

## **INTERIM ADVICE NOTE 192/16**

# **STRUCTURES INSPECTOR COMPETENCIES AND CERTIFICATION**

### **Summary**

This Interim Advice Note provides details on the competencies required for structures inspectors and their certification.

### **Instructions for Use**

This document supplements the requirements of BD63, The Inspection of Highway Structures, and takes immediate effect.

## **Structures Inspectors Competencies and Certification**

### **1. Background**

1.1 The fundamental activity at the disposal of bridge owners to ensure their assets are safe for use and fit for purpose is inspection. Inspections assist organisations to check that bridges and other structures are safe for use and fit for purpose and provide the correct data required to support effective maintenance management and planning. It is therefore critical that inspections provide organisations with information in which they can have full confidence.

1.2 Generally bridge inspection practices in the UK have been highly successful and helped ensure safe and serviceable networks, this being largely due to the skill and experience of inspection staff. However studies have identified a lack of consistency in inspection reporting, while the use of asset management plans and decision support tools have created a greater need for better quality inspection data, both in terms of consistency and accuracy. International, high-profile bridge collapses in the United States, Canada and China have highlighted the importance of rigorous inspection routines.

1.3 The need for formal training has been widely discussed at various forums, not only to address issues such as those mentioned above, but also to help raise the profile and importance of inspectors at a time when many organisations are aware of dwindling numbers of inspection staff. BD 63, 'The Inspection of Highway Structures', places a responsibility on the Supervising Engineer to assess the suitability of the qualifications and experience of prospective inspectors before engaging them. However there has been a lack of guidance on the qualities or competencies that are required and it has been up to the individual to determine their own criteria for suitability.

1.4 A range of major bridge owners in the UK and Ireland have now produced a set of competence requirements which outline the required awareness, knowledge, experience and proficiency in relevant areas relevant to the bridge inspection and reporting process.

### **2. Action**

2.1 These requirements are in addition to the requirements stated in BD63, The Inspection of Highway Structures, and BD63 will be updated in due course. Where the term 'bridge' or 'bridges' appears in this IAN that is deemed to cover structures within the boundaries of the highway or which otherwise materially affect it, and also structures within the domain of rail, light rail and waterway sectors. These typically include: bridges, footbridges, subways, culverts, retaining walls, tunnels, masts, and other structures within the scope of BD63.

2.2 Personnel wishing to undertake inspections on structures owned by Highways England must be able to demonstrate the level of competence for the role which they are proposing to undertake. Two categories of inspector are considered appropriate, Inspector and Senior Inspector. These recognise different skills and experience of existing inspectors and requirements for the future. Different levels of competencies are prescribed for Inspectors (I) and Senior Inspectors (SI) and Appendix A describes the requirements in detail. The primary differences between the two competence requirements are that a Senior Inspector must be able to demonstrate broader experience and proficiency of the relevant areas and have evidence of having advised others.

2.3 A comprehensive package of evidence which demonstrates achievement of the competence requirements must be assessed by an independent person, the assessor. The assessor shall undertake a review of the evidence presented and if this is acceptable a face

to face interview shall be undertaken to confirm that the candidate is suitable and they would become a 'certified' Inspector or Senior Inspector. Once assessed a further review of experience and knowledge would be undertaken at regular intervals of approximately 5 years. Whilst compiling their evidence prior to submission and examination by an assessor the inspector will be regarded as a 'trainee inspector' and their role will be limited as set out below.

2.4 The assessor shall be a person who has had their competencies reviewed and examined by a relevant quality assured independent organisation and the certification shall be issued by, or on behalf of, that organisation.

2.5 Both inspector roles require Inspectors to have the necessary competencies to undertake Principal Inspections, General Inspections, and Acceptance Inspections. Inspections for Assessment, Special Inspections and Monitoring Inspections should be undertaken by personnel with the specialist expertise and experience relevant to the purpose of the inspection and it is expected that these personnel will be accompanied by a certified Inspector or certified Senior Inspector.

2.6 The authorisation of inspections on SMIS (Structures Management Information System) and the Supervising Engineer duties shall be undertaken by organisations or personnel with a direct relationship with Highways England in order to maintain knowledge of the asset close to the owner.

