



REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

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Glossary of Terms

AADT	Annual Average Daily Traffic
API	Agency Performance Indicator
AWP	Annual Works Program
B/C	Benefit/Cost Ratio
BOC	Bureau of Construction
BOD	Bureau of Design
BOE	Bureau of Equipment
BOM	Bureau of Maintenance
BMC	Bridge Maintenance Costs
BMS	Bridge Management System
BNR	Bridge Needs Ratio
BRF	Bridge Route Factor
COE	Certificate of Exemption
CRF	Capital Recovery Factor
DEO	District Engineering Office
DPD	Development Planning Division
DPWH	Department of Public Works and Highways
ECC	Environmental Compliance Certificate
EMK	Equivalent Maintenance Kilometer
FAP	Foreign Assisted Project
FS	Feasibility Study
GAA	General Appropriations Act
GIS	Geographic Information System
IC	Intervention Cost
ICC	Investment Coordination Committee
IPRSD	Infrastructure Planning Research and Statistics Division
IQL	Information Quality Level
IRR	Internal Rate of Return
IT	Intervention Type
JBIC	Japanese Bank for International Cooperation
JICA	Japanese International Cooperation Agency
KPI	Key Performance Indicator
LFP	Locally Funded Project
LRM	Locational Referencing Method
LRP	Locational Reference Point
LRS	Locational Referencing System
MIS	Monitoring & Information Service
MM	Major Maintenance
MPS	Maintenance Priority Score
MTIDP	Medium Term Infrastructure Development Plan
MTPDP	Medium Term Philippine Development Plan
MTPIP	Medium Term Public Infrastructure Program
MVUC	Motor Vehicle User Charge



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MWP	Multi-year Work Program
MYPS	Multi-Year Program and Scheduling
ND	Network Development
NMPS	Normalized Maintenance Priority Score
NPV	Net Present Value
NPV/C	Benefit Cost Ratio
OIC	Officer In Charge
PMO	Project Management Office
PPI	Process Performance Indicator
PS	Planning Service
PS	Priority Score
PWF	Present Worth Factor
QA	Quality Assurance
QC	Quality Control
RBIA	Road and Bridge Information Application
RDBL	Road Diagram and Bridge List
RIMSS	Road Information and Management Support System
RMMS	Routine Maintenance Management System
RO	Regional Office
RODD	Regional Office Design Division
ROMD	Regional Office Maintenance division
RPO	Road Program Office
SQL	Standard Query Language
SRSF	Special Road Support Fund



BRIDGE MANAGEMENT SYSTEM OPERATION GUIDE

1 INTRODUCTION

1.1 Background

A Bridge Management System (BMS) has been established within the DPWH to provide a computer based system for the management of Philippine national bridges. The process was designed and the application developed to provide an analytical tool that will enable the DPWH to monitor the state of the national bridges and to establish a rational and defensible case for specific funding for bridge asset preservation (bridge major maintenance) and network development (bridge upgrading and replacement) funds.

1.2 Scope of This Guide

The BMS Operation Guide is developed as an overview document to assist the user in implementing the BMS process. The basic aim of this guide is to provide BMS users with a road map on implementing the system.

This document guides user through the consecutive steps of this process briefly explaining why these steps are needed to be performed. Reference to relevant technical documentation for more detail information about the principles applied is given where appropriate. Similarly various sections of software user guides are referred to for the operations mentioned.

1.3 Scope of BMS

The BMS will manage all bridges on national roads. The definition of a bridge for inclusion in the BMS is as follows:

Definition of Bridge *A structure carrying a road over a road, waterway or other feature, with a clear span along the centerline between the inside faces of supports over 3.0 meters. A bridge may have an independent deck supported on separate piers and abutments, or may have a deck constructed integral with the supports.*

The RBIA will be responsible for ensuring that all bridges on national roads are included in the RBIA. The BMS will cover only those national bridges included in the RBIA.



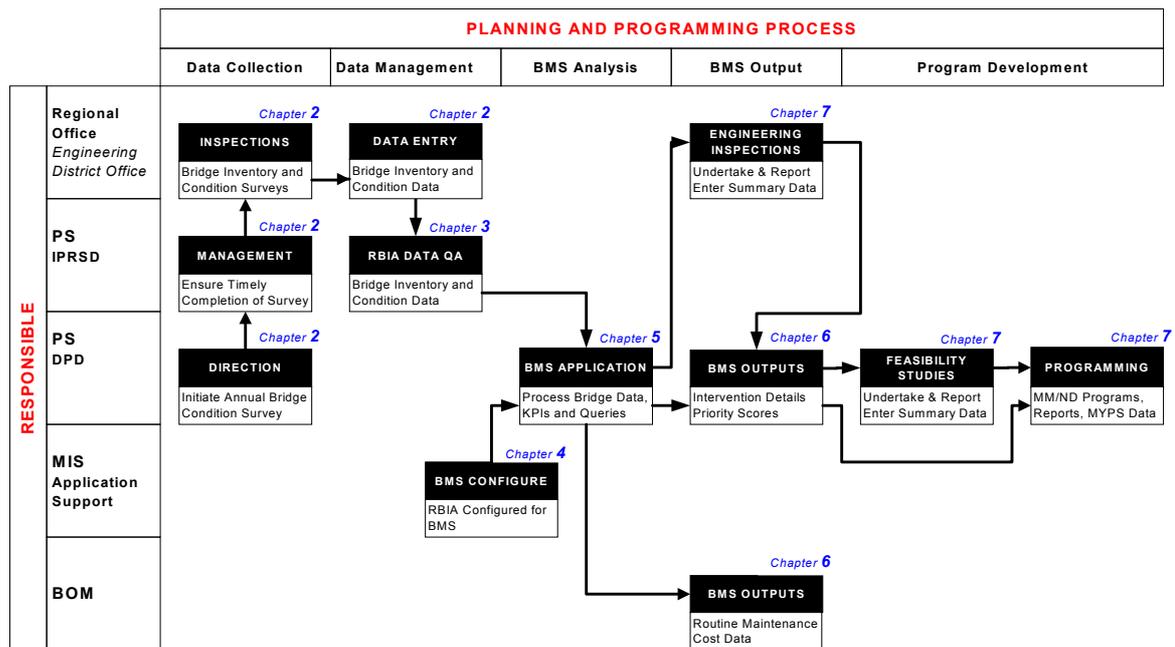
Large or complex bridges may have a dedicated management plan that covers their inspections and maintenance. These bridges may be excluded from the BMS analyses but summary data should be included in the BMS.

1.4 Overall Process

The overall process related to the BMS is illustrated in Figure 1-1. The process is broadly divided into the following stages:

- Data collection,
- Data management,
- Undertaking analysis,
- Generating outputs, and
- Works Program development.

Figure 1-1
Overall BMS Process



The activities to be carried out in each of the stages is quite different in nature and will be required to be undertaken by different offices within DPWH. Hence, each stage is described in separate chapters in this guide.



1.5 BMS Policies

The following policies have been adopted by the DPWH for the implementation of the BMS:

Policy 1: BMS Implementation

The RBIA and BMS will be implemented and maintained for all national bridges.

Policy 2: BMS Funding

The DPWH will provide the necessary funding in the DPWH annual budget to implement and maintain the BMS.

Policy 3: Bridge Planning

The BMS will be fully integrated into the DPWH overall planning process.

Policy 4: Annual Condition Inspections

All national bridges should have an annual condition inspection and assessment to enable the BMS to be updated and maintained.

Policy 5: Bridge Major Maintenance Funding

A specific funding allocation will be provided in the DPWH annual budget for a major maintenance program to repair deteriorated national bridges.

Policy 6: Bridge Major Maintenance Design and Implementation

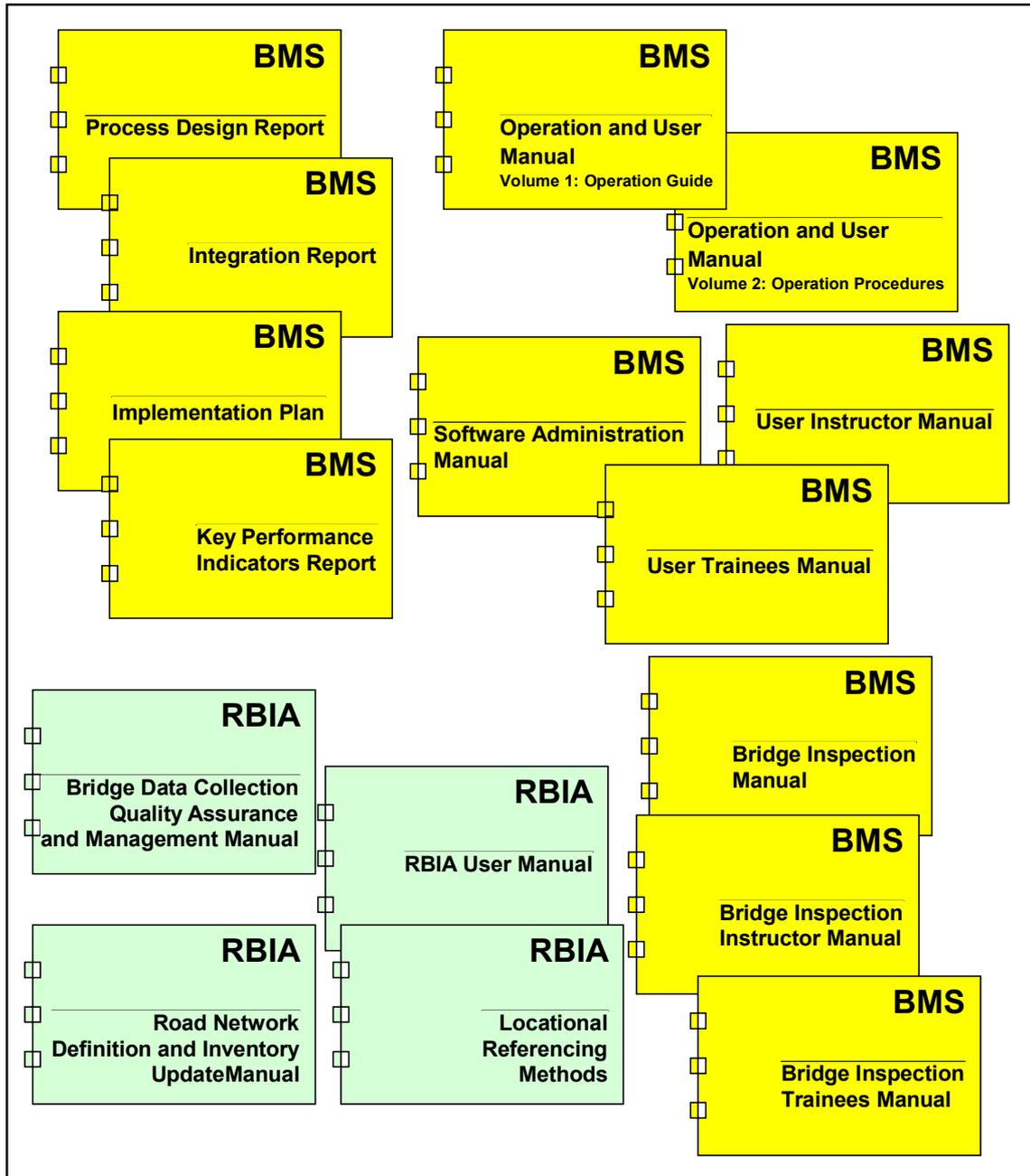
The design and implementation of major maintenance to national bridges should be certified by responsible or authorized officers as complying with DPWH standards, guidelines and other requirements.

1.6 BMS Documentation

A large number of reports and other documentations on basic principles and system implementation related to the BMS are available. Figure 1-2 summarizes the available reports and other documentation and how these relate to each other. The latest versions of these reports and documents are listed in Appendix A. These documents are referred to in this guide using the short name (bolded in Figure 1-2) where relevant.



Figure 1-2
BMS Documentation Map



1.7 BMS Operations Documentation

The BMS is a bridge management tool provided to collect and manage data pertinent to the management of the bridge stock.



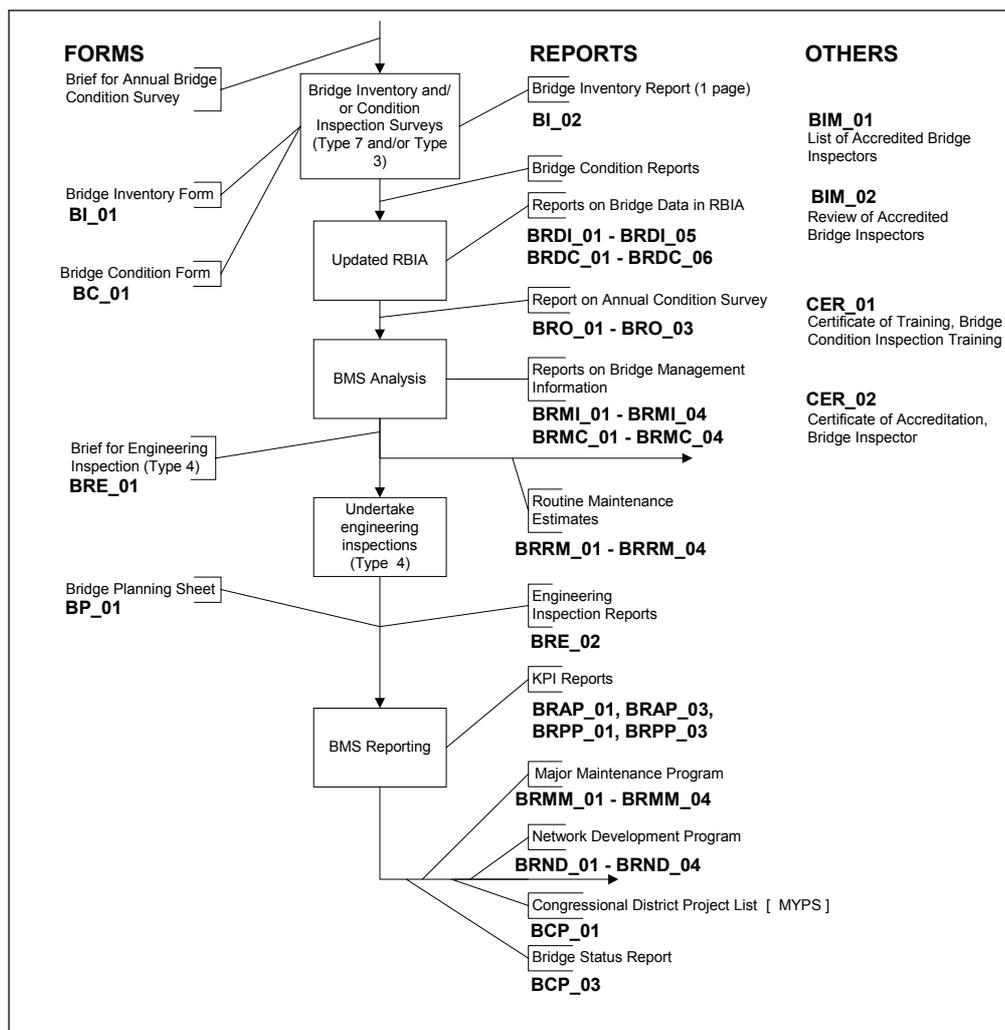
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The RBIA will hold a vast amount of bridge data but this data is essentially useless without proper documentation to collect and store the data, and to produce bridge management reports as required. Users of bridge data will not make use of the capabilities of the BMS unless the bridge data is relevant to their needs and can be supplied in the format or reports that they require.

The range of reports and other documentation that is used by the BMS to fulfill its function and to supply data to BMS users is summarized in Figure 1-3.

Refer to Appendix A for full details of the format of the reports.

Figure 1-3
BMS Operations Documentation





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The operation documentation listed in Figure 1-3 has many varied uses and will be generally available to all BMS user as listed in Table 1-1.

Some reports are restricted to the BMS team in the Planning Service for use.

