
**VOLUME 1 HIGHWAY STRUCTURES:
 APPROVAL PROCEDURES
 AND GENERAL DESIGN**

**SECTION 2 OTHER PROCEDURAL
 DOCUMENTS**

PART 3

BD 95/07

**TREATMENT OF EXISTING
STRUCTURES ON HIGHWAY
WIDENING SCHEMES**

SUMMARY

This Standard sets out principles, processes and requirements in relation to existing structures affected by highway widening schemes. Advice applicable to commonly encountered situations is also given.

INSTRUCTIONS FOR USE

1. Remove contents pages from Volume 1 and insert new contents pages dated August 2007.
2. Insert new Standard BD 95/07 into Volume 1, Section 2.
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THE DEPARTMENT FOR REGIONAL DEVELOPMENT
NORTHERN IRELAND

Treatment of Existing Structures on Highway Widening Schemes

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REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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1. INTRODUCTION

General

1.1 Making better use of existing roads, including the widening of highways, is consistent with Government objectives. The intention should be to reuse as much existing infrastructure as possible.

1.2 Widening gives rise to many issues affecting existing structures. The treatment of these issues can have a major influence on the design and cost of the widening scheme. Valuable experience has been gained from a number of previous schemes, but this has not been recorded centrally and is not readily available to others in the form of advice. This Standard has been produced to set out the principles to be applied and to promulgate advice and guidance relating to the treatment of structures affected by widening schemes.

Purpose

1.3 The objectives of this Standard are to:

- explain the principles and requirements applicable to the development of proposals for existing structures on highway widening schemes;
- describe the process that should be applied through preliminary and detailed design;
- provide advice and ideas for solutions to commonly encountered situations.

1.4 A consistent approach is promoted to improve efficiency and avoid unnecessary design and construction work, with the overall aim of achieving better value for money on widening schemes.

Scope

1.5 This Standard applies to motorway and trunk road widening schemes.

1.6 The principles and advice contained in this Standard may also be helpful to designers in relation to widening schemes on other roads.

Implementation

1.7 This Standard must be used forthwith on all widening schemes on the motorway and trunk road network except where the procurement of works has reached a stage at which, in the opinion of the Overseeing Organisation, its use would result in significant additional expense or delay progress. Designers or Assessors must confirm application of this standard to particular projects with the Overseeing Organisation.

Mandatory Requirements

1.8 Sections of this Standard that are mandatory requirements of the Overseeing Organisation are highlighted by being contained within boxes. The remainder of the document contains advice and guidance.

Definitions

1.9 The following definitions apply throughout this Standard:

Approval in Principle (AIP)	A document, which records the agreed basis and criteria for the detailed design or assessment of a Highway Structure.
Current Assessment Standards	Standards applicable to the assessment of highway structures as implemented in the Design Manual for Roads and Bridges.
Current Design Standards	Standards applicable to the design of highway structures as implemented in the Design Manual for Roads and Bridges.
Maintenance Aspect of a Current Design Standard	Requirements in Current Design Standards where there are specific statements that they should be applied to existing structures or parts of structures.
Departure from Standards	Criterion, which departs from, or is an aspect not covered by, the Standards and other mandatory requirements contained in the Technical Approval Schedule.
GDMS	The Highways Agency Geotechnical Data Management System.
Latent Departure	A non-compliance with a Current Design Standard associated with an existing structure.
Maintaining Authority	An organisation that is contracted to manage or is responsible for the maintenance of structures.
Overseeing Organisation	The highway authority responsible for motorways and trunk roads in England, Scotland and Wales and all designated roads in Northern Ireland.
Preliminary Design Report (PDR)	A report compiled from the various documents produced during the preliminary design stage.
Railway Authority	The organisation responsible for the construction operation and maintenance of railway infrastructure.
Review of Existing Assessment Form (REAF)	A form on which the decision to accept that an existing assessment is still valid is recorded.
SMIS	The Highways Agency Structures Management Information System. An electronic database of structure records.
Special Order Vehicle	A Special Order vehicle that does not conform to the AW or STGO Regulations but is covered by Section 44 of the 1988 Road Traffic Act. In Northern Ireland the equivalent vehicles are covered by Article 60 of the Road Traffic (Northern Ireland) Order 1995. Refer to BD 86 (DMRB Volume 3.4.19) for details.
Special Types General Order Vehicle	A Special Types General Order Vehicle conforming to the STGO Regulations.

Unaffected Structure	A structure which is not being modified and for which no strengthening or upgrading is proposed as part of the scheme. An Unaffected Structure may be subject to some change in geometry or load but the changes are not deemed significant such that an existing assessment is still valid (this is explained further in paragraphs 3.1-3.5).
Modified Structure	A structure at which the geometry of structural elements is being changed by a significant amount or a structure which is subject to a significant increase in load effect in order to accommodate a widened or re-aligned carriageway (this is explained further in paragraphs 3.1-3.5).
Strengthened or Upgraded Structure	A structure for which the geometry of structural elements is essentially appropriate for the scheme but strengthening/upgrading is proposed as part of the works.
Structure Options Report (SOR)	A report which, prior to the preparation of the Structure Review Process Documents, summarises the preliminary design proposals for a structure.
Structure Review Process Documents	Documents, such as AIPs, which record the agreed basis and criteria for the detailed design or assessment of a Highway Structure.
Widening Scheme	A scheme involving widening of the existing cross-section of part of the highway network.

2. PRINCIPLES TO BE ADOPTED IN THE DEVELOPMENT OF THE WIDENING SCHEME

Structure – Highway Interface

2.1 The cost of widening schemes is heavily influenced by the treatment of existing structures. In particular, there is potential for substantial savings if the widened motorway or trunk road can be accommodated at existing structures without demolition/reconstruction or major alteration. It is therefore important to give careful consideration to the highway geometry at structures (set-back, verge widths, lane widths etc.), taking advantage of reductions in standard requirements where it is appropriate to do so. Reference should be made to TD 27 (DMRB Volume 6.1.2) ‘Cross-sections and Headrooms’.

2.2 The design team should develop a holistic solution for the widening scheme, taking into account the difficulty and cost in accommodating the desired cross-section but at the same time producing a highway design which achieves the necessary standards for operation, safety and maintenance.

2.3 Highway specialists within the Overseeing Organisation should be consulted at the earliest opportunity to agree the likely acceptable standards for the scheme as a whole. Due to the number of variables, in particular accident statistics, each structure is then likely to require individual consideration to determine if the desired cross-section can be achieved. Variations in highway cross-section may be the appropriate solution although the need for consistency along the route should not be overlooked. Ultimately Departures from Standard will be required where non-standard cross-sections are proposed.

2.4 Consultations with the Overseeing Organisation will also allow discussion on the latest innovations/developments in alignment design.

2.5 Temporary alignments and traffic management requirements must also be considered and consultation with the Overseeing Organisation is required to agree traffic management constraints and implications for congestion.

2.6 Reference to reductions in geometric standards, including Departures from Standard, should be made in the Structure Review Process Documents.

Treatment of Existing Non-compliances

2.7 As a minimum, any known structures related non-compliance with a Current Assessment Standard or a Maintenance Aspect of a Current Design Standard must be considered and addressed as part of the scheme.

2.8 Similarly, any known structures related non-compliance with a Current Design Standard must be considered and addressed as part of the scheme if one or more of the following criteria apply.

1. The risks associated with the non-compliance are exacerbated by the widening scheme.
2. There is a national policy to upgrade particular elements during major schemes or Current Design Standards include a relevant mandatory requirement to be implemented on improvement schemes.
3. Retaining a non-compliance is considered to represent a significant safety risk.
4. Based on an assessment of whole life costs, there is a clear case for upgrading, maintenance or even replacement to be carried out as part of the widening scheme.
5. Upgrading works at the structure that would address the non-compliance are required to be carried out in the short term.

