1.0 CHAPTER 1 – INTRODUCTION

1.1 INTRODUCTION

The Alberta Transportation bridge inspection program is an essential part of a comprehensive inventory, inspection, maintenance, and data management system called the Bridge Inspection and Maintenance (BIM) System. The inspection component, introduced in 1987, allows for regular scheduled inspections at all bridge and culvert sites.

These inspections provide information to the system that allow inspection management, maintenance programming, budget development, strategic planning, and life cycle planning so that the safety of the traveling public and the investment in bridge structures is optimized.

Occasionally, the regular Level 1 inspections highlight problems that require more detailed inspections in order to determine the proper course of action to address a problem. The Level 2 inspections are the tools that provide the detailed inspection and test information to the system. This helps to maximize the life and serviceability of bridge structures by identifying problems and initiating effective maintenance, rehabilitation, or monitoring schemes.

1.2 LEVEL OF INSPECTION

Level 1 inspections conducted on a routine basis are adequate for monitoring the condition of most major bridges, standard bridges, and culverts. Some sites or components will require an inspection by a bridge or culvert inspector with specialized knowledge, tools and equipment during their service life. This specialized inspection is a Level 2 inspection.

1.2.1 LEVEL 1 INSPECTIONS

Level 1 inspections are general visual inspections conducted using standard tools and equipment. This level of inspection requires completion of the BIM Level 1 inspection forms by certified bridge inspectors and must be performed at time intervals not exceeding those specified by Department policy. Level 1 inspections rate the worst part of each element and do not take the overall element condition into account.

1.2.2 LEVEL 2 INSPECTIONS

Level 2 inspections are in-depth, quantitative inspections conducted using specialized tools, techniques, and equipment. This level of inspection requires completion of the appropriate BIM Level 2 forms by a bridge inspector with specialized knowledge and experience. This level of inspection gathers detailed information on the condition of a particular bridge component.

1.2.2.1 Types of Level 2 Inspections

There are numerous types of Level 2 inspections. Each type of inspection focuses on a particular part or aspect of a greater bridge component.

Common Level 2 inspections described in this manual include:

- Concrete Deck Inspection
- Copper Sulfate Electrode (CSE) Testing
- Chloride Testing
- Ultrasonic Truss Inspections
- Culvert Barrel Measurements
- Vertical Clearance Measurements

Other types of Level 2 inspections that have been identified for regular use but are not described in this manual include:

- Paint Inspection
- Concrete Girder Inspection
- Scour Monitor
- Timber Coring
- Special Structure Monitor

There are additional specialized inspections that may be performed. However, these inspections are not completed routinely enough to warrant a formal Level 2 inspection module. These inspections will usually be conducted using program or site specific terms of reference and reports. Examples include:

- Underwater Inspection
- Linear Polarization Measurement
- Bond Testing
- Steel Culvert Corrosion Testing
- Pin and Hanger Connection Inspections
- Steel Girder Cover Plate Inspections

Other types of inspections such as collision damage assessments are not considered to be Level 2 inspections since they do not gather consistently similar data.

1.3 ITEMS COMMON TO LEVEL 2 FORMS

Several numbering systems, fields, and terms are common to most Level 2 forms, thus allowing for consistent, repeatable results between different Level 2 inspections. Persons familiar with a single Level 2 form will also be able to understand the general content of another Level 2 form. Several fields common to Level 2 forms are described in the following sections.

1.3.1 BRIDGE STATIONING AND ELEMENT NUMBERING

Bridge stationing and element numbering refers to how bridge structures and their elements are numbered and referenced relative to compass directions and the road. The same numbering convention applies to all bridge structures and their elements except for truss bridge elements (described in Chapter 5). A standard numbering system allows different inspectors to consistently identify and refer to the same individual elements of a bridge or culvert during an inspection.

1.3.1.1 Longitudinal Direction

Bridge stationing increases from south to north and from west to east along the general direction of the road. This is generally also the direction of increasing chainage.

