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EIRSPAN Bridge Management System Routine Maintenance Manual

AM-STR-06055
February 2017

AM Asset Management & Maintenance

Standards

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TII Publications

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1. Description of the Routine Maintenance Module

1.1 Introduction

The Routine Maintenance Manual is produced by Transport Infrastructure Ireland (TII) to describe fully the procedure for undertaking Routine Inspections and Maintenance and inputting data into the database of the EIRSPAN Bridge Management System.

The Routine Inspection and Maintenance manual is primarily a reference document for all parties involved in the management of bridges on the national roads including TII, Local Authorities, PPP Concessionaires, Bridges Term Maintenance Contractors and Motorway Maintenance and Renewals Contract (MMARC) Contractors, and successors. It is expected that the reader will have access to the EIRSPAN database.

1.2 Scope

Routine Inspections are a frequent, superficial checking of a structure. They are carried out to ensure day to day traffic safety and also to avoid or delay the development of structural deterioration.

Routine Maintenance comprises simple remedial works frequently or periodically required.

The purpose of this manual is to describe in detail how Routine Inspections and Maintenance is carried out in the EIRSPAN system. Furthermore, this manual describes how to input the data into the EIRSPAN database.

The EIRSPAN system is applicable to all structures with a total length (span) of 2.0m or greater and retaining walls with a retained height greater than 1.5m.

2. Description of the Routine Inspection and Maintenance Activities

2.1 Introduction

As soon as a structure has been constructed and put into service, its deterioration begins. The deterioration is due to ageing and the impact from the environment, the climate and daily traffic.

The purpose of the Routine Inspection and Maintenance is to:

- Ensure day-to-day traffic safety and serviceability.
- Avoid or delay the development of deterioration (preventive maintenance).
- Bring back a structure or a structural component to an acceptable maintenance condition.

The aims are achieved by frequent routine inspections to record possible damage or deterioration and subsequent execution of routine maintenance works.

The Engineer, assisted by the Road Supervisor and the Maintenance Crew or Contractor, is responsible for undertaking Routine Inspection and the Routine Maintenance. For further information on the Bridge Management structure, reference should be made to Chapter 4 of this manual.

2.2 Routine Inspection

Two types of regular routine inspections with different frequencies and extents will be carried out:

- The Roads Supervisor inspection.
- The Engineer inspection.

In addition to the above, the foreman of the Maintenance Crew shall check the condition of the structures as part of his duties.

The Roads Supervisor inspection shall be carried out at least once a week. It is an inspection of the structure from the roadside (from a car) and will be a part of the regular check of the road section in question. Further information on the Road Supervisor's Inspection is provided in Chapter 3.

The Engineer Routine Inspection shall be carried out by the Engineer at least once every year, and furthermore after an event of significance, such as flooding or collision at a structure site. The inspection will include a check of all visible structural components.

During the inspection the Engineer shall register the specific needs for:

- Routine maintenance.
- Principal inspection.

If the Engineer observes serious damage and is uncertain of its consequences, a Principal Inspection should be requested. The form for request of Principal Inspection (Appendix I) will be filled in and handed over to the Bridge Manager for further action to be taken.

The need for routine maintenance for each component is registered on specially prepared report forms.

2.3 Routine Maintenance

There are two types of works:

- Routine Maintenance works.
- Non-Routine Maintenance works.

Routine Maintenance Works are carried out at regular intervals and include activities such as:

- Cleaning of the drainage system.
- Repair of impact damage to bridge parapets/safety barriers.
- Sweeping of carriageway.
- Cutting of vegetation growth on Revetments/Embankments adjacent to the bridge.

Non-Routine Maintenance Works are carried out at irregular intervals and usually according to previous reporting of isolated incidents, such as collisions or erosion damage due to unusual weather. This will in most cases lead to a recommendation for a Principal Inspection (Appendix I).

The complete list of routine maintenance works appears in Appendix B.

The data from the routine inspection is input into the database, and used to print out work orders for the Maintenance Crew or Contractor.

When the Maintenance Crew or Contractor carries out the routine maintenance activities, the Crew Foreman or the Roads Supervisor should perform a visual inspection of the entire structure. They must report any new damage or deterioration including ordered but not yet completed works, to the Engineer for further action.

The routine maintenance works shall be carried out in accordance with the work specifications of Appendix J.

2.4 The Routine Inspection and Maintenance Module

Within the EIRSPAN Routine Maintenance Module various routine maintenance works have been identified and categorised for all structural components.

When a Routine Inspection has been undertaken the Inspector enters into the database the amount (total and expected quantities) and nature of the maintenance work required for each structure component. Having entered the above data the Routine Maintenance Module can serve as a tool for the management of the structure in the following manner:

- Work order forms are being created regularly for each structure in order that all maintenance works are executed and that no structural components or structures are left out.
- The works are being carried out at appropriate times (neither too often nor too late).
- An appropriate planning of the work by grouping the work orders, for example into roads, Maintaining Agents, maintenance activities.
- An optimisation of the purchase of materials.
- The preparation of overviews and budgets for routine maintenance works (Bills of Quantity) once the unit prices for each work are known.

The Routine Maintenance Module shall be implemented in the whole of Ireland and for every local authority, PPP Contract, Term Maintenance Contract and Motorway Maintenance and Renewals Contract (MMARC) Contract, and successors.

The Routine Maintenance Module will be implemented separately in each Maintaining Agent, and the central co-ordination of the TII will perform an overall management of all the information.

In the Appendices, various reports for a structure illustrate the use of the Routine Maintenance Module.

For further details on creation and updating of all the data in the Routine Maintenance Module, reference should be made to Chapter 5.

3. Execution of the Routine Inspection and Maintenance Activities

3.1 Introduction

This chapter gives a detailed description of:

- The activities of the Routine Inspection and Maintenance.
- The data to be registered stored and updated in the Routine Maintenance Module.
- The different types of reports that can be prepared by the module.
- How the Routine Maintenance Module is used for the management of the Routine Inspections and Maintenance activities.

3.1.1 Objectives

The objectives behind the Routine Inspections and Maintenance Works are:

- Ensure day-to-day traffic safety and serviceability for the road users.
- Delay the development of deterioration (preventive maintenance).
- Bring back a structure or a structural component to an acceptable condition of maintenance.

The aims are achieved by frequent routine inspections to record possible damage or deterioration, and subsequent execution of routine maintenance works.

3.1.2 The Routine Inspection and Maintenance Module

The EIRSPAN Routine Maintenance module can be used as a tool for the management of the routine inspections and routine maintenance activities once the following data for each structure has been created and entered into the system:

- The components to be maintained.
- The amount (total and expected) of works related to the individual components.
- The materials to be used for the works.

The use of the EIRSPAN Routine Maintenance Module will, with the afore-mentioned data, allow the following to be undertaken:

- Work order forms to be printed out for each structure regularly, in order that all maintenance works are carried out, and that no components or structures are left out.
- Works to be carried out at appropriate times (not too often or too late).
- An appropriate planning of the work by grouping the work orders, for example into roads, Maintaining Agents, maintenance activities.
- An optimisation of the purchase of materials.
- Overviews and budgets for routine maintenance works to be prepared (Bill of Quantity) knowing the unit price for each work.

Transport Infrastructure Ireland has classified the stock of structures by Maintaining Agent. All Maintaining Agents will be provided with access to the web-based version of the EIRSPAN database.

This will allow each Maintaining Agent to input data directly onto the central database. Overall management of all data and upgrading of the system will be handled by Transport Infrastructure Ireland centrally.

3.2 Routine Inspection

The objective of the Routine Inspection is to ensure that road traffic safety shall be maintained at all times, and that the impact from the environment and the traffic on the structures shall be checked.

To achieve this aim the structures shall be frequently inspected and routine maintenance works ordered and carried out, all with the intention to keep the operational efficiency of the structures intact and to avoid the development of serious and costly damage.

3.2.1 Types of Inspections

The routine inspection will be carried out on three levels:

- The Road Supervisor inspection.
- The Engineer inspection.
- The inspection by the foreman of the Maintenance Crew or contractor.

The interrelationship between these activities is detailed in a flowchart in Appendix K.

3.2.2 The Roads Supervisor Inspection

The Roads Supervisor inspection of the structures is performed as part of the inspection of the actual road section. The inspection includes a check of structure components that are directly visible from the Supervisor's vehicle. The inspections are carried out at least once a week.

When the Roads Supervisor passes a structure, he/she must check whether damage and/or deterioration has occurred, for example:

- Damages on the carriageway, expansion joints, parapets and railings due to impact from traffic.
- Signs of settlements or displacements of structural components such as Revetments, Wingwalls/Spandrel Walls/Retaining Walls and approach slabs.
- Erosion of Revetments and shoulders.
- Deposits and other objects that may affect the traffic safety.

If the Roads Supervisor observes damage influencing the function or safety of the structure he/she should carry out a closer investigation. He/she shall note the type, extent, and, if possible, the cause of the damage. Also he/she shall evaluate if the damage is likely to develop further in the near future. If deemed necessary, he/she should arrange for emergency sign posting. Finally, he/she should report the damage as soon as possible to:

- The Local Authority Engineer, and
- The Gardaí (if hazards to the road users is likely to occur).

A complete description of the inspection is provided in Appendix H, Road Supervisor Instruction.

A typical Road Supervisor's Inspection Report can be seen in Appendix H.

On receipt of the Road Supervisor's Inspection Report the Engineer should carry out the following:

- The Engineer should carry out an inspection on the structure in question and recommend maintenance works if necessary. If maintenance works are required the 'Works to carry out' list should be revised and re-issued to the Supervisor for action.
- If the defect requires further investigation the Engineer should bring this defect to the Bridge Managers attention by means of the Principal Inspection Recommendation Form.

3.2.3 The Engineer Inspection

The TII/Local Authority/PPP/MMaRC Engineer will carry out, at least once every year or at intervals defined by Transport Infrastructure Ireland, a Routine Inspection of all the structures in the region concerned. This inspection will be the basis for registering the structural routine maintenance works for the coming year.

Between these annual inspections the Engineer will supervise the ongoing works on site.

The Engineer must inspect the bridge, not only from the road, but also from the crossing passage, by going down under the bridge or up on the bridge, respectively.

A superficial visual inspection of all the structure components once every year will determine the need for maintenance activities such as:

- Spot-painting of steel structures, and handrails, barriers and parapets.
- Repair of areas with damaged (spalled or cracked) concrete or masonry.
- Repair of damaged surfacing over a structure.
- Filling and reshaping eroded Revetments.
- Removal of vegetation.
- Removal of graffiti.

Works such as complete reconstruction of the superstructure, the pavement, expansion joints, safety barriers and bearings, and substantial repairs that constitute improvements are identified in the Principal or Special Inspection reports. These types of works are generally classified as major works and would usually be financed from sources other than the maintenance budgets.

In the event of particular incidents such as flooding or collision, the Engineer shall make a supplementary routine inspection. If the damages are estimated to be critical or will be so within a short time, the Engineer must call for a principal inspection, using, for this purpose, the Principal Inspection Recommendation Form shown as Appendix I. The form will be handed over immediately to the Regional Bridge Manager of the TII for further action.

The form should include a description of the damage and its background, and state the reason for a principal inspection. The description must give adequate information on the damage type and cause, location, extent and severity. A sketch and a series of photographs will often illustrate the case better than many words, therefore such material should always be enclosed with the Principal Inspection Recommendation Form.

3.2.4 The Initial Inspection

For the initial routine inspection the Engineer will prepare an Inventory form for Routine Inspection. For every structure to be inspected the engineer will then make copies of this form. For printing out the report, reference should be made to Chapter 5, “User’s Guide to the Database”.

During the inspection the Engineer will review all the structure components in accordance with the inventory form, and fill in data for those components that require maintenance. For each component the type of required work must be stated, together with the total and the expected quantity of work.

The quantity of a specific maintenance activity to be executed must be measured on site (the expected quantity) together with the total possible amount of each type of maintenance work for each component (total quantity).

For components which exist but for which no maintenance works are to be executed in the initial year, the total and expected quantities must both be filled in as 0 (zero). It is very important for the future use of the system that all components for which future maintenance work can be foreseen are registered at the initial inspection, even with zero work.

As mentioned in Chapter 2 of this manual, various types of routine maintenance works have been identified and categorised for each component in the database. When creating data for the module, the Engineer will state the quantities (total and expected) and nature of work related to the individual components. If the Engineer, during the inspection, finds the need for works which are not included in the standard list of maintenance works then works should be recorded using Work No.99 ‘Miscellaneous Work’ and the remarks field used to explain the work required.

If the Engineer observes serious damages and is uncertain of its importance with regards to safety and repair costs, a principal inspection must be requested. The Principal Inspection Recommendation Form (Appendix I) can be used for this purpose. The form will be handed over to the Regional Bridge Manager of TII for further action.

When these initial routine inspections have been completed, the introduction of data to the Routine Maintenance Module will take place as described in Section 3.4, “Maintenance Works Data Entry ”.

3.2.5 Routine Inspection in General

Every time the Engineer is to carry out the subsequent routine inspections, the report from the previous inspection will be produced for each structure. An example is shown in Appendix D. For printing out the Report refer to Chapter 5.

The printed report contains all components which have been registered for maintenance works at the initial inspection (or last inspection) and components registered with a 0 in total and expected quantities. Furthermore the report describes the works to be executed and the materials to be used.

With the Inspection Report at hand, the Engineer will now initiate the new routine inspection. The engineer fills in by hand corrections to the expected/total quantities, if any, for each recorded maintenance work item for each component. ‘If maintenance works are required and the Works No. and description is not detailed in the previous inspection report then the Works No. and description shall be added, together with the expected and total amounts.

New maintenance works must be filled in by hand during the inspection. It will be a great help for the engineer to have a copy of the Routine Inspection inventory form on the site in order to obtain an overview of the components with the possible works to choose from see Appendix C. Total and expected quantities must be entered for newly recorded maintenance works.

Request for a Principal Inspection must be registered under ‘Remarks’. The recommendation form must be filled in also (Appendix I).

When the inspections are finished the Engineer records the data in the Routine Maintenance Module as described in Section 3.4, Maintenance Works Data Entry.

As a general rule, all components should be measured at the initial inspection for total quantities.

3.2.6 The Maintenance Crew Inspection

When the maintenance crew (or a contractor) executes routine maintenance works, the foreman or engineer in charge shall perform a visual inspection of the entire structure. Any new damage or deterioration must be reported to the Engineer, together with information on ordered but not yet accomplished works on the structure. A form for this is included as an appendix to the work orders (Appendix E).

3.3 Routine Maintenance

The objective of routine maintenance is to undertake cleaning and minor maintenance works to avoid or delay the development of deterioration.

3.3.1 Types of Works

Routine maintenance works include many relatively uncomplicated works that should be executed periodically and generally using simple tools and equipment.

Examples of structural routine maintenance works are:

- Replacement or refilling of bituminous joints.
- Cleaning of expansion joints, gullies and manholes and similar openings in the bridge surface.
- Repair of damaged safety barriers, parapets, expansion joints, pavement etc., in order to eliminate safety hazards.
- Sweeping of bridge bearing shelves.
- Sweeping of bridge carriageway.
- Cleaning of drainage system.

3.3.2 Work Specification

To ensure correct and uniform execution of routine maintenance works, a “Work Specification” has been prepared for this Manual.

The “Work Specification for Routine Maintenance Works” is shown as Appendix J.

3.3.3 Tender

In the case of a Contractor being employed for the execution of the maintenance works, a Bill of Quantities can be prepared and used as part of the tender documents (Appendix G). It will be the responsibility of the Regional Bridge Managers to update this section of the module. Engineers will not be required to contribute to this section.

3.3.4 Work Order

A work order form, “Works to Carry Out” is submitted to the maintenance crew or contractor. The form contains a description of the work to be executed for each component, including the description of products.

The total and expected quantities are printed out for all works.

After the work is completed the' total amount of work carried out (measured) including completion date should be filled in (by hand) by the maintenance crew foreman or the contractor's engineer (Appendix E) before leaving the structure. This updated report "Works to Carry Out" must be handed over to the Engineer for further action.

3.4 Maintenance Works Data Entry

This Section describes in detail the information to enter into the data fields in the EIRSPAN database. Instructions for operating the Routine Maintenance Module is outlined in Chapter 5, "User's Guide to the Database".

When collecting data at the structure site, the engineer will use registration forms as shown in Appendices 3 and 4.

3.4.1 Structural Components

Each structure comprises thirteen standard components and a fourteenth component 'Structure in General'. A total overview of the components appears in Appendix A.

New components can only be created and entered into the EIRSPAN system by the structure management of TII. A number, name and abbreviation will describe any new components.

3.4.2 Maintenance Works

Work numbers and descriptions have been allocated to each component. A total overview of all work numbers and descriptions for each component is found in Appendix B.

New maintenance works can be created and entered into EIRSPAN only centrally by the structure management of TII. Works are characterised by number, name, abbreviation, unit and unit price, and a description.

3.4.3 Inventory Form for Routine Inspection

For the initial routine inspection the Engineer will print out one inventory form for routine inspection as described in Chapter 5.

For each structure to be inspected, the engineer will make copies of this form, as seen in Appendix C. As the first step, the inspector fills in the structure number and name in the upper part of the form.

The inventory form contains all possible components for a structure with related maintenance works for each component given by a number, name and unit. During the inspection, the engineer must go through all the structure components.

Components that need maintenance works must be registered with total and expected quantity in the same line for the actual work needed. The quantities must be measured on site. The total quantity corresponds to the total amount of the component that exists on the structure and the expected quantity is the amount to be executed. More than one work may be registered for each component.

For components that exist but for which no maintenance works are to be executed the initial year, the total and expected quantities must be filled in as 0 (zero). It is very important for the future use of the system that all possible components with permanent maintenance work are registered at the initial inspection (even with 0).

If the inspector during his inspection observes serious damage to a structure component and is uncertain of its importance in relation to safety and/or repair costs, a principal inspection will be called for, using the Principal Inspection Recommendation Form of Appendix I.

3.4.4 Work Orders

This form is used to record the need for maintenance work for each structure. Once the data for a structure has been completed, in general it should not be changed, except for modifications of expected quantities.

The work orders may be considered as a type of inventory for the maintenance data. From this program the inspection list and the actual work to be carried out in a given year for each structure is generated.

A work order lists a component by number and name, a specific work by number and name, plus quantities and date for the inspection. For each 'maintenance work item the engineer shall record a description of the location for the work.

3.4.5 Routine Inspection List

Before the Engineer carries out the routine inspection of a structure, an inspection list must be printed out for each structure, as indicated in Chapter 5. An example for a typical structure is shown in Appendix D.

The routine inspection will be performed as described above. When the inspection is completed, the data must be entered into the EIRSPAN database. The inspector types in new registered or measured expected quantities for all maintenance works including an updating of the total quantities, if any, in the programme 'Work orders' under the menu item 'Details', as explained in Chapter 5.

3.4.6 Works to Carry out

The Engineer prints out the report with work orders for each structure and for all the corresponding works to be executed by the maintenance crew or a contractor for a given year. An example of this report, "Works to carry out" is shown in Appendix E. Instructions on how to prepare the report are given in Chapter 5 of this Manual.

The report gives the total and expected quantity for all registered components with related works to be executed on site for the fiscal year.

During the carrying out of maintenance works on a structure, the maintenance crew foreman or the contractor's engineer must state in the report the amount carried out for each component and details of the related work. During the supervision of the work the Engineer will verify the accuracy of the data.

The recording of the data for the executed works into the database is undertaken in the programme 'Work orders' under the menu item 'Details', as seen in Chapter 5.

The data for each component and related work are entered into the screen picture for 'Work carried out' as described in Chapter 5. The completion date, informed by the maintenance crew foreman or the contractor's engineer, is entered into the database.

The entered data can be used for future reference and budget planning (quantities, costs, etc.).

3.5 Reports

It is possible to make various standard reports on the data input into the EIRSPAN Maintenance Module.

For instructions on how to prepare the reports, reference should be made to Chapter 5. For most types of reports the user may choose reports covering the whole of a Maintaining Agent, one specific road or one particular structure.

Centrally, in Transport Infrastructure Ireland, it is possible to produce reports for all Maintaining Agent combined, one specific Maintaining Agent, a road or a structure. The header of the report will show which selections have been made.

In the following sections each of the standard reports is described. In the appendices examples of reports are shown. These reports are prepared by means of the Routine Maintenance Module.

3.5.1 List of Components

This report states all the possible structure components, by name and number, to be maintained. New components can and will only be created centrally by the TII structure management. Every component has an abbreviation used in the screen pictures. The report is ordered from the menu item 'Report of components'. Appendix A shows a list containing all the components in the EIRSPAN Routine Maintenance Module.

3.5.2 List of Components and Works

This report gives a total overview of the maintenance works to be executed for each specific component. New maintenance works can and will only be created centrally by the TII structure management. A name, an abbreviation, a number, a unit and a unit price will define each of the works. The TII structure management establishes the units and the unit prices.

The report is created by the menu item 'Report of components and works / List'. An example giving all components and related works in the EIRSPAN Maintenance Module is shown in Appendix B.

3.5.3 Inventory Form for Routine Inspection

This report is used for the first inspection only for each structure. It lists all the components with related maintenance works to choose from, and includes space for name and number of the structure, and for the introduction of the total and expected quantities for each maintenance work item. All existing components of the structure for which maintenance activity can be foreseen (the first year or in the future) should be registered at the initial inspection. The report is created in the menu item 'Report of components and works / Inventory form'. An example of an initial report is enclosed in Appendix C.

3.5.4 Inspection List

This report is used for the yearly routine inspection of a specific structure. The report contains all components with related maintenance works and the total possible quantity for each work. Furthermore, the work to be executed on a component, together with a product suggested for use, is stated. The report is created in the menu item 'Work orders / Inspections list – all works'. An example of an inspection list is shown in Appendix D.

3.5.5 Works to Carry out

This report is prepared after the completion of the inspection and after the inspection data has been entered into the database and is handed over to the maintenance crew or the contractor prior to maintenance works being carried out. It contains a description of the work to be executed for each component. The total and expected quantities are given for all works. The foreman of the maintenance crew or the engineer of the contractor will measure the amount of work actually undertaken, which may vary from the expected quantity on occasions, and write by hand on the printed 'Works to carry out' form the total amount of work done on each component as measured, and the execution date. The report is created in the menu item 'Report of work orders / Works to carry out'. An example is enclosed in Appendix E.

3.5.6 Works Carried out

After the Works have been completed and the Engineer has measured the Works he shall update the database by entering the quantity of work carried out for each item and a date on which the work was carried out. This report can be prepared for each structure once all the data for total expected and carried-out quantities of work have been recorded in the database. The report gives for each structure a total overview of the components including the quantities carried out and date of execution of the Works'. The report is created in the menu 'Report for work orders / works carried out'. An example of the report is shown in Appendix F.

3.5.7 Bill of Quantities

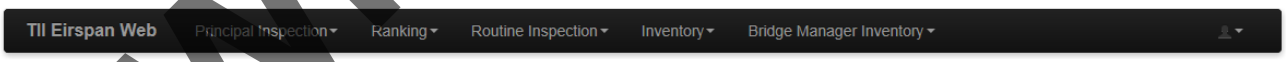
This report can be prepared for one Maintaining Agent, one road, one specific structure, or for the whole country (the latter option only by the TII structure management). The report can be used in connection with tendering of routine maintenance works, or to prepare a cost estimate. It adds up all active works (expected quantities) to be executed on all the components for a given structure, a road, all the structures of a Maintaining Agent or in the whole of Ireland. It is possible to select particular Works items to be included in the Bill of Quantities. The report can be printed out from the menu item 'Report of Bill of quantities' (for the whole country) or from the menu 'Report of selected part of BOQ'. An example of this report type is found in Appendix G.

3.6 Activity Plan

3.6.1 The First Year

To give a brief overview of all the activities to be carried out through the first year after a structure has been commissioned, the following is stated as a guideline for the engineers responsible for the routine inspections and the subsequent routine maintenance:

1. The TII database administrator will set up relevant personal in relevant Maintaining Agents with the appropriate database user profile to facilitate data entry into the Routine Maintenance Module. User profiles are listed in Figure 3.1.
2. Each Engineer shall familiarise himself/herself with all structures within his/her area. Principal Inspection Reports can be printed from the Principal Inspection module.
3. Prior to carrying out a routine inspection the Engineer shall print the Inventory form. Details on how to do this is given in Chapter 5.
4. The Engineer shall also print a copy of the List of Components and Works with description of works for reference purposes. Details on how to do this is given in Chapter 5
5. The inspection of structures is carried out with 'total quantities' and 'expected quantities' filled in for each maintenance works item.
6. The information gathered during the inspection is input into the database. Components, works, products, date of inspection, total quantities and expected quantities fields are filled in for each structure.
7. The 'works to carry out' report is prepared for each structure and is handed over to the Road Supervisor/Foreman. The works listed on this form shall be completed by the maintenance crew.
8. The work will be carried out according to the 'Works to carry out' form. Quantities carried out will be entered by hand on the printed 'works to carry out form' and the work done signed for. The revised data including the carried out quantities and date on which the works were carried out is entered into the database. Finally, the "Works carried out" report should be printed, as reference for future activities.



