ASSISTING MUNICIPALITIES TO DETERMINE THE MOST APPROPRIATE INDICATOR FOR FUNDING ALLOCATIONS TOWARDS MAINTENANCE

Report to the

Water Research Commission

by

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EXECUTIVE SUMMARY

BACKGROUND

The poor state of operations and the maintenance of infrastructure in South Africa, not only in water services but across all sectors, are widely bemoaned. Few municipalities put adequate portions of their budgets aside for maintenance.

RATIONALE

Within this context, assisting municipalities to determine the level of funding they should allocate to maintenance is of vital importance. It is for this reason that the Water Research Commission (WRC) has commissioned this research study.

OBJECTIVES AND AIMS

The aims of the study were:

- Consolidate and review existing literature to determine appropriate allocations towards operations and maintenance.
- Provide clarity regarding definitions and the way indicators are calculated and applied.
- Recommend appropriate indicators to be used and the context in which they can be applied.

METHODOLOGY

In comparison to most undertaken by the WRC, this was an exploratory study. The methodology was based largely on reviewing the literature, interviewing municipalities and other stakeholders, and doing some desktop analysis.

FINDINGS AND DISCUSSION

There remains significant confusion about definitions and terminology in the maintenance space, and more work needs to be done to ensure consistent and clear definitions. Aligning the City Infrastructure Delivery and Management System (CIDMS) and the Municipal Standard Chart of Accounts (mSCOA) has been a good start.

Further clarity on what expenditure items should be considered as ‘maintenance’ is needed to ensure that reported expenditures on maintenance refer to the same thing. The mSCOA alone is unlikely to address this as municipalities need guidance regarding which entries under the ‘Item’ segment should be recorded as maintenance under the ‘Project’ segment.

The Municipal Finance Management Act (MFMA) Circular 71’s benchmark of 8% of the carrying value of property, plant and equipment (PPE) and investment property is a significant improvement on benchmarks based on the percentage of the municipal budget, but it does not have a theoretically sound basis. It may be adequate as an indicator for high-level monitoring by National Treasury, but should not be used by municipalities themselves when determining whether they are making adequate allocations to maintenance. When interpreting performance against this benchmark, National Treasury should consider that it overstates maintenance needs in new water and sanitation systems, but understates maintenance in older systems. Accuracy will also differ depending on the composition of water and sanitation assets.

For internal monitoring purposes, a benchmark as a percentage of the current replacement cost (CRC) of assets (developed individually for each municipality with consideration of asset mix and condition in the municipality) can be used. There is work that can be done to assist municipalities in developing such benchmarks. A possible area of work includes regularly maintaining data on infrastructure unit costs to be used in calculating CRC estimates. The Department of Water and Sanitation (DWS) is already doing good work in this area, but unit costs for other sectors (electricity, roads etc.) are not as readily available. The DWS unit cost document can also be better publicised among municipalities.

There is also potential for developing a tool that can be used when doing CRC calculations in which the unit costs can be applied to data on asset extent and composition.

CONCLUSIONS

When determining how much should actually be set aside in the budget for maintenance each year, even a benchmark based on CRC should be considered as a starting point only. The National Infrastructure Maintenance Strategy (undated) Infrastructure Maintenance Budgeting Guideline probably states it most clearly:

> *"There is no simple formula that can be applied across the board with respect to maintenance planning … It is only by putting in place a comprehensive infrastructure asset management system focusing on efficient and effective service delivery, that adequate infrastructure maintenance can be addressed … Furthermore, it is not possible to adequately 'average' the maintenance costs of infrastructure as two components of the same infrastructure may have very different operational and maintenance costs … It is essential to treat each infrastructure asset as a separate element and plan the infrastructure maintenance accordingly."*
>
> (NIMS, undated, p. 3)

Ultimately, the only way to assist municipalities to make adequate financial allocations to maintenance is to support them in progressively implementing sound infrastructure asset management and life cycle costing.

RECOMMENDATIONS FOR FUTURE WORK

This has been an exploratory study and conclusions are tentative, pointing to the need for further work more than anything else. This work might include:

- Providing more clarity to municipalities on what expenditures they should record as 'maintenance'.
- Developing of a CRC calculator that draws on the DWS standard unit costs to estimate CRC in a municipality.
- Developing a tool that assists municipalities to determine their required maintenance expenditure based on a benchmark for maintenance as a percentage of CRC.

