



**Republic of the Philippines**  
**Department of Public Works and Highways**

**Bridge Data Collection,  
Quality Assurance  
and Management Manual**

**March 2004**

### **Glossary of Terms**

<b>BOM</b>	Bureau of Maintenance
<b>HI</b>	highway imaging
<b>IPRSD</b>	Infrastructure Planning Research and Statistics Division
<b>IQL</b>	Information Quality Level
<b>km</b>	kilometer
<b>KPI</b>	Key Performance Indicator
<b>LRP</b>	Locational Reference Point
<b>LRS</b>	Locational Referencing System
<b>LRM</b>	Locational Referencing Method
<b>NCR</b>	National Capital Region
<b>PBAC</b>	Project Bid and Award Committee
<b>PMO</b>	Project Management Office
<b>PMS</b>	pavement management system
<b>QA</b>	quality assurance
<b>RBIA</b>	Road and Bridge Information Application

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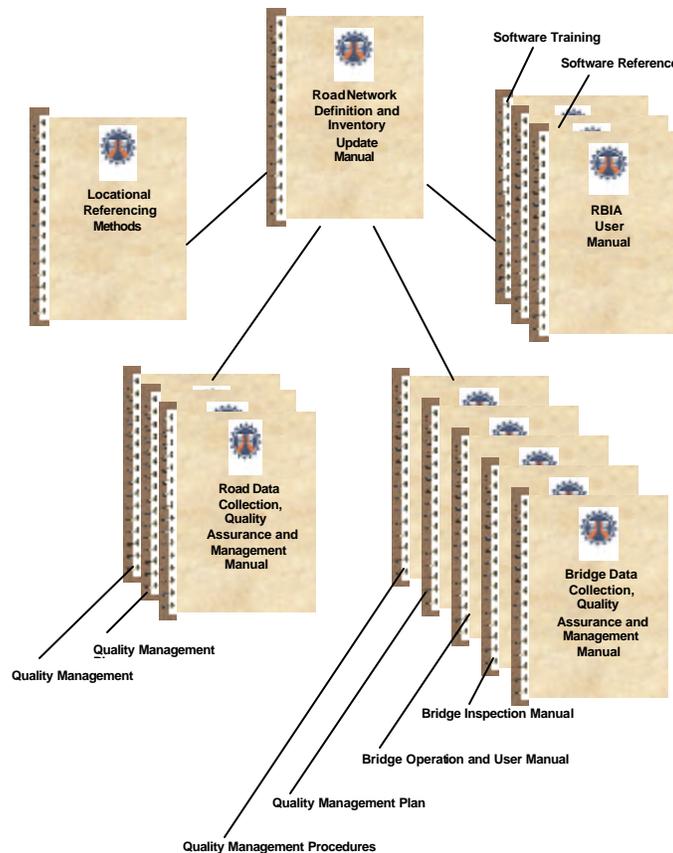
## 1 Introduction

This document describes the policies, processes and procedures for the collection of bridge condition data required by the Road and Bridge Information Application (RBIA). The data requirements and standards included are designed to meet the needs of the Bridge Management System (BMS). The data is designed to provide the basis for long and medium term planning, not day to day maintenance. The Bureau of Maintenance (BOM) will continue to collect condition data for sanctioning and short term maintenance requirements.

The responsibility for management of the RBIA rests with the Infrastructure Planning Research and Statistics Division (IPRSD). 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 1-1.

**Figure 1-1  
Document Map**



### 1.1 Policy

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

Each Region is responsible for maintaining a pool of accredited bridge inspectors that may be drawn from either the Regional Office or the District Offices. These inspectors will carry out the annual Bridge Condition Inspections.

Depending on the nature of Engineering Inspections required, 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 Inspections. These will generally be carried out as a result of findings from a condition inspection. Refer to the BMS Operation and User Manual for more information.

Table 1-1 details the frequency, coverage and Information Quality Level (IQL) of the network level bridge data that is to be collected. A description and definitions of IQL is given in APPENDIX A - Summary of Information Quality Level Definitions. Unless specific reasons are identified, data is to be collected in accordance with Information Quality Level 3 (IQL 3).<sup>1</sup> 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 1-1  
Frequency and Coverage of Bridge Information**

Data Collected	Survey Frequency	IQL	Inventory Item	Network/Project data
Bridge Condition	annual	3	all bridges	network

### 1.3 Bridge Condition Assessment

The condition of National Bridges will be assessed during the annual Bridge Condition survey. Bridge Condition is the only survey covering the entire inventory of National Bridges. The surveys will take place over a 4-month period from January to April, and be confirmed for use in the RBIA in April. The bridge survey will collect condition data at IQL 3 during a walking survey.