Roles

Description	Principal Inspection	Inventory	Routine Maintenance	Ranking	Bridge Manage Inventory	Third Party Inventory	Third Party PI	System
Bridge Manager	W	W	W	W	W	N	N	N
DBA	W	W	W	W	W	N	N	W
LocalAuth	R	R	R	N	N	N	N	N
MMarc	R	R	W	N	N	N	N	N
PPP	W	W	W	N	W	N	N	N
ThirdPartyPI	R	R	N	N	N	W	W	N
ThirdPartyPI_RI	R	R	W	N	N	W	W	N
ThirdPartyRI	R	R	W	N	N	N	N	N

Figure 3.1: Database User Roles showing 'Write' and 'Read Only' access

3.7 Year 2 and Beyond

To give a brief overview of all the activities to be carried out through a year subsequent to the first year with regards to the Routine Inspection and Maintenance activities, the following is stated as a guideline for the engineers responsible for the routine inspections and the subsequent routine maintenance:

1. The database will be prepared for a new year. Maintenance data from last year can be printed for record purposes. The database does not store historic routine inspection reports. The data will be collected on the inventory forms.
2. All expected and carried out quantities from the last year in the work orders should be deleted.
3. The inspection lists for each structure will be created in Routine Inspection/Work Order/Inspection List All Works.
4. The inspection lists will be printed.
5. The inspections are carried out, filling in quantities expected by hand on the Inspection List. Works to carry out' form is generated and printed, and handed to the Foreman for action. It should be checked and made sure that the work orders are correct and complete.
6. The work will be carried out according to the 'works to carry out' form. Quantities carried out will be entered by hand on the printed 'works to carry out form' and the work done signed for. The revised data including the carried out quantities and date on which the works were carried out is entered into the database. Finally, the "Works carried out" report should be printed, as reference for future activities.

4. Bridge Management Structure

4.1 Introduction

There is a diverse network of organisations involved in managing bridges on Motorways, National Primary and National Secondary roads in Ireland:

Transport Infrastructure Ireland

The organisation of EIRSPAN in Transport Infrastructure Ireland's Central Office involves the following persons:

- Senior Project Manager (Structures) – Leads the TII structures section.
- Senior Engineer (Structures - Bridge Management) – Responsible for TII bridge management.
- 3 Regional Bridge Managers – (Leinster, Munster and Connaught/Ulster), help to implement bridge management in the regions
- Database Administrators –maintains the EIRSPAN database.

Public Private Partnership Concessionaires

- Implement bridge management on PPP structures.

Local Administrations (County and City Councils)

- Area Engineers and Maintenance Crews – Assist in regional bridge maintenance

Motorway Maintenance and Renewals Contract (MMaRC) Contractors

- Engineers and Maintenance Crews – Assist in bridge maintenance on MMaRC network.

4.2 Responsibility

In the following, the responsibility for the different activities related to the EIRSPAN Routine Inspection and Maintenance module is described.

Transport Infrastructure Ireland

The TII Senior Project Manager and Senior Engineer (Structures) are responsible for the overall implementation of the EIRSPAN programme.

Regional Bridge Managers

The Regional Bridge Managers will, in connection with the Routine inspection and maintenance activities, be responsible for:

- Training of the Engineers in the EIRSPAN Routine Activities.
- Follow-up on principal inspections recommended by the Engineers.
- Control the quality of the performed routine maintenance as a part of the principal inspection.

Maintaining Agents (Local Authority/PPP/MMaRC)

The Director of Services/Senior Engineer of a Maintaining Agent is responsible for the implementation of the EIRSPAN system within the relevant Maintaining Agent, with regards to:

- Technical performance.
- Budgets.
- Resources for the Engineers.

The Engineer has the following responsibilities in the Maintaining Agent concerning the activities of Routine Inspection and Maintenance:

- Perform routine inspections of all bridges in the Maintaining Agent (at least once a year) for registration of needs for routine maintenance works for the next year.
- Planning of the execution of the routine maintenance works.
- Record the routine inspection data into EIRSPAN.
- Prepare cost estimates and budgets for maintenance works for all bridges.
- Report the need for principal inspections to the Bridge Manager.
- Manage the routine maintenance works (handover of work orders to the Maintenance Crew), after approval of budgets from the TII Central Office. Supervise the activities of the Maintenance Crew.
- Report the accomplished maintenance works to the Maintaining Agent management.
- Inform the Regional Bridge Manager of urgently needed repair works (for safety reasons, or if repair is vital for the bridge).
- Update and maintain the information in the Routine Maintenance module of the EIRSPAN database.
- Arrange training of Maintenance Crews and Overseers.
- Control the Road Supervisor's structure inspection.

The Roads Supervisor has the following duties:

- The daily routine inspection (performed when passing the structure during the road inspection).
- Report to the Engineer (and possibly the Gardaí) if a sudden failure, or risk of failure, is observed.

The Maintenance Crew foreman is responsible for:

- The execution of routine maintenance works in accordance with specifications and work orders for each structure.
- Reporting accomplished works to the Road Supervisor.
- Reporting to the Road Supervisor the need for further maintenance observed during the execution of maintenance works.
- Routine inspection during the performance of maintenance works.

5. User's Guide to the Database

5.1 Introduction

The EIRSPAN database for Motorway and National Road bridges is a web-based system maintained by the Transport Infrastructure Ireland. Usernames and passwords are provided by TII to Regional Bridge Managers, PPP Companies and third parties including consultants who undertake inspection work on behalf of TII. User rights and access to particular parts of the database for each type of user will be defined by TII.

The "Routine Inspection" module can be selected from the system menu screen of EIRSPAN. All the following functions will be initiated from this drop down menu (Figure 5.1).

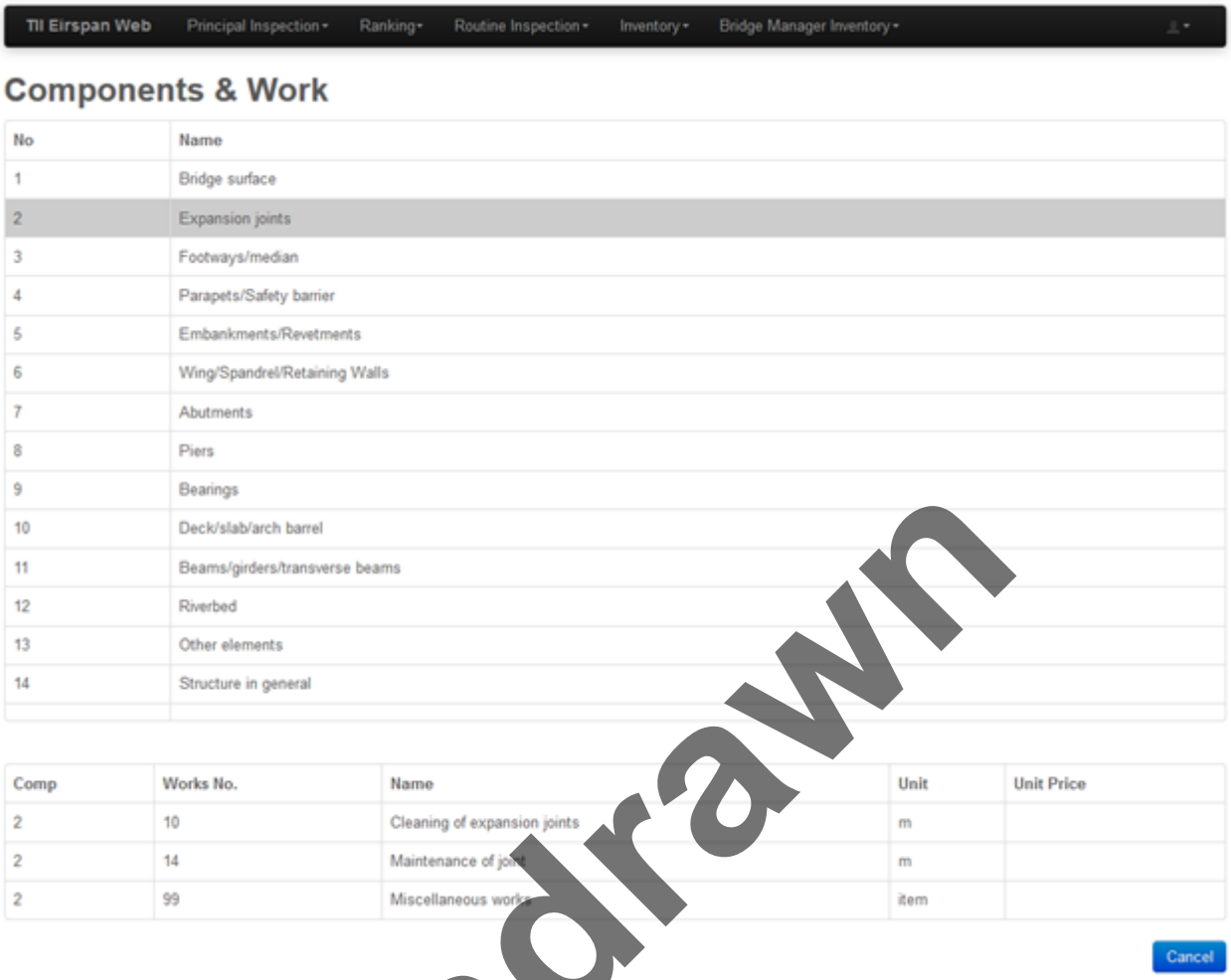
Figure 5.1 Routine Inspection, main screen

5.2 Components and Works

This function is used for creating or updating the list of components and works. The user must choose the item 'Components and Works' from the "Routine Inspection" drop down menu. Only the TII Database Manager can change items relating to components and works.

5.2.1 Overview

The components and works are shown in two selection tables as seen from Figure 5.2. When you select a component in the first table, the corresponding list of works relating to that component are listed in the second table.



No	Name
1	Bridge surface
2	Expansion joints
3	Footways/median
4	Parapets/Safety barrier
5	Embankments/Revetments
6	Wing/Spandrel/Retaining Walls
7	Abutments
8	Piers
9	Bearings
10	Deck/slab/arch barrel
11	Beams/girders/transverse beams
12	Riverbed
13	Other elements
14	Structure in general

Comp	Works No.	Name	Unit	Unit Price
2	10	Cleaning of expansion joints	m	
2	14	Maintenance of joints	m	
2	99	Miscellaneous works	item	

Figure 5.2 Components and works.

5.3 Work Orders

This function is used to update or create the work orders for a structure. Once the data for a structure is complete it should normally not be subject to any changes except from the data fields with 'Expected' and 'Carried Out' quantities. The work orders are the basic data from which the 'List of Inspections' and actual 'Works Orders' for any given year is generated.

The user must choose the function 'Work order' from the "Routine Inspection" drop down menu.

5.3.1 Overview

The structure will be selected from the Structure List by highlighting the structure and clicking on "Select" (see Figure 5.3). Once the structure has been found and selected, all work orders for that structure will be shown on a list (see Figure 5.4). If no work orders exist for the structure the selected table will be empty (see Figure 5.5).

TII Eirspan Web | Principal Inspection | Ranking | Routine Inspection | Inventory | Bridge Manager Inventory

Structures

Reg No	Structure Id	Structure Name	Structure No.	Primary Passage Name
	KK-N			
506	KK-N10-008.00	Ossary Bridge	008.00	Danesfort, County Kilkenny - Rathcash, Co Kilkenny
3653	KK-N10-009.00	Pococke River Bridge	009.00	Danesfort, County Kilkenny - Rathcash, Co Kilkenny
3654	KK-N10-010.00	Leggetsrath East Access Under Pass	010.00	Danesfort, County Kilkenny - Rathcash, Co Kilkenny
3655	KK-N10-011.00	Lyrath Culvert	011.00	Danesfort, County Kilkenny - Rathcash, Co Kilkenny
3656	KK-N10-012.00	Templemartin Over Bridge	012.00	Danesfort, County Kilkenny - Rathcash, Co Kilkenny
3657	KK-N10-013.00	Kilkenny Link Existing N10 Under Bridge	013.00	Danesfort, County Kilkenny - Rathcash, Co Kilkenny
3658	KK-N10-014.00	Ballynamona Culvert	014.00	Danesfort, County Kilkenny - Rathcash, Co Kilkenny
3659	KK-N10-015.00	Rathgarvan Over Bridge	015.00	Danesfort, County Kilkenny - Rathcash, Co Kilkenny
844	KK-N24-002.00	Ballynamountain Bridge	002.00	Limerick - Waterford
2535	KK-N24-005.00	Turkstown Farm Pass	005.00	Limerick - Waterford

1 of 6 pages

Select

First | Previous | Next | Last

Figure 5.3 Structure Look Up

TII Eirspan Web | Principal Inspection | Ranking | Routine Inspection | Inventory | Bridge Manager Inventory

Work Order

Registration Number: 844

Structure ID: KK-N24-002.00

Structure Name: Ballynamountain Bridge

	Component		Work	Total Quantity	Expected Quantity	Carried Out Quantity	Carried Out Date	Inspection Date
1	Bridge surface	15	Maintenance of kerb stones	0				26-9-2003
1	Bridge surface	16	Patching of potholes	0				26-9-2003
1	Bridge surface	20	Pavement Remedial Works	0				26-9-2003
1	Bridge surface	21	Sweeping and cleaning	36				26-9-2003
1	Bridge surface	30	Cleaning of drain gullies	2	2	2	1-11-2008	26-9-2003
1	Bridge surface	32	Establish drainage facility	0				26-9-2003
1	Bridge surface	34	Hosing of drainage system	0				26-9-2003
1	Bridge surface	99	Miscellaneous works	1				26-9-2003
4	Parapets/Safety barrier	03	Removal of vegetation	42	21	24	1-11-2008	26-9-2003
4	Parapets/Safety barrier	54	Maintenance of bedding mortar	0				26-9-2003
4	Parapets/Safety barrier	55	Repair of parapet	0				26-9-2003
4	Parapets/Safety barrier	60	Masonry repointing	42	13	20	6-9-2006	26-9-2003
4	Parapets/Safety barrier	61	Masonry repair	7.2	7.2	5.8	24-11-2007	26-9-2003
5	Embankments/Revetments	03	Removal of vegetation	60	60	60	1-11-2008	26-9-2003
5	Embankments/Revetments	45	Maintenance of slope protectio	0				26-9-2003
5	Embankments/Revetments	47	Reshaping (imported materials)	0				26-9-2003

Figure 5.4 Work Order List (Populated).

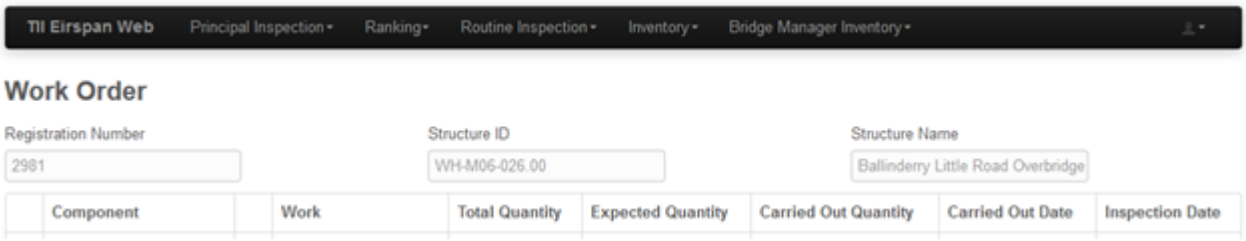


Figure 5.5 Work Order List (empty).

5.3.2 Creating New Work Orders

When creating new work orders for a structure the 'Add' function is used. This will open the dialogue box as shown in Figure 5.6. All fields are completed as appropriate and data is saved by selecting the 'Save' button. The new work order will now be shown on the 'Overview' tab.

For the initial Routine Inspection all fields with the exception of carried out quantities and date should be completed. These fields will be completed once Routine Maintenance works have been completed on this particular structure.

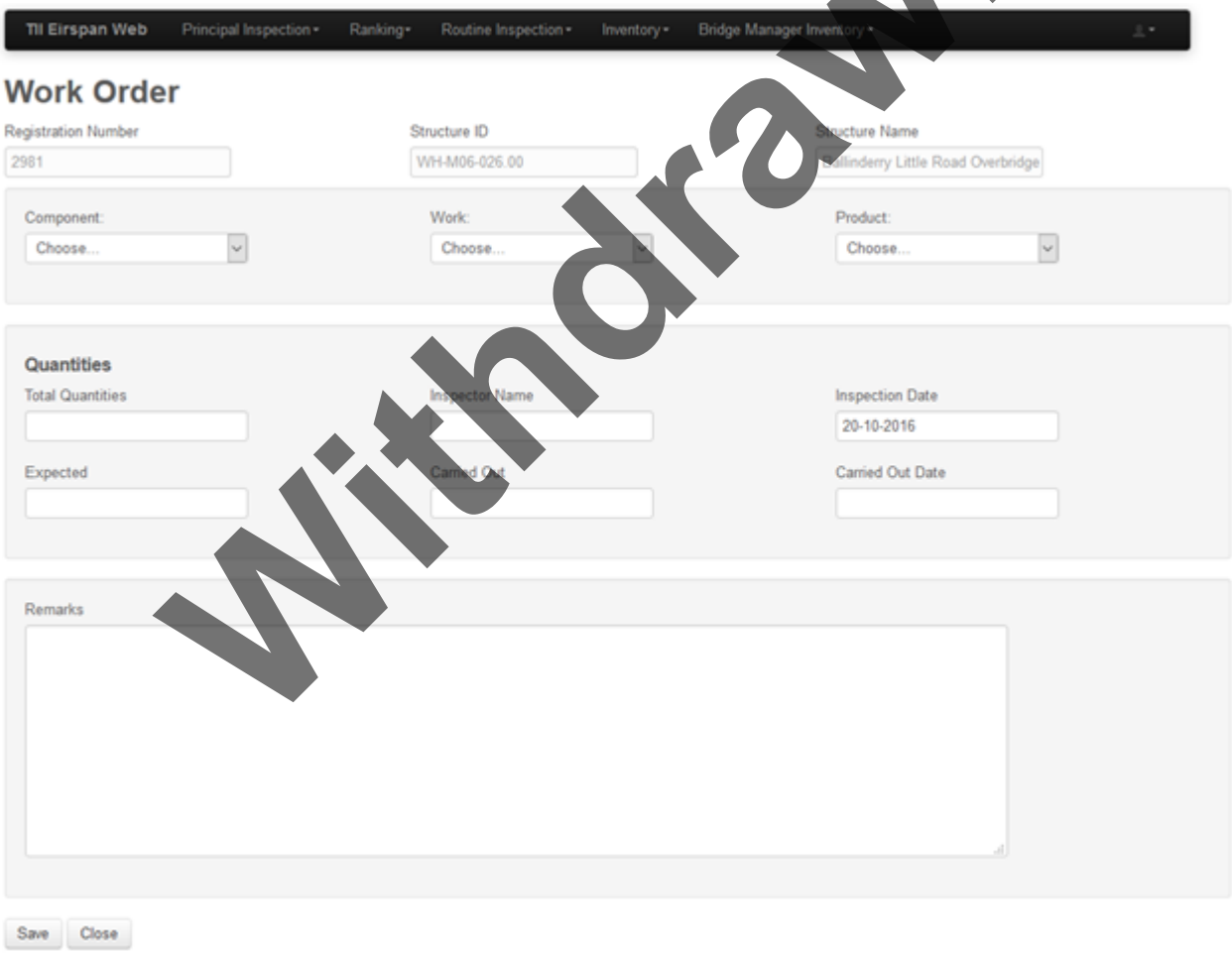


Figure 5.6 Creating New Work Order

5.3.3 Editing Existing Work Orders

Existing work orders for a structure can be edited by selecting the 'Edit' button and making the necessary changes within the work order dialogue box (see Figure 5.7). On making all the necessary changes the 'Save' button should be selected. This is also how you update for the works carried out (see Figure 5.7).

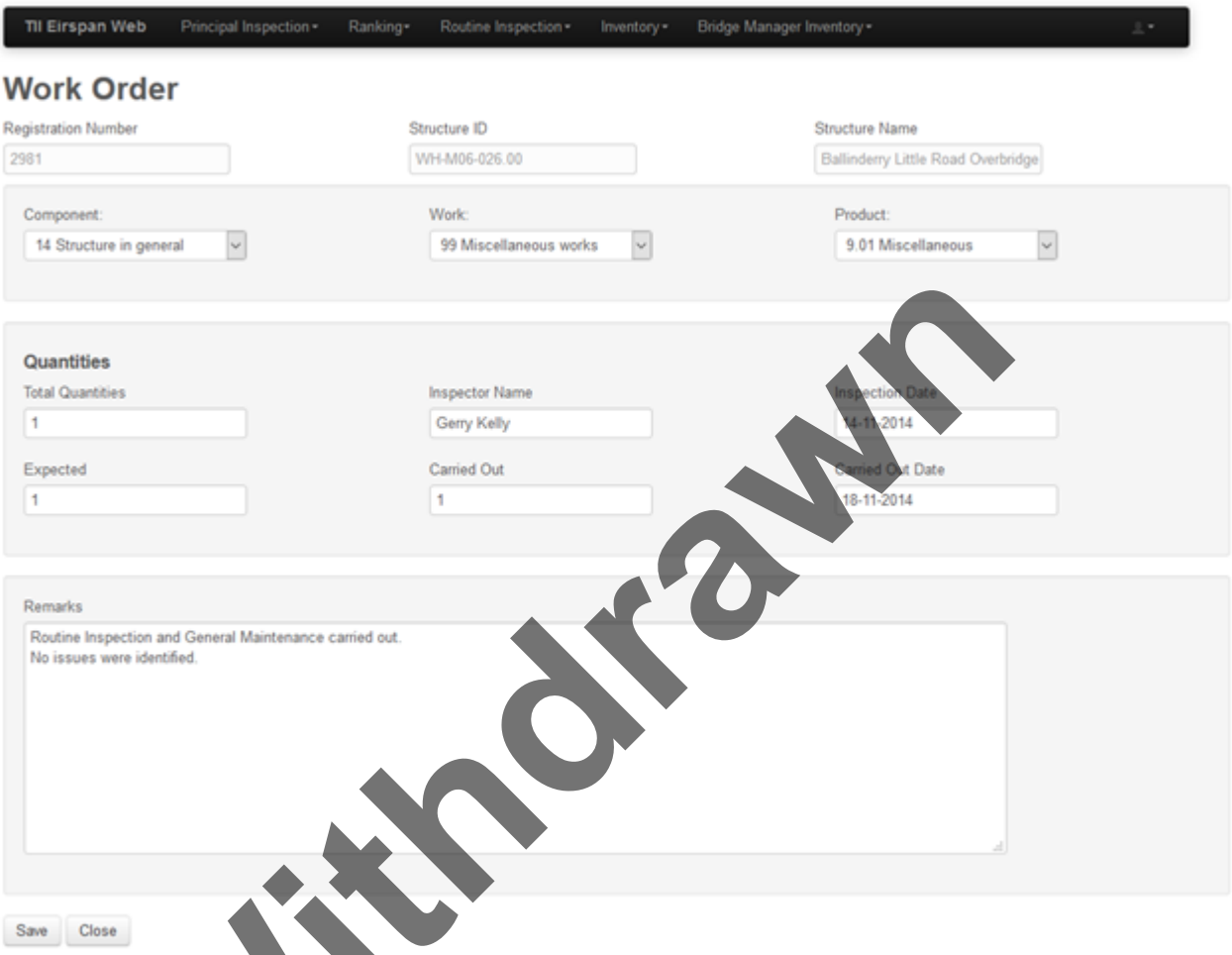


Figure 5.7 Editing Work Order

5.3.4 Deleting an Existing Work Order

Existing work order can be removed by selecting the 'Delete' button when the particular work order is highlighted in the work order overview window.

5.4 Work Order Functions

On selecting 'Work Order Functions' the following functions are available to the user (see Figure 5.8).

- 'Copy all work orders from another structure'
- 'Function for quantities for selection of structure'

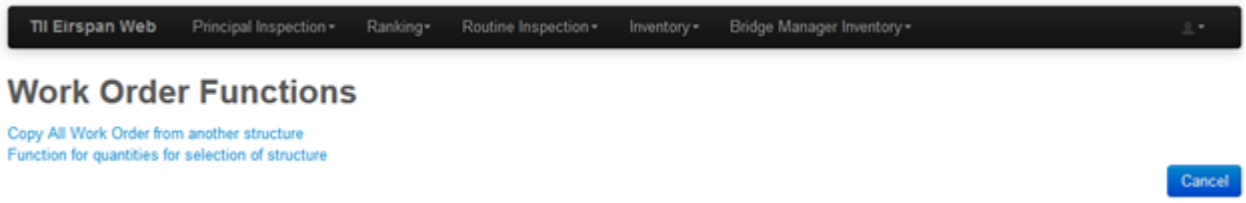


Figure 5.8 Work Order Functions

5.4.1 Copy All Work Orders from Another Structure

This function allows for work orders to be copied from one structure to another rather than having to input each individual work order. This is particularly useful where work orders are similar from one structure type to another, e.g. single span masonry arch structures. All details within a work order are copied, e.g. quantities, dates, remarks, etc. Certain fields will require amending when the work order is copied, e.g. dates, quantities and remarks.

