



Republic of the Philippines
Department of Public Works and Highways

Bridge Data Collection
Quality Assurance
and Management Manual
Version 2

September 2014

Revision Register

Version/ Rev No	Clause Number	Description of Revision	Authorised By	Date
Ver 1/ Rev 0		First Release of the Document		June 2003
Ver 2 Rev 0	General	All workflows redrawn to DPWH ISO Standard	Justino Jaime T. Surot, Jr.	Jan 2014
Ver 2 Rev 0	General	IPRSD Replaced with SD	Justino Jaime T. Surot, Jr.	Jan 2014
Ver 2 Rev 0	General	Assign responsibilities for Annual Condition Assessments to BMS Team In Central Office including Quality Assurance	Justino Jaime T. Surot, Jr.	Jan 2014
Ver 2 Rev 0	General	Assign responsibilities for Data Collection and Quality Assurance to Planning and Design Division in the Regional Offices	Justino Jaime T. Surot, Jr.	Jan 2014
Ver 2 Rev 0	General	Replace all screen shots of RBIA with new version	Justino Jaime T. Surot, Jr.	Jan 2014
Ver 2 Rev 0	Section 2.2	New section on Training of Bridge Inspectors	Justino Jaime T. Surot, Jr.	Jan 2014
Ver 2 Rev 0	Section 2.3	New section on Auditing of Annual Condition Surveys	Justino Jaime T. Surot, Jr.	Jan 2014
Ver 2 Rev 0	Section 2.4	New section on Reviewing, Checking and Uploading Bridge Condition Assessment Data	Justino Jaime T. Surot, Jr.	Jan 2014
Ver 2 Rev 0	Appendix A	New examples of quality assurance checks for bridge condition assessment data	Justino Jaime T. Surot, Jr.	Jan 2014

Abbreviations and Acronyms

API	Agency Performance Indicator
BIC	Bridge Inventory and Condition
BMS	Bridge Management System
BNR	Bridge Needs Ratio
BOM	Bureau of Maintenance
DPD	Development Planning Division
IQL	Information Quality Level
km	Kilometer
KPI	Key Performance Indicator
LRP	Locational Reference Point
LRS	Locational Referencing System
LRM	Locational Referencing Method
PMO	Project Management Office
PS	Planning Service
QA/QC	Quality Assurance/ Quality Control
RBIA	Road and Bridge Information Application
SD	Statistics Division

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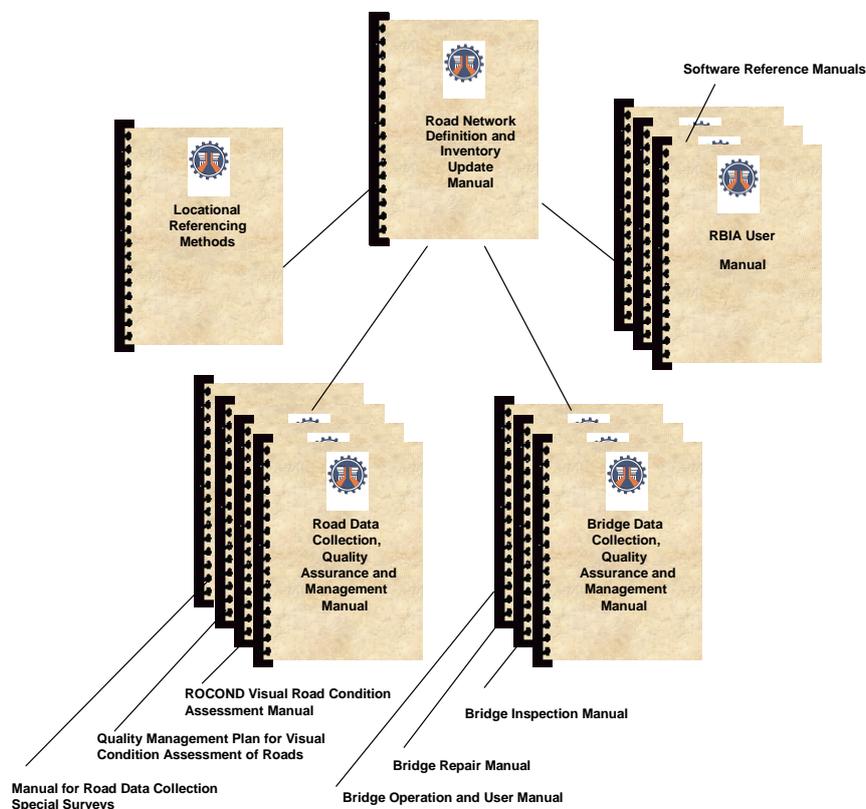
1 Introduction

This document describes the policies, processes and procedures for the collection of bridge condition data required by the Bridge Management System (BMS). The data is designed to provide the basis for long and medium term planning for bridges, not day to day maintenance.

The responsibility for management of the BMS rests with the Development Planning Division (DPD). In terms of functional management there are two areas of responsibility:

- **Bridge Inventory**, responsible for managing and coordinating the program of inventory change notification and for quality assurance of inventory update. The policies and procedures for these activities are detailed in The Road Network Definition and Inventory Update Manual and the Bridge Inspection Manual: and
- **Bridge Condition Surveys**, responsible for planning and coordinating bridge condition surveys and managing quality assurance for survey assignments and data quality within RBIA. Policies and procedures for these responsibilities are detailed in this manual. Other RBIA related manuals and guides and their usage is shown in Figure 1.

**Figure 1
Document Map**



1.1 Policy

The road and bridge data shall be of an appropriate quality that is verifiable by statistical procedures.

District Staff will carry out Bridge Condition Inspections. Depending on the nature of Engineering Inspections and Emergency Inspections, these may be carried out either by Contract or DPWH.

1.2 Bridge Data Surveys

The bridge condition data that will be collected at network level will be visual assessment of bridge condition in accordance with the Bridge Inspection Manual.

Other bridge data surveys may be required at a project level include Engineering and Emergency Inspections. These will generally be carried out as a result of findings from a condition inspection or a calamity event. Refer to the BMS Operation and User Manual for more information.

Table 1 details the frequency, coverage and Information Quality Level (IQL) of the bridge data that is to be collected. A description and definitions of IQL is given in Appendix 2.

Unless specific reasons are identified, network data is to be collected in accordance with Information Quality Level 3 (IQL 3)¹. IQL 3 data may be generally described as information suitable for network planning and programming. The data needs to identify projects within the network, for which more detailed, project level data can then be sought.

**Table 1
Frequency and Coverage of Bridge Information**

Survey Type	Survey Type	Survey Frequency	IQL	Scope	Network/ Project Data
2	Condition Assessment	Annual	3	All bridges	Network
3	Engineering Inspection	As Required	2	Required for any bridge if the condition state of any defined components is 2 or 3	Project
4	Emergency Inspection	As Required	2	Required for any bridge damaged as a result of a calamity	Project

1.3 Bridge Condition Assessment

The condition of National Bridges will be assessed during the annual Bridge Condition survey. The surveys will take place over a 6-month period from May to November each year, and be confirmed for use in the BMS in January. The bridge survey will collect condition data at IQL 3 during a visual survey.

1.4 Data Held in RBIA

The BMS will hold bridge condition data for all National Bridges. However, the BMS is a dynamic database that can be amended and extended to include additional data types as required. If there is a perceived requirement for the inclusion of additional data within BMS, the originator of the requirement should request inclusion of the data from the BMS Central Office Coordinator, who will discuss this with other users, prior to a decision being made. The User Group meetings (see The User Satisfaction Program) provides a forum for such discussions.

¹ Briefly IQL 1 = research level data, 2 = project level, 3 = network level data, 4 = summary, statistics level data, 5 = data for key performance level indicators.

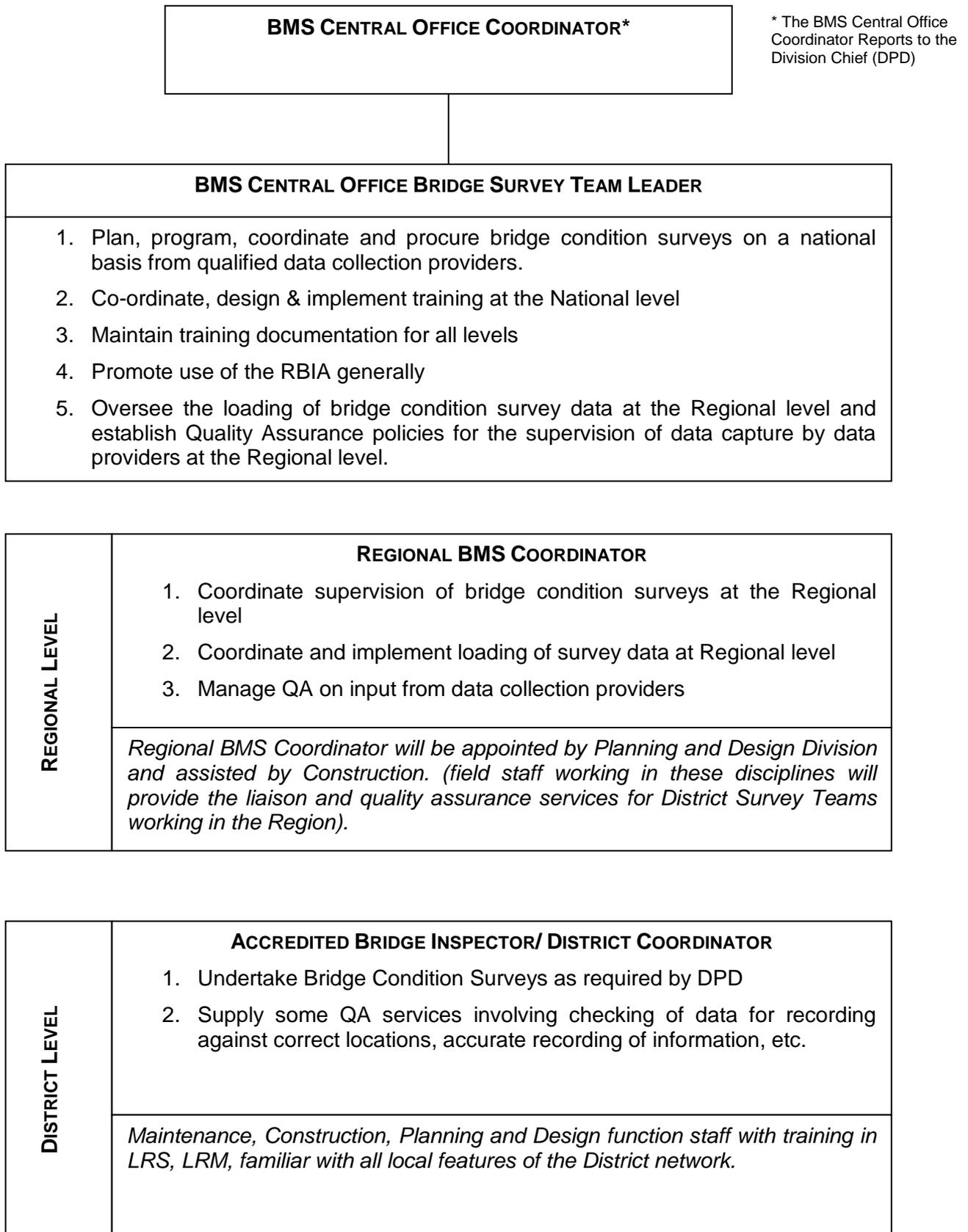
1.5 Organizational Responsibilities

Bridge Condition surveys take place annually, to a scheduled timetable. Surveys will involve large volumes of data and will cover the all National Bridges. Planning, scheduling, and initiation of surveys by DPWH staff and quality assurance will be a significant workload.

