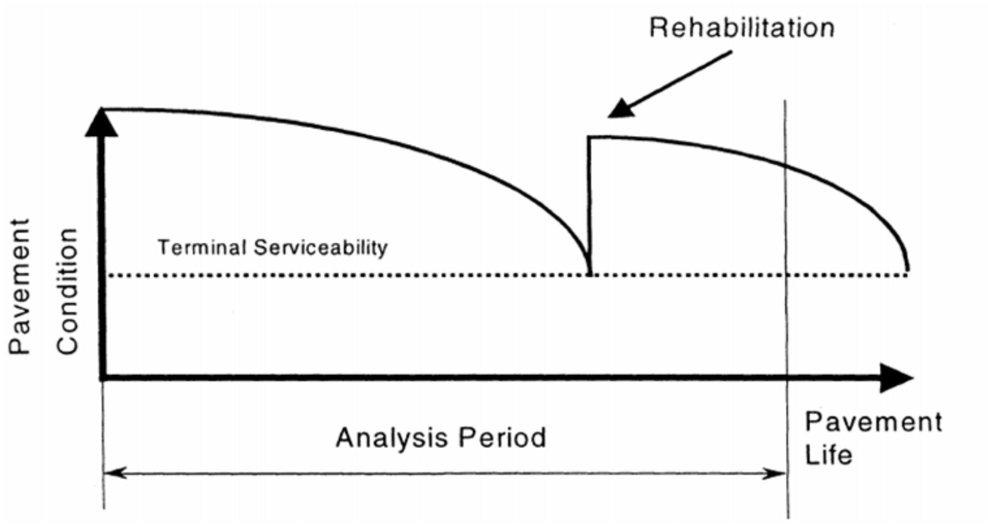
Activities	Schedule	
	Original	**Revised 2012 (Output for 2014 NEP)**
Road Condition Survey (ROCOND) by DEOs	01 February – 30 April	As scheduled
Encoding of Survey Data by the DEOs	16 February – 31 May	As scheduled
Uploading of database file to the Central Office Server by the ROs/DEOs	01 March – 30 June	01 March – 15 June
Desk Q&A by the Infrastructure Planning Research and Statistics Division and Planning Service	-	16 – 30 June
ROCOND joint field validation by the CO/RO/DEOs	01 May – 15 August	Not applicable
Re-assessment/re-survey of incorrect data by the DEOs	01 June – 15 September	Not applicable
Re-uploading of corrected data to the CO server by the ROs/DEOs	01 June – 30 September	01 – 15 July
Importing of ROCOND Database File into the RBIA	01 – 15 October	16 – 23 July
Report Generation/Database File	16 – 31 October	24 – 31 July

In order to address issues pertaining to uniformity and consistency in pavement maintenance, the DPWH is rolling out Long Term Maintenance Contracts (LTMC) for highways. LTMCs will be bidded out to the private sector and the terms of reference will be the basis for evaluating the performance of contractors in maintaining the quality of roads.

7. IMPLICATIONS OF CURRENT PRACTICE ON ECONOMIC LIFE

Roads are designed to provide efficient service for a specified design period as illustrated in Figure 7. It is further assumed that during this service life, the roads will not undergo major rehabilitation. However, when these are not designed and constructed according to standards, major defects and deficiencies will manifest within the projected service life.

The frequencies of periodic maintenance for Philippine roads are shown in Table 5. As can be seen from the data obtained, more than 50% of the national roads have major defects. Key informant interviews with DPWH revealed that although PCCP is designed to last for 20 years, experience on the ground is that periodic maintenance is conducted every ten years for roads carrying heavy traffic heavy traffic (ESAL of 120 million) and 15 years for moderate and light traffic (ESAL of 50 million and 20 million, respectively. On the other hand, the design life of ACP is 10 years. Yet periodic maintenance is performed every 3 years for roads carrying heavy traffic and 5 years for moderate traffic. Only under light traffic will ACP roads last for 10 years. One account even stated that ACP would have to be replaced after 1 year when the area is prone to flooding.



(Source: Hicks, Lundy, and Epps, 1999)

Figure 7. Maintenance and Rehabilitation Activities within analysis period

Table 5. Frequency of Periodic Maintenance

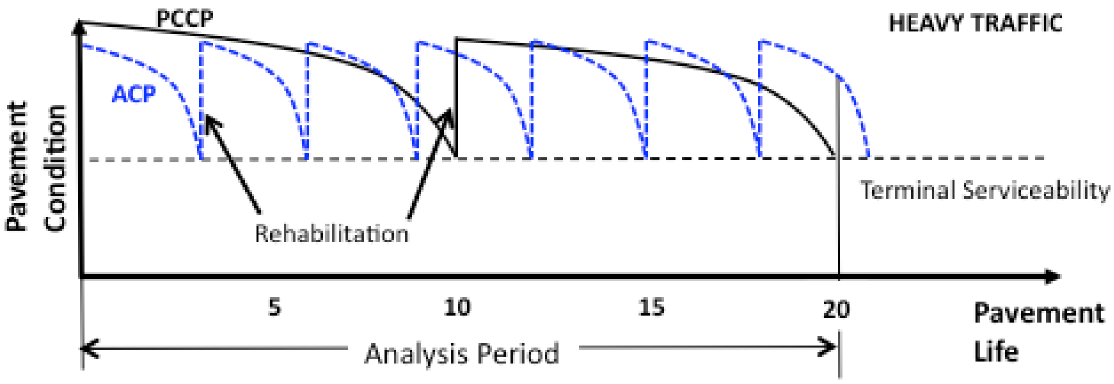
TRAFFIC CONDITION	SERVICE LIFE	
	PCCP	ACP
Heavy Traffic	10 years	3 years
Moderate traffic	15 years	5 years
Light traffic	15 years	10 years

