A BRIEF HISTORY AND ANALYSIS OF PHILIPPINE BRIDGES (2007-2015)

I. Introduction

In line with the thrust of the national government to improve the quality of roads and bridges nationwide and spur the economic development from the urban to the rural areas of the country, the DPWH has developed programs to improve the quality of the national road network. Part of these programs includes the asset preservation and network development of the national bridges. The asset preservation program includes the routine and major maintenance and rehabilitation/reconstruction of bridges while the network development program is comprised of the upgrading, replacing and constructing of new bridges along national roads.

Bridges, which are vital part of the national road network, are classified into two (2) types of structures, permanent and temporary bridges. The composition of permanent bridge structures are concrete and steel bridges while temporary bridge structures are bailey and timber.

The inventory of bridges nationwide is made up of bridges along national roads. However, it does not include spillway, overflow, fording, footbridge and reinforced concrete box culvert with lengths less than 6 meters.

Bridge service lives are also relevant to the management of bridges. Long life bridges normally have a design life of 50 years though this does not imply that the actual service life of a bridge is only 50 years or that the bridge must be replaced after this period. The effective life of modern well-designed bridges is normally far in excess of the design life. Bridges are normally replaced for other reasons such as changes in road geometry requirements, changes in design standards or increased traffic volumes. Where these factors do not change, the life of a bridge may be indefinite.

II. Bridge Management System (BMS)

DPWH has established the BMS in 2003 under the Road Information and Management Support System (RIMSS-CO7) Project in order to effectively manage the national bridge stock. It was eventually institutionalized in 2004 thru D. O. No. 47. BMS bridge data are annually collected based on the bridge inventory and condition survey being conducted by the accredited Bridge Inspectors (BI's) from the district offices. The accredited Regional BMS Coordinators from the regional offices conduct the supervision of bridge inventory and condition survey and manage quality assurance on input bridge data.

The bridge data collected from the surveys are encoded in the Bridge Inventory Condition (BIC) stand-alone-program and uploaded in the RBIA which is the repository of all national road and bridge data. The BMS team in the Central Office manages the uploading and quality

assurance of the BMS data, as well as the conduct of the BMS analysis to determine the Bridge Needs Ratio (BNR) for each bridge to enable the bridges to be ranked and prioritized for major maintenance, upgrading and replacement which can be funded locally or foreign-assisted bridge programs in the annual General Appropriations Act (GAA).From 2005 to 2008, improvements in the conduct of bridge condition surveys were instituted. Hence, in 2009 that the BI's started the conduct of the bridge condition surveys supervised by the BMS Regional Coordinators. The uploading of the bridge condition data conducted in the CY 2010 bridge condition survey was completed in 2011.

The BMS was instituted to manage the maintenance/rehabilitation, retrofitting/strengthening, upgrading and replacement of bridges required to address the deterioration of bridges and to maintain the bridge stock to an acceptable standard. It does not directly consider the capacity of a bridge in traffic or structural terms. It is important to recognize that bridge upgrading and replacement may occur for other reasons including: upgrading of a road link to a higher standard, increasing traffic density on a bridge, increased traffic loadings (vehicle weight); and changes in bridge design standards.

For example, bridges may also be upgraded as part of major upgrading of the roads on which they are located. For example, upgrading a two lane road to a divided four lane motorway requires the bridges to be similarly upgraded though the existing bridges may still be sound and suitable for the current traffic levels.

For CY 2012 to present, the annual condition survey starts every 3rd quarter of the year conducted by the accredited BIs from the district engineering offices, allowing them a period of six (6) months to complete all the activities including the uploading of BIC stand-alone-program and file-named photographs such as, site visit, mandatory, inventory and condition *(defects photos)*.

III. Data Analysis

A. Bridge Inventory

Based on the generated BMS output for CY 2015, the total number of bridges nationwide summed up to 8,166 with an aggregate length of 364,724 linear meters, of which 8,061 (99.08%), with an aggregate length of 361,380 linear meters are permanent and only 105 (0.92%) with an aggregate length of 3,344 linear meters are temporary.

Table 2.1a shows the summary of existing national bridges indicating the types of permanent and temporary bridges with the corresponding number and length by region. On the other hand, ***Table 2.1b*** shows the breakdown of the existing national bridges by district.

Majority of the national bridges are concrete structures, as shown in *Table 2.1a* with a total of 6,968 bridges (292,373 linear meters), for steel structures are 1,093 bridges (69,007 linear meters) while bailey and timber bridges have a total number of 86 (3,044 linear meters) and 19 (300 linear meters), respectively.

