PROPOSED METHOD TO CALCULATE ASSET VALUES FOR ROAD STRUCTURES

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ABSTRACT

The Public Finance Management Act (PFMA), requires national and provincial government departments to "*prepare financial statements for each financial year in accordance with generally recognised accounting practice*". The Municipal Finance Management Act (MFMA) includes similar requirements for municipalities. The "generally recognised accounting practice" for national and provincial government departments is the Modified Cash Standard, being the reporting framework prescribed by the National Treasury, Office of the Accountant General (OAG). Municipalities have to comply with the Standards of Generally Recognised Accounting Practice 17 (GRAP 17). Both these accounting standards require that an immovable asset, which qualifies for recording as a capital asset such as road structures (bridges, major culverts, etc.), must be measured at its cost. Where the cost of an immovable asset cannot be determined accurately, the immovable asset should be measured at fair value. In the case of specialised buildings and other man-made structures, an entity need to estimate fair value using a depreciated replacement cost approach. Replacement cost is the value of an asset that replicates the existing asset most efficiently, while providing the same level of service.

This paper describes a proposed method to calculate the depreciated replacement cost for road structures, such as bridges and major culverts. The replacement cost of a structure is the cost to replace the structure with a similar structure at current rates. It is based on a unit rate for the replacement cost. The depreciated replacement cost is the optimised replacement cost after deducting an allowance for wear or consumption to reflect the remaining or economic service life of the structure. This is achieved by multiplying the replacement cost of the structure with an average condition index. The average condition index is calculated using the degree and extent ratings from the DER-ratings for the structural elements of the structure. The DER-ratings are the degree, extent and relevancy ratings of defects on the structure, using the defects based rating system described in the draft TMH19 Manual for the Visual Assessment of Road Structures.

1 BACKGROUND

The Public Finance Management Act (PFMA), No 1 of 1999, requires national and provincial government departments to "prepare financial statements for each financial year in accordance with generally recognised accounting practice". The Treasury Regulations require the accounting officer of a department to ensure that the annual financial statements are prepared on a modified cash basis in accordance with the formats prescribed by the

National Treasury. The Office of the Accountant General (OAG) in the National Treasury has accordingly developed and issued the Modified Cash Standard (MCS) which sets out the principles for the recognition, recording, measurement, presentation and disclosure of information required in terms of the prescribed formats. (National Treasury, 2017)

Chapter 9 of the MCS provides guidance on the identification of and the types of capital assets in the public sector. It further prescribes the accounting treatment for capital assets in the secondary financial information to the annual financial statements. One of the types of capital assets is infrastructure assets. While there is no universally accepted definition of infrastructure assets, these assets usually display some or all of the following characteristics:

- Part of a system or network;
- Specialised in nature and do not have alternative uses;
- Generally immovable; and
- May be subject to constraints on disposal.

Examples of infrastructure assets include road networks, sewer systems, water and power supply systems and communication networks. Capital assets are also classified as movable assets and immovable assets. Infrastructure assets are obviously regarded as immovable assets. (National Treasury, 2017)

The MCS requires that immovable assets that qualifies for recording as a capital asset in the asset register shall be measured at its cost. The cost is the cash price equivalent, which is the actual amount paid for the asset or to construct the asset. Where the cost of an immovable asset cannot be determined reliably, the immovable asset is measured at its fair value. In the case of specialised buildings and other man-made structures, fair value may be estimated using a depreciated replacement cost approach. In cases where the depreciated replacement cost of a capital asset is required in lieu of fair value, this may be established by reference to the market buying price of components used to produce the asset or the indexed price for the same or a similar asset based on a price for a previous period. (National Treasury, 2017)

In terms of the MCS, all capital assets currently remain in the asset register at their original cost (or deemed cost). Capital assets are not depreciated nor subject to impairment testing or valuation adjustments for appreciation or devaluation. However, any subsequent expenditure incurred on an existing capital asset that is of a capital nature is added to the cost of that asset. (National Treasury, 2017)

While national and provincial government departments have to comply with the MCS, municipalities (and all other entities under their control) and public entities are subject to the Standards of Generally Recognised Accounting Practice (GRAP), issued by the Accounting Standards Board. Public entities relevant to the subject of this paper is the South African National Roads Agency (SANRAL) and the Roads Agency Limpopo (RAL).