2.9 Note: A non-compliance may be addressed by undertaking works to eliminate the non-compliance or by providing justification and obtaining approval from the Overseeing Organisation to retain the non-compliance, e.g. through the Departure from Standards procedure.

2.10 Note: Consideration should be given to undertaking works to address other non-compliances with Current Design Standards if sufficient funds are available. For example, Overseeing Organisations may wish to undertake works to address issues if there are benefits in terms of improving the reliability of

journeys. A widening scheme will often present the opportunity to carry out maintenance, upgrading or strengthening works in a cost effective manner and with minimal further impact on network operation. Therefore, in circumstances where none of the mandatory criteria apply, it may still be appropriate to address other non-compliances as part of the widening scheme.

2.11 When considering existing non-compliances, the design organisation should liaise with the Maintaining Authority and seek the agreement of the Overseeing Organisation regarding:

- the scope of works including which non-compliances may be considered acceptable;
- the responsibility for design and construction;
- the funding for the work.

2.12 This should be agreed at preliminary design stage and included in tender documents and/or statements of intent for detailed design.

2.13 In many cases, the Maintaining Authority will already be aware and have records of non-compliances at existing structures. Additional non-compliances may become apparent from inspections and/or assessments undertaken as part of the scheme. However, irrespective of whether non-compliances were known about in advance, the principles to be applied for dealing with them remain the same.

2.14 Annex B.3 includes a list of common situations and possible solutions to issues encountered on widening schemes. Many of the examples in the list relate to the treatment of existing non-compliances.

2.15 Note that where there is any discrepancy between the above principles and the requirements of the contract, the requirements of the contract take precedence.

2.16 The agreed scope of any maintenance, upgrading or strengthening works should be recorded as described in Chapter 5.

Retention and Replication of Non-compliances

Retention of a Structures Related Non-compliance

2.17 Any non-compliance with a Current Assessment Standard or a Maintenance Aspect of a Current Design Standard requires a Departure from Standards.

2.18 A non-compliance with other aspects of a Current Design Standard does not require a Departure from Standards provided that none of the five criteria listed in paragraph 2.8 are applicable. However, if other works are being carried out at the structure then brief details of the retained non-compliance should be included in a list of Latent Departures.

2.19 Note: No Departure from Standards is necessary in relation to the assessed capacity of a structure for Special Types General Order and Special Order vehicles.

2.20 The action required for the retention of known non-compliances at existing structures is summarised in Table 2.1.

2.21 Note: In cases of doubt, the Technical Approval Authority should be consulted to confirm whether or not an issue is structures related.

2.22 Confirmation of requirements for 'Departures from Standards' on individual schemes must be sought from the Overseeing Organisation.

Replication of a Structures Related Non-compliance

2.23 Any proposal to deviate from Current Design Standards for new construction (extensions, strengthening or modifications) requires a Departure from Standards.

2.24 The action required for the replication of a known non-compliance when modifying existing structures is summarised in Table 2.2.

2.25 Note: In cases of doubt, the Technical Approval Authority should be consulted to confirm whether or not an issue is structures related.

2.26 Confirmation of requirements for 'Departures from Standards' on individual schemes must be sought from the Overseeing Organisation.

Out of Favour Forms of Construction

2.27 There are numerous structures on the highway network which are in a serviceable condition but which utilise 'out of favour' forms of construction, e.g. half joint decks. Work on recent projects has indicated that there is no overriding justification to replace all such structures. Further, when it comes to widening these structures, replicating the 'out of favour' detail, taking care to mitigate known durability, maintenance and safety issues, may be the appropriate solution in circumstances where the existing structure can be managed in a cost-effective way. Replicating 'out of favour' forms of construction should only be considered when there are no practical alternatives and acceptance of the approach will require a Departure from Standards.

2.28 Further information is included in Annex B.2.

Modifying Strengthening or Upgrading an Existing Bridge

2.29 If a structure is to be modified or a non-compliance is to be addressed, then the modification, strengthening or upgrading must be designed in accordance with Current Design Standards, except that substructure strengthening for impact should be designed to BD 48 (DMRB Volume 3.4.7).

2.30 In general, the existing elements of a Modified or Strengthened or Upgraded Structure need only comply with Current Assessment Standards. Further information is given in paragraphs 3.6-3.8.

2.31 The designer of a modified bridge should normally certify the whole structure, although with the agreement of the Overseeing Organisation isolated strengthening or upgrade works can be dealt with by partial certification.

2.32 Some requirements for new works, such as multi-span structures to be continuous over intermediate supports, can be waived with a Departure from Standards. Further advice is given on this issue in Annex B.1.

2.33 Further advice on the process for the design of extended/modified bridges is provided in paragraph 5.2.

2.34 If different requirements are applied to the new and existing parts of a bridge, there is potential for it to have varying capacity. In some cases the capacity of the whole bridge will be limited by the existing elements. In other cases, heavier loads can be permitted but may need to be restricted to particular lanes. These restrictions should be identified in the assessment report and certificate. The Overseeing Organisation should be consulted to agree how the capacity is to be recorded in order to ensure compatibility with any asset databases which may be in use.

Future Inspection and Maintenance

2.35 In developing a cost effective widening scheme, there will often be advantages in minimising clearances and other facilities which are utilised for inspection and maintenance. The effects on future maintenance and inspection must be considered in the development of the proposals. This consideration must be recorded in the Structure Options Reports (SORs), see Annex A and later in the Structure Review Process Documents. It is also required for inclusion on relevant applications for Departures from Standards.

2.36 The Maintaining Authority must be consulted at the earliest opportunity and invited to comment on proposals which affect future inspection and maintenance.

Health and Safety

2.37 Health and Safety must be considered from the commencement of conceptual design and must include a full review of potential risks and hazards associated with strengthening, upgrading and modification works. Current legislative, and Overseeing Organisation standard and policy requirements must be observed.

2.38 Input to the project Health and Safety Plan must be provided with key health and safety issues recorded in the SORs and Structure Review Process Documents.

Aesthetics and Heritage Issues

2.39 The aesthetics of Modified Structures should be considered in the context of the existing infrastructure. Guidance on this topic is provided in BA 41 (DMRB Volume 1.3.11) 'The Design and Appearance of Structures' and in the publication 'The Appearance of Bridges and Other Highway Structures'.

2.40 In addition there may be heritage issues associated with the existing structures. Guidance on this subject is provided in BD 89 (DMRB Volume 3.2.4) 'The Conservation of Highway Structures'.

Adaptability of Modified Construction

2.41 In general, when modifying structures, designs that would be particularly difficult to further modify in the future, or which preclude future changes in use of the highway (hard-shoulder running, active traffic management etc.), should be avoided. Where the provision of an adaptable design would have significant cost implications a less adaptable design may be appropriate. Overbridge designs with open spans are generally preferred to other alternatives as these offer greater scope for future changes in use of the carriageway.

Redundant Structures

2.42 In general, all abandoned or redundant existing structures within the new highway boundary should be demolished, partially demolished, concrete filled or otherwise made safe in order to remove any maintenance liability and to eliminate any effect on the performance of the network.

2.43 Where responsibility for an existing structure may be transferred to another owner, they must be consulted to agree the treatment of the structure.

2.44 The possible need to retain structures for their heritage value should be considered. In addition, structures fulfilling other functions, e.g. carrying services, may need to be retained.

Buildability

2.45 It is important to give careful consideration to buildability in the design of structural modifications. In particular, it is vital that the designs provide sufficient space to accommodate traffic management schemes that are required to achieve adequate traffic flows during the various stages of a widening scheme.

