London Bridges Engineering Group

LoBEG Technical Note

Asset Valuation for Highway Structures

This Technical Note does not fully comply with the Department for Transport's and the UK Bridges Board's "Structures Asset Management Planning Toolkit" (2012) or CIPFA's "Code of Practice on Transport Infrastructure Assets: Guidance to Support Asset Management, Financial Management and Reporting" (2010).

LoBEG considers this Technical Note an interim solution until the Structures Asset Management Planning Toolkit has been programmed into BridgeStation.

Version 3.0

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The photograph on the front cover is Temple Mills Bridge which was constructed in 2006. The photograph was kindly provided by Joe Figurado.

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Many thanks to all those LoBEG members who contributed to previous versions of this Technical Note.

1 Introduction

1.1 Background

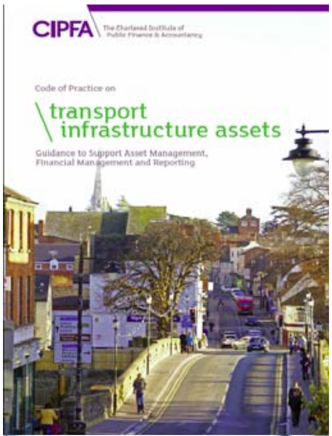
This Technical Note has been prepared by LoBEG to provide members with guidance on the approach they should use to value their highway structures.

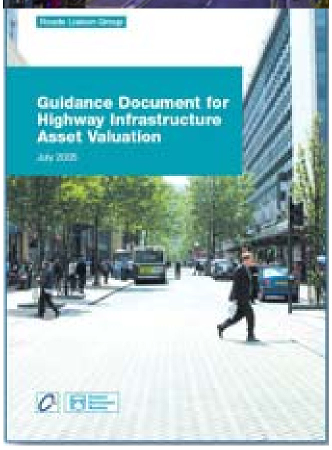
The calculation of Gross Replacement Cost (GRC) described in this guidance complies with the *Structures Asset Management Planning Toolkit*[1] and the *Code of Practice on Transport Infrastructure Assets: Guidance to Support Asset Management, Financial Management and Reporting*[2].

However, the calculation of Depreciated Replacement Cost (DRC) described in this guidance is complementary to and supplements the now superseded *Guidance Document for Highway Infrastructure Asset Valuation*[3]. LoBEG considers the calculation of DRC described in this guidance an interim solution until the *Structures Asset Management Planning Toolkit* has been programmed into BridgeStation.

Where required, this Technical Note references the *Structures Asset Management Planning Toolkit*, the *Code of Practice on Transport Infrastructure Assets: Guidance to Support Asset Management, Financial Management and Reporting* and the *Guidance Document for Highway Infrastructure Asset Valuation*.

Where their content is replicated in this guidance, it is provided for clarity and completeness.





1.2 Valuation Requirements

The UK Government introduced the Whole of Government Accounts (WGA) process to produce a consolidated set of financial statements for the UK public sector. It consolidates around 1,300 bodies, including central government departments, local authorities, devolved administrations, the health service, and public corporations. It is prepared using accounting standards (International Financial Reporting Standards), as adapted and interpreted for the public sector, and is similar in presentation to private sector accounts.

CIPFA's *Code of Practice on Transport Infrastructure Assets: Guidance to Support Asset Management, Financial Management and Reporting*[2] moves the valuation of infrastructure assets from a historic cost basis (as described in *Guidance Document for Highway Infrastructure Asset Valuation*[3]) to a DRC valuation which is consistent with the accounting policy adopted for WGA.

1.3 Compliance with Current Requirements

The Department for Transport and the UK Bridges Board published the *Structures Asset Management Planning Toolkit*[1], which interprets and complies with CIPFA's *Code of Practice on Transport Infrastructure Assets: Guidance to Support Asset Management, Financial Management and Reporting*[2]. As a member of the Steering Group for this project, LoBEG supports the principles of the Toolkit and intends to incorporate this in its structures management system, BridgeStation, in the financial year 2012/2013.

LoBEG believes that implementing the *Structures Asset Management Planning Toolkit* in its entirety outside BridgeStation is too resource-intensive and would take more time than the deadline for L Pack returns for 2011/2012 allows. As an interim solution to be applied until the Toolkit is available in BridgeStation, LoBEG intends to calculate DRC in line with the now superseded *Guidance Document for Highway Infrastructure Asset Valuation*[3]. While this calculation of DRC is not consistent with the accounting policy adopted for WGA, LoBEG will comply with the Toolkit and the CIPFA Code for its calculation of GRC.

