Agenda Item	26
Report No	**EDI 61/19**

HIGHLAND COUNCIL

Committee: Environment, Development and Infrastructure

Date: 15 August 2019

Report Title: Risk Based Approach to Structures Inspections

Report By: Interim Chief Officer Resources (Community Services)

1. Purpose/Executive Summary

1.1 This report provides an outline of the Risk Based Approach proposed for inspection of the Council's road structures stock (over 3800 structures). The introduction of a risk-based approach increases the number of inspections required per annum. It reduces the exposure to risk for the Council and to the travelling public.

1.2 Recommendations are made for the inspection regimes to be adopted, as well as prioritisation of works.

2. Recommendations

2.1 Members are asked to:

i. Approve adoption of the Structures Inspections policy in **Appendix 1** for the proposed Risk Based Approach in Highland; and
ii. note the current position in Highland in relation to the resources available for inspections.

3. Implications

3.1 Resources: Staffing requirements can be met from current budgets. Four additional Structures Technicians have now been appointed following the Committee's agreement initially in November 2017 and confirmed in November 2018. Not all defects can be addressed given capital and revenue budget constraints; however, repairs and improvements to structures can be prioritised in a more effective manner with a risk based approach to inspections.

3.2 Legal: The Council has a duty to maintain structures to a reasonable standard and to manage risk effectively.

3.3 Community (Equality, Poverty and Rural): Due to the geographic nature of Highland,

many structures are located in remote areas where communities rely on them.

3.4 Climate Change / Carbon Clever: There are no known Climate Change / Carbon Clever implications arising as a direct result of this report.

3.5 Risk: The move to a risk-based approach reduces the Council's exposure to risk, as well as the travelling public. The approach recommended draws on relevant codes of practice and professional associations. The recruitment of the four Structures Technicians supports Corporate Risk 6, Workforce Planning. Although not specifically mentioned in CR10 Condition of our Roads, structures are a vital part of the road network and require active management.

3.6 Gaelic: There are no known Gaelic implications arising as a direct result of this report.

4. Background Information

4.1 The Roads (Scotland) Act 1984 states that a local roads authority shall manage and maintain roads within their area that are included in the list of public roads, more commonly known as 'adopted roads'. As Members will already know, Trunk Roads are maintained by the Scottish Ministers through various contracts across Scotland.

4.2 Structures are part of the road asset. The term 'road structure' is used to describe bridges, culverts and retaining walls; cattle grids are also included. Not all road structures which carry or hold up an adopted road are in the ownership of the Council.

4.3 More detail on road structures is given in the Road Asset Management Plan (RAMP) 2016-2019, available through the link below.
https://www.highland.gov.uk/info/20005/roads_and_pavements/99/roads_information/4

4.4 The information provided in the RAMP was correct at the time it was produced. A table showing the numbers and types of road structures the Council is responsible for is shown below (2018/19 figures from asset valuation calculations).

Structure Type	**Quantity**
Road Bridges	1,677
Footbridges	31
Unusual Structures	104
Retaining Walls	1,056
Culverts	423
Cattle Grids	580
Total	**3,871**

(Note: the majority of 'Unusual Structures' are listed bridges with 3 being post tensioned bridges.)

4.5 Inspections are important as they can identify serious defects which require attention. The most catastrophic result of these is obviously the collapse of a structure. In Highland, collapses are normally a result of storm damage on bridges where the foundation has been undermined. It is therefore vital that we invest in the inspection regime to mitigate the risk to the travelling public.

5. Risk Based Approach

5.1 The 'Well-Managed Highway Infrastructure: Code of Practice' was published in October 2016. It recommends using a risk-based approach for managing all aspects of the road network which includes inspection and repair. The Society of Chief Officers of Transportation (SCOTS) has drafted a risk-based approach as part of the Road Asset Management project. The Highland Council Structures Group of officers reviewed this approach and agreed it should be adopted it at its meeting on the 4 December 2018.