To copy all work orders from another structure select this function in the 'Work Order Functions' menu. The screen in Figure 5.9 will appear. Select the structure you wish to copy from for the first line and then the one you wish to copy to in the second line. Then select "execute": you will be asked whether you are certain, just click "yes"

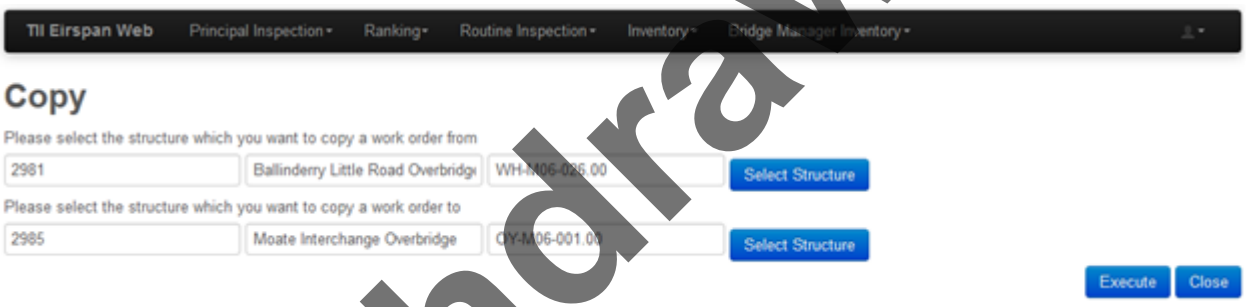


Figure 5.9 Copy All work orders from another structure, screen

5.4.2 Function for Quantities for Selection of Structure

The 'Functions for quantities for selection of structures' may be used for the following purposes (see Figure 5.10):

- Clear 'Quantities expected'.
- Clear 'Quantities carried out'.
- Copy 'Total quantities' to 'Quantities expected'.
- Copy 'Quantities expected' to 'Quantities carried out'.

The Engineer can select to apply these options to one structure, one road or to the whole Maintaining Agent.

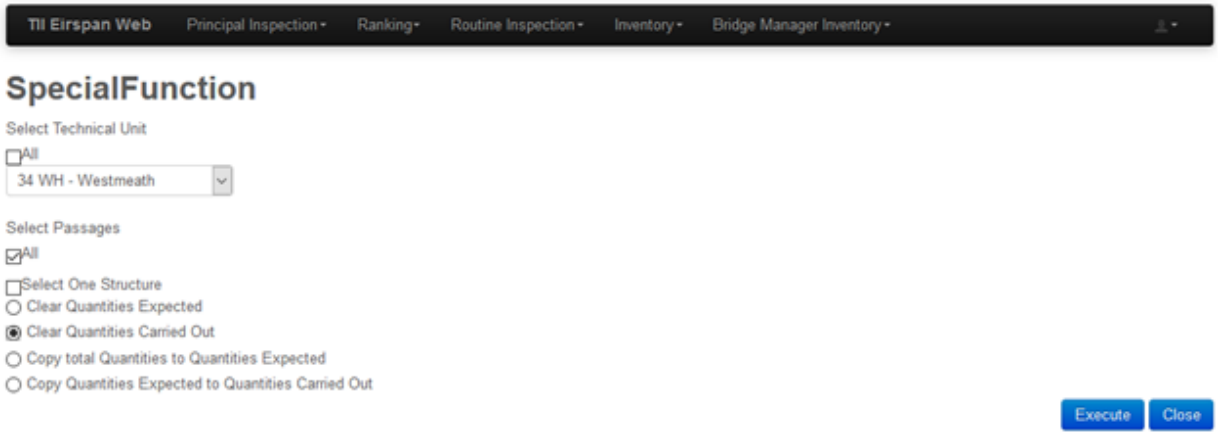


Figure 5.10 Functions for quantities for selection of structures.

5.5 Reports

The ability to produce the following reports is a feature of the EIRSPAN Routine Inspection and Maintenance module:

- Report of Work Order
- Report of Bill of Quantities
- Report of Components and Works
- Report of Components

5.5.1 Report of Work Orders

As shown in Figure 5.11 four different reports can be generated within 'Report of Work Orders', namely;

- Inspection List – All Works

This produces a routine inspection report for all Work Items that have been inputted into the database for the structures in question. This can be for all or one maintaining agent, by passage, or by single structure.

- Inspection List – Selected Works

This produces a routine inspection report for selected work items. When this function is selected another window opens allowing the user to select work items for specific components (see Figure 5.12). This can be for all or one maintaining agent, by passage, or by single structure.

- Works to Carry Out

This produces a report of works to carry out for one or more structures. This report will only be generated for work items where the expected quantity has been inputted and is greater than zero. This can be for all or one maintaining agent, by passage, or by single structure.

- Works Carried out

This produces a report of works carried out for one or more structures. This report will only be generated for work items where the carried out quantity has been inputted and is greater than zero. This can be for all or one maintaining agent, by passage, or by single structure.

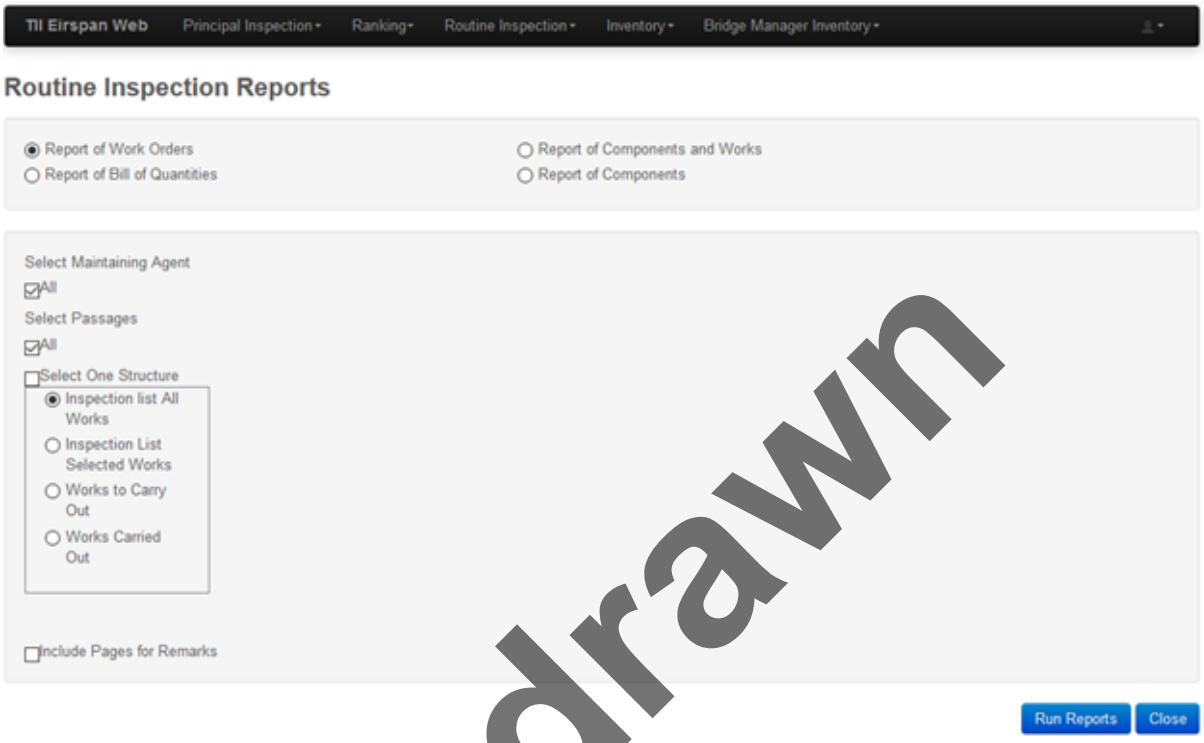


Figure 5.11 Inspection List – All Works Report

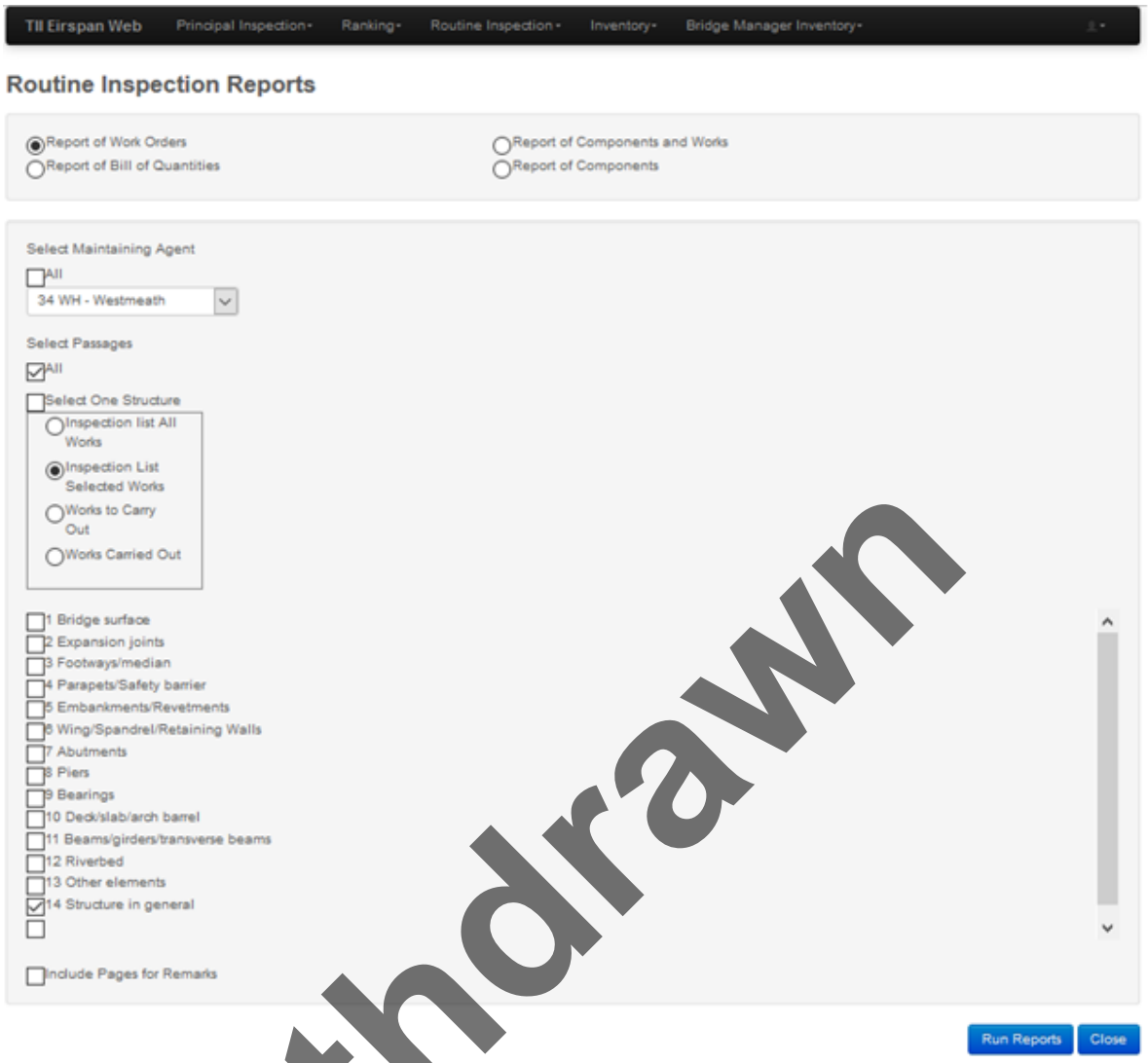


Figure 5.12 Inspection List –Selected Works Report

5.5.2 Report of Bill of Quantities

As shown in Figure 5.13 two different types of reports can be generated within 'Report of Bill of Quantities', namely;

- Bill of Quantities – All Works

This report produces a Bill of Quantities for all work items inputted into the database. The Bill of Quantities will provide an accumulated quantity for all structures selected, indicate the number of structures to which a particular work item applies, provide a cost per unit, an overall cost per work item and an overall total for the structure(s) selected. An example of a Bill of Quantities is shown in Appendix C.

- Bill of Quantities – Selected Work

This report produces a Bill of Quantities for selected work items inputted into the database. When the 'Bill of Quantities – Selected Work' function is selected more options appear allowing the user to select work items for specific components (see Figure 5.14). The Bill of Quantities will provide an accumulated quantity for all structures selected, indicate the number of structures to which a particular work item applies, provide a cost per unit, an overall cost per work item and an overall total cost for the structure(s) selected.

Within both reports listed above it is possible to print costs and include works with empty or zero quantities by ticking the respective box.

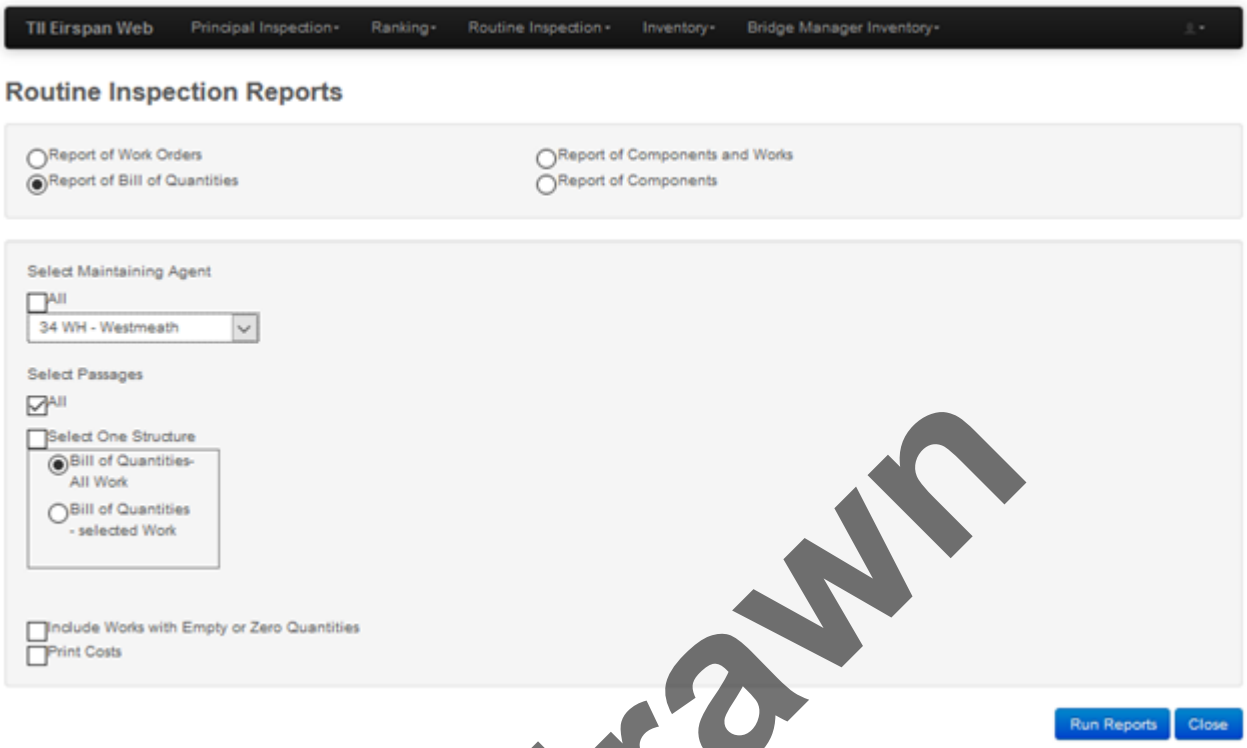


Figure 5.13 Bill of Quantities - All Works Report

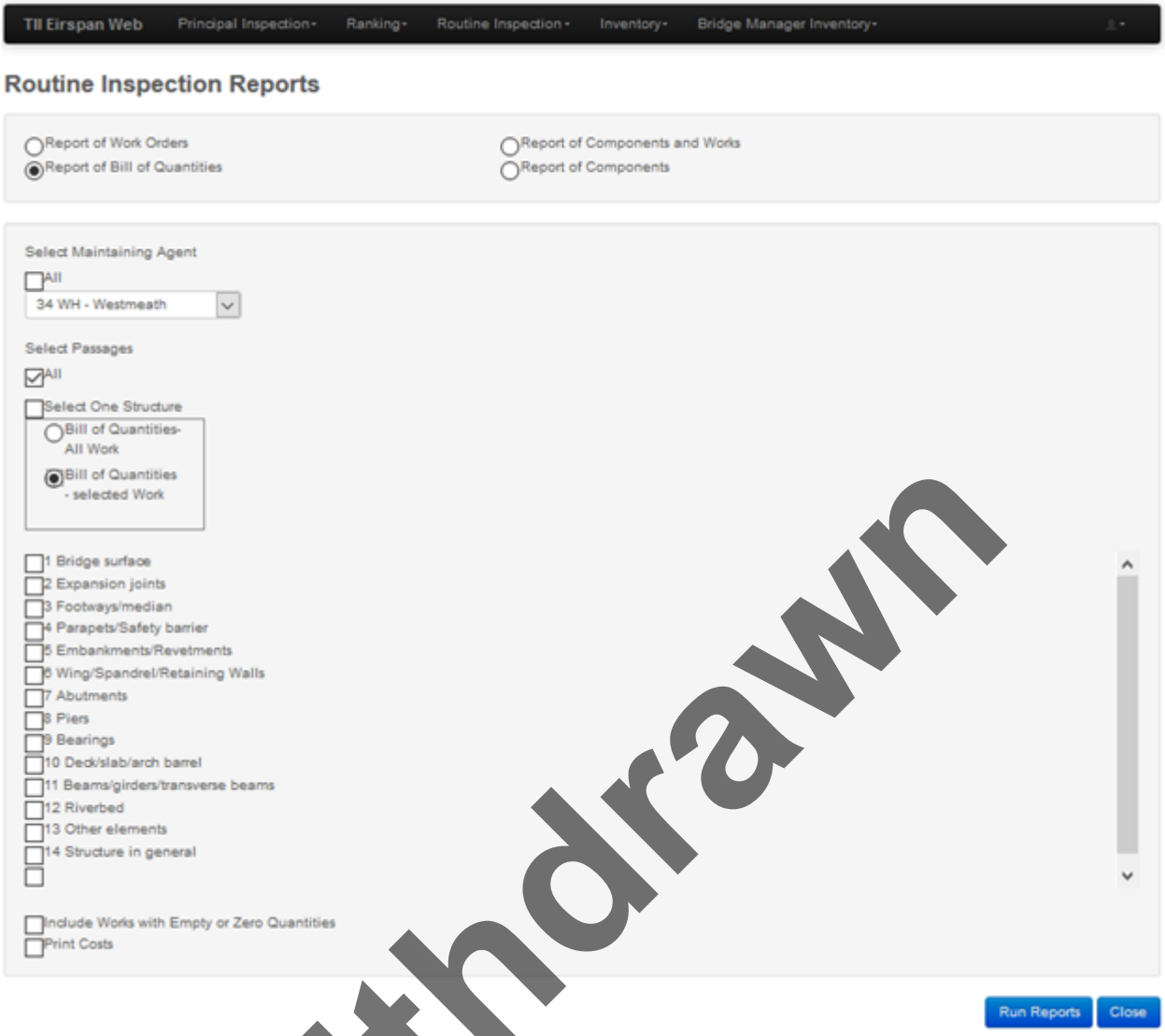


Figure 5.14 Bill of Quantities- Selected Works Report

5.5.3 Report of Components

This report lists all components, see Appendix A.

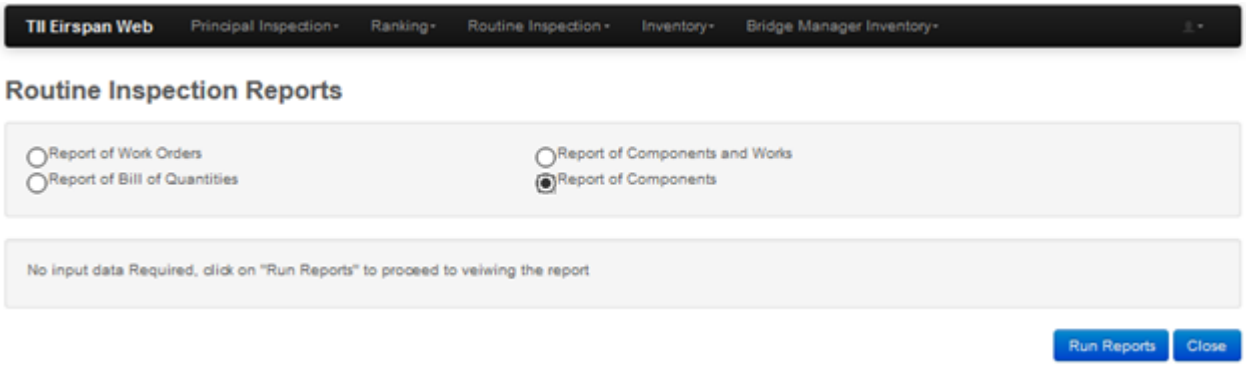


Figure 5.15 Report of Components

5.5.4 Report of Components and Works

This report lists all the components and works associated with them, see Appendix B for List and Appendix C for Inventory Form.

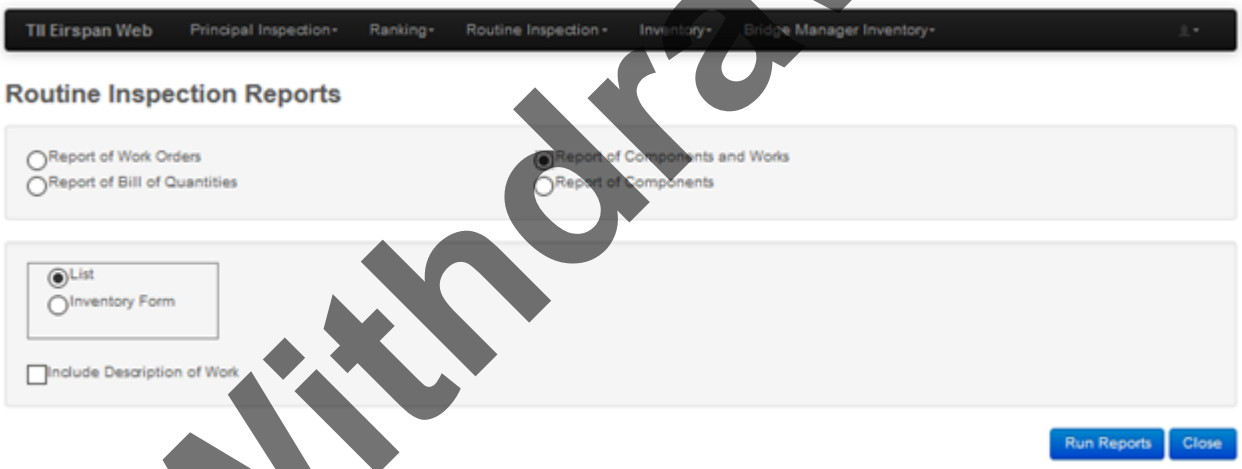


Figure 5.16 Report of Components and Works

Appendix A:

Report of Components

TII

EIRSPAN
Report of components

Printed
19-Oct-2016

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1 of 1

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Components
1 Bridge surface
2 Expansion joints
3 Footways/median
4 Parapets/Safety barrier
5 Embankments/Revetments
6 Wing/Spandrel/Retaining Walls
7 Abutments
8 Piers
9 Bearings
10 Deck/slab/arch barrel
11 Beams/girders/transverse beams
12 Riverbed
13 Other elements
14 Structure in general

Appendix B:

Report of Components, Works and Descriptions

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List

Components and works		Unit	Unit Price
	Bridge surface		
12	Sealing of pavement cracks	m	
	Pavement cracks shall be sealed with a hot poured bitumen or similar approved product. The purpose of sealing these cracks is to prevent water ingress onto the deck of the structure.		
15	Maintenance of kerb stones	m	
	Disturbed, broken or misaligned kerbstones shall be re-layed or replaced as appropriate.		
16	Patching of potholes	m2	
	Potholes present over or adjacent to structures shall be filled with a macadam material or similar approved material.		
20	Pavement Remedial Works	m2	
	Pavement Remedial Works shall be carried out in accordance with TII Standards		
21	Sweeping and cleaning	m2	
	All debris, silt and vegetation shall be removed from the bridge surface.		
30	Cleaning of drain gullies	no.	
	All drain gullies on or adjacent to structures shall be cleaned of silt, debris and vegetation.		
32	Establish drainage facility	no.	
	Where a drainage facility does not exist over or adjacent to a structure a drainage facility shall be created. This may take the form of a newly installed gully connected to a drainage system or a water cut in the grass verge leading to a drainage channel. Note: A water cut shall only be created on the approaches to a structure and not over the structure.		
34	Hosing of drainage system	m	
	Drainage systems such as gullies, drainage kerbs, Beanie blocks etc. shall be power hosed to remove all dirt, debris and vegetation.		
99	Miscellaneous works	item	
	Expansion joints		
10	Cleaning of expansion joints	m	
	All dirt, debris and vegetation shall be removed from expansion joints by either sweeping clean with a brush or using a power hose.		
14	Maintenance of joint	m	
	Asphaltic plug joints with potholes shall be temporarily reinstated with a macadam material with the defect reported to the Bridge Manager. Joints with loose bolt fixings shall be tightened.		
99	Miscellaneous works	item	

	Components and works	Unit	Unit Price
	Footways/median		
12	Sealing of pavement cracks	m	
	Pavement cracks shall be sealed with a hot poured bitumen or similar approved product. The purpose of sealing these cracks is to prevent water ingress onto the deck of the structure.		
2	Installation of Rubbing Strip	m2	
21	Sweeping and cleaning	m2	
	All debris, silt and vegetation shall be removed from the footway or median.		
22	Maintenance of surface	m2	
	Maintenance of surface may include the following: Re-laying paving flags/cobblestones on the footway/median. Resurfacing of footway with a bitumen macadam or similar approved material. Maintenance of concrete footway.		
99	Miscellaneous works	item	
	Parapets/Safety barrier		
03	Removal of vegetation	m2	
	All vegetation growth shall be removed from masonry, concrete and steel parapets.		
50	Concrete repair	m2	
54	Maintenance of bedding mortar	no.	
	Bedding mortar under steel or aluminium parapet post baseplates shall be maintained to prevent standing water around the baseplates.		
55	Repair of parapet	m	
	Any minor impact or other damage to parapets shall be made good.		
59	Removal of graffiti	m2	
60	Masonry repointing	m2	
	Masonry parapets with loose mortar shall be raked out, then all open joints shall be repointed with an appropriate masonry cement/sand mortar.		
61	Masonry repair	m3	
	Damaged masonry parapets shall be repaired with similar stonework and an appropriate masonry cement/sand mortar.		
70	Patch-painting of steel	m	
	Painted steel parapets showing evidence of minor corrosion shall be patch painted with an approved protective paint. Prior to painting, the surface shall be prepared as necessary.		
72	Replacement of guardrail	m	
	Damaged parapet posts and guardrails shall be replaced with a similar approved and compatabile post or guardrail. All bolts shall be tightened to the required torque and anti-theft bolts shall be fitted.		

