PHILIPPINE NATIONAL BRIDGE STOCK

I. Introduction

Our country, the Philippines, is home to a vast number of bridges along both local and national road systems. The responsibility for national bridges lies with the national government through the Department of Public Works and Highways (DPWH). This centralized oversight ensures a coordinated and strategic approach to planning, constructing, maintaining, and developing bridges at the national level. Having the DPWH manage national bridges reflects a dedication to preserving and enhancing essential transportation infrastructure, which is vital for economic growth, accessibility, and overall mobility.

Bridges are crucial in driving economic growth by acting as key links in the road network. Their importance lies in enabling smooth traffic flow and connecting various regions, which enhances the country's overall accessibility and connectivity.

Maintaining in a regular manner is essential for maintaining the strength of bridges and their parts. This strategy helps prevent further deterioration, ensuring the safety and efficiency of the structures. It also aids in preserving or even improving their condition over time, allowing them to fulfill their intended role effectively. Classifying bridges as either permanent or temporary structures reflects the diverse nature of the infrastructure. Permanent bridges, often constructed from concrete and steel, are built for long-term use and are expected to last for several decades. Temporary bridges, like bailey and timber structures, are utilized when a more flexible or short-term solution is required.

Every bridge type serves a distinct purpose based on factors like location, expected traffic load, and duration of use. The use of concrete and steel in permanent bridges emphasizes the focus on durable and sturdy infrastructure, while the use of bailey and timber in temporary bridges shows adaptability in meeting varying needs.

The typical service life of a permanent bridge can extend up to fifty years, but this doesn't necessarily mean it must be replaced after that period. Well-designed modern bridges often last longer than their initial design life, thanks to advancements in engineering, materials, and construction techniques.

While the overall condition of a bridge is crucial in determining its lifespan, other factors may also drive the decision to replace a bridge. Changes in road design, updated standards, and increased traffic volume are all key factors that can influence the replacement decision.

The DPWH has established programs to enhance the quality of the national road network, acknowledging its vital role in sustaining economic development and linking urban and rural areas. These initiatives, which focus on asset preservation and network expansion, demonstrate a commitment to maintaining and improving infrastructure for the benefit of the nation, as outlined in the following Bridge Program:

1. Asset Preservation

    - Retrofitting/Strengthening of Permanent Bridges: It is the modification of existing bridge structures to make more resistant to seismic activity, ground motion, or soil failure due to earthquakes.

- Rehabilitation/Major Repair of Permanent Bridges: This involves major work required to restore the structural integrity of a bridge, as well as work necessary to correct major safety defects.

2. Network Development

- Replacement (Temporary to Permanent): A bridge with a short life span and with limited loading capacity and restrictions on speed.

- Replacement of Permanent Weak Bridges: A bridge that has an overall condition of bad and shall have major defects, no longer structurally sound and are considered to be beyond repair.

- Widening of Permanent Bridges: This involves enhancing the capacity and capabilities of existing bridges to accommodate increased traffic volumes or changing infrastructure requirements. Bridge construction can be widening of the existing or constructing a parallel bridge.

- Constructing of New Permanent Bridges: The construction of permanent concrete bridge structures along river crossings/fording and upgrading of box culverts and spillways into standard bridge structure.

II. Bridge Management System (BMS)

In the year 2003, DPWH has established the BMS 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 Department Order (DO) No. 47. BMS bridge data are annually collected based on the bridge inventory and condition survey being conducted by the accredited Bridge Inspectors (BIs) from the DPWH District Engineering Offices (DEOs) and the BMS Regional Coordinators from the DPWH Regional Offices (ROs) who are tasked to supervise the bridge inventory and condition survey and also manage the quality assurance on the bridge data.

The collected bridge data 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 (CO) 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 according to bridge program.

The funding for the bridge program can come from various sources. It may be included in the DPWH annual budget under the General Appropriations Act (GAA) or in foreign-assisted programs. The GAA is the government's annual budget law that specifies the allocation of funds for different government agencies, while foreign-assisted programs are initiatives supported by international organizations.

The period from 2005 to 2008 marked a phase of improvement in the conduct of bridge condition surveys by the DPWH in the Philippines. Several changes were introduced during this timeframe to enhance efficiency and simplify the inspection process.

In 2005, the DPWH issued DO No. 43, which aimed at streamlining and improving the bridge condition survey process. One of the key changes introduced was the reduction of inspection types from seven (7) to five (5). This reduction was likely implemented to eliminate overlapping activities and simplify the required actions during inspections.