Table 2.1 Action Required for the Retention of Known Non-compliances at Existing Structures

Circumstances applicable to the Structure	Non-compliance with respect to: Assessment Standards or Maintenance Aspect of a Current Design Standard (See Note 2) or Current Design Standards (See Note 4)	Are any of the five numbered criteria in paragraph 2.8 applicable? • The scheme exacerbates the risk(s). • There is a national policy to upgrade or Current Design Standards include mandatory requirements for improvement schemes. • Significant safety risk. • WLC supports addressing the issue as part of the scheme. • The issue will have to be addressed in the short-term.	Proposed Action (See Note 1)	Comments
Structure within the length of the scheme but 'Unaffected'	Assessment Standards or Maintenance Aspect of a Current Design Standard	Yes or No	Departure from Standards submission required	Any non-compliance with an Assessment Standard must be a Departure from Standards. The principle of this Standard is that structures are assessed to Assessment Standards and deficiencies addressed accordingly.
	Current Design Standards	Yes	Departure from Standards submission required	Although a structure may be 'Unaffected', an element (e.g. parapet) may require upgrading on the basis of a national policy.
		No	None	If none of the criteria of paragraph 2.8 apply then this Latent Departure can be accepted without seeking approval.
Structure at which works are required to accommodate the scheme (e.g. width of deck to be increased) or other works, not directly related to widening, are required (e.g. deck deck strengthening) (See Note 3)	Assessment Standards or Maintenance Aspect of a Current Design Standard	Yes or No	Departure from Standards submission required	Any non-compliance with an Assessment Standard must be a Departure from Standards. The principle of this Standard is that structures are assessed to Assessment Standards and deficiencies addressed accordingly.
	Current Design Standards	Yes	Departure from Standards submission required	This may apply if, for example, WLC shows that addressing low cover is appropriate.
		No	Include in list of Latent Departures and submit to the Overseeing Organisation	Identifying the non-compliance in a list submitted to the Overseeing Organisation gives the Overseeing Organisation the opportunity to consider the issue and instruct works if appropriate. It is recommended that these Latent Departures are identified in Structure Options Reports.

Notes:

- Where a Departure from Standards has previously been approved for a specific issue, a further Departure from Standards submission for that issue will only be required if any of the criteria of paragraph 2.8 apply (e.g. the risks at the time the previous Departure from Standards was approved are increased as a consequence of the scheme).
- Maintenance requirements are specific stated requirements in design standards for a performance feature to be maintained during the service life of a structure, e.g. TD 27 Maintained Headroom requirement.
- Requirements under this section apply only to the retained part of the structure after modification. Departures from Standards for modifications are required in all cases where they do not comply with Current Design Standards.
- In the context of this table, non-compliances with Current Design Standards are not relevant where there are Assessment Standards covering the same issue. For example, substructure impact to BD 60 is not relevant.

Table 2.2 Action Required for the Replication of Known Non-compliance when Modifying Existing Structures

Circumstances applicable to the Structure	Proposed Action	Comments
Structure at which works are required to accommodate the scheme (e.g. width of deck to be increased) or other works, not directly related to widening, are required (e.g. deck strengthening)	Departure from Standards submission required	When extending or modifying an existing structure there could often be good justification for replicating an existing non-compliance (e.g. providing joints to match existing over intermediate supports). However, this does not lower the status of the issue. Therefore, a formal Departure from Standards submission is required in every case.

3. CLARIFYING REQUIREMENTS FOR ASSESSMENT OF EXISTING STRUCTURES

Structures to be Assessed

3.1 Structures should only be assessed if there is:

- no existing assessment or design valid for the proposed treatment of the structure; or
- evidence of an assessment being carried out, but the results of the assessment cannot be clearly identified, or there is evidence to suggest the results are questionable (specific project requirements should be agreed with the Overseeing Organisation).

3.2 Where it has been decided that an existing assessment is, and will remain, valid, this must be recorded using the Review of Existing Assessment Form (REAF) in Annex A. It is not necessary to verify the accuracy of the existing assessment, however a clear reasoning as to why the structure can be deemed acceptable without further assessment must be recorded.

3.3 In determining whether an existing assessment is (and will remain) valid, the following advice may be used:

Assessment Valid

- Generally, a marginal increase in design load effect can be accepted without treating the structure as modified and, therefore, invalidating any existing assessment.
- Similarly, a marginal increase in design load effect on foundations can generally be accepted. However, the site specific ground conditions need to be considered as in some circumstances small changes can have significant effects. The effect of the widening scheme on the ground water levels may be an important consideration.

Assessment Invalid

- Structures which are being modified in a way which affects their structural behaviour will always require some assessment (see the note below regarding local assessment of affected elements).
- Where a structure has previously been assessed and found to have a reduced capacity, any increase in loading may invalidate the assessment.
- Although there is no time limit on the validity of assessments, there may be changes in standards or applied loading which have taken place since an assessment was carried out. These may invalidate the assessment.
- Deterioration in condition since the assessment was carried out may invalidate an assessment if the deterioration results in a lower condition factor than that used in an earlier assessment. In this case however, advice from the Maintaining Authority should be sought to clarify whether there is any planned maintenance.
- A reduction in headroom such that collision loads on superstructure requirements are invoked may invalidate an assessment.

3.4 These principles and the need for assessments should be agreed with the Overseeing Organisation on a project by project basis. Note: What constitutes a 'marginal increase in design load effect' will need to be agreed with the Overseeing Organisation for individual cases. If the changes are not considered significant such that the existing assessment is still valid, then the structure is considered as 'unaffected'.

3.5 In some circumstances only a partial assessment may be required. A particular example is an assessment for vehicle impact (see paragraphs 3.11-3.14). Certification relating to a partial assessment should identify the elements covered and should record the extent to which the previous assessment remains valid. It may not be necessary

to rectify deficiencies in local failures provided that these would not jeopardise the global performance of the bridge. This, however, must be agreed with the Overseeing Organisation.

Assessment Standards

3.6 As a minimum existing structures or existing elements of Modified Structures must be assessed to Current Assessment Standards. In Scotland, with particular reference to loading standards, existing elements of Modified Structures must be assessed to Current Design Standards unless the use of assessment standards has been agreed with Transport Scotland.

3.7 In addition to the live loading described in BD 21 (DMRB Volume 3.4.3) and BD 86 (DMRB Volume 3.4.19), there may be a requirement to assess for Special Order Vehicles. This must be agreed with the Overseeing Organisation and may involve consultation with the Maintaining Authority.

3.8 If an existing element complies with Current Design Standards (as implemented by the Overseeing Organisation), a check to assessment standards is not required. Paragraphs 5.32-5.34 describe a scenario where this approach may be simpler.

Achieving Minimum Required Capacity

3.9 Where a structure is found not to be capable of carrying the specified assessment loading there are generally three options:

- Carry out further assessment (more accurate field measurements, materials testing or more detailed analysis techniques can be employed). Advice on levels of assessment is included in BD 79 (DMRB Volume 3.4.18) 'The Management of Sub-standard Highway Structures'.
- Obtain a Departure from Standards.
- Carry out strengthening or replacement.

3.10 It is not possible to globally set thresholds for when each of these options should be adopted and the proposals should be agreed with the Overseeing Organisation once the first pass of assessments are complete.

Assessment for Substructure Impact and Parapet Impact

3.11 If the proposed works increase the likelihood or consequences of vehicle/substructure impact (e.g. traffic will be in closer proximity to existing piers in the completed scheme) then, unless a valid assessment for substructure impact already exists, this particular assessment must be carried out. Where the substructure fails an assessment to BD 48 (DMRB Volume 3.4.7) the non-compliance should be addressed as part of the scheme. Note: The non-compliance may be addressed by undertaking strengthening/protection works or by obtaining approval from the Overseeing Organisation to retain the non-compliance.