2.7 The following are the requirements of Highways England for the suitability of personnel undertaking inspections:

- a) Personnel undertaking inspections shall have achieved the competencies required as set out in Appendix A and achieved certification, except as in b) below;
- b) Trainee Inspectors may assist certified Inspectors or certified Senior Inspectors; however their numbers and role shall be limited. For a small or medium structure which requires a 1 or 2 person inspection team to complete the inspection a Trainee Inspector may accompany a certified Inspector or Senior Inspector but cannot undertake an inspection on his/her own. For the inspection of a more complex or larger structure the certified Inspectors and Senior Inspectors may be supplemented by Trainee Inspectors who can make up to 25% of the team which are on site throughout the inspection. This is intended to balance the requirement for experienced personnel and requirements for training;
- c) It is recognised that junior engineers/technicians can gain useful experience by being involved on bridge inspections, although this may form a small part of their workload. This experience can be gained by observing the work being undertaken by the Inspector(s) and possibly assisting with access;
- d) For complex structures, where unusual elements or load paths exist, a certified Senior Inspector with the relevant competencies should lead and undertake the inspection. Such structures are likely to have one or more of the following features :
  - i. Skews greater than 25°;
  - ii. Unconventional or novel design aspects;
  - iii. Half-joints, hinge-joints or post-tensioning;
  - iv. Any individual span exceeding 50m;
  - v. History of unresolved foundation problems, significant structural defects, or significant safety issues, or subject to BD79 interim measures;
  - vi. Moveable bridges;

- vii. Scour susceptibility;
  - viii. Moveable inspection access gantries, gantry rail and gantry support systems;
  - ix. Suspension systems (e.g. cable stayed, or suspension bridges); and
  - x. Retaining walls greater than 2.5m in height.
- e) For structures of uncommon materials, such as laminated timber or fibre composite materials, certified inspectors with knowledge and experience of those materials and the mechanisms of deterioration shall only be used.

2.8 As it may take some time for personnel to become certified, interim arrangements will apply for a period of 18 months from the date of this IAN. These arrangements allow the Supervising Engineer to determine the suitability of experienced personnel using the competencies outlined in Appendix A as a framework. Those who are considered suitable can undertake the roles of Inspector or Senior Inspector as outlined above, others can undertake the role of Trainee Inspectors as detailed in 2.7(b).

2.9 Applications for review and examination of evidence of competencies should be made in good time, to ensure certification is achieved within this transition period.

### 3. Bridge Inspector Certification Scheme

3.1 In order to streamline the process of reviewing and examining the competencies of prospective inspectors there is a new certification scheme for Bridge Inspectors, entitled 'Bridge Inspector Certification Scheme' (BICS). This has been jointly developed by the UK Bridges Board and the Transport Infrastructure Ireland (previously Irish National Roads Authority) and has been overseen by ADEPT, Department for Transport, Highways England, London Bridges Engineering Group, London Transport Asset Management Board, Transport Infrastructure Ireland, Transport for London and Transport Scotland. The scheme is being administered by LANTRA as National Highways Sector Scheme 31.

3.2 The scheme considers seven core competencies which are applicable to the role of inspectors in all sectors. Core modules of the scheme, which address these requirements, are detailed in the guidance available; further modules, which address specific areas of interest, may be developed, as required by different sectors or organisations.

3.3 The introduction of the scheme will have the advantage of providing a quick evaluation of the suitability of staff for bridge inspections and the Supervising Engineer (as defined in BD63) will not need to undertake further assessments of suitability, as evidence of core competencies, and specific additional competencies if applicable, will be readily accessible and can be reviewed for the inspection tasks to be completed.

3.4 Within the scheme the route to becoming a certified Inspector or Senior Inspector involves four key stages

- Stage 1** – Enrolment on the BICS as a Trainee Inspector and obtain an e-portfolio (Note the term 'Trainee Inspector' is a scheme term and is not intended to diminish the status of current inspectors who may be very experienced)
- Stage 2** - Achievement of the required level (awareness, knowledge, experience and proficiency) of competencies, as outlined in the Core Modules as a minimum and populate the e-portfolio accordingly (Additional competencies may be added)
- Stage 3** - Successful review of completed e-portfolio and external interview to achieve Certification
- Stage 4** - Continued consolidation/broadening of experience for additional competencies and to maintain registration.