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List

Components and works		Unit	Unit Price
74	Tightening of bolts	no.	
	All loose bolt connections on steel and aluminium parapets shall be tightened.		
99	Miscellaneous works	item	
	Embankments/Revetments		
03	Removal of vegetation	m2	
	All heavy vegetation growth within 1.0m of the structure shall be removed.		
33	Establish drainage channel	m	
	Drainage channels shall be provided/created on the embankments/slopes to prevent erosion of same. These channels shall provide a positive drainage system for water run-off from the carriageway.		
44	Maintenance of gabion	m2	
	Gabions alongs embankments, slopes and watercourses shall be maintained.		
45	Maintenance of slope protectio	m2	
	Slope protection such as gabions and revetments shall be maintained at all times.		
47	Reshaping (imported materials)	m3	
	Reform the damaged embankment/slope to original shape using suitable imported fill.		
59	Removal of graffiti	m2	
99	Miscellaneous works	item	
	Wing/Spandrel/Retaining Walls		
03	Removal of vegetation	m2	
	All vegetation affecting the integrity of the wingwall shall be removed. This shall include small trees growing out of masonry wingwalls, vegetation in mortar joints and all vegetation within 1.0m of the wingwall.		
50	Concrete repairs	m2	
52	High-pressure hosing of surfac	m2	
	Any growth (fungal, algael etc) on the wingwalls shall be removed by high pressure hosing.		
53	Maintenance of joints	m	
	Any soft joints present on a wingwall shall be maintained. This may include replacing a polysulphide sealant with a similar approved material.		
56	Establish base protection	m	
	Base protection shall be provided where there is evidence of water ponding around wingwalls. This will take the form of a sloped concrete apron.		
57	Maintenance of base protection	m	
	Base protection at the base of wingwalls shall be maintained to prevent water ponding at the base of the wingwall.		
59	Removal of graffiti	m2	

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List

Components and works		Unit	Unit Price
60	Masonry repointing	m2	
	Masonry wingwalls with loose mortar shall be raked out, then all open joints shall be repointed with an appropriate masonry cement/sand mortar.		
61	Masonry repair	m3	
	Masonry wingwalls with loss of stones and mortar shal be repaired with similar stonework and an appropriate masonry cement/sand mortar.		
99	Miscellaneous works	item	
	Abutments		
03	Removal of vegetation	m2	
	All vegetation affecting the integrity of the abutment shall be removed. This shall include small trees growing out of masonry abutments, vegetation in mortar joints and all vegetation within 1.0m of the abutment.		
35	Maintenance of drainage channe	m	
	The drainage channel on the bearing shelf and associated drainage outlets shall be cleaned and rodded to ensure un-impeded flow of water from the bearing shelf.		
50	Concrete repairs	m2	
52	High-pressure hosing of surfac	m2	
	Any growth (fungal, algael etc) on the abutments shall be removed by high pressure hosing.		
53	Maintenance of soft joints	m	
	Any soft joints present on an abutment shall be maintained. This may include replacing a polysulphide sealant with a similar approved material.		
56	Establish base protection	m	
	Base protection shall be provided where there is evidence of water ponding around abutments. This will take the form of a sloped concrete apron.		
57	Maintenance of base protection	m	
	Base protection at the base of abutments shall be maintained to prevent water ponding at the base of the abutments.		
59	Removal of graffiti	m2	
60	Masonry repointing	m2	
	Masonry abutments with loose mortar shall be raked out, then all open joints shall be repointed with an appropriate masonry cement/sand mortar.		
61	Masonry repair	m3	
	Masonry abutments with loss of stones and mortar shall be repaired with similar stonework and an appropriate masonry cement/sand mortar.		
99	Miscellaneous works	item	

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List

	Components and works	Unit	Unit Price
	Piers		
03	Removal of vegetation	m2	
	All vegetation affecting the integrity of the piers shall be removed. This shall include small trees growing out of masonry piers, vegetation in mortar joints and all vegetation within 1.0m of the piers.		
35	Maintenance of drainage channel	m2	
50	Concrete repairs	m2	
52	High-pressure hosing of surfac	m2	
	Any growth (fungal, algael etc) on the piers shall be removed by high pressure hosing.		
56	Establish base protection	m	
	Base protection shall be provided where there is evidence of water ponding around piers. This will take the form of a sloped concrete apron.		
57	Maintenance of base protection	m	
	Base protection at the base of piers shall be maintained to prevent water ponding at the base of the piers.		
59	Removal of graffiti	m2	
60	Masonry repointing	m2	
	Masonry piers with loose mortar shall be raked out, then all open joints shall be repointed with an appropriate masonry cement/sand mortar.		
61	Masonry repair	m3	
	Masonry piers with loss of stones and mortar shall be repaired with similar stonework and an appropriate masonry cement/sand mortar.		
99	Miscellaneous works	item	
	Bearings		
50	Concrete repairs	m2	
54	Maintenance of bedding mortar	no.	
	Bedding mortar under bearings shall be maintained to prevent standing water around the baseplates.		
58	Cleaning of bearings	no.	
	All bearings, particularly roller, sliding and pot bearing, shall be cleaned with all silt, dirt and debris removed.		
70	Patch-painting of steel	m	
	Painted bearings showing evidence of minor corrosion shall be patch painted with an approved protective paint. Prior to painting, the surface shall be prepared as necessary.		
99	Miscellaneous works	item	

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	Components and works	Unit	Unit Price
	Deck/slab/arch barrel		
31	Cleaning of drip-tubes	no.	
	Drip tubes present on the soffit of decks shall be rodded clear.		
50	Concrete repairs	m2	
52	High-pressure hosing of surfac	m2	
	Any growth (fungal, algael etc) on the deck/slab shall be removed by high pressure hosing.		
59	Removal of graffiti	m2	
60	Masonry repointing	m2	
	Masonry arches with loose mortar shall be raked out, then all open joints shall be repointed with an appropriate masonry cement/sand mortar.		
61	Masonry repair	m3	
	Masonry arches with loss of stones and mortar shall be repaired with similar stonework and an appropriate masonry cement/sand mortar.		
70	Patch-painting of steel	m2	
	Painted steel decks showing evidence of minor corrosion shall be patch painted with an approved protective paint. Prior to painting, the surface shall be prepared as necessary.		
99	Miscellaneous works	item	
	Beams/girders/transverse beams		
50	Concrete repairs	m2	
52	High-pressure hosing of surfac	m2	
	Any growth (fungal, algael etc) or graffiti on the beams/girders/transverse beams shall be removed by high pressure hosing.		
59	Removal of graffiti	m2	
70	Patch-painting of steel	m2	
	Painted beams or girders showing evidence of minor corrosion shall be patch painted with an approved protective paint. Prior to painting, the surface shall be prepared as necessary.		
99	Miscellaneous works	item	
	Riverbed		
01	Clearance of watercourse	m2	
	The watercourse shall be cleared of all obstructive materials i.e materials which may impede the flow of water. Such materials may include trees and other vegetation, sand, silt and dumped materials.		
04	Scour Repairs	m2	
99	Miscellaneous works	item	

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	Components and works	Unit	Unit Price
	Other elements		
50	Concrete repairs	m2	
59	Removal of graffiti	m2	
80	Repair of lighting	no.	
	Light fittings on all overpasses shall be maintained, particularly in pedestrain subways.		
99	Miscellaneous works	item	
	Structure in general		
05	Removal of Signage	item	
50	Concrete repair	item	
	Concrete repairs to be carried out to the specification in the Routine Maintenance manual using an approved proprietary repair mortar.		
59	Removal of graffiti	m2	
	Offensive graffiti shall be removed using an approved material.		
81	Maintenance of structure ID	no.	
	The structure ID number shall be re-painted/applied if deemed necessary using an approved paint system. ID numbers shall be applied as per Appendix 5 of the Inventory Manual.		
99	Miscellaneous works	item	

Appendix C:

Inventory Form for Routine Inspection

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Inventory

Structure: Name:

Inspection Date:

	Components and Works	Unit	Total Qty	Expected Qty
	Bridge surface			
12	Sealing of pavement cracks	m		
15	Maintenance of kerb stones	m		
16	Patching of potholes	m2		
20	Pavement Remedial Works	m2		
21	Sweeping and cleaning	m2		
30	Cleaning of drain gullies	no.		
32	Establish drainage facility	no.		
34	Hosing of drainage system	m		
99	Miscellaneous works	item		
	Expansion joints			
10	Cleaning of expansion joints	m		
14	Maintenance of joint	m		
99	Miscellaneous works	item		
	Footways/median			
12	Sealing of pavement cracks	m		
2	Installation of Rubbing Strip	m2		
21	Sweeping and cleaning	m2		
22	Maintenance of surface	m2		
99	Miscellaneous works	item		
	Parapets/Safety barrier			
03	Removal of vegetation	m2		
50	Concrete repair	m2		

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Inventory

Components and Works		Unit	Total Qty	Expected Qty
54	Maintenance of bedding mortar	no.		
55	Repair of parapet	m		
59	Removal of graffiti	m2		
60	Masonry repointing	m2		
61	Masonry repair	m3		
70	Patch-painting of steel	m		
72	Replacement of guardrail	m		
74	Tightening of bolts	no.		
99	Miscellaneous works	item		
	Embankments/Revetments			
03	Removal of vegetation	m2		
33	Establish drainage channel	m		
44	Maintenance of gabion	m2		
45	Maintenance of slope protectio	m2		
47	Reshaping (imported materials)	m3		
59	Removal of graffiti	m2		
99	Miscellaneous works	item		
	Wing/Spandrel/Retaining Walls			
03	Removal of vegetation	m2		
50	Concrete repairs	m2		
52	High-pressure hosing of surfac	m2		
53	Maintenance of joints	m		
56	Establish base protection	m		
57	Maintenance of base protection	m		
59	Removal of graffiti	m2		
60	Masonry repointing	m2		
61	Masonry repair	m3		
99	Miscellaneous works	item		

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Inventory

Components and Works		Unit	Total Qty	Expected Qty
	Abutments			
03	Removal of vegetation	m2		
35	Maintenance of drainage channe	m		
50	Concrete repairs	m2		
52	High-pressure hosing of surfac	m2		
53	Maintenance of soft joints	m		
56	Establish base protection	m		
57	Maintenance of base protection	m		
59	Removal of graffiti	m2		
60	Masonry repointing	m2		
61	Masonry repair	m3		
99	Miscellaneous works	item		
	Piers			
03	Removal of vegetation	m2		
35	Maintenance of drainage channel	m2		
50	Concrete repairs	m2		
52	High-pressure hosing of surfac	m2		
56	Establish base protection	m		
57	Maintenance of base protection	m		
59	Removal of graffiti	m2		
60	Masonry repointing	m2		
61	Masonry repair	m3		
99	Miscellaneous works	item		
	Bearings			
50	Concrete repairs	m2		
54	Maintenance of bedding mortar	no.		
58	Cleaning of bearings	no.		
70	Patch-painting of steel	m		
99	Miscellaneous works	item		

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Inventory

	Components and Works	Unit	Total Qty	Expected Qty
	Deck/slab/arch barrel			
31	Cleaning of drip-tubes	no.		
50	Concrete repairs	m2		
52	High-pressure hosing of surfac	m2		
59	Removal of graffiti	m2		
60	Masonry repointing	m2		
61	Masonry repair	m3		
70	Patch-painting of steel	m2		
99	Miscellaneous works	item		
	Beams/girders/transverse beams			
50	Concrete repairs	m2		
52	High-pressure hosing of surfac	m2		
59	Removal of graffiti	m2		
70	Patch-painting of steel	m2		
99	Miscellaneous works	item		
	Riverbed			
01	Clearance of watercourse	m2		
04	Scour Repairs	m2		
99	Miscellaneous works	item		
	Other elements			
50	Concrete repairs	m2		
59	Removal of graffiti	m2		
80	Repair of lighting	no.		
99	Miscellaneous works	item		

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Inventory

Components and Works		Unit	Total Qty	Expected Qty
	Structure in general			
05	Removal of Signage	item		
50	Concrete repair	item		
59	Removal of graffiti	m2		
81	Maintenance of structure ID	no.		
99	Miscellaneous works	item		

Appendix D:

Routine Inspection Report (example)

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One Structure

Inspection List

Struct. DT-M08-003.00 Scartbarry Road Overbridge
Tech. Unit 44 DT - Direct Route
Road Cork - Portlaoise

Component Location	Work Product	Quantity Total Expected Carried Out	Date Inspected Carried Out
1 Bridge surface Reseal open saw-cut joint with hot poured bitumen.	12 Sealing of pavement cracks 4.04 Hot poured bitumen	12 m 6 m _____ m	27 Jul 2016
1 Bridge surface	15 Maintenance of kerb stones	120 m 0 m _____ m	27 Jul 2016
1 Bridge surface	16 Patching of potholes	0 m2 0 m2 _____ m2	27 Jul 2016
1 Bridge surface	20 Pavement Remedial Works	0 m2 0 m2 _____ m2	27 Jul 2016
1 Bridge surface Remove debris and vegetation at edge of carriageway	21 Sweeping and cleaning	366 m2 180 m2 _____ m2	27 Jul 2016
1 Bridge surface	30 Cleaning of drain gullies	4 no 0 no _____ no	27 Jul 2016
3 Footways/median	12 Sealing of pavement cracks	0 m 0 m _____ m	27 Jul 2016

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One Structure

Inspection List

Struct. DT-M08-003.00 Scartbarry Road Overbridge
Tech. Unit 44 DT - Direct Route
Road Cork - Portlaoise

Component Location	Work Product	Quantity Total Expected Carried Out	Date Inspected Carried Out
3 Footways/median Remove debris at back of footpath	21 Sweeping and cleaning	180 m2 100 m2 _____ m2	27 Jul 2016
3 Footways/median	22 Maintenance of surface	180 m2 0 m2 _____ m2	27 Jul 2016
4 Parapets/Safety barrier	03 Removal of vegetation	0 m2 0 m2 _____ m2	27 Jul 2016
4 Parapets/Safety barrier Remove loose bedding mortar from north parapet plinth over northbound lane	54 Maintenance of bedding mortar	3 no 2 no _____ no	27 Jul 2016
4 Parapets/Safety barrier	55 Repair of parapet	0 m 0 m _____ m	27 Jul 2016
4 Parapets/Safety barrier	72 Replacement of guardrail	0 m 0 m _____ m	27 Jul 2016
4 Parapets/Safety barrier Remove algal staining from parapet	99 Miscellaneous works	120 it 0 it _____ it	27 Jul 2016

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One Structure

Inspection List

Struct. DT-M08-003.00 Scartbarry Road Overbridge
Tech. Unit 44 DT - Direct Route
Road Cork - Portlaoise

Component Location	Work Product	Quantity Total Expected Carried Out	Date Inspected Carried Out
5 Embankments/Revetments Spray grass/weeds growing between paving slabs. Remove trees near structure.	03 Removal of vegetation	300 m2 20 m2 _____ m2	27 Jul 2016
6 Wing/Spandrel/Retaining Walls	03 Removal of vegetation	0 m2 0 m2 _____ m2	27 Jul 2016
6 Wing/Spandrel/Retaining Walls	52 High-pressure hosing of surfac	0 m2 0 m2 _____ m2	27 Jul 2016
6 Wing/Spandrel/Retaining Walls	53 Maintenance of joints	0 m 0 m _____ m	27 Jul 2016
7 Abutments	52 High-pressure hosing of surfac	0 m2 0 m2 _____ m2	27 Jul 2016
8 Piers	52 High-pressure hosing of surfac	0 m2 0 m2 _____ m2	27 Jul 2016
10 Deck/slab/arch barrel	52 High-pressure hosing of surfac	0 m2 0 m2 _____ m2	27 Jul 2016

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One Structure

Inspection List

Struct. DT-M08-003.00 Scartbarry Road Overbridge
Tech. Unit 44 DT - Direct Route
Road Cork - Portlaoise

Component Location	Work Product	Quantity Total Expected Carried Out	Date Inspected Carried Out
11 Beams/girders/transverse beams	52 High-pressure hosing of surfac	0 m2 0 m2 _____ m2	27 Jul 2016
14 Structure in general	59 Removal of graffiti	0 m2 0 m2 _____ m2	27 Jul 2016
14 Structure in general	81 Maintenance of structure ID	3 no 0 no _____ no	27 Jul 2016

Appendix E:

Report of Works to Carry Out (example)

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One Structure

Works to Carry Out

Struct. DT-M08-003.00 Scartbarry Road Overbridge
Tech. Unit 44 DT - Direct Route
Road Cork - Portlaoise

Component Location	Work Product	Quantity Total Expected Carried Out	Date Inspected Carried Out
1 Bridge surface Reseal open saw-cut joint with hot poured bitumen.	12 Sealing of pavement cracks 4.04 Hot poured bitumen	12 m 6 m _____ m	27 Jul 2016
1 Bridge surface Remove debris and vegetation at edge of carriageway	21 Sweeping and cleaning	366 m2 180 m2 _____ m2	27 Jul 2016
3 Footways/median Remove debris at back of footpath	21 Sweeping and cleaning	180 m2 100 m2 _____ m2	27 Jul 2016
4 Parapets/Safety barrier Remove loose bedding mortar from north parapet plinth over northbound lane	54 Maintenance of bedding mortar	3 no 2 no _____ no	27 Jul 2016
5 Embankments/Revetments Spray grass/weeds growing between paving slabs. Remove trees near structure.	03 Removal of vegetation	300 m2 20 m2 _____ m2	27 Jul 2016

Appendix F:

Report of Works Carried Out (example)

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One Structure

Work Carried Out

Struct. DT-M08-003.00 Scartbarry Road Overbridge
Tech. Unit 44 DT - Direct Route
Road Cork - Portlaoise

Component Location	Work Product	Quantity Total Expected Carried Out	Date Inspected Carried Out
1 Bridge surface Reseal open saw-cut joint with hot poured bitumen.	12 Sealing of pavement cracks	12 m 6 m	27 Jul 2016
	4.04 Hot poured bitumen	6 m	25 Aug 2016
1 Bridge surface Remove debris and vegetation at edge of carriageway	21 Sweeping and cleaning	366 m2 180 m2	27 Jul 2016
		180 m2	25 Aug 2016
5 Embankments/Revetments Spray grass/weeds growing between paving slabs. Remove trees near structure.	03 Removal of vegetation	300 m2 20 m2	27 Jul 2016
		20 m2	25 Aug 2016

Appendix G:

Bill of Quantities (example)

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All Technical Units

All Passages

Component Work		Accumulated Quantity	No of Struct	Cost / Unit	Cost
1 12	Bridge surface Sealing of pavement cracks	2486.8 m	116		
1 15	Bridge surface Maintenance of kerb stones	1181.85 m	91		
1 16	Bridge surface Patching of potholes	1033.375 m2	90		
1 20	Bridge surface Pavement Remedial Works	16869.08 m2	133		
1 21	Bridge surface Sweeping and cleaning	509360.203 m2	772		
1 30	Bridge surface Cleaning of drain gullies	12224 no.	384		
1 32	Bridge surface Establish drainage facility	278 no.	54		
1 34	Bridge surface Hosing of drainage system	22837.7 m	223		
1 99	Bridge surface Miscellaneous works	42938.32 item	206		
10 31	Deck/slab/arch barrel Cleaning of drip-tubes	42 no.	8		
10 50	Deck/slab/arch barrel Concrete repairs	631.6 m2	27		
10 52	Deck/slab/arch barrel High-pressure hosing of surfac	2867.78 m2	20		
10 59	Deck/slab/arch barrel Removal of graffiti	826 m2	13		
10 60	Deck/slab/arch barrel Masonry repointing	1991.35 m2	93		
10 61	Deck/slab/arch barrel Masonry repair	206.8 m3	37		
10 70	Deck/slab/arch barrel Patch-painting of steel	317.9 m2	9		
10 99	Deck/slab/arch barrel Miscellaneous works	72 item	50		
11 50	Beams/girders/transverse beams Concrete repairs	1584.78 m2	24		
11 52	Beams/girders/transverse beams High-pressure hosing of surfac	10359.575 m2	28		
11 59	Beams/girders/transverse beams Removal of graffiti	376 m2	12		
11 70	Beams/girders/transverse beams Patch-painting of steel	875.5 m2	15		

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All Technical Units

All Passages

11 99	Beams/girders/transverse beams Miscellaneous works	414 item	16		
12 01	Riverbed Clearance of watercourse	14299.85 m2	306		
12 99	Riverbed Miscellaneous works	172 item	31		
13 50	Other elements Concrete repairs	2 m2	2		
13 59	Other elements Removal of graffiti	1.2 m2	3		
13 80	Other elements Repair of lighting	207 no.	45		
13 99	Other elements Miscellaneous works	17652.3 item	127		
14 50	Structure in general Concrete repair	168.5 item	61		
14 59	Structure in general Removal of graffiti	4410.3 m2	110		
14 81	Structure in general Maintenance of structure ID	643 no.	425		
14 99	Structure in general Miscellaneous works	651 item	376		
2 10	Expansion joints Cleaning of expansion joints	3391.64 m	119		
2 14	Expansion joints Maintenance of joint	3283.5 m	183		
2 99	Expansion joints Miscellaneous works	151 item	34		
3 12	Footways/median Sealing of pavement cracks	2126.96 m	118		
3 21	Footways/median Sweeping and cleaning	86034.56 m2	492		
3 22	Footways/median Maintenance of surface	6289.48 m2	116		
3 99	Footways/median Miscellaneous works	1129 item	81		
4 03	Parapets/Safety barrier Removal of vegetation	17287.16 m2	456		
4 50	Parapets/Safety barrier Concrete repair	998.43 m2	26		
4 54	Parapets/Safety barrier Maintenance of bedding mortar	1114.4 no.	87		
4 55	Parapets/Safety barrier Repair of parapet	2197.85 m	190		
4 59	Parapets/Safety barrier Removal of graffiti	355.96 m2	40		
4 60	Parapets/Safety barrier Masonry repointing	2562.49 m2	163		