Table 1-1
Report Availability

Access User	Available Reports	Comment
Level 1: System Administrator	All reports	For review
Level 2: BMS Configuration	All reports	For review and creation of reports
Level 3: BMS Analyses and Reporting	All reports	For full use of all reports
Level 4: BMS Data Entry	BRDI series BRDC series	For data entry checking purposes
Level 5: Bridge Data Viewers	BRDI series BRDC series BRO series BC and BI series BP series BRE series BRMI series BRAP and BRPP series BRRM, BRMM and BRND series BCP series	For use of all reports

Explanation of Report Series:

BRDI	Bridge Inventory Data reports
BRDC	Bridge Condition Data reports
BRO	Bridge Annual Condition Survey reports
BC	Bridge Condition Inspection Form header
BI	Bridge Inventory Inspection Form header and Report
BP	Bridge Planning reports
BRE	Bridge Engineering Inspection reports
BRMI	Bridge Management Inventory reports
BRAP	Bridge Agency Performance Indicator reports
BRPP	Bridge Process Performance Indicator reports
BRRM	Bridge Routine Maintenance reports
NRMM	Bridge Major Maintenance Program reports
NRND	Bridge Network Development Program reports
BCP	Bridge Combined Programs reports



2 BRIDGE DATA COLLECTION

2.1 Background

The BMS relies on the availability of inventory and annual condition information on each national bridge to provide reference data, to track the deterioration of bridges and hence, to enable the management of the national bridge stock. Without accurate and timely data, the BMS cannot fulfill this function.

2.2 BMS Data Requirements

The data related to bridges kept in the RBIA are:

- Bridge referencing,
- Bridge inventory,
- Bridge condition, and
- Bridge engineering inspection summaries.

2.2.1 Bridge Referencing

The DPWH Location Referencing System (LRS) refers to a bridge as a **point** element within a road. The location of the bridge is generally expressed in terms of distance from the start of the road.

Each bridge has a unique identifier. The coding convention for the Bridge ID includes:

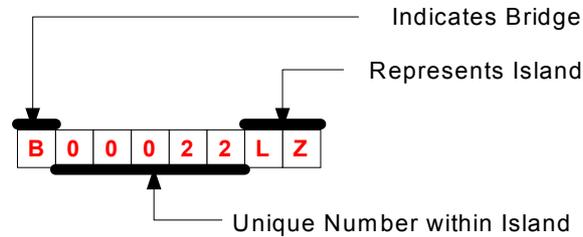
- The code is composed of 8 characters,
- The first character is always “B”,
- The last two characters comprise the code used to represent Island on which the bridge is located, e.g. “LZ” for Luzon, and
- The middle 5 characters are numbers, unique for island.

Refer Figure 2-1.

- The RBIA includes a wide range of geographical and administrative data relevant to bridges. This data will be useful in preparing reports for particular purposes. For example, a listing of bridges in each Congressional District or Municipality.



Figure 2-1
Bridge Identification Code



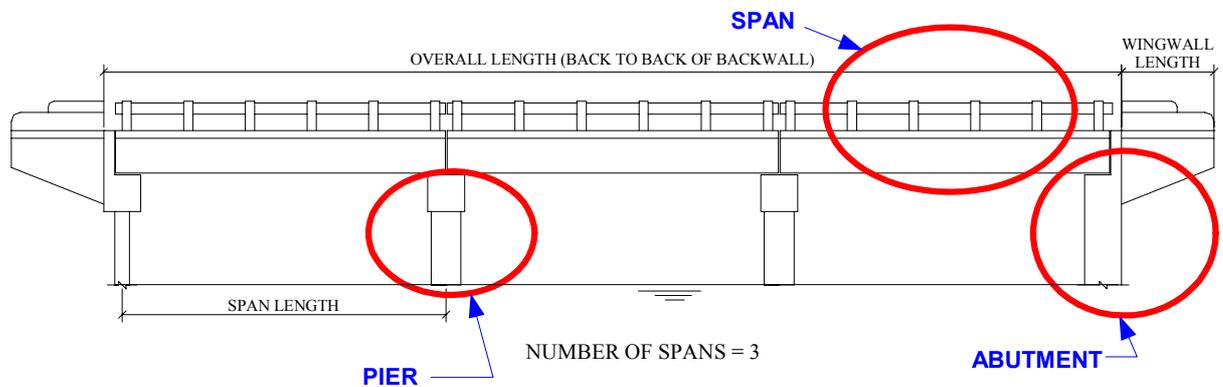
2.2.2 Bridge Inventory

Bridge is divided into the following elements:

- Overall bridge,
- Modification
- Span,
- Pier, and
- Abutment.

Refer to Figure 2-2.

Figure 2-2
Bridge Elements



Each of these elements has a number of attributes. For example some of the attribute of a pier are main structure, foundation, expansion joint, bearings/restraints and scour protection.

The defined bridge inventory attributes are listed in Table 2-1.



Table 2-1
Defined Bridge Inventory Attributes

Elements	Attributes
Overall	Special inspection requirements
	Posted load limit
	Clearances
	Geometry
	Traffic direction
	Type of bridge
	Age of bridge
	Public utilities carried
	Lighting
	Terrain crossed
	Bridge type of construction
	Main member material
	Substructure type
	Deck material
	Deck wearing surface
	Deck drainage
	Design load
	Design drawings
As-built drawings	
Modification	Bridge widening
	Bridge strengthening
	Bridge seismic retrofit
	Bridge lengthening
Span	Main members
	Continuity
	Secondary members
	Other members
	Deck
	Railings
Pier	Main structure
	Foundation
	Expansion joint
	Bearings
	Restraints
	Scour protection



Table 2-1 (Continued)

Abutment	Main structure
	Foundation
	Bearings
	Restraints
	Expansion joint
Abutment (cont...)	Scour protection
	Slope protection
	Wing walls
	Bridge approach

For each attribute, appropriate parameters are defined as recorded as listed below:

- Physical dimensions (Length, width, height etc.),
- Type of structure (Girder, slab, voided slab etc.), and
- Materials (Concrete, steel, timber, etc).

BMS Inspection Manual –S9.3 Form BI_01

Refer to Bridge Inspection Manual for more details of bridge inventory items and to Bridge Inventory Inspection (Type 7) Form for Inventory data.

RBIA Network Definition & Inventory Update Manual

Bridge inventory data is collected once for each bridge. The inventory data is updated as necessary to reflect changes in the bridge.

2.2.3 Bridge Condition

BMS Inspection Manual –S5.4 Form BC_01

The Bridge Inspection Procedure treats bridge condition assessment in three (3) distinct parts as follows:

- Routine maintenance requirements,
- Major maintenance requirements, and,
- Overall assessment of bridge.

Condition Requirements – Routine Maintenance

The overall routine maintenance requirements for bridges are assessed based on estimates of cost included in the condition survey. This process will enable the estimated requirement for funding for routine maintenance to bridges in each District to be determined.

This information will assist in the preparation of a bridge routine maintenance program for each District for the next budget year.



Condition Requirements – Major Maintenance

The condition is assessed for a series of defined attributes (nominated to cover all components of the bridges) in the bridge.

The defined attributes for condition assessment are summarized in *Table 2-2*.

**Table 2-2
Defined Bridge Condition Attributes**

Element	Attributes
Span	Deck
	Main members
	Secondary members (including other members)
	Left parapet
	Right parapet
Pier	Main structure
	Foundation
	Expansion joint
	Bearings/Restraints
	Scour protection
Abutment	Main structure
	Foundation
	Bearings/Restraints
	Expansion joint
	Left wingwall
	Right wingwall
	Scour/Bank protection
	Bridge approach

*BMS Inspection
Manual –S9.3
Form BC_01*

The condition state of each defined attribute is assessed based on a simple four-point scale. This scale expresses the condition in terms of the need for maintenance as detailed in Table 2-3. The condition states are generally based on the urgency in which it is considered each observed defect should receive intervention.

This scale involves a subjective judgment, but is sufficiently simple to ensure that most competent bridge inspectors would make the same assessment.

Those attributes that are not relevant to a bridge are recorded as such in the Condition Inspection (Type 3) Form and omitted from the assessment.



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Overall Assessment of Bridge

The overall condition (e.g. good, fair, poor or bad), the recommended intervention type (e.g. none, major maintenance, upgrading or replacement) and the estimated remaining life of the bridge are assessed based on the Major Maintenance Assessment of each attribute.

*BMS Insp. Manual –
S5.4*

Refer to Bridge Inspection Manual for more details on how conditions are assessed for each defined attribute.

**Table 2-3
Bridge Condition States**

Condition State	Description
0	No maintenance required in the foreseeable future, implying that the element or component is in good condition
1	Maintenance may be required within 10 years implying that there is some superficial deterioration but maintenance can be safely deferred for a significant period
2	Maintenance required within 2 years implying significant deterioration that could soon lead to a safety problem or a substantial increase in the rate of deterioration
3	Maintenance required within the next year implying that there is an immediate serious problem.

For all attributes with condition states of 1, 2 or 3, the type of maintenance shall be recorded as listed in Table 2-4. The standard types of work must be used to enable future analyses of bridge maintenance requirements.

For all attributes with condition state 0, the type of maintenance required would be recorded as *none*.

**Table 2-4
Bridge Repair Descriptions**

Type of Maintenance	Comment
Repair damage	
Protective measures	Painting steel members
Strengthen	
Replace	
Other	
None	For attributes in good condition



For each defined bridge attribute with an assessed condition state of 2 or 3, the cost of the recommended maintenance is estimated based on a visual assessment of the extent of the repair. These cost estimates must be based on local unit costs including all activities necessary (e.g. scaffolding) to undertake the repair. The accuracy of the cost estimate does not have to be high as the main function of the inspection is to detect defects and give an indication of the magnitude of the defects.

The cost of maintenance to each bridge attribute must be separately estimated and recorded for each bridge attribute that has a condition state of 2 or 3, even where it is apparent that the complete bridge must be replaced. It is not correct to give the estimated replacement cost of the bridge. This is required as the type of intervention required is partly assessed on the ratio of the estimated maintenance cost to the estimated replacement cost of the bridge.

The maintenance cost of bridge attributes with a condition state of 1 is not estimated and recorded.

Bridge Condition Inspection (Type 3) surveys are undertaken annually for all national bridges.

2.3 Bridge Inspection

Consistent and standardized bridge inspection procedures are required to ensure consistent inspection reports are delivered from all bridge inspections.

Different types of bridge inspections identified in DPWH Bridge Inspection Manual are listed in Table 2-5.



Table 2-5
Bridge Inspections Types

Type	Name	Frequency	Purpose
Scheduled Bridge Inspections			
1	Routine	Monthly	Scheduling of routine maintenance, check on bridge condition to ensure the safety of bridges
2	Maintenance	Quarterly	QA review of routine maintenance activities and level of service provided by bridges
3	Condition	Annual	To obtain condition data on and major maintenance needs of the bridges for operation of the BMS
4	Engineering	As required	To investigate the major maintenance needs of bridges with identified defects determined by a condition or other inspection
5	Detail	Ten years	To review the bridges in the light of traffic, load capacity and current requirements
Non-Scheduled Bridge Inspections			
6	Emergency	As required	To determine emergency work to bridges following calamities, ensure safety of bridges
7	Inventory	As required	To obtain/update bridge inventory data for the RBIA and the BMS

To use the BMS for planning and programming purposes, the following three inspections are required:

- Type 7: Bridge Inventory inspection,
- Type 3: Bridge Condition inspection, and
- Type 4: Bridge engineering inspection.

BMS Inspection Manual –S9.3

Bridge Inventory inspections are a non-scheduled type of inspection typically carried out once only for each bridge. During a bridge condition survey, verification of the bridge inventory data is done. The surveys are to be carried out by accredited bridge inspectors based on the Bridge Inspection Manual.

BMS Inspection Manual –S5.4

Bridge condition inspections are to be carried out annually. The bridge condition surveys are to be carried out by accredited bridge inspectors based on the Bridge Inspection Manual.

Bridge engineering inspections are to be carried out on bridges where an annual bridge condition inspection survey has identified defects in bridges and where the BMS has determined that intervention is required. The bridge engineering inspections are to be carried out by experience bridge engineers.

2.4 Inspection Forms Preparation

Forms BI_01 and BC_01

Preprinted standard inspection forms should be available for both Inventory and Condition Inspection Surveys.

BMS User Guide:

Inventory data if available in RBIA for a given bridge will be printed out with the Bridge Inventory Summary Report, *BI_02*.



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BMS User Guide: The title page of inspections forms for each annual condition inspection shall be pre-printed using the BMS Application. The set of preprinted forms for each bridge will be prepared to match the configuration (e.g. number of spans) for the bridge.

Brief for Engineering Inspection, Form BP_01 There is no inspection form for an engineering inspection as the scope of these inspections is determined to suit the defects detected in each bridge. These inspections are triggered by the issue of Brief for Engineering forms from the BMS.

The forms and materials to be taken in the field to undertake each type of inspection are summarized in Table 2-6.

Table 2-6
Bridge Inspection Requirements

Type of Inspection	Status	Prerequisite	Form & Reports	Activity
Inventory Type 7	No prior inventory inspection	Copy of any prior inventory records Bridge location data	BI_01	Complete inventory form based on inspection and measurement
Condition Type 3	No prior inventory inspection	Copy of any prior inventory records Bridge location data	BI_01 BC_01	Complete inventory form based on inspection and measurement Complete condition form based on inspection
	With prior inventory inspection	Inventory report	BI_02 BC_01	Complete condition form based on inspection
	With prior engineering inspection	Inventory report Prior condition report Current engineering report	BI_02 BC_01 BRE_02	Complete condition form based on inspection, and recommendations and costs of engineering report
Engineering Type 4	No prior engineering inspection	Inventory report Current condition report Brief for engineering inspection	BI_02 BI_01 (completed) BRE_01	Inspect bridge, undertake investigations and prepare engineering report
	Prior engineering inspection	Inventory report Current condition report Prior engineering report Brief for engineering inspection	BI_02 BI_01 (completed) BRE_01 BRE_02	Inspect bridge, review prior engineering report, update costs and prepare update report

2.5 Process for Annual Bridge Condition Surveys

The long-term process for undertaking the bridge condition surveys is shown in Figure 2-3.



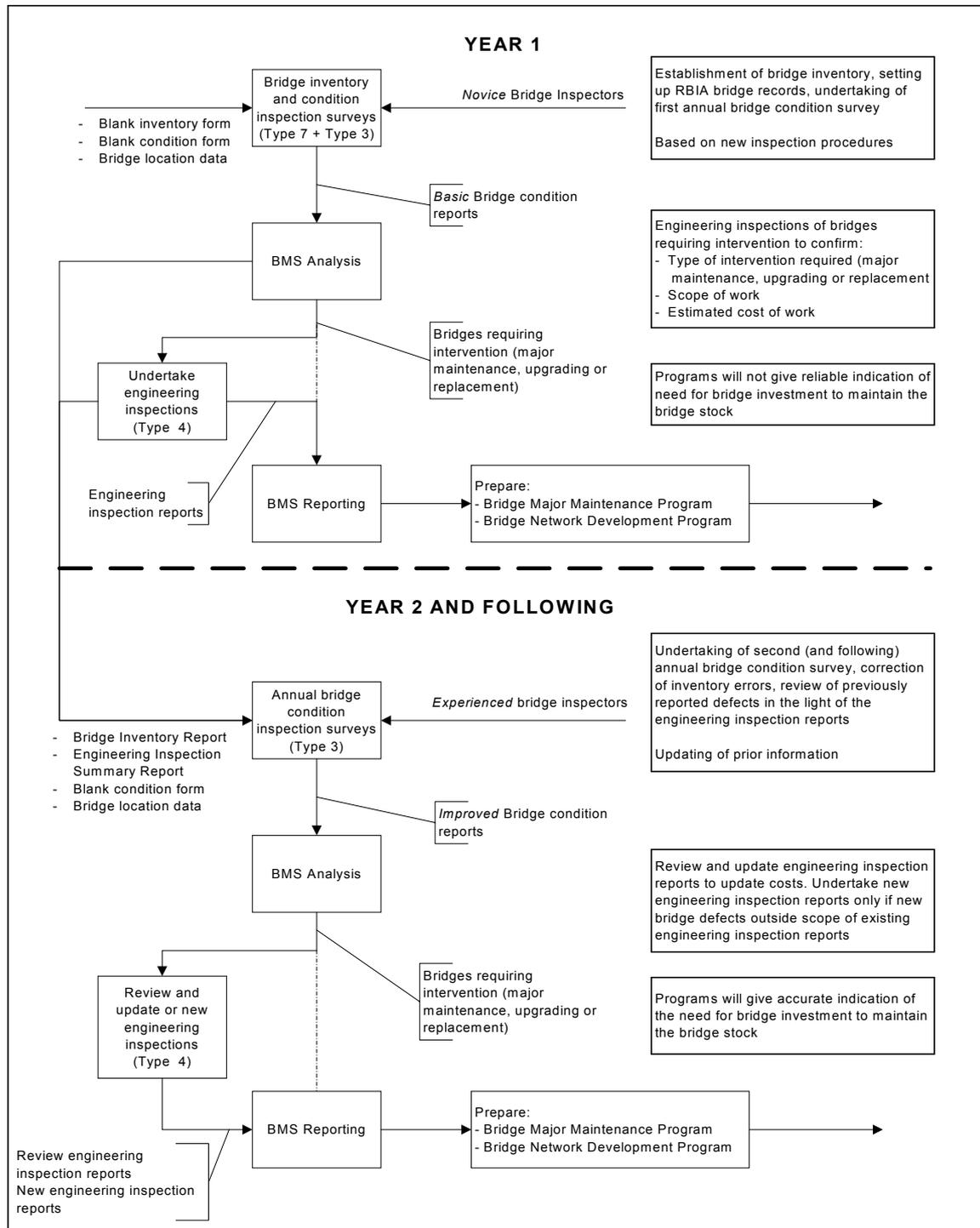
Figure 2-3 includes separate processes for the initial BMS establishment survey and the ongoing annual condition inspection surveys, as these are very different processes. The establishment survey includes an inventory survey as well as the first condition survey and will produce preliminary programs, as the supporting engineering inspection data will not have been obtained. The program prepared from the BMS will improve in accuracy over the initial years of operation as the RBIA database is compiled and verified, as the supporting data is developed and as the DPWH develop experience in the procedures and requirements of the BMS.