3.5 The Bridge Inspector Certification Scheme has the Administrator as detailed below:

Lantra Awards,  
Lantra  
Stoneleigh Park  
Coventry  
Warwickshire  
CV8 2LG

3.6 For registration of interest in the scheme and to enrol for an e-portfolio go to:

<http://www.bridge-inspectors.com>

## 5. Existing Structures Inspectors

5.1 There are a significant number of people currently undertaking inspections who have been doing so for a large number of years and have extensive knowledge and experience. They are highly valued and it is critical to the bridge community that these people are not 'lost' through the introduction of the requirement for review and examination of competencies. With their knowledge and experience, it is expected that the demonstration of meeting the required competencies should be readily achievable. In the BICS this may be facilitated through support and guidance from a mentor.

5.2 Where there are shortcomings in the awareness, knowledge, experience or proficiency in some of the modules this may require some targeted additional experience or training. There are training courses currently available which can be used to supplement a Trainee Inspector's knowledge and assist in meeting the competence requirements; however participation in formal learning courses is not mandatory to attain scheme certification.

## 6. Further Information and Contacts

6.1 Appendix A has details of the competence requirements and the level of attainment to be expected for Inspectors and Senior Inspectors. Further information may be obtained from:

Francis McKeown  
Highways England,  
Piccadilly Gate,  
Manchester  
M1 2WD

Tel. 03004705271

Email: [Standards\\_Feedback&Enquiries@highways.gsi.gov.uk](mailto:Standards_Feedback&Enquiries@highways.gsi.gov.uk)

6.2 Details of how these competencies can be certified via the BICS are available on:  
<http://www.bridge-inspectors.com>

6.3 The Inspection Manual for Highway Structures, Volumes 1 & 2, (ISBN 0115506381 & ISBN 0115527982), is a useful guide which covers many aspects of the required competencies.

6.4 For details of mutual recognition of other standards see GD 01 'Introduction to the Design Manual for Roads and Bridges' (DMRB 0.1.2).

## Appendix A

### Core Competence Requirements

The competencies are set out as seven 'headline' competencies and sub-competencies together with the level of competency in terms of Awareness (A), Knowledge (K), Experience (E), Proficiency (P).

Achievement Rating		Description	
A	Awareness	General <b>understanding</b> of the competence, including an <b>appreciation</b> of its relevance.	<i>These apply to theory only</i>
K	Knowledge	Knowledge and understanding of the competence with an ability to <b>demonstrate</b> its relevance/application.	
E	Experience	Knowledge, understanding and <b>experience</b> of undertaking the competence.	<i>These apply to practical application, as well as theory</i>
P	Proficiency	Knowledge, understanding and <b>experience</b> of undertaking the competence and <b>competent to advise others</b> .	

## C1 – Introduction to Inspections

### Introduction

This unit outlines the background to the importance of undertaking inspections. Fundamental to effective management is an inspection regime that provides timely, accurate and appropriately detailed information on asset condition and performance. The overall purpose of inspection, testing and monitoring is to check that structures are safe for use and fit for purpose and to provide the data required to support effective maintenance management and planning.

Ref.	Outcome/Skill	I	SI
C1.1	Purpose of Inspections <ul style="list-style-type: none"> <li>be able to outline the importance of undertaking inspections</li> <li>be able to explain the terms 'safe for use' and 'fit for purpose'</li> </ul>	K K	K K
C1.2	Inspector Roles, Responsibilities and Competencies <ul style="list-style-type: none"> <li>be able to describe the two inspector roles and their associated responsibilities.</li> <li>demonstrate appropriate level of knowledge of the competencies for the different roles</li> </ul>	K K	K K
C1.3	Inspection types <ul style="list-style-type: none"> <li>be able to explain the different inspection types</li> <li>demonstrate the importance of having an appropriate inspection regime</li> <li>demonstrate awareness of the range of different Special Inspections, their function and which factors typically initiate their use.</li> </ul>	K K K	K K K
C1.4	Codes of Practice and guidance <ul style="list-style-type: none"> <li>demonstrate appropriate knowledge and use of the relevant structure inspection codes of practice and guidance e.g. Inspection Manual for Highway Structures etc.</li> </ul>	E	P

