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Level 3

Handbook for the examination of Structures – Part 1C: Determining the Examination Regime

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1 Purpose

An Examination Regime defines the planned frequency of undertaking different types of examination.

The type of examination determines the extent and detail of the information obtained. (Types of Examination Regime are specified in NR/L3/CIV/006/1B.)

2 Scope

This Part of the *Handbook for the examination of Structures* provides instruction and guidance on determining the Examination Regime for Structures.

It applies to the following categories of Structure, as defined in NR/L1/CIV/032, *Managing structures*:

- A: Bridges and Culverts
- B: Retaining Walls
- C: Tunnels
- F: Coastal, Estuarine and River Defences
- G: Ancillary Structures.

3 Roles and responsibilities

The Route Asset Manager (Structures) [RAM(S)] is responsible for:

- a) setting the Examination Regime for Structures; and
- b) for requesting examinations to be undertaken through the Task Schedule.

The activities stated to be undertaken by a RAM(S) may be delivered by their nominated representative (referred to in this standard as the “Structure Manager”).

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4 Components of an Examination Regime

4.1 General

The Examination Regime shall be such that the information obtained enables timely and appropriate actions to be taken that maintain the safety and performance of the Structure in a cost-effective manner.

Thus an Examination Regime for a Structure shall:

- a) determine and record the condition of the Structure;
- b) identify and record the presence, nature, severity and extent of defects that could indicate or cause deterioration of the Structure;
- c) provide information that allows the rate of deterioration and any significant change in the condition, loading, use or environment of the Structure to be determined;
- d) inform decisions on the actions that have to be taken so that there is no unacceptable risk to the safe use or performance of the Structure.

An Examination Regime shall include a series of Visual Examinations undertaken at annual intervals.

NOTE An Examination Regime should include a series of Detailed Examinations undertaken at specified intervals. An Examination Regime could also comprise:

- a) a series of Underwater Examinations undertaken at specified intervals; and
- b) additional Examinations, undertaken as and when required in response to an Incident (or a report of one), and/or as a planned addition to the other types of examination.

For safety and economy, the frequency of the different types of planned examinations shall be:

- a) commensurate with the type, condition and use of the Structure, and the vulnerability of the Structure to accidental or deliberate damage or misuse; and
- b) a function of the scope, quality and detail of the information that can be gained from the various types of examination.

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4.2 Visual Examinations

Visual Examinations shall be undertaken at 12-month intervals, except:

- a) where the timing of a Detailed Examination falls within the timeframe of a Visual Examination, in which case a separate Visual Examination is not required;
- b) where a shorter interval is necessary because of (for example) the particular type, condition or use of the structure (or part of one);
- c) for non-operational Tunnels, where Visual Examinations of the Bore shall be undertaken at six-monthly intervals.

Visual examinations of underline bridges (with spans up to 10 metres) identified at risk of Scour (i.e. with a scour risk scour ≥ 16) shall be undertaken prior to the (expected) start of the flood season.

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4.3 Detailed Examinations

NOTE The requirements and appropriate frequency of Detailed Examinations are largely a function of the scope and detail of the information obtained from Visual Examinations. The requirements vary according to the information required to be obtained from the Detailed Examinations, whilst the frequency varies, by and large, according to the characteristics of the Structure (such as its type, condition, and failure modes).

For Bridges, Footbridges and Tunnels, (including Tunnels with non-operational bores where a detailed exam is required by the Structures Manager), in the absence of any other documented method for determining the appropriate interval between Detailed Examinations, the maximum interval shall be determined as follows.

- a) Assign a risk category to each of the primary attributes of the Structure or part of one. Three risk categories (Higher, Medium, and Lower) are defined in this Part of the standard.
- b) From Step a), determine the maximum interval for the most demanding risk category.
- c) Review the appropriateness of the maximum interval determined from Step b), and reduce if necessary in the light of, for example:
 - 1) the effectiveness of the visual examination to monitor known defects and record emerging new defects;
 - 2) other subordinate attributes and hazards.

These processes shall be as defined in Appendix A for Bridges, Appendix B for Footbridges and Appendix E for Tunnels.

The appropriate detailed examination frequency for culverts, retaining walls, coastal, estuarine and river defences and ancillary structures shall be determined using the factors considered within Appendices C, D, F and G respectively.

NOTE Equivalent processes have yet to be completed for these asset types.

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4.4 Underwater Examinations

NOTE Those parts of a Structure that are exposed (permanently or intermittently) to flowing water are at risk of damage by (a) Scour, and (b) impact with the debris carried by the water. The detrimental effects can be cumulative and vary with changes in the direction and volume of flow. Furthermore, exposure to standing water can lead to material degradation.