Elements such as spans and supports are numbered starting at the south or west end of the structure. Supports are identified by two digits: one digit represents the function of the element and the other digit represents the assigned number of the element. Therefore, abutment 1 would be A1 and abutment 2 would be A2. Similarly, piers would be numbered P1, P2, and so forth. Hinges would be identified as H1, H2 and so on. There is an example on the numbering of bridge elements shown in Figure 1.1.

1.3.1.2 Transverse Direction

For the transverse direction, element numbering will increase from south to north or from west to east. This will apply to elements such as girders or stringers.

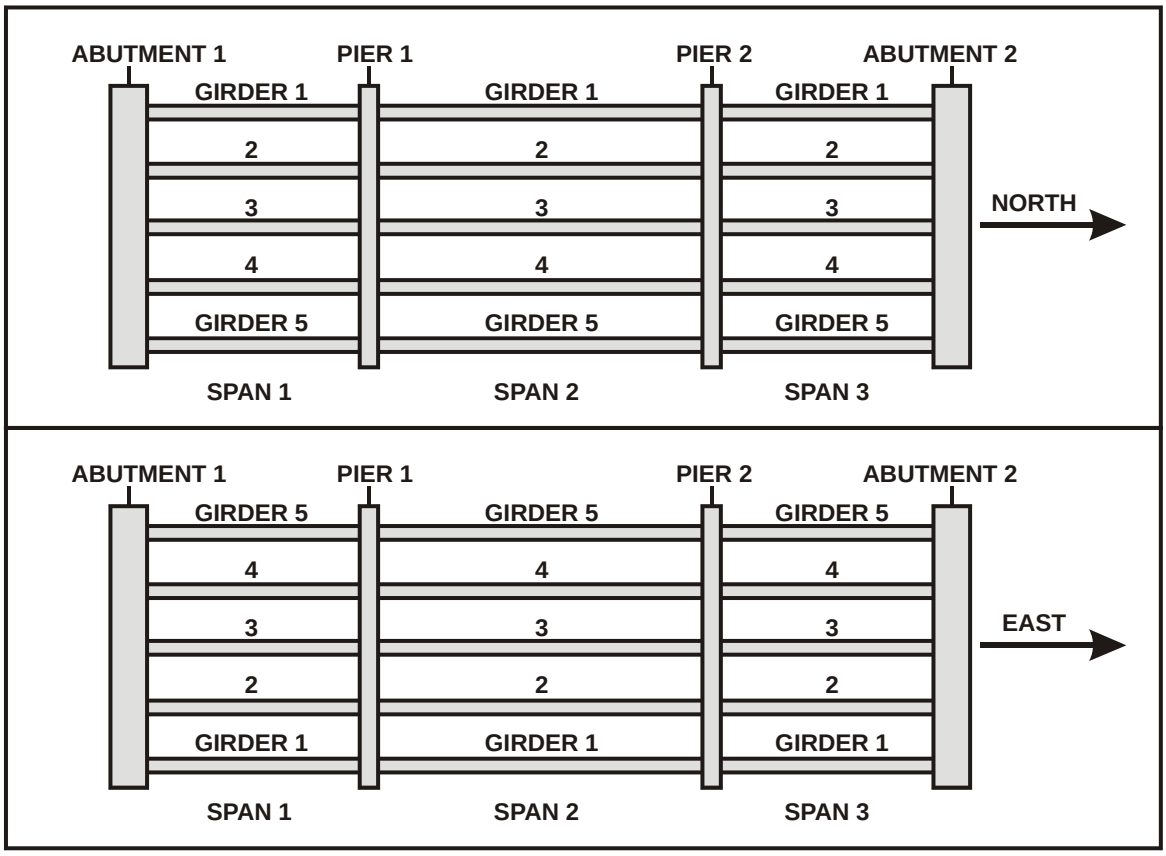

Figure 1.1 – Element Numbering Examples

1.3.1.3 Adding or Removing Elements

When elements are added or removed from the structure, the elements will be renumbered accordingly. For example, a culvert or bridge span may be added to an existing structure or the structure may be widened.