LoBEG has performed a trial (Appendix A) which shows that the DRC calculated according to LoBEG's interpretation of the *Guidance Document for Highway Infrastructure Asset Valuation* differs from the DRC calculated in the *Structures Asset Management Planning Toolkit*:

- by 15.8% if the DRC from the Toolkit is calculated according to the HAMFIG requirements for L Pack returns for 2011/12 (i.e. using the 'Unplanned Reactive' maintenance/renewal strategy and an unlimited annual budget)
- by 1.8% if the DRC from the Toolkit is calculated according to the requirements for 2012/13 and later (i.e. using an appropriate mix of maintenance/renewal strategies and an appropriate annual budget for LoBEG's structures)

Based on these results, LoBEG believes that this Technical Note provides an acceptable interim solution for the valuation of highway structures until the *Structures Asset Management Planning Toolkit* is available in BridgeStation.

2 Concept and Terminology

In this section, all references to asset value, DRC and depreciation align with the now superseded *Guidance Document for Highway Infrastructure Asset Valuation*[3]. These references are mostly not in line with the *Structures Asset Management Planning Toolkit*[1] and the *Code of Practice on Transport Infrastructure Assets: Guidance to Support Asset Management, Financial Management and Reporting*[2].

Asset valuation is the calculation of the current monetary value of an organisation's assets (Section 1.1.1 in the *Guidance Document for Highway Infrastructure Asset Valuation*). Central to the approach used for highway infrastructure assets is the assumption that the transport network is maintained in perpetuity, and therefore the most appropriate way to value the network is using replacement cost (in current location) but reduced to account for current condition/performance. This is evaluated as:

Asset Value (or Depreciated Replacement Cost) =
Gross Replacement Cost – Accumulated Depreciation

This relationship is shown in Figure 1 and the terminology described below, with specific references to highway structures.

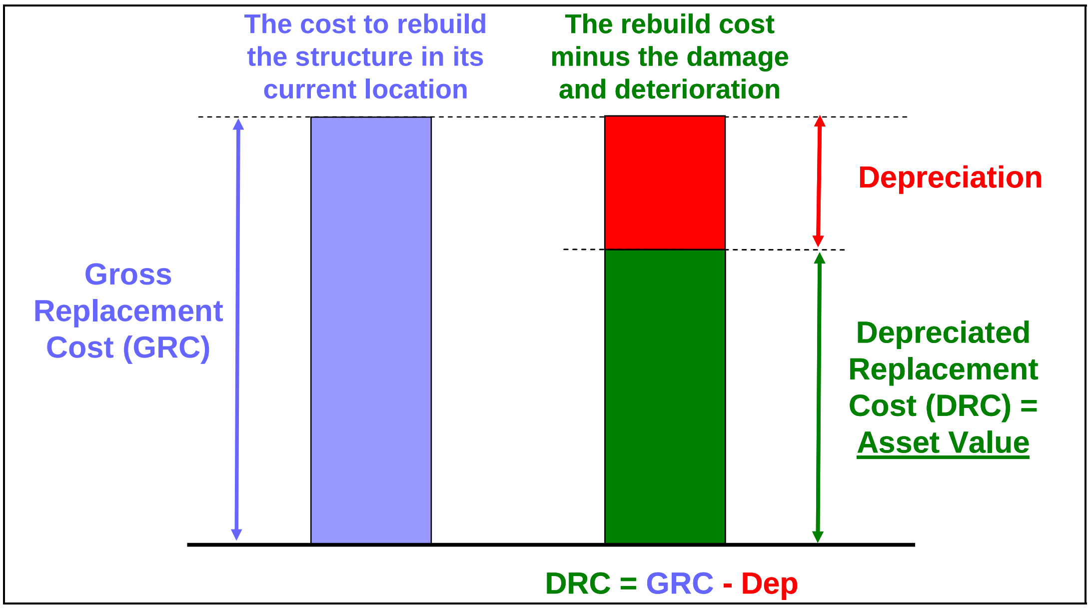


Figure 1: Asset Valuation Concept

Gross Replacement Cost – the total admissible cost of replacing a highway asset as part of the existing highway network, e.g. the cost of demolishing and reconstructing a bridge that is in use.

Depreciation – the systematic consumption of economic benefits embodied in an asset over its service life arising from use, ageing, deterioration or obsolescence, e.g. the cumulative cost of restoring any damaged/deteriorated bridge elements to 'as new' condition.

Therefore, by monitoring the relationship between GRC, DRC and Depreciation over time it is possible to assess if the value of the assets is increasing, declining or remaining in a steady state. Given that this can be presented in monetary terms, it will be a beneficial tool in demonstrating and justifying funding needs.

Important: Asset valuation – as calculated according to the *Guidance Document for Highway Infrastructure Asset Valuation* – while deemed to be a "true and fair" representation (Section 2.1.6 in the *Guidance Document for Highway Infrastructure Asset Valuation*) of the value of the assets, is unlikely to be suitable for use as an engineering estimate.

3 Rules and Assumptions

The following rules and assumptions for deriving unit rates and adjustment factors for GRC have been adopted in the *Structures Asset Management Planning Toolkit*[1] and are in line with CIPFA's *Code of Practice on Transport Infrastructure Assets: Guidance to Support Asset Management, Financial Management and Reporting*[2].