In 2009, a new set of Bridge Condition Rating Criteria and Rating Card was introduced. This likely included updated guidelines and assessment criteria for evaluating the condition of bridges.

The introduction of new condition criteria had been accompanied by training for BIs to ensure consistent and accurate assessments. Additionally, the surveys were administered by the BMS Regional Coordinators. This indicates a collaborative and coordinated effort with regional coordinators overseeing and supporting the survey process.

Following the changes in inspection types and the introduction of new criteria, there was a significant improvement in the uploading of bridge condition data from the calendar year (CY) 2010 up to present. This suggests that the modifications made to the survey process positively impacted the efficiency and accuracy of data collection and management.

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 bridges 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.

Bridges may also be upgraded as part of major upgrading of the roads on which they are located. Further, 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.

Currently, the annual condition survey starts every second quarter of the year, the first three (3) months is intended for inventory and condition inspection survey and the remaining three (3) months will be accomplishing the bridge data and uploading, allowing them to complete the task for a period of six (6) months. These tasks include, among others, inspecting the condition of bridges, updating the bridge inventory, encoding data, and preparing and uploading the BIC stand-alone program into the CONFIRM[1] for updating the BMS including photographs using the prescribed format, such as: site visit, mandatory, inventory and defects photos that are file-named accordingly.

[1] CONFIRM is an asset management solution specifically designed to empower public bodies with the insight to make informed decision on repair, maintenance and investment for critical public infrastructure assets.

III. Data Analysis

A. Bridge Inventory

Based on the generated BMS output for CY 2024, the total number of bridges nationwide is 9,007, with an aggregate length of 414,897.99 linear meters; of which, 8,996 (99.88%) are classified as permanent bridges having an aggregate length of 414,521.02 linear meters and only 11 (0.12%), with an aggregate length of 376.97 linear meters, are considered as temporary bridges.

Table 1 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** shows the breakdown of the existing national bridges by district and per regional basis.

Majority of the national bridges are concrete type structures, as shown in Table 1, with a total of 7,590 bridges (326,120.64 linear meters), Steel type structures are 1,406 bridges (88,400.37 linear meters), while Bailey type structures are 11 bridges (913 linear meters) and no Timber type structures.

The summary by region and by engineering district in **Table 2** shows that in terms of the total number of bridges, Region VIII has registered the highest with 928 bridges, followed by Region III with 758 bridges and the last two (2) lowest are Region XI and BARMM with 306 and 184 bridges respectively.

B. Bridge Condition

The overall condition of a bridge is based on the condition of its attributes component. **Table 3 shows the distribution of the bridge condition (good, fair, poor and bad)**. Based on the CY 2024 bridge condition survey, the figures indicate that 44.33% (3,993 bridges) of the total numbers of bridges are in good condition, 48.61% (4,378 bridges) in fair condition, 6.25% (563 bridges) in poor condition, 0.81% (73 bridges) in bad condition and there are no bridges for further assessment, as illustrated in **FIGURE A** below. These figures show that majority of the bridges are in a good to fair state that requires routine or major maintenance, while poor to bad condition state requires major maintenance, upgrading or replacement.