3.12 Vehicle restraint system provision on a widening scheme should be determined in accordance with TD 19 (DMRB Volume 2.2.8).

3.13 The decision on whether to upgrade or replace parapets must be determined in consultation with the Overseeing Organisation. In this evaluation the capacity of the supporting structure should also be considered.

3.14 Where a new vehicle restraint system (e.g. parapet) is being installed an assessment is required to verify that the load effects acting on the structure can be accommodated. However, no further assessment is required if an existing assessment is valid for the load effects associated with the new parapet.

Road Surface Condition

3.15 For the purpose of undertaking structural assessments and in the absence of any contradictory evidence, 'good surfacing' condition can be assumed for roads forming part of the trunk road and motorway network.

3.16 Other roads should be categorised in accordance with BD 21 (DMRB Volume 3.4.3).

Unknown Foundation Details

3.17 Where foundations require assessment (see paragraphs 3.1-3.5) difficulty can be encountered where there is insufficient as constructed information available to determine their capacity. Unless exhaustive detailed surveys are carried out, some assumptions may need to be made regarding the foundations.

3.18 Specialists within the Overseeing Organisation should be consulted prior to formal geotechnical procedures in order to seek advice on whether the risks associated with making an assumption are justified compared to the risks and costs associated with undertaking surveys.

3.19 In developing a pragmatic solution, the following suggestions should be considered.

3.20 Trial holes and boreholes can be used to determine foundation and backfill soil parameters as well as providing access to record structural details. For deeper foundations or where access is particularly difficult, other surveying techniques may prove useful. There is wide range of techniques available that could be considered.

3.21 The most efficient way to deal with the problem could be to avoid adding further load to the foundations such that analytical assessment is not necessary. Techniques which may be utilised to this end include:

- providing protection from impact by means of an independent structure;
- adjusting the alignment to minimise the risk of vehicle impact (reasonable mitigation of risk may be achieved such that a Departure from Standards could be granted);
- reducing surfacing thickness;
- providing independent foundations for widened or extended structures.

3.22 Without a detailed knowledge of the structural foundations, some consideration should be given to any reserve capacity that may be available. For example:

- a granular founding material will often have more bearing capacity than required for the foundations;
- the strength of cohesive soils under load usually increases with time;

- older design codes may be more conservative than current standards;
- a more conservative analysis may have been utilised in the original design. For example, passive resistance from the fill to the side of a pad foundation may have been ignored but can reasonably be included for a short term condition such as pier impact.

3.23 An understanding of the past behaviour of the ground under the current configuration is important when considering adding load to existing foundations. The Maintaining Authority should be consulted to identify any available records or knowledge.

3.24 The SOR, Structure Review Process Documents and Form C (in accordance with HD 22 (DMRB Volume 4.1.2)) should record any assumptions or unusual techniques.

Load Sharing Between New and Existing Foundations

3.25 Where new foundations are provided for an extension to an existing structure difficulties arise due to the differential settlement between the new and existing foundations. Frequently the solution to this problem is to provide piled foundations even where piles were not required for the existing structure. Alternatives to this solution should be considered which include:

- configure the road over such that a longitudinal joint can be provided, e.g. through the central reserve, allowing a structurally independent extension to be provided;
- construct the extension and backfill then allow a settlement period with a monitoring regime before stitching the structures together.

3.26 It should be remembered that induced settlements and stresses in existing structures may need to be considered and analyses performed.

Assessment Criteria and Residual Life

3.27 The structural assessment of existing structures should be based on normal assessment criteria using an appropriate condition factor.

3.28 If a structure includes fatigue sensitive details then it may be necessary to assess the residual life of these elements.

4. LIABILITY ISSUES

4.1 Liability issues are a source of protracted debate on widening schemes. The guidance below sets out principles to be considered when preparing contracts. This section is not mandatory as contracts take precedence.

Existing Assessments

4.2 Where a valid certified assessment for a structure is available, expending resources re-assessing the structure or undertaking a detailed check on the assessment is not usually justified. Therefore, where the Designer or Contractor is using, has the option to use, or is required to use an existing structure without modification and the structure has an existing assessed capacity, the Designer or Contractor should assess whether the existing assessment is valid using the Review of Existing Assessment Form (REAF see Annex A). The Designer or Contractor does not need to verify and should not be responsible for the accuracy of the assessment.

4.3 Note: The principles of paragraph 4.2 are equally applicable to certified designs (see paragraphs 3.1-3.5).

Hand-Over Condition of Structures

4.4 The Contractor is usually responsible for maintaining the structures while they have possession of the site.

4.5 If existing structures are being used without restriction prior to hand-over to the Contractor and there are no interim measures (including monitoring) in place, it should be assumed that the structure is in an acceptable condition for its current use and in its current configuration.

4.6 If particular maintenance or strengthening works are included in the widening scheme, these should be clearly identified at the preliminary design stage.

Retained Parts of Existing Structures

4.7 The designer should generally certify the capacity of an extended/Modified Structure as a whole. Subject to the agreement of the Overseeing Organisation, however, isolated strengthening or upgrade works, e.g. parapet upgrade, can be dealt with by partial certification, with the designer only taking responsibility for the particular element. In these circumstances it must be demonstrated that the work does not affect other elements or the overall performance of the structure.

4.8 Works to rectify non-compliances not covered by the mandatory requirements of paragraphs 2.7-2.9 may be specified in the Contract, e.g. in order to avoid further route disruption in the future. However, in many cases non-compliances with respect to Current Design Standards will not require rectification (see paragraphs 2.7-2.28 and Annex B). Some deficiencies, e.g. defective waterproofing on a concrete deck, may be identified during construction. In such cases the Overseeing Organisation and Maintaining Authority should be consulted to discuss whether the opportunity to carry out rectification should be utilised.