3.1 Admissible Costs

Admissible costs (Sections 4.6 and 4.7 in CIPFA's *Code of Practice on Transport Infrastructure Assets: Guidance to Support Asset Management, Financial Management and Reporting*[2]) for the measurement of asset valuation are defined as only those costs that are directly attributable to bringing the asset into working condition for its intended use; where, working condition, is interpreted 'as new' condition for highway structures. The following sets down the costs that are included or excluded from valuation:

Included (admissible costs):

1. Direct cost of material, labour, plant and equipment, site clearance and preparation costs with the contractor's profit margin and finance costs, any extensions to the work;
2. Project management and supervision costs, feasibility and scheme design;
3. Costs of authority's own staff time;
4. Cost of demolishing or breaking out of the existing assets and their disposal;
5. Cost of temporary works, e.g. diversions and temporary bridging;
6. Temporary traffic management costs, e.g. coning, traffic lights and signage;
7. Possession costs for assets over – or that impact on – railway lines, canals, etc., easements, land possessions etc.

Excluded (non-admissible costs):

8. Utility service diversion/disruption costs, e.g. gas, water, electric – these costs are uncertain, difficult to estimate and change dramatically over time, so should be "written off" when incurred, i.e. after a scheme is complete the expenditure on STATS is removed from the value;

1. Pre-feasibility costs;
2. General management and monitoring or overhead costs not attributable to an individual scheme;
3. Any abortive costs, e.g. costs due to errors, delays and disputes. It was agreed that this should only be considered where there is clear evidence of abortive costs that amount to more than 5% of the scheme/project costs. For example, if a bridge costs £15million to construct but then requires retrofitting with special equipment (say £5million for retrofitting), the asset value is not necessarily £20million (i.e. £15m + £5m), instead it would be the cost of constructing the bridge correctly in the first place, which may be only £17.5million, thereby giving £2.5milion in abortive costs that are attributed to design error.
4. Wastage, e.g. excess materials purchased that have not been used in the construction.

3.2 Modern Equivalent Assets and Heritage Assets

A Modern Equivalent Asset (MEA) is defined as one that has the same potential performance as the existing asset, but takes account of up-to-date technology (Section 6.3 in the CIPFA Code). If the construction form of an existing asset is no longer considered appropriate as a replacement, or when existing assets can be replaced more economically by new construction forms to provide a similar function, then this should be reflected in the asset valuation by using the MEA instead of the existing construction form. However, some heritage structures are not suitable for valuation on a MEA basis. These should be valued on a “like for like” or “nearly like as is possible” basis. However, in some cases a MEA may be used as long as it maintains the ‘look and feel’ of the original structure and any relevant legislation is satisfied. Three categories may therefore be used for highway structures in London:

1. Modern Equivalent Assets – the GRC of the structure is calculated assuming it will be replaced by a Modern Equivalent Asset.
2. Heritage Structures – the GRC of the structure is calculated assuming it will be replaced on a “like for like” basis in terms of look and feel.
3. Modern Equivalent with Heritage Façade (Replica Heritage) – the GRC of the structure is calculated by assuming the structural elements will use modern techniques/technology. However, the final structure will have facades that replicate the heritage look and feel (thereby giving higher replacement unit rates than a straight MEA).

The structure groupings provided in Section 4.1 assume a MEA will be used. Adjustment criteria (Section 4.2) are applied to the MEA GRCs to account for heritage structures or replica heritage structures.

3.3 Substandard Structures

The following simple examples provide guidance on how to take account of structures that require upgrades, e.g. strengthening, waterproofing and parapets. Valuation is based on the intended service/performance of the original asset. For example:

1. The assessment programme found a bridge to have full load carrying capacity of 40 tonne. However, the bridge has now deteriorated and is currently only providing 10 tonne capacity due to poor condition. In this case, the GRC is based on a replacement with 40 tonne capacity, and the cost of work required to restore the bridge from 10 to 40 tonne capacity is taken as depreciation.
2. The full load carrying capacity is 10 tonne (even in new condition) but 40 tonne capacity is required. The GRC is evaluated based on a replacement with 10 tonne capacity. The shortfall in structural capacity below the required performance has no impact on the asset value, i.e. the cost to upgrade this structure to 40 tonne is not used to depreciate the GRC because the original capacity of the structure is only 10 tonne.
3. It can be argued that from a social and economic aspect a non-functional/closed structure has zero asset value. However, this is more applicable to assets that have a market value. The approach to be adopted for such structures is as defined in 1 or 2 above, e.g. in the case of 1, the cost to strengthen the bridge to 40 tonne capacity is taken as the depreciation.

It is recognised that modern structures are not constructed with substandard loading capacity. Therefore, the cost of constructing a sub-40 tonne structure cannot be readily derived from recent construction schemes. Thus, adjustment criteria are used to account for structures that were originally designed and constructed to sub-40 tonne capacity.