The BMS Central Office Coordinator within the DPD will have overall responsibility for coordinating and managing condition surveys and for the associated quality assurance procedures. The day to day responsibility will be delegated to the BMS Coordinators in the Regional Offices.

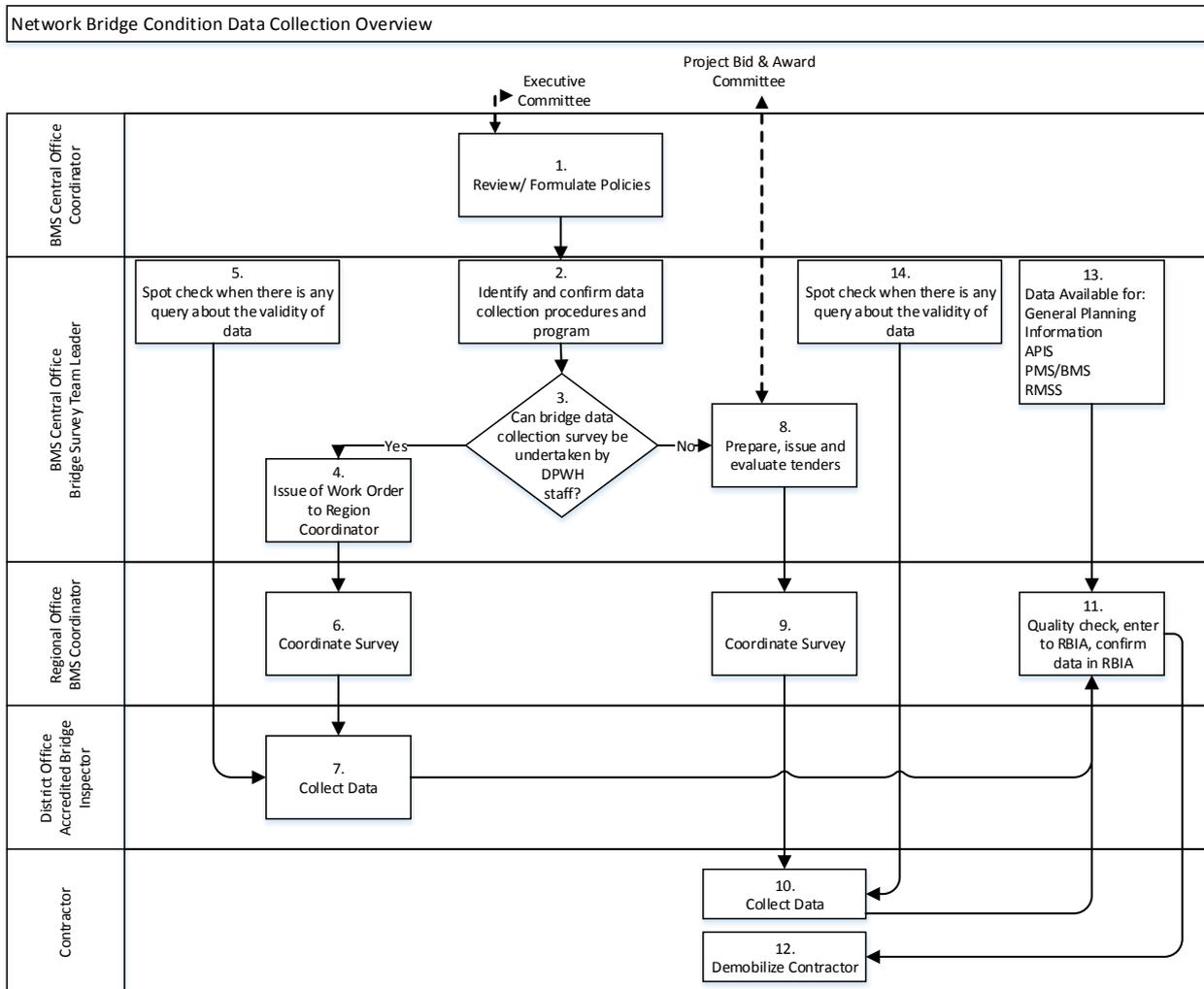
The summary of the management and coordination of the bridge condition survey process is summarized in Table 2 following.