## C2 – Structures Types and Elements / Behaviour of Structures

### Introduction

This unit outlines common types of structures, their key elements and materials. It also covers background information and guidance on the fundamentals of structural behaviour, the basic principles of structural mechanics and material properties.

Ref.	Outcome/Skill	I	SI
C2.1	<b>Bridges</b> <ul style="list-style-type: none"> <li>● Demonstrate knowledge of the major bridge elements: Superstructure, Substructure, Safety Elements, Durability Elements and Ancillary Elements.</li> <li>● Demonstrate knowledge of typical Primary and Secondary deck element types.</li> <li>● Demonstrate knowledge of bridge types using: span form, construction form and construction material.</li> <li>● Demonstrate knowledge of water management systems, their function and importance.</li> <li>● Demonstrate knowledge of utilities, private services, signs and lighting.</li> </ul>	E E E E E	P P P P P
C2.2	<b>Other Structure Types</b> <ul style="list-style-type: none"> <li>● Demonstrate knowledge of the definition of a culvert and the different types</li> <li>● Demonstrate knowledge of the definition of a subway and the different types</li> <li>● Demonstrate knowledge of the definition of a retaining wall and the different forms.</li> <li>● Demonstrate knowledge of sign/signal gantries and the different types.</li> <li>● Demonstrate knowledge of the different mast types and functions.</li> <li>● Demonstrate knowledge of ancillary structures, function and type.</li> </ul>	E E E E K K	P P P P E E
C2.3	<b>Structural Mechanics</b> <ul style="list-style-type: none"> <li>● Be able to describe the loadings to which bridges are subjected</li> <li>● Be able to demonstrate knowledge/experience of the loadpath for a structure</li> <li>● Be able to demonstrate knowledge of modes of failure</li> <li>● Demonstrate an understanding of materials' responses to loadings</li> <li>● Demonstrate an understanding of structures' responses to loadings</li> </ul>	K K K K K	E E E E E
C2.4	<b>Properties of Common Construction Materials</b> <ul style="list-style-type: none"> <li>● Demonstrate an understanding of the properties of the following common primary materials and how they influence the safety, durability and functionality of a specific component and the whole structure: <ul style="list-style-type: none"> <li>- concrete; reinforced concrete; pre-stressed concrete (pre-tensioned and post-tensioned); steel; masonry; timber</li> </ul> </li> <li>● Demonstrate an understanding of the following secondary materials: <ul style="list-style-type: none"> <li>- asphalt; asbestos</li> </ul> </li> </ul>	K  K	E  E
C2.5	<b>Properties of Specialist Construction Materials</b> <ul style="list-style-type: none"> <li>● Demonstrate an understanding of the properties of the following materials and how they influence the safety, durability and functionality of a specific component and the whole structure: - wrought iron; cast iron; aluminium and its alloys; advanced composites</li> </ul>	A	K

## C3 – Inspection Process

### Introduction

This unit outlines the fundamentals of the inspection process, including scheduling, planning, undertaking, reviewing and interpreting the results. It also includes consideration of environmental impacts, selection of appropriate access equipment and safe working practices. In addition, it highlights the importance of accurate, reliable data capture and storage post the inspection.