1.3.1.4 Intersections

For structures at intersections, the stationing and element numbering will be referenced with respect to the road on which the structure is located, as described in the Bridge Information System (BIS) Codes and Explanation Manual. In general, structures on numbered highways will be properly identified in the BIS inventory as being 'on' a given road. If it does not clearly define the road (i.e. intersecting local roads), then the structure will be considered to be on the east-west road.

1.3.2 INVENTORY DATA

The following inventory data shown in Figure 1.2 is stored in the Department's BIS Inventory. These fields will automatically be populated by the BIM system.

```
Bridge File Number : ..... ...          Structure Usage   : ..
Legal Land Location: ...-..-...-..-.    Year Built        : ../..
Latitude/Longitude : ........./.........Clear Roadway/Skew: ....m/...Deg
Road Auth./Region  : .../R.
Bridge or Town Name: .............      Prev. Insp. Date  : ____/__/__ (YMD)
Stream Name        : .............      Insp. Req'd Date  : ____/__/__ (YMD)
Highway #:Cntrl Sec: ....:...          (based on _____________________)
Road Classification: ........-...
AADT/Year          : .-......./..      Current Insp. Date: ____/__/__ (YMD)
Detour Length      : ...km             Inspector's Code  : ____
```

Figure 1.2 – Common Level 2 Inventory Fields

1.3.2.1 Bridge File Number

Every bridge and culvert in the Alberta Transportation inventory is identified by a unique five-digit bridge file number. Multiple structures sharing the same bridge file number will also have an additional visual identifier of up to three letters. The first letter indicates the direction of the traffic (N, S, E or W). The second and possibly third letter indicate the structure usage, such as a sign structure or a collector.

1.3.2.2 Legal Land Location

The Legal Land Location is defined by the following designations:

a) Quarter Section designation (3 letter code from Figure 1.3, i.e. 'WNE')
b) Section Number (01 to 36),
c) Township Number (001 to 126),
d) Range Number (01 to 30), and
e) Meridian east of the site (4 to 6).

An example of a Legal Land Location is 'WNE25-028-03-5'. This is the sum of the above designations, and is also illustrated in Figure 1.3 below.

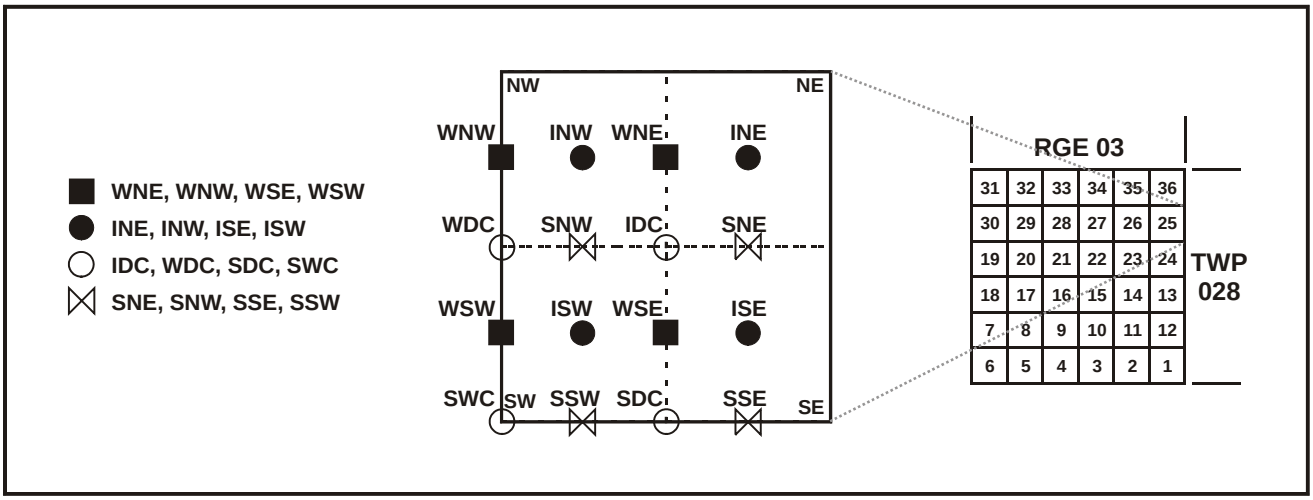

Figure 1.3 – Legal Land Location

1.3.2.3 Latitude/Longitude

These fields are for the Longitude and Latitude of the site. This information is not currently stored in the BIS and is shown only for future use. These fields should be left blank unless otherwise directed.