### 1.4 Data Held in RBIA

The RBIA will hold bridge condition data for all National Bridges. However, the RBIA 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 RBIA, the originator of the requirement should request inclusion of the data from the LRS/GIS, Inventory and Data Collection Administration Section Chief, 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.

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<sup>1</sup> Briefly IQL1 = 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**

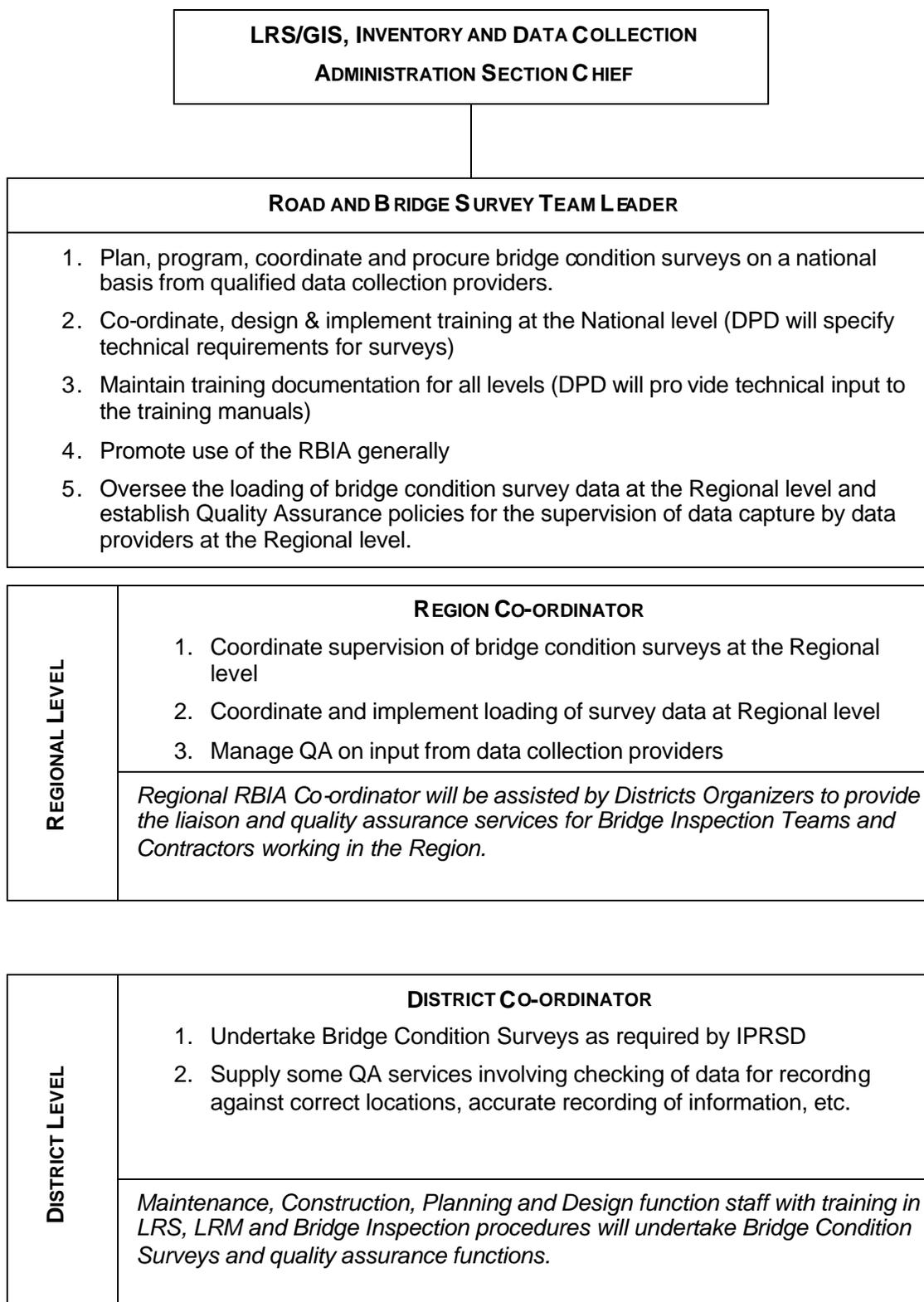
### **1.5.1 DPWH Responsibilities**

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 works from DPWH staff and quality assurance will be a significant workload.

