

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

TII Publications



Structural Review and Assessment of Road Structures

AM-STR-06042

June 2014

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NRA DMRB and MCDRW References

For all documents that existed within the NRA DMRB or the NRA MCDRW prior to the launch of TII Publications, the NRA document reference used previously is listed above under 'historical reference'. The TII Publication Number also shown above now supersedes this historical reference. All historical references within this document are deemed to be replaced by the TII Publication Number. For the equivalent TII Publication Number for all other historical references contained within this document, please refer to the TII Publications website.

Structural Review and Assessment of Road Structures

June 2014

Summary:

This standard gives the requirements and guidance for Structural Review and Assessment of road structures.

**VOLUME 3 ROAD STRUCTURES:
INSPECTION AND MAINTENANCE**

SECTION 4 ASSESSMENT

PART 18

NRA BD 101/14

**STRUCTURAL REVIEW AND
ASSESSMENT OF ROAD
STRUCTURES**

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1. INTRODUCTION

Background

- 1.1. This standard gives requirements and guidance for Structural Review and Assessment of road structures. A Structural Review will be used to support decisions on whether a particular road structure is required to undergo an Assessment.
- 1.2. Road vehicles in Ireland are categorised for regulatory purposes into two broad groups as given below:
 - 1.2.1 Normal vehicles are those complying with The Road Traffic (Construction and Use of Vehicles) Regulations 2003, as amended (referred to as the C&U Regulations for the remainder of this standard). This group includes cars, light goods vehicles, buses and rigid and articulated heavy goods vehicles up to a gross weight of 46 tonnes. These vehicles are covered by the C&U Regulations and are not subject to permit and notification requirements. For convenience, the term C&U referred to hereinafter will be taken to mean the vehicles given in the C&U Regulations. The effects of these C&U vehicles are assessed in accordance with NRA BD 21.
 - 1.2.2 Abnormal Vehicles refer to any vehicle or load that falls outside the limits allowed by the C&U regulations. Any operator who wants to transport a vehicle or load that falls outside the C&U regulations must obtain a permit for its movement. Refer to the Abnormal Load section of the Road Safety Authority website for details of the two permit schemes in operation. The effects of abnormal vehicles may be assessed in accordance with NRA BD 86.
- 1.3. The NRA bridge assessment programme assesses the bridge stock for C&U vehicles/loading. However, for those bridges that could safely carry C&U vehicles, the assessed HB capacity (for abnormal vehicles) was often less than required. Also studies in the UK have shown that the HB loading model does not represent accurately the effects of real abnormal vehicles, and is particularly onerous for structures with loaded lengths of less than 10m. Thus the concept of assessing for more realistic abnormal vehicles was introduced by NRA BD 86 – The Assessment of Road Bridges and Structures for the Effects of Abnormal and Exceptional Abnormal Load Vehicles using SV and SOV Load Models. This offers the benefit of attainment of higher load capacity ratings, particularly for structures with loaded lengths of less than 10m. Although HB capacity is still used in some cases as a comparator for determining some Abnormal Load routes, the intention is that use of HB ratings will be phased out (see NRA BD 86).

Objectives

- 1.4. This standard introduces a system for Structural Review and Assessment of structures.
- 1.5. The objective of Structural Review and Assessment of road structures is to meet and maintain the operational requirements of the route and network.
- 1.6. Structural Review and, where necessary, Assessment and strengthening are on-going activities in the management of road structures, ensuring that the operational capacity available reflects the needs of the network, including abnormal vehicle movements. This will ensure that the capacities of structures are kept up-to-date and reduce the risk of structural inadequacy due to on-going deterioration, accidental or other damage, changes in vehicle loading, and changes in design and Assessment standards.
- 1.7. Structural Review and Assessment contributes to route strategies, for example enabling identification of the points of lowest capacity on a route and supporting decisions on route upgrades.

Scope

- 1.8. Requirements and guidance are provided on:
- a) Structural Review – the method of establishing whether structures need to undergo Assessment.
 - b) Assessment procedures and reporting.
- 1.9. This standard is applicable to the following road structures:
- Bridge, buried structure, subway, underpass, culvert and any other structure supporting the road and subject to applied vehicular traffic loading with clear span or internal diameter of 2m or greater.
- 1.10. This standard may be applied to road structures which are outside the descriptions in paragraph 1.9 (such as footbridges), provided this is agreed or specified by the National Roads Authority.

Implementation

- 1.11. This Standard shall be used forthwith on all projects for the assessment, design, construction, operation, management and maintenance of motorway and national roads.