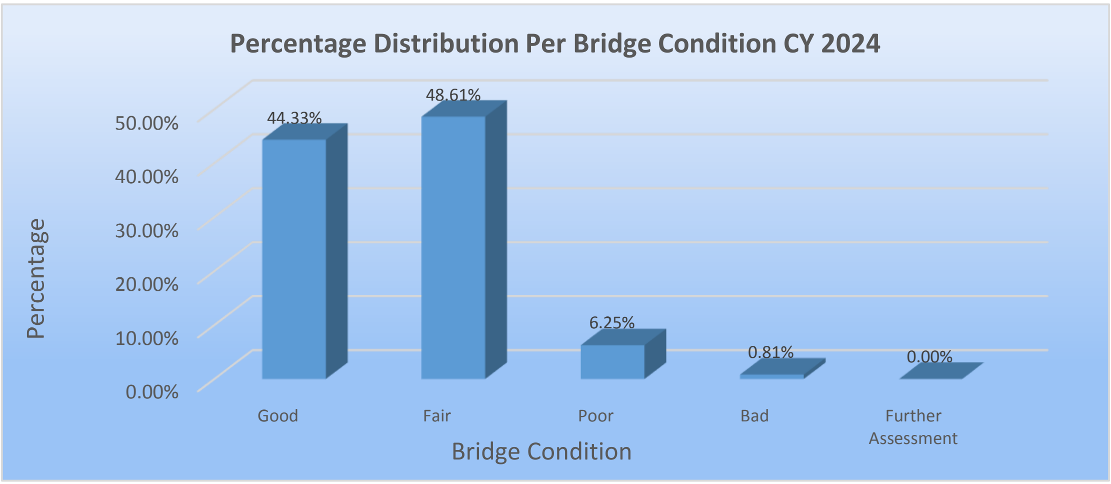

FIGURE A

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

Structures in good or fair condition that have adequate traffic capacity and adequate load rating are preserved more easily than they could be rebuilt or replaced. But necessary action at structures in poor and most especially bad condition may seem to be more urgent. Bridges in good condition are candidates for routine maintenance actions, those in fair conditions may receive major repair, poor condition bridges are eligible for upgrading and bad are for replacement work. The key is that there are separate funds for each level of work, so that cost effective investments to maintain bridges in good condition are still made.

The matrix below are the recommended countermeasures:

Bridge Condition	Recommended Countermeasure
Good	Routine Maintenance
Fair	Major Maintenance *(Repair, Strengthening, Protective Works)*
Poor	Major Maintenance or Upgrading
Bad	Upgrading or Replacement

The list of district engineering offices, with the length and corresponding condition rating, is found in Table 4.

C. Comparative Report on Bridge Data (2009-2024)

The comparison of the increase or decrease in the number of permanent and temporary bridges from 2009 as the base year to 2024 is presented in Table 5. This comparative analysis covers bridges along national roads but it does not include fording, spillways and overflow structures.

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.

In general, the annual increase in the total number of bridges and aggregate length is the result of significant number of bridges that were replaced from temporary to permanent bridge structures, including those bridges leading to tourist service centers that were converted into national roads and those converted from local roads to national roads, respectively. Most of these bridges are locally-funded projects and foreign-assisted bridge projects as well.

Furthermore, the annual increase/decrease in number of bridges from 2009 to 2024 was due to the following: a) additional bridges from the newly converted national roads through Department Orders and legislations, b) newly constructed parallel bridges, c) newly constructed bridge structures across river crossings including box culverts, d) replacement of spillways and overflow structures with either permanent or temporary bridges and e) implementation of the foreign-assisted bridge programs.

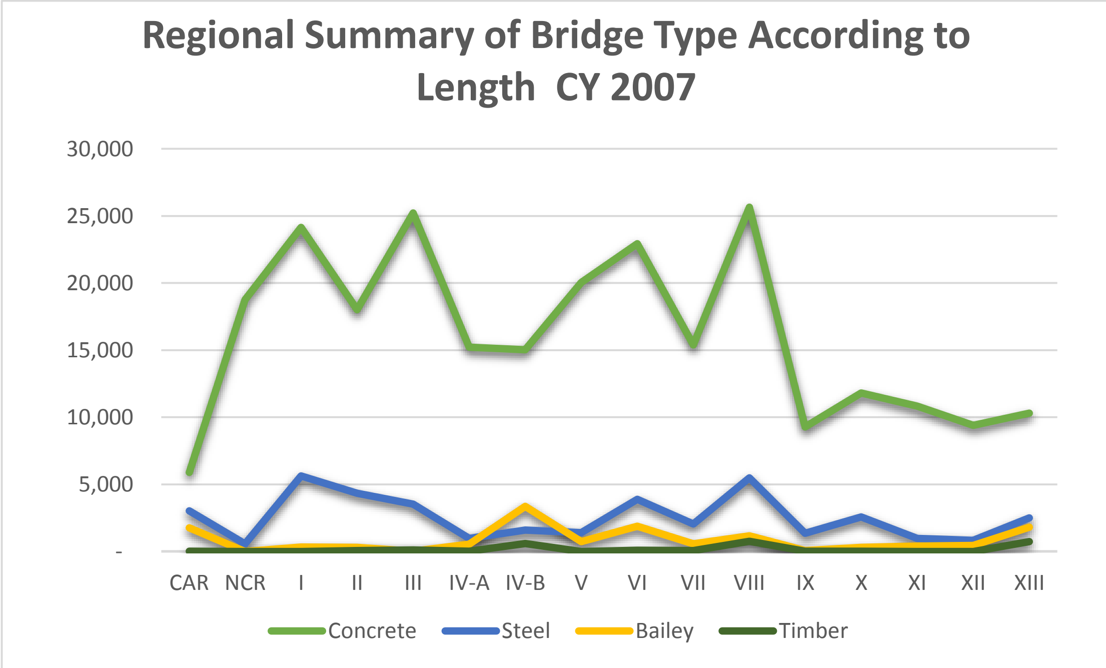

FIGURE B

Figure B, based on the succeeding matrix below, shows the length of bridges in linear meter by region for the year 2007. Concrete type is notably the predominant bridge structure nationwide, with Region III having the longest aggregate length of 29,622 linear meters while BARMM has the shortest length at 4,943 linear meters.