The GRAP standard dealing with infrastructure assets is GRAP 17 for Property Plant and Equipment (PPE). Property, plant and equipment are defined as tangible items that are:

- Held for use in the production or supply of goods or services, for rental to others, or for administrative purposes; and
- Expected to be used during more than one reporting period.

Infrastructure assets are included in PPE and are defined in GRAP 17 in the same way as in the MCS. GRAP 17 also requires an item of property, plant and equipment that qualifies for recognition as an asset to be measured at its cost. In cases were the cost is not known, the asset can be recognised at fair value. For specialised buildings and other man-made structures, the fair value may be estimated using a depreciated replacement cost approach. (ASB, 2010)

Where GRAP 17 differs from the MCS in the treatment of infrastructure assets, is with the measurement after recognition. While in terms of the MCS, all capital assets currently remain in the asset register at their original cost (or deemed cost), GRAP 17 requires measurement after recognition, using either the cost model or the revaluation model. In terms of the cost model, after recognition as an asset, an item of property, plant and equipment shall be carried at its cost less any accumulated depreciation and any accumulated impairment losses. In terms of the revaluation model, after recognition as an asset, an item of property, plant and equipment whose fair value can be measured reliably shall be carried at a revalued amount, being its fair value at the date of the revaluation less any subsequent accumulated depreciation and subsequent accumulated impairment losses. Once again, in the case of specialised buildings and other man-made structures, the fair value may be estimated using a depreciated replacement cost approach. (ASB, 2010)

2 PROBLEM STATEMENT

Both the MCS and GRAP 17 allow for the determination of fair values for infrastructure assets using the depreciated replacement cost approach. These two publications do not provide detail on how the DRC should be calculated. However, the following equation to calculate the DRC is provided in the National Treasury's Local Government Capital Asset Management Guideline. (National Treasury, 2008)

$$DRC = CRC \times \frac{RUL}{EUL} \qquad \text{Equation 1}$$

Where CRC = Current Replacement Cost
RUL = Remaining Useful Life; and
EUL = Estimated Useful Life

The Current Replacement Cost is defined in the guideline as the cost of replacing an existing asset with a new asset of equivalent capacity. The guideline includes recommended EUL for a whole range of asset types. Examples of recommended EUL for road structures are as follows:

Concrete bridges:	60 to 80 years
Concrete retaining walls:	25 to 30 years
Expansion and construction joints:	15 to 20 years
Concrete Culverts:	40 to 60 years

The Draft TMH22 Road Asset Management Manual (COTO, 2013) also includes an equation for the calculation of the DRC that is the same as Equation 1. TMH22 also defines EUL for a range of asset types. For example, the EUL for bridges is 80 years and for road tunnels it is 100 years.

According to the PIARC Asset Management Guide, assets and components fall into one of two categories (PIARC, 2018):

1. Those with a finite life, at the end of which they will need to be replaced, typically 20–40 years, although some assets will have considerably shorter or longer lives; and
2. Those that, given the necessary capital expenditure, will have an indefinite life.

Bridges and major culverts, and other road structures such as tunnels and retaining walls, fall in the second category, making the concepts of EUL and especially RUL theoretical and difficult to apply to such structures.

3 AIM OF PAPER

The aim of the paper is to propose a method to calculate the depreciated replacement cost for road structures, such as bridges and major culverts, which does not require the need to know the age of the structure or the use of deterioration curves.

4 SCOPE OF PAPER

The paper proposes a method to calculate the depreciated replacement cost for road structures, which include bridges; major culverts; road tunnels; lesser culverts; retaining walls; and gantries. The proposed method uses the degree and extent ratings of the DER-rating methodology as described in the draft TMH19 Manual for the Visual Assessment of Road Structures (COTO, 2013(2)) and can therefore only be applied on structures that were inspected using the DER-rating methodology.