The data included in the RBIA as printed out with the Condition Inspection Form for each bridge shall be checked for correctness during the annual bridge condition inspections and corrections made or missing information added as necessary.

All bridges shall receive an annual condition inspection including bridges included in committed projects. Where work is under way at a bridge, the condition assessment would not be undertaken. This process ensures that all bridges are checked annually but committed projects are omitted from the BMS analyses.



Figure 2-3
Process for Annual Bridge Condition Surveys





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The BMS is based on annual bridge condition inspections of all bridges to monitor bridge condition and to detect defects in bridges that require attention. The bridge condition inspections are quick but subjective.

The accuracy of the system is achieved by the undertaking of engineering inspections of all bridges where a bridge annual condition inspection indicates a defect. Over a period of years, engineering inspections are undertaken for all bridges with recognized defects and the information from these reports is fed back into the condition inspections to provide accurate bridge data for the BMS.

The BMS relies on the annual bridge condition inspection surveys and the as-required engineering inspections to develop an accurate picture of the overall state of the national bridges.

The engineering inspections are also required to enable the required intervention to bridges to be divided into the two methods of implementation:

- Major maintenance (asset preservation), and
- Network development (bridge upgrading and replacement)

Without these engineering inspections, the BMS will not develop a bridge inventory and condition database of sufficient accuracy for this purpose.



3 INPUT DATA MANAGEMENT

3.1 Background

The bridge data need to be available in a properly managed electronic format, so that it can be used for generating various information and carryout the required analysis for planning and programming process.

3.2 RBIA Database

Road and Bridge Information Applications database (RBIA) is a network level data repository developed to assist in planning processes within DPWH. Data on road and bridge inventory including condition, traffic, and etc. data is kept in the RBIA database.

The data related to bridges kept in the RBIA are:

- Bridge location,
- Bridge inventory,
- Bridge condition, and
- Bridge operations.

Bridge location data covers the identification of the bridge and road on which the bridge is located, and general geographical data of the bridge as described in Section.2.2.1.

Bridge inventory data includes the geometry, type and material of each bridge in a standardized form as described in Section 2.2.2.

Bridge condition data includes data on the condition of each bridge as obtained from the annual bridge condition survey.

Bridge operations data includes data on the operation of the bridge, including engineering inspection data, feasibility study data and bridge status data.



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The RBIA also includes links to other relevant bridge records held in the DPWH Information Management Systems. Links are available to:

- Bridge photographs,
- Bridge reports (e.g. engineering inspection reports), and
- Design and as-built drawings.

3.3 User Access Levels

BMS User Guide

BMS users are divided into five (5) different access levels as detailed in Table 3-1.

The Administrator will be responsible for changing settings in the software for the allocated access levels to DPWH staff using the BMS. However the BMS System Manager will be responsible for allocation of access levels to DPWH personnel.

Table 3-1
BMS Users

Access Level	Access Rights	Office
Level 1: System Administrator	Full rights to change the system. Can assign access levels to other users.	MIS
Level 2: BMS Configuration	Can change the configuration of BMS Application	MIS
Level 3: BMS Analyses and Reporting	Can run analyses and edit bridge data	PS - DPD
Level 4: BMS Data Entry	Can input bridge data	Regional Offices
Level 5: Bridge Data Viewers	Allowed to view and printout bridge data and results of analyses using predefined reports, graphs, etc	Nominated offices with access to RBIA and BMS



3.4 Bridge Data Management

3.4.1 Data Input

Defining the bridge referencing is the first step in entering the bridge data. The following steps are required to be followed:

*BMS User Guide -
2.3.2*

BMS Training

Exercises - M.12, T.1

*BMS User Guide -
2.3.2*

BMS Training

Exercises - M.12, T.1

- Define a road section (if not defined earlier) or bridge
OR

- Define a new bridge (i.e. Bridge ID, location etc.)(if not defined earlier).

Bridge Inventory data are kept in RBIA as a ‘Structure’ element. The data related to type, materials, physical dimensions for each of the components of the bridges are kept in a hierarchy order.

*Road Network
Definition &
Inventory Update
Manual*

Bridge inventory data such as number of piers and number of spans must be entered before the bridge condition data can be imported.

Data can be manually entered by the User or can be imported in bulk.

*BMS User Guide –
S.2.3.2*

BMS Training

*Exercises – M13, T.1
& T.2*

- Manually enter data inter-reactively using Confirm

A typical complete bridge Condition Inspection (Type 3) Form is included in the Bridge Inspection Manual.

OR

*Bridge Inspection
Manual*

*BMS User Guide –
S.15.4*

BMS Training

Exercises – M13, T.4

- Import data prepared in a standard electronic format

A typical Excel spreadsheet condition data input file for ten (10) bridges is included in Figure 3-1 in three (3) parts.



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Figure 3-1
Example of BMS Condition Data Entry Spreadsheet
Part A

1	survey	record id	survtype	startdate	enddate	surveyor	description	length							
2	survey	SURV1	BRC2	2/17/03	2/21/03	Renand	Batangas								
1	assess	record id	parent id	assessment type	xsp	start distance	end distance	attr 1	attr 2	attr 3	attr 4	attr 5			
2	assess	SURV1	1 BR2					B00001LZ	Fair	Major Maintenance			Scour and erosion		
2	assess	SURV1	1 BCSPAN					1	None	Fully Assessed					
2	assess	SURV1	1 BCSPAN					2	None	Fully Assessed					
2	assess	SURV1	1 BCSPAN					3	None	Fully Assessed					
2	assess	SURV1	1 BCSPAN					4	None	Fully Assessed					
2	assess	SURV1	1 BCPIER					1		8.2	8.2 None	Fully Assessed			
2	assess	SURV1	1 BCPIER					2		8.8	8.8 None	Fully Assessed			
2	assess	SURV1	1 BCPIER					3		8.8	8.8 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					Low Chainage		7.5	7.5 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					High Chainage		7.3	7.3 None	Fully Assessed			
2	assess	SURV1	1 BR2					B00002LZ	Fair	Major Maintenance			Bridge Deterioration		
2	assess	SURV1	1 BCSPAN					1	Within 2 years	Fully Assessed			Repair damage	30000	
2	assess	SURV1	1 BCSPAN					2	Within 2 years	Fully Assessed			Repair damage	30000	
2	assess	SURV1	1 BCPIER					1		8.8	8.8 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					Low Chainage		6.25	6.25 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					High Chainage		6.4	6.4 None	Fully Assessed			
2	assess	SURV1	1 BR2					B00003LZ	Fair	Major Maintenance			Bridge Deterioration		
2	assess	SURV1	1 BCSPAN					1	None	Fully Assessed					
2	assess	SURV1	1 BCABUT					Low Chainage		4.5	4.5 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					High Chainage		4.4	4.4 Within 2 years	Fully Assessed			
2	assess	SURV1	1 BR2					B00004LZ	Fair	Major Maintenance			Bridge Deterioration		
2	assess	SURV1	1 BCSPAN					1	Within 2 years	Fully Assessed			Repair damage	30000	
2	assess	SURV1	1 BCABUT					Low Chainage		4.62	4.62 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					High Chainage		4.5	4.5 None	Fully Assessed			
2	assess	SURV1	1 BR2					B00005LZ	Fair	Major Maintenance			Bridge Deterioration		
2	assess	SURV1	1 BCSPAN					1	Within 2 years	Fully Assessed			Replace	883000	
2	assess	SURV1	1 BCSPAN					2	Within 2 years	Fully Assessed			Replace	883000	
2	assess	SURV1	1 BCPIER					1		4.35	4.35 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					Low Chainage		3.2	3.2 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					High Chainage		3.4	3.4 None	Fully Assessed			
2	assess	SURV1	1 BR2					B00006LZ	Poor	Major Maintenance			Bridge Deterioration		
2	assess	SURV1	1 BCSPAN					1	None	Fully Assessed					
2	assess	SURV1	1 BCSPAN					2	None	Fully Assessed					
2	assess	SURV1	1 BCSPAN					3	None	Fully Assessed					
2	assess	SURV1	1 BCSPAN					4	None	Fully Assessed					
2	assess	SURV1	1 BCSPAN					5	None	Fully Assessed					
2	assess	SURV1	1 BCPIER					1		10.15	10.15 None	Fully Assessed			
2	assess	SURV1	1 BCPIER					2		10.25	10.25 None	Fully Assessed			
2	assess	SURV1	1 BCPIER					3		10.3	10.3 None	Fully Assessed			
2	assess	SURV1	1 BCPIER					4		10.15	10.15 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					Low Chainage		8.5	8.5 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					High Chainage		8.5	8.5 None	Fully Assessed			
2	assess	SURV1	1 BR2					B00007LZ	Good	Routine Maintenance only			Bridge Deterioration		
2	assess	SURV1	1 BCSPAN					1	None	Fully Assessed					
2	assess	SURV1	1 BCABUT					Low Chainage		3	3 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					High Chainage		3	3 None	Fully Assessed			
2	assess	SURV1	1 BR2					B00009LZ	Fair	Major Maintenance			Bridge Deterioration		
2	assess	SURV1	1 BCSPAN					1	Within 2 years	Fully Assessed			Repair damage	1000	
2	assess	SURV1	1 BCSPAN					2	Within 2 years	Fully Assessed			Repair damage	9000	
2	assess	SURV1	1 BCSPAN					3	Within 2 years	Fully Assessed			Repair damage	1000	
2	assess	SURV1	1 BCPIER					1		3.25	3.25 None	Fully Assessed			
2	assess	SURV1	1 BCPIER					2		3.15	3.15 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					Low Chainage		2.75	2.75 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					High Chainage		2.8	2.8 None	Fully Assessed			
2	assess	SURV1	1 BR2					B00010LZ	Fair	Major Maintenance			Bridge Deterioration		
2	assess	SURV1	1 BCSPAN					1	Within 2 years	Fully Assessed			Replace	100000	
2	assess	SURV1	1 BCABUT					Low Chainage		7.85	7.85 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					High Chainage		7.9	7.9 None	Fully Assessed			
2	assess	SURV1	1 BR2					B00011LZ	Poor	Major Maintenance			Severely damaged	Bridge Deterioration	
2	assess	SURV1	1 BCSPAN					1	Within 2 years	Fully Assessed			Replace	267000	
2	assess	SURV1	1 BCABUT					Low Chainage		3.5	3.5 None	Fully Assessed			
2	assess	SURV1	1 BCABUT					High Chainage		3.55	3.55 None	Fully Assessed			



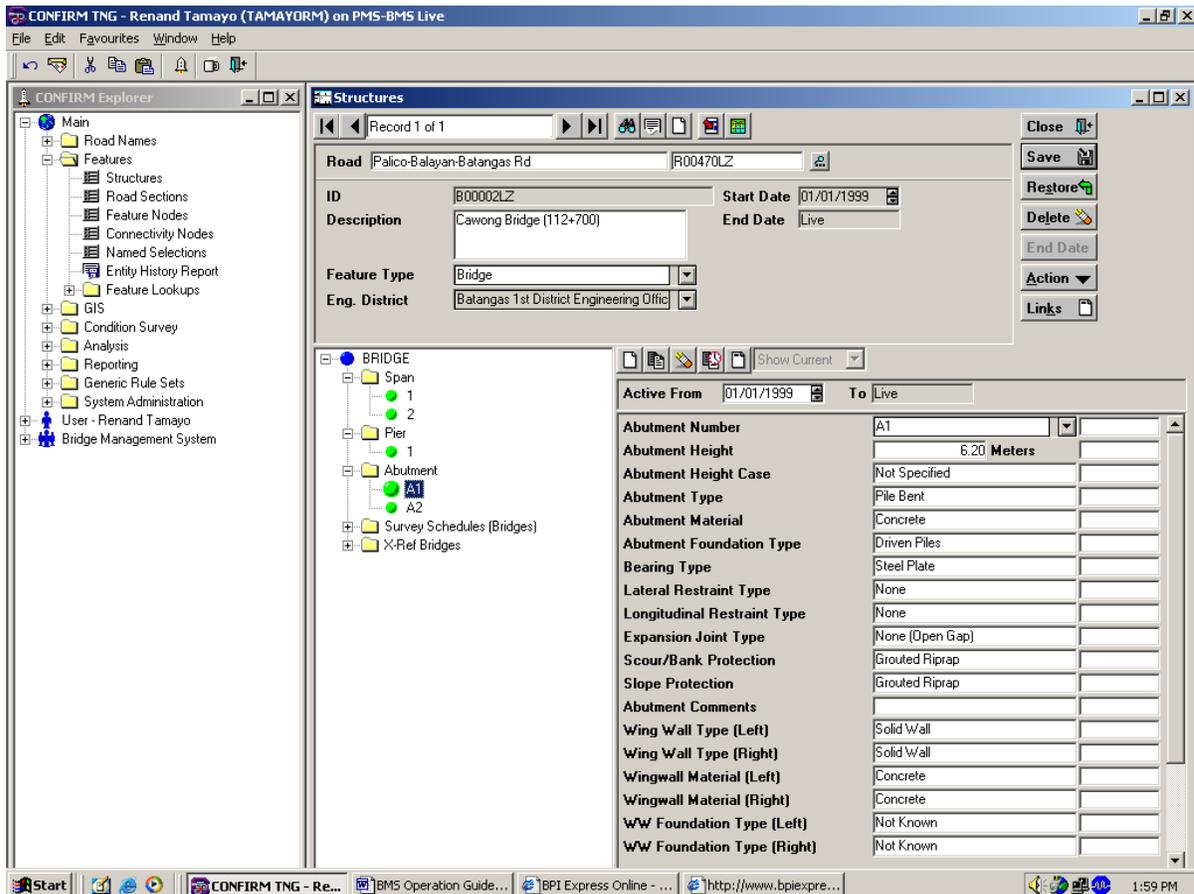
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Part C

attr 21	attr 22	attr 23	attr 24	attr 25	attr 26	attr 27	attr 28	attr 29	attr 30	attr 31	attr 32	attr 33	attr 34	attr 35
Fully assessed	Protective measures	12000												
Fully assessed	Protective measures	12000												
Fully assessed	Protective measures	12000												
Fully Assessed			None	Fully Assessed			None	Fully Assessed			None	Fully Assessed		
Fully Assessed			None	Fully Assessed			None	Fully Assessed			None	Fully Assessed		
Fully assessed	Protective measures	32000												
Fully Assessed			None	Fully Assessed			Immediate	Fully Assessed	Replace	114000	None	Fully Assessed		
Fully Assessed			None	Fully Assessed			Immediate	Fully Assessed	Replace	114000	None	Fully Assessed		
Fully Assessed			None	Fully Assessed			None	Fully Assessed			None	Fully Assessed		
Fully Assessed			None	Fully Assessed			None	Fully Assessed			None	Fully Assessed		
Fully assessed	Protective measures	31000												
Fully assessed	Protective measures	31000												
Fully assessed	Protective measures	31000												
Fully assessed	Protective measures	31000												
Fully Assessed			None	Fully Assessed			None	Fully Assessed			None	Fully Assessed		
Fully Assessed			None	Fully Assessed			None	Fully Assessed			None	Fully Assessed		
Fully Assessed			None	Fully Assessed			None	Fully Assessed			None	Fully Assessed		
Fully Assessed			None	Fully Assessed			None	Fully Assessed			None	Fully Assessed		
Fully Assessed			None	Fully Assessed			None	Fully Assessed			Within 10 years	Fully Assessed	Repair damage	30000
Fully Assessed			None	Fully Assessed			None	Fully Assessed			Within 10 years	Fully Assessed	Repair damage	30000
Fully assessed	Repair damage	12000												
Fully assessed	Repair damage	12000												
Fully Assessed			None	Fully Assessed			None	Fully Assessed			None	Fully Assessed		
Fully Assessed			None	Fully Assessed			None	Fully Assessed			None	Fully Assessed		
Fully Assessed			None	Fully Assessed			None	Fully Assessed			Within 2 years	Fully Assessed	Other - Provide	30000
Fully Assessed			None	Fully Assessed			None	Fully Assessed			Within 2 years	Fully Assessed	Other - Provide	30000
Fully Assessed			None	Fully Assessed			Within 2 years	Fully Assessed	Repair damage	4000	None	Fully Assessed		
Fully Assessed			None	Fully Assessed			Within 2 years	Fully Assessed	Repair damage	4000	None	Fully Assessed		



Figure 3-2
RBIA Screen for Entering Inventory Data



Bridge Condition data are kept in RBIA as a ‘Hierarchical Survey’. The annual condition data collected can be manually entered by the User or can be imported in bulk if provided in an electronic format.