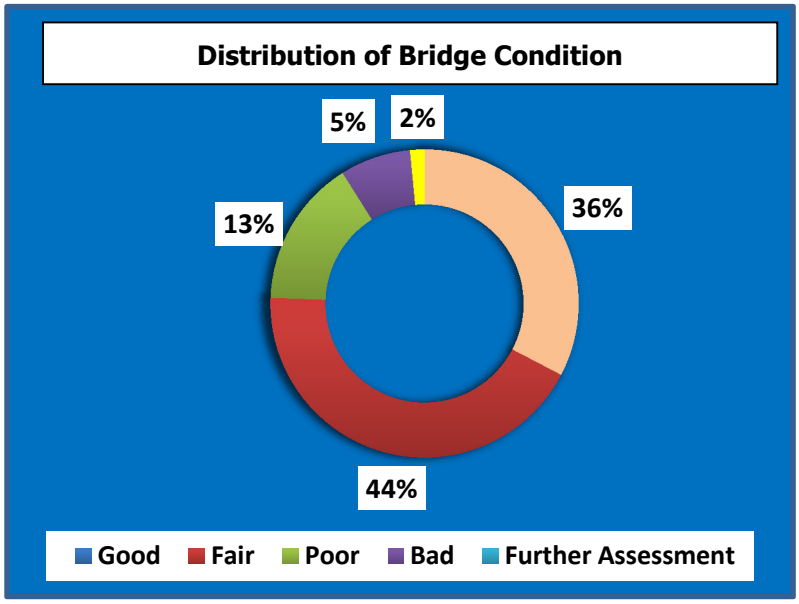
The **summary by region and by engineering district in *Table 2.1b*** shows that in terms of the total number of bridges, Region VIII has registered the highest with 885 bridges and Region XI is the lowest with 290 bridges.

B. Bridge Condition

The overall condition of the bridge is based on the condition of the bridge attributes component, and based on the CY 2015 bridge condition survey, ***Table 2.1c* shows the distribution of the bridges by condition (good, fair, poor and bad)**. The figures indicate that 36% of the total numbers of bridges are in good condition, 44% in fair condition, 13% in poor condition, 5% in bad condition and 2% are for further assessment, as illustrated in the subsequent chart. Bridges that are for further assessment are those under the circumstances of on-going construction, under major maintenance work or washed-out. These figures show that majority of the bridges are in a good to fair state. The bridges in poor to bad condition are the bridges that require rehabilitation, strengthening, retrofitting or replacement.

In general, structures described as "**good"** condition are free of defects, those described in **Fair** condition may have defects which affect the durability, those described as "**poor"** in condition may have defects which affect the performance and structural integrity of the structure and those structures described as "**bad"** shall have major defects and are considered to be beyond repair.

Table 2.1c



The list of bridges nationwide with the length and corresponding condition rating can be found in *Table 2.1d*.

C. Comparative Report on Bridge Data (2007-2015)

The comparison of the increase/decrease in the number of permanent and temporary bridges from 2007 to 2015 is presented in *Table 2.2*. This comparative analysis covers bridges along national roads but it does not include fording, spillways and overflow structures.