5.2 A risk based approach is also recommended by the Institute of Highway Engineers in their guidance document 'Well Managed Highway Liability Risk'.

5.3 The SCOTS approach has limitations. It does not apply to retaining walls or include a methodology for determining special monitoring regimes or frequencies. Engineering input is still required in all cases to ensure that an appropriate inspection interval has been determined by the SCOTS spreadsheet.

5.4 The proposed policy is contained in **Appendix 1**. It addresses the various types and intervals of inspections as they relate to the assorted categories and sizes of structures that the Roads Authority is responsible for. It also states redefined categories for works prioritisation. The only category with a timescale attached is for a critical or emergency defect. Examples of this would be serious scour or when a parapet has been hit by a vehicle and severely damaged.

6. Inspections and Resources

6.1 The risk-based default inspection intervals are 6 years for a Principal Inspection (PI) and 2 years for a General Inspection (GI) which is a 2/4/6 cycle (GI/ GI/ PI). Highland has been undertaking PIs on a 9-year cycle and GIs on a 3 year one (3/6/9 cycle). The introduction of a risk-based approach therefore increases the number of inspections required per annum. The tables below show the **AVERAGE** number of inspections expected annually for a 6-year cycle. The actual number will vary as data is gathered and the Risk Based Approach is rolled out. Additionally, there are around 300 structures on a 12-year, 9 year or special inspection cycle. Note that only GIs will be undertaken on cattle grids on a 3-year cycle. This is to gather data then implement a risk based approach in the future.

Bridges, Culverts and Retaining Walls		
Inspection Type	**Interval (Years)**	**Ave No. Inspections**
PI (PDU)*	6	110
PI (Areas)	6	115
GI (PDU)	3	10
GI (Areas)	3	135
GI (PDU)	2	33
GI (Areas)	2	289
Estimated Annual Average		**692**

*PDU - Project Design Unit

Cattle Grids		
Inspection Type	**Interval (Years)**	**Ave No. Inspections**
PI (Areas)	9	No PIs as per policy
GI (Areas)	3	193
Estimated Annual Average		**193**

6.2 Inspections are generally undertaken within a calendar, rather than financial year. This is to allow for programming. Highland will not apply a fixed tolerance as outside circumstances such as track possessions from Network Rail may cause unavoidable delays. Section 6.3 of the policy in **Appendix 1** provides more detail. Obviously, undertaking inspections can be weather dependent and there can be delays in completing inspections due to high water levels.

6.3 Principal Inspections are undertaken by the Project Design Unit and paid for from the Roads and Transport revenue budget. General Inspections are normally undertaken by Roads and Transport Area staff along with their other duties. The Highland Structures Group agreed to extend the remit of the PDU Structures Section to include GIs on some of the larger structures.

6.4 Members agreed at the November 2017 EDI Committee to reallocate more resources to structures inspections from within the overall road's maintenance budget. Since the November 2018 EDI Structures update report, the four additional Structures Technician posts have been filled, with the final one started in July 2019. This has resulted in an increase in the number of GIs completed so far in 2019. Note that cattle grid inspections have not been programmed yet and are expected to start in the autumn/ winter of 2019. The GI figure below may include inspections of structures not programmed for this year, as the technicians address the backlog.

Bridges, Culverts and Retaining Walls		
2019 Inspections	**Due in 2019**	**Inspected (as at 03/07/19)**
PI	118	27
GI	216	117
Totals	**334**	**144**

7. Works Prioritisation

7.1 Members will appreciate that technical decisions require to be made in relation to the management of structures, especially due to budget constraints. Structures may be left to decline, if safe to do so, with little or no maintenance until they are replaced as part of the Capital programme. Other structures that do not appear to need maintenance to members of the public may have works prioritised to prevent further decline. We all know that budget pressures mean that not all defects can be addressed. However, a risk based prioritisation method will mitigate the risk to the travelling public and the Council itself.