The depreciated replacement cost calculated using the proposed method can then be used as the fair value required to recognise assets in an asset register as required by the MCS and GRAP 17. It can also be used as the fair value when applying the Revaluation Model as prescribed in GRAP 17 for the measurement of assets after recognition.

5 PROPOSED METHOD TO CALCULATE DEPRECIATED REPLACEMENT COST

The proposed method to calculate the depreciated replacement cost is a modified version of Equation 1, based on the assumption that asset life is directly proportional to condition. Under this assumption, the remaining useful life of an asset in a perfect condition is equal to the estimated useful life. Substituting RUL with EUL in Equation 1, reduces the equation to DRC = CRC, i.e. for an asset in a perfect condition, the depreciated replacement cost is equal to the current replacement cost.

For an asset in a less than perfect condition, the depreciated replacement cost is less than the current replacement cost in proportion to the current condition of the asset. The current condition of the asset is therefore a proxy for the remaining useful life of the asset.

The proposed equation to calculate the DRC is therefore as follows:

$$DRC = CRC \times ACI \qquad \text{Equation 2}$$

Where CRC = Current Replacement Cost
ACI = Average Condition Index

ACI varies from 0 to 100%, with an ACI of 100% indicating a structure in a perfect condition.

6 RATING OF DEFECTS ON ROAD STRUCTURES USING THE DER RATING METHODOLOGY

Road structures are rated using a defects-based system as described in TMH19 Manual for the Visual Assessment of Road Structures. This defects based system has been in use for more than 20 years, but only became the standard rating method for road structures in South Africa in 2012. Structures are visually rated by structural engineers, with design experience in the type of structure being rated, using DER ratings of 1 to 4 as follows:

D = Degree of defect:	How bad or severe is the defect.
E = Extent of defect:	How widespread is the defect on the inspection item being inspected.
R = R relevancy of defect:	The consequence of the defect with regards the structural/functional integrity of the inspection item or the safety of the user of the structure.

For inspection purposes, each type of structure is divided into inspection items, which are individual elements of the structure, such as deck slabs, deck expansion joints, abutments, piers and foundations, and items associated with the structure type, such as waterways.

These inspection items are subdivided into sub-items where appropriate, such as Abutment 1 and Abutment 2; or Pier 1, 2 and 3 for a bridge with 3 piers. The DER ratings are done at an inspection item, or sub-item level where applicable, and only the worst defect on the item is rated. If a defect is present, the rating values allocated for D, E and R are 1; 2; 3; or 4. If no defect is present, D is allocated a value of 0 and E and R are not rated. (Roux MP & Taute, A, 2016)

7 CONDITION INDICES CALCULATED FOR ROAD STRUCTURES

TMH22 (COTO, 2013) defines two condition indices that can be calculated for road structures. The first index is the Priority Condition Index (PCI) and the second index is the Average Condition Index (ACI).

The PCI is calculated using the Structure Deduct Points Method (SDPM) and is used to identify structures with critical defects that should receive urgent attention. The degree, extent and relevancy ratings are all used in the calculation of the PCI.

The ACI is a measure of the present structure condition and can be used to evaluate the change in structure condition over time and to predict structure performance over time. The calculation of the ACI uses only the degree and extent ratings.

This difference between the PCI and the ACI may be explained by considering a two span bridge with only a few minor defects, with the exception of a critical defect on the pier (DER of 4-4-4 or 4-3-4) that could cause the pier (and therefore the bridge) to collapse. The average condition of the structure would be good with a fairly high Average Condition Index. The one critical defect on the pier is “hidden” in this average condition. This critical defect on the pier would however result in a low PCI value, placing the structure in the poor or critical category and therefore high on the priority list for repairs and maintenance.

The opposite is also true – a bridge with many minor or moderate defects on less important structural elements and no critical defects on important structural elements would have a high PCI, but a low ACI.