4 Structure Groupings and Adjustment Criteria

This section describes the structure groupings and adjustment criteria that meet the HAMFIG requirements and may be used for the L Pack returns for 2011/2012. These groupings and criteria are defined in Section 12 in Part C: Supporting Information of the *Structures Asset Management Planning Toolkit*[1].

4.1 Structure Groupings

The following table shows the structure groupings (and associated definitions) that should be used by LoBEG members for asset valuation.

Table 1: Structure Types and Groups

Structure Group	Description	Sub-Groups
Special structure	For example, moveable bridges, Millennium Bridge, Tower Bridge.	Each dealt with individually
Bridge: Vehicular	A structure with a span of 1.5m or more spanning and providing passage for vehicular traffic over an obstacle, e.g. watercourse, railway, road.	Single span 2 and 3 span 4 and more span
Bridge: Pedestrian/ cycle	As for vehicular bridge, but provides passage for pedestrians and cyclists.	Single span Multi-span
Cantilever Road Sign	A structure with a single support that projects over the network in order to carry a traffic sign.	
Chamber/cellar/vault	An underground room or chamber with an average length of 1.5m or more.	
Culvert	A drainage structure with a span of 0.9m or more passing beneath a network embankment that has a proportion of the embankment, rather than a bridge deck, between its uppermost point and the road running courses.	Single cell Multi cell Depth of Fill > 1m Depth of Fill ≤ 1m
High Mast Lighting (>20m)	Lighting columns over 20m in height.	
Retaining Wall	A wall associated with the network where the dominant function is to act as a retaining structure (>1.35m).	Height > 3m Height ≤ 3m
Sign/signal gantry	A structure spanning the network, the primary function of which is to support traffic signs and signalling equipment.	Cantilever Spanning
Structural Earthworks – Reinforced/Strengthened Soil/Fill Structure	A structure associated with the network where the dominant function is to stabilise the slope and/or retain earth. All structures with an effective retained height of 1.5m or greater.	Height ≤ 3m Height > 3m
Subway: Pipe	Subways that provide passage for utility service pipes and cabling.	
Tunnel	An enclosed length of 150m or more through which vehicles pass.	Bored Cut and Cover

Structure Group	Description	Sub-Groups
Underpass (or subway): Pedestrian	A structure with a span of 1.5m or more that provides passage for pedestrians.	
Underpass: Vehicular	The underpass includes approach slab, retaining walls, bridge, drainage, etc.	

4.2 Adjustment Criteria

The criteria that are considered to have a significant impact on the GRC of the groupings in Table 1 are shown in Table 2.

Table 2: Adjustment Criteria

<table>
<tr><th>ID</th><th>Factors</th><th colspan="2">Description</th></tr>
<tr><td>1</td><td>Heritage</td><td colspan="2">Exact replacement (materials and look and feel) of existing structure.</td></tr>
<tr><td rowspan="2">2</td><td>Replica Heritage</td><td>Same finish as existing structure - impacts on aesthetics, type of material and quality of finish.</td><td rowspan="2">These two criteria are considered to cover similar criteria, therefore a structure can only have one of these assigned against it in order to avoid double counting.</td></tr>
<tr><td>Conservation area</td><td>Impacts on aesthetics, type of material and quality of finish.</td></tr>
<tr><td>3</td><td>Environmentally sensitive</td><td colspan="2">To take account of protected flora and fauna.</td></tr>
<tr><td>4</td><td>Route supported – A, B or C</td><td colspan="2" rowspan="2">To take account of the route type supported by the structure.</td></tr>
<tr><td>5</td><td>Route Supported - unclassified</td></tr>
<tr><td>6</td><td>Obstacle (Highway)</td><td colspan="2" rowspan="7">To take account of the different activities and costs incurred when constructing a bridge over different obstacles. This should take account of costs such as possessions (for railways), traffic management, access etc.</td></tr>
<tr><td>7</td><td>Obstacle (Railway)</td></tr>
<tr><td>8</td><td>Obstacle (Watercourse - Nav)</td></tr>
<tr><td>9</td><td>Obstacle (Watercourse - Non-nav)</td></tr>
<tr><td>10</td><td>Obstacle (Footway/cycleway)</td></tr>
<tr><td>11</td><td>Obstacle (Tenanted/business)</td></tr>
<tr><td>12</td><td>Obstacle (Land/disused)</td></tr>
<tr><td>13</td><td>Substandard Structures</td><td colspan="2">To take account of the lower cost of constructing a bridge with a substandard capacity.
LoBEG breaks this factor down into:
- Substandard Structure: Load Design Factor (0t - 5t)
- Substandard Structure: Load Design Factor (>5t - 20t)
- Substandard Structure: Load Design Factor (>20t - 40t)</td></tr>
<tr><td>14</td><td>Location - Urban</td><td colspan="2" rowspan="2">To take account of the difference in cost between rural and urban locations.</td></tr>
<tr><td>15</td><td>Location - Rural</td></tr>
</table>

ID	Factors	Description
16	River Wall	To take account of the specific activities involved in the construction of river walls.
17	Tunnel (150 to 400m)	To take account of the different safety, drainage and M&E required for tunnels > 400m.
18	Tunnel (> 400m)	

5 Replacement Unit Rates, Adjustment Factors and GRC

5.1 General Approach

The following describes the unit rates and adjustment factors that meet the HAMFIG requirements and may be used for the L Pack returns for 2011/2012, and how these should be used to calculate the Gross Replacement Cost (GRC).