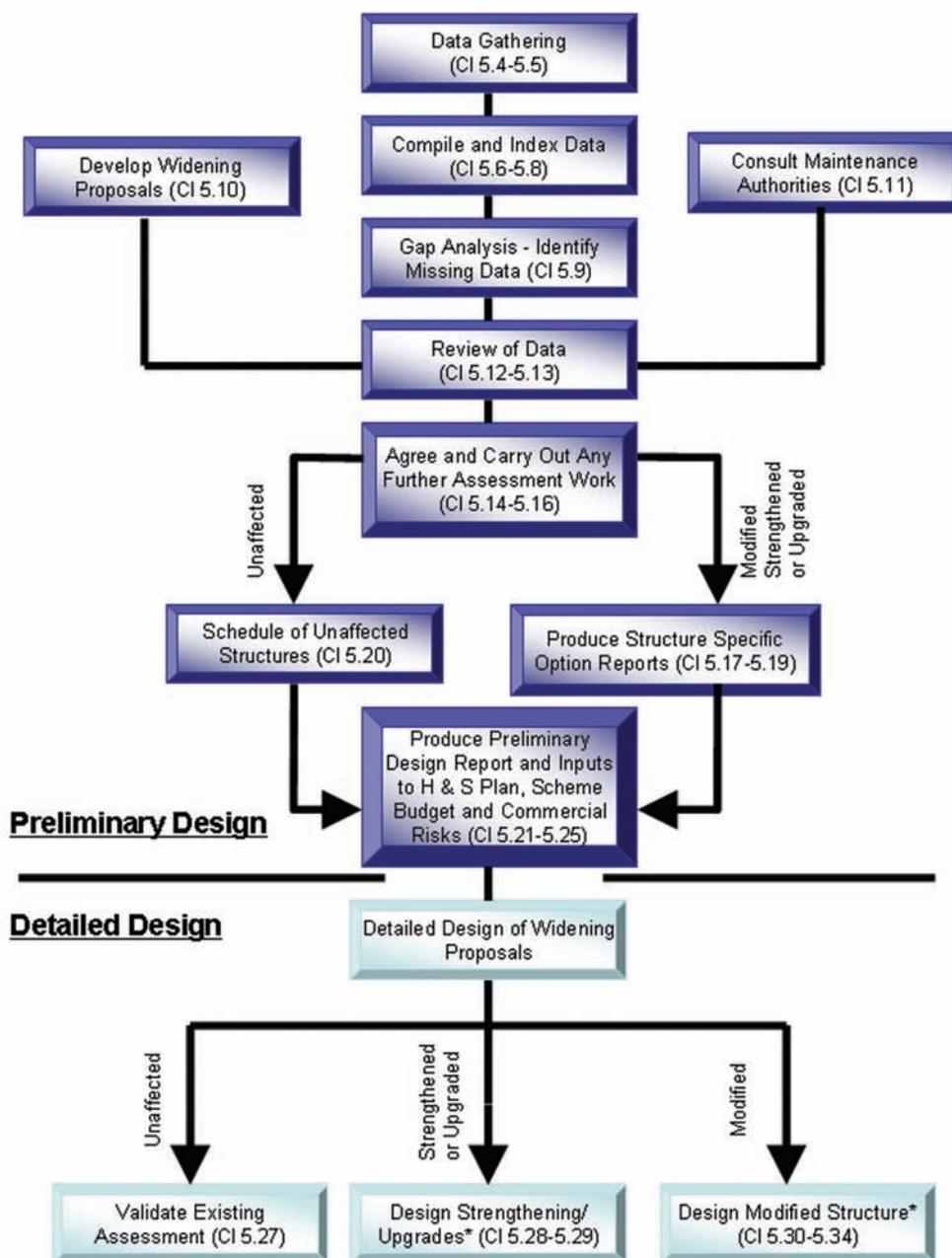
5. THE PROCESS FOR DEALING WITH EXISTING STRUCTURES

Introduction

5.1 The process for dealing with existing structures is, to some extent, dependent on the contract form and scheme specifics. However the following guidance is likely to be applicable in most cases.

Process Flow Chart

5.2 The flow chart below illustrates the typical process required at both the preliminary and detailed design stages. Commentary on each of these activities is included later in this section.



* Where an existing assessment is used in part it should be validated in the same manner as for unaffected structures.

The Preliminary Design Process

5.3 The preliminary phase is prior to publication of Draft Orders.

Data Gathering

5.4 A full search for data relating to all of the structures on the widening scheme should be undertaken. Although not all of the data may be required at this early stage it is often more efficient to carry out one complete retrieval exercise.

5.5 There are various sources of information available which include:

- Overseeing Organisation or their Agents records (including asset databases such as the HA SMIS and HA GDMS);
- Maintaining Authority or their Agents or Contractors records;
- Local Highway Authority records;
- Railway Authority records;
- British Waterways records;
- Design Consultants (original assessor or designer);
- Libraries retain numerous papers and articles regarding bridges;
- British Geological Survey.

Compile and Index Data

5.6 There is likely to be a vast amount of data collected which must be compiled and indexed. The Overseeing Organisation should be consulted to agree if there are any special requirements for the system to be employed.

5.7 Consideration should be given to converting all data to electronic format and loading onto a Project Extranet Site. This may achieve significant savings through the life of a project.

5.8 The asset database should be updated if inaccuracies or supplementary information is found. The advice of the Overseeing Organisation should be sought on what action needs to be taken.

Gap Analysis

5.9 A gap analysis should be undertaken to identify missing data.

Proposals for Structures to Accommodate the Widening

5.10 At the same time as the data collection and verification, initial proposals for how the structures will be modified to accommodate the widening should be developed.

Consultation with Maintenance Authorities

5.11 Consultation with Maintaining Authorities should be undertaken in order to consider any upgrade or refurbishment work that could be carried out as part of the widening scheme. Paragraphs 2.7-2.10 describes the decision making process to be employed.

Review of Data

5.12 Data should be reviewed to identify any discrepancies. This process does not require detailed study of assessment calculations or preparation of further calculations. A review of the results should highlight for example:

- inconsistency in assessed capacity between similar structures;
- changes in current condition that may invalidate an assessment;
- changes in standard that may invalidate an assessment;
- changes in loading that may invalidate an assessment.

5.13 Note that formal validation of existing assessments using the Review of Existing Assessment Form (REAF) is carried out at detailed design stage (see paragraphs 5.26-5.34).

Agree and Carry Out Further Assessment Work

5.14 In certain circumstances, it may be appropriate to carry out further assessment work at the preliminary design stage. The purpose may be to address:

- missing assessments or certificates;
- assessments where the results are questionable;
- old assessments where significant deterioration of the structure may have occurred, or where the standards used in the assessment are out of date;
- for a Modified Structure, in order to more accurately determine whether the modification proposed is feasible.

5.15 The benefit of carrying out assessment work at this stage is that the risk transferred to the next stage is reduced. This allows a more robust estimate of cost and reduced allowance for contingency. The Overseeing Organisation should be consulted to agree the need for any assessment work.

5.16 In addition, in some circumstances it may be appropriate to verify some key dimensions or depths of overlays, for example. Again the Overseeing Organisation should be consulted if field survey/investigation work is recommended.

Structure Options Reports (SORs)

5.17 The Structure Options Reports (SORs) are brief preliminary proposal documents covering many of the issues addressed in the Structure Review Process Documents (produced at a later stage).

5.18 SORs should be prepared for all Modified or Strengthened or Upgraded Structures. The required information for the SORs is included in Annex A.

5.19 The preparation of information at the preliminary design stage should be detailed enough to allow a robust estimate of cost to be carried out and to permit a reduced allowance for contingency.

Schedule of Unaffected Structures

5.20 The Unaffected Structures should be described in a schedule. It is important that the assumptions which classify the structure as unaffected, such as permissible changes in surfacing levels, are recorded.

Health and Safety

5.21 Requirements for input to the Health and Safety Plan are included in paragraphs 2.37-2.38.

Budget and Evaluation of Commercial Risks

5.22 Input into the scheme budget and commercial risk assessment process for the project should be carried out at this stage.

The Preliminary Design Report

5.23 The separate reports, tables and submissions described above should be combined to form the Preliminary Design Report (PDR).

5.24 The Preliminary Design Report is therefore a compilation of documents prepared previously during the preliminary design process.

5.25 An outline for the PDR is included in Annex A.

Detailed Design

5.26 In some forms of procurement, the detailed design may be carried out by a separate organisation. In others the same organisation may carry out both stages of the design. The latter form more readily permits the option of carrying out some of the detailed design activities during the Preliminary Phase. Any proposals of this nature should be agreed with the Overseeing Organisation.

Unaffected Structures

5.27 For structures where the existing assessment is still valid, the detailed design organisation is required to certify the validation process. The criteria for validating assessments and the process to be adopted are described in paragraphs 3.1-3.5.

Strengthened or Upgraded Structures

5.28 Design of strengthening or upgrade works should be developed as new design in the usual manner.

5.29 Where existing assessments are relied upon to conclude that some part of the structure is adequate for the proposed configuration, they should be validated using the process described in paragraphs 3.1-3.5.

Modified Structures

5.30 The requirements in terms of structure category and Structure Review Process Documents are described in BD 2 (DMRB Volume 1.1.1), or specific contract requirements.