3.4.2 Editing Data

The bridge data available in RBIA can be edited/updated by the Users who have Level 3: Operator access level.

Editing is generally done manually if the amount of editing required is little. The following parameters need to be opened to edit the following bridge data:



- BMS User Guide – S.2.3.6*
BMS Training Exercises - M.12, T.2
 - Road Section - For editing referencing data
- BMS User Guide – S.14.1 – S.14.3*
BMS Training Exercises – M.12, T.1 & T.3
 - Structure – For editing inventory data
- BMS User Guide – S.15.1 & S.15.2*
BMS Training Exercises – M.13, T.1 & T.2
 - Condition Survey – For editing bridge condition survey data

3.5 Exporting Data

Bridge data available in the RBIA database can be exported in different formats including the most common .asc, .xls and .dbf formats. Data can be exported in different ways:

- BMS User Guide – S.2.4*
BMS Training Exercises – M.1, T.4
 - Extract data available in a given table in RBIA,
- BMS User Guide – S.18.3 – S.18.6*
BMS Training Exercises – M.16, T.4 – T.12
 - Export data based on predefined report, or
- BMS User Guide – S.18.1 – S.18.2*
BMS Training Exercises – M.16, T1 - T.2
 - Export data based on specially defined query for this purpose.

3.6 Data Validation

For the best possible output of the system it is important that the bridge data available in the system is reliable. The error in data can occur during data collection, entering data in the system and processing the data.



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Various quality assurances (QA) procedures are applied during the data collection process, so that accuracy of the collected data can be assured.

3.6.1 Data Import Validation

While importing bridge data the following validations are applied:

*BMS User Guide –
S.15.4
BMS Training
Exercises – M.13,
T.4*

- Number of elements: If the data available in the import file were more than number of attributes (e.g. Span) specified, the RBIA would flag an inconsistency.
- Data Codes and Descriptions: If codes and descriptions of the data being imported does not match the code and descriptions in the RBIA the system will flag and highlight where those errors occur.
- Bridge Labels: If a Bridge label is supplied in the import file that does not exist in the RBIA it will be flagged and highlighted as an error.

3.6.2 Validation during Data Processing

*BMS User Guide –
S.16.3.1 – S.16.3.3
BMS Training
Exercises – M.14,
T.1 – T.3*

The software does not check for missing data while running the routines (e.g. BNR calculation routine). If there is no condition data for a bridge, the BNR analysis is not run for that bridge and the BNR is recorded as 0. If there is incomplete data, the BNR analysis will be run for the available data.

The condition data must be reviewed for completeness prior to running the BNR calculation routine.

3.6.3 Additional Validation

The user can also extract the data from RBIA using standard reports for each component of the bridge and carry out the manual checks for missing or any ambiguous values.

*BMS Training
Exercises – M.16,
T.6, T.10 – T.12*

The following standard reports can be used for this purpose:

- BRDI_01 to BRDI_05
- BRDC_01 to BRDC_06



4 BMS APPLICATION CONFIGURATION

4.1 Background

The BMS Application is built into the DPWH RBIA Application (Based on Southbank System's Confirm TNG application) configured for BMS process implementation. The required configuration was already been done. There will be minor ongoing refinements required during the implementation of system. This Chapter will give an overview on the process related to the configuration so that any required modification can be carried out.

This Chapter is more applicable for the system analyst and programmer who will be responsible for carrying out such modifications.

4.2 Configuring Database

4.2.1 Modify Inventory Data Structure

RBIA User Guide – S.4 The user can modify, create, delete the following configuration tables that define the way Bridges are structured within the RBIA:

- RBIA User Exercises – M.3, S.7, S.8, S.9*
- Parameter Types
 - Attribute Types
 - Element Types

4.2.2 Modify Condition Data Structure

RBIA User Guide – S.4 The user can modify, create, delete the following configuration tables that define the way Bridges are surveyed within the RBIA:

- RBIA User Exercises – M.3, S.7, S.8*
- Parameter Types
 - Attribute Types

RBIA User Guide – S.6 The user can modify, create, delete the following configuration tables that define the way Bridges are surveyed within the RBIA:

- RBIA User Exercises – M.5, S.2, S.3*
- Assessment Types
 - Survey Types



4.3 Configuring of BMS Application (BNR Analysis)

The BNR Analysis requirements may change through the use of the BMS over time. Administrators will be required to make these changes to the following components of the BNR Analysis.

- RBIA User Guide – S.3*
RBIA User Exercises – M.11, T.1
 - Parameter Types
 - Attribute Types
- RBIA User Guide – S.7*
 - Data Sources
- RBIA User Exercises – M.11, T.2*
RBIA User Exercises – M.11, T.3
 - Analysis Template

4.4 Configuring Queries and Reports

The numbers of standard reports are built for extracting the information related to the BMS Application. Some modifications could be required to these reports or totally new reports might need to be created to produce the information required by management.

4.4.1 Defining Data sources

- RBIA User Guide – S.8*
RBIA User Exercises – M.7, T.1

Data Sources hold the underlying piece of SQL (Standard Query Language) that identify the tables the user wants to interrogate for the Data Source for use in Data Queries, Reports, and Analysis.

4.4.2 Building Queries

- RBIA User Guide – S.7*
RBIA User Exercises – M.7, T.1

Queries are the SQL (Standard Query Language). These are created in the following methods:

 - Import Report Template
 - Written using the Data base Schema

4.4.3 Building Report Templates

- RBIA User Guide – S.8*
RBIA User Exercises – M.7, T.2

Users can create, amend, delete, their own Report formats as required by management.



4.4.4 Building Diagram Templates

RBIA User Guide – S.8 Users can create, amend, and delete, their own Diagram Templates as required by management.

RBIA User Exercises - M.7, T.4

4.4.5 Building Analysis Templates

RBIA User Guide – S.16 The Analysis Template defines the Data Source that is used to interrogate the Surveys entered into the RBIA and enables the user to define the necessary calculations and required outputs for BNR Analysis

BMS Training

Exercises - M.11, T.3

4.5 System Security

RBIA User Guide – S.12 Users within the RBIA are required to be set-up with passwords and appropriate system privileges and data access.

RBIA User Exercises - M.10, T.1 – T.6

RBIA User Guide – S.12 System Administrators can administer System Access upgrades, run Data Checks, re-set users.

RBIA User Exercises – M.10, T.8 – T.12

4.6 Historical Data Management

System Administrators or Users will be able to administer the amount of old data left within the RBIA. The following will be able to be removed when required:

BMS User Guide – S.16
BMS Training Exercises – M.14, T.3

- BNR Analysis Instances

BMS User Guide – S.15
BMS Training Exercises – M.13, T.6

- Condition Surveys
- Inventory Surveys
- Engineer Inspections

BMS User Guide – S.14
BMS Training Exercises – M.12, T.5, T.6

- Bridges
- Bridge Attributes

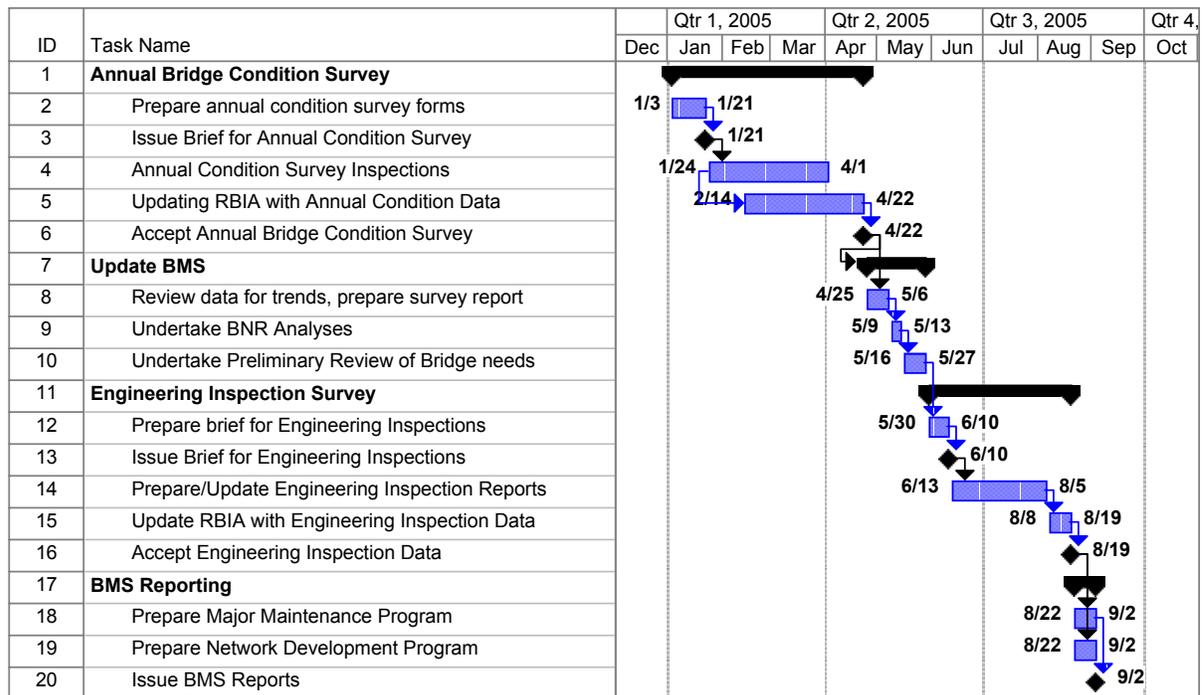


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4.7 Current Data Management

The BMS operates in an annual cycle as part of the DPWH budget preparation process as shown in Figure 4-1. The annual bridge condition survey will commence in January of each year and the updated Bridge Major Maintenance and Network Development Programs will be available in every September for MYPS.

Figure 4-1
BMS Annual Program



All reports prepared in the calendar year of any BMS cycle will be regarded as current. Any reports dated in the preceding or earlier years will be regarded as non-current and require the preparation of replacement or review reports.

The BMS will be operated on a *batch* process with an annual cycle to meet the requirements of the budget preparation process. Key deliverable dates are as follows:

- January – issue of brief for annual condition survey,
- April – update of RBIA with condition survey data,
- June – issue of briefs for engineering inspections,
- August – update of RBIA with eng. inspection data, and
- September – finalization of BMS analyses and preparation of programs.



5 BMS ANALYSIS PROCESS

5.1 Background

The purpose of collecting bridge data is to establish an improved method for deciding which bridges are in most need to interventions such as major maintenance or replacement, and collectively to decide the required investment to maintain the bridge stock, the split between major maintenance and network development funding and the spread between different Regions and Districts.

The data collected during the annual condition inspection surveys are of three types:

- Condition state of each defined attribute,
- Recommended maintenance type for each attribute, and
- Estimated maintenance cost for each attribute.

This data can be used to assess the relative importance of bridge needs and hence indicate the level of asset preservation and network development required and to provide estimated costs of this work.

The RBIA bridge inventory contains data about the importance of the roads carried by bridges and this data can be used to assess the relative importance of bridges.

Design Report
S3.12
Procedures

The data is used in the BMS in a series of algorithms based on:

- The extent of the maintenance requirements,
- Importance of the maintenance requirements, and
- Importance of the road/bridge.

The algorithms may be modified based on experience with the BMS to more appropriately suit local conditions and requirements.

The algorithms determine the Bridge Needs Ratio (BNR) for each bridge to enable the bridges to be ranked and prioritized on the basis of need for intervention.

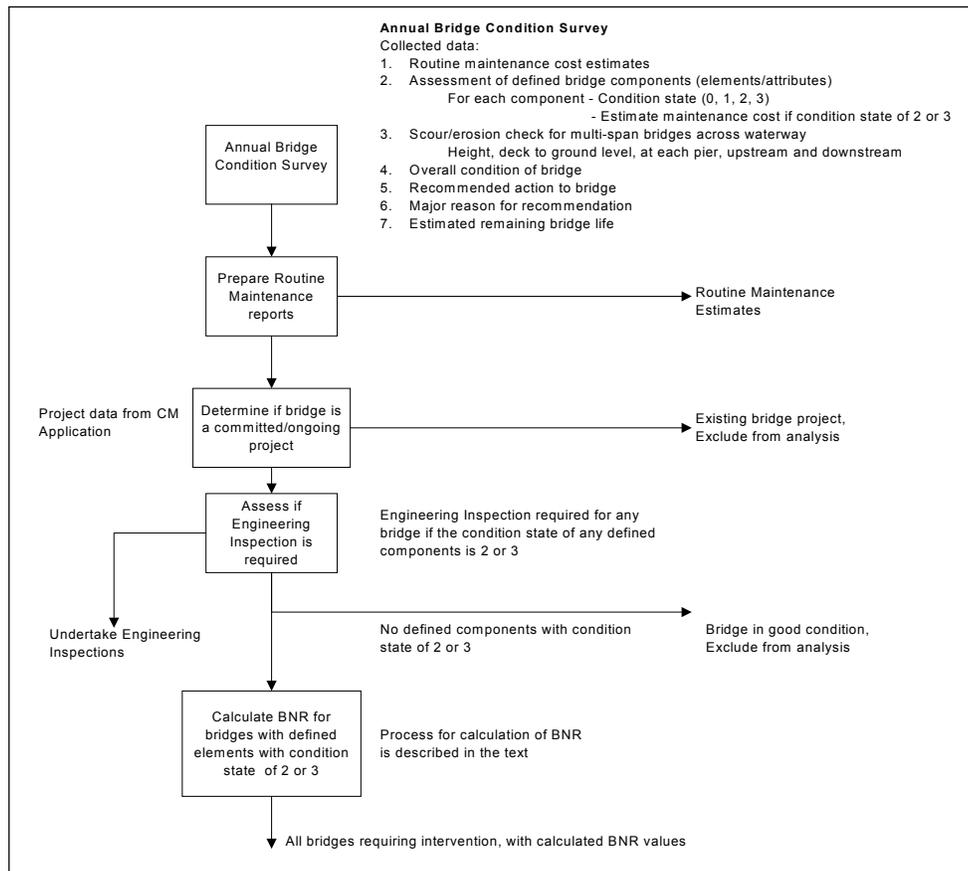


5.2 Calculation of BNR

Design Report
S3.12.2

The overall process for the determination of BNR is illustrated in Figure 5-1.