1.3.2.4 Road Authority and Region (Road Auth./Region)

The Road Authority field is an alphanumeric entry consisting of a single letter followed by a two-digit number. This field describes the road authority that has geographical jurisdiction of the site. The road authority may be the Department or a Municipal Authority. The first digit of this road authority indicates the type of Municipal Authority, while the last two digits identify the number of the municipality. Only the last two numbers are used for municipalities with three digit numbers.

Alberta Transportation has divided the province of Alberta into four geographic regions. Each region has been assigned single numeric value to represent it. The number that represents the region that the bridge or culvert is located in is entered in the Region field. The numbers assigned to the four geographic regions are:

1 = Southern Region
3 = Central Region
5 = North Central Region
6 = Peace Region

1.3.2.5 Bridge Or Town Name

This is a text field that describes the bridge name or the nearest town name. The naming convention in order of precedence is: structures with an established name,

the nearest well known town or lesser known town shown on the Alberta road map, and finally, the nearest post office. This field may be a maximum of 12 characters in length.

1.3.2.6 Stream Name

This is a field for the name of the river, stream, highway, railway, or other facility that the structure crosses. Unnamed streams are left blank or called 'Watercourse'. This field may be a maximum of 12 characters in length.

1.3.2.7 Highway Number And Control Section (Highway #:Cntrl Sec)

The Highway Number is a code of up to four characters in length that refers to the highway that the structure is located on. The following are examples of Highway Number codes:

Primary Highways	-	M01A
Secondary Highways	-	S520
Local Roads	-	L
Approach Roads	-	A046
Provincial Park Roads	-	P109
Forestry Roads	-	F
Indian Reserve Roads	-	R
Railroad (over)	-	CPR, CNR, etc.
None of the above	-	X

The control section of a numbered highway is a two-digit number that identifies a specific section of that highway. For example, in the code 'M02:04', the primary highway is '02', while '04' refers to the control section of that section of the highway. If two control sections meet at the middle of the structure, then the structure will be coded with the higher control section number of the two.

1.3.2.8 Road Classification

All public rural roads in Alberta have a Road Classification that describes the highway standard of the facility that the bridge is a part of. This classification is described in a typical format such as 'RLU 209G-090', where:

- The first letter 'R', is an abbreviation for Rural.
- The second letter is either a 'L' for Local, 'C' for Collector, 'A' for Arterial, or 'F' for Freeway.
- The third letter is either an 'U' for Undivided or a 'D' for Divided.
- The first numerical digit indicates the number of lanes.
- The second and third numerical digits (also fourth for RAD, RAU and RFD), indicate the sum of the lane and shoulder width in metres.
- The last three digits indicate the design speed in kilometres per hour.

Refer to Section 4.23 of the Level 1 BIM Inspection Manual for a complete list of road standards.

1.3.2.9 Average Annual Daily Traffic (AADT/Year)

The Average Annual Daily Traffic (AADT) is brought forward from the Alberta Traffic Information System or from the BIS Inventory. This information is described in a typical format such as 'A001250/98', where:

- The first letter is either an 'A' for Actual AADT or 'E' for Estimated AADT.
- This is followed by the traffic count, which may be up to 6 digits.
- Next, there is a '/' followed by a two-digit number that indicates the year the traffic count was completed or estimated.

1.3.2.10 Detour Length

The Detour Length is recorded to the nearest kilometre and is the minimum extra distance to be traveled if the bridge on the intended route is removed or closed. The detour bridge is the nearest bridge on the same stream that has about the same load capacity as the removed or closed bridge. The detour bridge can also be a bridge that is capable of being temporarily strengthened on short notice.