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All Technical Units

All Passages

4 61	Parapets/Safety barrier Masonry repair	524.64 m3	95		
4 70	Parapets/Safety barrier Patch-painting of steel	7839.6 m	82		
4 72	Parapets/Safety barrier Replacement of guardrail	943.4 m	51		
4 74	Parapets/Safety barrier Tightening of bolts	766 no.	57		
4 99	Parapets/Safety barrier Miscellaneous works	805.8 item	180		
5 03	Embankments/Revetments Removal of vegetation	47080.9 m2	801		
5 33	Embankments/Revetments Establish drainage channel	365.5 m	19		
5 44	Embankments/Revetments Maintenance of gabion	335 m2	8		
5 45	Embankments/Revetments Maintenance of slope protectio	2123.8 m2	60		
5 47	Embankments/Revetments Reshaping (imported materials)	265 m3	19		
5 59	Embankments/Revetments Removal of graffiti	134 m2	15		
5 99	Embankments/Revetments Miscellaneous works	823.5 item	96		
6 03	Wing/Spandrel/Retaining Walls Removal of vegetation	16420.3 m2	460		
6 50	Wing/Spandrel/Retaining Walls Concrete repairs	1670 m2	27		
6 52	Wing/Spandrel/Retaining Walls High-pressure hosing of surfac	5240.3 m2	62		
6 53	Wing/Spandrel/Retaining Walls Maintenance of joints	389.5 m	30		
6 56	Wing/Spandrel/Retaining Walls Establish base protection	124 m	9		
6 57	Wing/Spandrel/Retaining Walls Maintenance of base protection	77.5 m	7		
6 59	Wing/Spandrel/Retaining Walls Removal of graffiti	1983.5 m2	44		
6 60	Wing/Spandrel/Retaining Walls Masonry repointing	3977.65 m2	121		
6 61	Wing/Spandrel/Retaining Walls Masonry repair	463.005 m3	66		
6 99	Wing/Spandrel/Retaining Walls Miscellaneous works	144 item	74		
7 03	Abutments Removal of vegetation	4886.3 m2	165		
7 35	Abutments Maintenance of drainage channe	1598 m	54		

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All Passages

7 50	Abutments Concrete repairs	779.252 m2	37		
7 52	Abutments High-pressure hosing of surfac	14336.27 m2	87		
7 53	Abutments Maintenance of soft joints	521.55 m	28		
7 56	Abutments Establish base protection	372 m	22		
7 57	Abutments Maintenance of base protection	155.5 m	9		
7 59	Abutments Removal of graffiti	4186.25 m2	67		
7 60	Abutments Masonry repointing	848.9 m2	82		
7 61	Abutments Masonry repair	204.85 m3	36		
7 99	Abutments Miscellaneous works	308 item	66		
8 03	Piers Removal of vegetation	3633 m2	101		
8 50	Piers Concrete repairs	102.27 m2	8		
8 52	Piers High-pressure hosing of surfac	9402 m2	21		
8 56	Piers Establish base protection	30.5 m	5		
8 57	Piers Maintenance of base protection	72.5 m	6		
8 59	Piers Removal of graffiti	618 m2	32		
8 60	Piers Masonry repointing	294.5 m2	22		
8 61	Piers Masonry repair	33.5 m3	9		
8 99	Piers Miscellaneous works	480 item	23		
9 50	Bearings Concrete repairs	19 m2	2		
9 54	Bearings Maintenance of bedding mortar	60 no.	9		
9 58	Bearings Cleaning of bearings	179 no.	14		
9 70	Bearings Patch-painting of steel	138.8 m	23		
9 99	Bearings Miscellaneous works	14 item	7		
Total:					

Appendix H:

Road Supervisor Instructions

Routine Inspection

Roads Supervisor Instruction

Inspection	As the Roads Supervisor passes a structure, he/she shall check whether damage or other abnormal incidents have occurred. For example check: • Railings, columns etc. for damage due to traffic impact. • Roads, girders, columns, wing walls etc. for signs of settlements or displacements. • Revetments, shoulders, etc. for dangerous erosion. • Roads and river channels for deposits or other objects that may affect traffic safety or the safety of the structure. Normally the structure inspections are carried out from the vehicle, as part of the inspection of the road stretch.
Serious damage	If the Roads Supervisor observes or suspects damage, affecting the function of the structure, he/she shall leave the vehicle and carry out a closer investigation. He shall note the extent and cause of damage and assess if further development of damage is likely to occur in the near future. If necessary, he/she shall arrange emergency sign posting.
Remove debris	He shall remove debris from the structure that may affect traffic safety.
Check drainage	These frequent inspections enable the Roads Supervisor to see the structure under changing weather conditions. Therefore, the Roads Supervisor should observe the drainage system. Does it work efficiently?
Report of damage	Finally, the Roads Supervisor shall promptly report unsolved problems to the Engineer, and if necessary to the Gardaí.

Roads Supervisor Inspection Report

Structure:
Identification no.: _____
Name of structure: _____
Name of road: _____
Date of inspection: _____-_____-_____ **Name of Road Supervisor**: _____

Description of damage and/or deterioration. The Roads Supervisor must state the following information, and any remarks, in the field below:

- Damage type (erosion, failure etc.).
- Cause of damage (flooding, vehicles impact etc.).
- Location of damage.
- Extent (number, m2, m3, etc.).
- Severity.
- Recommendations.

Engineer's remarks:
_____
_____
__
_____

Action ordered by Engineer, Yes/no: _____

Date:_____ Signed: _____

Appendix I:

Principal Inspection Recommendation Form

Routine Inspection

Principal Inspection Recommendation

Structure:
Identification no.: _____
Name of structure: _____
Name of road: _____
Date of preparation: _____ **Name of Engineer**:_____

Engineer's recommendation of Principal Inspection. The Engineer must state the following information in the field below:

- Cause of inspection.
- Damage type (erosion, failure etc.).
- Cause of damage (Flooding, vehicle impact etc.).
- Location of damage.
- Extent (number, m2, m3, etc.).
- Severity.
- Remarks.
- Photos.

Bridge Manager's remarks:

_____
_____
_____

Principal Inspection ordered, Yes/no: _____

Date: _____ Signature:_____

Appendix J:

Specifications for Routine Maintenance Works

SECTION 1.0 – BRIDGE SURFACE

Item No	Title and Written Text
12	**Sealing of pavement cracks up to 15mm wide** All dirt, debris and vegetation shall be removed from pavement and carriageway cracks either by sweeping clean with a brush, using a power hose (air line) or manual raking out. The cracks shall be sealed with hot poured bitumen or similar approved product in accordance with standard good practice or any proprietary product manufacturer's specified method. Any material to be used shall be compatible with the existing surfacing material.
15	**Maintenance of kerb stones** Disturbed, broken or misaligned kerbstones shall be re-laid or replaced as appropriate. The replacement kerbstones shall comply with BS 7263 Part 1, unless specified otherwise by the Client. Prior to replacement old backing and bedding shall be broken out and removed and replaced with new material.
16	**Patching of potholes** Potholes present over, beneath or adjacent to structures shall be cleaned of loose debris. All surfaces shall be cleaned and broken back as necessary to ensure a sound surface both at the sides and at the base of the pothole. The sides of the excavation shall be excavated as near as possible to vertical but not as to undermine the surrounding pavement. The road pavement shall be reinstated in accordance with CC-SCD-00705 using macadam or similar approved surfacing material compatible with the existing. A bitumen tack coat shall be applied to all prepared surfaces prior to placement of premix materials (if appropriate). Prior to application of the base course, the sub-base shall be fully compacted using appropriate mechanical or hand-ramming means. The depth of bituminous surfacing shall be no less than the existing. On completion the surfacing shall be flush with the existing at the interface and by a tolerance of +/-10mm on a 500mm long straight edge. The running surface of the repair and the repair joints carried out under the above specification shall be waterproof. All repair joints will be sealed with hot poured bitumen. For areas of localised surface deterioration, each of an area less than 0.5sq.m. which could result in potholes and/or surface delamination, these shall be broken out as necessary and repaired as for pot holes.
20	**Pavement Remedial Works** Pavement remedial works shall be carried out in accordance with TII Publications.
21	**Sweeping and cleaning** All debris, silt and vegetation shall be removed from the bridge surface using a mechanical road sweeper or other appropriate means. An ordinary sweeping brush may be acceptable on smaller bridges with the Engineer's consent.

Item No	Title and Written Text
30	**Cleaning of drain gullies** All drain gullies on or adjacent to structures shall be cleaned of silt, debris and vegetation by sweeping, rodding, power water jetting or other appropriate means. All gully connection and/or outlet pipes shall be cleared by rodding, power water jetting or other appropriate means to ensure the unimpeded flow of water from the gullies and through the drainage outlets.
32	**Establish drainage facility** Existing drainage channels in verges on the approaches to bridge decks shall be brushed, pressure hosed or otherwise cleared of all vegetation and debris from any source and then re-profiled and relined as necessary to establish the channel and ensure positive and rapid dispersal of surface water. Where drainage channels are not provided adjacent to a structure but are required the Contractor shall establish a channel by excavating a water-cut in the soft verge to allow excess water to drain off the road into the road embankment. Typically the water cut shall be 500mm wide and draining at a minimum gradient of 1:5 away from the road.
34	**Hosing of drainage system** All drainage kerbs, Beanie Blocks, channels and similar on or adjacent to structures shall be cleaned of silt, debris and vegetation by sweeping, rodding and/or power water jetting to the nearest manhole down-gradient.
99	**Miscellaneous works** *Replacing Gully Gratings* Replacement gully gratings shall meet the requirements of clauses 508.4 and 508.5 of the TII Specification for Roadworks and installed in accordance with the relevant TII Standard Construction Detail. *Replacing Traffic Signs* Traffic signs shall be replaced in accordance with TII Specifications and Standard Details Any other routine repair and maintenance works to bridge surfaces not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of TII.

SECTION 2.0 – EXPANSION JOINTS

Item No	Title and Written Text
10	**Cleaning of expansion joints** All dirt, debris and vegetation shall be removed from expansion joints by either sweeping clean with a brush or using an airline/hose.
14	**Maintenance of joints** Cracked, rutted, worn or delaminated asphaltic plug joints in the carriageway or footway shall be made good using a macadam material or a proprietary material. Such material must be compatible with the existing material have similar or better expansion/contraction properties than the original material and have the prior approval of the Engineer. When using an accepted proprietary material the method of repair shall be in accordance with the manufacturer's specification. Missing and/or poor condition sealant at movement joints in parapet upstands shall be removed, the joints cleaned out and replacement compressible filler and polysulphide sealant or similar approved material installed in accordance with manufacturer's instructions.
99	**Miscellaneous works** *Tightening of Bolts* All loose holding down bolts shall be tightened to the correct torque. Any missing bolts and associated brackets shall be replaced to match original. Any other routine repair and maintenance works to expansion joints not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of the Clients instructions.

SECTION 3.0 – FOOTWAY/MEDIAN

Item No	Title and Written Text
02	**Installation of Rubbing Strips** Rubbing Strips shall be in accordance with TII Publications.
12	**Sealing of pavement cracks up to 15mm wide** All dirt, debris and vegetation shall be removed from pavement cracks either by sweeping clean with a brush using a power hose (air line) or manual raking out. For bituminous footways the cracks shall be sealed with hot poured bitumen or similar approved product in accordance with standard good practice or any approved proprietary product manufacturer's specified method. For concrete footways the cracks shall be sealed with an approved non shrink mortar in accordance with standard good practice or any approved proprietary product manufacturer's specified method.
21	**Sweeping and cleaning** All debris, loose grit, general litter and vegetation shall be removed from the footways, verges and median surface using mechanical road sweeper or hand brushing.
22	**Maintenance of Surface** All potholes, excess wear, rutting and general degradation of surfacing shall be repaired to match existing. All loose and broken material shall be removed and exposed surfaces cleaned and an approved repair material placed in accordance with normally approved methods as follows: *a) Concrete.* Concrete shall be repaired by removing loose or damaged material, preparing the repair perimeter by saw cutting to a depth of 10mm, roughening the face of the exposed concrete below and then reinstating with an approved non shrink mortar, and primer if necessary, in accordance with the manufacturer's instructions. *b) Asphalt* The area to be repaired shall be saw cut through the asphalt layer. Loose waste material shall be removed. Bedding material shall be made up to the required level and compacted to the satisfaction of the Engineer and the remaining hole reinstated with material compatible with the original. *c) Paving slabs/flags* Broken flags shall be removed and replaced with similar. Loose or displaced flags to be rebedded using material comparable with existing. (Cont'd)

Item No	Title and Written Text
22	**Maintenance of surface (Cont'd)** d) Cobbles/sets are to be re-bedded in a manner similar to the original. Before placing any surfacing, paving slabs, setts/cobbles etc. the sub-base/bedding shall be made up to the required level with full compaction to the satisfaction of the Engineer. Where dig out and replace is the approved repair method, the perimeter of the repair shall be saw cut and the repair area excavated to ensure all weak and contaminated or disturbed material is removed. The perimeter of the area where re-shaping is required shall be determined by the Contractor and shall be the minimum required to achieve the surface shape criteria. The deviation (up or down) when measured with a 2m straightedge shall not be greater than 5mm, both within the repair and between the existing pavement and the repair, and there shall be no sharp ridges. There shall be no depressions in the finished surface that allow water to pond. Surfacing treatments shall match the adjacent carriageway material. Surface texture shall match that of the adjacent pavement and have a similar or greater skid resistance value. Where necessary the circumference of the repair shall be crack sealed to ensure waterproof joints. All line markings and raised pavement markers disturbed or removed during the completion of the repair shall be reinstated in accordance with CC-SPW-01200.
99	**Miscellaneous works** Any other routine repair and maintenance works to footway medians not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of the Clients instructions.

SECTION 4.0 – PARAPETS/SAFETY BARRIERS

Item No	Title and Written Text
03	**Removal of Vegetation** All vegetation shall be removed from masonry, concrete and steel parapets in such a manner as to avoid damage to mortar, concrete, protective systems and fixings. Ivy growth may be chemically sprayed with a product to be approved by the Engineer and left to wilt before removal. Notification of intention to spray is to be given to the relevant Local Authority at least one week prior to work commencing in any Local Authority area. Chemicals used for vegetation control shall be approved by TII as suitable for the uses as specified in the contract documents. All operators must hold a current (*local industry)* qualification and be in possession of training certificates for the type of work specified. Chemicals shall be prepared and applied in accordance with manufacturers' recommendations and Codes of Practice and in strict compliance with all relevant Acts, Regulations and Bylaws governing their use. The Contractor shall supply the details regarding chemicals and application rates to be used for each area, the methodology including programme for chemical application and equipment to be used. The Contractor shall notify the Engineer prior to any change in chemicals, planned application rates and methods from those detailed at the time of tendering. During spraying operations applications rates may be varied at the Contractor's discretion to achieve the specified standard of vegetation control. Changes to daily application rates shall be recorded by the Contractor on his diary sheet. The Contractor shall complete a daily chemical diary detailing all work undertaken including application rates and chemicals used, wind direction, rainfall and any other relevant information and submit to the Engineer with each monthly payment claim. The Contractor shall ensure that no toxic or contaminating substances are allowed to spill or drift onto non-targeted land or water during the work and take precautions to prevent the contamination of water courses by chemical run-off from sprayed areas. Due consideration is to be given to run-off and the risk of contaminates entering water courses of affecting the surrounding flora and fauna. Where necessary, run-off shall be contained by water retaining barriers and disposed of at an approved disposal site. No spraying shall be undertaken in the rain or when rain is forecast to fall before the manufacturers labelled drying times can be met. The Contractor shall prevent chemical drift when spraying. Chemicals are not to be used when wind speed exceeds 10 km/hr unless an approved "anti-drift" nozzle is used. No chemicals shall be used when wind speed is in excess of 15 km/hr. Edible fruits and berries shall not be sprayed between the period May to August inclusive. Waste or surplus chemicals shall be disposed of in a safe manner. In the event of contamination caused by any action or inaction of the Contractor, the Contractor shall comply with all relevant Acts, Regulations and Bylaws governing the remedy and mitigation of any adverse effects on the environment. (Cont'd)

Item No	Title and Written Text
03	**Removal of vegetation (Cont'd)** All costs associated with such remedial or mitigatory work shall be borne by the Contractor. When working within these areas of special conservation and national monuments the Contractor shall only carry out chemical spraying on the written approval of the Authority controlling the Park, Reserve or other land, shall submit a copy of such written approval to the Engineer prior to commencement or work and shall implement any measures set by the Controlling Authority. Additionally, in areas where chemical use has been allowed no spray tanks shall be emptied or sluiced out or any other equipment cleaned anywhere within the boundaries. Where chemical use has been allowed the Warden, Ranger or other concerned authority shall be notified immediately following any accidental chemical spillage that may endanger the flora and fauna of the area.Trees shall be cut above ground level and the stumps grubbed out. The stumps of vegetation with a diameter greater than 100mm shall have vertical saw cuts made into the stub to promote natural rotting. Any roots remaining after the above work shall be treated with a root killer approved by the Engineer. Deeply rooted trees and other vegetation which are likely to result in damage to the structure on removal are to be referred to the Engineer for further guidance. Mould/fungus/algae are to be removed by a combination of stiff brush, hand scraper and high pressure water hosing. Should a chemical spray be necessary to assist with the removal of stubborn mould/fungus/algae then the consent of the Engineer shall first be obtained. On completion of removal of vegetation the parapets are to be cleaned using a combination of solvent (as necessary and with the approval of the Engineer), high pressure water hose and/or stiff brush to restore the original condition as far as possible. Any damage to masonry, mortar or other materials shall be repaired in accordance with the relevant Section of this Specification.
50	**Concrete Repair** Concrete repairs shall be carried out where minor areas of defective concrete are identified by the Engineer. Cracked, honeycombed, delaminated, contaminated or otherwise defective concrete shall be broken out by hand held drill/impact hammer or other specified method, taking due care to avoid damage to sound concrete and reinforcement. The concrete shall be broken out to a depth equal to the maximum size of aggregate plus 5mm beyond the reinforcement. The exposed faces shall be formed by cutting neat straight edges and shall be scabbled if necessary and cleaned off. The exposed surfaces shall be suitably primed and an approved, proprietary prebagged repair mortar, complying with the requirements of AM-STR-06052, placed by hand ensuring a flush finish with the adjoining surface. The repair mortar shall be prepared and placed in accordance with the manufacturer's requirements.
54	**Maintenance of bedding mortar** Loose and broken bedding mortar beneath parapet post base plates shall be made good with a compatible proprietary bedding mortar of no less strength than the original. All loose and broken material shall be broken out, surfaces cleaned and roughened prior to placement of the repair material. During replacement of bedding material appropriate support arrangements for maintaining the parapet posts in an upright position shall be provided.

Item No	Title and Written Text
55	**Repair of parapet** All missing parapet holding down and fixing nuts shall be replaced by similar and tightened in accordance with the manufactures method to the required torque. All loose nuts shall be retightened similarly unless they are damaged or show signs of excessive corrosion in which case they shall be removed and replaced as above. Any damaged holding down bolts and studs shall be reported to the Engineer. Any damaged mesh facing panels shall be removed and, together with missing panels, replaced by new of similar form, colour, size and protective system as the original. Replacement fixings and trims shall be provided as necessary. Parapet posts or rails which have incurred localised damaged or deformation shall be replaced to match the original. The new rail or post shall be sourced from an TII approved supplier and shall meet the existing level of containment. Sealing of cracks in concrete parapets or any other concrete repairs called up under this heading shall be carried out in accordance with Section 4 , Item No. 50 of this specification. All missing concrete coping (wall caps) and pilasters (pillar caps) shall be replaced using units of a similar type, shape and size to the original and to the original line and level. Mortar used shall be a suitable cementitious mortar. All damaged blockwork shall be replaced, together with all missing blockwork, using blocks of a similar type, shape and size to the original and to the original line and level. Blockwork repairs shall match existing blockwork. Mortar used shall be a suitable cementitous mortar.

Item No	Title and Written Text
59	**Removal of Graffiti** When removing graffiti, where possible the use of proprietary graffiti removing products shall be favoured over abrasive cleaning techniques to avoid unnecessary damage to the fabric of the structure. Therefore, graffiti shall be removed by a combination of proprietary materials such as water-soluble sprays and aerosols, gels and poultices, and high pressure hosing, stiff brush and abrasives when so approved by the Engineer. Regardless of the method of removal of graffiti it will always be necessary to carry out insitu trials on a small unobtrusive section of the structure to determine the effectiveness of the chosen method and to confirm that no undue damage is caused to the substrate during the process. Proprietary materials shall be applied strictly in accordance with the manufacturers recommendations and shall be appropriate both for the substrate material (concrete, masonry, metalwork, etc.) and the marking agent (paint, ink, wax based materials, etc.). Acid based cleaners should never be used on acid sensitive materials that might be etched or abraded by acid. These include stonework such as limestone, marble or calcareous sandstone. The thicker consistency of gels and poultices, which are expressly designed to draw out pigment from permeable materials, make them more suitable for brickwork and other porous substrates. However, aluminium (parapets, etc.) and anodised metals can be attacked by bleach, ammonia and other alkalis. Ink and felt tip marker stains should be removed using a glycol ether solvent, such as methoxypropanol, applied with a clean white cloth over the area affected. The minimum amount of solvent necessary to remove the stain shall be used as excess solvents on porous substrates (i.e. concrete) can potentially carry the dyes further into the parent material. Materials such as brick and stone are generally not adversely affected by glycol ether. However, if a reaction is noted, the area should be immediately dosed in water. All personnel using glycol ethers shall be trained in their use and application and alerted to the dangers of using these chemicals in accordance with the requirements of the Health Safety and Welfare at Work (Construction) Regulations 2006. The majority of the graffiti encountered on bridge structures consist of spray-applied paint. Graffiti caused by spray-applied paints shall be removed using a water based cleaning gel. The gel shall be applied to the affected area with a brush in a circular motion. After a short waiting time the mixture of paint and gel shall be washed off with water, collected and disposed of off site in a suitable waste disposal facility. In the case of persistent graffiti stains the cleaning action should be repeated. In certain instances, it may be necessary to over paint the graffiti rather than to remove it, especially in the structure has been coated with an anti-carbonation or crack bridging coating. In these circumstances the use of an anti-graffiti coating should be considered in combination with over painting the structure especially on high-risk structures where graffiti is a persistent problem. Repainting of graffiti covered surfaces must be preceded by the use of a sealer coat to prevent the graffiti pigment from bleeding through. Where over painting is required, the colour of the applied paint shall match the existing.

Item No	Title and Written Text
60	**Masonry Repointing** Prior to commencement of all repointing and repair works, all vegetation and algae to be removed from face of walls and arch barrel soffits in accordance with the specification. Loose and cracked pointing shall be raked out to sound material and the joint cleaned. All such joints and joints with deep pointing shall be repointed flush with the masonry face. All repointing shall be undertaken with lime mortar in accordance with the contents of the Specification for Masonry Repointing. Repointing shall only be undertaken by stonemasons who have attended the TII approved 'Masonry Arch Bridge Repair Workshop' or are members of the Guild of Master Craftsmen and their qualifications shall be submitted to the Engineer. Hand pointing only required to a depth not exceeding 50mm.
61	**Masonry repair** All damaged masonry shall be replaced, together with all missing masonry, by stone of a similar type, shape and size to the original and to the original line and level. Masonry repair shall match existing stonework. Mortar shall be lime mortar in accordance with the Specification for Masonry Repointing. Masonry repairs shall only be undertaken by stonemasons who have attended the TII approved 'Masonry Arch Bridge Repair Workshop' or are members of the Guild of Master Craftsmen and their qualifications shall be submitted to the Engineer.
70	**Patch painting of steel** Steelwork with damaged, missing, flaking or otherwise poor condition paintwork shall be touch repainted over the defective areas. Prior to repainting all loose paint shall be removed, the surfaces exposed down to bare metal using a wire brush or other suitable method and the surfaces repainted using a compatible TII approved paint system in accordance with the approval procedures outlined in CC-SPW-00900 to the original full paint thickness and matching colour applied in accordance with the paint systems specification.
72	**Replacement of Safety Barrier** Lengths of Safety Barrier (both safety barriers and pedestrian Safety Barriers) on the bridge approaches or across the bridge which exhibit localised damage and which can be repaired by simply unbolting the damaged section and bolting on a new length with new bolts shall be so repaired. In some instances it may be necessary to cast new post footings, provide new connections with parapets or install safety barrier terminal concrete end blocks. All replacement components shall meet the requirements of EN1317.
74	**Tightening of bolts** All loose bolt connections on steel and aluminium parapets or Safety Barriers shall be tightened to the correct torque. Any missing bolts, nuts or washers and associated brackets shall be replaced to match original.