5.31 Where existing assessments are relied upon to conclude that some part of the structure is adequate, they should be validated using the process described in paragraphs 3.1-3.5.

5.32 The technical process for the assessment/design of a Modified Structure may be simplified with the agreement of the Overseeing Organisation. The approach will depend on the type of structure and the modification proposed.

5.33 Note that the use of assessment standards and in particular assessment loading in Scotland is only permitted with the agreement of Transport Scotland. See paragraph 3.6.

5.34 To illustrate the types of approach which may be acceptable, two scenarios are described below:

A bridge being widened by a significant amount (e.g. the addition of several beams)

A single AIP (or other Structure Review Process Document), covering both the assessment of the existing elements and design of the new elements is utilised.

Using an appropriate load distribution analysis model, design loading is initially applied to the whole deck.

If the existing deck has insufficient capacity (evaluated to Current Design Standards) for the full design loading, then assessment loading is applied. Only the particular elements/load effects for which failure was determined under design loading need to be re-examined with capacity evaluated to Current Assessment Standards. The assessed capacity of the existing deck is then reported.

The assessment report is produced and agreement reached, with regard to any further assessment or applications for Departure from Standards.

Design drawings are prepared and certified.

A bridge requiring only a small amount of widening

In this situation it may be more appropriate to first carry out the assessment of the unmodified deck in accordance with Current Assessment Standards.

The new elements are then designed, including the connection to the existing structure using Current Design Standards.

The effects on the existing elements need to be considered in accordance with Current Assessment Standards and included in the assessment report.

The documentation would essentially be the same as the first scenario.

6. REFERENCES

[1] The Highways Agency (1996): The Appearance of Bridges and Other Highway Structures. HMSO

[2] The following is a list of documents in the Design Manual for Roads and Bridges to which reference is made in this Standard:

- BD 89 The Conservation of Highway Structures. *English Addendum applicable for use in England. Northern Ireland Addendum applicable for use in Northern Ireland. Scottish Addendum applicable for use in Scotland. Welsh Addendum applicable for use in Wales.* (DMRB 3.2.4)
- BD 21 The Assessment of Highway Bridges and Structures (DMRB 3.4.3)
- BD 86 The Assessment of Highway Bridges and Structures For The Effects of Special Types General Order (STGO) and Special Order (SO) Vehicles (DMRB 3.4.19)
- BD 2 Technical Approval of Highway Structures (DMRB 1.1)
- BA 41 The Design and Appearance of Structures (DMRB 1.3.11)
- HD 22 Managing Geotechnical Risk (DMRB 4.1.2)
- TD 27 Cross-Sections and Headroom (DMRB 6.1.2)
- BD 48 The Assessment and Strengthening of Highway Bridge Supports (DMRB 3.4.7)
- TD 19 Requirements for Road Restraint Systems (DMRB 2.2.8)
- BD 79 The Management of Sub-standard Highway Structures (DMRB 3.4.18)

7. ENQUIRIES

All technical enquiries or comments on this Standard should be sent in writing as appropriate to:

Chief Highway Engineer
The Highways Agency
123 Buckingham Palace Road
London
SW1W 9HA

G CLARKE
Chief Highway Engineer

Director of Trunk Roads: Infrastructure and
Professional Services
Transport Scotland
Trunk Road Network Management
8th Floor, Buchanan House
58 Port Dundas Road
Glasgow
G4 0HF

A C McLAUGHLIN
Director of Trunk Roads: Infrastructure
and Professional Services

Chief Highway Engineer
Transport Wales
Welsh Assembly Government
Cathays Parks
Cardiff
CF10 3NQ

M J A PARKER
Chief Highway Engineer
Transport Wales

Director of Engineering
The Department for Regional Development
Roads Service
Clarence Court
10-18 Adelaide Street
Belfast BT2 8GB

R J M CAIRNS
Director of Engineering

ANNEX A REQUIRED CONTENT OF REPORTS

A.1 Suggested Contents of Structure Options Reports (SORs)

The Structures Options Reports (SORs) are documents prepared prior to production of the Structure Review Process Documents. They are particularly useful for tenderers in helping them to understand the constraints identified in the preparation of the preliminary design.

What follows is a suggested format for a SOR. The particular project requirements should be agreed with the Overseeing Organisation.

1.0 Structure Location

Identify the location of the structure, and include a location plan.

1.1 Description of Structure and Current Condition

Briefly describe the existing structure and its current condition.

2.0 Constraints and Requirements

In this section all considerations that influence the options should be discussed under the following suggested headings.

2.1 Loading and Headroom

As well as considering the standard loading and headroom requirements this section should include details of any High or Heavy Load routes that currently, or could in the future affect the design of the structure. There may also be opportunities for the managed passage of heavy vehicles using specific lanes.

2.2 Form of Construction

Describe the existing structural form.

2.3 Construction Issues

Describe any buildability constraints, including interfaces with the existing highway or other transport infrastructure. Consider undertakings with regard to Traffic Management and congestion. Identify the effects for infrastructure users and likely mitigation measures.

2.4 Span Arrangements and Cross-sections

Identify existing and proposed span arrangements and cross-sections. Designers should consider whether Departures from Standard relating to cross-section are appropriate for the type and level of use of the proposed structure. This would need to be balanced against safety, accessibility and maintenance issues.

2.5 Superstructure

Describe the existing superstructure. Record any problems identified in inspection reports, assessments etc.

2.6 Substructure

Describe the existing substructure. Record any problems identified in inspection reports, assessments etc.

2.7 Foundations

Describe the existing foundations. Record any problems identified in inspection reports, assessments etc.

2.8 Aesthetics

Describe the aesthetic form of the existing structure and the setting.

2.9 Details and Finishes

Describe the existing details and finishes. The main aim is to use this information to develop a solution which is in harmony with the aesthetics of the existing structure, or making a positive decision to improve the appearance of the structure.

2.10 Maintenance

Describe the methods and facilities utilised for maintenance and inspection of the existing structure. Identify any requirements for improvements.

2.11 Utilities and Drainage

Describe the current and proposed utilities and drainage requirements. Identify any requirements for improvements. Note: Drainage can be a critical design issue when moving traffic closer to edge details.

2.12 Health and Safety

Describe any health and safety issues relating to the existing structure, cross referencing the Health and Safety Plan where appropriate. Identify any planned improvements.

2.13 Latent Departures

Record any known Latent Departures from Current Design Standards for which none of the five criteria listed in paragraph 2.8 are applicable. See paragraph 2.17-2.22.

2.14 Departures from Standard

Record any known Departures from Standard that apply to the existing structure, or those which may be required for the proposed use. Comment on the status of the Departures.

2.15 Others

Record any constraints related to third parties (Railway Authorities etc.) The Overseeing Organisation should be consulted to agree if there are any other project specific constraints, e.g. land, traffic, environmental, public consultations etc.

3.0 Options Comparison

In a tabular form, compare options using headings 2.1 to 2.15 above. The additional headings below should also be included to assist in evaluating the options.

3.1 Upgrading or Strengthening to be Made to the Existing Elements

Identify any problems in the existing structure which are to be rectified. These may in themselves form separate options.

3.2 Capital and Whole Life Costing of Options

Costings should take full account of the overall scheme considerations.

3.3 Adaptability for Future Infrastructure Developments.

Describe the opportunities or limitations on future upgrades that each option presents.

4.0 Drawings

Existing general arrangement drawing and drawings showing the options. Cross refer to an Appendix where A3 drawings of the options are contained.

5.0 Preferred Option

A brief conclusion identifying the preferred option.