**Table 2
Summary of Bridge Survey Management Responsibilities**

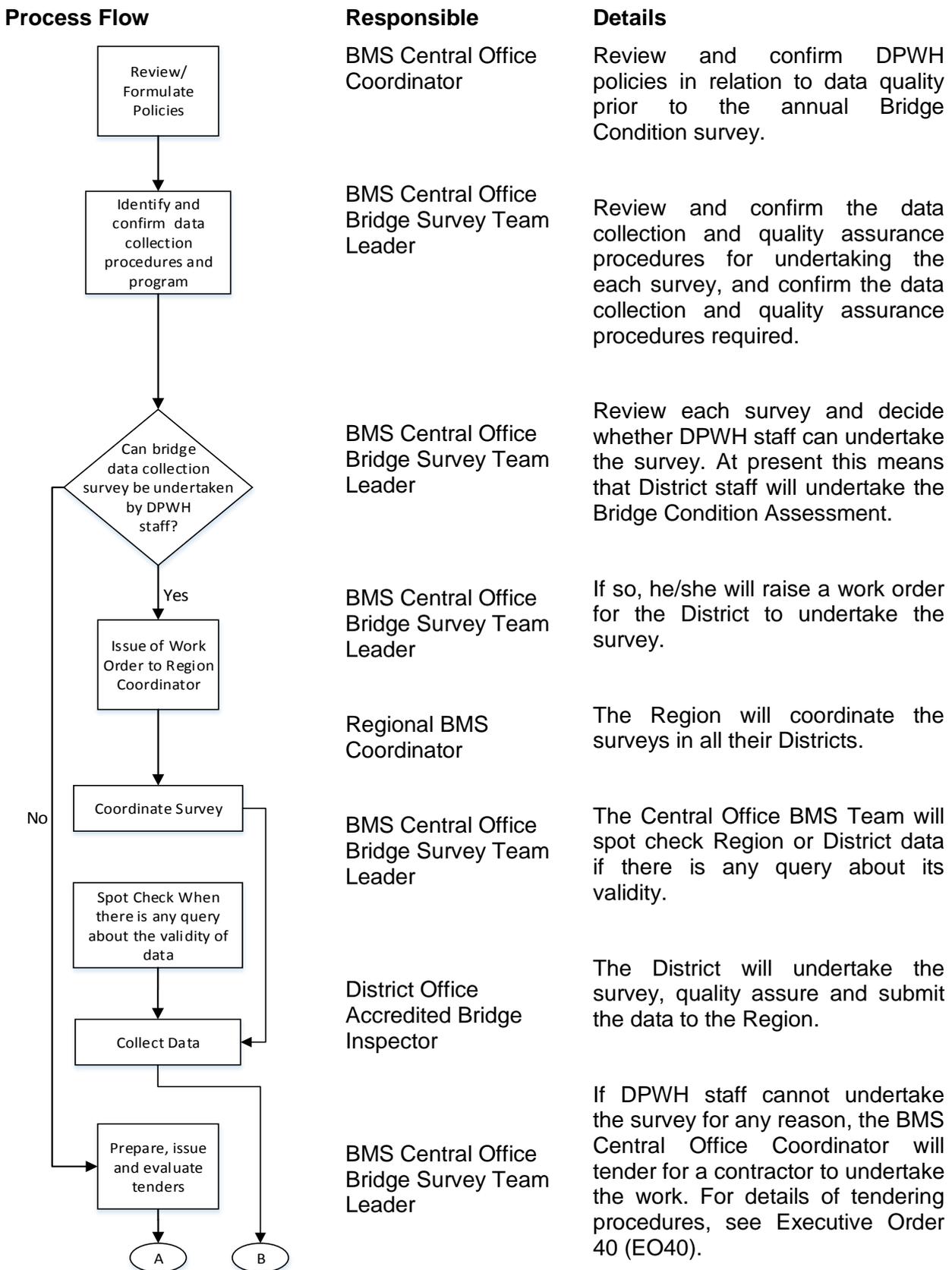


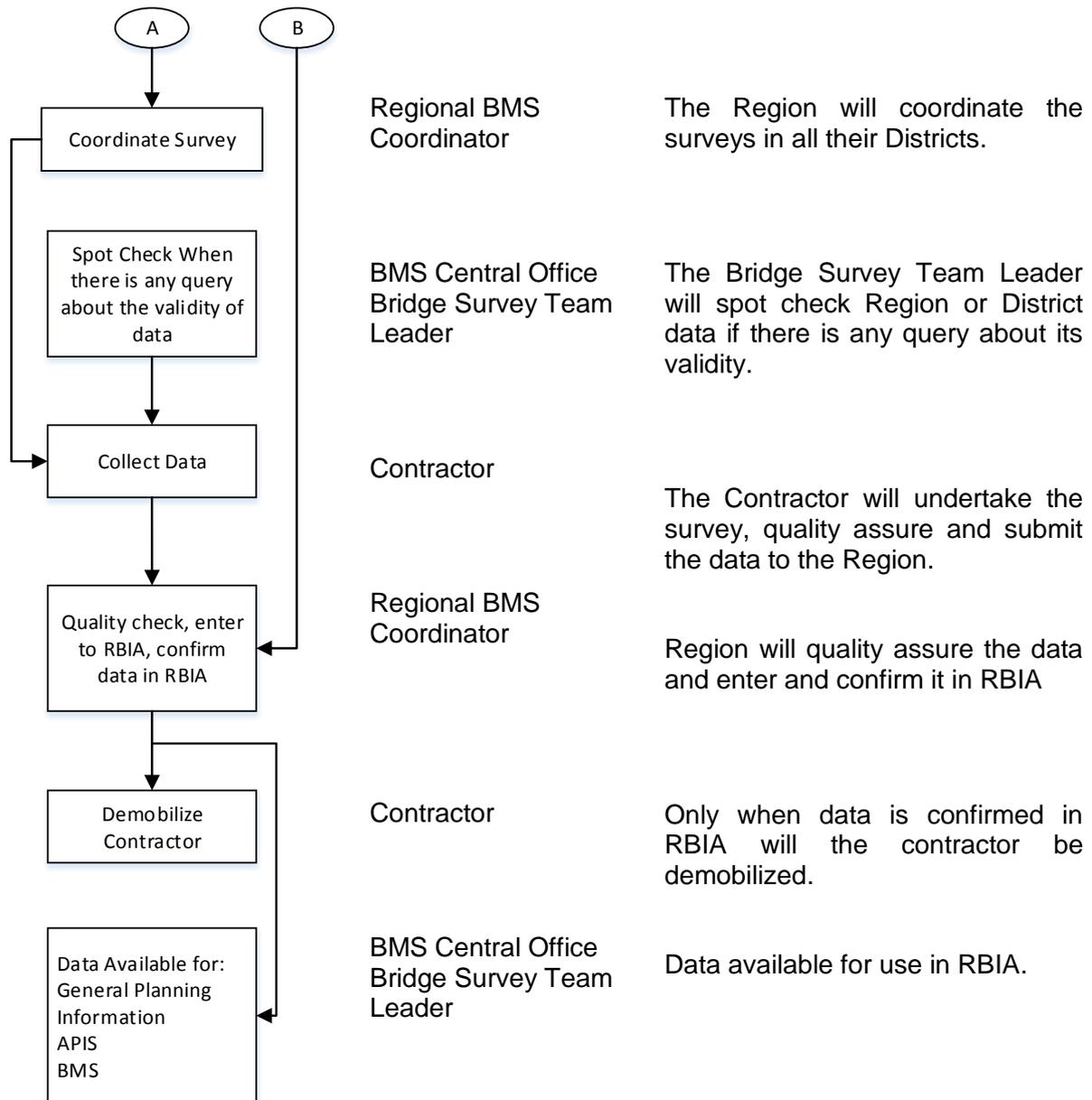
1.6 Overview of Bridge Data Collection Procedures

Figure 2
Overview of the Procedures for Bridge Data Collection Surveys



**Figure 3
Overview of the Procedures for Bridge Data Collection Surveys**





Detailed workflow charts and procedures for each of these activities are provided in this manual.

1.7 Quality Assurance

The quality control and quality assurance procedures are common for all bridge surveys, although the detail varies from survey to survey. Further detail is given for each survey type in the detailed procedures for bridge condition described below.

1.7.1 DPD Responsibilities

The BMS Central Office Coordinator is responsible for agreeing a quality plan with each survey organizer, whether the Regions, Districts or Contractors undertake the bridge condition survey. In the case of the District, the BMS Central Office Team will provide a pro forma plan for the District to complete.

The BMS Central Office Team, working through the Region, will ensure that the District or contractor understands their obligations under the plan, and follows the procedures, using the specified accredited people and equipment. They will ensure that the plan is updated during the course of the procedure if required. For example, if the definition of a condition rating is not understood, and so assessments are not consistent between survey teams, BMS Central Office Coordinator will ensure that the definition is redrafted, and consistently applied.

The BMS Central Office Team will also ensure that Regional and District staff are trained in the procedures needed to undertake bridge surveys, and for Regions to coordinate District bridge condition surveys. The BMS Central Office Team will also have the responsibility for accrediting Region and District Staff as bridge inspectors for the bridge condition surveys. Only assessors accredited by the Central Office will be allowed to undertake assessments.

Finally, BMS Central Office Team will spot check any part of the conduct of surveys, or data collected from them, if they have any reason to query compliance with the quality plan or the quality of data that is being collected.

1.7.2 Regional Responsibilities

Regions have the responsibility to coordinate surveys, and for verification of data and entry into the RBIA database. Data from the survey team, whether District staff or contractor, will be checked for completeness, quality assurance and accuracy before input to RBIA.

For further detail, see the Bridge Inspection Manual and the Bridge Operation and User Manual.

1.7.3 District and Contractor Responsibilities

District and contractors will be responsible for implementing the agreed quality plan for the bridge condition survey. The District or contractor will check data collected by the survey teams, before submitting it to Region.

2 Bridge Condition Assessment Survey Procedure

2.1 Introduction

To plan and program maintenance over the medium and long term the DPWH requires regular and reliable data on the condition of the National Bridges. The condition of the bridges will be assessed through a combination of annual bridge condition surveys.

The condition assessment process will be rapid and relatively low-cost in order to be sustainable. It is to be used in several distinct management processes and therefore must capture attributes that are relevant, or can be interpreted easily in the different applications.

The basic condition data must serve three primary purposes within the general bridge management function:

- as the basis for key performance indicators (KPIs) to assess the state of the National Bridges
- as input to the BMS, for planning and programming;
- provide as much information as possible to assist in planning of routine maintenance at the DPWH District level.

Bridge Condition surveys will be carried out on all National Bridges on an annual basis. The surveys will take place over a six-month period from May to November, subject to a quality audit and be confirmed for use in the BMS in January.

2.2 Procedure for Managing a Bridge Condition Survey

2.2.1 Policies

The road and bridge data shall be of an appropriate quality that is verifiable by statistical procedures.

2.2.2 Definition

Bridge Condition Survey: A survey to assess the condition of the National Bridges.

2.2.3 Attributes Stored in RBIA:

Refer to Bridge Inspection Manual for details.

2.2.4 Standard:

Data is to be maintained at the 95% confidence level.

2.2.5 Currency of Data:

Changes to be available in RBIA (networked) within 1 month of the acceptance date

2.2.6 Data Stewards

Regional Planning and Design Division

2.2.7 Users

Planning Service (PS)

Bureau of Maintenance (BOM)