5.2 Replacement Unit Rates

The replacement unit rates that meet the HAMFIG requirements and may be used for the L Pack returns for 2011/2012 are provided in Section 12 in Part C: Supporting Information of the *Structures Asset Management Planning Toolkit*[1]. These are replicated in Table 3.

Table 3: Replacement Unit Rates[1]

Structure Type/Group	Sub Groups	Replacement Unit Rate	Sample Size	Rationale
Special structure	Each dealt with individually	Not Available		
Bridge: Vehicular	Single span	£6,347/m^2	14	Based on scheme data and engineering judgement
	2 and 3 span	£4,552/m^2	1	Based on scheme data and engineering judgement
	4 and more span	£3,248/m^2	1	Based on scheme data and engineering judgement
Bridge: Pedestrian/ cycle	Single span	£3,866/m^2	7	Based on scheme data and engineering judgement
	Multi span	£2,320/m^2	0	Based on engineering judgement
Cantilever Road Sign [Same as cantilever sign/signal gantry]	-	£88,078 per unit	0	Based on engineering judgement
Chamber/cellar/vault	-	£4,404/m^2	0	Same as pipe subway
Culvert	Single cell	£4,539/m^2	3	Based on scheme data and engineering judgement
	Multi cell	£2,270/m^2	0	Based on engineering judgement
	Depth of Fill > 1m	-	-	-
	Depth of Fill ≤ 1m	-	-	-
High Mast Lighting (>20m)	-	£26,423 per unit	1	Based on scheme data and engineering judgement
Retaining Wall	Height > 3m	£2,155/m	1	Based on scheme data and engineering judgement
	Height ≤ 3m	£1,616/m	0	Based on engineering judgement
Sign/signal gantry	Cantilever	£8,807/m	0	Based on engineering judgement
	Spanning	£8,807/m	0	Based on engineering judgement
Structural earthworks -	Height ≤ 3m	£1,055/m^2	0	Based on engineering judgement

Structure Type/Group	Sub Groups	Replacement Unit Rate	Sample Size	Rationale
reinforced/strengthened soil/fill structure [Same as retaining wall]	Height > 3m	£789/m^2	0	Based on engineering judgement
Subway: Pipe	-	£4,404/m^2	0	Based on engineering judgement
Tunnel	Bored	£19,818/m^2	0	Based on engineering judgement
	Cut and Cover	£13,212/m^2	0	Based on engineering judgement
Underpass (or subway): Pedestrian	-	£4,275/m^2	0	Based on engineering judgement
Underpass: Vehicular		£7,927/m^2	0	Based on engineering judgement

5.3 Adjustment Factors

The adjustment factors that meet the HAMFIG requirements and may be used for the L Pack returns for 2011/2012 are provided in Section 12 in Part C: Supporting Information of the *Structures Asset Management Planning Toolkit*[1]. These are replicated in Table 4.

Table 4: Adjustment Factors[1]

ID	Factors		Value	Rationale
1	Heritage		2.00	This is an indicative factor. Heritage and Special Structures are those that due to a combination of their size, construction and/or character are not suitable to be valued using standardised Unit Rates (e.g. the Jubilee Bridge). They should be valued individually using the principles given in the Transport Infrastructure Assets Code, including the concept of Modern Equivalent Asset. In many cases, this information is unlikely to be available; therefore Heritage/Special Structure Unit Rates can be either: - MEA Unit Rates adjusted by an appropriate factor, either the default factor provided or a locally derived/agreed factor; or - Unit Rates derived using engineering judgement and experience (and advice sought from a Quantity Surveyor if appropriate).
2	Replica Heritage		-	Based on engineering judgement
	Conservation area		1.25	
3	Environmentally sensitive		1.40	Based on engineering judgement
4	Route Supported	A, B or C	1.00	Based on scheme data
5		Unclassified	0.80	Based on scheme data
6	Obstacle crossed	Highway	1.00	Based on scheme data
7		Railway	2.00	Based on scheme data