A.2 Suggested Contents of Preliminary Design Reports (PDRs)

This standard proposes that various documents are prepared during the preliminary design stage. These various documents should ultimately be compiled to form the Preliminary Design Report (PDR). The PDR is not an additional document to be prepared; it is effectively a binder containing an index and the documents already prepared through the preliminary design process.

Standardisation of the format of the documents is desirable to improve efficiency and to ensure good quality data is prepared for the next stage. What follows is a standard contents list for the PDR. The final contents should be agreed with the Overseeing Organisation for each project.

As well as existing structures there are likely to be new structures required on a widening scheme. The PDR should be modified to satisfy the requirements for all structures.

1.0 Structures List

List structures and basic information such as chainage, structural family etc. It should identify whether the structure is to be modified, strengthened, upgraded, subject to non-structural changes or maintenance.

2.0 Contacts for Existing Structure Data

List contact details for the organisations which hold data relating to the structures on the project.

3.0 List of Data Available for Each Structure

Including inspections and assessments or reports on specific issues carried out during preliminary design.

4.0 Schedule of Unaffected Structures

The Unaffected Structures should be described in a schedule. Refer to paragraph 5.20 for the required content.

5.0 Structure Options Reports

Include reports and drawings showing the options. A typical drawing for a family of structures may suffice. Cross refer to an Appendix where A3 drawings of the options are contained.

A.3 Review of Existing Assessment Form (REAF)

1	Structure Details				
	Structure Name		<Structure Name>		
	Structure Number		<Structure Number>		
	Structure Key		<Structure Key Number>		
	Date Commissioned		<Date that the structure came into service>		
	Bridge Spans		<Name of road, railway, river etc.>		
	Minimum Headroom		<Minimum headroom>		
	Bridge Carries		<Name of road, railway etc>		
	Brief Description of Structure				
<i>Give a brief description of the structure including structural type (deck, substructure and foundations). Identify any unusual features or modifications since first constructed.</i>					
2	Existing Assessment Details				
	Inspection for Assessment Date		<Date>	Recorded Condition	<Condition Factor>
	Assessment Date		<Date>	Report Number	<Report Number>
	Current Assessed Capacity				
	HA/ALL		<eg 40te ALL>	HB/SV/STGO/SO	<eg 30HB>
	Parapet				
	<eg P2/113 with mesh infill assessed as satisfactory>				
	Pier Impact				
	<eg Passes to BD 48>				
	Certification				
	<Record if certificates exist>				
	Calculations				
<Record if calculations exist>					
As built drawings		<Record if as built drawings exist>			
Comments on Assessment					
<A brief summary of the assessment method and findings.>					
3	Evaluation for Proposed Use				
	Inspection Date		<Date of inspection being used to assess current condition.>		
	Change In Condition		<Identify any significant changes in condition since the original assessment/ inspection. Field surveys and investigations may be required to identify depths of existing overlays etc.>		
	Change In Assessment Standards		<Identify any significant changes to standards since the assessment>		
	Change In Use/Loading		<Identify the key changes that are proposed such as a requirement to carry heavier vehicles or the addition of more lanes. Cross refer and attach drawings if necessary.>		
	Superstructure		<Unless there is absolutely no change, justify the validation of the existing assessment for the proposed use. This may involve demonstrating that the additional load effects are marginal.>		
	Substructure		<The substructure is likely to be qualitatively assessed. For any change provide justification as described for the superstructure. Consider other changes which may affect capacity such as lowering road levels in front of an abutment.>		
Foundations		<Issues to consider and record are similar to those for the substructure. In addition thought should be given to changes which may affect soil properties, e.g. new drainage systems causing changes in the ground water levels.>			
4	Confirmation that Existing Assessment is Valid				
	We confirm that for the proposed use described above the existing assessment is still valid				
	Signed		Name		
	Position		Company		
	Date				
5	Acceptance of Review Details by TAA				
	Signed		Name		
	Date				

ANNEX B COMMON SITUATIONS AND SUGGESTED SOLUTIONS

B.1 Latent Departures in Modified or Strengthened or Upgraded Structures

Introduction

Paragraph 2.30 explains that existing elements of Modified or Strengthened or Upgraded Structures need only be assessed to Current Assessment Standards (see paragraph 3.6 for requirements in Scotland). This definition is straightforward to apply where assessment standards exist (e.g. loading and capacity checks). However, the position is less clear in terms of the application of other DMRB standards to existing structures. Furthermore, the application of all DMRB standards to new elements of Modified Structures may be impractical and Departures from Standards are likely to be appropriate.

What follows is a rationale developed from experience gained on recent widening schemes. It provides guidance on standard requirements that, subject to Overseeing Organisation agreement, are not mandatory for existing elements of Modified or Strengthened or Upgraded Structures. Specifically, when Current Design Standard requirements are not complied with for existing structures and none of the five criteria in paragraph 2.8 apply, a formal Departure from Standards is not necessary. In these circumstances it is only necessary that these Latent Departures are identified in Structure Options Reports and the Structure Review Process Documents. Guidance is also given on Departures from Standard that may be justified in relation to new elements of existing structures.

The approach to be adopted on a scheme should be agreed in advance with the Overseeing Organisation, so as to avoid unnecessary delay in the approval process.

The Rationale

Many of the DMRBs new or replacement standards have been introduced as a result of the poor performance in service of some of the older bridges or as a measure to improve safety. In many cases, meeting the new requirements in full would only be possible on existing bridges by complete reconstruction. Clearly this would not provide an economic solution in many cases.

For Modified or Strengthened or Upgraded Structures, new elements of the structure should, where reasonably practical, comply with Current Design Standards. Any proposal to deviate from Current Design Standards for new construction (extensions, modifications, strengthening or upgrading) requires a Departure from Standards.

Table B.1 is a typical list of current design standard requirements that may not be met by existing structures. As noted in paragraphs 2.17-2.22, provided that none of the five criteria in paragraph 2.8 apply, a formal Departure from Standards is not required in relation to these requirements for existing construction. In addition, the table gives a preliminary indication of Current Design Standard requirements that may be waived for new construction (e.g. extensions to existing structures) with a formal Departure from Standards.

The list is not exhaustive. It is expected that other items where current standard requirements could be amended for similar reasons, e.g. maintenance or durability would be added to project specific lists.

These issues should be considered and proposals included in the SORs. At detailed design stage the particular items relevant to a structure should be included in the Structure Review Process Document. This document will subsequently be included with the structure records and will assist future maintenance planning.

Standard	Title	Standard Requirement	Comments	Departure from Standards likely to be supported for new elements of Structure
BD 10/97	Design of Highway Structures in Areas of Mining Subsidence	Piled foundations not permitted	Impossible to apply to existing structure. Extension may require piling to control differential settlement	✓
		Additional reinforcement in footings to counteract 50% loss of support	Impossible to apply to existing structure. Not feasible to apply only to new extension	✓
		Blinding to include slip membrane	Impossible to apply to existing structure. Not feasible to apply only to new extension	✓
		Transition slabs not permitted at abutments	Impractical to apply to existing structure or to new extension	✓
BD 20/92	Use of BS 5400 Part 9.1 1983	Pad and strip bearings restricted to simply supported spans < 10m	Impractical to apply to existing structure or to new extension	✓
BD 24/92	Use of BS 5400: Part 4: 1990	Stress range limits in reinforcing bars	Impractical to apply to existing structure. Should be adopted for new extension	
BD 28/87	Early Thermal Cracking of Concrete	Levels of secondary reinforcement	Impractical to apply to existing structure. Requirement to be adopted for new extension	
BD 29/03	Design Criteria for Footbridges	Minimum section thickness	Impractical to apply to existing structures. Requirement to be adopted for new extension	
BD 33/94	Expansion Joints for Use in Highway Bridge Decks	Vertical movements either side of joint	Impractical to apply to existing structure. Requirement to be adopted for new extension	
BD 47/99	Waterproofing and Surfacing of Concrete Bridge Decks	Permitted system	Impractical to apply to existing structure unless deck is resurfaced. Requirement to be adopted for new extension	