8 CALCULATION OF CURRENT REPLACEMENT COST (CRC)

The MCS (National Treasury, 2017) states that in cases where the depreciated replacement cost of a capital asset is required in lieu of fair value, this may be established by reference to the market buying price of components used to produce the asset. National Treasury's Accounting Guideline for GRAP 17 (National Treasury, 2014) refers to using either the replacement cost or the reproduction cost in the calculation of DRC. The replacement cost is defined as the cost to replace the service potential of an asset, while the reproduction cost is defined as the cost of creating an exact replica of the asset. According to TMH22 (COTO, 2013), for road assets the Current Replacement Cost (CRC) should provide a fair and reasonable value of what it would cost to replace the asset based on recent construction cost of similar assets.

The three descriptions of CRC, when applied to infrastructure assets, such as roads and bridges, all come down to the same thing, namely that the CRC is the cost of creating an exact replica of the asset. TMH22 defines this approach by stating that the CRC is based on the product of the quantity of the component type and its unit rate, as shown in Equation 3.

$$CRC = Current\ Unit\ Rate\ \times Quantity\ of\ Component \qquad \text{Equation 3}$$

To calculate the CRC for road structures, a modification of Equation 3 is proposed for the different road structures. The methodology is as follows:

1. Use a unit rate for the construction of the structure that has been determined by expressing the total cost to construct the structure per a component of the structure that is easy to measure, for example the deck area of a bridge;
2. Adjust this unit rate by multiplying it with a factor that takes into account a dimension of another component of the structure that would influence the unit rate, for example the height of the piers of a bridge; and
3. Multiply the adjusted unit rate with the quantity of the base component for the specific structure, for example the deck area of a bridge.

The specific equations for the different structure types are presented below.

8.1 Current Replacement Cost for General Bridges

The equation to calculate the Current Replacement Cost (CRC_{bg}) for general bridges is as follows:

$$CRC_{bg} = L_d \times W_d \times f_{ph} \times R_{bg} \qquad \text{Equation 4}$$

Where:
L_d = Length of bridge deck (m)
W_d = Width of bridge deck (m)
f_{ph} = Factor for maximum pier height
R_{bg} Current unit rate for general bridges (R/m^2)

Values for f_{ph} (the factor for maximum pier height), are presented in Table 8-1.

Table 8-1: Values for f_{ph}

Maximum Pier Height (m)	f_{ph}
0 < max pier height ≤ 8	1
8 < max pier height ≤ 30	1.5
Max pier height > 30	3.0

8.2 Current Replacement Cost for Arch Bridges

The equation to calculate the Current Replacement Cost (CRC_{ba}) for arch bridges is as follows:

$$CRC_{ba} = L_d \times W_d \times f_{sl} \times R_{ba} \qquad \text{Equation 5}$$

Where:
- L_d = Length of bridge deck (m)
- W_d = Width of bridge deck (m)
- f_{sla} = Factor for maximum span length
- R_{ba} Current unit rate for arch bridges (R/m^2)

Values for f_{sla} (the factor for maximum span length), are presented in Table 8-2.

Table 8-2: Values for f_{sla}

Maximum Span Length (m)	f_{sla}
0 < max span length ≤ 100	1
100 < max span length ≤ 200	1.25
Max span length > 200	1.5

8.3 Current Replacement Cost for Cable Stayed Bridges

The equation to calculate the Current Replacement Cost (CRC_{bc}) for cable stayed bridges is as follows:

$$CRC_{bc} = L_d \times W_d \times f_{sl} \times R_{bc} \qquad \text{Equation 6}$$

Where:
- L_d = Length of bridge deck (m)
- W_d = Width of bridge deck (m)
- f_{slc} = Factor for maximum span length
- R_{bc} Current unit rate for cable stayed bridges (R/m^2)

Values for f_{slc} (the factor for maximum span length), are presented in Table 8-3.