Regional Planning and Design Division

Regional Maintenance Division

District Offices

2.2.8 Workflow

Figure 4
Workflow for Managing a Bridge Condition Survey

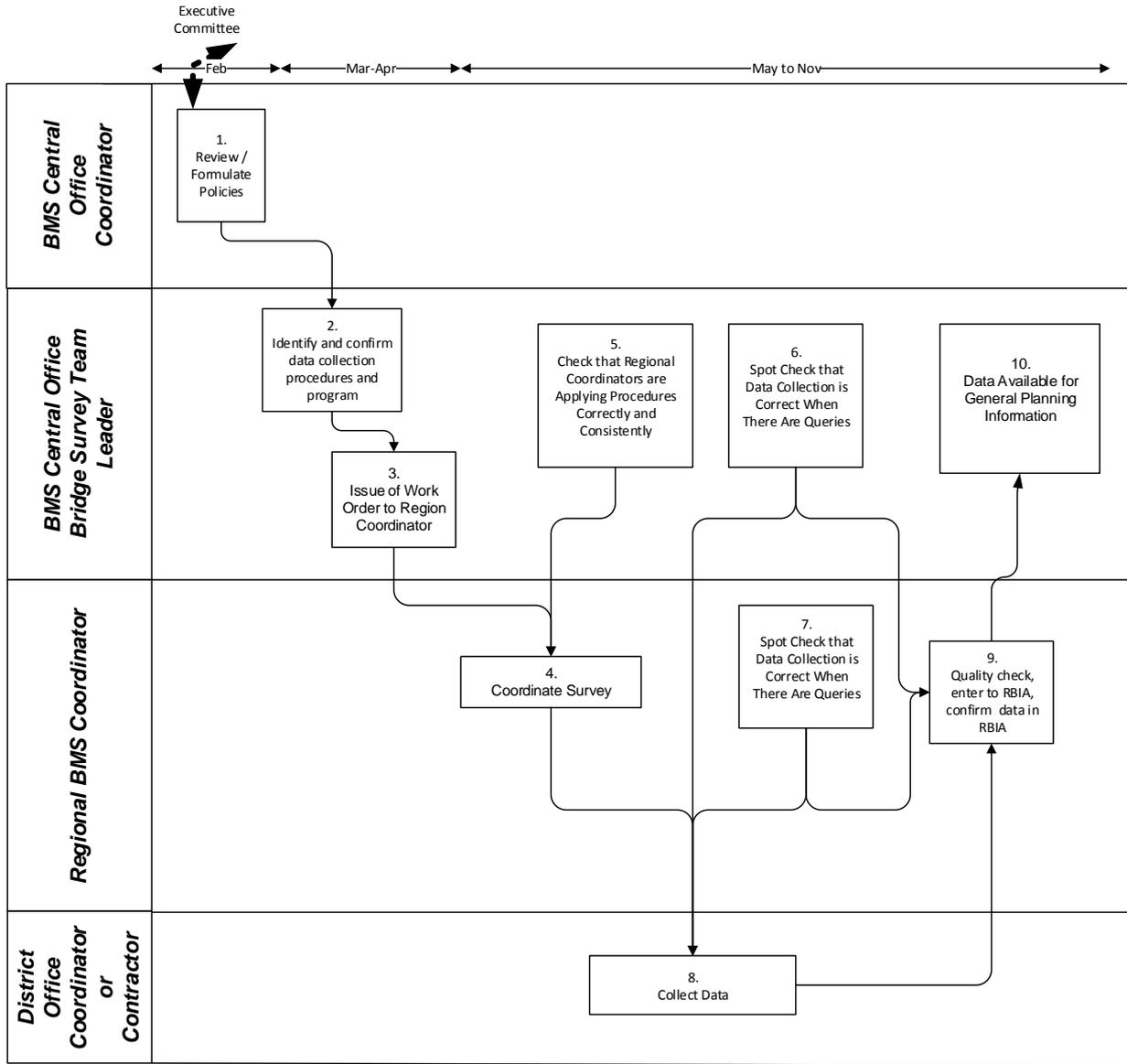
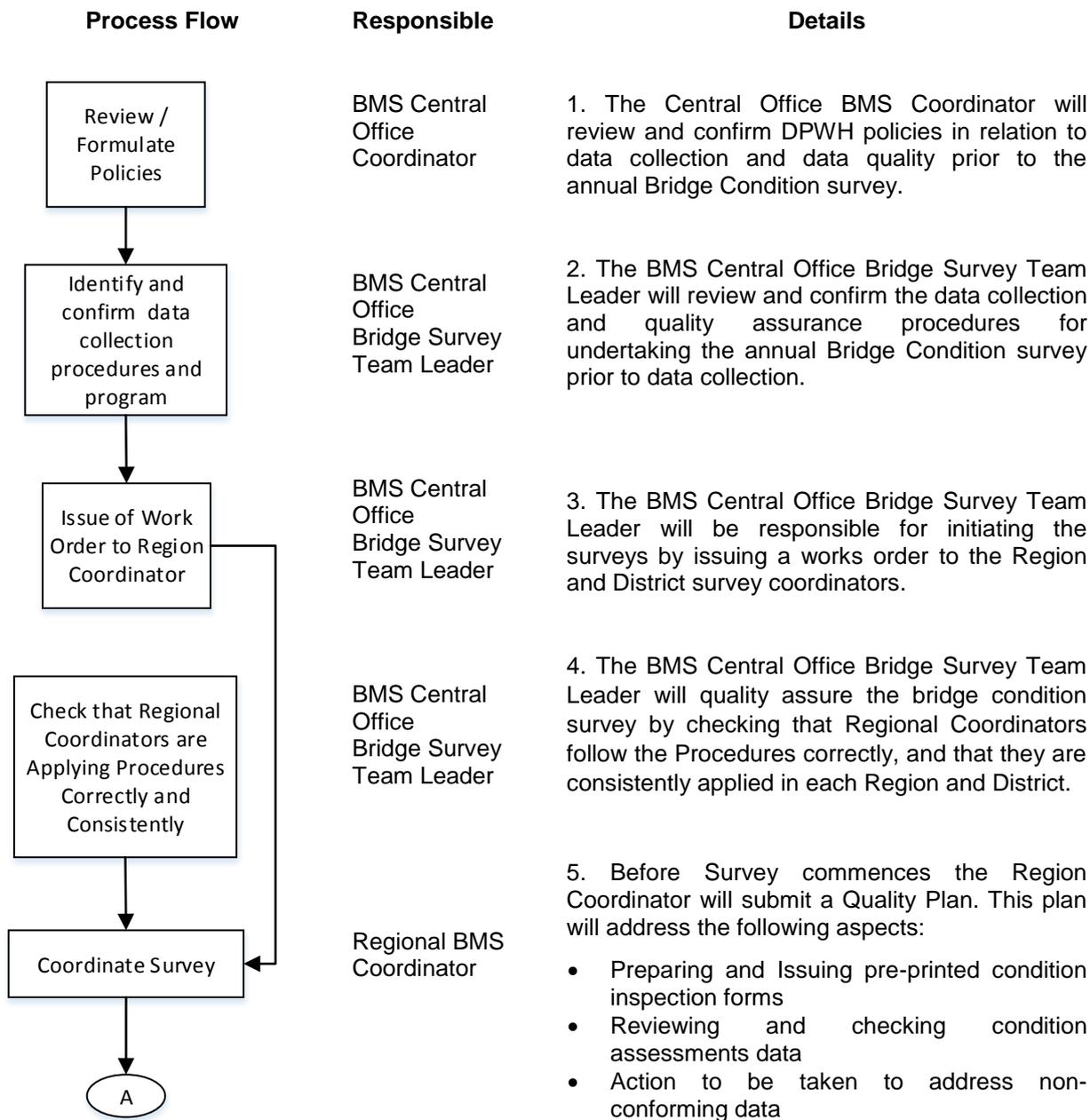
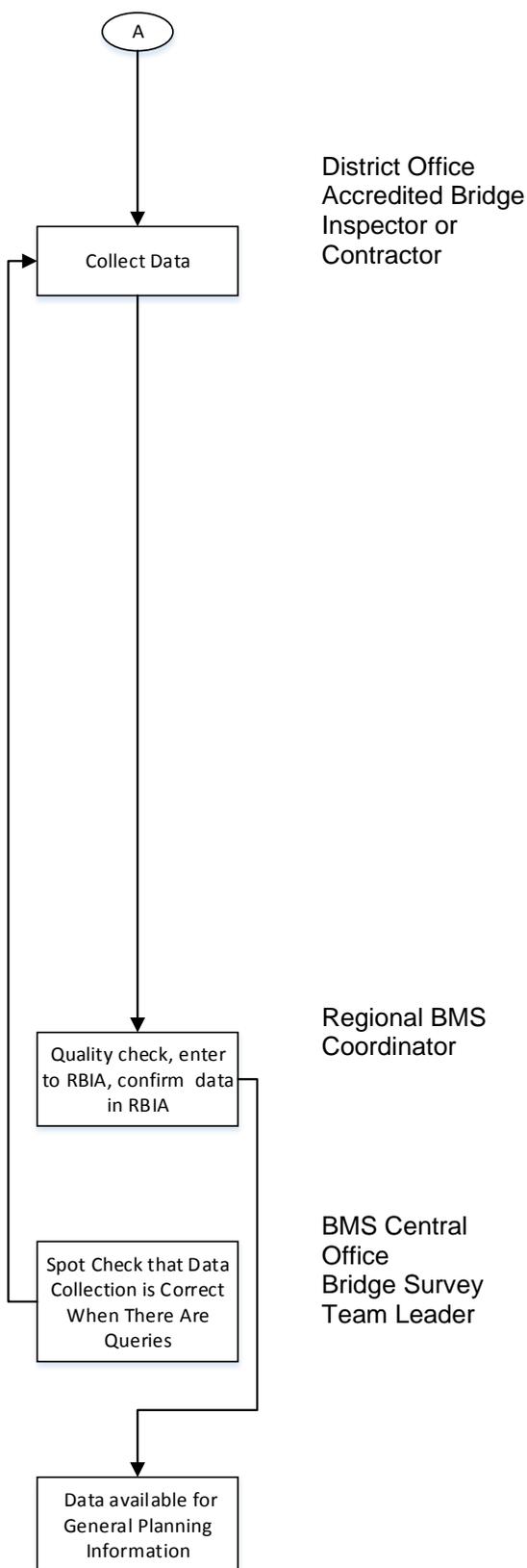


Figure 5
Workflow for Managing a Bridge Condition Survey





6. Districts will complete the annual Bridge Condition survey including Quality Assurance between May and November each year. The data will be delivered to the Regional offices for quality assurance checks, prior to acceptance. All condition data will be referenced in accordance with the Locational Referencing Method. The results of the survey will be made available to the appropriate Regional Office in the specified format. The data supplied must be in electronic format (tab-separated text), the column items conforming to the format as specified in the data specifications of the DPWH Road and Bridge Information Application (RBIA) system. This will allow direct importing of the data into the RBIA. Data will not be accepted until all QA/QC procedures have been satisfied. Data submissions will include the results from the validation surveys implemented during the course of the survey. Data should be submitted daily or weekly, as field conditions permit, so that any problems with completeness or accuracy can be detected as soon as possible and remedial action taken. Data will be collected annually on a fixed route and timings. Apart from weather delays and breakdowns there is no requirement for any variation or rescheduling of the condition data collection circuit from year to year. There are considerable advantages in terms of assessment consistency in keeping the collection route and timings constant

7. The Regional Office will be responsible for importing the data into the RBIA and any further quality audits carried out on behalf of the DPWH. The Regional Office will also prepare a quarterly report for the DPWH that details the Key Performance Indicators for data collection and outline any problems and solutions that have arisen with the District.

8. The BMS Team in DPD will undertake spot checks of inventory and condition data provided by Districts and Regions if there is any query about its validity. The BMS Central Office Bridge Survey Team Leader will implement changes to resolve the problems if Key Performance Indicators fall short of expected levels, or if performance of the District is not satisfactory. These may involve changes to a contractor, contract specifications, QA/QC procedures, or improved training or a combination of all four.

2.2.9 Actions in the RBIA

Log in to Confirm with appropriate user privileges (permission to edit/add data using the 'Surveys' form and/or permission to use the 'Import Data' utility, depending on whether the data is to be entered directly into the RBIA or bulk imported).

The RBIA may be populated with the bridge condition survey data in either one of two ways:

- Entered manually using the software user interface, or
- Entered into a spreadsheet and later bulk imported.

Manual data encoding is not encouraged as it is difficult to control quality. The preferred method is to create an import file and import to the RBIA using the bulk import utility.

Import files may be created by using the Department's Bridge Inventory and Condition (BIC) Application. This application provides a simple method for entering bridge condition data into customized forms that create a text file meeting the import file specification (e.g. 'composite comma separated' format as shown in Figure 7) of the RBIA.

Import this file into the RBIA using the 'Import Data' utility provided in the RBIA. Details of the process are provided in the BMS Operation Guide. For technical information about importing files to the RBIA, refer to 'User's Guide to RBIA'. This covers file import specifications, sample import files, and help in performing basic operations in the RBIA software.

Figure 6
Screenshot from the Bridge Inventory and Condition (BIC) Application

Bridge Inventory And Condition Application - B0

| Want to... Help

New Open Survey General Info Import File Exit

Major Maintenance Save

Start Date: 01/17/2014
 End Date: 01/17/2014
 Surveyor:

Element

- Bridge Condition - Major Maintenance Inspection
- Abutment (Condition)
- Pier (Condition)
- Span (Condition)

Number of Required Attributes with Error: 0
 Validation Result: ■ Accepted

Attribute	Value
Bridge Label	B00000XX
Overall Condition	Not Specified
Recommended Action	Not Specified
Inspector's Comment	
Type of Bridge	Not Specified
Level of Inspection Undertaken	Not Specified
Major Reason for Recommendation 1	Not Specified
Major Reason for Recommendation 2	Not Specified
Major Reason for Recommendation 3	Not Specified
Estimated Remaining Bridge Life	null years

Figure 7
Example of Bridge Condition Data Import File (3 parts)
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				B00008LZ	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 damag	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	

2.2.10 Key Performance Indicators for Data Collection

The District Survey Team shall achieve 99% coverage of bridges specified in the detailed scope of work and will be expected to work during periods where traffic conditions allow this coverage requirement to be achieved. Exceptions to this may include bridges that:

- are under construction or maintenance;
- are affected by natural disasters; and
- have been closed by the authorities for security or other reasons.

2.3 Training of Bridge Inspectors

2.3.1 Introduction

Policies

Bridge data shall be of an appropriate quality that is verifiable by statistical procedures.