Ref.	Outcome/Skill	I	SI
C3.1	<p>Scheduling Groups of Inspections</p> <ul style="list-style-type: none"> <li>● Demonstrate knowledge of relevant documentation which outlines details regarding the frequency of inspections</li> <li>● Demonstrate understanding of criteria which can constrain or influence a schedule, for example, confined spaces, use of MEWPs etc.</li> <li>● Explain the objectives of each cyclical inspection type</li> <li>● Demonstrate ability to monitor progress of inspections against schedules</li> <li>● Demonstrate experience of access requirements, for example, roadspace booking, track possessions, waterways access, major events, etc</li> <li>● Demonstrate knowledge of the ability to vary frequency of inspections based on a risk based approach, including special inspections</li> </ul>	<p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>A</p>	<p>P</p> <p>P</p> <p>P</p> <p>P</p> <p>P</p> <p>K</p>
C3.2	<p>Planning and Preparing for an Inspection</p> <ul style="list-style-type: none"> <li>● Explain the function and importance of existing records</li> <li>● Demonstrate ability to challenge validity of existing structures records.</li> <li>● Demonstrate awareness of the importance of the structures current assessed capacity</li> <li>● Explain what further information may need to be determined from pre-inspection visit</li> <li>● Demonstrate experience of and an appreciation of the importance of method statements, health and safety considerations and risk assessments in undertaking inspections.</li> <li>● Demonstrate understanding of aspects to be considered in deciding method of access. This may include: consideration of types of access equipment, restrictions/obstructions caused by equipment, lone working, traffic management requirements and routes to be used to and from the site</li> <li>● Explain the types of notifications which may be required prior to gaining access.</li> <li>● Demonstrate an understanding of the range of equipment which may be utilised to undertake an inspection. Range to include: access equipment; PPE; data recording equipment; measuring or inspection equipment</li> <li>● Demonstrate an understanding of the environmental considerations to be taken into account, for example, asbestos, bats, badgers etc.</li> <li>● Explain the process for planning any testing which may be required as part of an inspection.</li> <li>● Outline the key aspects for an inspection method statement.</li> <li>● Demonstrate knowledge of how to cost undertaking inspections, the procurement of 3rd party support and budgetary constraints.</li> </ul>	<p>E</p>	<p>P</p>
C3.3	<p>Performing Inspections</p> <ul style="list-style-type: none"> <li>● Describe a practical approach of undertaking an inspection, highlighting the key aspects.</li> <li>● Explain the reasons and implications of restricted working hours on the process of undertaking an inspection.</li> <li>● Explain the reasons why 'good housekeeping' whilst on site is imperative and what does it involve.</li> <li>● Demonstrate an understanding of the need to escalate potential safety critical defects</li> <li>● Demonstrate an understanding of substandard parapets &amp; road restraint systems</li> <li>● Demonstrate an understanding of communication protocols (for example, who is the Principal Contractor etc) and how to set one up</li> </ul>	<p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>E</p>	<p>P</p> <p>P</p> <p>P</p> <p>P</p> <p>P</p> <p>P</p>