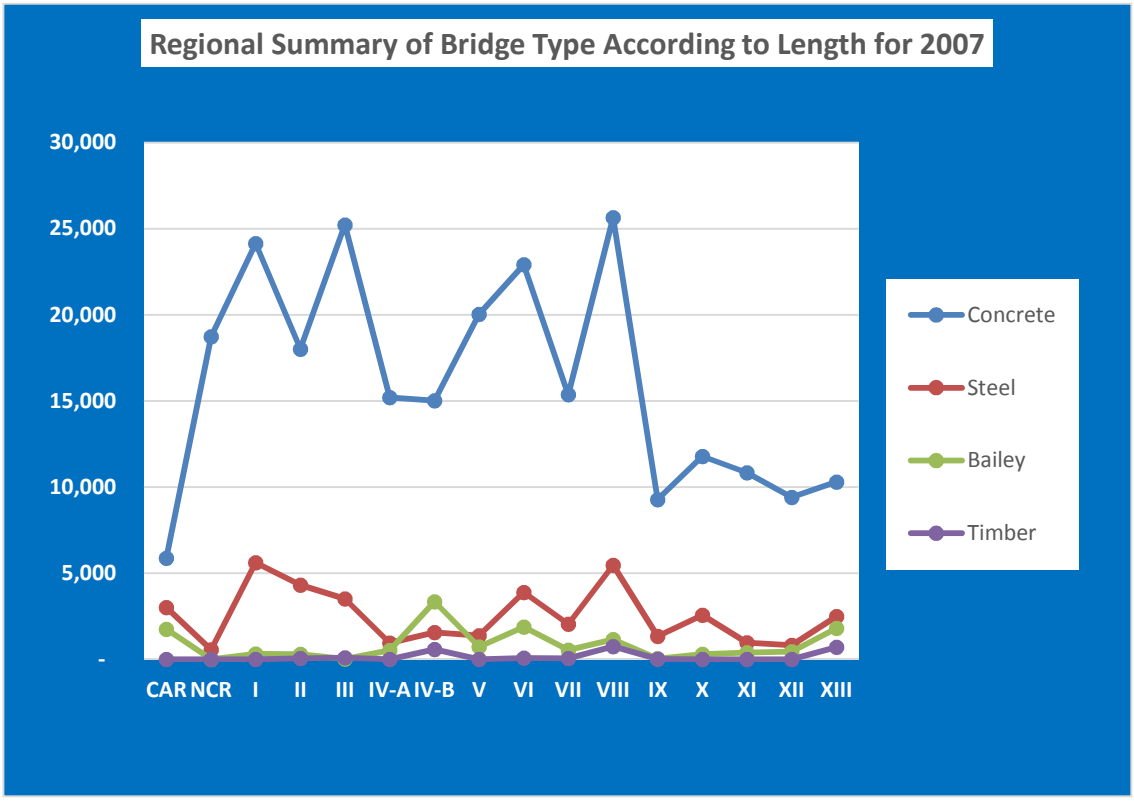
From 2010 to 2012, there was a decrease in the number of bridges from 8,024 to 7,928 but an increase in aggregate length from 345,056 linear meters in 2010 to 348,575 linear meters in 2012. The decrease in the number of bridges was due to the downgrading/replacement of some temporary bridges to Reinforced Concrete Box Culverts (RCBC). On the other hand, the increase in the aggregate length was due to the replacement of temporary to permanent bridges which entailed the construction of longer spans and also the construction of new bridges across river crossings, spillways and newly converted roads.

Generally, data from 2007 to 2015 show that there is an annual increase in the number of bridges. In 2007 and 2010, there was a significant increase of 231 in the number of bridges. A significant number of bridges were replaced from temporary to permanent in 2007, 2009, 2013 and 2014 with a total of 255, 397, 149 and 154, respectively. Most of these replacements were under foreign-assisted bridge projects and locally funded as well. On the other hand, the increase in the number of bridges was minimal during 2008 and 2009 with only 15 and 35 respectively. During these years, the number of permanent bridges increased while the number of temporary bridges decreased due to the replacement of temporary bridges with permanent bridges.

Meanwhile, there is an increase of 35 in the total number of bridges between 2014 and 2015 with respect to concrete, steel, bailey and timber structures as shown below:

Year	Concrete	Steel	Bailey	Timber	Total
2014	6861	1061	170	39	8131
2015	6968	1093	86	19	8166

The annual increase in number of bridges from 2007 to 2015 was due to the following: a) additional bridges from the newly converted national roads through Department Orders and Legislations, b) newly constructed bridge structures across river crossings including box culverts c) replacement of spillways and overflow structures with either permanent or temporary bridges, and d) implementation of the foreign-assisted bridge programs.