Definition

Condition Assessment: A score that indicates a level of distress.

Standards

Data is to be maintained with 95% confidence level.

Data Stewards

Regional Planning and Design Division

Users

Planning Service (PS)

Bureau of Maintenance (BOM)

Regional Maintenance Divisions

District Offices

2.3.2 Bridge Inspection Training Requirements

The specific requirements for trained personnel to undertake bridge inspections are given in Table 3 for the various types of bridge survey types.

Table 3
Requirements for Bridge Inspection Personnel

Type	Name	Personnel Requirements
<i>Scheduled Bridge Inspections</i>		
1	Routine	District Maintenance Engineer
2	Condition	Accredited Bridge Inspector
3	Engineering	Senior Bridge Inspection Engineer
<i>Non-Scheduled Bridge Inspections</i>		
4	Emergency	District Maintenance Engineer
5	Inventory	Accredited Bridge Inspector

Bridge inspection types 2 and 5 are to be conducted by accredited Bridge Inspectors who shall be engineers or other professional staff with relevant experience in the inspection, construction,

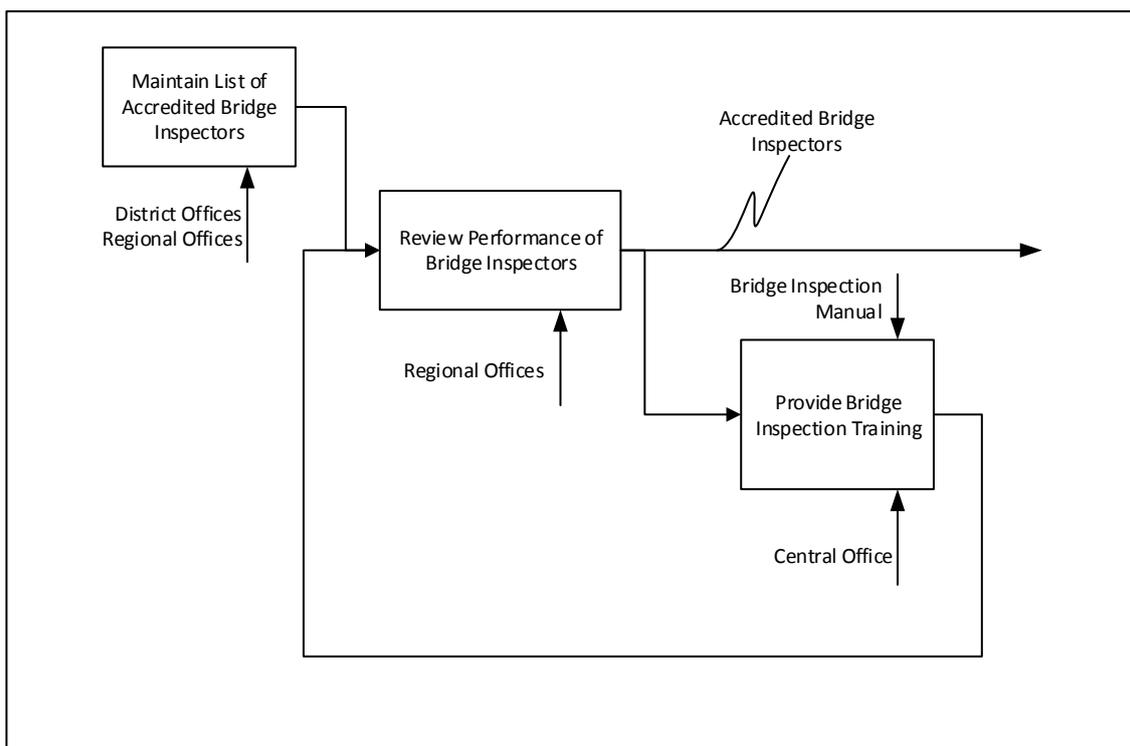
design, maintenance or repair of bridges and who have received certificates after successfully completed a training course in bridge inspection in accordance with the Bridge Inspection Trainers Manual. The Bridge Inspectors have to develop and demonstrate competency in the assessment of the condition of structures and the importance of visual defects.

Bridge Inspection Type 3 requires a high level of bridge engineering knowledge and will be undertaken by an Inspectorate Team comprising the Regional BMS Coordinator, Bridge Design Engineer and an Accredited Bridge Inspector. Type 1 and 4 inspections shall be undertaken by the Regional Office/District Engineering Office Engineers.

2.3.3 Training District Bridge Inspectors

The process for maintaining a pool of Accredited Bridge Inspectors is illustrated in Figure 8. The training shall be based on the Bridge Inspection Training Manual and includes procedures to train, test and certify bridge inspectors to undertake bridge condition inspections.

Figure 8
Process for Training Bridge Inspectors



Each Regional Office is required to maintain a listing of accredited Bridge Inspectors in their region including District Engineering Offices. This monitoring is required to ensure that the requirement to maintain at least two Accredited Bridge Inspectors in each Regional and District Engineering office is achieved and to enable the Regional Office to arrange a training program as required to maintain this level.

2.3.4 Bridge Inspector Training Course

The Regional Office must arrange to conduct a Bridge Inspector training course whenever additional accredited Bridge Inspectors are required to maintain the required number.

The training course is to be conducted in accordance with the procedures and requirements contained within the Bridge Inspection Trainers and Bridge Inspection Trainees Manuals. The

principal textbook for the course shall be the Bridge Inspection Manual which shall be provided to each participant undertaking the course. The training course comprises classroom lectures supported by extensive field work inspecting bridges.

2.3.5 Accreditation of Bridge Inspectors

Bridge inspectors will be accredited following the completion of a bridge inspection test to the satisfaction of the instructor. The participants in the bridge condition training course are graded on a review of three bridge condition reports prepared and submitted by the participants.

Certification as a bridge inspector remains valid for a period of five (5) years. The accredited Bridge Inspectors must undergo follow-up bridge inspection tests after 5 years to renew their certification for a further period.

2.3.6 Actions in the RBIA

None

2.4 Auditing

2.4.1 Introduction

The audit process comprises a field audit comprising a check on the survey teams while conducting the surveys.

The field auditing process will be vetted by the Regional BMS Coordinator on a regular basis to ensure the quality of the data. This vetting will consist of observation of data collection in the field for one day per District Office to verify that all procedures have been carried out correctly. As the raters record their bridge condition assessments the Regional BMS Coordinator will countersign all those observed during the audit.

Policies

The road and bridge data shall be of an appropriate quality that is verifiable by statistical procedures.

Definition

Condition Assessment: A score that indicates a level of distress.

Standards

Data is to be maintained with 95% confidence level.

Data Stewards

Regional Planning and Design Division

Users

Planning Service (PS)

Bureau of Maintenance (BOM)

Regional Planning and Design Divisions

District Offices

2.4.2 Workflow for Field Audit

Figure 9
Workflow for Field Audit

Process Flow	Responsible	Details
<div style="border: 1px solid black; padding: 5px; text-align: center;">Visit Bridge Condition Assessment Team</div>	Regional BMS Coordinator	1. Each District Office Survey team shall be visited by the BMS Coordinator once during the survey process to ensure that procedures are being followed correctly. The visit should be conducted on a random basis but coordinated from the Work Schedule submitted by the District Office. That is, the visit shall be unannounced.
<div style="border: 1px solid black; padding: 5px; text-align: center;">Check Team Members have attended training course</div>	Regional BMS Coordinator	2. Upon locating a team in the field, the BMS Coordinator shall identify each team member and verify that they have successfully completed a Bridge Condition Assessment training course. A note shall be made where non-compliance is observed. Where no trained team member is present, the matter shall be reported to the District Engineer for action. Generally, this will require that the team cease any further survey work until a trained person is available to carry out the work.
<div style="border: 1px solid black; padding: 5px; text-align: center;">Observe Worksheets completed on the day of audit</div>	Regional BMS Coordinator	3. Each Worksheet that has been completed by the team on the day of audit shall be observed by the BMS Coordinator. Checks shall be carried out on the following items with respect to the section they are assessing: <ul style="list-style-type: none"> • The entries are legible; • All calculations for assessing each bridge component are correct.
<div style="border: 1px solid black; padding: 5px; text-align: center;">Check Team have appropriate equipment and safety devices</div>	Regional BMS Coordinator	4. Each team shall be checked for presence of Bridge Condition Survey equipment and road safety devices. These will include measuring tape (5m or greater), camera, appropriate stationary, and those required to warn traffic of the presence of personnel on the road.
<div style="border: 1px solid black; padding: 5px; text-align: center;">Provide brief report on any observed deficiency to District Engineering Office</div>	Regional BMS Coordinator	5. Any observed deficiency shall be noted on the audit report, copies of which shall be provided to the District Engineering Office.

2.5 Reviewing, Checking and Uploading Bridge Condition Assessment Data

2.5.1 Introduction

Policies

The road data shall be of an appropriate quality that is verifiable by statistical procedures.

Definition

Condition Assessment: A score that indicates a level of distress.

Standards

Data is to be maintained with 95% confidence level.

Data Stewards

Regional Planning and Design Division

Users

Planning Service (PS)

Bureau of Maintenance (BOM)

Regional Planning and Design Divisions

District Offices

2.5.2 Workflow

The Regional BMS Coordinator will review data import files submitted each day or week. He/She will check that:

- The condition data reflects the expected condition of each bridge (e.g. a new bridge should be in “good condition”).
- The data is not copied from previous years or other bridges;
- The data is consistent with the procedures in the Bridge Inspection Manual;

If there are any queries with data quality, the Regional BMS Coordinator should compare the data on with the data for the previous year and bridge photographs. The data should be broadly comparable from year to year, unless there has been bridge work carried out during the year. If there are significant difference, e.g. improvement when no bridge work has taken place, or more deterioration than expected, review the bridge photos and if appropriate, query the results with the District.