7.2 SCOTS are developing a risk-based approach for prioritising works relating to structures. It had not been completed at the time of writing this report. However, the method is expected to take account of various factors including those related to risk, safety, functionality, environmental impacts and local circumstances. The Highland Structures group will review the methodology when available and bring a further report to committee if changes to the policy in **Appendix 1** are necessary.

8. Further Development Work

8.1 Structural assessments are used to assess the load bearing capacity of a bridge. These will be subject to a separate policy and report brought to a future committee.

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Date:	2 July 2019
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Background Papers:	COM 58/15 Bridges and Road Structures EDI 23/17 Road Structures Annual Report EDI 81/18 Road Structures Annual Report

Appendix 1

Policy Statement

Structures Inspections

1. Introduction

1.1. This policy applies to all structures (bridges, culverts and retaining walls) which form part of the adopted road and are maintained by The Highland Council. It does not include structures owned by other parties or Services within the Council. At the time of writing this policy, the Roads Authority did not own or have responsibility for any sign/ signal gantries, cantilever road signs or tunnels within its boundary.

1.2. Other parties may include, but are not limited to, Network Rail, Scottish Canals and private landowners. Maintenance and inspection responsibilities for these structures are agreed between the private party and The Highland Council.

1.3. Structures are inspected to monitor their condition and identify defects requiring remedial action or intervention measures which may be required to effectively maintain the asset.

2. Structures Definitions

2.1. There are various definitions applied to structures for different purposes. The following will apply in Highland for inspection purposes and have been derived from BD63/17 Inspection of Highway Structures, table B.1.

Asset	Dimension	Comment
Bridge, buried structure, subway underpass, culvert and any other similar structure	• All structures greater than or equal to 3m span • Culverts 2 – 3m span, or multi-cell culverts where cumulative span is greater than or equal to 5m • Corrugated metal culverts 0.9m or more in span • Pedestrian subways	Includes road bridges, subways, footbridges, cycle route bridges, bridleway bridges, underpasses, etc.
Earth retaining structure	• All structures with an effective retained height, i.e. the level of fill at the back of the structure above the finished ground level at the front of the structure, greater than 1.5m	

Asset	Dimension	Comment
Reinforced/ strengthened soil/ fill structure with hard facings	• All structures with an effective retained height of greater than 1.5m	
Sign and/ or signal gantry	• Structural aspects of large sign/signal gantries and large Variable Matrix Signs (VMS) signs	Not applicable for Highland Council.
Masts	• Structural aspects of all cantilever masts • Structural aspects of all lighting masts of 20m or greater, i.e. the vertical distance from top of post to bottom of flange	Not included in this policy (Lighting Section organises any inspections necessary).
	• Structural aspects of mast for camera, radio, speed camera and telecommunication transmission equipment	Not included in this policy (Lighting Section organises any inspections necessary).
	• Structural aspects of any signs defined as requiring technical approval (TA) in accordance with BD2	Not applicable for Highland Council (none in Highland at the time of writing this policy).
Access gantry	• A moveable structure providing access to a road asset, typically for bridge inspection and maintenance.	Part of the existing structure.
Tunnels	• An enclosed length of road of 150m or more	Not applicable for Highland Council.
Other structures	• Other structures that are within the footprint of the road, e.g. service/utility crossings	Will only apply to those owned and/ or maintained by Highland Council.
	• Any remaining structures defined as requiring technical approval in accordance with BD2 or any agreed with the Overseeing Organisation.	Cattle grids.
Third Party structures	• Any of the above categories but owned by others, e.g. private owners or utility companies	See section 5.1 for more details.

2.2. Notwithstanding the above, BD 2 Technical Approval of Highway structures applies to all road structures with a clear span of 0.9m and above and to retaining walls greater than 1.5m high. This policy does not change those parameters and Technical Approval should be applied for as necessary.

2.3. The records maintained by Roads and Transport are the definitive ones of structures and take precedence over the above text descriptions.