Figure 5-1
BNR Calculation Process

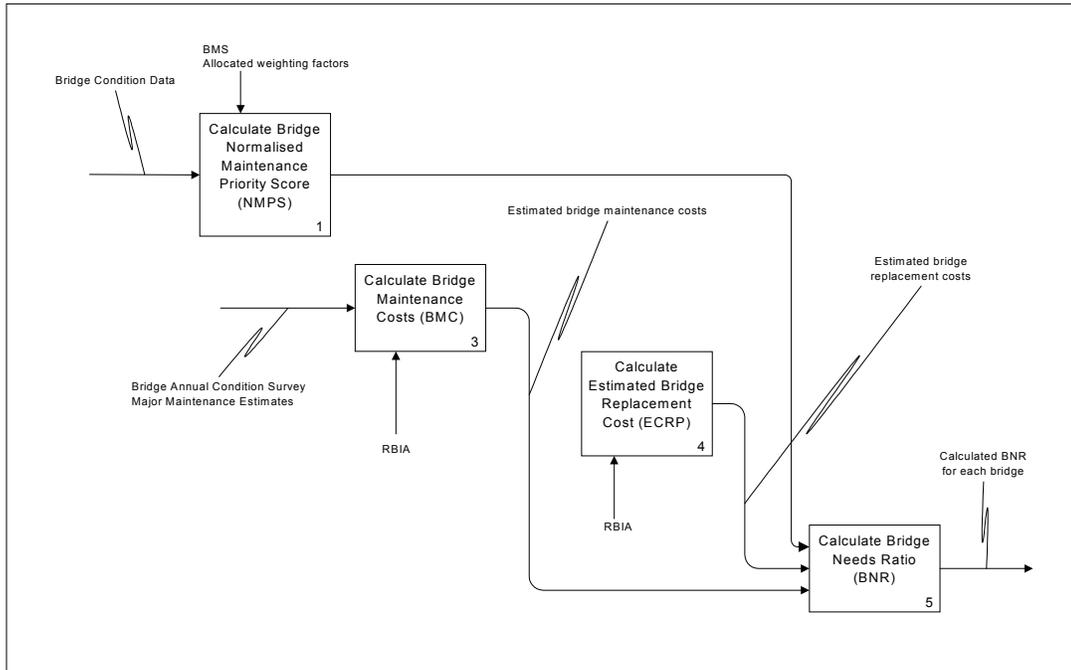


Design Report
S3.12.2

The process for calculation of the BNR is shown in Figure 5-2.



Figure 5-2
BNR Calculation



*Volume 2 –
Operation
Procedures*

The calculation of the BNR is described in detail in Procedure A22.

5.3 Prioritization of Bridge Intervention Using Bridge Need Ratio

The bridges are ranked on the basis of the calculated BNR values. All bridges on national roads in all Regions are ranked in a single analysis to ensure that the adopted rankings are the same across the country. Bridges are ranked in order of descending BNR, i.e. bridge with the highest calculated BNR has the ranking of 1.

The bridges with the highest BNR values have the greatest need for intervention. The majority of bridges will have BNR values of 0 or close to 0, indicating that the bridge is in good condition and does not require any intervention.



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5.4 Key Performance Indicators

KPI Report
S2.2

Bridge data available in the RBIA can be used to monitor the performance of the DPWH in areas related to the BMS and to assist in reaching informed decisions for future network development and long term funding.

Key performance indicators (KPIs) are established to permit long-term monitoring against established baseline data and set targets on a standard consistent approach.

Agency Performance Indicators (APIs) are used to monitor the performance of the DPWH in meeting the requirements of road users in terms of accessibility, and mobility, traffic safety, program development, program delivery and program performance.

Process Performance Indicators (PPIs) are used to monitor the performance of various functions with the DPWH, in this case the BMS.

The KPIs for the BMS that are prepared from the RBIA are summarized in Table 5-1.

Table 5-1
BMS Key Performance Indicators

No.	Title	Target
Agency Performance Indicators (APIs)		
API-B1	Bridges in satisfactory condition	Percentage of national bridges that have condition states of 0 or 1 for all bridge attributes recorded in a current bridge condition survey, shall be at least 95% of the total number of national bridges
API-B2	Bridge Condition Summary	Percentage of national bridges in RBIA in good, fair, poor or bad condition in a current bridge condition survey, shall be the following percentages of the total number of national bridges: Bridges in good condition More than 80% Bridges in good or fair condition More than 90% Bridges in good, fair or poor condition More than 95%
Process Performance Indicators (PPIs)		
PPI-B5	Bridge condition inspections	Percentage of national bridges that have a current Bridge Condition Report, shall be at least 95% of the total number of national bridges
PPI-B6	Bridge engineering inspections	The percentage of bridges in the RBIA with current Bridge Engineering Inspection Reports compared to the number of bridges requiring Engineering Reports, shall be at least 90%



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Other KPIs relevant to the BMS are prepared by MYPS to demonstrate the efficiency of the BMS in encouraging investment in bridge major maintenance and network development, and a user survey to monitor the service provided by the BMS team.

Refer to the KPI Report for full details of the KPIs.

The following standard reports can be used to report on the KPIs included in Table 5-1:

- BRAP_01
- BRAP_03
- BRPP_01
- BRPP_03



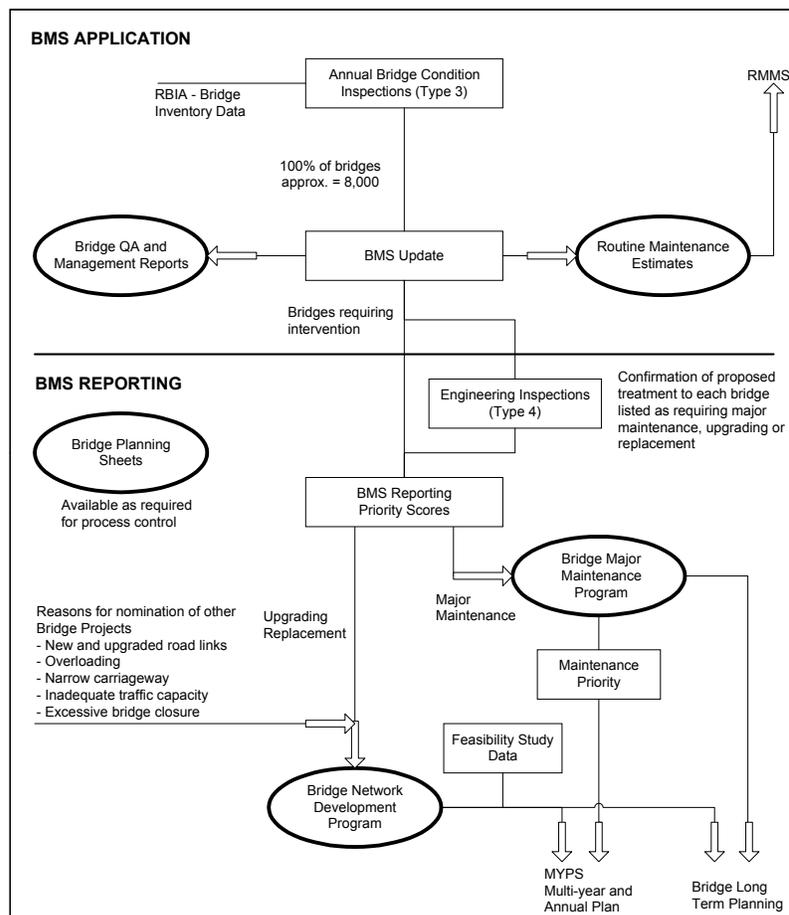
6 BMS OUTPUT IN PLANNING PROCESS

6.1 Overview

The BMS is a powerful tool for the management of the national bridges. The full benefit of this tool is only achieved if the BMS is fully established and maintained for all bridges on an annual basis in accordance with Chapters 2 and 3 of this guide. The BMS would rapidly become obsolete without the ongoing data collection process.

The principal outputs of the BMS are shown in Figure 6-1.

Figure 6-1
Principal BMS Outputs





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The BMS provides the following reports for use in the planning process:

Report BP_01

- Bridge Planning Sheets. These are available throughout the annual planning process as required for process control of the planning process.

*Reports BRRM_01,
BRRM_02,
BRRM_03 and
BRRM_04*

- Bridge Routine Maintenance Estimates. These reports are available when the annual bridge condition survey data has been loaded into the BMS and confirmed. These reports are provided for use in planning of routine maintenance funding.

*Reports RBMM_01,
BRMM_02,
BRMM_03 and
BRMM_04*

- Bridge Major Maintenance Program. This report gives the ranked major maintenance requirements for all bridges. To provide this report, the BMS requires additional information on bridge engineering inspections. A bridge can only be included in the Major Maintenance Program if major maintenance is recommended by a current engineering inspection report.

*Reports BRND_01,
BRND_02,
BRND_03 and
BRND_04*

- Bridge Network Development Program. This report gives the Philippine requirement for bridge upgrading and replacement for all bridges. To provide this report, the BMS requires additional information on bridge engineering inspections. A bridge can be included in the Network Development Program if upgrading or replacement is recommended by a current engineering inspection report. A bridge can also be included in the Network Development Program if nominated for other reasons.

The BMS also provides the following general reports:

*Report BCP_03
Graph BGCP_02*

- Bridge Status Report
- Overall Bridge Management Program



6.2 Planning Process

The planning process is designed to ensure that the bridges on the national road network are safe and reliable and that the bridges are constructed and maintained as most economical as possible, within the policies of the DPWH. The essential requirements of the bridge management process are established procedures that develop with time but do not change abruptly. The BMS is designed to be the tool to encompass the data procedures for the planning process.

The BMS will provide lists of bridges, ranked on need, for major maintenance and network development. These lists will enable planners to concentrate their efforts on those bridges where there is a demonstrated need for intervention.

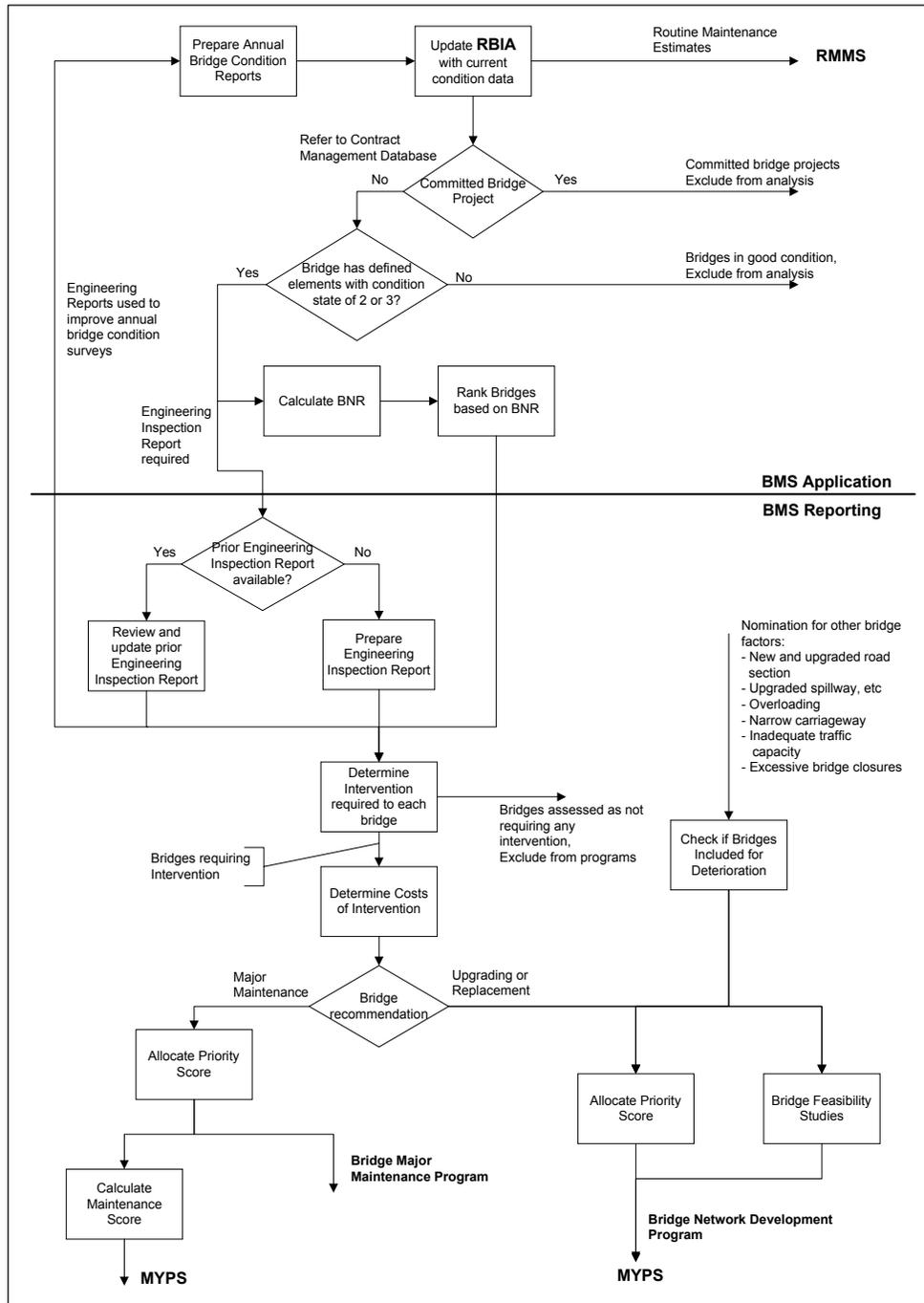
The principal requirement of the planning process of the BMS is the output of reports that provide the necessary information on the state of the bridge stock to the planners. The planners are not the operators of the BMS and the BMS is not the planning process. The BMS will not achieve its objectives if reports are not available to the users of the data in the necessary format.

The role of the BMS in the planning process is illustrated in Figure 6-2.



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Figure 6-2
Bridge Management Process





6.3 Routine Maintenance Requirements

The BMS will record the estimated annual routine maintenance funding requirement for each bridge. A routine maintenance summary can be prepared for all national bridges, listed under Region and District. This schedule would enable funding estimates to be prepared for all national bridges, for each Region and District, for the annual routine maintenance.

Typical bridge routine maintenance estimates reports are included in Appendix A for:

*Reports BRRM_01,
BRRM_02,
BRRM_03 and
BRRM_04*

- Country summary,
- Region summary,
- District summary, and
- Bridge details.

Estimates of cost for routine maintenance activities are just that and may have little comparison or correlation to the funds actually spent on routine maintenance to bridges. However, as the BMS develops, the routine maintenance estimates may become based on actual data from the RMMS and may become a more accurate reflection of the real need for routine maintenance to bridges. A bridge routine maintenance guide should be prepared by the DPWH in due course to set procedures for the preparation of annual bridge routine maintenance cost estimates.

If the routine maintenance cost estimates are converted to cost per square meter of bridge deck by dividing by the total deck surface area (e.g. overall length multiplied by overall width), the data can be analyzed by Region and District to compare cost estimates between Regions and Districts, by main member material to compare the routine maintenance requirements for different construction types, or any other combination of interest. Special reports could be developed for such comparison studies.



6.4 Types of Intervention

The standard bridge activities and their treatment within the BMS are described below.

Routine Maintenance

All routine and periodic maintenance to bridges undertaken through RMMS. Works undertaken as routine maintenance should include:

- Works that are urgent to safeguard the bridge and the public,
- Works not requiring formal design and documentation, and
- Works that can be undertaken with a MBA allocation of 10 crew days per bridge per year or equivalent cost.

The BMS records the estimated costs of routine maintenance to bridges, but it has no role in the allocation of routine maintenance funding. The RMMS Application handles all activities associated with routine maintenance.

All bridges would receive routine maintenance, independent of any recommendations by the BMS.

Emergency Maintenance

Any work undertaken to a bridge to address an emergency event or calamity outside the scope of RMMS but without normal procedures.

This class of maintenance is not managed by the BMS.

Major Maintenance

All repair work to bridges that is outside the scope of work handled under routine maintenance and which requires a separate allocation of funds. This category should include all works to bridges to prevent deterioration, to address existing damage and to overcome conditions that may impact on the bridges. It does not include any work that would improve the level of service provided by the bridges.



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Major maintenance is recommended by the BMS and is included in the Major Maintenance Program.

The DPWH will provide funding to implement the Major Maintenance Program recommended by the BMS. Specific funding shall be provided to ensure that the major maintenance does not have to compete with other asset preservation and network development projects.

Upgrading

All work to existing bridges that is outside the scope of work of major maintenance would be defined as upgrading. This would include extensive and expensive repairs, strengthening, retrofitting, widening and reconstruction of elements.

Upgrading is recommended by the BMS and is included in the Network Development Program.

Upgrading is considered as network development and will compete against other proposed network development projects for funding.

Replacement

Replacement is defined as the construction of new bridges including the replacement of existing bridges.

Replacement is recommended by the BMS and is included in the Network Development Program.

Replacement is considered as network development and will compete against other proposed network development projects for funding.