Table 8-3: Values for f_{sl}

Maximum Span Length (m)	f_{slc}
0 < max span length ≤ 150	1

150 < max span length ≤ 300	1.4
Max span length > 300	1.8

8.4 Current Replacement Cost for Cellular Bridge

The equation to calculate the Current Replacement Cost (CRC_{bc}) for cellular bridges is as follows:

$$CRC_{bc} = L_{bc} \times W_{bc} \times f_{fh} \times R_{bc} \qquad \text{Equation 7}$$

Where:
- L_{bc} = Length of the cellular bridge (m)
- W_{bc} = Width of the cellular bridge (m)
- f_{fh} = Factor for the height of the fill over the cellular bridge
- R_{bc} = Current unit rate for cellular bridges (R/m^2)

Values for f_{fh}, the factor for the height of the fill over the cellular bridge, are presented in Table 8-5.

Table 8-4: Values for f_{fh}

Maximum Height of Fill over the Culvert (m)	f_{fh}
0 < max fill height ≤ 3	1.0
3 < max fill height ≤ 6	1.2
6 < max fill height ≤ 10	1.4
Max fill height > 10	1.6

8.5 Current Replacement Cost for Major Culverts

The equation to calculate the Current Replacement Cost (CRC_{cm}) for major culverts is as follows:

$$CRC_{cm} = L_{cm} \times W_{cm} \times f_{fh} \times R_{cm} \qquad \text{Equation 8}$$

Where:
- L_{cm} = Length of the major culvert (m)
- W_{cm} = Width of the major culvert (m)
- f_{fh} = Factor for the height of the fill over the major culvert
- R_{cm} = Current unit rate for major culverts (R/m^2)

Values for f_{fh}, the factor for the height of the fill over the culvert, are presented in Table 8-5.

Table 8-5: Values for f_{fh}

Maximum Height of Fill over the Culvert (m)	f_{fh}
0 < max fill height ≤ 3	1.0
3 < max fill height ≤ 6	1.2
6 < max fill height ≤ 10	1.4
Max fill height > 10	1.6

8.6 Current Replacement Cost for Retaining Walls

The equation to calculate the Current Replacement Cost (CRC_{rw}) for retaining walls is as follows:

$$CRC_w = H_w \times L_w \times f_{wh} \times R_w \qquad \text{Equation 9}$$

Where: H_w = Height of the retaining wall (m)
L_w = Length of the retaining wall (m)
f_{wh} = Factor for the height of the retaining wall
R_w Current unit rate for retaining walls (R/m^2)

Values for f_{wh}, the factor for the height of the retaining wall, are presented in Table 8-6.

Table 8-6: Values for f_{wh}

Maximum Height of the Retaining Wall (m)	f_{wh}
$2 < h_w \leq 5$	1.0
$5 < h_w \leq 10$	1.2
$h_w > 10$	1.4

9 CALCULATION OF AVERAGE CONDITION INDEX (ACI)

The procedure for calculating the Average Condition Index for a structure is described in Appendix J7 of TMH22 (COLTO, 2013) and is as follows:

- A condition index is calculated for each relevant inspection sub-item (a sub-item with a D-rating of 0; 1; 2; 3; or 4);
- The condition indices for all relevant inspection sub-items making up an inspection item are added together and divided by the number of relevant sub-items to give the condition index for the inspection item;
- The condition index for each relevant inspection item* is then multiplied by an inspection item weight; and
- These weighted inspection item condition indices for all the relevant inspection items are then added together and divided by the sum of the weights to arrive at the Average Condition Index.

*Relevant items are inspections items that are elements of the structure. For example, there are 21 inspection items for bridges, but some of these items are not elements of the structure, such as the waterway; guardrails; and miscellaneous items.