Source: Key informant interviews with DPWH officials, 2015

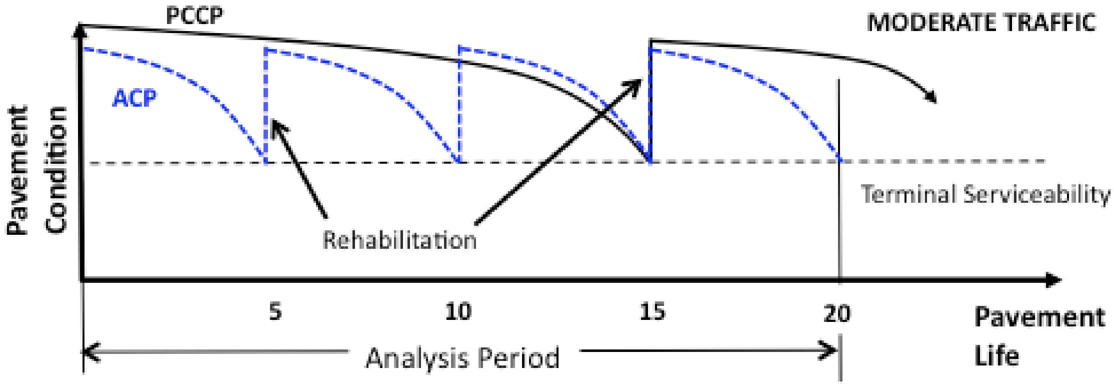
The information shown in Table 5 is applied together with the concepts illustrated in Figure 7. Figure 8 shows the serviceability of PCCP and ACP roads under various traffic conditions (i.e., heavy, moderate and light traffic). The illustrations indicate that although it is possible to extend the service life of the flexible pavements, disruptions due to frequent maintenance (i.e., rehabilitation) will incur economic costs to users.

8. CONCLUSION

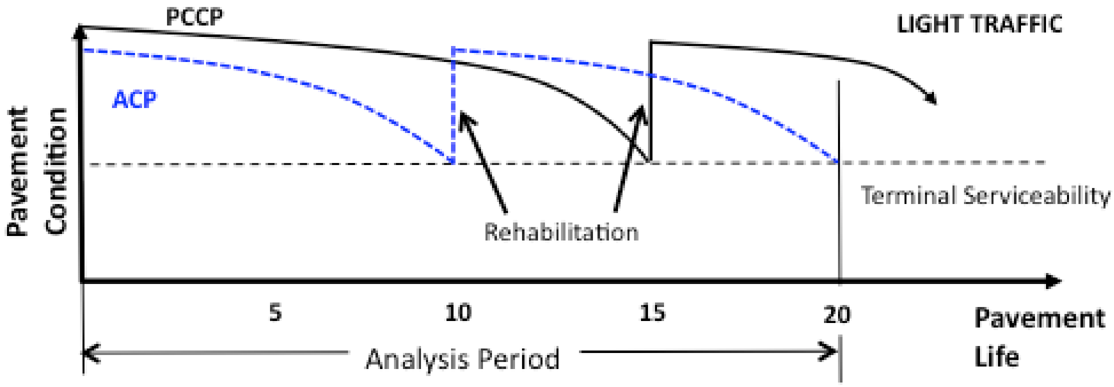
This paper presented the current state of pavement engineering in the Philippines. This includes current practices and the issues arising from these that affect the quality of roads resulting in the reduction of economic life of the pavements. The DPWH has the sole mandate to develop and maintain national roads yet the agency operates within a fixed budget. Thus, its current direction of engaging in Long Term Maintenance Contracts (LTMC) for highways will provide the agency with the much-needed impetus to meet its goal of completely rehabilitating and paving the 31,242 km of national roads by 2016. This will also remove the burden of day-to-day operations from the agency and focuses its efforts on long-term plans.



a. Case of heavy traffic



b. Case of modified traffic



c. Case of light traffic

Figure 8. Maintenance and Rehabilitation Activities within a 20-year analysis period for the Philippines

Issues pertaining to design, construction and maintenance need to be addressed particularly since these issues have significant impacts to the life of the pavements. Careful estimation of traffic loads over the design period can easily be addressed, and stricter monitoring of road construction should be encouraged and reinforced. At present, the Office of the Secretary of the DPWH is assessing the effectiveness of having the private sector participate in the independent monitoring of projects to ensure that contractors would comply with standards in construction work. While such private sector participation is promising, the bottom-line is that the DPWH should encourage a culture of quality work in all stages of pavement engineering, especially at the district level where engineers are in the frontline of design, construction and maintenance of roads.

It can likewise be concluded that even under conditions when the initial capital outlay of ACP will be cheaper compared to PCCP, the economic costs incurred by the users due to frequent rehabilitation work for ACP pavement may render PCCP to be a more viable option.

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