A Basic Bridge Information System

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SYNOPSIS

To effectively support bridge asset management practice and aid engineering decisions, many Roading Agencies require a Bridge Information System which is:

- Easy to use
- Cheap to maintain
- Robust/reliable/durable
- Accessible to a range of users
- Flexible and adaptable
- Able to readily provide key asset management information
- Able to support the bridge management process

Proprietary Bridge Information Systems are available. However these are not always suitable, as they can be:

- Sophisticated
- Require specialist training
- Data hungry
- User unfriendly
- Costly to maintain data
- Expensive to purchase, adapt and maintain

To meet Local Authority demand, and a need for an information system to support NZ Transport Agency regional bridge management contracts, a basic Bridge Information System has been developed by Opus, which:

- Provides basic information suitable for effective bridge management
- Supports engineering decision making
- Supports the bridge inspection process
- Uses a proprietary database system
- Is user friendly and readily accessible
- Is suitable for both small (<50) and large (>1000) bridge stocks
- Is adaptable to specific client needs
- Is cheap to maintain

This paper outlines the system functionality, how it complements the bridge management process and its key features.
1 INTRODUCTION

Electronic Bridge Information Systems (BIS) are becoming an essential tool to assist the effective management of bridge stocks (and other significant highway structures). While proprietary systems are available, these can be unsuitable for many bridge owners due to their sophistication, their cost to purchase, modify and maintain (to suit local bridge management processes), the need for specialist training, the need for extensive data in order to operate, and often their difficulty to use for infrequent users.

Over many years, Opus International Consultants (Opus) has progressively developed a BIS (OBIS) to assist with the management of bridges and other structures for Territorial Authorities, Private Clients and for NZTA contracts managed by Opus. This development has been based on a thorough understanding of bridge management processes and practices in NZ, the close involvement of bridge owners and a desire to “keep it simple”. One of the fundamental principles throughout development has been that the system must support good management practice while balancing cost and usability with system sophistication.

The BIS development is based on the assumption that Engineers/Technicians manage bridges, but that to do so effectively and efficiently, a database to capture and manage essential information and knowledge is needed.

2 BRIDGE MANAGEMENT FRAMEWORK

All bridge owners need to develop a bridge management framework which defines the practices and procedures they will implement to meet their organisation’s needs. A wide range of systems has been developed from very simple to very complex. These systems are driven by legislative requirements (e.g. Health and Safety), Government policies, stakeholder needs, strategic plans, asset management planning, financial systems and reporting, and organisational objectives. The bridge management framework is often dictated by organisational asset management systems.

Figure 1 describes a generic bridge management framework adopted in NZ. A key component of the bridge management system is the Bridge Information System.

For many bridge owners, particularly Local Authorities, management of their bridge stock is a subset of the management of their broader roading asset. The management practices are often driven by Government policy and funding agency procedures. While sophisticated bridge management practices are being developed internationally, for many bridge owners, these sophisticated practices cannot be justified because of the costs, resource requirements, and lack of commensurate benefits. Rather, many bridge owners consider a simple, robust, “fit for purpose” management system is currently appropriate.
3 BRIDGE INFORMATION SYSTEM REQUIREMENTS
The Bridge Information System has been developed progressively to meet the specific needs of clients, based on the following criteria:

- Utilise readily available database software;
- Keep the system simple with minimal data input and updating;
- Ensure simplicity of use and intuitive operation for a range of users;
- Adopt a common framework for all clients, but provide for specific customisation as required;
- Capture essential bridge management information (including historic institutional bridge knowledge);
- Support and prompt key management processes;
- Support engineering decision making;
- Provide modular structure to allow structured development/client flexibility;
- Adopt a philosophy of continual development based on User needs.

4 BRIDGE INFORMATION SYSTEM FUNCTIONALITY
Figure 2 illustrates how the Bridge Information System supports the bridge management process.
5 SYSTEM COMPONENTS
The following is a series of example screen shots from the system:

• Main User Screen

The main screens that users access are the **Bridge Data** and **Other Structures Data**. These comprise eight modules: Inventory Data, Condition Assessment, Work Schedule, Strategy, Condition Photographs/Attached Files, Inspection Schedule, Risk Register and Inventory Checklist.

• Inventory Data

- Descriptive Inventory Data (E.g. location, general structure information, basic geometry etc.)
- Descriptive photographs (4-8 dependant on client)
- All data can be edited except fields downloaded from clients own descriptive database (to maintain consistency of data).
• **Condition Assessment**
  - Add, edit or view condition assessments;
  - Previous assessments are retained in the system;
  - Assessments stored in chronological order;
  - Assessment is based on current NZTA format;

• **Work Schedule**
  - Add, edit or view maintenance/component replacement schedules;
  - Work items refer back to condition assessment. Includes items identified as part of scheduled inspections and any other defects reported in intervening period (e.g. by Network Consultant, Network Contractor, General Public etc.)
  - Work allocated to appropriate work categories (E.g. routine maintenance, routine component replacement)
  - Cost estimates included
  - Assign work types (e.g. Concrete repairs, Steelwork painting etc.).
  - Can include completed repairs to allow review of structure maintenance history.
• Engineer’s Comments/Future Strategy
  - Allows user to record issues associated with the structure that may affect future management or impact on other work programmes. E.g. Bridge replacement programmed, access issues, consent issues etc.

  Future Maintenance Strategy

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  • Attached Files
  
  - Include condition related photographs (to allow monitoring of defects etc)
  
  - Include any relevant files associated with the structure E.g. As-built drawings, Google Earth location files, Resource Consents, Building Consents, historic inspection reports etc. All files can be opened from database.
• Inspection Schedule
  – Programme inspection frequency;
  – Identify level of inspection required (e.g. General, Detailed, Special etc.)

– Identify issues for a given inspection type. E.g. Specialist access required, specific components to be targeted etc;

• Valuation
  – Calculate replacement costs, Optimised Depreciated Replacement Cost (ODRC) and Annual Straight Line Depreciation for each structure in the network;

– Grey fields are user input, white fields populated from stored data and yellow fields calculated.

– All in accordance with NAMS Infrastructure Asset Valuation and Depreciation Guidelines
6 REPORTING FUNCTIONS

The system can generate a wide variety of reports covering individual bridges through to the entire network. The following are examples of some of the reports the system generates. Typically the reports are either output to Adobe Acrobat format or exported to MS Excel.

Figure 1 - Descriptive Inventory Report
Figure 2 – Inspection Report
Figure 3 – Inventory Summary Report
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**Figure 4 - Network Maintenance Summary**

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**Figure 5 - Network Area Maintenance Report**
7 FUTURE IMPROVEMENTS

Development of the system is ongoing and is tailored to meet the changing needs of bridge management and Clients.

Developments currently being considered include:

- Migration to a web-based database: This will allow remotes access to the system (allowing real-time updates of condition data, work schedules etc.) and, with appropriate permissions allow restricted access to other key stakeholders (e.g. Network Contractor can access maintenance schedules).
- Further development of the Risk Register
- Structural data inventory
- Overweight permit processing
- Automatic notification of upcoming/overdue tasks (e.g. inspections, defect monitoring)