Figure 10
Workflow for Reviewing, Checking and Importing Data

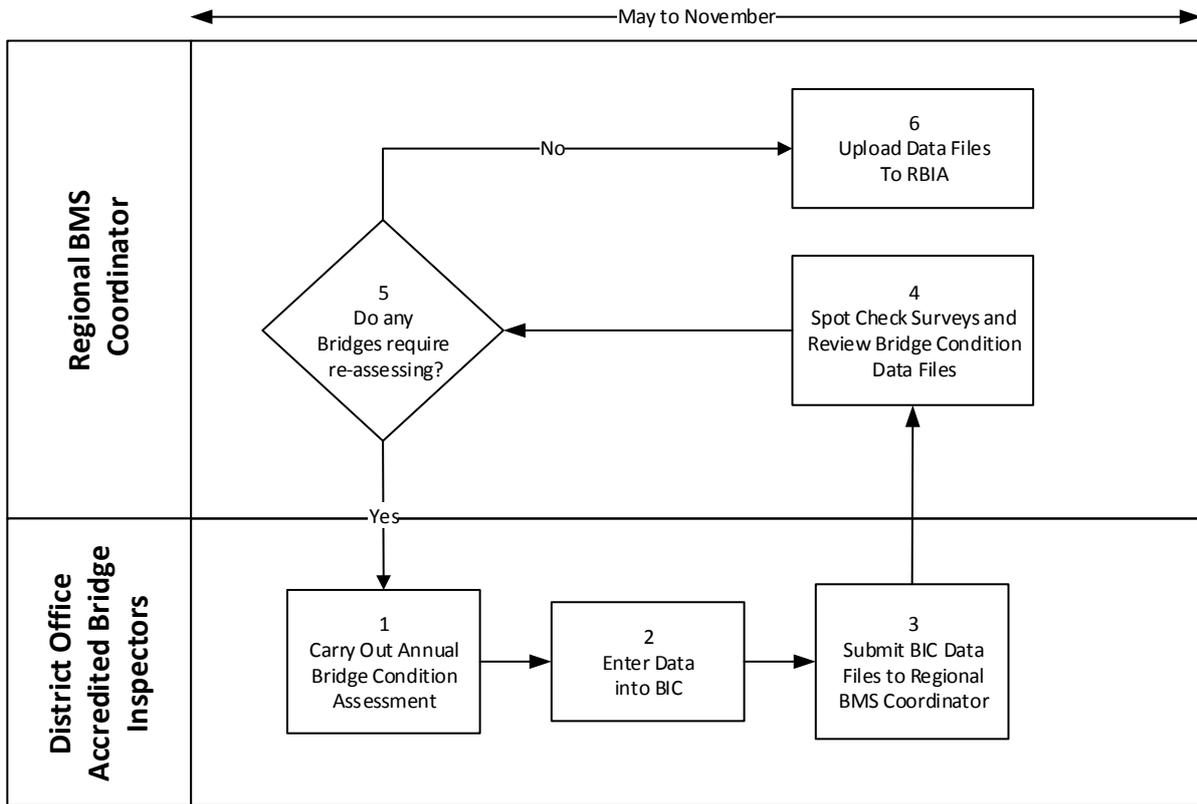
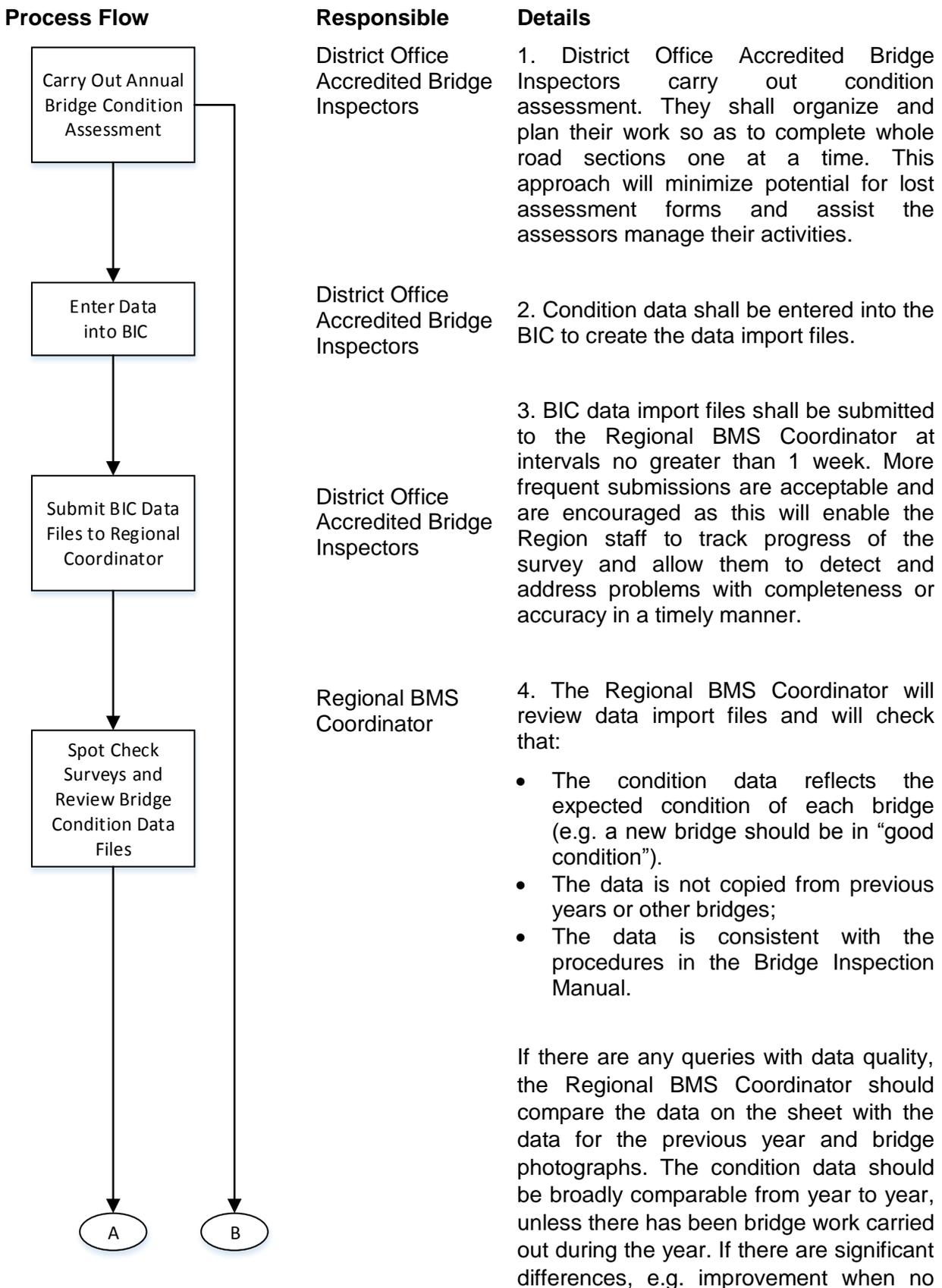
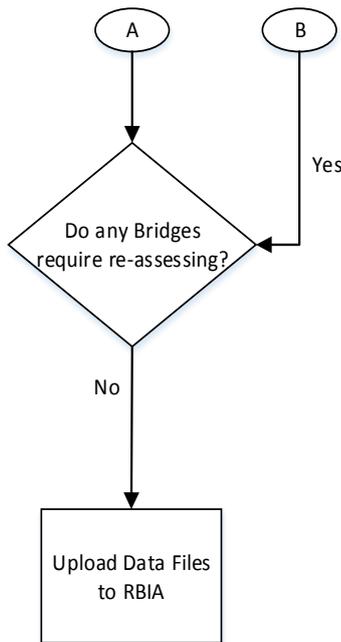


Figure 11
Workflow for Reviewing, Checking and Importing Data





Regional BMS Coordinator

Regional BMS Coordinator

bridge work has taken place, or more deterioration than expected, review the bridge photos and if appropriate, query the results with the District.

5. Identify bridges that indicate re-assessment and request the District Office Coordinator/Accredited Bridge Inspector to re-survey and resubmit new data import file.

6. Upload Bridge Condition Data files to RBIA.

APPENDIX A – Quality Assurance Checks

1. Introduction

These Quality Assurance Checks apply to Bridge Condition Assessment Surveys recorded by the District Bridge Inspectors. They focus on analysis of bridge condition data after upload of the surveys to the RBIA by the Regional BMS Coordinators.

The intention of these procedures is to provide guidance to the Central Office BMS Team and the Regional BMS Coordinators on specific elements of the surveys data that should be checked prior to confirming the data quality available for use in the planning and programming process.

The checks are not exhaustive but provide initial steps to identify potential quality issues.

2. Personnel

BMS Central Office Coordinator and Regional BMS Coordinator

3. Reference Material

BMS Operation and User Manual – Volume 1 – Operation Guide

BMS Operation and User Manual – Volume 2 – Operation Guide

4. Required Tools

Computer

RBIA and BMS Software and User Account

Microsoft Office

5. Procedures

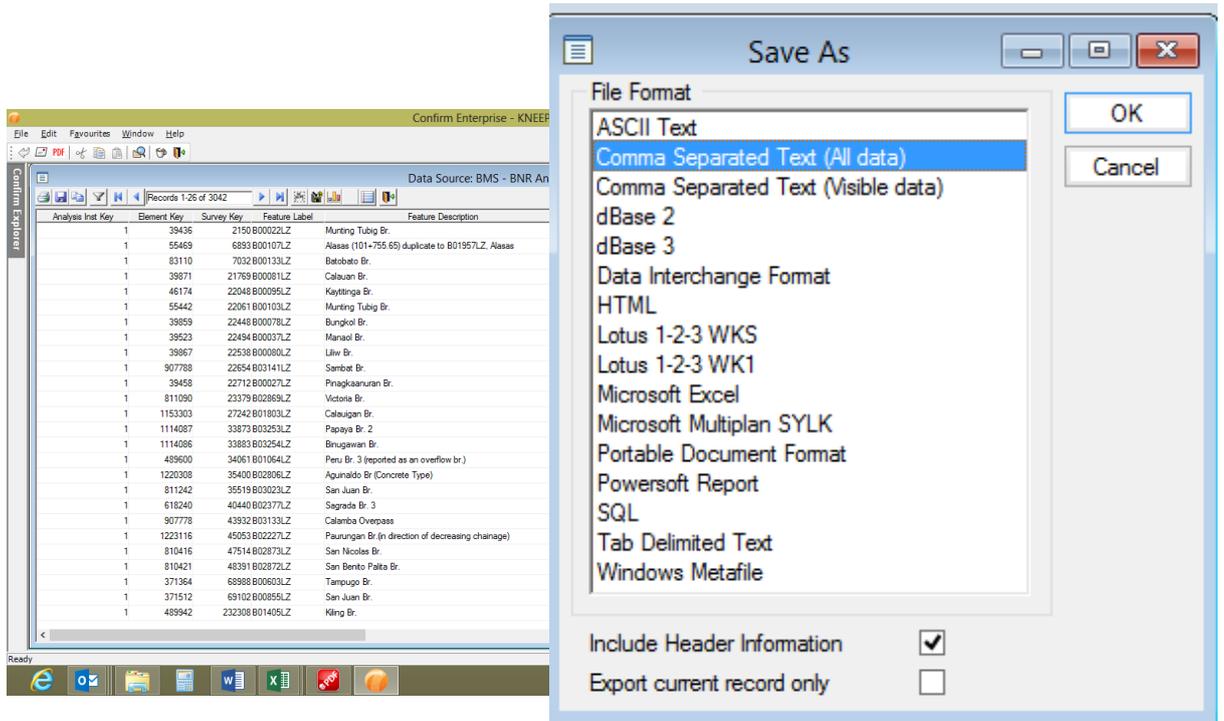
- a. The initial step is to run the Bridge Needs Ratio (BNR) Analysis in the BMS.