The Detour Length applies to the general overall flow of vehicles and is determined from the intersections on the detour route and the original route. The recorded value does not apply to the individual that resides next to the bridge and is required to backtrack.

There are exceptions for this detour length field in certain situations. These exceptions are as follows:

Detour Length = 0 for bridges on roads with four or more lanes.
Detour Length = 1 for bridges on divided highways.
Detour Length = 999 for bridges that are on a dead end route.

1.3.2.11 Structure Usage

The following two character codes are used to describe the Structure Usage:

RV - River or Stream crossing
FB - Pedestrian River or Stream crossing
FY - Ferry
GS - Grade Separation
IC - Irrigation Canal
PS - Pedestrian Grade Separation
RO - Railway Overpass (road over railway)
RU - Railway Underpass (road under railway)
SP - Stockpass or Cattlepass
XX - None of the Above

1.3.2.12 Year Built

This field is a four-digit number. The first two digits indicate the earliest year of fabrication or construction. These two digits are followed by a `/`, and then the last

two digits specify the year the last construction or rehabilitation took place. For example '65/87' represents a bridge that was constructed in 1965 and underwent a major rehabilitation in 1987. If a bridge is completely reconstructed, then both the year constructed and the year rehabilitated are changed, such as '99/99'.

1.3.2.13 Clear Roadway and Skew

For bridges, the Clear Roadway is the distance between the inner faces of the curbs, measured perpendicular to the centre line of the structure. For culverts, it is the width of the road over the culvert between the edge of the shoulders. The clear roadway is to be recorded to the nearest 0.1 m. Use the minimum width for tapered roadways. For structures with medians, the total clear width of all the lanes is used.

The Skew Angle is the complement of the acute angle between two centrelines both parallel and perpendicular to the curb. A 0^o skew denotes a bridge with rectangular, right angle ends in plan view. A positive skew angle is a 'RHF' or right-hand-forward skew and a negative skew angle is a 'LHF' or left-hand-forward skew as shown in Figure 1.4.

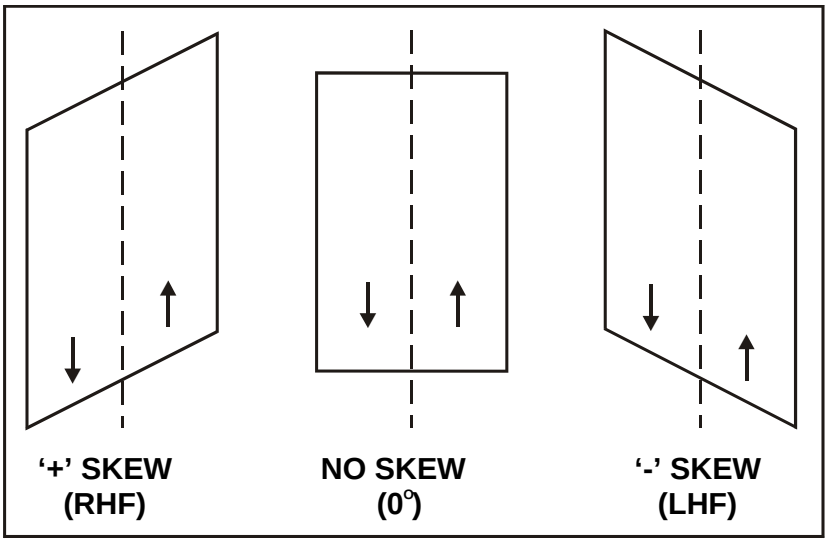

Figure 1.4 – Skew Angles, Plan View

1.3.3 SCHEDULING INFORMATION FIELDS

The Scheduling Information area is found on the lower right half of the header information on the first page of every Level 2 form. It contains the following information and is shown in Figure 1.5.

```
Bridge File Number : ..... ...          Structure Usage   : ..
Legal Land Location: ...-..-...-..-.    Year Built        : ../..
Latitude/Longitude : ........./.........Clear Roadway/Skew: ....m/...Deg
Road Auth./Region  : .../R.
Bridge or Town Name: .............      Prev. Insp. Date  : ____/__/__ (YMD)
Stream Name        : .............      Insp. Req'd Date  : ____/__/__ (YMD)
Highway #:Cntrl Sec: ....:...          (based on ____________________)
Road Classification: ........-...
AADT/Year          : .-......./..      Current Insp. Date: ____/__/__ (YMD)
Detour Length      : ...km             Inspector's Code  : ____
```