The LRS/GIS, Inventory and Data Collection Administration Section Chief within the IPRSD 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 staff within the IPRSD.

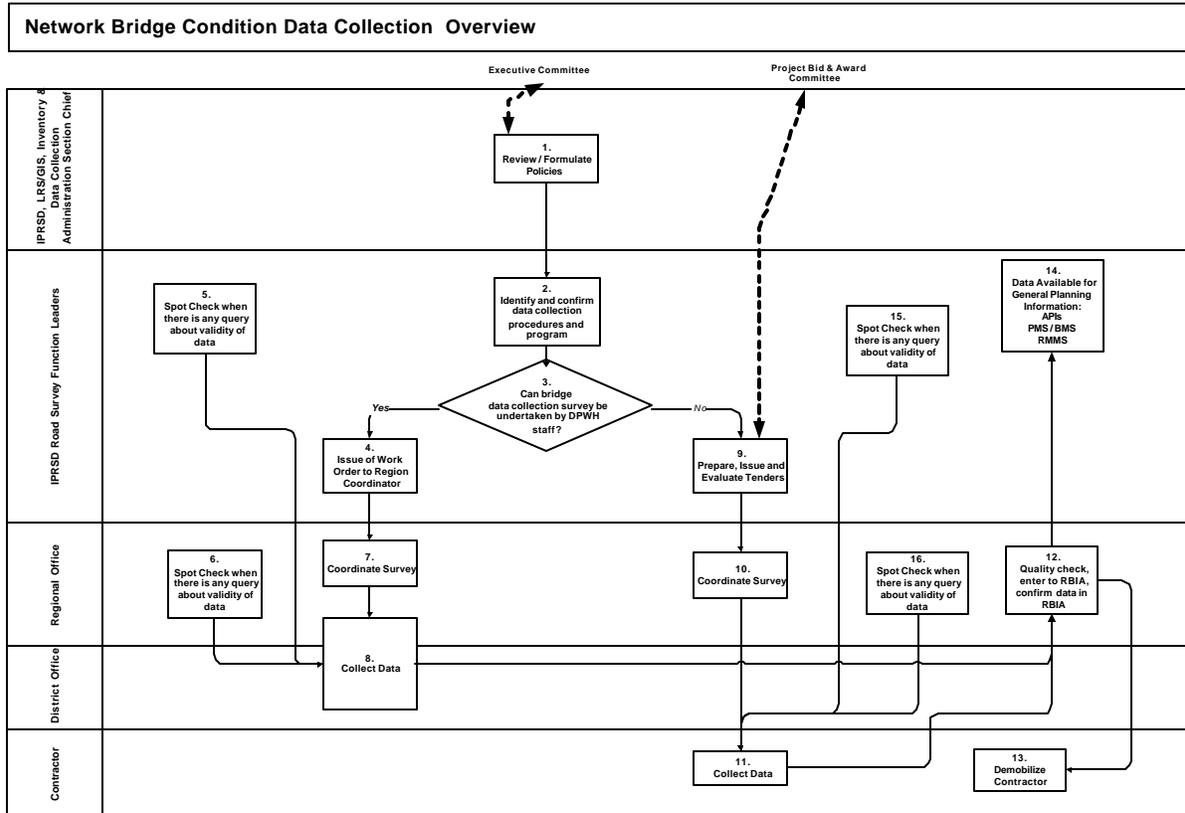
The summary of the management and coordination of the bridge condition survey process is summarized in Table 1-2 following.