Concrete is seconded by steel in terms of length. It spans a total of 91,084 linear meters, wherein the longest length falls in Region I, with a total length of 11,147 linear meters, and the shortest is at 1,285 linear meters in BARMM.

In terms of temporary bridges, Region IV-B has the longest bailey bridge structure of 363 linear meters; whereas, Region IV-B has also the longest timber bridge structure of 35 linear meters. Conversely, Region VII has the shortest aggregate bailey bridge structure at 16 linear meters; while, NCR, Region I, V, III, IV-A, V, VII, IX, X and XIII do not have any Bailey bridge. Notably, Region IV-B is the only region that has timber bridge.

NCR, Region I, III, IV-A, V, VII, IX, X, and XIII are the regions with 100 percent permanent bridges, while, Region IV-B has the longest total length of 398 linear meters of temporary bridges.

For 2024, as shown in **Figure C**, based on **Table 1**. Region III has the longest aggregate concrete bridge length at 31,669.14 linear meters. While BARMM has the shortest length at 5,452.55 linear meters. In terms of steel structures, the longest is 11,298.79 linear meters in Region I and the shortest is at 1,424.68 linear meters in BARMM.

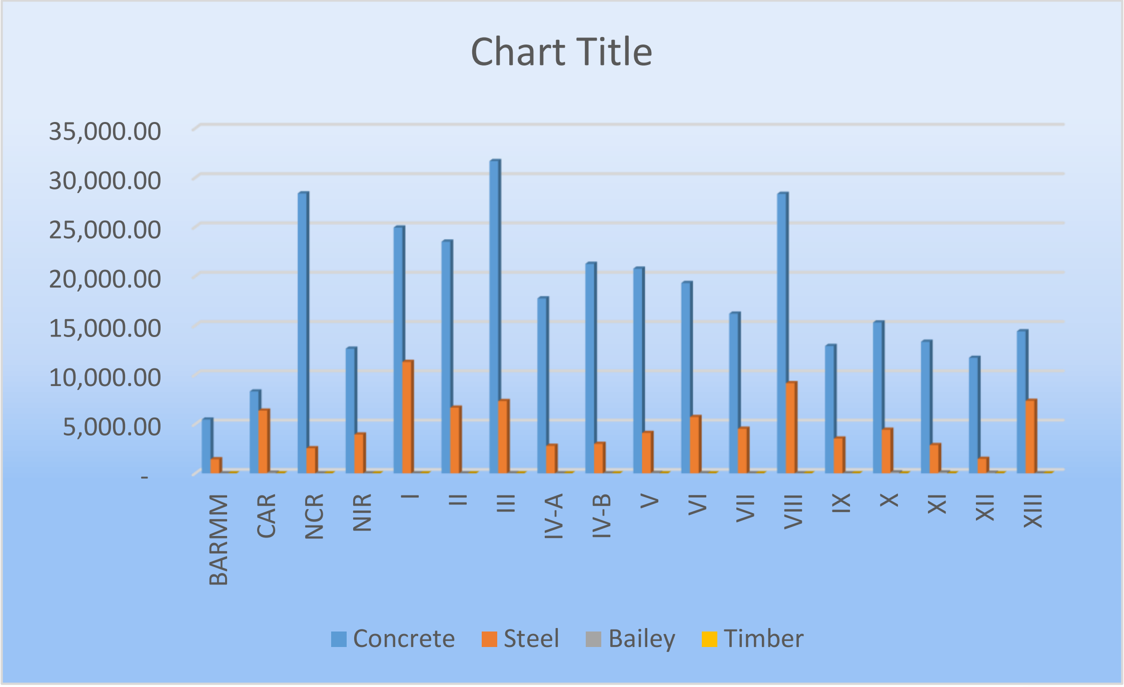

FIGURE C

SUMMARY OF EXISTING NATIONAL BRIDGES (LENGTH AND NUMBER) by TYPE - PER REGION
Table 1

RBIA Generated Report as of October 16, 2024 — *Unit of Measure: Linear Meter (lm)*