Item No	Title and Written Text
99	**Miscellaneous works** *Replacing missing concrete coping (wall caps) and pilasters (pillar caps).* Missing and/or damaged concrete coping and pilasters shall be replaced or repaired in accordance with Section 4 Item No. 55 or Section 14 Item No. 50 of this Specification respectively. *Blockwork Repair* Blockwork repairs shall be carried out in accordance with Section 4 Item No. 55 of this specification. *High-pressure hosing of surface* High-pressure hosing of parapets shall be carried out in accordance with Section 6 Item No. 52 of this Specification. Any other routine repair and maintenance works to parapets/Safety Barriers not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of the Clients instructions.

SECTION 5.0 – EMBANKMENTS/REVETMENTS

Item No	Title and Written Text
03	**Removal of vegetation** All trees, bushes, ivy and deep rooted vegetation within 1m of any part of a structure shall be removed down to ground level. In some instances it may be necessary to remove vegetation more than 1m from the structure to allow access to the substructure, where vegetation is deemed to be fast growing or where invasive roots may pose a threat to the structure. The stumps of vegetation with a diameter greater than 100mm shall have vertical saw cuts made into the stub to promote natural rotting. Remaining roots less than 0.5m deep shall be dug out and removed. Any roots remaining after the above work shall be treated with root killer with the approval of the Engineer. The treatment to be adopted may vary with the type of vegetation but shall be similar to that adopted in item 03 of Section 4.0 Parapets/Safety Barrier above.
33	**Establish drainage channel** Existing drainage channels on embankments/Revetments shall be brushed, pressure hosed or otherwise cleared of all vegetation and debris from any source and then reprofiled and relined as necessary to establish the channel and ensure positive and rapid dispersal of surface water. Where drainage channels are not provided adjacent to a structure but are required the Contractor shall establish a channel by excavating A water cut in the embankment/Revetment to allow excess water to drain down the embankment. Typically the water cut shall be 500mm wide and draining at a minimum gradient of 1:5 down the embankment.
44	**Maintenance of gabions** Damaged gabions shall be repaired wherever feasible using similar wire to the original. Missing stone infill shall be made good with stone of similar type and size. Gabions considered beyond repair shall be carefully removed so as to avoid all undue disturbance to the embankment and new gabions filled with the recovered or similar stone installed. New gabions shall have a Roads and Bridges Agrement Certificate and shall match as closely as possible the existing gabions. Gabions showing signs of or being at risk of excessive settlement shall be carefully removed, footings/foundations made good and compacted and the gabions reinstated. Any actual or likely significant slope instability shall be reported to the Client.
45	**Maintenance of Revetment protection** Revetment protection includes gabions, rock revetments, paving slabs, pavoirs, in situ concrete, stone or other materials placed specifically to protect an embankment slope. Revetment protection shall be maintained by replacing missing, damaged or otherwise poor condition units. Unstable or displaced units shall be reinstated in a manner to match the existing bedding. Soft spots occurring beneath unstable or displaced units shall be excavated out and replaced with suitable compacted stone fill in accordance with CC-SPW-00800.

Item No	Title and Written Text
47	**Reshaping (imported materials)** Earth embankments and Revetments shall be reprofiled to the original slope using recovered soil or suitable imported fill if soil is not available on site. All imported material is subject to approval by the Engineer.
59	**Removal of Graffiti** When removing graffiti, where possible the use of proprietary graffiti removing products shall be favoured over abrasive cleaning techniques to avoid unnecessary damage to the fabric of the structure. Therefore, graffiti shall be removed by a combination of proprietary materials such as water-soluble sprays and aerosols, gels and poultices, and high pressure hosing, stiff brush and abrasives when so approved by the Engineer. Regardless of the method of removal of graffiti it will always be necessary to carry out insitu trials on a small unobtrusive section of the structure to determine the effectiveness of the chosen method and to confirm that no undue damage is caused to the substrate during the process. Proprietary materials shall be applied strictly in accordance with the manufacturers recommendations and shall be appropriate both for the substrate material (concrete, masonry, metalwork, etc.) and the marking agent (paint, ink, wax based materials, etc.). Acid based cleaners should never be used on acid sensitive materials that might be etched or abraded by acid. These include stonework such as limestone, marble or calcareous sandstone. The thicker consistency of gels and poultices, which are expressly designed to draw out pigment from permeable materials, make them more suitable for brickwork and other porous substrates. However, aluminium (parapets, etc.) and anodised metals can be attacked by bleach, ammonia and other alkalis. Mechanical abrasive graffiti removal shall be carried out as a last resort by specialist firms and should only be carried out on uncoated concrete substrates. Typical methods include low and high-pressure water cleaning with or without detergents as well as sand or grit blasting. Due care shall be taken to protect the general public from the affects of all mechanical abrasive graffiti removal techniques, to the satisfaction of the Engineer. The Contractor shall provide method statements and risk assessments associated with graffiti removal to demonstrate compliance with the Specification at least 2 weeks prior to undertaking any trials on bridge structures. Ink and felt tip marker stains should be removed using a glycol ether solvent, such as methoxypropanol, applied with a clean white cloth over the area affected. The minimum amount of solvent necessary to remove the stain shall be used as excess solvents on porous substrates (i.e. concrete) can potentially carry the dyes further into the parent material. Materials such as brick and stone are generally not adversely affected by glycol ether. However, if a reaction is noted, the area should be immediately dosed in water. All personnel using glycol ethers shall be trained in their use and application and alerted to the dangers of using these chemicals in accordance with the requirements of the Health Safety and Welfare at Work (Construction) Regulations 2006. The majority of the graffiti encountered on bridge structures consist of spray-applied paint. Graffiti caused by spray-applied paints shall be removed using a water based cleaning gel. The gel shall be applied to the affected area with a brush in a circular motion. After a short waiting time the mixture of paint and gel shall be washed off

Item No	Title and Written Text
	with water, collected and disposed of off site in a suitable waste disposal facility. In the case of persistent graffiti stains the cleaning action should be repeated. In certain instances, it may be necessary to over paint the graffiti rather than to remove it, especially in the structure has been coated with an anti-carbonation or crack bridging coating. In these circumstances the use of an anti-graffiti coating should be considered in combination with over painting the structure especially on high-risk structures where graffiti is a persistent problem. Repainting of graffiti covered surfaces must be preceded by the use of a sealer coat to prevent the graffiti pigment from bleeding through. Where over painting is required, the colour of the applied paint shall match the existing.
99	**Miscellaneous works** *Clearance of Litter* The embankments shall be cleared of all obstructions and debris. This includes but is not limited to dumped household or domestic appliances / waste, concrete or masonry rubble or any detritus material. Any other routine repair and maintenance works to embankments/Revetments not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of the Clients instructions.

SECTION 6.0 – WING WALLS/SPANDREL WALLS/RETAINING WALLS

Item No	Title and Written Text
03	**Removal of vegetation** All vegetation rooted in, undermining or otherwise affecting the integrity of a Wingwalls/Spandrel Walls/Retaining Walls shall be removed in such a manner as to avoid damage to the wall. This shall include but not be limited to trees, shrubs, ivy, moss and roots within 1m of a masonry or concrete wing wall. The treatment to be adopted may vary with the type of vegetation but shall be similar to that adopted in item 03 of Section 4.0 Parapets/Safety Barrier above. Any damage to masonry, mortar or other materials resulting from this work shall be repaired in accordance with the relevant Section of this Specification.
50	**Concrete Repairs** Concrete repairs shall be carried out where minor areas of defective concrete are identified by the Engineer. Cracked, honeycombed, delaminated, contaminated or otherwise defective concrete shall be broken out by hand held drill/impact hammer or other specified method, taking due care to avoid damage to sound concrete and reinforcement. The concrete shall be broken out to a depth equal to the maximum size of aggregate plus 5mm beyond the reinforcement. The exposed faces shall be formed by cutting neat straight edges and shall be scabbled if necessary and cleaned off. The exposed surfaces shall be suitably primed and an approved, proprietary prebagged repair mortar, complying with the requirements of AM-STR-06052, placed by hand ensuring a flush finish with the adjoining surface. The repair mortar shall be prepared and placed in accordance with the manufacturer's requirements.
52	**High pressure hosing of surface** Any growth (fungal, algal, etc) or staining on Wingwalls/Spandrel Walls/Retaining Walls shall be removed by high pressure hosing. Care to be taken with masonry bridges to avoid damage to pointing. It may be necessary to treat staining with a suitable herbicide/fungicide prior to hosing. Consent of the Engineer shall first be obtained for the herbicide/fungicide. Due consideration is to be given to run-off and the risk of contaminates entering water courses of affecting the surrounding flora and fauna. Where necessary, run-off shall be contained by water retaining barriers and disposed of at an approved disposal site. All works shall be carried out after consultation with and in accordance with the requirements of the Office of Public Works, Waterways Ireland, National Parks and Wildlife and/or Inland Fisheries Ireland as necessary.
53	**Maintenance of joints** Missing and/or poor condition sealant at movement joints between non-continuous structural elements shall be removed, the joints cleaned out and replacement compressible filler and polysulphide sealant or similar approved material installed in accordance with manufacturer's instructions.

Item No	Title and Written Text
56	**Establish base protection** Base protection shall be provided where there is evidence of water ponding around Wingwalls/Spandrel Walls/Retaining Walls. This will take the form of a sloped concrete apron. Where wing wall footings have been identified as at risk of undermining, by washout, embankment instability or other means, mass concrete of not less than Grade C20/25 shall be placed and compacted in any void and an apron of not less than 300mm depth (below ground level) and 300mm width provided immediately in front of the wall over the length and width specified or otherwise directed by the Engineer.
57	**Maintenance of base protection** Where base protection is already in place but requires stabilisation/protection it shall be reinstated as necessary in accordance with item 56 above.
59	**Removal of Graffiti** When removing graffiti, where possible the use of proprietary graffiti removing products shall be favoured over abrasive cleaning techniques to avoid unnecessary damage to the fabric of the structure. Therefore, graffiti shall be removed by a combination of proprietary materials such as water-soluble sprays and aerosols, gels and poultices, and high pressure hosing, stiff brush and abrasives when so approved by the Engineer. Regardless of the method of removal of graffiti it will always be necessary to carry out insitu trials on a small unobtrusive section of the structure to determine the effectiveness of the chosen method and to confirm that no undue damage is caused to the substrate during the process. Proprietary materials shall be applied strictly in accordance with the manufacturers recommendations and shall be appropriate both for the substrate material (concrete, masonry, metalwork, etc.) and the marking agent (paint, ink, wax based materials, etc.). Acid based cleaners should never be used on acid sensitive materials that might be etched or abraded by acid. These include stonework such as limestone, marble or calcareous sandstone. The thicker consistency of gels and poultices, which are expressly designed to draw out pigment from permeable materials, make them more suitable for brickwork and other porous substrates. However, aluminium (parapets, etc.) and anodised metals can be attacked by bleach, ammonia and other alkalis. Mechanical abrasive graffiti removal shall be carried out as a last resort by specialist firms and should only be carried out on uncoated concrete substrates. Typical methods include low and high-pressure water cleaning with or without detergents as well as sand or grit blasting. Due care shall be taken to protect the general public from the affects of all mechanical abrasive graffiti removal techniques, to the satisfaction of the Engineer. The Contractor shall provide method statements and risk assessments associated with graffiti removal to demonstrate compliance with the Specification at least 2 weeks prior to undertaking any trials on bridge structures. Ink and felt tip marker stains should be removed using a glycol ether solvent, such as methoxypropanol, applied with a clean white cloth over the area affected. The minimum amount of solvent necessary to remove the stain shall be used as excess solvents on porous substrates (i.e. concrete) can potentially carry the dyes further into the parent material. Materials such as brick and stone are generally not adversely affected by glycol ether. However, if a reaction is noted, the area should

Item No	Title and Written Text
	be immediately dosed in water. All personnel using glycol ethers shall be trained in their use and application and alerted to the dangers of using these chemicals in accordance with the requirements of the Health Safety and Welfare at Work (Construction) Regulations 2006. The majority of the graffiti encountered on bridge structures consist of spray-applied paint. Graffiti caused by spray-applied paints shall be removed using a water based cleaning gel. The gel shall be applied to the affected area with a brush in a circular motion. After a short waiting time the mixture of paint and gel shall be washed off with water, collected and disposed of off site in a suitable waste disposal facility. In the case of persistent graffiti stains the cleaning action should be repeated. In certain instances, it may be necessary to over paint the graffiti rather than to remove it, especially in the structure has been coated with an anti-carbonation or crack bridging coating. In these circumstances the use of an anti-graffiti coating should be considered in combination with over painting the structure especially on high-risk structures where graffiti is a persistent problem. Repainting of graffiti covered surfaces must be preceded by the use of a sealer coat to prevent the graffiti pigment from bleeding through. Where over painting is required, the colour of the applied paint shall match the existing
60	**Masonry repointing** Repointing shall be undertaken in the same manner as in Section 4.0 Parapets/Safety Barrier.
61	**Masonry repair** Repairs shall be undertaken in the same manner as in Section 4.0 Parapets/Safety Barrier.
99	**Miscellaneous works** *Training Walls* Masonry, concrete and gabion training walls shall be maintained in a manner similar to relevant items in Section 4.0. Where training walls have been undermined by scour and are in danger of collapse their condition shall be brought to the attention of the Engineer. *Sealing of Cracks* Sealing of cracks in concrete Wingwalls/Spandrel Walls/Retaining Walls or headwalls, or any other concrete repairs called up under this heading shall be carried out in accordance with Section 6 Item No. 50 of this specification. Repair of Concrete Buttresses Any concrete repairs to buttresses called up under this heading shall be carried out in accordance with Section 6 Item No. 57 and Section 6 Item No. 50 of this specification.

SECTION 7.0 – ABUTMENT

Item No	Title and Written Text
03	**Removal of vegetation** All vegetation rooted in, undermining or otherwise affecting the integrity of an abutment shall be removed in such a manner as to avoid damage to the wall. This shall include but not be limited to trees, shrubs, ivy, moss and roots within 1m of a masonry, concrete or reinforced earth abutment. The treatment to be adopted may vary with the type of vegetation but shall be similar to that adopted in item 03 of Section 4.0 Parapets/Safety Barrier above. Any damage to masonry, mortar or other materials resulting from this work shall be repaired in accordance with the relevant Section of this Specification.
35	**Maintenance of bearing shelf drainage channel** The drainage channel on the bearing shelf and associated drainage outlets shall be cleaned by hand brush and pressure hose as necessary and then rodded to ensure the unimpeded flow of water from the bearing shelf and through the drainage outlets. Bearing shelves shall be cleared of all loose debris by brushing or air line. Similarly, all abutment gallery drainage runs shall be cleaned by hand brush and pressure hose as necessary and then rodded to ensure the unimpeded flow of water from the gallery and through the drainage outlets. Any staining to the gallery walls is to be removed by high pressure hosing and any miscellaneous debris is to be disposed of. The Contractor is to make all necessary arrangements for access to abutment galleries including liaison with the relevant Local Authority and any traffic management as required.
50	**Concrete Repairs** Concrete repairs shall be carried out where minor areas of defective concrete are identified by the Engineer. Cracked, honeycombed, delaminated, contaminated or otherwise defective concrete shall be broken out by hand held drill/impact hammer or other specified method, taking due care to avoid damage to sound concrete and reinforcement. The concrete shall be broken out to a depth equal to the maximum size of aggregate plus 5mm beyond the reinforcement. The exposed faces shall be formed by cutting neat straight edges and shall be scabbled if necessary and cleaned off. The exposed surfaces shall be suitably primed and an approved, proprietary prebagged repair mortar, complying with the requirements of AM-STR-06052, placed by hand ensuring a flush finish with the adjoining surface. The repair mortar shall be prepared and placed in accordance with the manufacturer's requirements.
52	**High pressure hosing of surface** Any growth (fungal, algal, etc) or staining on abutments shall be removed by high pressure hosing. Care is to be taken with masonry bridges to avoid damage to pointing. It may be necessary to treat staining with a suitable herbicide/fungicide prior to hosing. Consent of the Engineer shall first be obtained for the herbicide/fungicide. Due consideration is to be given to run-off and the risk of contaminates entering water courses of affecting the surrounding flora and fauna. Where necessary, run-off shall be contained by water retaining barriers and disposed of at an approved

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	disposal site. All works shall be carried out after consultation with and in accordance with the requirements of the Office of Public Works, Waterways Ireland, National Parks and Wildlife and/or Inland Fisheries Ireland as necessary.
53	**Maintenance of soft joints** Missing and/or poor condition sealant at movement joints between non-continuous structural elements shall be removed, the joints cleaned out and replacement compressible filler and polysulphide sealant or similar approved material installed in accordance with manufacturer's instructions.
56	**Establish base protection** Base protection shall be provided where there is evidence of water ponding around abutments. This will take the form of a sloped concrete apron. Where abutment footings have been identified as at risk of undermining, by washout, embankment instability or other means, mass concrete of not less than Grade C20/25 shall be placed and compacted in any void and an apron of not less than 300mm depth (below ground level) and 300mm width provided immediately in front of the wall over the length and width specified or otherwise directed by the Engineer. When working within the river channel the Contractor shall adhere to the requirements listed in Section 0.0 Item No. 1 part f of this specification.
57	**Maintenance of base protection** Where base protection is already in place but requires stabilisation/protection it shall be reinstated as necessary in accordance with item 56 above.
59	**Removal of Graffiti** When removing graffiti, where possible the use of proprietary graffiti removing products shall be favoured over abrasive cleaning techniques to avoid unnecessary damage to the fabric of the structure. Therefore, graffiti shall be removed by a combination of proprietary materials such as water-soluble sprays and aerosols, gels and poultices, and high pressure hosing, stiff brush and abrasives when so approved by the Engineer. Regardless of the method of removal of graffiti it will always be necessary to carry out insitu trials on a small unobtrusive section of the structure to determine the effectiveness of the chosen method and to confirm that no undue damage is caused to the substrate during the process. Proprietary materials shall be applied strictly in accordance with the manufacturers recommendations and shall be appropriate both for the substrate material (concrete, masonry, metalwork, etc.) and the marking agent (paint, ink, wax based materials, etc.). Acid based cleaners should never be used on acid sensitive materials that might be etched or abraded by acid. These include stonework such as limestone, marble or calcareous sandstone. The thicker consistency of gels and poultices, which are expressly designed to draw out pigment from permeable materials, make them more suitable for brickwork and other porous substrates. However, aluminium (parapets, etc.) and anodised metals can be attacked by bleach, ammonia and other alkalis. Mechanical abrasive graffiti removal shall be carried out as a last resort by specialist firms and should only be carried out on uncoated concrete substrates. Typical

Item No	Title and Written Text
	methods include low and high-pressure water cleaning with or without detergents as well as sand or grit blasting. Due care shall be taken to protect the general public from the affects of all mechanical abrasive graffiti removal techniques, to the satisfaction of the Engineer. The Contractor shall provide method statements and risk assessments associated with graffiti removal to demonstrate compliance with the Specification at least 2 weeks prior to undertaking any trials on bridge structures. Ink and felt tip marker stains should be removed using a glycol ether solvent, such as methoxypropanol, applied with a clean white cloth over the area affected. The minimum amount of solvent necessary to remove the stain shall be used as excess solvents on porous substrates (i.e. concrete) can potentially carry the dyes further into the parent material. Materials such as brick and stone are generally not adversely affected by glycol ether. However, if a reaction is noted, the area should be immediately dosed in water. All personnel using glycol ethers shall be trained in their use and application and alerted to the dangers of using these chemicals in accordance with the requirements of the Health Safety and Welfare at Work (Construction) Regulations 2006. The majority of the graffiti encountered on bridge structures consist of spray-applied paint. Graffiti caused by spray-applied paints shall be removed using a water based cleaning gel. The gel shall be applied to the affected area with a brush in a circular motion. After a short waiting time the mixture of paint and gel shall be washed off with water, collected and disposed of off site in a suitable waste disposal facility. In the case of persistent graffiti stains the cleaning action should be repeated. In certain instances, it may be necessary to over paint the graffiti rather than to remove it, especially in the structure has been coated with an anti-carbonation or crack bridging coating. In these circumstances the use of an anti-graffiti coating should be considered in combination with over painting the structure especially on high-risk structures where graffiti is a persistent problem. Repainting of graffiti covered surfaces must be preceded by the use of a sealer coat to prevent the graffiti pigment from bleeding through. Where over painting is required, the colour of the applied paint shall match the existing.
60	**Masonry Repointing** Loose and cracked pointing shall be raked out to sound material and the joint cleaned. All such joints and joints with deep pointing shall be repointed flush with the masonry face. All repointing shall be undertaken with lime mortar in accordance with the TII Specification for Masonry Repointing. Repointing shall only be undertaken by stonemasons who have attended the TII approved 'Masonry Arch Bridge Repair Workshop' or are members of the Guild of Master Craftsmen and their qualifications shall be submitted to the Engineer. Hand pointing only required to a depth not exceeding 50mm.
61	**Masonry repairs** All damaged masonry shall be replaced, together with all missing masonry, by stone of a similar type, shape and size to the original and to the original line and level. Masonry repair shall match existing stonework. Mortar shall be lime mortar in accordance with the TII Specification for Masonry Repointing. Masonry repairs shall only be undertaken by stonemasons who have

Item No	Title and Written Text
	attended the TII approved 'Masonry Arch Bridge Repair Workshop' or are members of the Guild of Master Craftsmen and their qualifications shall be submitted to the Engineer.
99	**Miscellaneous** *Clearance of weep holes* Weep holes shall be rodded clear and any loose debris removed. Any broken pipes shall be repaired.

SECTION 8.0 – PIERS

Item No	Title and Written Text
03	**Removal of vegetation** All vegetation rooted in, undermining or otherwise affecting the integrity of a pier shall be removed in such a manner as to avoid damage to the wall. This shall include but not be limited to trees, shrubs, ivy and roots within 1m of a masonry or concrete pier. The treatment to be adopted may vary with the type of vegetation but shall be similar to that adopted in item 03 of Section 4.0 Parapets/Safety Barrier above. Any damage to masonry, mortar or other materials resulting from this work shall be repaired in accordance with the relevant Section of this Specification.
35	**Maintenance of Drainage Channel** The drainage channel on the bearing shelf and associated drainage outlets shall be cleaned by hand brush and pressure hose as necessary and then rodded to ensure the unimpeded flow of water from the bearing shelf and through the drainage outlets. Bearing shelves shall be cleared of all loose debris by brushing or air line.
50	**Concrete Repairs** Concrete repairs shall be carried out where minor areas of defective concrete are identified by the Engineer. Cracked, honeycombed, delaminated, contaminated or otherwise defective concrete shall be broken out by hand held drill/impact hammer or other specified method, taking due care to avoid damage to sound concrete and reinforcement. The concrete shall be broken out to a depth equal to the maximum size of aggregate plus 5mm beyond the reinforcement. The exposed faces shall be formed by cutting neat straight edges and shall be scabbled if necessary and cleaned off. The exposed surfaces shall be suitably primed and an approved, proprietary prebagged repair mortar, complying with the requirements of AM-STR-06052, placed by hand ensuring a flush finish with the adjoining surface. The repair mortar shall be prepared and placed in accordance with the manufacturer's requirements.
52	**High pressure hosing of surface** Any growth (fungal, algal, etc) on piers shall be removed by high pressure hosing. Care to be taken with masonry bridges to avoid damage to pointing. It may be necessary to treat staining with a suitable herbicide/fungicide prior to hosing. Consent of the Engineer shall first be obtained for the herbicide/fungicide. Due consideration is to be given to run-off and the risk of contaminates entering water courses of affecting the surrounding flora and fauna. Where necessary, run-off shall be contained by water retaining barriers and disposed of at an approved disposal site. All works shall be carried out after consultation with and in accordance with the requirements of the Office of Public Works, Waterways Ireland, National Parks and Wildlife and/or Inland Fisheries Ireland as necessary.
56	**Establish base protection** Base protection shall be provided where there is evidence of water ponding around piers. This will take the form of a sloped concrete apron.