6.5 Determination of Intervention Type

The BMS determines the initial type of intervention (e.g. none, Major Maintenance, Upgrading or Replacement) required to each bridge using a set of algorithms based on:

- Bridge Inspector's recommendation as included in the annual bridge condition survey,

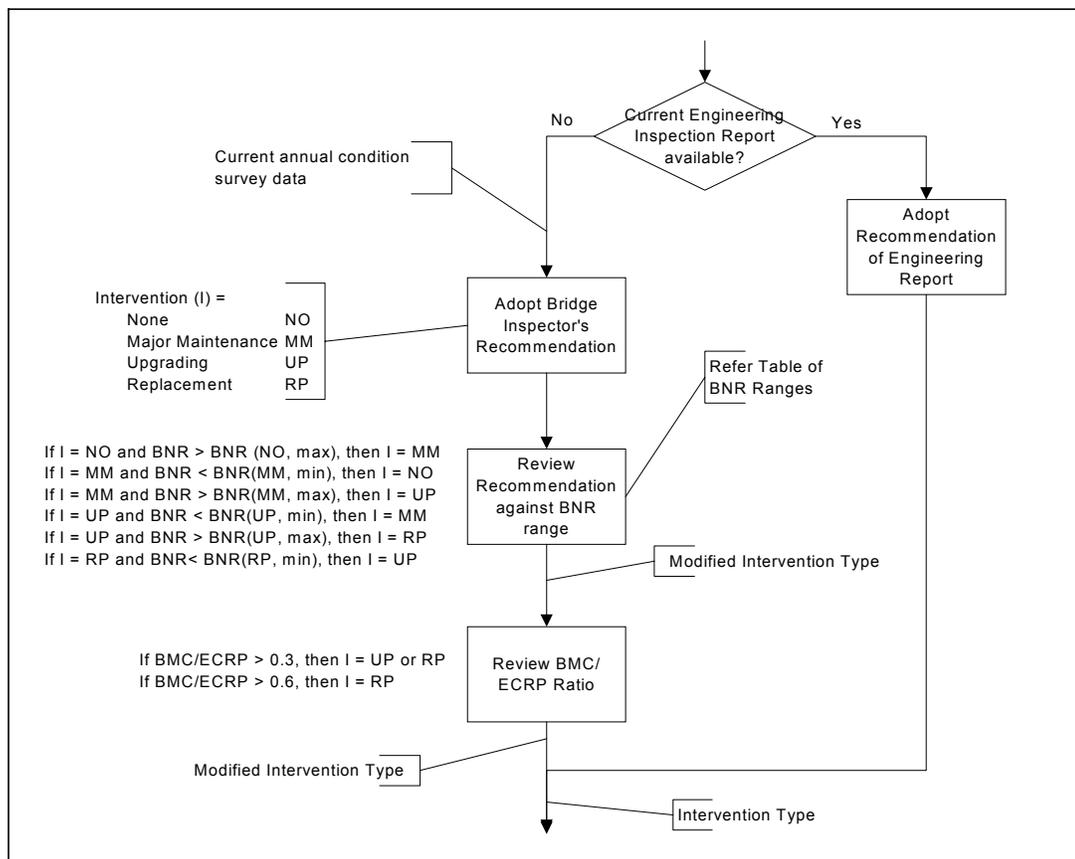


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- The allowable BNR range for the proposed intervention as included in Table 6-1, and
- Ratio of BMC to ECRP.

The process for determination of the intervention type is shown in Figure 6-3.

Figure 6-3
Determination of Intervention Type



Limits on the BNR ranges for various types of intervention have been imposed to ensure that the type of intervention undertaken is reasonable for the overall condition of the bridge. These limits will ensure that bridges that can be maintained receive major maintenance and are not unnecessarily replaced.



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Table 6-1
BNR Ranges for Intervention Type

Options for Intervention	BNR Range
None	0.00 – 0.06
Major maintenance	0.03 – 0.35
Upgrading/Replacement	0.20 – 1.00

The BNR ranges shown in Table 6-1 may be modified based on experience with the BMS and to suit any modified BNR algorithm. The ranges overlap as explained in Volume 2.

Limits have been imposed on the BMC/ECRP ratio for intervention types to ensure that the types of intervention are reasonable. For example, if the cost of major maintenance to a bridge is more than 30% of the estimated replacement cost, the bridge should receive upgrading or replacement rather than major maintenance.

Table 6-2
Cost Ranges for Intervention Type

Options for Intervention	Limit for BMC/ECRP Ratio
Major maintenance	0.3
Upgrading	0.6
Replacement	1.0

The BMC/ECRP limits shown in Table 6-2 may be modified based on experience with the BMS.

6.6 Determination of Estimated Cost for Intervention

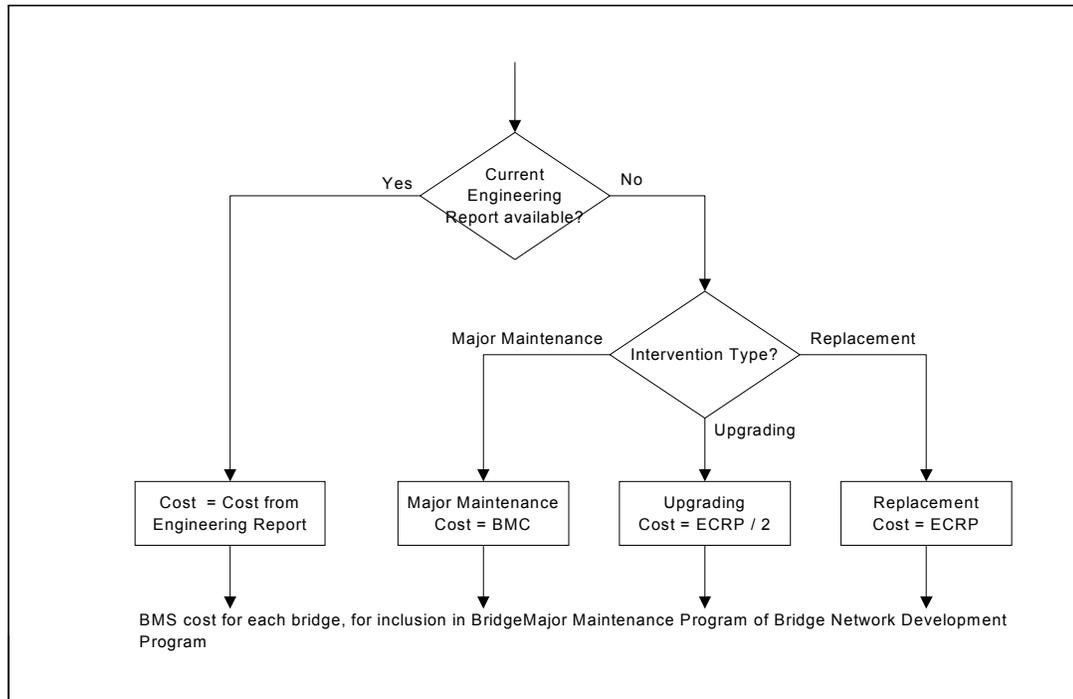
The estimated cost of the recommended intervention type is required for the compilation of the Bridge Major Maintenance Program and the Bridge Network Development Program.

The cost will be based on the engineering inspection report if available or otherwise will be based on the annual condition inspection data.



The process for determination of the estimated cost of the recommended intervention is shown in Figure 6-4.

Figure 6-4
Determination of Intervention Estimated Cost



6.7 Allocation of Priority Scores

The BMS ranks bridges on the basis of their calculated BNR. For example, if there are 800 bridges assessed as requiring intervention (major maintenance, upgrading or replacement), these are ranked from a ranking of 1 to the bridge with highest priority through to a ranking of 800 for the bridge with the lowest priority. This ranking of bridges is not useful for the development of bridgework programs.

For the development of bridgework programs, the bridges will be grouped into ten priority score zones with priority scores (PS) generated according to severity grading from 10 for the group with the highest priority through to 2 for the group with the lowest priority, for both the bridge major maintenance (MM) program and the bridge network development (ND) program.



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The priority score for all bridges not requiring any intervention and not included in either the Network Development Program or the Major Maintenance Program will be 1.

The method for determination of bridge priority scores is shown in Figure 6-5.

Bridges with current engineering inspection reports will be effectively given priority as all bridges without engineering inspection reports will have their priority score decreased by 2.

The bridges will be allocated into the various priority score zones by setting the number of bridges to be included in each zone. Indicative numbers in each zone are shown in the Priority Score Allocation Tables given in Table 6-3 and Table 6-4 for Major Maintenance and Network Development respectively. The numbers in each priority score zone will be set annually based on initial experience with the BMS and to suit the total number of bridges included in the Major Maintenance and Network Development Programs.

For the Major Maintenance Program, the sum of the numbers set in priority score zones 10 to 2 inclusive, shall equal the number of bridges assessed by the BMS as requiring major maintenance.

For the Network Development Program, the sum of the number set in priority score zones 10 to 2 inclusive, shall equal the number of bridges assessed by the BMS as requiring network development, plus the number of bridges nominated for network development for other reasons but not including twice those bridges included in both sources. In this case, the number of bridges allowed in the priority score zone of 2 shall be greater than the number of bridges nominated for other reasons less the number of bridges included in both sources as these bridges do not have a ranking based on BNR.

The BMS will not limit the number of bridges that can be included in the priority score zone 2 for either program, as the number of bridges assessed with a priority score of 2 may be greater than the number included in the priority score allocation tables if the high priority score zones are not fully allocated due to lack of bridges with engineering inspection data in both programs.

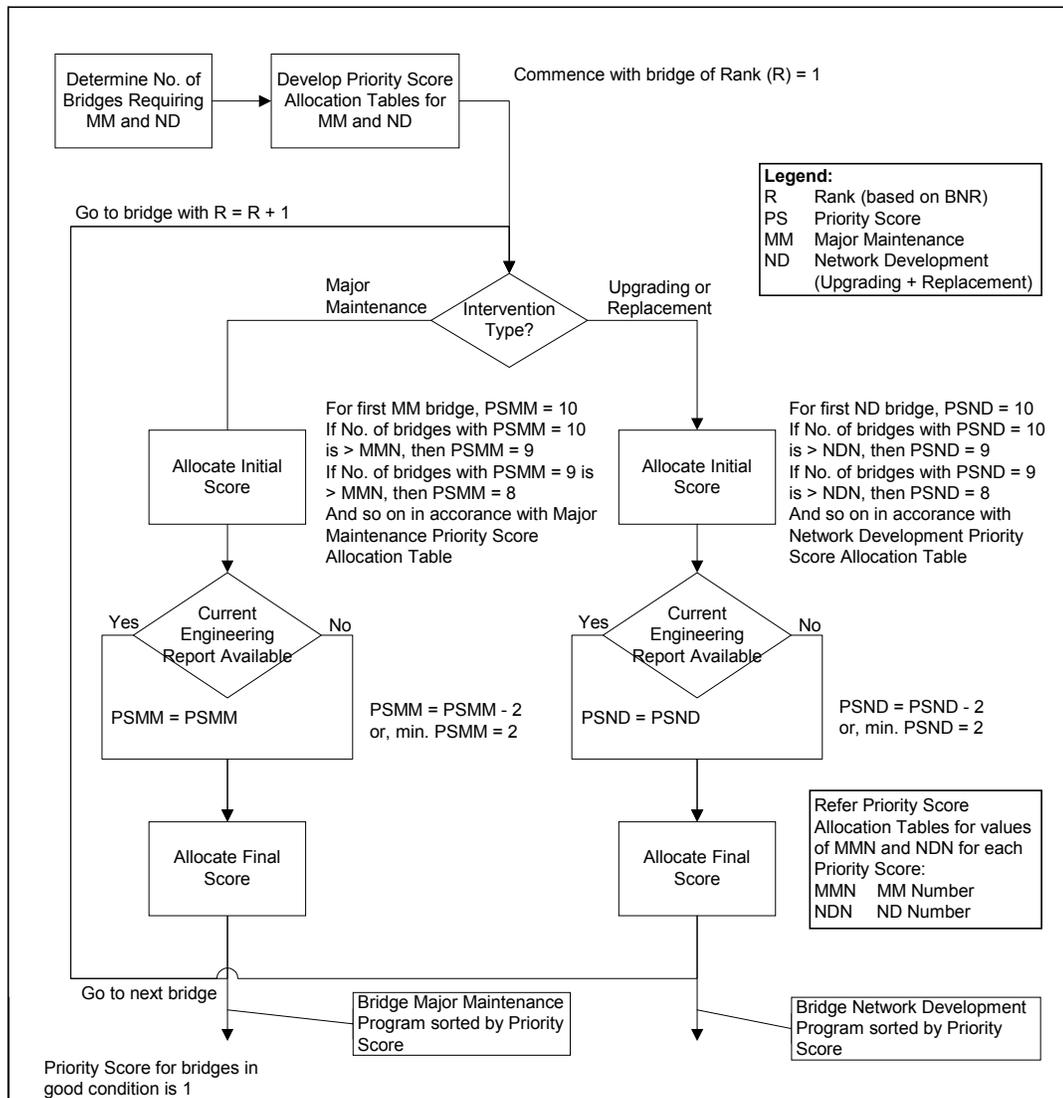


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All bridges throughout the country will be sorted into the various priority zones in a single exercise together to ensure uniform treatment of bridges.

Separate lists of ranked bridges may be prepared for each Region or District but in all cases, the ranking shown will be those determined on a national basis.

Figure 6-5
Determination of Bridge Priority Score





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Table 6-3
Priority Score Allocation Table, Major Maintenance Program

Priority Score (PS)	No of Bridges in Zone (MMN)
10	50
9	50
8	50
7	50
6	75
5	75
4	75
3	100
2	Balance

Indicative numbers only, actual numbers to be determined.

The sum of the number of bridges included in priority score zones 10 to 2 in Table 6-3 will be the total number of bridges included in the Major Maintenance Program.

Table 6-4
Priority Score Allocation Table, Network Development Program

Priority Score (PS)	No of Bridges in Zone (NDN)
10	50
9	50
8	50
7	50
6	75
5	75
4	75
3	100
2	Balance

Indicative numbers only, actual numbers to be determined.

The sum of the number of bridges included in priority score zones 10 to 2 in Table 6-4 will be the total number of bridges included in the Network Development Program.



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All bridges nominated for other reasons and not included by the BMS on the basis of deterioration will have a priority score of 2.

The allocated priority score for all other bridges that are in a good or fair condition and not included in either the Major Maintenance or Network Development Program, shall be 1.

6.8 Maintenance Score

A further score, the **Maintenance Priority** is used to determine the overall ranking for inclusion in the budget within the MYPS. The Maintenance Priority score is determined using the formula given below to account for the volume of traffic carried by each bridge and the urgency of the major maintenance as reported by a current Engineering Inspection Report.

$$\text{Maintenance Priority} = \text{MM Priority Score} + \text{Traffic Factor} + \text{Urgency Factor}$$

The Maintenance Priority Score is the Priority Score for the Bridge Major Maintenance Program.

The Traffic Factor allows for the volume of traffic using the bridge to give high volume bridges priority in the project selection. The Traffic Factor is determined based on the AADT per two lanes for the bridge, using the values specified in Table 6-5.

Table 6-5
Determination of Traffic Factor

AADT per 2 lanes	Traffic Factor
< 750	0.0
750 – 1,999	0.5
2,000 – 5,999	1.0
6,000 – 9,999	1.5
10,000 – 14,999	2.0
15,000 – 20,000	2.5
> 20,000	3.0

The Urgency Factor allows for the urgency of the required major maintenance, as reported by a current Engineering Inspection Report. This allocates priority to bridges where urgent deterioration is necessary to prevent deterioration and bridge failure.



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The Urgency Factor is determined based on the Engineering Inspection Report Summary Data, using the values specified in Table 6-6.

Table 6-6
Determination of Urgency Factor

Case		Urgency Factor
Current	Immediate	3.0
Engineering	Within 2 years	2.0
Report – Urgency	Within 10 years	1.0
No current engineering report		1.0

6.9 Bridge Codes

Simple bridge codes that describe a bridge in three letters are required for some summary reports. These bridge codes are based on the form and material of the superstructure of the bridge, as recorded in the RBIA. The bridge code refers to the major span or majority spans of a bridge. For example, a concrete arch bridge would be given the bridge code of CAR. These codes are standardized to eliminate confusion in the meaning of the codes.

The bridge codes are derived by the BMS as shown in Figure 6-6.

The BMS includes only the bridge code for the principal or major span of the bridge based on the inventory data held in the RBIA.

This arrangement is suitable for most bridges that are of uniform construction throughout that can be described using the same bridge code. It is also suitable for bridges where there is a major span(s) of one form of construction and minor approach spans of different construction as practice is to describe the major span(s) only.

If a bridge incorporates different spans of different construction, and it is wished to include these all in a standard description, the bridge codes can be applied to each span.