**Table 1-2  
Summary of Bridge Survey Management Responsibilities**



1.6 Overview of Bridge Data Collection Procedures

Figure 1-2  
Overview of the Procedures for Bridge Data Collection Surveys



- Step 1: The LRS/GIS, Inventory and Data Collection Administration Section Chief will review and confirm DPWH policies (especially technical requirements with DPD) in relation to data collection and data quality prior to the annual Bridge Condition survey.
- Step 2: The IPRSD Road & Bridge Survey Team Leader will review and confirm the data collection and quality assurance procedures for undertaking the each survey, and confirm the data collection and quality assurance procedures required
- Step 3: The IPRSD Road & Bridge Survey Team Leader will review each survey and decide whether DPWH staff can undertake the survey. At present this means that Region and District staff will undertake the Bridge Condition Assessment.
- Step 4: If so, he/she will raise a work order for the Regions and Districts to undertake the survey.
- Step 5: The Road and Bridge Survey Team Leader will spot check Region or District data if there is any query about its validity.
- Step 6: As per step 5, the Region Coordinator is also expected to conduct spot checks as part of this process.
- Step 7: The Region will coordinate the surveys in all their Districts.

- Step 8: The Region and District will undertake the survey, quality assure and submit the data to the Region.
- Step 9: If DPWH staff cannot undertake the survey for any reason, the IPRSD Road & Bridge Survey Team Leader will tender for a contractor to undertake the work. For details of tendering procedures, see Executive Order 40 (EO40).
- Step 10: The Region will coordinate the surveys in all their Districts.
- Step 11: The Contractor will undertake the survey, quality assure and submit the data to the Region.
- Step 12: Region will quality assure the data and enter and confirm it in RBIA .
- Step 13: Only when data is confirmed in RBIA will the contractor be demobilized.
- Step 14: Data available for use in RBIA.
- Step 15: The Road and Bridge Survey Team Leader will spot check Region or District data if there is any query about its validity.
- Step 16: As per step 15, the Region Coordinator is also expected to conduct spot checks as part of this process.

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 IPRSD Responsibilities**

The LRS/GIS, Inventory and Data Collection Administration Section 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 LRS/GIS, Inventory and Data Collection Administration Section will provide a pro forma plan for the District to complete.

The LRS/GIS, Inventory and Data Collection Administration Section, 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, LRS/GIS, Inventory and Data Collection Administration Section will ensure that the definition is redrafted, and consistently applied.

The LRS/GIS, Inventory and Data Collection Administration Section will also ensure that Regional and District staff are trained in the procedures needed to undertake bridge surveys, and for Regions to coordinate bridge condition surveys.

Finally, LRS/GIS, Inventory and Data Collection Administration Section 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 Region staff, District staff or contractor, will be checked for completeness and accuracy before input to RBIA.

Region will also have the responsibility for training and accrediting Region and District Staff as bridge inspectors for the bridge condition surveys. Only assessors accredited by the Region will be allowed to undertake assessments.

Furthermore Accredited Bridge Inspectors will be responsible for carrying out the inspections in accordance with the agreed quality plan for the bridge condition survey. The District Office or contractor will check data collected by the survey teams, before submitting it to Region .

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

## **2 Bridge Condition 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 major maintenance;
- 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 four-month period from January to April, subject to a quality audit and be confirmed for use in the RBIA in April.

## **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 Maintenance Divisions

### **2.2.7 Users**

Planning Service (PS)

Bureau of Maintenance (BOM)