Definitions and Abbreviations

- 1.12. For the purpose of this standard the following definitions apply:
- i) Structural Review: A Review of an individual structure or group of structures, within the road structures stock, to establish or confirm the validity of the latest Assessment (or original design, if there has been no subsequent Assessment) and identify any need for further assessment.
 - ii) Assessment: Inspections and determination of load carrying capacity of a structure or part of a structure in terms of either full C&U loading or specified gross vehicle weights, or other applied vehicle loading (including impact).
 - iii) Condition Factor: As defined in NRA BD 21.
 - iv) Reserve Factor: As defined in NRA BD 86.
 - v) Abnormal Vehicles, Exceptional Abnormal Vehicles and SV and SOV Load Models: As defined in NRA BD 86.
 - vi) Type HA Loading: As defined in NRA BD 37
 - vii) Type HB Loading: As defined in NRA BD 37.
 - viii) Vehicle Rating: As defined in NRA BD 86.

1.13. The following abbreviations are used in this standard:

ALL	Assessment Live Loading
C&U	Normal Vehicles allowed to use the road without a special permit, as defined by the Road Traffic Regulations 2003, as amended
BS	British Standard
BSALL	Bridge Specific Assessment Live Loading
DMRB	Design Manual for Roads and Bridges
NRA	National Roads Authority
TAR	Technical Acceptance Report. As defined in NRA BD 2
VR	Vehicle Rating

2. THE STRUCTURAL REVIEW AND ASSESSMENT PROCESS

General

- 2.1. The process comprises two stages. The first stage is the Structural Review. The second stage is Assessment (or part Assessment) in accordance with the appropriate NRA DMRB Assessment standard. The Structural Review is used to determine whether the second stage is required.

Structural Review

- 2.2. Structural Reviews should only be carried out if the need arises. Events that might trigger a Structural Review include changes in:
- condition (detected by the Eirspan inspection programme);
 - operational load carrying requirements;
 - Assessment standards.
- 2.3. Structures with known load management problems should be reviewed at the earliest opportunity.
- 2.4. The Structural Review shall identify the validity of existing Assessment records, changes in Assessment and design standards, changes in condition of the structure from inspection reports and changes to the required operational capacity of the network, including abnormal vehicles. Changes in condition of the structure might result from deterioration, accidental damage or vandalism. The abnormal load capacity requirements for a particular structure must be agreed with the NRA.
- 2.5. The Structural Review should be carried out in the light of NRA DMRB Assessment standards current at the time of the Review. It will be for the Reviewer to consider any differences between the current Assessment standards and the standards used for previous Assessment or design, and to make a recommendation as to whether those differences are significant.
- 2.6. Unless otherwise specified, the Structural Review is not expected to verify the accuracy of existing Assessment calculations. Notwithstanding this, any obvious inaccuracies noted may be considered in the Structural Review.
- 2.7. Structures with a Structural Review confirming they have previously been assessed and their capacity recorded as 40 tonne ALL and 45 units of HB with no significant change in condition may, if necessary and with the agreement of the NRA, have their corresponding Reserve Factors for SV load models ascertained using the conversion charts given in NRA BD 86 (subject to the stated limitations). It is intended that over time Vehicle Ratings will replace HB ratings as an indication of the abnormal load capacity of a bridge.
- 2.8. The Structural Review process is illustrated in the flowchart in Annex A.
- 2.9. The Structural Review shall be documented in a Record of Structural Review Form in accordance with the format shown in Annex B, summarising the evidence considered together with a recommendation as to whether an Assessment is required.
- 2.10. The Record of Structural Review Form shall be submitted to the NRA for acceptance and the completed form must be recorded in the National Roads Authority's records management system.

Assessment

- 2.11. An Assessment shall not be carried out unless the Structural Review recommends that it is necessary, and that recommendation is accepted by the NRA.
- 2.12. Assessments shall be carried out in accordance with NRA BD 21, NRA BA 16, NRA BD 86, NRA BD 303 and NRA BD 304 as appropriate, as well as any other NRA DMRB standards relevant to the specific Assessment task.
- 2.13. The Lead Structural Assessment Engineer should recommend the stage of Assessment required in the TAR, drawing on the advice in NRA BD 79, NRA BD 303 and NRA BD 304, taking into account the complexity of the structure and the operational requirements of the route/network and in consultation with the relevant parts of the National Roads Authority.
- 2.14. New Assessments for HB ratings may be permitted in addition to Assessment for SV load models (see NRA BD 86), subject to the agreement of the National Roads Authority, where they are needed for the continued operation of load management systems in use at the date of publication of this standard.
- 2.15. For consistency in reporting, all Stage 1 Assessments shall be reported in accordance with NRA BD 303. Stage 2 Assessments reporting shall be in accordance with NRA BD 304.
- 2.16. Assessment results shall be recorded in the National Roads Authority's records management system.
- 2.17. Any structures found by Assessment to be unable to carry the required operational load shall be managed in accordance with NRA BD 79.