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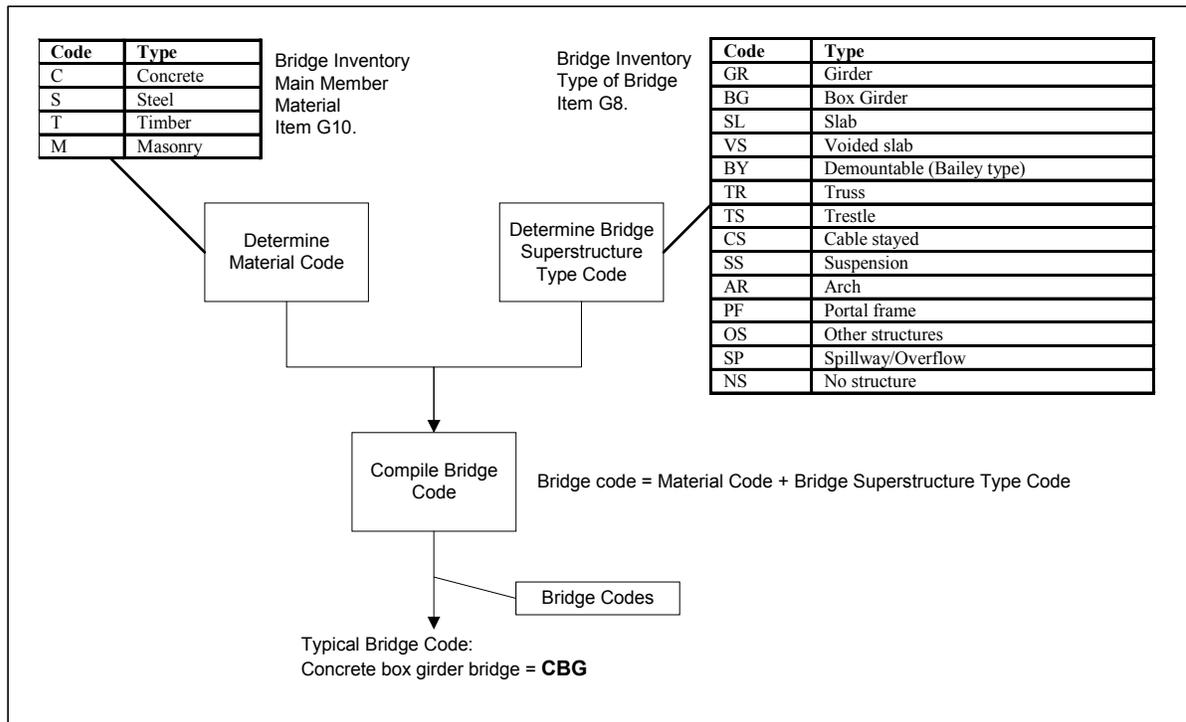
For example, a three (3) span bridge of different forms of construction could be described as:

CGR/STR/TTS

Where the first span is a concrete girder, the second span is a steel truss and the third span is a timber trestle.

This multiple description could be used generally outside the BMS.

Figure 6-6
Determination of Bridge Codes



Where a bridge is composed of several main member types and/or materials, the dominant one will be used in the BMS.



7 BRIDGE WORKS PROGRAM DEVELOPMENT

7.1 Background

The use of the BMS requires downstream processing to confirm the recommendations of the BMS in each case, based upon engineering inspections of each bridge found by the BMS to require intervention to address deterioration of the structure.

7.2 Bridge Engineering Inspections

A bridge engineering inspection shall be undertaken of each bridge where the annual bridge condition inspection survey indicates that major maintenance, upgrading or replacement is required.

Bridge engineering inspections shall be undertaken by appropriately experienced bridge engineers. The bridge engineers shall be selected by the Regional Offices as appropriate to investigate the defects identified by the bridge condition inspection surveys. The bridge engineers may be drawn from District Engineering Offices, Regional Offices, BOD, PMO Special Bridges or consultants, as appropriate based on the availability of resources.

The purpose of the engineering inspection is to undertake a more detailed inspection of a bridge than the annual bridge condition inspection. The engineering inspection will confirm that intervention is required to the bridge and will recommend the necessary work based on a whole-of-life assessment of the available options.

The engineering inspection will also consider other factors such as overloading, traffic, carriageway width, and road closures in the selection of options.

The engineering inspection report will include detail estimates of the costs of the options considered leading to the recommended works.



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The date of the engineering inspection, recommendation on the required work to the bridge and the detailed estimate of cost of the recommended work will be entered into the BMS to enable the BMS to keep track of the engineering inspections and to enable the BMS to maintain accurate records of the required bridge work.

The scope of engineering inspections will vary significantly depending on the nature and magnitude of the bridge defects. A damaged railing would require only a minor engineering inspection report while a major settlement problem to a large bridge pier would require an extensive investigation and a major engineering report. However, it is expected that the majority of engineering inspection reports would be quite small.

The preparation of engineering inspection reports will only be an onerous task in the first year of the BMS as such reports are not currently available for all bridges requiring intervention.

In future years, engineering inspection reports will exist for all such bridges from prior years, and will merely require updating to reflect changes in the scope of work and the estimated cost. Single page Review engineering inspection reports would be prepared in such cases.

Future analysis of BMS records may reveal particular defects that are common to some or all bridges of a particular period or design. In such cases, a common engineering investigation of a number of bridges may be appropriate to develop a generic maintenance solution suitable to be applied to all such bridges.

The recommendations of engineering inspection reports shall be based on whole-of-life analyses of all options to ensure that the most economical option is adopted.

For example, the options considered could include:

- Repair of the identified defects,
- Repair and upgrade to improve performance, and
- Replace the existing bridge.

Design Report
S. 3.19.3

For each option, a program of costed activities during the life of the bridge to maintain the bridge in good condition would be developed.



The activities would include construction, major maintenance and routine maintenance. It may be economical to undertake major maintenance and/or upgrading to reduce future maintenance costs of existing bridges.

7.3 Nomination of Other Bridge Projects

Additional bridges may be included in the Network Development Program based on factors other than need as assessed by the BMS. Such factors include:

- Bridges located on new or upgraded road sections,
- Overloaded bridges (e.g. a bridge with a calculated safe load capacity less than the heavy vehicles using the bridge),
- Narrow bridges (e.g. 2 lane bridges on 4 lane divided roads),
- Inadequate traffic capacity bridges, and
- Bridges with excessive road closures (e.g. low bridges subject to frequent closure due to flooding and overtopping).

This process is shown in Figure 7-1.

Form BP_01

The nomination of bridges for reasons other than deterioration is manual based on the use of Bridge Planning Sheets, as it is not considered practical to include this as part of the BMS algorithms. This is because all data required is not available in the RBIA and, as some subjective assessment of the bridge is required.

Bridges may be nominated for other reasons as follows:

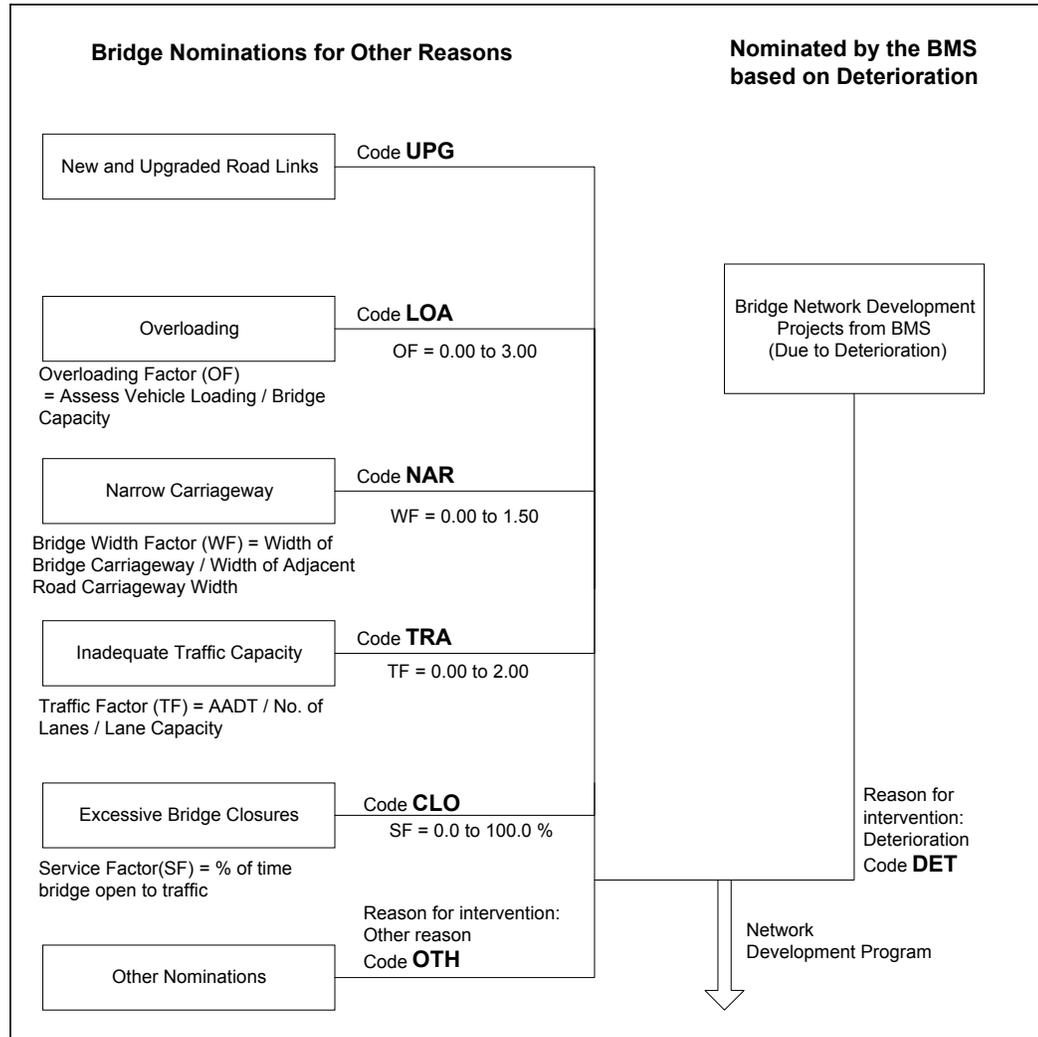
- Nominated from an Engineering Inspection Report following a review of the nominated factors, or
- Nominated by a Regional Director based on local factors.

Bridges may be nominated for inclusion in the Network Development Program for more than one reason. However, the BMS will record only a single reason and this should be nominated as the principal reason for the recommendation. All factors will be considered in feasibility studies arising from such nominations.



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Figure 7-1
Inclusion of Other Bridges



New or Upgraded Road Links

Bridges may be nominated for Network Development as part of road construction or upgrading, for example, the duplication of a two-lane road to a four-lane divided construction. In this case, the bridges will be assessed as part of the road.

These bridges are coded **UPG**.



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A special case in this classification is the upgrading of a spillway (ford) or causeway to a bridge. These sites are not recorded in the RBIA as a bridge and are therefore not considered by the BMS. To include these sites in the BMS, a new bridge must be created at the sites and included in the bridge inventory as *no structure*.

Overloading

Bridges may be nominated for Network Development due to overloading.

The actual loading of bridges in particular Region or along particular roads will be assessed based on axle weight surveys carried out by IPRSD. At the same time, structural reviews may be undertaken of the safe loading capacities of bridges.

Based on these studies, the Overloading Factor (OF) can be determined for each bridge. The need for upgrading or replacement as a consequence of the overloading would be assessed based on an consideration of:

- The Overloading Factor OF,
- The traffic volume (AADT) utilizing the bridge,
- The availability of alternative routes and
- Evidence of structural damage to the bridge.

The OF for bridges may vary in the range from 0.00 to 3.00. Bridges with an OF in excess of 2.0 should be considered for upgrading or replacement.

Overloaded bridges are coded **LOA**.

Narrow Bridges

Bridges may be nominated for Network Development due to inadequate width, e.g. two-lane bridges on four-lane roads and bridges with restricted carriageway widths on roads with generous carriageways and shoulders.

In such cases, upgrading or replacement is frequently justified on congestion or safety grounds.

The Bridge Width Factor (WF) would be assessed for all bridge in a region or along a particular road.



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The WF for bridges may vary in the range from 0.00 to 1.50. Bridges with a WF less than 0.8 should be considered for upgrading or replacement.

Narrow Bridges are coded **NAR**.

Inadequate Traffic Capacity Bridges

Bridges may be nominated for Network Development due an inadequate capacity to cope with the road traffic volume without congestion. This condition may be associated with inadequate approach roads and intersections adjacent to the bridges compounding the problem.

In such cases, upgrading or replacement is frequently justified on congestion or safety grounds.

The Traffic Capacity Factor (TF) would be assessed for all bridge in a Region or along a particular road based on a nominal lane capacity of 12,000 vehicles/day.

The TF for bridges may vary in the range from 0.00 to 2.00. Bridges with a TF in excess of 1.0 should be considered for upgrading or replacement.

Inadequate traffic capacity bridges are coded **TRA**.

Excessive Bridge Closures

Bridges may be nominated for Network Development if they suffer from excessive bridge closures as a result of flooding, wave attack, high winds, earthquake activity, volcanic activity, lahar flows or excessive maintenance.

The Service Factor (SF) would be determined for such bridges based on records of bridge closure over a historical period of say five (5) years.

The SF for bridges may vary in the range from 0.0 to 100.0%. Bridges with a SF less than the limits listed in Table 7-1 should be considered for upgrading or replacement.



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Table 7-1
Bridge Closure Limits

Road Integrity	Service Factor Limit
North-south backbone	100
East-west lateral	100
Other roads of strategic importance	98
Secondary national roads	95

Excessive bridge closures are coded **CLO**.

- Other Nominations Bridges may be nominated for inclusion in the Network Development Program for other reasons including:
- Local factors,
 - Special events, e.g. seismic retrofitting projects after major earthquakes and
 - Changes in design standards.

In each case, the nomination would be considered on its merits in the feasibility study or driven by DPWH policy.

Other nomination bridges are coded **OTH**.

- Nomination Process The process involved in nomination of a bridge into the Network Development Program is shown in Figure 7-2.

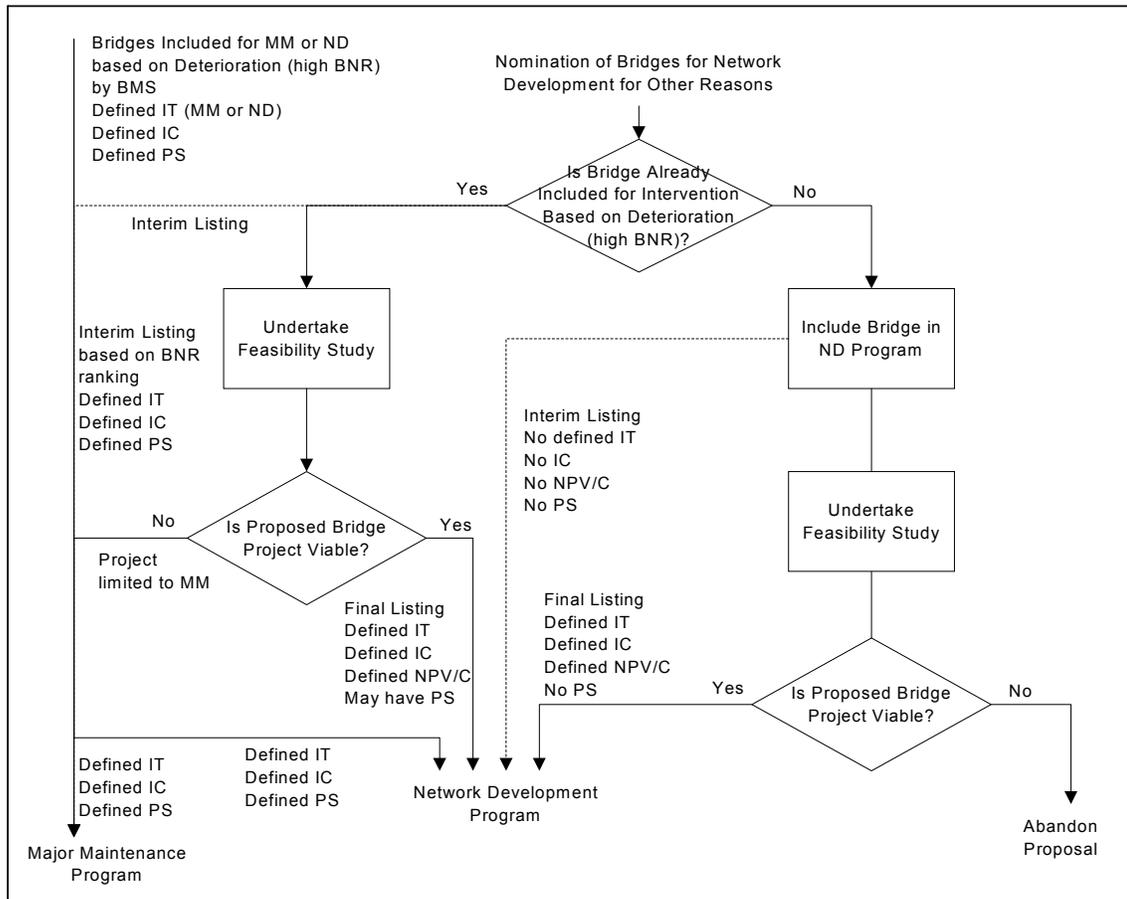
Such bridges will be assessed by the BMS as having a low priority unless a feasibility study is completed that demonstrates that the bridge has an acceptable BPV/C ratio.