ID	Factors		Value	Rationale
8		Watercourse - Navigable	1.00	Based on scheme data
9		Watercourse - Non-navigable	0.90	Based on scheme data
10		Footway/cycleway	0.75	Based on engineering judgement
11		Tenanted/business	1.10	Based on engineering judgement
12		Land/disused	0.90	Based on scheme data
13	Substandard Structures *		0.85	Based on engineering judgement
14	Location	Urban	1.00	All schemes used were urban
15		Rural	0.70	Based on comparison with Surrey CC
16	River Wall		1.60	Based on engineering judgement
17	Tunnel (150 – 400m)		1.00	Based on engineering judgement
18	Tunnel (> 400m)		1.25	Based on engineering judgement

* LoBEG breaks the factor ‘Substandard Structures’ down into:

- Substandard Structure: Load Design Factor (0t - 5t)
- Substandard Structure: Load Design Factor (>5t - 20t)
- Substandard Structure: Load Design Factor (>20t - 40t)

In line with the HAMFIG requirements for the L Pack returns for 2011/2012, LoBEG uses the same value of 0.85 for all of these with a view to refining the adjustment values in the future.

5.4 Gross Replacement Cost

GRC is calculated for each structure as:

GRC = Dimension x Unit Rate x Adjustment Factors

Where:

- <u>Dimension</u> – the dimension relevant to the structure type, e.g. m, m^2 or number, as defined in the *Structures Asset Management Planning Toolkit*[1]
- <u>Unit Rate</u> – the cost per dimension relevant to the structure type, e.g. £/m^2 (Table 3)
- <u>Adjustment Factors</u> – the adjustment factors that reflect criteria which have a significant impact on GRC (Table 4)

This is a relatively straightforward calculation, but in order to ensure year-on-year consistency (and comparability between boroughs), it is important that the dimensional information is robust.

<u>Important:</u> LoBEG members should bear in mind that structure dimensions are frequently of interest during asset valuation audits (based on the experience of the Trunk Road Authorities) because they are finite values and can be readily checked on site. It is therefore important for LoBEG members to ensure that structure dimensions held in BridgeStation are accurate and up-to-date – this can be achieved by systematically reviewing/checking these dimensions as part of the on-going General and Principal Inspection regime.

6 Approach for Calculating Depreciation

6.1 Depreciation for Highway Structures

Highway structures are long-life assets (frequently with an age well in excess of 100 years) that deteriorate at a range of different rates and due to a wide range of influencing factors. As such, it is difficult to predict, with a good degree of accuracy or confidence, the service life of the different structure components. Also, it is normally the case that structures are maintained in perpetuity.

As such, LoBEG has aligned with Section 14.7.1 in the *Guidance Document for Highway Infrastructure Asset Valuation*[3] in that highway structures are depreciated using the Renewals Accounting method rather than the Conventional (straight-line) Method. This is primarily because (i) the former more accurately reflects usage and maintenance practices; and (ii) condition data is regularly collected for all structure components. Section 10.3.1 in the *Guidance Document for Highway Infrastructure Asset Valuation* suggests that some structure components (e.g. bearings and expansion joints) could be depreciated using a time-based (straight-line) approach. LoBEG considers it more appropriate to treat these components using Renewals Accounting because (i) condition data is regularly collected; (ii) service lives are highly variable; and (iii) straight-line depreciation would require unnecessary effort in updating component service lives.

The Renewals Accounting approach uses the information provided by the Condition Indicator (Average) score[4] to measure depreciation.

6.2 Condition Indicator

The Condition Indicator[4] is the accepted UK approach for inspecting and reporting on the condition of highway structures. The information produced by inspections is used to evaluate a Condition Indicator (the inspection and evaluation methods are fully documented in national guidance documents). This approach has been in use since 2002.

The fundamentals of the Condition Indicator are:

- Structures are inspected every 2 years (General Inspection) and 6 years (Principal Inspection).
- A standardised inspection pro forma is used during these inspections; this includes a standardised list of structure components.
- Each element on a structure is scored using severity (1 to 5) and extent (A to E) condition rating scales (where 1A represents as new condition and 5E represents extensive failure). This information supports maintenance identification, prioritisation and planning.
- The severity and extent condition information is used to evaluate a Condition Indicator score for each structure (the algorithms are documented in national guidance documents). The Condition Indicator algorithms take account of the condition of all the elements on the structure and their importance to the structure. This gives each structure a score between 100 (best possible condition) to 0 (worst possible condition).
- The Condition Indictor scores can be further combined at group and stock level to allow structure engineers/managers to monitor condition trends over time.

LoBEG consider the Condition Indicator (Average) score[4] to (i) be the most robust and reliable measure of structure condition; and (ii) provide a sound basis for depreciation. Also, the regular and systematic updates of condition data through ongoing General and Principal Inspections make it ideal for measurement of annual depreciation.

6.3 Depreciation Relationship

A relationship between Condition Indicator (Average) and Depreciation Factor has been established using a sample of LoBEG maintenance schemes. The relationship is:

$$\text{Depreciation Factor } (F_D) = (a \times CI^2) - (b \times CI) + c$$

Where:

- a = 0.00003
- b = 0.013
- c = 1.0
- CI = Condition Indicator (Average) score[4] for the structure (on a scale of 0 to 100)

This relationship is shown in Figure 2.