Figure 1.5 – Common Level 2 Scheduling Information Fields

1.3.3.1 Previous Inspection Date

On a blank inspection form, this field contains the date of the last inspection. When viewing or printing an inspection that has already been completed, this field will contain the date of the last inspection. The format is yyyy/mm/dd.

1.3.3.2 Inspection Required Date (Insp. Req'd Date:_____Based On)

The 'Inspection Required Date' is the date by which the next inspection should be completed. The method of calculating this next inspection date is explained in the Inspector and Reviewer sections (Sections 1.5.4 and 1.5.5).

On a blank, unused form, this date is calculated by the Department after the input of the last inspection. When printing a completed report, this is the date calculated by the Department after the input of the next to last inspection. The 'Based On' field is a brief description of how the Inspection Required Date was arrived at. For example, the date may be based on annual monitoring or on a predetermined default inspection cycle.

1.3.3.3 Current Inspection Date

On a blank inspection form for a new inspection, this is the date the inspection is carried out. The format is yyyy/mm/dd. The inspector completes this field.

1.3.3.4 Inspector's Code

This is a unique code of up to 3 letters given to each inspector by the Department. The inspector is to enter their assigned code in this field. If the inspector has not been assigned a code, the field should be left blank. Ensure the full name of the inspector is recorded on the last page of the Level 2 form, as outlined in Section 1.5.4.2.

1.4 ADDITIONAL INVENTORY INFORMATION

In addition to the inventory data in the header of the form, several Level 2 forms provide supplementary information about the structure. The additional inventory information is located

immediately below the header information on page one of most Level 2 forms. This information is taken from BIS or from the most recently completed Level 1 inspection.

Additional culvert information appears on culvert-related Level 2 forms, such as the Steel Culvert Barrel Measurement forms. Refer to Section 6.2 for a complete description of these fields.

The fields that appear on most bridge-related Level 2 forms, including the Level 2 Concrete Deck Inspection, CSE Testing, Chloride Testing, and Vertical Clearance Measurement forms are shown in Figure 1.6 and described in the sections below.

```
STRUCTURE INFORMATION:

No. of spans: ..    Span Types: .../...  Substructure Types: .../...
Span Lengths: .....-.....-.....-.....-.....m    Total Length: .....m
```

Figure 1.6 – Additional Structure Information for Bridges

1.4.1 NUMBER OF SPANS (NO. OF SPANS)

This is a two-digit numeric value (i.e. 01 to 99) that describes the number of spans at a bridge site. Spans are numbered from west to east or from south to north, in the direction of increasing chainage.

1.4.2 SPAN TYPES

This field identifies up to two different span types for a given bridge. The first field is used to identify the primary span type. This is considered to be the most important span type of the bridge, typically the main or middle spans. If there is a secondary span type at the bridge, this span type is recorded in the second field. The secondary span type is typically those of the approach spans.

Refer to the BIS Codes and Explanations Manual for a complete list of span types.

1.4.3 SUBSTRUCTURE TYPES

The 'Substructure Types' field is a three letter code that is brought out of BIS. There are fields for two different substructure elements (i.e. two different 3-letter fields). The first 3-letter field is for the abutments while the second 3-letter field is for the pier.

The first letter of each of these 3-letter fields represents the type of Foundation, the second letter corresponds to the type of Pier Shaft, Column, or Abutment Backwall, and the third letter is the type of Pier Cap or Abutment Seat.

Detailed descriptions of substructure codes are in the BIS Codes and Explanations Manual.

1.4.4 SPAN LENGTHS

The length of each span is taken from BIS and recorded in these blank fields. The span length is nominal, and noted in metres, to the nearest 0.1 m. The order of the spans is south to north, or west to east (increasing chainage). A maximum of five spans may be listed in this field, starting with span number 1. Span length measurements are further detailed in Section 4.19 of the Level 1 BIM Inspection Manual.