Ref.	Outcome/Skill	I	SI
C3.4	<p>Recording Inspection Findings</p> <ul style="list-style-type: none"> <li>● Demonstrate understanding of the importance of recording defects accurately in terms of type, location, extent, severity and cause.</li> <li>● Outline different methods used for recording defects.</li> <li>● Demonstrate knowledge of the prerequisites of a data capture and inspection proforma.</li> <li>● Be able to explain the importance of 'signing off' an inspection.</li> <li>● Demonstrate knowledge of the principals of an element condition rating process.</li> <li>● Explain the level of detail to be recorded depending upon the type of inspection.</li> <li>● Understand how the accuracy of reporting can affect overall structure condition performance indicators, as well as element condition rating.</li> </ul>	<p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>K</p>	<p>P</p> <p>P</p> <p>P</p> <p>P</p> <p>P</p> <p>P</p> <p>E</p>
C3.5	<p>Interpreting Inspection Findings</p> <ul style="list-style-type: none"> <li>● Demonstrate knowledge of factors which affect whether a structure is safe for use and/or fit for purpose.</li> <li>● Be able to identify possible safety critical defects and report them within the prescribed timescales.</li> <li>● Understanding of the need to utilise existing records to help interpret defects</li> <li>● Demonstrate knowledge of a the range of maintenance works which are commonly recommended following an inspection</li> <li>● Demonstrate an awareness of how defects are managed to identify future maintenance works, based on priority and cost</li> </ul>	<p>K</p> <p>K</p> <p>E</p> <p>E</p> <p>K</p>	<p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>E</p>
C3.6	<p>Maintenance Planning Process</p> <ul style="list-style-type: none"> <li>● Demonstrate understanding of how the data captured from inspections complements other information held for a structure.</li> <li>● Explain the importance of up-to-date and comprehensive data on the condition of a structure with respect to its input to maintenance planning.</li> <li>● Demonstrate an overview of the process for obtaining funding for future maintenance works and how it is value managed.</li> <li>● Demonstrate knowledge of a bridge management system</li> </ul>	<p>K</p> <p>K</p> <p>K</p> <p>K</p>	<p>E</p> <p>E</p> <p>E</p> <p>E</p>
C3.7	<p>Obligations of Current Health and Safety &amp; Environment Legislation</p> <ul style="list-style-type: none"> <li>● Demonstrate understanding of the need to minimise health and safety risks to the public and others who may be affected by the work activities</li> <li>● Demonstrate understanding of the need to minimise health and safety risks to those actually carrying out the works</li> <li>● Demonstrate understanding of the need and breadth of personal protective equipment (PPE) utilised for undertaking inspections for safe working.</li> <li>● Demonstrate understanding and practical experience of managing and applying safe systems of work.</li> <li>● Demonstrate knowledge of relevant legislation and sources of guidance.</li> <li>● Demonstrate understanding of the need to minimise the impact on the environment, seeking expert advice if necessary to identify and implement appropriate working practices and/or mitigation measures.</li> <li>● Experience of having dealt with: <ul style="list-style-type: none"> <li>- utilising access equipment; moving on foot alongside live carriageways; accessing and exiting from traffic management; working at height; working in, on or adjacent to water, railways etc; toxic substances, e.g. lead in paint; lone working; night work; confined spaces</li> </ul> </li> </ul>	<p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>E</p> <p>E</p>	<p>P</p> <p>P</p> <p>P</p> <p>P</p> <p>P</p> <p>P</p> <p>P</p>
C3.8	<p>Other Skills</p> <ul style="list-style-type: none"> <li>● Demonstrate basic knowledge of traffic management practices and relevant reference material, e.g. Chapter 8 of Traffic Signs Manual.</li> </ul>	<p>K</p>	<p>K</p>

## C4 – Defects Descriptions and Causes

### Introduction

This unit outlines the importance and requirements for describing and categorising defects. Emphasis is placed on principal defects are that are likely to be encountered in concrete structures, steel and steel/concrete composite structures, masonry structures and structures built of other materials.