9.1 Inspection sub-item condition index:

The condition index of inspection sub-item j of inspection item i, CI_{ij} is calculated using the following equation:

$$CI_{ij} = 100 - \frac{100(D + E)}{b_{ci}} \qquad \text{Equation 10}$$

Where:	D	=	Degree rating for inspection sub-item j of inspection item i
	E	=	Extent rating for inspection sub-item j of inspection item i
	b_{ci}	=	$D_{max} + E_{max} = 4 + 4 = 8$

CI_{ij} ranges from 0 for D = 4 and E = 4, i.e. the worst condition, to 100 for D = 0 (no defect), i.e. the best condition.

9.2 Inspection item condition index:

The condition index of inspection item i, CI_i is calculated using the following equation:

$$CI_i = \frac{\sum_{j=1}^{j=n} CI_{ij}}{n} \quad \text{Equation 11}$$

Where:	CI_{ij}	=	Condition Index of inspection sub-item j of inspection item i
	n	=	number of relevant inspection sub-items in inspection item i

CI_i ranges from 0, i.e. the worst condition, to 100, i.e. the best condition. If an inspection item has a Condition Index of 100, it means that there are no defects on any of the relevant sub-items making up the inspection item.

9.3 Structure Average Condition Index:

The Average Condition Index (ACI) for the structure is calculated using the following equation:

$$ACI = \frac{\sum_{i=1}^{i=N} (CI_i \times cw_i)}{\sum_{i=1}^{i=N} cw_i} \quad \text{Equation 12}$$

Where:	CI_i	= Condition Index of inspection item i
	cw_i	= condition weight for inspection item i
	N	= number of relevant inspection items

Inspection items with no relevant inspection sub-items are excluded from the calculation of the ACI. ACI ranges from 0, i.e. the worst condition, to 100, i.e. the best condition. If a structure has an ACI of 100, it means that there are no defects on the structure.

9.4 Weight sets for structure types:

The inspection item weights (cw_i in Equation 12) for the various structure types are included in Appendix J7 of TMH22 (COLTO, 2013). As an example, the item weights for bridges are presented in Table 9-1.

Table 9-1: Inspection Item Weights for ACI Calculations for Bridges

Inspection Item	cw_i	Inspection Item	cw_i
01. Approach Embankment	2	12. Pier Protection Works	1
02. Guardrail*	0	13. Pier Foundations	5
03. Waterway*	0	14. Piers & Columns (and Arch Springings)	5
04.Approach Embankment Protection Works	2	15. Bearings	3
05. Abutment Foundations	5	16. Support Drainage	1

Inspection Item	cw_i	Inspection Item	cw_i
06. Abutments	5	17. Expansion Joints	2
07. Wing/ Retaining Walls	4	18. Longitudinal Members (& Cable Groups)	5
08. Surfacing	1	19. Transverse Members	3
09. Superstructure Drainage	1	20. Decks, Slabs & Arches	5
10. Kerbs / Sidewalks	1	21. Miscellaneous Items*	0
11. Parapet	3		

*Non-relevant inspection items

10 TESTING OF THE PROPOSED METHOD TO CALCULATE DEPRECIATED REPLACEMENT COST

The proposed method to calculate depreciated replacement cost was applied to a sample of 4 514 bridges from three road authorities, as summarised in Table 10-1.

Table 10-1: Information on the Sample of Bridges

Road Authority	Number of bridges	Inspection Period	PCI			ACI		
			Min	Ave	Max	Min	Ave	Max
1	540	15/02/2016 to 30/07/2016	24.0	83.9	99.4	62.1	90.3	100
2	478	18/10/2007 to 07/07/2009	7.7	83.3	99.6	52.9	79.5	100
3	3 496	04/09/2011 to 12/11/2014	2.8	84.3	99.6	39.2	86.6	100
Total	**4 514**		**2.8**	**84.1**	**99.6**	**39.2**	**86.3**	**100**

Equation 4 was used to calculate the total Current Replacement Cost for these 4 514 bridges, using a value of R 25 500/m^2 for R_{bg}. Equation 2 was then used to calculate the Depreciated Replacement Cost. The results of these calculations are summarised in Table 10-2.