1.4.5 TOTAL LENGTH

This is the total length of the bridge to the nearest 0.1 m. The total span length is taken from BIS and is the sum of all of the span lengths. If there are more than five spans at the site, then this field represents the total of all of the spans, not just the 5 spans shown in the 'Span Length' fields.

1.4.6 COMMENT FIELDS

Each section of the Level 2 form has four lines provided for additional comments. Use the comment lines to help describe the situation at the bridge. Note trends, typical conditions, and isolated conditions.

One of the goals of the Level 2 deck inspection is to create a clear picture of an existing problem or concern at a bridge site for the Department, so a decision or course of action can be undertaken. Inspectors must continually ask themselves if their inspection report is accomplishing this goal of accurately portraying a bridge site.

1.5 THE LAST PAGE OF THE LEVEL 2 FORMS

All of the Level 2 inspection forms have similar fields on the last page. Some of the fields on the last page are provided for information only, others will be completed by the inspector or the Department.

1.5.1 LEVEL 1 INSPECTION (INFORMATION ONLY)

The Level 1 Inspection information section shown in Figure 1.7 is for the inspector's information only. It includes the date of the last Level 1 inspection that has been entered into the BIM system and the calculated Structural Condition Rating, Sufficiency Rating, Estimated Remaining Life of the Structure, and any Special Comments, all from the last Level 1 inspection. The next scheduled Level 1 inspection (yyyy/mm/dd) and the Level 1 inspection cycle in months are also shown.

```
LEVEL 1 INSPECTION (INFORMATION ONLY)     Level 1 date: ____/__/__

Structural Condition Rating: __%    Sufficiency Rating: __%
Estimated Remaining Life of Structure: __ years

Special Comments for Next Inspection:

Next Scheduled Level 1 inspection: ____/__/__          Current Cycle: __months
```

Figure 1.7 – Last Page of Level 2 Forms; Level 1 Inspection Information

1.5.2 ITEMS REQUIRING IMMEDIATE ATTENTION

This critical text field, as shown in Figure 1.8, is for the inspector to describe items that may require immediate attention and cannot wait for the next Level 1 or Level 2 inspection. If any item is a hazard to the safety of the public, the inspector must take appropriate action, such as closing the structure or contacting the Bridge Manager. These critical items may or may not be related to the component that is being tested or inspected. Leave this area blank if no immediate action is required.

```
ITEMS REQUIRING IMMEDIATE ATTENTION:
```

Figure 1.8 – Last Page of Level 2 Forms; Items Requiring Immediate Attention

1.5.3 LEVEL 2 INSPECTION SPECIAL REQUIREMENTS

Record in this section shown in Figure 1.9, any special requirements for tools, equipment, traffic control, or access required to carry out the Level 2 inspection.

Normally, the person responsible for initiating the Level 2 inspection, typically the previous Level 1 inspector or Department personnel, will identify the special requirements so that these are in place at the time of the Level 2 inspection.

```
LEVEL 2 INSPECTION SPECIAL REQUIREMENTS:

Y =>  Snooper: __   Lift: __   Traffic control: __    Boat: __   Ladder: __
Other: _____________________________________________________________________
```

Figure 1.9 – Last Page of Level 2 Forms; Special Inspection Requirements

1.5.4 INSPECTOR

This section, as shown in Figure 1.10, is to be completed by the inspector.