Ref.	Outcome/Skill	I	SI
C4.1	<p>Understanding Principal Defects</p> <ul style="list-style-type: none"> <li>• Demonstrate understanding of the principal causes of defects, including: inadequate structural capacity; substandard clearance etc; naturally occurring damage e.g. scour; accidental or deliberate damage; structural materials deterioration; structural elements functionality e.g. bearings, drainage, expansion joints etc.; failure of water management systems; adequacy and function of parapets &amp; vehicle restraint systems.</li> <li>• Demonstrate understanding of the implications of deterioration</li> <li>• Demonstrate understanding of issues that cause collapses or structure closures, for example, erosion, scour, bridge strikes etc.</li> <li>• Demonstrate knowledge of bridge specific defects</li> <li>• Demonstrate knowledge of culvert specific defects</li> <li>• Demonstrate knowledge of retaining wall specific defects</li> <li>• Demonstrate knowledge of sign/signal gantry and mast specific defects</li> </ul>	E  E K  E E E K	P  P K  P P P E
C4.2	<p>Concrete Defects</p> <ul style="list-style-type: none"> <li>• Demonstrate knowledge of defects caused by structural distress</li> <li>• Demonstrate knowledge of defects arising due to material nature</li> <li>• Demonstrate knowledge of defects caused by external agents e.g. reinforcement corrosion, thaumasite sulphate attack (TSA) etc.</li> <li>• Demonstrate knowledge of defects caused by accidental or deliberate damage</li> <li>• Demonstrate knowledge of defects due to construction or detailing errors</li> <li>• Demonstrate knowledge of defects associated with protective coatings and repair systems</li> <li>• Demonstrate knowledge of minor defects e.g. defects which generally only affect the visual appearance of the concrete</li> <li>• Demonstrate knowledge of defects that can occur in prestressed concrete</li> <li>• Demonstrate knowledge of defects that can occur in post-tensioning systems</li> </ul>	E E E  E E E  E  E K	P P P  P P P  P  P E
C4.3	<p>Steel Defects</p> <ul style="list-style-type: none"> <li>• Demonstrate knowledge of defects caused by structural distress</li> <li>• Demonstrate knowledge of defects arising due to material nature</li> <li>• Demonstrate knowledge of defects instigated by external agents e.g. bimetallic corrosion</li> <li>• Demonstrate knowledge of defects caused by accidental or deliberate damage</li> <li>• Demonstrate knowledge of defects arising due to fabrication errors e.g. poor welds</li> <li>• Demonstrate knowledge of defects associated with protective systems</li> <li>• Demonstrate knowledge of defects associated with closed members</li> <li>• Demonstrate knowledge of defects associated with corrugated steel buried structures</li> <li>• Demonstrate knowledge of defects which affect the whole system, for example, beams with jack arches</li> </ul>	E E E  E E E E E  E	P P P  P P P P P  P
C4.4	<p>Masonry Defects</p> <ul style="list-style-type: none"> <li>• Demonstrate knowledge of defects caused by structural distress</li> <li>• Demonstrate knowledge of defects arising due to material nature</li> <li>• Demonstrate knowledge of defects instigated by external agents e.g. frost, vegetation</li> <li>• Demonstrate knowledge of defects caused by accidental or deliberate damage</li> <li>• Demonstrate knowledge of defects arising due to alterations to masonry structures e.g. concrete saddle etc</li> </ul>	E E E  E E	P P P  P P
C4.5	<p>Defects in Miscellaneous Materials</p> <ul style="list-style-type: none"> <li>• Demonstrate appropriate level of awareness of defects which can occur in other materials: cast iron; wrought iron; aluminium; timber; advanced composites; wire rope</li> </ul>	K	K

## C5 – Investigation and Testing

### Introduction

This unit outlines the background to the range of different testing techniques available. A candidate is required to understand the purpose of undertaking testing, what it involves, the outputs and any other relevant considerations.

Ref.	Outcome/Skill	I	SI
C5.1	<p>The Testing Process</p> <ul style="list-style-type: none"> <li>● Demonstrate an understanding of the need and purpose of testing, and when it is appropriate.</li> <li>● Demonstrate an understanding of the different investigations and testing to examine: <ul style="list-style-type: none"> <li>- structural arrangement and hidden defects; distortion and movement; material properties; deterioration activity; deterioration rate; deterioration cause or potential</li> </ul> </li> <li>● Explain what is required in developing an effective testing programme. <ul style="list-style-type: none"> <li>- setting objectives of testing; identification of testing options; appraisal of testing options; monitor and supervise testing; evaluate results and make recommendations for corrective action</li> </ul> </li> <li>● Demonstrate knowledge of investigation processes, for example, trial holes etc.</li> <li>● Demonstrate awareness of the procurement processes for engaging specialist services</li> </ul>	<p>K</p> <p>K</p> <p>A</p> <p>K</p> <p>A</p>	<p>K</p> <p>K</p> <p>K</p> <p>K</p> <p>K</p>
C5.2	<p>Common Testing Techniques</p> <ul style="list-style-type: none"> <li>● Demonstrate knowledge of common testing techniques, such as: delamination survey; cover surveys; half-cell potential surveys; strain gauges; carbonation test; chloride / sulfate / alkali content; ultrasonic testing; coring; paint film thickness measurements</li> <li>● Demonstrate knowledge of limitations of investigations and tests</li> </ul>	<p>K</p> <p>A</p>	<p>K</p> <p>K</p>

## C6 – Repair Techniques

### Introduction

This unit outlines the importance on understanding the range of repair techniques available.