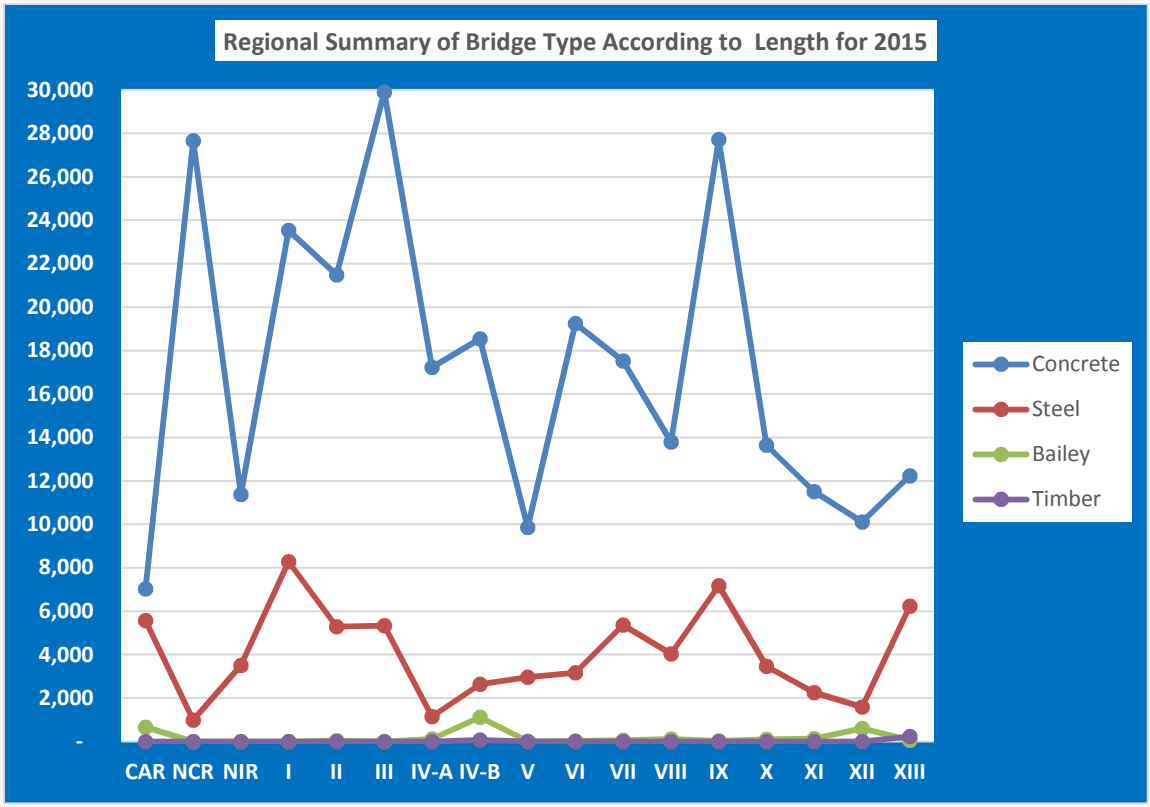


The chart above shows the length of bridges in linear meter by region for the year 2007. Concrete is notably the predominant bridge structure nationwide, with Region VIII having the longest aggregate length of 25,646 linear meters; while, the shortest is CAR at 5,883 linear meters, from a combined length of 257,839 linear meters.

Concrete is seconded by steel in terms of length. It spans a total of 40,570 linear meters, wherein the longest is Region I, with a total length of 5,611 linear meters, and the shortest is at 567 linear meters in NCR.

In terms of temporary bridges, Region IV-B has the longest bailey structure; whereas, Region VIII has the longest timber aggregate bridge length at 3,358 and 759 linear meters respectively. Conversely, Region III has the shortest aggregate bailey bridge structure at 21 linear meters; while, NCR, Region I, V, XI and XII do not have any timber bridge.

NCR is the only region with 100 percent permanent bridge, whilst, Region IV-B has the longest combined length of 3,939 linear meters of temporary bridges.



For 2015, as shown in the chart above, Region III has the longest aggregate concrete bridge length at 29,896 6 linear meters. The shortest is CAR at 7,034 linear meters. In terms of steel structures, the longest is 8,285 linear meters in Region I and the shortest at 990 linear meters in NCR.

It is apparent that in a period of eight (8) years, there has been a significant number of upgrades that have been implemented which accounts for the decrease in the length of temporary bridges nationwide. From 16,047 linear meters in 2007 down to 3,344 linear meters in 2015. On the other hand, there has been a relative increase in the stretch of permanent bridges in 2015 at 361,380 linear meters from 298,409 linear meters back in 2007.

Also, it is evident that a number of regions in the country no longer have temporary bridges. From just NCR in 2007, Region I, III and the recently included NIR, are now among the regions that have absolutely 100 percent permanent bridges.

With eleven (11) out of sixteen (16) regions in 2007 having timber bridge structure, excluding NIR, to just two (2) in 2015, we can say that improvements in the national bridge network have truly come a long way. It doesn't stop here. The Department still has projects lined up to continue to enhance the country's bridge system, in accordance to its mandate of improving the lives of every Filipino, as well as achieving total connectivity, through quality infrastructure.

IV. Target Outcome by 2016 for the National Bridges

The medium term plan for 2011-2016 is to achieve a target outcome of making all national bridges 100% permanent and in good condition by 2016. This is in line with the present administration's goal to provide funding for the rehabilitation and replacement of all temporary bridges through local and foreign assistance including soliciting the needed funding via the Public Private Partnership (PPP) scheme. Currently, several foreign loan packages are also being worked out to augment the local funds. With all these mechanisms in place, it is expected that the Department's objective for all national bridges to be in a permanent and good condition by 2016, shall be realized.