Underwater Examinations shall be undertaken at a maximum interval of three years to identify or determine and record:

- a) the levels of the bed of the Watercourse or the sea, and any changes in the levels that could affect the safety of the Structure;
- b) the condition of those parts of the Structure that are exposed (permanently or intermittently) to water (and within two metres of the usual water level) and any change in their condition since the last examination that could affect the safety of the Structure.

In conjunction with an underwater examination, an assessment of the assets susceptibility to scour action should be undertaken and recorded within an asset management database.

NOTE Changes in the bed profile can substantially affect the risks posed by flowing water and might also highlight changes in the characteristics of the catchment, which could affect the management of rail infrastructure within that catchment.

For effectiveness and efficiency, examinations of bed profiles and “underwater parts” shall be undertaken when the bed (or parts of it) are exposed and the parts (or most of them) are not submerged, for example, at low tide.

NOTE When parts of a Structure are submerged and the depth of water prevents their condition from being determined to an adequate level of detail, usually it is necessary to employ a diver to undertake the Underwater Examination.

NOTE The characteristics of a Culvert can preclude man-entry and thereby prevent a close examination for the full extent of the culvert length. By and large, the probability and consequences of the failure of such a Structure are a function of site conditions, such as the span, depth of cover, and rate of water flow through the Structure. It could be appropriate to undertake a CCTV survey of the condition of the inside of such Culverts as part of an Underwater Examination.

Where Underwater Examinations are required to be undertaken on Structures whose characteristics do not preclude man-entry to the parts to be examined, the maximum interval between such Examinations shall be three years.

NOTE This interval should be reduced where, for example, there is a high probability that there will be changes in the characteristics of the Watercourse, and/or where adjacent Structures are susceptible to the effects of Scour.

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NOTE For Structures whose characteristics preclude man-entry, the scope, and requirements of Underwater Examinations should be varied according to (a) the information required for the effective management of the Structure, and (b) what information is to be gathered from other types of examination.

4.5 Additional Examinations

NOTE For effectiveness and efficiency, the details of planned Additional Examinations (including their scope, and frequency) should be tailored to suit the particular requirements for gathering information on the Structure. The need for and the details of planned Additional Examinations can, therefore, change in response to changes in such requirements.

NOTE Routine Additional Examinations can be undertaken to determine the condition of a particular element, part or defect – and thereby enhance the frequency and/or detail of the information obtained from other types of examination on such items. Additional Examinations can include taking readings from instruments and/or checking/changing the array of instruments.

All bridge spans (of up to 10 metres) over water that fall within the area covered by a flood alert or severe weather warning associated with rain shall be examined to check for obstructions against upstream faces following the receipt of such an alert or warning. Such examinations are to be undertaken as soon as practicable following the receipt of the alert or warning.

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5 Reviewing the Examination Regime

The Structure Manager shall review the adequacy of the Examination Regime for a Structure following an Evaluation of that structure, as a matter of course.

NOTE As far as possible, the timing of examinations undertaken on different parts, elements and defects of a Structure should coincide so that:

- a) current information is obtained for the whole Structure;*
- b) the quality and volume of information obtained for a single site visit are enhanced;*
- c) the number of site visits to the Structure is minimised.*

NOTE Where possible, examinations of a Tenanted Span should be undertaken when the Span is unoccupied.

So far as is reasonably practicable, examinations shall be undertaken in daylight.
The Examination Regime for a Structure shall be assessed as a whole.

NOTE A Regime should not usually include Detailed Examinations beyond the maximum permitted interval determined following consideration of the principal attributes/hazards listed in this standard.

NOTE There might be instances where the Structures Manager considers a detailed examination frequency beyond the maximum permitted interval is sufficient to maintain, in a cost-effective manner, the safety and performance of the Structure.

NOTE Such a revision to the examination regime should consider for example:

- a) changing the frequency of Detailed Examinations by installing monitoring points and/or instruments to enhance the scope and/or detail of the information gained from Visual Examinations;*
- b) changing the frequency of Visual and/or Detailed Examinations by undertaking Additional Examinations on particular parts or defects;*
- c) improving access to the Structure (or to parts of it) for undertaking examinations – such as by providing removable cover plates;*
- d) the need for undertaking routine Detailed Examinations where the information provided by a Visual Examination is sufficient for the effective management of the Structure;*
- e) the timing of an Assessment of the Structure;*
- f) the timing of Works to be undertaken on or about the Structure. Such Works could allow advantage to be taken of a track possession or temporary access arrangements.*

If the Structures Manager wishes to set an examination frequency beyond the maximum permitted or if the structure becomes non-compliant against its current calculated examination frequency, agreement of the Professional Head shall be sought through NR/L2/EBM/STP001/004.