Table B.1 Typical Current Design Standard Requirements Not Met by Existing Structures

Standard	Title	Standard Requirement	Comments	Departure from Standards likely to be supported for new elements of Structure
BD 57/01	Design for Durability	Moratorium on post tensioned segmental structures	Impractical to apply to existing structure. Requirement to be adopted for new extension	
		Provision of facilities for jacking to inspect/replace bearings	Impractical to apply to existing structure. Should be considered for new extension	
		Multi-span structures to be continuous over intermediate supports	Impractical to apply to existing structure or to new extension. Note: Where widening is accommodated on a separate deck(s) this should be continuous over supports	✓
		Half joints not permitted	Impractical to apply to existing structure. Requirement to be adopted for new extension in most cases	Depends on particular circumstances
		Bridges less than 60m long or 30° skew to be integral (unless large differential settlements can occur) – see BA 42/96	Impractical to apply to existing structure or to new extension	✓
		Reduce or limit the use of corrodible reinforcement	Impractical to apply to existing structure. Requirement to be adopted for new extension	
		Provision of abutment galleries	Impractical to apply to existing structure. Should be considered for new extension where practical	Depends on particular circumstances
		Concrete mix characteristics to control sulphate attack	Impractical to apply to existing structure. Requirement to be adopted for new extension	
		Facilities for inspection of post tensioned tendons	Impractical to apply to existing structure. Requirement to be adopted for new extension	
		Drainage to be a closed system and roddable. Down pipes cast into piers not permitted	Impractical to apply to existing structure. Requirement to be adopted for new extension	

Table B.1 Typical Current Design Standard Requirements Not Met by Existing Structures (continued)

B.2 Out of Favour Forms of Construction

For extensions to structures, it is often appropriate to replicate the existing articulation/form of construction in order to avert or reduce the problems associated with differential movements under applied loading.

However, this gives rise to the question of whether to adopt this approach for existing structures where the form of construction is no longer favoured (e.g. hinge decks, half-joints etc.). These situations require consideration on a structure-by-structure basis. When faced with this issue, one of the options is to consider changing the articulation of the existing structure. However, where this does not offer value for money, or introduces longitudinal joints that increase future maintenance, there may be ways of replicating the original form of construction without inheriting the original maintenance problems. For example, the hinge extension could utilise stainless steel for the reinforcement most susceptible to corrosion. This may overcome the potential durability concerns. Any proposal to replicate these out of favour forms of construction should be considered only after exploring all other options and after giving careful consideration to ongoing maintenance and operational issues. For example, will half-joints be more difficult to access after widening. Any proposal to replicate these out of favour forms of construction would be inconsistent with

the requirements of BD 57 and a Departure from Standards would be required (see paragraph 2.27).

The treatment of existing hinge and half joint structures is detailed in guidance documents produced by Overseeing Organisations. Initially, the capacity of existing hinges or half joints should be assessed, to ensure that their capacity is adequate. A qualitative risk assessment of the half joint or hinge should also be carried out, using the methodology outlined in the Overseeing Organisations guidance documents to establish the cost effectiveness of retention. Note: The method developed for half joint structures can be adapted to suit hinge structures. Some Maintaining Authorities are currently undertaking a programme of these assessments. If a structure on a widening scheme has not been assessed in this manner then it should normally be carried out at the preliminary design stage. Savings can be made by grouping structures into families and carrying out assessments to represent a group of structures. This assessment will confirm whether the detail can be retained in the Modified Structure. The capacity of all parts of existing structures still needs to be checked individually as part of the detailed design of the Modified Structure.

If widening the existing structure can be demonstrated to be cost effective, Table B.2 summarises the appropriate process and suggests treatment for widening.

Deck Form	Existing Deck Checks	Proposed Action for Widened Section
Preflex beam decks	Carry out an SLS check of Preflex beam design. Re-check Preflex losses to establish load carrying capability	Beam type no longer used. Design extension deck to match stiffness of Preflex beam deck as closely as possible, e.g. pre-tensioned beams and slab
Half joints	Check half joint capacity in 'as-built' and 'deteriorated' state. If adequate widening with similar construction can be considered	Consider improving durability of extension half joint by using stainless steel for vulnerable reinforcement. Consider including instrumentation or facilities to allow examination/monitoring
Hinges	Check hinge capacity in 'as-built' and 'deteriorated' state. If adequate widening with similar construction can be considered	Consider improving durability of extension hinge by using stainless steel for vulnerable reinforcement. Consider including instrumentation or facilities to allow examination/monitoring
Freyssinet hinges	BE 5/75 provides design rules for hinge. Requires mild steel reinforcement	Replace mild steel with stainless steel in extension hinge. Consider including instrumentation or facilities to allow examination/monitoring
Short span deck on bearings	Confirm existing capacity	Provide compatible bearings and replicate existing beams. Galleries on extension may not be essential. Final bridge form may not need to be integral (see Annex B.1)

Table B.2 Suggested Strategy for Dealing with Out of Favour Forms of Construction

B.3 Other Common Situations and Possible Solutions

A list of potential widening situations and possible solutions is included in the table below.

The list is not exhaustive.

Situation	Implications of Scheme Proposals	Possible Action
Over bridge with weak pier supports and minimum headroom between the 'maintained' and 'new construction' requirements	Traffic will be moved closer to the piers but the minimum headroom will not be reduced	Protect/strengthen the piers to the requirements of BD 48 or seek a Departure from Standards to retain piers without strengthening. No action with respect to headroom
Over bridge with weak cantilevers protected by a partially effective barrier	Carriageway widened beneath the bridge	No action to address weak cantilevers as the arrangement complies with Current Assessment Standards (BD 21 Annex J DMRB Volume 3.4.3)
Over bridge with inclined verge supports	Carriageway moves towards support reducing headroom below 'Maintained Headroom' in 'Structure Free Zone'	Vehicle restraint system complying with Current Design Standards provided such that Maintained Headroom is provided at the traffic face of the barrier. In addition 3.0m of headroom to be provided over the working width appropriate to the vehicle restraint system. Note: This requires agreement as a Departure from Standards
Under bridge with substandard deck capacity for STGO vehicles	Increase in load on bridge	Liaise with Maintaining Authority to establish capacity requirements. Consider an operation regime where heavy vehicles utilise a particular lane. Alternatively, strengthen to the required capacity using Current Design Standards
Under bridge with low cover to reinforcement. However, chloride contamination is not significant (e.g. < 0.3% by weight of cement) and the depth of carbonation is minimal	The bridge is being widened	No action with respect to low cover. Include details of non-conformance in a list of Latent Departures
Under bridge with low cover to reinforcement, significant chloride contamination (e.g. 0.3% by weight of cement) and concrete spalling taking place	The bridge is being widened and whole life costing indicates a clear case for undertaking maintenance as part of the widening scheme	Address low cover
Symmetrically widened under bridge with substandard edge (e.g. pre-cast service bay with limited load capacity)	Bridge will be widened	Consider removing more of existing deck than is necessary to remove the deficient elements
Traffic face of abutment is clad or has a feature with a deep relief	Carriageway edge is closer to the abutment with insufficient space for a safety fence	Fill cavity behind cladding to a minimum height of 1.5m. A rough finish may need to be removed and replaced with a concrete infill to a height of 1.5m

Table B.3 Common Situations and Possible Solutions