INSPECTOR:

Recommended Cycle __ months OR Next Insp. Date ____/__/__ (blank for default) Recommended Additional Cycles: _ (blank for default, 0 for discontinue)		
Inspector's Code: ___	Inspector's Name: _____	Class: _
Assistant's Code: ___ Assistant's Code: ___	Assistant's Name: _____ Assistant's Name: _____	Class: _ Class: _
Comments: _____		

Figure 1.10 – Last Page of Level 2 Forms; Inspector Information

1.5.4.1 Recommendations for Adjustments to the Inspection Schedule

The inspector may recommend adjustments to the default inspection cycle and to the number of additional inspection cycles required. Alternately, the inspector may recommend the next inspection date. However, the inspector cannot make recommendations regarding both the inspection cycle and the next inspection date. These fields should be left blank to continue with the current defaults shown in the Reviewer section. To recommend discontinuing the inspections, the inspector enters '0' in the Recommended Additional Cycles field. These inspection date recommendations provide information to the Department's Reviewer and will not necessarily be used to make adjustments to the scheduled inspections.

1.5.4.2 Inspector Information and Inspector's Team Information

After each inspection, the inspector and any assistants must print their Department assigned three-letter Inspector's Code, their names and their inspector class on the Level 2 form. Some members of the inspection team may not have a Department assigned three-letter Inspector's Code. In this case, it is sufficient to write the individual's name and their inspector class. There are fields provided for the principal inspector who is responsible for the inspection, and up to two assistants.

The standard format for names in this section is the first name in full, followed by the middle initial with a period, and then the last name, such as 'ROBERT H. SMITH'. Names should be written in all capital letters.

1.5.4.3 Miscellaneous Comments

The inspector shall record any miscellaneous comments in the lines provided that are pertinent to the current inspection, but do not belong in any another area of the Level 2 form.

1.5.5 REVIEWER

This is the last section of the Level 2 form and is shown in Figure 1.11. It is very similar to the Inspector's section that is directly above it, as described in Section 1.5.4. This section is completed by the Department's Reviewer and it describes revisions made to the inspection cycle and the Reviewer's name.

REVIEWER: Review Date: ____/__/__

Approved Cycle __ months OR Next Insp. Date ____/__/__ (blank for default)
Approved Additional Cycle: _ (blank for default, 0 for discontinue)\

Reviewer's Code: ___	Reviewer's Name:_____	Class: _

Comments: _____
_____

Default No. of Inspections: _	Number completed to date: __
Default Cycle: __ months	Next Inspection Required Date ____/__/__

Figure 1.11 – Last Page of Level 2 Forms; Reviewer Information

1.5.5.1 Review Date

In this field, the Reviewer from the Department records the date the inspection was reviewed. The format is 'yyyy/mm/dd'.

1.5.5.2 Approved Adjustments to the Bridge Inspection Schedule

The inspector can recommend changes be made to the inspection cycle, however only Department personnel can approve this recommendation. The Reviewer records the approved adjustments to the inspection cycle, next inspection date, or number of additional inspections to be performed. They can either recommend a shorter inspection cycle or define the next inspection date, but not both.

The Reviewer will leave these fields blank to continue with the current defaults for the inspection cycle. To approve discontinuing the inspections, the Reviewer enters a '0' in the Approved Additional Cycle field.

1.5.5.3 Reviewer Information

The Reviewer records their Department assigned three-letter Inspector's Code, their name, and their inspector class as applicable. The name should be recorded in the standard format described in Section 1.5.4.2.

1.5.5.4 Miscellaneous Comments

The Reviewer records any comments pertinent to the inspection or the review.

1.5.5.5 Default Number of Inspections

This is the total number of inspections of that particular type to be completed on the structure. This value may have been adjusted by a previous reviewer who had approved an adjustment to the number of additional cycles. This field may be blank if the inspection is on an ongoing cycle.

1.5.5.6 Default Cycle

This is the current cycle, in months, at which the inspections are to be performed. The cycle can be set for a particular site or for a given inspection type. This field will rarely be blank. An example where it may be blank is when an inspection of a bridge element is performed on a one time only basis using the Special Structure Monitor inspection.

1.5.5.7 Number Completed To Date

This is the number of inspections that have been completed to date, not including the current inspection.

1.5.5.8 Next Inspection Required Date

This field is the date that the next inspection should be completed by. This date is calculated using the current inspection date and the default cycle, or as modified by the Reviewer's approved adjustment. Where the reviewer has approved a next inspection date, this date will govern. The 'Next Inspection Required Date' is in the format of 'yyyy/mm/dd'.