Item No	Title and Written Text
	Where pier footings have been identified as at risk of undermining, by washout, embankment instability or other means, mass concrete of not less than Grade C20/25 shall be placed and compacted in any void and an apron of not less than 300mm depth (below ground level) and 300mm width provided immediately in front of the wall over the length and width specified or otherwise directed by the Engineer. When working within the river channel the Contractor shall adhere to the requirements listed in Section 0.0 Item No. 1 part f of this specification.
57	**Maintenance of base protection** Where base protection is already in place but requires stabilisation/protection it shall be reinstated as necessary in accordance with item 56 above.
59	**Removal of Graffiti** When removing graffiti, where possible the use of proprietary graffiti removing products shall be favoured over abrasive cleaning techniques to avoid unnecessary damage to the fabric of the structure. Therefore, graffiti shall be removed by a combination of proprietary materials such as water-soluble sprays and aerosols, gels and poultices, and high pressure hosing, stiff brush and abrasives when so approved by the Engineer. Regardless of the method of removal of graffiti it will always be necessary to carry out insitu trials on a small unobtrusive section of the structure to determine the effectiveness of the chosen method and to confirm that no undue damage is caused to the substrate during the process. Proprietary materials shall be applied strictly in accordance with the manufacturers recommendations and shall be appropriate both for the substrate material (concrete, masonry, metalwork, etc.) and the marking agent (paint, ink, wax based materials, etc.). Acid based cleaners should never be used on acid sensitive materials that might be etched or abraded by acid. These include stonework such as limestone, marble or calcareous sandstone. The thicker consistency of gels and poultices, which are expressly designed to draw out pigment from permeable materials, make them more suitable for brickwork and other porous substrates. However, aluminium (parapets, etc.) and anodised metals can be attacked by bleach, ammonia and other alkalis. Mechanical abrasive graffiti removal shall be carried out as a last resort by specialist firms and should only be carried out on uncoated concrete substrates. Typical methods include low and high-pressure water cleaning with or without detergents as well as sand or grit blasting. Due care shall be taken to protect the general public from the affects of all mechanical abrasive graffiti removal techniques, to the satisfaction of the Engineer. The Contractor shall provide method statements and risk assessments associated with graffiti removal to demonstrate compliance with the Specification at least 2 weeks prior to undertaking any trials on bridge structures. Ink and felt tip marker stains should be removed using a glycol ether solvent, such as methoxypropanol, applied with a clean white cloth over the area affected. The minimum amount of solvent necessary to remove the stain shall be used as excess solvents on porous substrates (i.e. concrete) can potentially carry the dyes further into the parent material Materials such as brick and stone are generally not adversely affected by glycol ether. However, if a reaction is noted, the area should be immediately dosed in water. All personnel using glycol ethers shall be trained in their use and application and alerted to the dangers of using these chemicals in accordance with the

Item No	Title and Written Text
	requirements of the Health Safety and Welfare at Work (Construction) Regulations 2006. The majority of the graffiti encountered on bridge structures consist of spray-applied paint. Graffiti caused by spray-applied paints shall be removed using a water based cleaning gel. The gel shall be applied to the affected area with a brush in a circular motion. After a short waiting time the mixture of paint and gel shall be washed off with water, collected and disposed of off site in a suitable waste disposal facility. In the case of persistent graffiti stains the cleaning action should be repeated. In certain instances, it may be necessary to over paint the graffiti rather than to remove it, especially in the structure has been coated with an anti-carbonation or crack bridging coating. In these circumstances the use of an anti-graffiti coating should be considered in combination with over painting the structure especially on high-risk structures where graffiti is a persistent problem. Repainting of graffiti covered surfaces must be preceded by the use of a sealer coat to prevent the graffiti pigment from bleeding through. Where over painting is required, the colour of the applied paint shall match the existing.
60	**Masonry Repointing** Loose and cracked pointing shall be raked out to sound material and the joint cleaned. All such joints and joints with deep pointing shall be repointed flush with the masonry face. All repointing shall be undertaken with lime mortar in accordance the TII Specification for Masonry Repointing. Repointing shall only be undertaken by stonemasons who have attended the TII approved 'Masonry Arch Bridge Repair Workshop' or are members of the Guild of Master Craftsmen and their qualifications shall be submitted to the Engineer. Hand pointing only required to a depth not exceeding 50mm.
61	**Masonry repairs** All damaged masonry shall be replaced, together with all missing masonry, by stone of a similar type, shape and size to the original and to the original line and level. Masonry repair shall match existing stonework. Mortar shall be lime mortar in accordance with the TII Specification for Masonry Repointing. Masonry repairs shall only be undertaken by stonemasons who have attended the TII approved 'Masonry Arch Bridge Repair Workshop' or are members of the Guild of Master Craftsmen and their qualifications shall be submitted to the Engineer.
99	**Miscellaneous** *Clearance of weep holes* Weep holes shall be rodded clear and any loose debris removed. Any broken pipes shall be repaired.

SECTION 9.0 – BEARINGS

Item No	Title and Written Text
50	**Concrete Repairs** Concrete repairs shall be carried out where minor areas of defective concrete are identified by the Engineer. Cracked, honeycombed, delaminated, contaminated or otherwise defective concrete shall be broken out by hand held drill/impact hammer or other specified method, taking due care to avoid damage to sound concrete and reinforcement. The concrete shall be broken out to a depth equal to the maximum size of aggregate plus 5mm beyond the reinforcement. The exposed faces shall be formed by cutting neat straight edges and shall be scabbled if necessary and cleaned off. The exposed surfaces shall be suitably primed and an approved, proprietary prebagged repair mortar, complying with the requirements of AM-STR-06052, placed by hand ensuring a flush finish with the adjoining surface. The repair mortar shall be prepared and placed in accordance with the manufacturer's requirements.
54	**Maintenance of bedding mortar** Cracked and missing bedding mortar to bearings shall be made good by cleaning out all broken mortar, cleaning off surfaces and reforming the original profile with an approved fully compatible repair mortar of no less strength than the original mortar.
58	**Cleaning of bearings** Bearings shall be cleared of all silt, dirt and debris or any other material which may impede the movement of or otherwise adversely affect the bearing by hand brushing and/or airline. Where required by the Client moving and sliding parts shall be regreased. Material which may impede moving parts and cannot be removed must be reported immediately to the Engineer
70	**Patch painting of steelwork** Painted bearings showing evidence of minor corrosion shall be patch painted with an approved protective system. The surface shall be prepared as necessary to suit the particular protective system.
99	**Miscellaneous works** Any other routine repair and maintenance works to bearings not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of the Clients instructions.

SECTION 10.0 – DECK/SLAB

Item No	Title and Written Text
31	**Cleaning of drip tubes** Any drip tubes or honel drains on the soffit of a bridge deck shall be rodded clear. Any broken pipes shall be repaired and made good.
50	**Concrete Repairs** Concrete repairs shall be carried out where minor areas of defective concrete are identified by the Engineer. Cracked, honeycombed, delaminated, contaminated or otherwise defective concrete shall be broken out by hand held drill/impact hammer or other specified method, taking due care to avoid damage to sound concrete and reinforcement. The concrete shall be broken out to a depth equal to the maximum size of aggregate plus 5mm beyond the reinforcement. The exposed faces shall be formed by cutting neat straight edges and shall be scabbled if necessary and cleaned off. The exposed surfaces shall be suitably primed and an approved, proprietary prebagged repair mortar, complying with the requirements of AM-STR-06052, placed by hand ensuring a flush finish with the adjoining surface. The repair mortar shall be prepared and placed in accordance with the manufacturer's requirements.
52	**High pressure hosing of surface** Any growth (fungal, algal, etc) on decks/slabs shall be removed by high pressure hosing. Care to be taken with masonry bridges to avoid damage to pointing. It may be necessary to treat staining with a suitable herbicide/fungicide prior to hosing. Consent of the Engineer shall first be obtained for the herbicide/fungicide. Due consideration is to be given to run-off and the risk of contaminates entering water courses of affecting the surrounding flora and fauna. Where necessary, run-off shall be contained by water retaining barriers and disposed of at an approved disposal site.
59	**Removal of Graffiti** When removing graffiti, where possible the use of proprietary graffiti removing products shall be favoured over abrasive cleaning techniques to avoid unnecessary damage to the fabric of the structure. Therefore, graffiti shall be removed by a combination of proprietary materials such as water-soluble sprays and aerosols, gels and poultices, and high pressure hosing, stiff brush and abrasives when so approved by the Engineer. Regardless of the method of removal of graffiti it will always be necessary to carry out insitu trials on a small unobtrusive section of the structure to determine the effectiveness of the chosen method and to confirm that no undue damage is caused to the substrate during the process. Proprietary materials shall be applied strictly in accordance with the manufacturers recommendations and shall be appropriate both for the substrate material (concrete, masonry, metalwork, etc.) and the marking agent (paint, ink, wax based materials, etc.). Acid based cleaners should never be used on acid sensitive materials that might be etched or abraded by acid. These include stonework such as limestone, marble or calcareous sandstone. The thicker consistency of gels and poultices, which are expressly designed to draw out pigment from permeable materials, make them more suitable for brickwork and other porous substrates. However, aluminium (parapets, etc.) and anodised metals can be attacked by bleach, ammonia and other alkalis.

Item No	Title and Written Text
	Mechanical abrasive graffiti removal shall be carried out as a last resort by specialist firms and should only be carried out on uncoated concrete substrates. Typical methods include low and high-pressure water cleaning with or without detergents as well as sand or grit blasting. Due care shall be taken to protect the general public from the affects of all mechanical abrasive graffiti removal techniques, to the satisfaction of the Engineer. The Contractor shall provide method statements and risk assessments associated with graffiti removal to demonstrate compliance with the Specification at least 2 weeks prior to undertaking any trials on bridge structures. Ink and felt tip marker stains should be removed using a glycol ether solvent, such as methoxypropanol, applied with a clean white cloth over the area affected. The minimum amount of solvent necessary to remove the stain shall be used as excess solvents on porous substrates (i.e. concrete) can potentially carry the dyes further into the parent material. Materials such as brick and stone are generally not adversely affected by glycol ether. However, if a reaction is noted, the area should be immediately dosed in water. All personnel using glycol ethers shall be trained in their use and application and alerted to the dangers of using these chemicals in accordance with the requirements of the Health Safety and Welfare at Work (Construction) Regulations 2006. The majority of the graffiti encountered on bridge structures consist of spray-applied paint. Graffiti caused by spray-applied paints shall be removed using a water based cleaning gel. The gel shall be applied to the affected area with a brush in a circular motion. After a short waiting time the mixture of paint and gel shall be washed off with water, collected and disposed of off site in a suitable waste disposal facility. In the case of persistent graffiti stains the cleaning action should be repeated. In certain instances, it may be necessary to over paint the graffiti rather than to remove it, especially in the structure has been coated with an anti-carbonation or crack bridging coating. In these circumstances the use of an anti-graffiti coating should be considered in combination with over painting the structure especially on high-risk structures where graffiti is a persistent problem. Repainting of graffiti covered surfaces must be preceded by the use of a sealer coat to prevent the graffiti pigment from bleeding through. Where over painting is required, the colour of the applied paint shall match the existing.
60	**Masonry repointing** Joints in masonry arches with loose mortar shall be raked out and repointed flush with the masonry face. All repointing shall be undertaken with lime mortar in accordance with the TII Specification for Masonry Repointing. Repointing shall only be undertaken by stonemasons who have attended the TII approved 'Masonry Arch Bridge Repair Workshop' or are members of the Guild of Master Craftsmen and their qualifications shall be submitted to the Engineer. Due consideration is to be given to the risk of contaminates entering water courses or affecting the surrounding flora and fauna and a method of working and precautions adopted to prevent same. Hand pointing only required to a depth not exceeding 50mm.

Item No	Title and Written Text
61	**Masonry repair** Loose stone/brickwork is to be reinstated and missing stone/brickwork is to be replaced with stone/brickwork of a similar size and shape. An approved mortar shall be used to bed and repoint the masonry. Mortar shall be lime mortar in accordance with the TII Specification for Masonry Repointing. Masonry repairs shall only be undertaken by stonemasons who have attended the TII approved 'Masonry Arch Bridge Repair Workshop' or are members of the Guild of Master Craftsmen and their qualifications shall be submitted to the Engineer. Due consideration is to be given to the risk of contaminates entering water courses or affecting the surrounding flora and fauna and a method of working and precautions adopted to prevent same.
70	**Patch painting of steelwork** Steelwork with damaged, missing, flaking or otherwise poor condition paintwork shall be touch repainted over the defective areas. Prior to repainting all loose paint shall be removed, the surfaces exposed down to bare metal using a wire brush or other suitable method and the surfaces repainted using a compatible TII approved paint system to the original full paint thickness and matching colour applied in accordance with the paint systems specification.
99	**Miscellaneous works** Any concrete repairs called up under this heading shall be carried out in accordance with Section 14 Item No. 50 of this specification. Any other routine repair and maintenance works to deck/slab not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of the Clients instructions.

SECTION 11.0 – BEAMS/GIRDERS/TRANSVERSE BEAMS

Item No	Title and Written Text
50	**Concrete Repairs** Concrete repairs shall be carried out where minor areas of defective concrete are identified by the Engineer. Cracked, honeycombed, delaminated, contaminated or otherwise defective concrete shall be broken out by hand held drill/impact hammer or other specified method, taking due care to avoid damage to sound concrete and reinforcement. The concrete shall be broken out to a depth equal to the maximum size of aggregate plus 5mm beyond the reinforcement. The exposed faces shall be formed by cutting neat straight edges and shall be scabbled if necessary and cleaned off. The exposed surfaces shall be suitably primed and an approved, proprietary prebagged repair mortar, complying with the requirements of AM-STR-06052, placed by hand ensuring a flush finish with the adjoining surface. The repair mortar shall be prepared and placed in accordance with the manufacturer's requirements.
52	**High pressure hosing of surfaces** Any growth (fungal, algal, etc) or graffiti shall be removed by high pressure hosing or other approved system. Chemical cleaning shall not be undertaken except with the prior approval of the Engineer. Due consideration is to be given to run-off and the risk of contaminates entering water courses of affecting the surrounding flora and fauna. Where necessary, run-off shall be contained by water retaining barriers and disposed of at an approved disposal site. All works shall be carried out after consultation with and in accordance with the requirements of the Office of Public Works, Waterways Ireland, National Parks and Wildlife and/or Inland Fisheries Ireland as necessary.
59	**Removal of Graffiti** When removing graffiti, where possible the use of proprietary graffiti removing products shall be favoured over abrasive cleaning techniques to avoid unnecessary damage to the fabric of the structure. Therefore, graffiti shall be removed by a combination of proprietary materials such as water-soluble sprays and aerosols, gels and poultices, and high pressure hosing, stiff brush and abrasives when so approved by the Engineer. Regardless of the method of removal of graffiti it will always be necessary to carry out insitu trials on a small unobtrusive section of the structure to determine the effectiveness of the chosen method and to confirm that no undue damage is caused to the substrate during the process. Proprietary materials shall be applied strictly in accordance with the manufacturers recommendations and shall be appropriate both for the substrate material (concrete, masonry, metalwork, etc.) and the marking agent (paint, ink, wax based materials, etc.). Acid based cleaners should never be used on acid sensitive materials that might be etched or abraded by acid. These include stonework such as limestone, marble or calcareous sandstone. The thicker consistency of gels and poultices, which are expressly designed to draw out pigment from permeable materials, make them more suitable for brickwork and other porous substrates. However, aluminium (parapets, etc.) and anodised metals can be attacked by bleach, ammonia and other alkalis. Mechanical abrasive graffiti removal shall be carried out as a last resort by specialist firms and should only be carried out on uncoated concrete substrates. Typical

Item No	Title and Written Text
	methods include low and high-pressure water cleaning with or without detergents as well as sand or grit blasting. Due care shall be taken to protect the general public from the affects of all mechanical abrasive graffiti removal techniques, to the satisfaction of the Engineer. The Contractor shall provide method statements and risk assessments associated with graffiti removal to demonstrate compliance with the Specification at least 2 weeks prior to undertaking any trials on bridge structures. Ink and felt tip marker stains should be removed using a glycol ether solvent, such as methoxypropanol, applied with a clean white cloth over the area affected. The minimum amount of solvent necessary to remove the stain shall be used as excess solvents on porous substrates (i.e. concrete) can potentially carry the dyes further into the parent material. Materials such as brick and stone are generally not adversely affected by glycol ether. However, if a reaction is noted, the area should be immediately dosed in water. All personnel using glycol ethers shall be trained in their use and application and alerted to the dangers of using these chemicals in accordance with the requirements of the Health Safety and Welfare at Work (Construction) Regulations 2006. The majority of the graffiti encountered on bridge structures consist of spray-applied paint. Graffiti caused by spray-applied paints shall be removed using a water based cleaning gel. The gel shall be applied to the affected area with a brush in a circular motion. After a short waiting time the mixture of paint and gel shall be washed off with water, collected and disposed of off site in a suitable waste disposal facility. In the case of persistent graffiti stains the cleaning action should be repeated. In certain instances, it may be necessary to over paint the graffiti rather than to remove it, especially in the structure has been coated with an anti-carbonation or crack bridging coating. In these circumstances the use of an anti-graffiti coating should be considered in combination with over painting the structure especially on high-risk structures where graffiti is a persistent problem. Repainting of graffiti covered surfaces must be preceded by the use of a sealer coat to prevent the graffiti pigment from bleeding through. Where over painting is required, the colour of the applied paint shall match the existing.
70	**Patch painting of steelwork** Steelwork with damaged, missing, flaking or otherwise poor condition paintwork shall be touch repainted over the defective areas. Prior to repainting all loose paint shall be removed, the surfaces exposed down to bare metal using a wire brush or other suitable method and the surfaces repainted using a compatible TII approved paint system to the original full paint thickness and matching colour applied in accordance with the paint systems specification.
99	**Miscellaneous works** Any other routine repair and maintenance works to beams/girders/transverse beams not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of the Clients instructions.

SECTION 12.0 – RIVERBED

Item No	Title and Written Text
01	**Clearance of watercourse** The watercourse shall be cleared of all obstructions, debris and vegetation that may impede flow. This includes household or domestic items dumped in the stream, tree branches, concrete or masonry rubble or other objects which have become lodged between abutments and /or piers or within pipes and silt /debris build up under the structure. This may also include obstructions up to 20m upstream or downstream of the bridge. The Contractor shall ensure that property boundary markings in the form of fencing, grates or grilles fixed to structure (i.e. at inlet or outlet) are not removed or disturbed throughout the works. Where debris or branches are snagged in any of the above, this is to be carefully removed and any damage to the fencing repaired, displaced grilles refixed etc. For the desilting of heavily silted culverts, the use of specialist drain clearing suction rigs may be required. Where clearance of obstruction may result in undermining or instability or scour of the abutments the Engineer shall be informed and clearance at the risk area shall not be undertaken until instructions are received.
04	**Scour Repair** Scour holes will be filled with Class 1C material as described in Table 6/1 CC-SPW-00600.
99	**Miscellaneous works** Any other routine repair and maintenance works to riverbed not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of the Clients instructions.

SECTION 13.0 – OTHER ELEMENTS

Item No	Title and Written Text
50	**Concrete Repairs** Concrete repairs shall be carried out where minor areas of defective concrete are identified by the Engineer. Cracked, honeycombed, delaminated, contaminated or otherwise defective concrete shall be broken out by hand held drill/impact hammer or other specified method, taking due care to avoid damage to sound concrete and reinforcement. The concrete shall be broken out to a depth equal to the maximum size of aggregate plus 5mm beyond the reinforcement. The exposed faces shall be formed by cutting neat straight edges and shall be scabbled if necessary and cleaned off. The exposed surfaces shall be suitably primed and an approved, proprietary prebagged repair mortar, complying with the requirements of AM-STR-06052, placed by hand ensuring a flush finish with the adjoining surface. The repair mortar shall be prepared and placed in accordance with the manufacturer's requirements.
59	**Removal of Graffiti** When removing graffiti, where possible the use of proprietary graffiti removing products shall be favoured over abrasive cleaning techniques to avoid unnecessary damage to the fabric of the structure. Therefore, graffiti shall be removed by a combination of proprietary materials such as water-soluble sprays and aerosols, gels and poultices, and high pressure hosing, stiff brush and abrasives when so approved by the Engineer. Regardless of the method of removal of graffiti it will always be necessary to carry out insitu trials on a small unobtrusive section of the structure to determine the effectiveness of the chosen method and to confirm that no undue damage is caused to the substrate during the process. Proprietary materials shall be applied strictly in accordance with the manufacturers recommendations and shall be appropriate both for the substrate material (concrete, masonry, metalwork, etc.) and the marking agent (paint, ink, wax based materials, etc.). Acid based cleaners should never be used on acid sensitive materials that might be etched or abraded by acid. These include stonework such as limestone, marble or calcareous sandstone. The thicker consistency of gels and poultices, which are expressly designed to draw out pigment from permeable materials, make them more suitable for brickwork and other porous substrates. However, aluminium (parapets, etc.) and anodised metals can be attacked by bleach, ammonia and other alkalis. Mechanical abrasive graffiti removal shall be carried out as a last resort by specialist firms and should only be carried out on uncoated concrete substrates. Typical methods include low and high-pressure water cleaning with or without detergents as well as sand or grit blasting. Due care shall be taken to protect the general public from the affects of all mechanical abrasive graffiti removal techniques, to the satisfaction of the Engineer. The Contractor shall provide method statements and risk assessments associated with graffiti removal to demonstrate compliance with the Specification at least 2 weeks prior to undertaking any trials on bridge structures. Ink and felt tip marker stains should be removed using a glycol ether solvent, such as methoxypropanol, applied with a clean white cloth over the area affected. The minimum amount of solvent necessary to remove the stain shall be used as excess solvents on porous substrates (i.e. concrete) can potentially carry the dyes further into the parent material. Materials such as brick and stone are generally not adversely

Item No	Title and Written Text
	affected by glycol ether. However, if a reaction is noted, the area should be immediately dosed in water. All personnel using glycol ethers shall be trained in their use and application and alerted to the dangers of using these chemicals in accordance with the requirements of the Health Safety and Welfare at Work (Construction) Regulations 2006. The majority of the graffiti encountered on bridge structures consist of spray-applied paint. Graffiti caused by spray-applied paints shall be removed using a water based cleaning gel. The gel shall be applied to the affected area with a brush in a circular motion. After a short waiting time the mixture of paint and gel shall be washed off with water, collected and disposed of off site in a suitable waste disposal facility. In the case of persistent graffiti stains the cleaning action should be repeated. In certain instances, it may be necessary to over paint the graffiti rather than to remove it, especially in the structure has been coated with an anti-carbonation or crack bridging coating. In these circumstances the use of an anti-graffiti coating should be considered in combination with over painting the structure especially on high-risk structures where graffiti is a persistent problem. Repainting of graffiti covered surfaces must be preceded by the use of a sealer coat to prevent the graffiti pigment from bleeding through. Where over painting is required, the colour of the applied paint shall match the existing.
80	**Repair of lighting** The Contractor shall replace parts, make repairs, or carry out whatever maintenance or preventive maintenance is necessary to repair the installation and to maintain it in good, sound operating condition. Replacement lamps, lanterns, fittings and columns shall be compliant with CC-SPW-01400, or similar to and compatible with those being replaced. In particular, internal lighting within subways.
82	**Traffic Signs** All traffic signs and edge marker posts shall be clean, vertical and serviceable within the required retro reflectivity standards. Retro reflectivity shall be as defined in BS EN12899-1:2001. Signs requiring replacement shall be replaced to the satisfaction of the engineer. The sign, post or edge marker shall be correctly orientated and located to deliver maximum reflectivity towards the oncoming traffic. Traffic signs shall be reinstated in the original location unless approved otherwise by the Engineer. Traffic signs shall be manufactured in accordance with the “Certification Scheme Specification, and Guidance for Construction of Traffic Signs – TS4” published by the Department of the Environment and Local Government or any amendment thereof. All lighting of traffic signs shall comply with Category 1 luminance of BS 873: Part 5. All repair work shall be carried out in accordance with the CC-SPW-01200. Traffic Signs and CC-SPW-01400, and the manufacturer’s instructions and recommendations. All work to Traffic Signs shall be carried out safely and efficiently in accordance with the requirements of the Traffic Signs Manual. All electrical works are to be carried out by personnel that have been fully trained and hold a current electrical practicing license. Edge marker posts shall be reinstated to the correct location, position and orientation. Works on traffic signs shall include but will not be limited to temporary repairs, re-siting of Traffic Signs, cleaning of traffic signs, re-fixing of posts, Installation of new Traffic Signs including the replacement of obsolete signs , reflectors, fixings or luminaries, straightening of posts and uprights to a vertical position, replacement of missing or damaged traffic signs, repainting of painted items, replacement of degraded coloured

Item No	Title and Written Text
	sign face materials, replacement of sign faces having reduced retro-reflectivity, realignment of Traffic Signs having incorrect orientation, replacement of corroded units, removal of unauthorised Traffic Signs or Traffic Signs that require removal for some other reason, cleaning, straightening and reinstating edge marker posts and installation of new sections of edge marker posts.
99	**Miscellaneous works** *Sweeping of Footways Under Bridge* Sweeping of footways under bridges called up under this heading shall be carried out in accordance with Section 3 Item no. 21 of this specification. Clearing Access Steps on Embankments of Vegetation and Debris Access steps on embankments shall be cleared of vegetation and any other debris in accordance with Section 3 Item No. 21 and Section 4 Item No. 03 of this Specification. *Repair of Protective Coating to Steel Culverts* Areas on the internal faces of steel culverts where the bituminous coating has broken down shall be refurbished with cold-applied bitumen in accordance with Chapter 4 of BAM-STR-06041 Management of Corrugated Steel Buried Structures. Any other routine repair and maintenance works to other elements not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of the Clients instructions.