2.4. Due to the number of structures in the Highland area and the resources available, Principal and General Inspections are expected to be undertaken for the following:

Asset	**PI Dimension**	**GI Dimension**
Bridges and Culverts	≥5.0m (overall length)	≥3.0m (overall length)
Retaining Walls (supporting the road)	≥5.0m (retained height)	≥5.0m (retained height)
Masts: Signs with Technical Approval (currently none in Highland)	No inspection	All
Cattle Grids	No inspection	All

2.5. The inspection programme will be determined annually and, depending on priorities identified or unforeseen circumstances, may change through the year.

2.6. To fully implement a risk-based approach for all structures, an initial principal inspection will be required on those that do not currently have one. This will take resource and time to achieve. There is no fixed timescale for implementing this but it is expected that information will be gathered on a continuing basis.

3. Inspections

3.1. The various types of inspections, and the Council's strategy relating to them, are as follows:

Inspection Type	**Description**	**Council Strategy**
General Inspection	Visual inspection undertaken without the need for special access equipment.	Risk Based Approach or 3 year intervals
Principal Inspection	Detailed inspection of all accessible parts utilising special access equipment if necessary.	Risk Based Approach or 9 year intervals
Routine Surveillance	To identify any obvious defects from the carriageway or footway.	Undertaken as part of routine Road Safety Inspections.
Special Inspection	Detailed inspection of a particular element of a structure.	Need determined by another inspection or event.
Safety	To identify the extent of any	Undertaken following

Inspection Type	Description	Council Strategy
Inspection	damage or special measures that may be required.	identification of a structure that may be damaged and unsafe.
Acceptance Inspection	Inspection documenting the status of/ outstanding work required on a structure prior to handover.	Undertaken approximately one calendar month before opening to traffic and an additional inspection before the end of the defects correction period.
Inspection for Assessment	Inspection carried out before a structural assessment.	Undertaken as determined by the need for an assessment.

3.2. Safety inspections are not the only means of identifying serious defects. Inspectors and other members of staff may also identify safety defects in the course of undertaking their general duties. These should be reported for repairs action as appropriate.

3.3. Other road users may also report defects to the Council and these will be processed for action as appropriate.

4. Special Inspections

4.1. The requirement for a Special Inspection will be identified by either the Principal Engineer, Structures Section and/ or the relevant Road Operations Manager, Roads and Transport.

4.2. Special Inspections may be carried out for, but are not limited to, the following reasons:-

- A particular issue has been detected during another inspection;
- Structure is of a particular form or type such as cast iron, post tensioned or strengthened with bonded plates;
- Structure has a loading or another form of restriction on use;
- The frequency or an access issue is beyond the scope of a GI or PI;
- Structures that have to carry an abnormal load;
- Structures involved in a major accident, chemical spillage or fire;
- Following a strike by a vehicle or other heavy object;
- To check for scour or other damage after high water flow;
- To check specific concerns;
- When subsidence has been identified or is suspected;
- Where settlement greater than design tolerances has been identified;
- Permanent access gantries are present; and
- Hoists, winches and associated cables are in use

5. Inspection Requirements of Other Owners

5.1. Other owners such as Network Rail have the responsibility for some structures within the road boundary. Where the Council is confident that the responsible

party has an inspection regime in place, it is not required to do its own inspections. However, where it is uncertain that a responsible owner has undertaken inspections, a General Inspection (GI) should be undertaken if it is in the interests of the wider public to do so. The requirement for these GIs will be determined by the relevant Road Operations Manager, Roads and Transport. The owner still retains the primary responsibility for the structure's integrity and public safety.

6. Frequency of Inspections

6.1. The frequency of inspections adopted will be based on the data available, the implementation of a risk based approach and efficient use of resources. Existing intervals for General (3 years) and Principal Inspections (9 years) will remain as is until a risk based approach has been implemented.

6.2. The frequencies of inspections will be maintained wherever possible but particular situations such as weather-related responses may require resources to be used elsewhere. Where this occurs, the delay in completing inspections will be kept to a minimum and the original programmed regime resumed.