Region	Permanent Bridges						Temporary Bridges						Grand Total	
	Concrete		Steel		Total		Bailey		Timber		Total			
	Number	Length	Number	Length	Number	Length	Number	Length	Number	Length	Number	Length	Number	Length
BARMM	155	5,452.55	29	1,424.68	184	6,877.23	0	-	0	-	0	-	**184**	**6,877.23**
CAR	255	8,300.87	96	6,358.55	351	14,659.42	2	62.22	0	-	2	62.22	**353**	**14,721.64**
NCR	288	28,389.70	19	2,542.35	307	30,932.05	0	-	0	-	0	-	**307**	**30,932.05**
NIR	353	12,637.80	79	3,933.44	432	16,571.24	0	-	0	-	0	-	**432**	**16,571.24**
I	496	24,928.03	90	11,298.79	586	36,226.82	0	-	0	-	0	-	**586**	**36,226.82**
II	452	23,498.80	69	6,659.72	521	30,158.52	0	-	0	-	0	-	**521**	**30,158.52**
III	664	31,669.14	93	7,326.14	757	38,995.28	1	14.50	0	-	1	14.50	**758**	**39,009.78**
IV-A	614	17,739.09	68	2,784.38	682	20,523.47	0	-	0	-	0	-	**682**	**20,523.47**
IV-B	583	21,244.30	72	2,984.45	655	24,228.75	0	-	0	-	0	-	**655**	**24,228.75**
V	638	20,756.91	96	4,091.17	734	24,848.08	1	36.80	0	-	1	36.80	**735**	**24,884.88**
VI	430	19,300.29	83	5,711.22	513	25,011.51	1	20.50	0	-	1	20.50	**514**	**25,032.01**
VII	352	16,192.61	82	4,519.53	434	20,712.14	0	-	0	-	0	-	**434**	**20,712.14**
VIII	764	28,341.87	164	9,140.17	928	37,482.04	0	-	0	-	0	-	**928**	**37,482.04**
IX	289	12,915.66	79	3,527.47	368	16,443.13	0	-	0	-	0	-	**368**	**16,443.13**
X	364	15,299.56	89	4,417.31	453	19,716.87	3	98.25	0	-	3	98.25	**456**	**19,815.12**
XI	259	13,338.65	46	2,861.57	305	16,200.22	1	91.65	0	-	1	91.65	**306**	**16,291.87**
XII	282	11,710.98	42	1,466.91	324	13,177.89	2	53.05	0	-	2	53.05	**326**	**13,230.94**
XIII	352	14,403.84	110	7,352.52	462	21,756.36	0	-	0	-	0	-	**462**	**21,756.36**
Grand Total	**7,590**	**326,120.65**	**1,406**	**88,400.37**	**8,996**	**414,521.02**	**11**	**376.97**	**0**	**-**	**11**	**376.97**	**9,007**	**414,897.99**

It is apparent that in a period of fifteen (15) 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 376 linear meters in 2024. On the other hand, there has been a relative increase in the stretch of permanent bridges in 2024 at 414,521 linear meters from 298,406 linear meters back in 2007.

Also, it is evident that a certain number of regions in the country no longer have temporary bridges. Among all the regions, Regions III, V, VI, X, XI are the only regions that has temporary bridges

Thus, we can simply 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.

D. Target Outcome for National Bridges

DPWH has set three major outcomes that shall be its contribution in achieving the goal of sustainable development that will improve the life of every Filipino. These include reduced travel time, improved road quality and safety as well as lives and properties protected from natural disasters.

To reduce travel time, the agency aims to construct new roads and bridges for a seamless transport system through the construction of expressways, through Private-Public Partnership (PPP), new roads to close gaps and missing gaps in the national road network, by-passes, flyovers and four long-span bridges (inter-island linkage projects).

As a country frequented by various natural disasters, the possibility of another major disaster in the Philippines is not a matter of where, but when. The Philippines ranked third among all of the countries with the highest risks worldwide wherein 60% of the country's total land area is exposed to multiple hazards, and 74% of the population is susceptible to their impact. This is largely due to the risk involving coastal hazards such as typhoons, storm surges and volcanic eruption. Unfortunately, there are no short-term solutions to the array of challenges the Philippine government faces in terms of coping with climate change-affected disasters. With this in mind, DPWH aims to build disaster-resilient structures in calamity-prone area and rehabilitate/strengthen five hundred nine (509) bridges along the primary roads identified vulnerable area.