SECTION 14.0 – STRUCTURE IN GENERAL

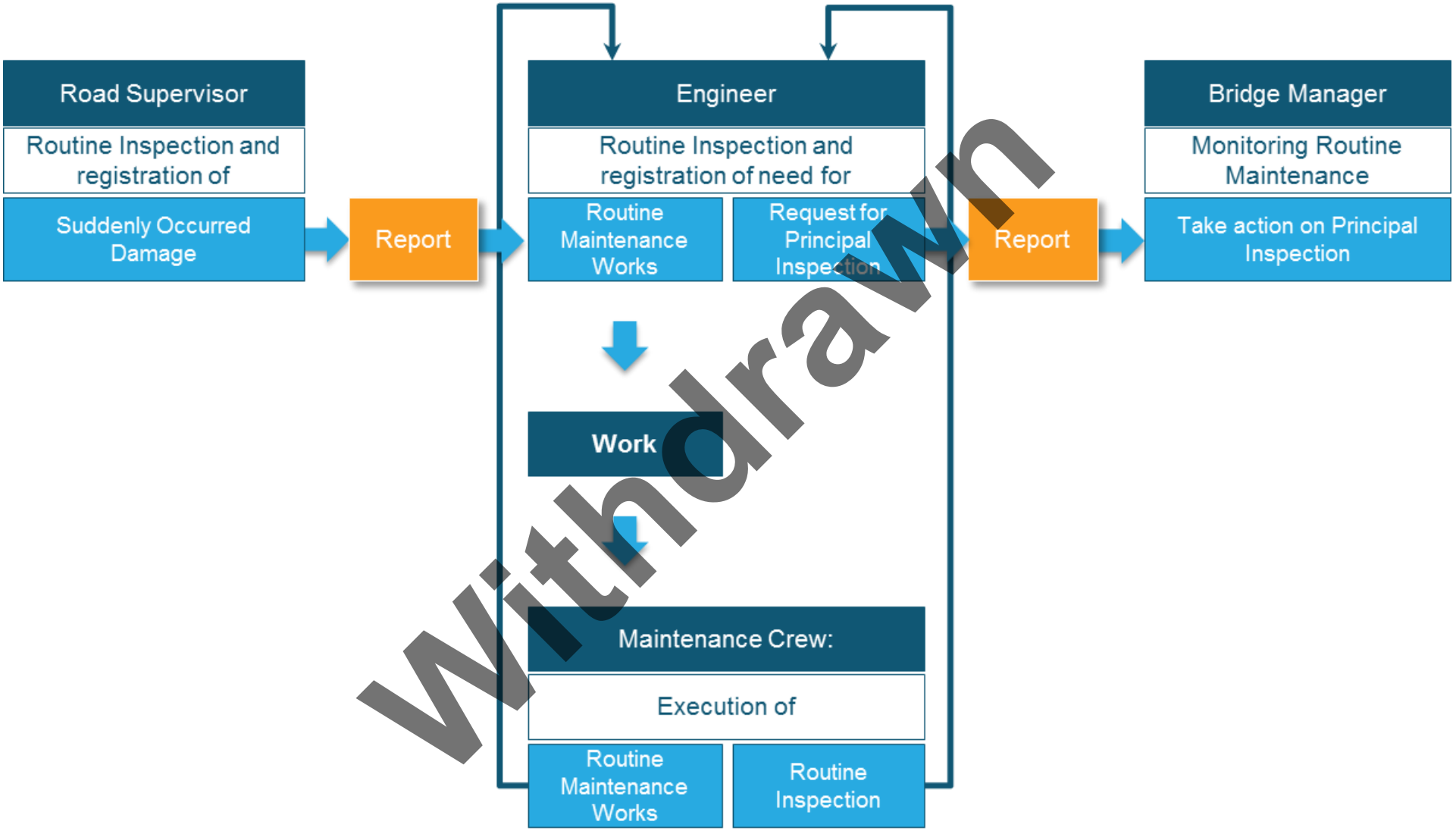
Item No	Title and Written Text
05	Removal of Signage All unauthorised signage including construction contractors advertising signage is to be carefully removed and disposed of at an approved disposal site.
50	Concrete Repairs Concrete repairs shall be carried out where minor areas of defective concrete are identified by the Engineer. Cracked, honeycombed, delaminated, contaminated or otherwise defective concrete shall be broken out by hand held drill/impact hammer or other specified method, taking due care to avoid damage to sound concrete and reinforcement. The concrete shall be broken out to a depth equal to the maximum size of aggregate plus 5mm beyond the reinforcement. The exposed faces shall be formed by cutting neat straight edges and shall be scabbled if necessary and cleaned off. The exposed surfaces shall be suitably primed and an approved, proprietary prebagged repair mortar, complying with the requirements of AM-STR-06052, placed by hand ensuring a flush finish with the adjoining surface. The repair mortar shall be prepared and placed in accordance with the manufacturer's requirements.
59	Removal of Graffiti When removing graffiti, where possible the use of proprietary graffiti removing products shall be favoured over abrasive cleaning techniques to avoid unnecessary damage to the fabric of the structure. Therefore, graffiti shall be removed by a combination of proprietary materials such as water-soluble sprays and aerosols, gels and poultices, and high pressure hosing, stiff brush and abrasives when so approved by the Engineer. Regardless of the method of removal of graffiti it will always be necessary to carry out insitu trials on a small unobtrusive section of the structure to determine the effectiveness of the chosen method and to confirm that no undue damage is caused to the substrate during the process. Proprietary materials shall be applied strictly in accordance with the manufacturers recommendations and shall be appropriate both for the substrate material (concrete, masonry, metalwork, etc.) and the marking agent (paint, ink, wax based materials, etc.). Acid based cleaners should never be used on acid sensitive materials that might be etched or abraded by acid. These include stonework such as limestone, marble or calcareous sandstone. The thicker consistency of gels and poultices, which are expressly designed to draw out pigment from permeable materials, make them more suitable for brickwork and other porous substrates. However, aluminium (parapets, etc.) and anodised metals can be attacked by bleach, ammonia and other alkalis. Mechanical abrasive graffiti removal shall be carried out as a last resort by specialist firms and should only be carried out on uncoated concrete substrates. Typical methods include low and high-pressure water cleaning with or without detergents as well as sand or grit blasting. Due care shall be taken to protect the general public from the affects of all mechanical abrasive graffiti removal techniques, to the satisfaction of the Engineer. The Contractor shall provide method statements and risk assessments associated with

Item No	Title and Written Text
	graffiti removal to demonstrate compliance with the Specification at least 2 weeks prior to undertaking any trials on bridge structures. Ink and felt tip marker stains should be removed using a glycol ether solvent, such as methoxypropanol, applied with a clean white cloth over the area affected. The minimum amount of solvent necessary to remove the stain shall be used as excess solvents on porous substrates (i.e. concrete) can potentially carry the dyes further into the parent material. Materials such as brick and stone are generally not adversely affected by glycol ether. However, if a reaction is noted, the area should be immediately dosed in water. All personnel using glycol ethers shall be trained in their use and application and alerted to the dangers of using these chemicals in accordance with the requirements of the Health Safety and Welfare at Work (Construction) Regulations 2006. The majority of the graffiti encountered on bridge structures consist of spray-applied paint. Graffiti caused by spray-applied paints shall be removed using a water based cleaning gel. The gel shall be applied to the affected area with a brush in a circular motion. After a short waiting time the mixture of paint and gel shall be washed off with water, collected and disposed of off site in a suitable waste disposal facility. In the case of persistent graffiti stains the cleaning action should be repeated. In certain instances, it may be necessary to over paint the graffiti rather than to remove it, especially in the structure has been coated with an anti-carbonation or crack bridging coating. In these circumstances the use of an anti-graffiti coating should be considered in combination with over painting the structure especially on high-risk structures where graffiti is a persistent problem. Repainting of graffiti covered surfaces must be preceded by the use of a sealer coat to prevent the graffiti pigment from bleeding through. Where over painting is required, the colour of the applied paint shall match the existing.
91	Maintenance of Structure ID The structure ID number plate to be replaced shall take the form of a plastic 'car registration plate type and shall measure 105mm X 520mm. The signs Shall be made from clear PET with radiused corners, with white reflective sheeting and black numbers/letters reverse applied to the PET. The plates shall be fixed to concrete abutments/piers/parapets using an approved adhesive which will ensure that the plate is securely bonded to the substrate. Previously approved adhesives include "Pinkgrip" and "Tech 7" polymer adhesives. Where it is not possible to fix a plate to a substrate using adhesive then metal/plastic fixings will be allowed. This will be required largely on masonry parapet walls. The Contractor should avoid using metal fixings on reinforced concrete abutments/piers or parapets For steel/aluminium parapets it may be possible to fix the plate to the Steel mesh by using plastic ties. Alternatively it may be possible to fix the plate to the approach safety barrier. This will be possible for OBB safety barriers. Again an appropriate adhesive shall be used. Where adhesives are used to fix the plates it is vitally important that proper surface preparation is carried out in accordance with the manufacturer's instructions. Where parapets are not present, marker posts labelled with the structure ID shall be erected within the verge or foothpath. The guidelines to be followed when siting marker plates and posts are as follows:

Item No	Title and Written Text
	In the case of single carriageway overbridges, the identification will be located on the left abutment or pier (in the direction of increasing chainage). The identification should be placed at a visible location on the front of the abutment (under the bridge). It is recommended that where possible the plate be fixed at a height of 2.5m above ground level. Additionally the identification marker plate shall be fixed to the parapet of all single carriageway bridges, locating it on the road face at the near end of the left parapet in the direction of increasing chainage. On dual carriageways the marker plate shall be fixed on both abutments, or piers, and on both parapets at the approach ends.
99	Miscellaneous works Any routine repair and maintenance works to other elements not covered by the above items and included in the bridge Works Order shall be undertaken in accordance with the requirements of the Clients instructions.

Appendix K:

Activity Flow Chart for Routine Inspection and Maintenance


Road Supervisor
Routine Inspection and registration of
Suddenly Occurred Damage
Report
Engineer
Routine Inspection and registration of need for
Routine Maintenance Works
Request for Principal Inspection
Work
Maintenance Crew:
Execution of
Routine Maintenance Works
Routine Inspection
Report
Bridge Manager
Monitoring Routine Maintenance
Take action on Principal Inspection

Appendix L:

Typical Maintenance Defects
(Photo exhibit)

Figure 1: Pothole development and cracked pavement in carriageway over structure

Figure 2: Footbridge drainage channel requires regular cleaning

Figure 3: Blocked drainage gully and build-up of silt in drainage channel

Figure 4: Road drainage kerb units require regular cleaning.

Figure 5: An asphaltic plug joint with a developing pothole.

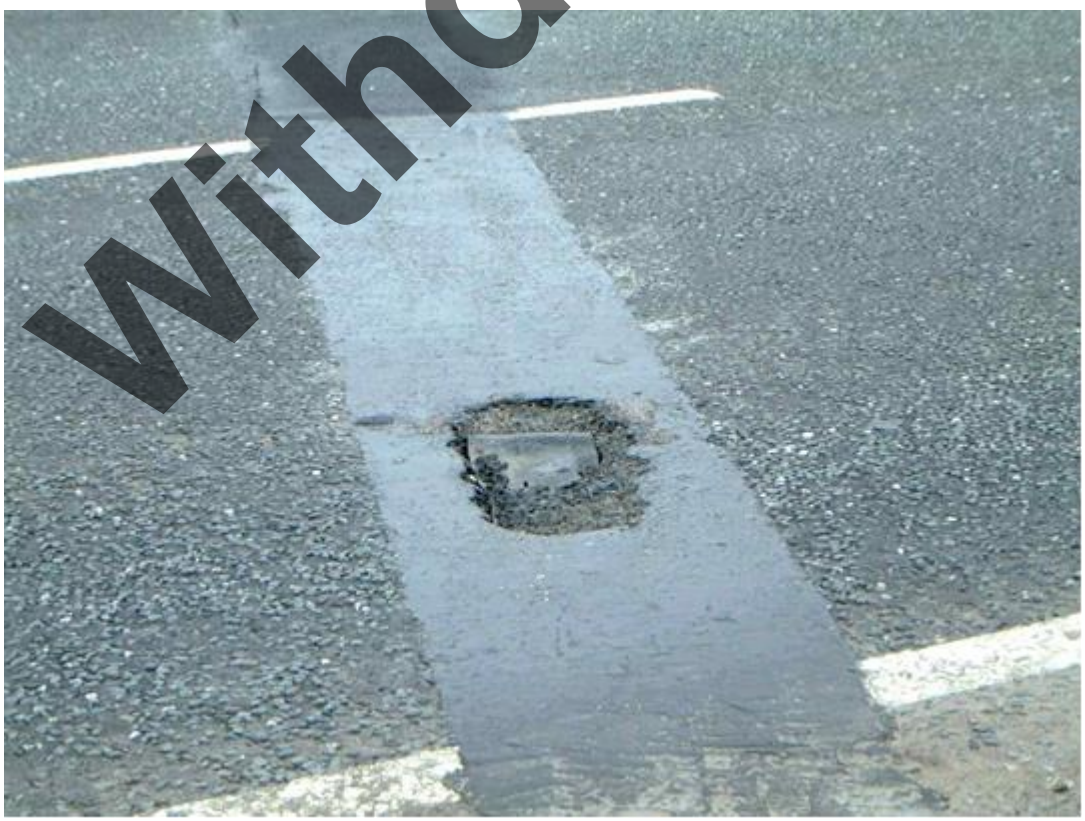


Figure 6: A build-up of silt between the steel plate and the rubber nosings can accelerate the deterioration of an expansion joint and lead to leakage

Figure 7: Footways and medians need to be cleared of vegetation and debris

Figure 8: A parapet and spandrel wall overgrown with vegetation. The tree which is growing over the arch barrel will, over time, lead to distortion of the masonry stonework if not removed

Figure 9: An aluminium parapet which has suffered from impact damage.

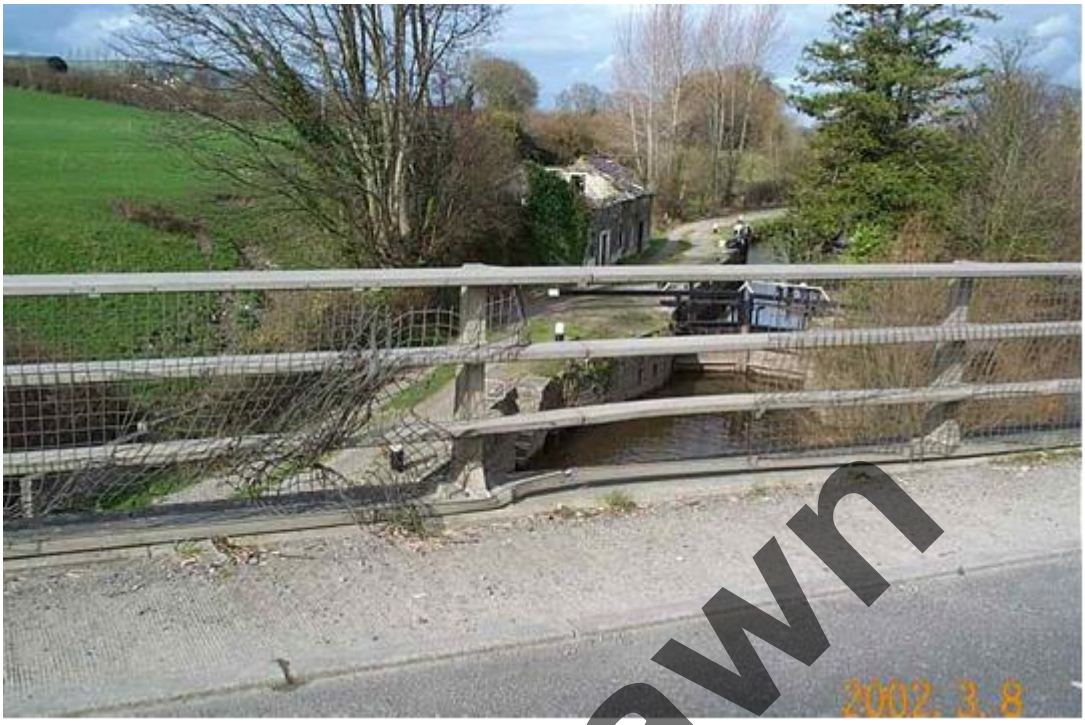


Figure 10: A steel parapet with isolated patches of flaking paint and subsequent minor corrosion. This will require touching up with an approved paint system

Figure 11: Lack of handrail protection to the culvert end and wingwalls

Figure 12: An embankment which requires re-shaping

Figure 13: A heavily overgrown wingwall and embankment

Figure 14: Collapse of an approach masonry training wall

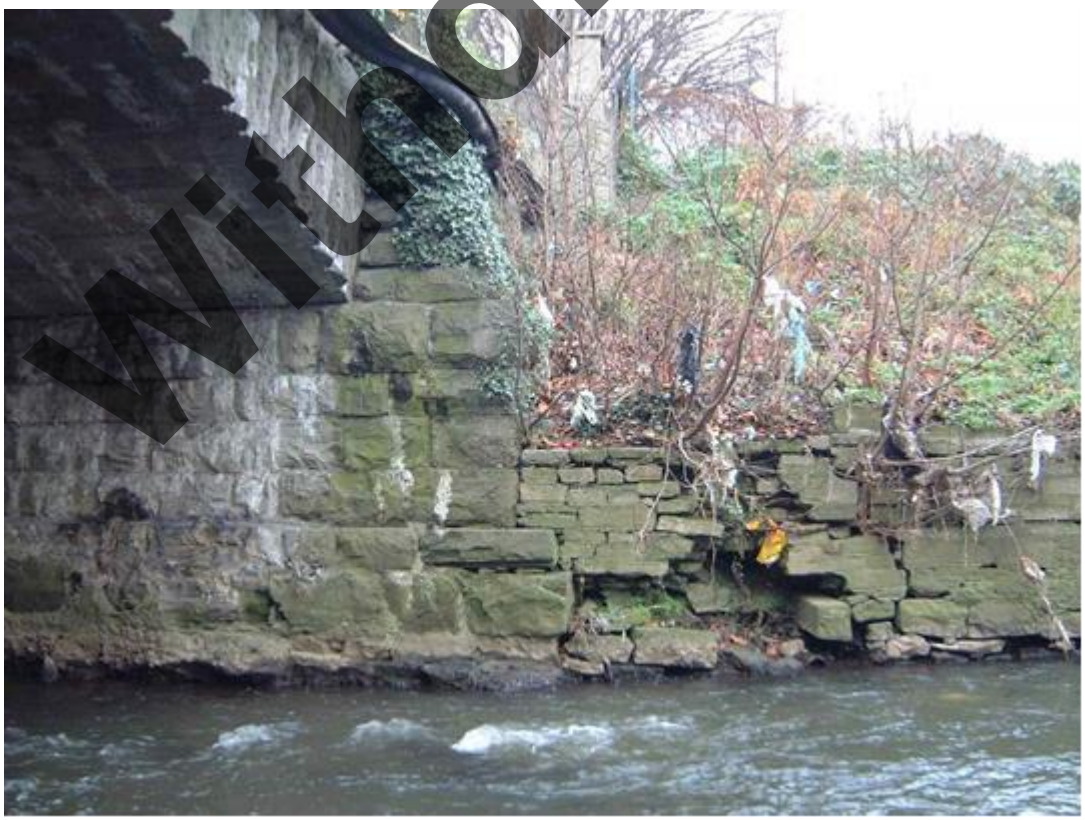


Figure 15: Inadequate maintenance of the abutment drainage system has led to standing water on the bearing shelf and subsequent water rundown on the face of the abutment.

Figure 16: Loss of pointing and missing stones in an arch barrel

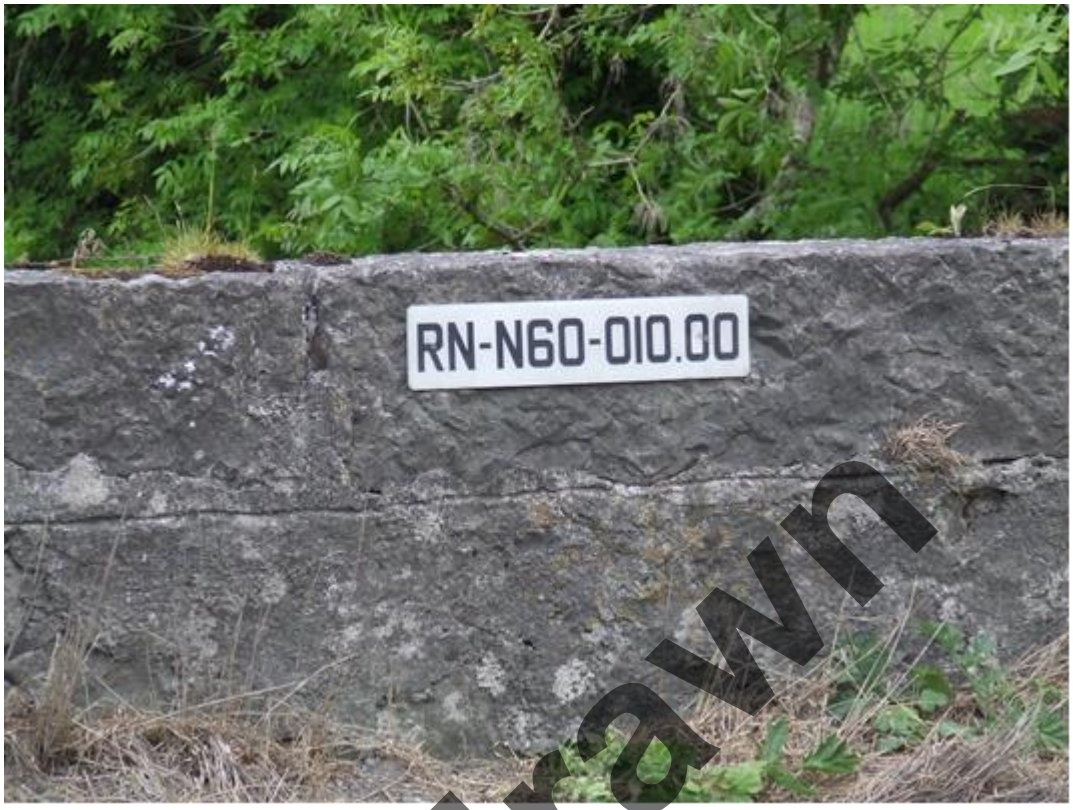
Figure 17: Dropped masonry stones in an arch barrel

Figure 18: Accumulation of debris upstream of a structure, and overgrown vegetation around the structure

Figure 19: Build-up of debris in front of grill on upstream end of pipe culvert

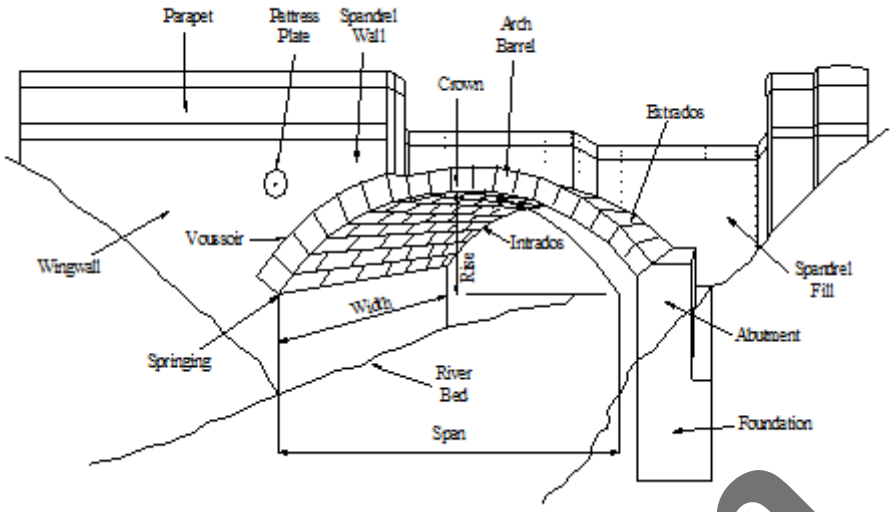
Figure 20: Build-up of silt in the river bed of a masonry arch structure.

Figure 21: Structure identification plate on a masonry parapet



Appendix M:

Masonry Arch Terminology



Abutment:	**That part of the structure which support the end of a span or accepts the thrust from the arch**
Arch Barrel:	The depth of masonry between the intrados and extrados for the full width of the structure
Crown:	The apex of the arches extrados. In symmetrical arches it is at midspan
Extrados:	The outer curved surface of the arch
Intrados:	The Interior curved surface of the arch
Keystone:	The upper most wedge-shaped voussoir at the crown of the arch
Pattress Plate:	Secured to the end of tie bars, they provide restraint to further movement of the spandrel walls
Parapet:	The masonry wall that provides protection to vehicles and pedestrians
Rise:	The dimension from the springing line to the highest part of the intrados
Span:	The clear distance between the two abutments
Voussoir:	Any one of the wedge shaped blocks used to form the arch

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