6.3. Principal Inspections are generally undertaken within a calendar year. General Inspections should also follow the calendar year but where circumstances do not permit this, delays should be contained to the financial year wherever possible. Inspections may require to be delayed for programming reasons, to take advantage of traffic management deployments or due to third party access requirements. It is therefore not practical to state a fixed tolerance limit for inspection dates.

Asset	Principal Inspection	General Inspection
Bridges and Culverts ≥5.0m (overall length)	Risk Based	Risk Based
Bridges and Culverts between 3.0m and 5.0m (overall length)	No inspection	3/6/9 year cycle then implement Risk Based
Bridges and Culverts less than 3.0m	No PI Inventory update and defect check	No GI Inventory update and defect check
Retaining Walls >=5.0m (retained height), supporting the road	3/6/9 year cycle then implement Risk Based	3/6/9 year cycle then implement Risk Based
All other Retaining Walls	No PI Inventory update and defect check	No GI Inventory update and defect check
Cattle Grids	No inspection	3/6/9 year cycle then implement Risk Based

Note: Inventory update and defect check
This has been introduced for certain structures to record inventory information and ensure that any significant defects are documented. A formal inspection

will not be recorded unless it is deemed necessary to undertake one due to any serious defects found.

7. Defects

7.1. Defects found during inspections are recorded with appropriate responses. There are two sets of categories used for defect responses depending on the type of inspection undertaken.

7.2. For routine surveillance inspections undertaken as part of routine Road Safety Inspections, the structure defects found will be passed to the relevant Area Structures Technician. If necessary, the Road Inspector will categorise the defect using the currently applicable categories for road safety defects. However, the Structures Technician, or other appropriate staff member, will reassess the defect and categorise it according to the risk categories below.

Category	Description	Response
S1: Critical/ Emergency	A defect likely to deteriorate significantly in the immediate future to a point where it can cause serious harm to the public or result in structural collapse.	Immediate action to protect public if necessary. At least temporary repair within 24 hours(1).
S2: High	Those not an emergency but requiring immediate attention as they may present a significant hazard to road users or short term structural deterioration.	Action within a reasonable timescale and within the budget available. Response could include creating a rolling programme of works.
S3: Medium	Defects requiring attention to improve longevity of the asset.	No fixed timescale. Response could include creating a rolling programme of works.
S4: Low	Minor defects unlikely to cause any significant deterioration or be of risk to the road user.	No fixed timescale. Response could include creating a rolling programme of works.
S5: Negligible	No foreseen hazard to road users or integrity of a structure.	No action or planned work as resources permit.

Note (1): 24 hours will be interpreted as the end of the following day.

7.3. The following 'S' category notes are intended as guidance and should not be taken to be definitive explanations for each response. Any defect can be put into any category, depending on the severity and hazard it may present.

S1: This would be for emergencies such as partial/ full structure collapses where the structure carries the road or will be a potential hazard to the public. A real emergency is when a defect is so serious that the person who noticed it

should not leave the site until it has been made safe. Making safe can include the use of cones, barriers or signs to warn the public.

S2: These could include stone or section loss, significant scour, etc.

S3: This could include bearing or joint replacement, clearing significant occurrences of vegetation, clearing drainage channels/offlets, pointing, painting, etc.

S4: These could include minor vegetation clearance, painting, minor pointing loss, etc.

S5: Insignificant vegetation (e.g. minor weeds), graffiti removal, etc.

7.4. Definitive response times are not included for the defect response categories, with the exception of making safe S1 emergency ones. In the case of S1 defects, the severity of the defect will dictate the time taken to undertake a permanent repair. Where possible, permanent repairs will be undertaken as soon as is practicable. Alternatively, permanent repairs will be included in annual maintenance programmes.

7.5. Inspectors should inform the relevant Area Road Operations Manager or Senior Engineer at the earliest possible opportunity of a defect which may present an immediate risk to public safety.

7.6. Where a structure has been identified in a replacement or repair programme, defects may not be addressed and therefore left to decline, to prevent inefficient use of resources.

7.7. Other inspection types have their own reporting methods and defects may be rectified by other parties (such as during a maintenance period).