The screenshot shows a 'Submit Analysis' dialog box with the following fields and values:

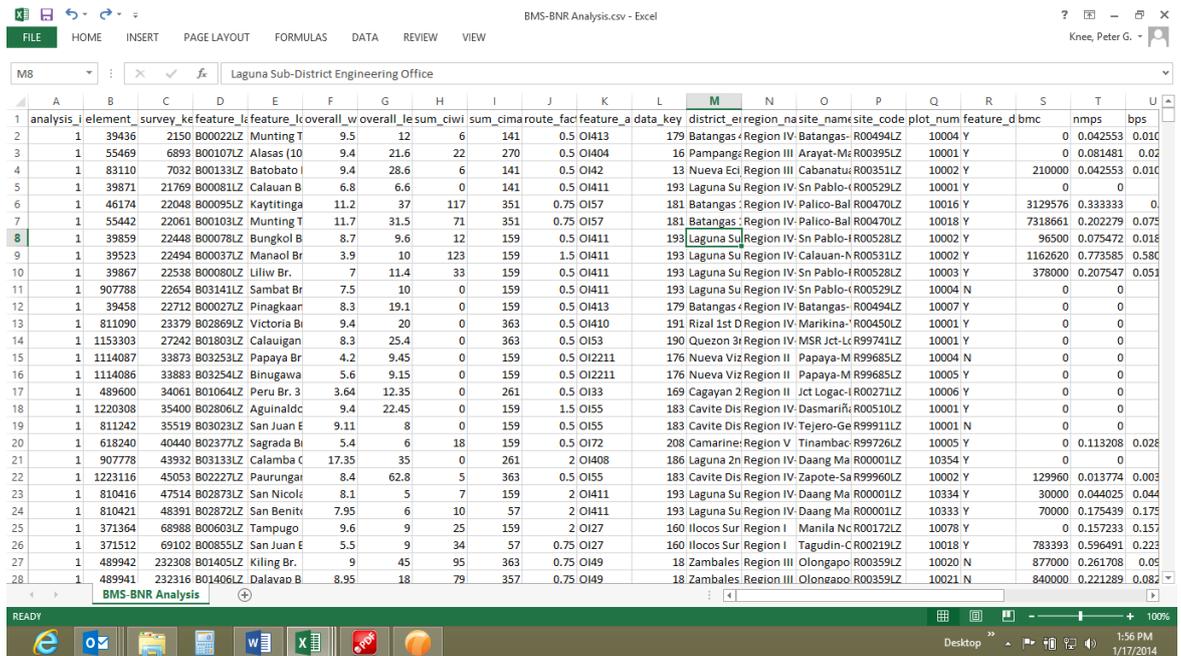
- Analysis Template: BMS-BNR Analysis
- Description: (empty)
- Output To View: BMS - BNR Analysis Results
- Output as Report: (empty)
- Progress Log: (empty)
- Governing Source: BMS-BNR Analysis Query

Buttons: OK, Cancel, Qualify

b. Save the data in a Comma Separated Text (All Data) file.



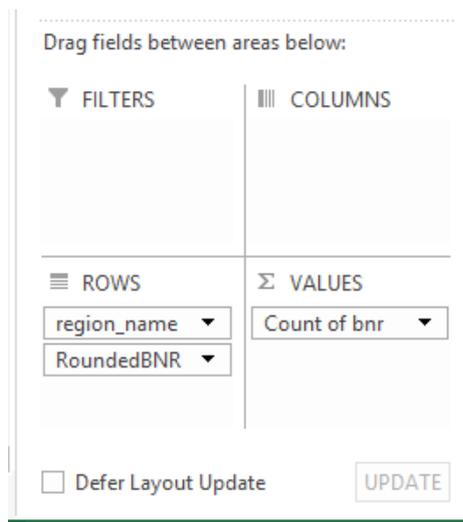
c. Open the file in EXCEL and save as a XLSX file.



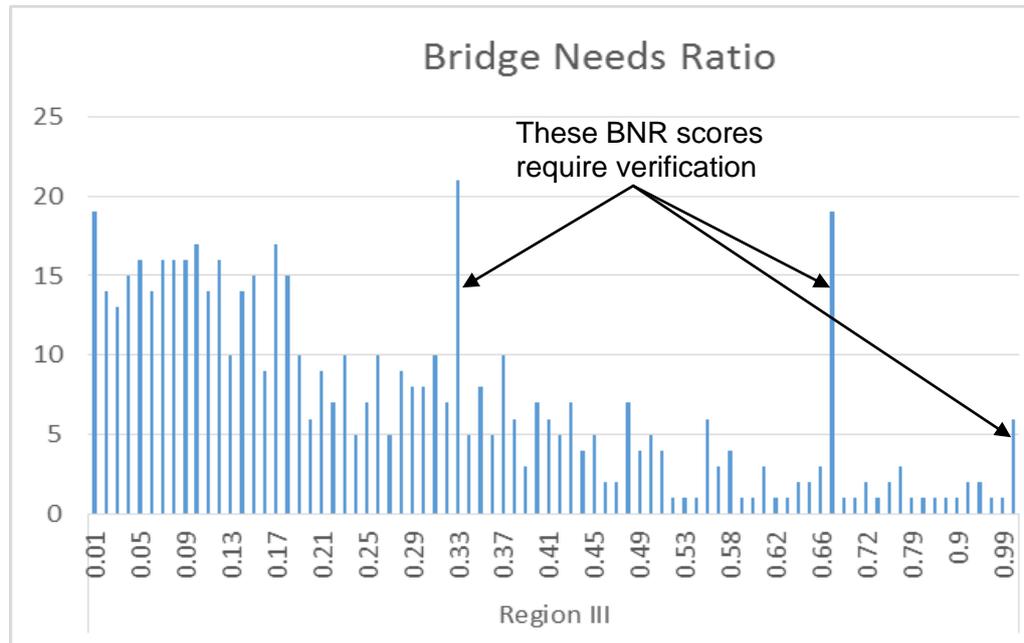
- d. Insert a column in the spreadsheet to round the BNR scores to two decimal places (i.e. use the EXCEL command : ROUND(cell, number of digits))

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
	feature_d	bmc	nmps	bps	ecrp	bnr	recomm	survey_date	eng_insp	eng_insp	eng_insp	eng_insp	RoundedBNR
1	Y	0	0.042553	0.010638	13680000	0.042553	NONE	2/19/2003 9:53			0		0.04
2	Y	0	0.081481	0.02037	24364800	0.081481	RP	3/14/2003 9:01			0		0.08
3	Y	210000	0.042553	0.010638	32260800	0.042553	MM	3/31/2003 15:23			0		0.04
4	Y	0	0	0	5385600	0	NONE	9/28/2005 17:15			0		0
5	Y	3129576	0.333333	0.125	49728000	0.333333	MM	10/4/2005 17:34			0		0.33
6	Y	7318661	0.202279	0.075855	44226000	0.202279	MM	10/4/2005 18:07			0		0.2
7	Y	96500	0.075472	0.018868	10022400	0.075472	NONE	10/18/2005 13:20			0		0.08
8	Y	1162620	0.773585	0.580189	4680000	0.773585	RP	10/19/2005 9:38			0		0.77
9	Y	378000	0.207547	0.051887	9576000	0.207547	MM	10/20/2005 10:03			0		0.21
10	N	0	0	0	9000000	0	NONE	10/20/2005 17:13			0		0
11	Y	0	0	0	19023600	0	NONE	10/24/2005 9:59			0		0
12	Y	0	0	0	22560000	0	NONE	11/21/2005 13:02			0		0
13	Y	0	0	0	25298400	0	NONE	4/7/2006 9:01			0		0
14	N	0	0	0	4762800	0	NONE	5/23/2006 18:41			0		0
15	Y	0	0	0	6148800	0	NONE	5/23/2006 19:16			0		0
16	Y	0	0	0	5394480	0	MM	5/24/2006 19:38			0		0
17	Y	0	0	0	25323600	0	NONE	6/2/2006 10:23			0		0
18	N	0	0	0	8745600	0	NONE	6/2/2006 14:12			0		0
19	Y	0	0	0	3888000	0	RP	3/23/2006 0:00			0		0.11

- e. Add a new sheet and create a Pivot Table of the Rounded BNR Results. The layout of the Pivot Table is described in the EXCEL screenshot below.



- f. Insert a simple bar chart using the data in the Pivot Table. These can be produced either Nationwide, by Region or District.