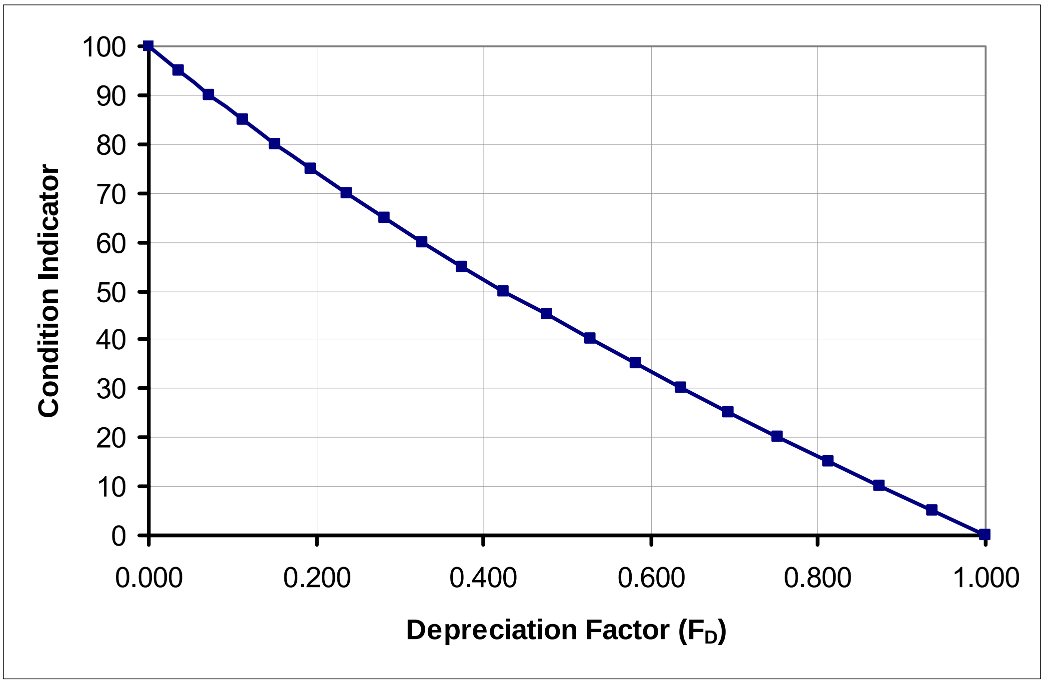


Figure 2: Relationship between Condition Indicator and Depreciation Factor

Therefore, the depreciation (Dep) of a structure is given by:

$$Dep = GRC \times F_D$$

Hence:

$$DRC = GRC - Dep = GRC - (GRC \times F_D) = GRC \times (1 - F_D)$$

Where:

- Dep = Depreciation
- DRC = DRC of the relevant structure
- GRC = GRC of the relevant structure

6.4 Example

Experience to date with the Condition Indicator (Average) has shown that, in general, structure stocks have a score greater than 80. Therefore, the factors calculated according to Section 6.3 mean that depreciation would, in general, be less than 20% of GRC (i.e. DRC would be more than 80% of GRC). For example:

- A bridge is 8m wide and 20m long.
- Its GRC unit rate is £5,000/m2.
- Its GRC is (8m x 20m x £5,000/m2 =) £800,000.
- The bridge has a Condition Indicator (Average) of 85.

Therefore:

$F_D = (0.00003 \times 85^2) - (0.013 \times 85) + 1$

$F_D = 0.11175$

Dep = £800,000 x 0.11175

= £89,400

DRC = £800,000 - £89,400

= £710,600

7 Implementation

7.1 Approach

The programme for the implementation of asset valuation for highway structures is:

- June 2012 – launch of Version 3 of LoBEG's *Technical Note on Asset Valuation for Highway Structures* and supporting Microsoft Excel spreadsheet with which BridgeStation fully complies
- March 2013 – BridgeStation fully compliant with the *Structures Asset Management Planning Toolkit*[1] and the *Code of Practice on Transport Infrastructure Assets: Guidance to Support Asset Management, Financial Management and Reporting*[2]

Version 3 of LoBEG's *Technical Note on Asset Valuation for Highway Structures* is intended to act as an interim solution until the *Structures Asset Management Planning Toolkit*[1] is programmed into BridgeStation.

7.2 Feedback

Any feedback on this technical note, or the associated spreadsheet, should be sent to Richard McFarlane (richard.mcfarlane@rbk.kingston.gov.uk).