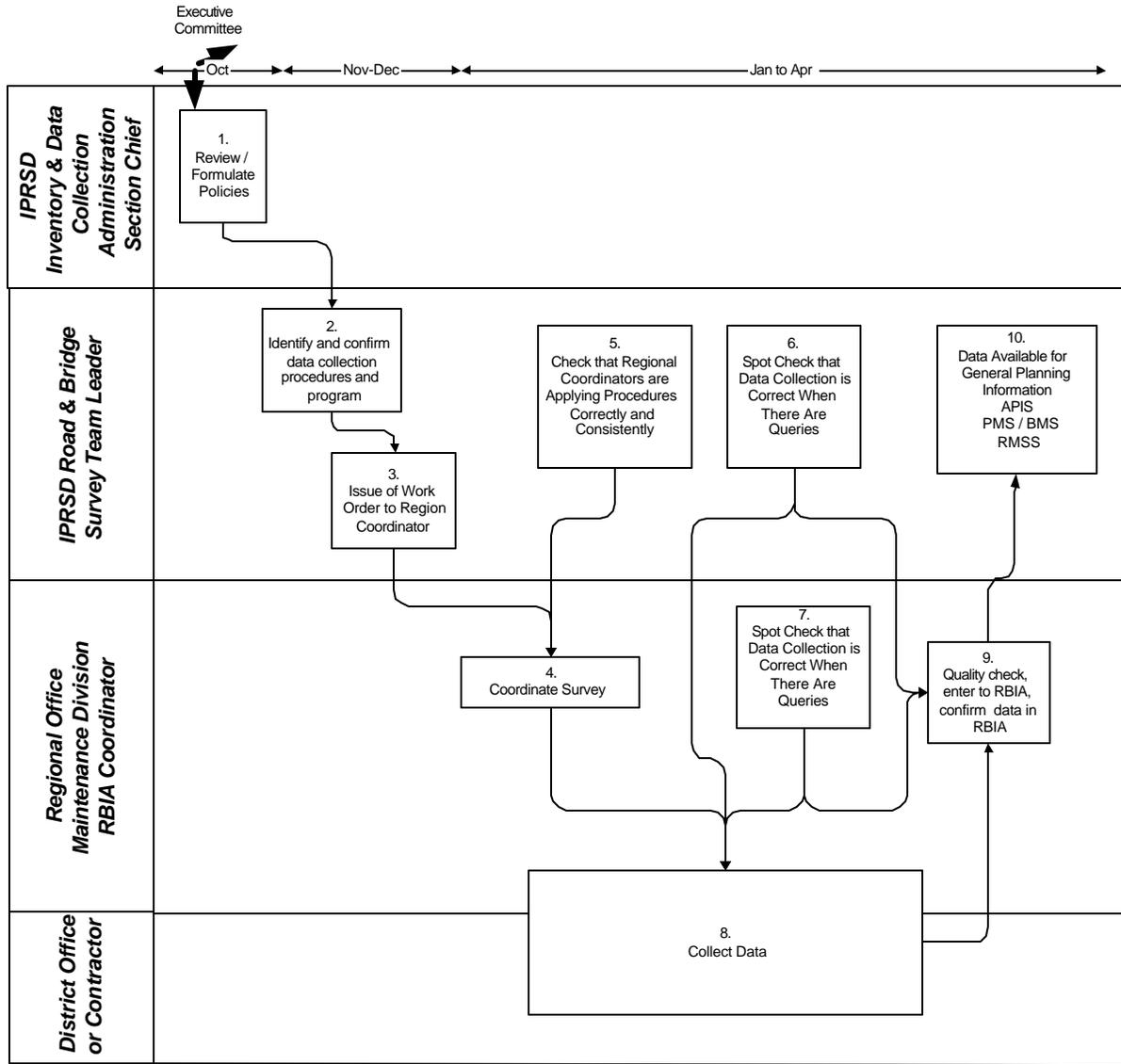
Regional Planning and Design Division

Regional Office Maintenance Division

District Offices

2.2.8 Workflow

**Figure 2-1  
Workflow for Managing a Bridge Condition Survey**



- Step 1: The LRS/GIS, Inventory and Data Collection Administration Section Chief will review and confirm DPWH policies (especially technical requirements with DPD) in relation to data collection and data quality prior to the annual Bridge Condition survey.
- Step 2: The IPRSD Road & Bridge Survey Team Leader will review and confirm the data collection and quality assurance procedures for undertaking the annual Bridge Condition survey prior to data collection.
- Step 3: The IPRSD Road & Bridge Survey Team Leader will be responsible for initiating the surveys by issuing a works order to the Regions.

- Step 4: Before survey commences the Region Coordinator will submit a Quality Plan. This plan will address the following aspects:
- Training Bridge Condition Inspectors
  - Preparing and Issuing pre-printed condition inspection forms
  - Reviewing and checking condition assessment data
  - Action to be taken to address non-conforming data
- Step 5: IPRSD will quality assure the bridge condition survey by checking that Regional Coordinators follow the procedures correctly, and that they are consistently applied in each Region and District.
- Step 6: The Data Quality Coordinators within IPRSD will undertake spot checks of condition data provided by the Districts and Regions if there is any query about its validity.
- Step 7: The Region Data Quality Coordinators within Maintenance Division will undertake spot checks of condition data provided by the Districts and Regions if there is any query about its validity.
- Step 8: Regions and Districts will complete the annual Bridge Condition survey within a four-month period between January and April in 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 Applications (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.
- Step 9: The Regional Office will be responsible for entering 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 District.
- Step 10: The Road and Bridge Survey Team Leader in the IPRSD will implement changes to resolve the problems if Key Performance Indicators fall short of expected levels, or if performance of the Regions and District are not satisfactory. These may involve changes to the mode of data collection, specification requirements, QA/QC procedures, or improved training or a combination of all four.