Table 10-2: Summary of Asset Value Calculations for Sample of Bridges

Road Authority	CRC (R bn)	DRC (R bn)	Loss in Asset Value (R bn)	Percentage Loss in Asset Value
1	R 10.3	R 9.4	R 0.9	8.9%
2	R 6.3	R 5.0	R 1.3	20.5%
3	R 78.4	R 69.2	R 9.2	11.7%
Total	**R 95.0**	**R 83.6**	**R 11.4**	**12.0%**

In Table 10-3 the loss in asset value as calculated with the proposed method is compared with a previous method used to calculate the DRC for bridges and other road structures. The previous method involved depreciating the CRC based on the age of the structure and then subtracting the cost of all repairs identified during the visual assessment of the structure. This method can be described as a deflated replacement cost method. In many cases the age of the structures are unknown and such cases a default year of construction of 1975 (being the average year of construction for a large sample of bridges with known years of construction) was used.

Table 10-3: Comparison of Loss in Asset Value Calculated with Proposed Method and Previous Method

Road Authority	CRC (R bn)	Percentage Loss in Asset Value Proposed Method	Percentage Loss in Asset Value Previous Method
1	R 10.3	8.9%	41.2%
2	R 6.3	20.5%	48.7%
3	R 78.4	11.7%	42.6%
Total	**R 95.0**	**12.0%**	**42.9%**

Table 10-3 shows that the deflated replacement cost method gave significantly higher losses in asset values, illustrating that this approach does not adequately capture the value of the asset, because it does not account for the level of preservation that the structure has experienced over its life. It further assumes that structures deteriorate at the same rate, independent from the location of the structure; the traffic loading on the structure; and the quality of construction of the structure. The proposed method does not require the actual historic construction cost and year of construction; and the level of preservation performed on a structure will be recognized in the valuation process. The proposed method is therefore considered to be superior to the previous method, as it takes the current condition of the asset into consideration.

11 CONCLUSIONS

The proposed method to calculate depreciated replacement cost using the Average Condition Index as a proxy for remaining useful life of a structure is simple to apply and does not require knowledge of the age of the structure or the use of depreciation curves. It would therefore assist road authorities to comply with the legal requirements to recognise infrastructure assets at their fair value in the annual financial statements. It would also assist those road authorities that are subject to GRAP 17, to measure such assets after recognition, using the revaluation model. The application of this method would require the annual updating of the unit costs for the different structure types that are used to calculate the current replacement costs.

The asset values, while required for financial purposes, have limited value in terms of the management of road structures. From an asset management point of view, especially for road structures, it is far more important to know what the current condition of the structures is; what defects are there; and which defects are critical that should be repaired first. However, monitoring how the asset value changes with time can indicate if the investment required to maintain the appropriate value of the asset is being provided. As such, monitoring can provide compelling arguments for investing in the preservation of the asset base to senior decision makers in all three levels of government.

12 REFERENCES:

ASB, 2010. Standards of Generally Recognised Accounting Practice - Property Plant and Equipment (GRAP 17). Accounting Standards Board, National Treasury, South Africa.

COTO, 2013. Draft TMH22 Road Asset Management Manual. Committee of Transport Officials, Department of Transport, South Africa.

COTO, 2013(2). Draft TMH19 Manual for the Visual Assessment of Road Structures. Committee of Transport Officials, Department of Transport, South Africa.

Centre for Transportation Research and Education (CTRE). PIARC (Asset Management Guide). Iowa State University, USA. (Accessed at: http://www.ctre.iastate.edu/piarc/)

National Treasury, 2014. Accounting Guideline for GRAP 17 - Property, Plant and Equipment. National Treasury, South Africa.

National Treasury, 2017. Generally Recognised Accounting Practice for National and Provincial Departments - Modified Cash Standard. National Treasury Department, South Africa.

National Treasury, 2008. Local Government Capital Asset Management Guideline. National Treasury Department, South Africa.

Roux, MP & Taute, A, 2016. Calculation of Condition Indices for Road Structures Using a Deduct Points Method. Proceedings of the 35th Southern African Transport Conference (SATC 2016).