Some bridges may be nominated for Network Development but may already be included in a Major Maintenance Program or Network Development Program as a result of deterioration (high BNR). These bridges continue to be considered in the BMS based on the Intervention Type, Intervention Cost and Priority Score determined based on the deterioration assessment, until a feasibility study is completed that demonstrates that the bridge has an acceptable BPV/C ratio with the nomination that may include a reclassification from Major Maintenance to Network Development.



In other cases, the feasibility study may show that the proposed network development is not financially viable and in these cases, the bridge would be limited to Major Maintenance.

Figure 7-2
Nomination of Bridges for Other Reasons



7.4 Bridge Feasibility Studies

Bridges included in the Network Development Program require feasibility studies before these projects can be processed by the MYPS Application.



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Bridge feasibility studies are outside the scope of the BMS but the principal recommendations of these studies will be included in the RBIA to enable this data to be included in the Network Development Program. This data will not be used by the BMS as part of the program development process.

7.5 Major Maintenance Program

The Major Maintenance Program includes all bridges for which major maintenance has been proposed either by an annual bridge condition inspection survey, by an engineering inspection or by a feasibility study. The bridges included in the Major Maintenance Program are allocated to priority scores by ranking based on the calculated BNR.

The Major Maintenance Program would exclude those projects committed (funded) or in implementation.

7.6 Network Development Program

The Network Development Program includes all bridges for which upgrading or reconstruction has been proposed either by an annual bridge condition inspection survey or by an engineering inspection. The bridges included in the Network Development Program are allocated to priority scores by ranking based on the calculated BNR.

Other bridges nominated for inclusion in the Network Development Program will be allocated priority scores either based on the assessed ranking where included for intervention as a result of deterioration or after bridges included because of condition inspections (deterioration).

The Network Development Program would exclude those projects committed (funded) or in implementation.

Bridges included in the Network Development Program as a result of the BMS may not be immediately available for implementation as these bridges are considered along with all other network development proposals for inclusion in funded work programs.



7.7 Long-term Needs Estimation

The DPWH requires information on the long-term major maintenance, upgrading and replacement needs of the bridge stock to maintain the national bridge stock.

The total long-term needs of the bridge stock are estimated in the Bridge Major Maintenance Program and Bridge Network Development (Upgrading/Replacement) Programs.

The deterioration rate of bridges is relatively slow and generally insensitive to the traffic carried by the bridges. However, overloading has resulted in rapid deterioration of many national bridges.

There is no reliable standard deterioration model that can be applied to bridges to determine the level of funding required to maintain the bridge stock at a particular standard.

The approach taken to determine the proposed funding levels to maintain the bridge stock is to adopt funding periods over which it is proposed all required works would be implemented. For example, the funding periods could be as follows:

- Major maintenance 10 years
- Network development 20 years

That is, the required funding for major maintenance would be 10% of the assessed major maintenance requirement for each year and the required funding for network development would be 5% of the assessed major maintenance requirement for each year.

7.7.1 Long-Term Funding Estimation – Major Maintenance

The number of bridges included in the highest priority score zone (Priority Score 10) in Table 6-3 for the Major Maintenance Program, would be varied so the estimated cost of the major maintenance to the included bridges, matched the estimated funding requirement for the first year, and so on. The various priority score zones therefore become the annual program for bridge maintenance for future years. This approach would be used for priority zones 10, 9, 8, 7, 6 and 5 to give the medium term program for the next six (6) year period.



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To estimate the longer term funding requirement outside the six-year period, the estimated intervention costs of the balance of bridges with priority score of 4, 3 and 2 would be totaled to indicate the long term funding requirement for bridge major maintenance. This sum could be converted to an estimated annual funding requirement either based on the average funding level determined for the medium term program or by assuming that the outstanding major maintenance would be undertaken in a set period, for example 4 years if the funding period given in Section 7.7 was adopted.

The first option would indicate the period required to address the outstanding major maintenance; if this period were excessive, this would be further evidence that the long term funding was insufficient to maintain the bridges to the desired standard.

The second option would indicate the long term funding requirement; this would also show if the long term funding was inadequate if the sum was significantly higher than the medium term period.

Experience over several years with the specific major maintenance funding allocation would indicate the appropriate approach and parameters for ongoing major maintenance planning.

The medium-term and long-term program would be updated each year and presented in form shown in Table 7-2.

Table 7-2
Medium-Term and Long Term Major Maintenance Program

Year	Funding
1	
2	
3	
4	
5	
6	
Long term	



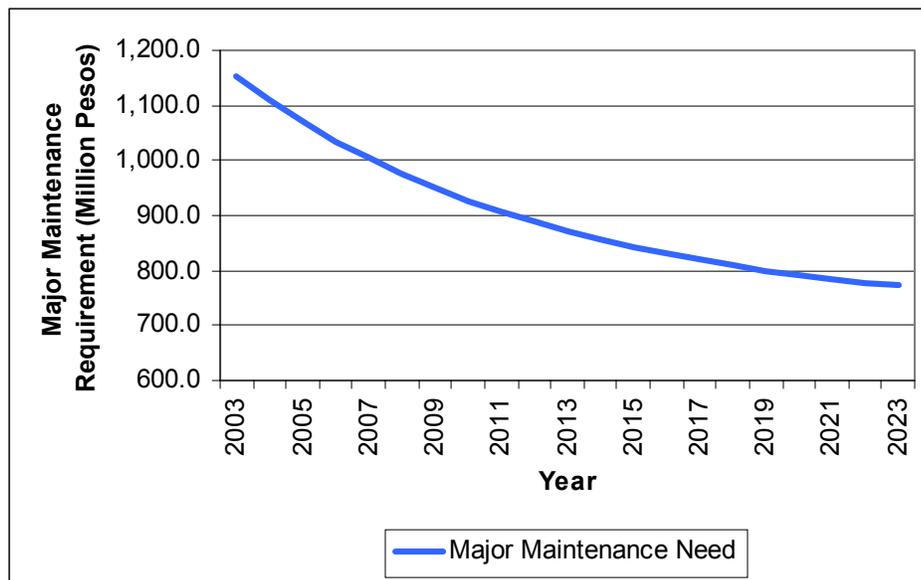
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The BMS would also be to monitor the total major maintenance requirement each year as a separate exercise to show whether the major maintenance program implemented was sufficient to address the requirement.

If the level of funding provided were adequate, the value of the assessed total major maintenance requirement would gradually drop to a constant sustainable level over a period of years. Over the same period, the required funding for major maintenance may drop as the backlog of bridge major maintenance was addressed.

An example of the funding requirement with a major maintenance program in place is given in Figure 7-3.

Figure 7-3
Long Term Funding of Bridge Major Maintenance Program



The information would be recorded in the format included in Table 7-3.



Table 7-3
Monitoring of Major Maintenance Funding

Year	Estimated Major Maintenance Need
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	

7.7.2 Long-term Needs Estimation – Network Development

A similar situation applies to the upgrading and replacement of bridges with the exception that bridges are upgraded and replaced for other reasons than to address bridge deterioration such as the upgrading in capacity of a bridge or the upgrading of a new or existing road link including bridge upgrading.

The total bridge replacement effort required can be estimated based on the number of bridges and the effective bridge life.

The number of bridges to be replaced each year as a result of deterioration will also be impacted by the effectiveness of the major maintenance program.

If the major maintenance program is effective in addressing the outstanding need for bridge major maintenance, the effective lives of bridges will be increased and this will reduce the number of bridged required to be replaced each year.

Basic assumptions are that there are 8,000 national bridges and that the average effective life of bridges in the Philippines is 100 years.



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This effective life is reasonable as many bridges have a shorter life (for example, a timber bridge may last only 20 years) but well designed bridges can last much longer with appropriate maintenance (for example, a major concrete bridge might be in service for 200 years).

Therefore, the number of bridges to be replaced each year as a result of deterioration is approximately 80 per year. This does not include bridges replaced for other reasons or new bridge construction.

If it were assumed that bridge upgrading and replacement due to deterioration is 50% of the total, then the total bridge network development program would be approximately 160 bridges per year. This is reasonable as most bridges are replaced before their replacement is required due to deterioration as a result of functional issues (e.g. traffic growth, changes in traffic corridors, etc).

These figures indicate the magnitude of the long-term network development program required to both upgrade and replace existing bridges and to upgrade the bridge network to meet the demands of the expanding network. If funding is not provided to address these requirements, the level of service provided by the bridges will decrease.

The number of bridges included in the highest priority score zone (Priority Score 10) in Table 6-4 for the Network Development Program, would be varied so the cost of the upgrading and replacement of the included bridges, matched the estimated funding availability for the first year, and so on. The various priority score zones therefore become the medium-term program for the bridge upgrading and replacement program. This approach would be used for priority zones 10, 9, 8, 7, 6 and 5 to give the medium-term program for the next six (6) year period.

To estimate the longer term funding requirement outside the six-year period, the estimated intervention costs of the balance of bridges with priority score of 4, 3 and 2 would be totaled to indicate the long term funding requirement for bridge network development.



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This sum could be converted to an estimated annual funding requirement either based on the average funding level determined for the medium term program or by assuming that the outstanding network development projects would be undertaken in a set period, for example 14 years in the funding period given in Section 7.7 was adopted.

The first option would indicate the period required to address the outstanding network development; if this period were excessive, this would be further evidence that the long term funding was insufficient to meet the requirement for network development.

The second option would indicate the long term funding requirement; this would also show if the long term funding was inadequate if the sum was significantly higher than the medium term period.

Experience over several years with the network development program would indicate the appropriate approach and parameters for ongoing network development planning.

The medium-term and long-term program would be updated each year and presented in form shown in Table 7-2.

Table 7-4
Medium-Term and Long Term Network Development Program

Year	Funding
1	
2	
3	
4	
5	
6	
Long term	

The BMS would also be to monitor the total network development requirement each year as a separate exercise to show whether the network development program implemented was sufficient to address the requirement.



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If the level of funding provided were adequate, the value of the assessed total bridge network development requirement would gradually drop to a constant sustainable level over a period of years. Over the same period, the required funding for network development may stabilize as the backlog of bridge network development was addressed.

The information would be recorded in the format included in Table 7-5.

Table 7-5
Monitoring of Bridge Upgrading/Replacement Funding

Year	Estimated Upgrading/Replacement Need		
	Based on Deterioration	Based on Other Reasons	Total
2003			
2004			
2005			
2006			
2007			
2008			
2009			
2010			



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Appendix A: Standard REPORT FORMATS In BMS Application

B1. Reports on Bridge Data in RBIA

Report ID	Graph ID	Report Name
Inventory		
BRDI_01	-	Bridge Inventory Summary
BRDI_02	-	Bridge Modification Summary
BRDI_03	-	Abutment Inventory
BRDI_04	-	Pier Inventory
BRDI_05	-	Span Inventory
Condition		
BRDC_01	-	Overall Condition Assessment
BRDC_02	-	Abutment Condition Part 1
BRDC_03	-	Abutment Condition Part 2
BRDC_04	-	Pier Condition
BRDC_05	-	Span Condition
BRDC_06	-	Routine Maintenance BMS Estimates

B2. Reports on BMS Operation

Report ID	Graph ID	Report Name
Annual Condition Survey		
BRO_01	GRO_01	Annual Bridge Condition Survey Report
BRO_02	-	Bridge Engineering Inspections Report
BRO_03	-	BNR Review Report
Management of Bridge Inspectors		
BIM_01	-	List of Accredited Bridge Inspectors*
BIM_02	GRO_03	Review of Accredited Bridge Inspectors*

* These reports are not produced in RBIA

B3. Forms for BMS Operation

Report ID	Graph ID	Report Name
Bridge Inspections		
BC_01	-	Bridge Condition Inspection (Type 3) Form - Header**
BI_01	-	Bridge Inventory Inspection (Type 7) Form - Header**
BI_02	-	Bridge Inventory Report

** Only the title page is produced in RBIA



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Report ID	Graph ID	Report Name
Bridge Planning		
BP_01	-	Bridge Planning Sheet

B4. Forms for Engineering Inspections

Report ID	Graph ID	Report Name
Bridge Engineering Inspections		
BRE_01	-	Brief for Engineering Inspection
BRE_02	-	Engineering Inspection Report Summary Sheet

B5. Reports on Management Information Related to Bridge

Report ID	Graph ID	Report Name
Inventory		
BRMI_01	BGMI_01	Total Number of Bridges, Country Summary
BRMI_02	BGMI_02	Total Number of Bridges, Region Summary
BRMI_03	BGMI_03	Total Number of Bridges, District
BRMI_04	BGMI_04	Total Number of Bridges Based on Bridge Code
Condition		
	BGMC_01	Total <u>Number</u> of Bridges in Different Condition (Good, Fair, Poor or Bad) by Number
	BGMC_02	Total <u>Number</u> of Bridges in Different Condition (Good, Fair, Poor or Bad), by Percentage
	BGMC_03	Total <u>Length</u> of Bridges in Different Condition (Good, Fair, Poor or Bad)
	BGMC_04	Total <u>Length</u> of Bridges in Different Condition (Good, Fair, Poor or Bad) by Percentage
General Information		
BRMG_01	-	List of Bridges in RBIA (Region)
BRMG_02	-	List of Bridges with Inventory Data
BRMG_03	-	List of Bridges without Inventory Data
BRMG_04	-	List of Bridges with Condition Data (Date Qualified)
BRMG_05	-	List of Bridges without Condition Data (Date Qualified)
BRMG_06	-	List of Bridges with Engineering Inspection Data (Date Qualified)
BRMG_07	-	List of Bridges without Engineering Inspection Data (Date Qualified)



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Report ID	Graph ID	Report Name
General Information (Continued)		
BRMG_08	-	List of Bridges with Feasibility Study (Date Qualified)
BRMG_09	-	List of Bridges without Feasibility Study (Date Qualified)

B6. KPI Reports

Report ID	Graph ID	Report Name
Agency Performance Indicators (APIs)		
BRAP_01	BGAP_01	Bridges in Satisfactory Condition
	BGAP_02	Bridges in Satisfactory Condition – Tracking***
BRAP_03	BGAP_03	Bridge Condition Summary
	BGPPT_04	Bridge Condition Summary – Tracking***
Process Performance Indicators (PPIs)		
BRPP_01	BGPP_01	Bridge Condition Inspections
	BGPT_02	Bridge Condition Inspections – Tracking***
BRPP_03	BGPP_03	Bridge Engineering Inspections
	BGPT_04	Bridge Engineering Inspections – Tracking***

*** Not included in RBIA



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B7. Reports on BMS

Report ID	Graph ID	Report Name
Routine Maintenance		
BRRM_01	-	Routine Maintenance Estimates, Country Summary
BRRM_02	-	Routine Maintenance Estimates, Region Summary
BRRM_03	-	Routine Maintenance Estimates, District Summary
BRRM_04	-	Routine Maintenance Estimates, Bridge Details
Bridge Major Maintenance Program		
BRMM_01	-	Major Maintenance Program, Country Summary
BRMM_02	-	Major Maintenance Program, Region Summary
BRMM_03	-	Major Maintenance Program, District Summary
BRMM_04	-	Major Maintenance Program by Priority Score
Bridge Network Development Program		
BRND_01	-	Network Development Program, Country Summary
BRND_02	-	Network Development Program, Region Summary
BRND_03	-	Network Development Program, District Summary
BRND_04	-	Network Development Program by Priority Score
Bridge Combined Programs		
BCP_01	-	Congressional District Project List****
-	BGCP_02	Overall Bridge Management Program
BCP_03	-	Bridge Status Report

**** Should be in MYPS

Copies of the above reports are available in the BMS Report Templates.

Graphs are produced based on the data extracted from running reports.