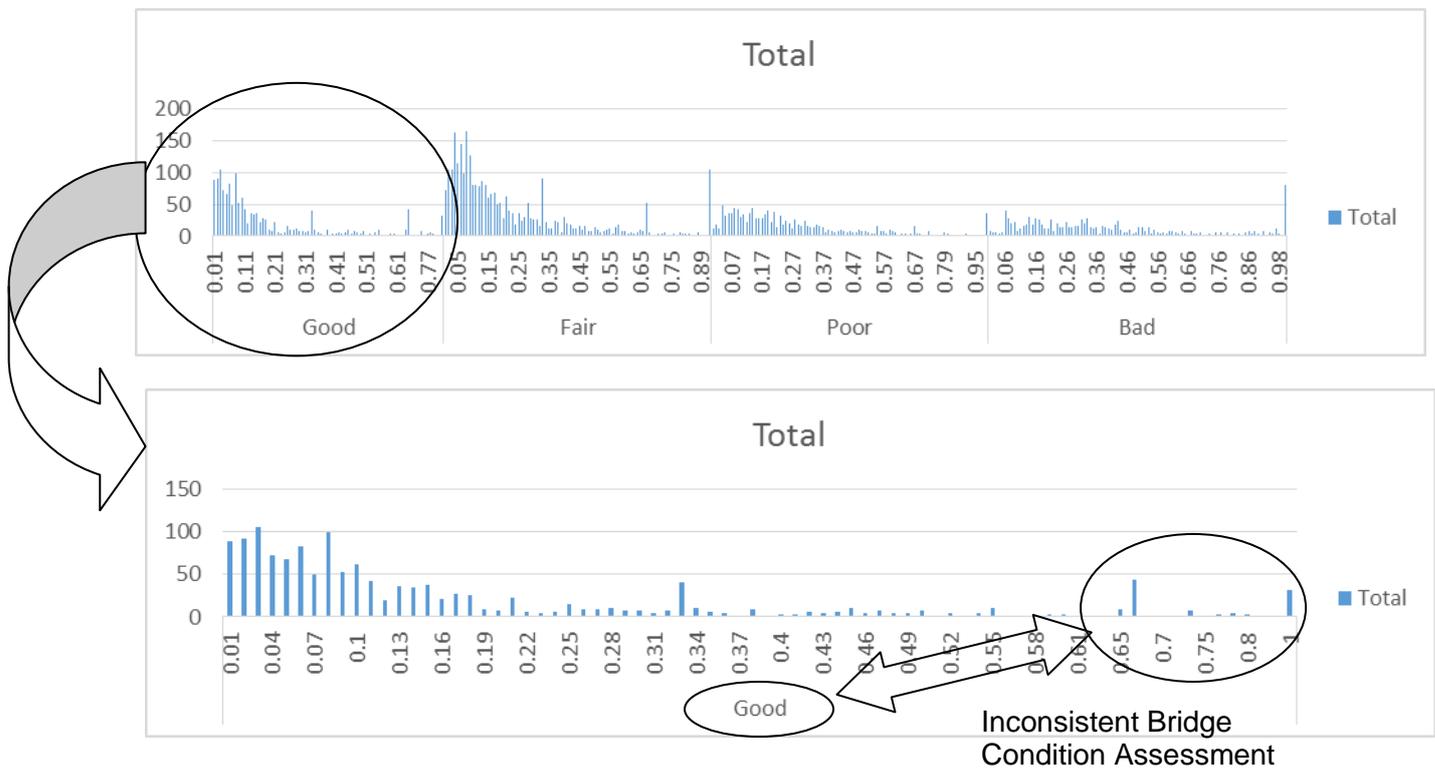


- g. Inspect the graph to identify potential errors.
- In the above graph there is likely to be a problem with the BNR Scores 0.33 and 0.67. It is generally expected that the graph slopes downwards from left to right and it is unlikely that many bridges will have the same BNR score (except for score 0)
 - The bar at BNR Score of 1 may also be a problem given that this score indicates the bridges require replacement.
- h. Check all bridges condition assessments with those BNR scores identified above. If the BNR scores are the same for many of the bridges in a single District enquires should be made through the Regional BMS Coordinator to verify the data.
- i. Bridges with BNR scores of 1 should be verified through cross checking the bridge photos. A simple color coding scheme is suggested in the example spreadsheet Figure 12.
- j. Compare the BNR scores with the District Bridge Inspectors overall condition assessment by importing the data from data source "BRDC_01 Overall Condition Assessment" into the spreadsheet and using VLOOKUP command to align the results with the BNR. An example comparison bar chart is shown in Figure 13. On examination of those bridges assessed as "good" it can be seen that there are significant numbers of bridges with corresponding high BNR scores (indicating a need for Bridge replacement). These scores should be reviewed with the Regional BMS Coordinator to establish the basis of the assessment and take appropriate action.

Figure 12
Comparison of BNR and Photos

		nt of Public Works and Highways					
ID	NMPS	BMC	ECRP	BNR	RANKING	ID	
B00585MN	1	95,552.00	11,684,425.00	1	1	B00585MN	
B00455NR	1	0	19,584,000.00	1	1	B00455NR	
B00483LZ	1	475,000.00	5,775,000.00	1	1	B00483LZ	
B01750LZ	1	1,333,803.00	64,605,000.00	1	1	B01750LZ	
B01052MN	1	1,120,000.00	9,950,850.00	1	1	B01052MN	
B00029NR	1	620,000.00	28,200,000.00	1	1	B00029NR	
B00047NR	1	150,000.00	21,037,500.00	1	1	B00047NR	
B03245LZ	1	10,138.00	11,712,000.00	1	1	B03245LZ	
B02427LZ	1	46,200.00	7,185,250.00	1	1	B02427LZ	
B01047MN	1	300,000.00	96,087,400.00	1	1	B01047MN	
B00024AB	1	550,000.00	3,825,000.00	1	1	B00024AB	
B02558LZ	1	2,800.00	4,450,000.00	1	1	B02558LZ	
B02442LZ	1	54,120.00	12,072,375.00	1	1	B02442LZ	

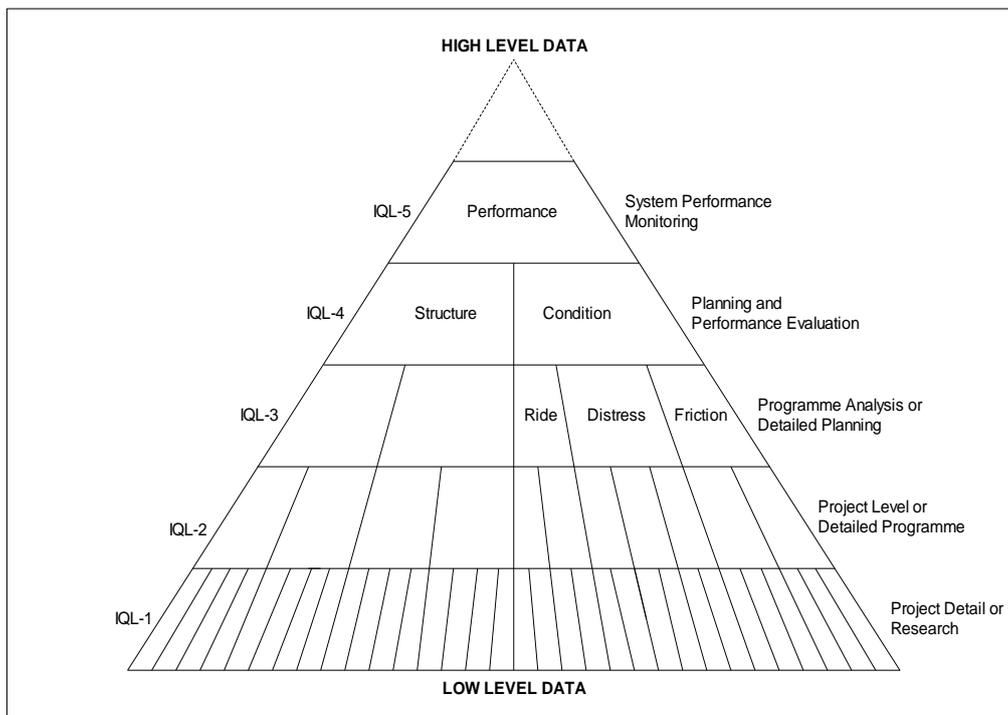
Figure 13
Comparison of BNR and Overall Condition Assessment



APPENDIX B - Summary of Information Quality Level Definitions

Introduction

As described in Bennett and Paterson (1999)², data can be collected—and represented—in either simple or detailed terms. The concept of Information Quality Levels (IQL), defined by Paterson and Scullion (1990)³, presents a structure for road management data in ways that suit the needs of different levels of decision making and the variety of effort and sophistication of methods for collecting and processing data. In the IQL concept, very detailed information at a low level ('low-level data') can be condensed or aggregated into progressively fewer items at successively higher levels of IQL ('high-level data') as shown in Figure C-1 (Bennett and Paterson, 1999).



² Bennett, C.R. and Paterson, W.D.O. (1999). *A Guide to the Application and Calibration*. HDM-4 Reference Guide 5. International Study of Highway Development and Management Tools. PIARC, Paris.

³ Paterson, W.D.O. and Scullion, T. (1990). *Information Systems for Road Management: Draft Guidelines on System Design and Data Issues*. World Bank Technical Paper INU 77, Infrastructure and Urban Development Department, The World Bank, Washington, D.C.

Summary of Information Quality Levels:

Information Quality Level	Quality	Description
IQL-1;	Detail	Fundamental, research-, laboratory-, theoretical- or electronic-type data where many attributes may be measured or identified
IQL-2	Practical Engineering	Level of detail typical of many engineering analyses for a project-level decision
IQL-3	Simplified	Simpler level of detail, typically two or three attributes, which might be used for large production uses like network-level survey or where simpler data collection methods are appropriate
IQL-4	Summary	Summary or key attribute which has use in planning, senior management reports, or alternatively in low effort data collection
IQL-5	Key Performance Indicators	Top level such as key performance indicators, which typically might combine key attributes from several pieces of information

The cost of data collection varies significantly according to the IQL level adopted, with IQL-1 data costing the most and IQL-5 data the least. While models such as HDM operate internally at an IQL-2 level, it is often appropriate to collect the data at a higher IQL level and then transform it to IQL-2 (Bennett and Paterson, 1999).

APPENDIX C - Quality Plan Example

The Regional Coordinator or Contractor will prepare a Quality Plan for each survey. The Quality Plan shall include, but not be limited to:

1 *Maintaining the Quality Plan*

- a document control procedure for the plan itself, including the authorization and revision of procedures;
- a procedure for updating the quality plan during the survey, to incorporate improvements and overcome shortcomings that occur during the conduct of the survey;

2 *The Survey Team*

- contractor's nominated contact., including name, address, phone, fax and cell phone numbers;
- survey team job descriptions and minimum qualifications;
- evidence/demonstration/certification of operators' competence;
- the contractor's previous experience, including the experience and professional qualifications of the operators;

3 *Equipment*

- equipment specification – survey equipment (including Bridge Inspection Vehicles) and computer equipment;
- equipment calibration method and intervals between calibration;
- circumstances where additional re-calibration is required;
- validation procedures;
- daily equipment checks;

4 *The Surveys*

- standards, codes, technical references to be used
- preparations before survey, including daily equipment checks before commencing surveying;
- survey procedure, including procedure to be followed when ending survey at intermediate points on a bridge (e.g. lunch breaks, puncture, failing lights, etc.);
- records to be maintained;
- health and safety requirements to ensure safety of survey staff and other road users;
- contingency planning for equipment failures;
- actions required at the end of each survey run and at the end of each day of surveying;

5 *Data Management*

- the procedure for processing and checking data following the survey and prior to submission;
- frequency of data submission;
- a sample of data for submission, in the specified format and on an acceptable electronic medium.

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