Once all data has been accepted and entered into the RBIA it will be made available for planning purposes.

### 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 Visual Surveys' 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.

*If the data is being entered directly into the RBIA software:*

Create a Survey for each Bridge of the 'Bridge Condition Survey' survey type, and enter the condition data manually using the 'Survey Assessments' form.

**Figure 2-2**  
**Survey Assessments Form**

The screenshot shows the 'Survey Assessments Form' within the 'Hierarchical Surveys' application. The form is divided into several sections:

- Survey Details:** Survey Number (1847), Survey Type (Bridge Condition (Major Mtc.)), Description (B00007CB), Surveyor ID (Pedro dela Pena Jr.), Length (.000), Start Date (11/28/02 03:18:40 PI), End Date (11/28/02 03:18:40 PI), and Loaded Date (02/07/03 03:18:40 PI).
- Analysis Options:** Available for Analysis (checkbox), Imported (checkbox checked).
- Tree View:** A hierarchical tree on the left shows the structure: Bridge Condition (Major Mtc.) > Major Mtc. Inspection > B00007CB > Abutment > Low Chainag, High Chainag > Pier > 1, 2, 3, 4 > Span > 1, 2, 3, 4, 5.
- Form Fields:** BRIDGE (B00007CB), Bridge Label (B00007CB), Overall Condition (Good), Recommended Action (Replacement), Inspector's Comment (Upgrading or replacement is recomm), Major Reason for Rec. (Bridge Deterioration), and Estimated Bridge Life (2).

If the data is entered into spreadsheet for later bulk import into the RBIA:

Enter the condition data into a spreadsheet and save it as a text file meeting the import file specification (e.g. 'composite comma separated' format as shown below). The column headings for this spreadsheet must correspond with the field names within RBIA. Import this file into the RBIA using the 'Import Visual Surveys' utility.

(Refer to 'User's Guide to RBIA' for reference to file import specifications, sample import files, and help in performing basic operations in the RBIA software.)

**Figure 2-3  
Survey Import File**

```
1,survey,record id,survtype,startdate,enddate,surveyor,description,length,,,,
2,survey,S00221CB,RCOND,2002-09-11 00:26,2002-09-11 00:26,Juliana M. Melencion,
Roadsection S00221CB,22336.747,,,,
1,survlane,parent id,sectlabel,survstart,survend,sectstart,sectend,,,,
2,survlane,S00221CB,S00221CB,0.000,3876.000,0.000,3876.000,,,,
1,assess,parent id,assessment type,xsp,start distance,end distance,attr 1,attr
2,attr 3,attr 4,attr 5,attr 6
2,assess,S00221CB,RCONDA,C,0.000,200.000,0.0,0.0,0.0,0
2,assess,S00221CB,RCONDA,C,200.000,400.000,0.0,0.0,0.0,1
2,assess,S00221CB,RCONDA,C,400.000,600.000,0.0,0.0,0.0,1
2,assess,S00221CB,RCONDA,C,600.000,800.000,0.0,0.0,0.0,1
2,assess,S00221CB,RCONDA,C,800.000,1000.000,0.0,0.0,0.0,1
2,assess,S00221CB,RCONDA,C,1000.000,1200.000,0.0,0.0,0.0,1
2,assess,S00221CB,RCONDA,C,1200.000,1300.000,0.0,0.0,0.0,1
2,assess,S00221CB,RCONDA,C,1300.000,1500.000,0.0,0.0,0.0,1
2,assess,S00221CB,RCONDC,C,1500.000,1700.000,1.0,0.0,0.1,
2,assess,S00221CB,RCONDC,C,1700.000,1900.000,1.0,0.0,0.1,
2,assess,S00221CB,RCONDC,C,1900.000,2100.000,0.1,0.0,0.1,
2,assess,S00221CB,RCONDC,C,2100.000,2300.000,0.0,0.0,0.1,
2,assess,S00221CB,RCONDC,C,2300.000,2500.000,0.0,0.0,0.1,
2,assess,S00221CB,RCONDG,C,2500.000,2700.000,2.1,2.1,
2,assess,S00221CB,RCONDG,C,2700.000,2900.000,2.1,1.1,
2,assess,S00221CB,RCONDG,C,2900.000,3100.000,2.2,2.2,
2,assess,S00221CB,RCONDG,C,3100.000,3276.000,2.2,1.1,
2,assess,S00221CB,RCONDG,C,3276.000,3476.000,2.2,1.1,
2,assess,S00221CB,RCONDG,C,3476.000,3676.000,2.2,2.2,
2,assess,S00221CB,RCONDG,C,3676.000,3876.000,2.2,2.2,]
```

**2.2.10 Key Performance Indicators for Data Collection**

The Survey Team shall achieve 100% 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;
- have been closed by the authorities for security or other reasons.