8 References

1. Structures Asset Management Planning Toolkit, Department for Transport and the UK Bridges Board, 2012.
2. Code of Practice on Transport Infrastructure Assets: Guidance to Support Asset Management, Financial Management and Reporting, CIPFA, 2010.
3. Guidance Document for Highway Infrastructure Asset Valuation, County Surveyors' Society and TAG Asset Management Working Group, 2005.
4. Guidance Document for Performance Measurement of Highway Structures – Part B1: Condition Performance Indicator, Highways Agency and CSS Bridges Group, 2007.
5. Valuation of a Sample of Structures on the Borough Principal Road Network based on 2006 Data and this Technical Note, LoBEG_AssetValuation_v3_BPRN_2006 Data.xls, LoBEG, 2012.
6. Valuation of a Sample of Structures on the Borough Principal Road Network based on 2006 Data in the Structures Asset Management Planning Toolkit according to the HAMFIG Requirements for L Pack Returns for 2011/12, SAMPt_Model_v01-01_small_BPRN_2006 Data_ScenarioDRC20112012.xlsm, LoBEG, 2012.
7. Valuation of a Sample of Structures on the Borough Principal Road Network based on 2006 Data in the Structures Asset Management Planning Toolkit but NOT according to the HAMFIG Requirements for L Pack Returns for 2011/12, SAMPt_Model_v01-01_small_BPRN_2006 Data_Scenario1.xlsm, LoBEG, 2012.

Appendix A

Comparing Results from the Spreadsheet Associated with this Technical Note with Results from the Structures Asset Management Planning Toolkit

Introduction

LoBEG has used a sample of 2006 data for structures on the Borough Principal Road Network to compare results from the spreadsheet associated with this Technical Note with results from the *Structures Asset Management Planning Toolkit*.

Valuation based on this Technical Note

The file *LoBEG_AssetValuation_v3_BPRN_2006 Data.xls*[5] provides the valuation in accordance with this Technical Note for the sample of structures. Based on these calculations:

- GRC = £687,820,167
- DRC = £593,938,005

Valuation in the Structures Asset Management Planning Toolkit according to the HAMFIG requirements for L Pack returns for 2011/12

The file
SAMPt_Model_v01-01_small_BPRN_2006 Data_ScenarioDRC20112012.xlsm[6]
values the sample of structures in the *Structures Asset Management Planning Toolkit* according to the HAMFIG requirements for L Pack returns for 2011/12. The HAMFIG requirements include:

- use of one specific strategy - 'Unplanned Reactive' - for all elements
- no allowance for uncertainty in the times to failure for any elements
- an unlimited annual budget in the model (therefore, maintenance is not postponed or carried over to later years)
- no changes to the reference data provided
- no upgrades, improvements or lifecycle plans in the 'Upgrades, Improvements & LCPs' worksheet

Based on these calculations:

- GRC = £687,820,167
- DRC = £499,827,879

As expected, the GRC calculated in
SAMPt_Model_v01-01_small_BPRN_2006 Data_ScenarioDRC20112012.xlsm is identical to the GRC calculated in *LoBEG_AssetValuation_v3_BPRN_2006 Data.xls*.

The DRC calculated in
SAMPt_Model_v01-01_small_BPRN_2006 Data_ScenarioDRC20112012.xlsm is **-15.8%** of the DRC calculated in *LoBEG_AssetValuation_v3_BPRN_2006 Data.xls*.

Valuation in the Structures Asset Management Planning Toolkit NOT according to the HAMFIG requirements for L Pack returns for 2011/12

The file
SAMPt_Model_v01-01_small_BPRN_2006 Data_Scenario1.xlsm[7]
values the sample of structures in the *Structures Asset Management Planning Toolkit* but NOT according to the HAMFIG requirements for L Pack returns for 2011/12. The following assumptions have been made:

- a mixture of ‘Planned Targeted’ and ‘Planned Do Minimum’ strategies have been applied to elements
- an allowance has been made for uncertainty in the times to failure for all elements
- an annual budget of £3,000,000 has been used in the model
    - an annual budget of £137,500 has been set aside for Revenue works
    - an annual budget of £2,862,500 is available for Capital works
- no changes have been made to the reference data provided
- no upgrades, improvements or lifecycle plans have been specified in the 'Upgrades, Improvements & LCPs' worksheet

These assumptions comply with the expected requirements for L Pack returns for 2012/13 and later.

Based on these calculations:

- GRC = £687,820,167
- DRC = £583,538,766

As expected, the GRC calculated in *SAMPt_Model_v01-01_small_BPRN_2006 Data_Scenario1.xlsm* is identical to the GRC calculated in *LoBEG_AssetValuation_v3_BPRN_2006 Data.xls*.

The DRC calculated in *SAMPt_Model_v01-01_small_BPRN_2006 Data_Scenario1.xlsm* is **-1.8%** of the DRC calculated in *LoBEG_AssetValuation_v3_BPRN_2006 Data.xls*.

Conclusion

Based on these results, LoBEG believes that this Technical Note provides an acceptable interim solution for the valuation of highway structures until the *Structures Asset Management Planning Toolkit* is available in BridgeStation.