3. REFERENCES

3.1. NRA Design Manual for Roads and Bridges

NRA BD 2	Technical Approval of Road Structures.
NRA BA 16	The Assessment of Road Bridges and Structures
NRA BD 21	The Assessment of Road Bridges and Structures.
NRA BD 37	Loads for Road Bridges
NRA BD 79	The Management of Substandard Road Structures.
NRA BD 86	The Assessment of Road Bridges and Structures for the Effects of Abnormal and Exceptional Abnormal Load Vehicles using SV and SOV Vehicles
NRA BD 303	The Stage 1 Structural Assessment of Sub-Standard Road Structures
NRA BD 304	The Stage 2 Structural Assessment of Sub-Standard Road Structures

3.2. Statutory Instruments

The Road Traffic (Construction & Use of Vehicles) Regulations 2003 (SI 5/2003), as amended.

3.3. Road Safety Authority website www.rsa.ie for further information on abnormal load permits.

4. ENQUIRIES

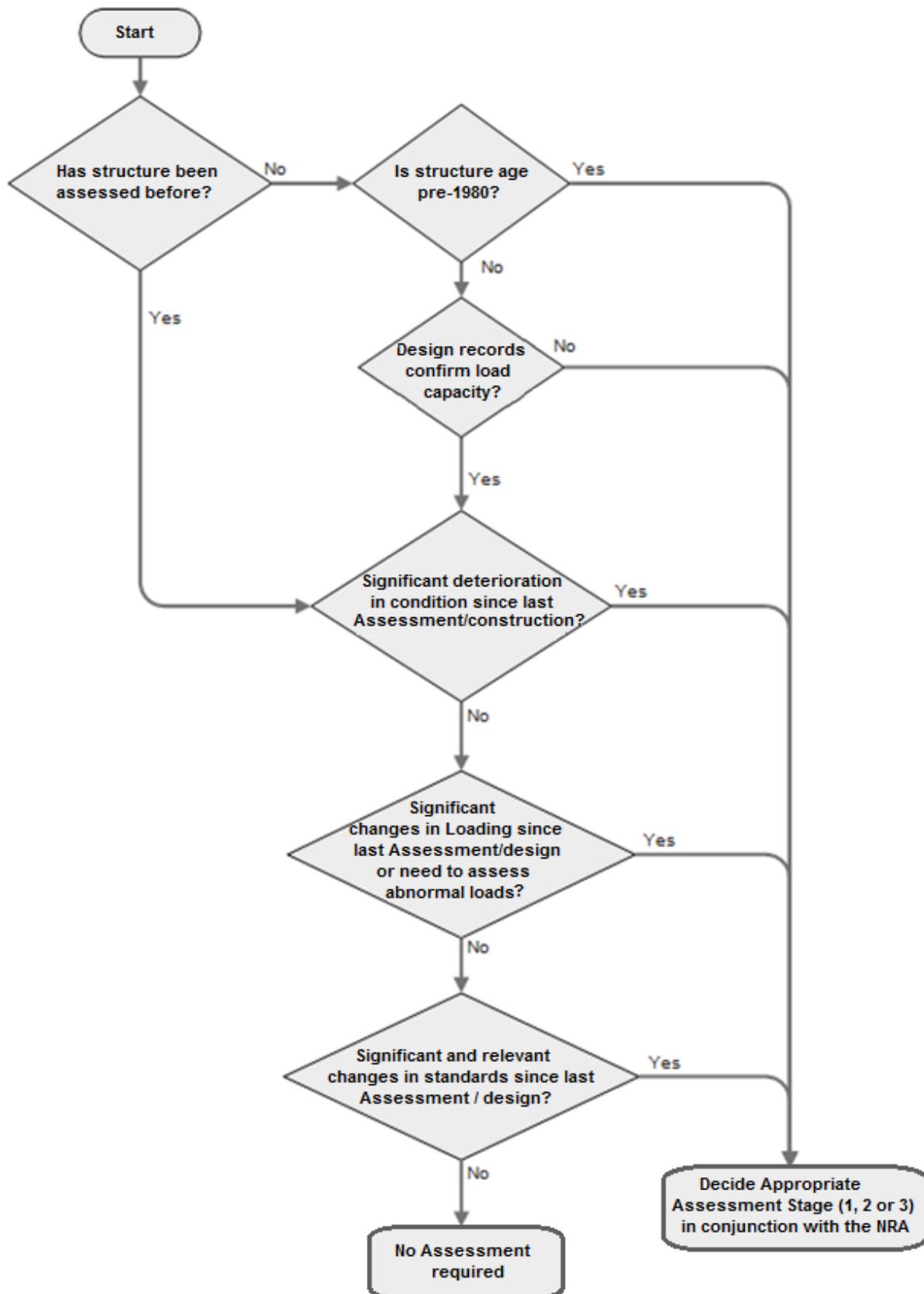
- 4.1. All technical enquiries or comments on this document or any of the documents listed as forming part of the NRA DMRB should be sent by e-mail to infoDMRB@nra.ie, addressed to the following:

“Head of Network Management, Engineering Standards & Research
National Roads Authority
St Martin’s House
Waterloo Road
Dublin 4”



Pat Maher
Head of Network Management,
Engineering Standards & Research

ANNEX A STRUCTURAL REVIEW FLOWCHART



ANNEX B RECORD OF STRUCTURAL REVIEW FORM

NATIONAL ROADS AUTHORITY			
			 An tÚdarás um Bóithre Náisiúnta National Roads Authority
Record of Structural Review Form			
Structure Details			
Structure Name	<Structure Name>		
Structure Number	<Structure Number>		
Date Commissioned	<Date that the structure came into service>		
Obstacles Crossed	<Name of road, railway, river etc.>		
Bridge Carries	<Name of road, etc>		
Brief Description of Structure			
<Give a brief description of the structure including structural type (deck, substructure and foundations) and span. Identify any unusual features or modifications since first constructed, and any interim measures in place.>			
Elements to be Reviewed (where not the whole structure)			
<List elements to be Reviewed>			
Reason for Structural Review	<May be routine or special circumstances>		
Existing Assessment Details or Design Records			
Inspection for Assessment Date	<Date>	Recorded Condition	<Condition Factor>
Technical Acceptance Report for Assessment	<Date>	Status	<eg Agreed>
Assessment Date	<Date>	Report Number	<Report Number>
Current Assessed/Design Capacity (include Reserve Factors)			
HA/ALL	<e.g. 40te ALL/30 HB>	SV	<eg SV196>
Critical Elements	<List the elements whose failure would result in significant local collapse or global collapse of the structure>		
Parapet	<State parapet type and Assessment result>		
Pier Impact	<State Assessment result and/or risk of impact>		
Certification	<Record if certificates exist and storage location>		
Calculations	<Record if calculations exist and storage location>		
As built drawings	<Record if as built drawings exist and storage location>		
Comments on Assessment or Design			
<A brief summary of the Assessment/design method and findings. Describe any strengthening works done as a result of existing Assessment, stating revised capacity.>			
Evaluation			
Inspection Date	<Date of Principal (or other) Inspection being used to assess current condition.>		
Change In Condition	<Identify any significant deterioration, damage or changes in condition since last Assessment/construction.>		
Change In Standards	<Identify any significant changes to standards since last Assessment/design>		
Change In Loading	<Identify any changes in loading since last Assessment/design, and any need to assess for abnormal loads.>		

Conclusion	<Having considered the records available and any changes in condition, standards or loading, give your conclusion on the validity of the existing Assessment or design.>
Recommendation	(delete and complete as applicable)
<Insert a recommendation as to the validity of the existing Assessment/design and whether a new Assessment is needed. The validity might be considered conditional on further inspection or investigation, which should be identified. The existing Assessment/design might be considered valid but unduly conservative, in which case a new Assessment might be appropriate. Where a new Assessment is recommended, an outline of the scope of the Assessment should be given.>	

4.2. THE ABOVE IS SUBMITTED FOR ACCEPTANCE

Signed¹ _____
 Name _____
 Position Lead Structural Assessment Engineer

Signed _____
 Name _____
 Position Principal Officer or Director – Design Office

Date ____/____/____

4.3. ACCEPTANCE OF REVIEW FORM

The National Roads Authority accepts this certificate

Signed _____
 Name _____
 Position _____ - Structures, National Roads Authority

Date ____/____/____

The persons who sign as Lead Structural Assessment Engineer must be a Chartered Engineer with a recognised University degree to Level 8 or equivalent with a minimum of 10 years post graduate experience in the assessment of bridge structures.



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