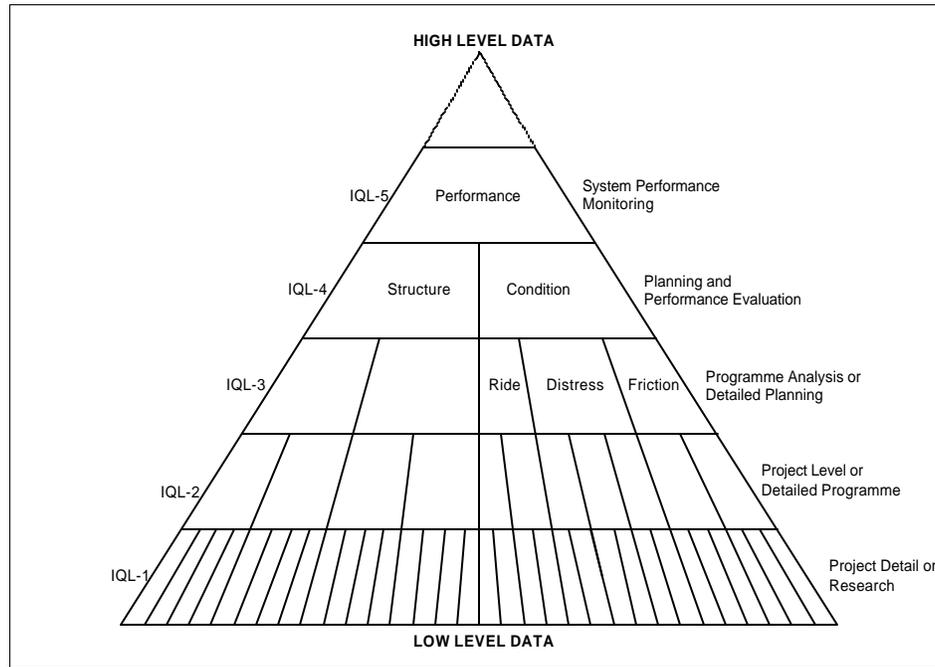
Any events that prevent a bridge inspection proceeding need to be recorded on the forms provided in the Bridge Inspection Manual.

## APPENDIX A - Summary of Information Quality Level Definitions

### Introduction

As described in Bennett and Paterson (1999)<sup>2</sup>, 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)<sup>3</sup>, 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).

### Information Quality Levels (IQL)



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<sup>2</sup> 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.

<sup>3</sup> 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 :**

<b>Information Quality Level</b>	<b>Quality</b>	<b>Description</b>
<b>IQL-1</b>	Detail	Fundamental, research -, laboratory-, theoretical- or electronic-type data where many attributes may be measured or identified
<b>IQL-2</b>	Practical Engineering	Level of detail typical of many engineering analyses for a project-level decision
<b>IQL-3</b>	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
<b>IQL-4</b>	Summary	Summary or key attribute which has use in planning, senior management reports, or alternatively in low effort data collection
<b>IQL-5</b>	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 B - 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 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.

An example of a completed quality plan, accepted by the Department, is the Quality Plan prepared for Road Infrastructure Surveys as part of the National Roads Improvement Project. This covers both inventory and condition surveys. The index to the plan is reproduced in ANNEX A, and the full document is available in the Department Planning Directorate.

<b>Department of Public Works &amp; Highways</b> <b>BIIPS – CO2b Road Infrastructure Survey</b> <b>Quality Management Program</b> <b>Contents and Preamble</b>	Approved by _____ Date _____ DPWH : Proj.Dir: Team Leader : A Noia, 30 May'02
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		DPWH : Proj. Dir. Team Leader : A Nola 30 May'02
		Document Name: OMP_rev_C.doc
		Revision No: C (prov)
		Issue Date: _____
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