Ref.	Outcome/Skill	I	SI
C6.1	Repair techniques for concrete structures <ul style="list-style-type: none"> <li>• Demonstrate knowledge of the principal repair techniques for concrete structures. Knowledge to include (but not limited to): materials used for repairs (e.g. sprayed concrete, hand-applied cementitious mortars, epoxy resins etc); methods for inhibiting corrosion (e.g. cathodic protection, impregnation, surface treatments etc); strengthening methods (e.g. plate bonding, composite column wrapping etc)</li> </ul>	K	K
C6.2	Repair techniques for metal structures <ul style="list-style-type: none"> <li>• Demonstrate knowledge of the principal repair techniques for metal structures. Knowledge to include (but not limited to): repairs by plating; member replacement; protective coatings and paints, such as epoxy resins and polyurethane; heat straightening</li> </ul>	K	K
C6.3	Repair techniques for masonry structures <ul style="list-style-type: none"> <li>• Demonstrate knowledge of the principal repair techniques for masonry structures. Knowledge to include (but not limited to): repointing/brickwork repairs; sprayed concrete; retrofitting of reinforcement; anchors; concrete saddle / relieving slabs; stitching</li> </ul>	K	K
C6.4	Repair techniques for 'other' structures e.g. timber <ul style="list-style-type: none"> <li>• Demonstrate knowledge of the principal repair techniques for 'other' materials</li> </ul>	K	K
C6.5	Importance of Routine Maintenance <ul style="list-style-type: none"> <li>• Demonstrate knowledge of the importance of undertaking Routine Maintenance</li> <li>• Demonstrate an understanding of the importance of balancing essential preventative maintenance works</li> </ul>	K K	K K
C6.6	Recommending appropriate repairs <ul style="list-style-type: none"> <li>• Demonstrate experience of recommending repairs appropriate to the identified defects</li> </ul>	E	P

## C7 – General Aptitude

### Introduction

This unit outlines the general aptitude skills required by an inspector.

Ref.	Outcome/Skill	I	SI
C7.1	<b>Practical Aptitude</b> <ul style="list-style-type: none"> <li>● Be able to demonstrate ability to make sound and prudent judgements</li> <li>● Demonstrate excellent attention to detail.</li> <li>● Be able to work to deadlines</li> <li>● Be able to appreciate one's own capability and scope of knowledge</li> </ul>	P P P P	P P P P
C7.2	<b>Working with people</b> <ul style="list-style-type: none"> <li>● Demonstrate experience of having worked successfully in a team</li> <li>● Demonstrate experience of having engaged successfully with 3rd parties and public</li> </ul>	P P	P P
C7.3	<b>Communication skills</b> <ul style="list-style-type: none"> <li>● Be able to interpret drawings and reports</li> <li>● Be able to draw clear sketches</li> <li>● Be able to write reports</li> <li>● Be able to communicate verbally in a clear and comprehensive way.</li> <li>● Be able to demonstrate proficiency in communicating findings from an inspection</li> <li>● Demonstrate range of IT skills</li> </ul>	P P P P P E	P P P P P P
C7.4	<b>Personal skills</b> <ul style="list-style-type: none"> <li>● Demonstrate self-motivation</li> <li>● Be able to decide and set priorities.</li> <li>● Be able to take decisions and have confidence to challenge a situation/decision if necessary.</li> <li>● Demonstrate understanding of knowing one's limitations</li> </ul>	P P P P	P P P P
C7.5	<b>Obligations of Current Health and Safety Legislation</b> <ul style="list-style-type: none"> <li>● Demonstrate knowledge and understanding of current health and safety legislation obligations.</li> <li>● Demonstrate a positive attitude towards health and safety</li> <li>● Demonstrate ability to develop working practices that promote safety and secure the compliance of subordinates.</li> <li>● Demonstrate knowledge and understanding of the importance of method statements and risk assessments</li> </ul>	P P P P	P P P P
C7.6	<b>Management / Supervision</b> <ul style="list-style-type: none"> <li>● Demonstrate ability to manage and motivate teams.</li> <li>● Demonstrate ability to advise and present recommendations to others.</li> <li>● Identify resources required for an inspection</li> <li>● Ensure that inspection activity complies with the appropriate contractual and legal requirements.</li> </ul>	K K E K	P P P P