Although not directly relevant to the water sector, maintaining a set of standard unit costs for all municipal infrastructure (building on the work done by DWS) would also be useful.

ACKNOWLEDGEMENTS

The authors would like to thank the municipal officials and other stakeholders who provided input to this research through one-on-one discussions or in the stakeholder workshop.

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LIST OF ABBREVIATIONS

DBSA	Development Bank of South Africa
SAICE	South African Institution of Civil Engineering
CIDB	Construction Industry Development Board
DWAF	Department of Water Affairs and Forestry
CSIR	Council for Scientific and Industrial Research
WRC	Water Research Commission
PPE	Property, Plant and Equipment
MFMA	Municipal Finance Management Act
CRC	Current Replacement Cost
CIDMS	City Infrastructure Delivery and Management System
mSCOA	Municipal Standard Chart of Accounts
NIMS	National Infrastructure Maintenance Strategy
CoGTA	Cooperative Governance and Traditional Affairs
MBRR	Municipal Budget Reform Reporting
dplg	Department of Provincial and Local Government
DWS	Department of Water and Sanitation
SAFCEC	South African Forum for Civil Engineering Consultants
CPAF	Contract Price Adjustment Factor

LIST OF DEFINITIONS

Note that in the interest of improving alignment of definitions across government, these have been drawn in their entirety from work done by CIDMS and mSCOA to align their definitions used[1].

Asset

A resource owned or controlled by an entity as a result of past events and from which future economic benefits or service potential are expected to flow to the entity.

Asset hierarchy

A framework for segmenting an asset base into appropriate classifications. The asset hierarchy can be based on asset function; asset type or a combination of the two.

Asset life

Period from asset creation to asset end-of-life.

Asset register

A record of asset information considered worthy of separate identification for both asset accounting and management purposes including inventory, historical, financial, condition and construction, technical and financial information about each.

Note: *The unit of account in an asset register is a component (see definition of a component).*

Capacity

Maximum output that can be produced or delivered using existing network or infrastructure.

Capital expenditure (capex)

Expenditure used to create new assets, increase the capacity of existing assets beyond their original design capacity or service potential, or to return the service potential of the asset or expected useful life of the asset to that which it had originally. Capex increases the value of capital asset stock.

Capital upgrading

Enhances the service potential of the asset or the economic benefits that can be obtained from using the asset and may also increase the life of the asset beyond that initially expected.

Component (IIMM)

A component *(Note 1)* is a specific part of a complex item *(Note 2)* that has independent physical or functional identity and specific attributes such as different life expectancy, maintenance and renewal requirements and regimes, risk or criticality.

Note 1: *A component is separately recognised and measured (valued) in the organisation's asset register as a unique asset record, in accordance with the requirements of GRAP[2] 17 to componentise assets.*

Note 2: *A complex item is one that can be disaggregated into significant components. Infrastructure and buildings are considered complex items.*

Condition (IIMM)

The physical state of an asset.

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1 SCOA and CIDMS (2015) "Discussion on matters pertaining to infrastructure planning and delivery", unpublished PowerPoint presentation

2 Generally Recognised Accounting Practice

Corrective maintenance

Maintenance carried out after a failure has occurred and intended to restore an item to a state in which it can perform its required function. Corrective maintenance can be planned or unplanned.

Decommissioning (IIMM)

Actions required to take an asset out of service.

Deferred maintenance

The portion of planned maintenance work necessary to maintain the service potential of an asset that has not been undertaken in the period in which such work was scheduled to be undertaken.

Disposal (IIMM)

Actions necessary to decommission and dispose of assets that are no longer required.

Economic life (IIMM)

The period from the acquisition of the asset to the time when the asset, while physically able to provide a service, ceases to be the lowest cost alternative to satisfy a particular level of service. The economic life is at the maximum when equal to the physical life; however, obsolescence will often ensure that the economic life is less than the physical life.

Facility (IIMM)

A complex comprising many assets (e.g. a hospital, water treatment plant, recreation complex, etc.) that represents a single management unit for financial, operational, maintenance or other purposes.

Life (LGIAMG)

A measure of the anticipated life of an asset or component; such as time, number of cycles, distance intervals etc.

Infrastructure assets (LGIAMG)

Stationary systems forming a network and serving whole communities, where the system as a whole is intended to be maintained indefinitely at a particular level of service potential by the continuing replacement and refurbishment of its components.

Level of service (IIMM)

Levels of service statements describe the outputs or objectives an organisation or activity intends to deliver to customers.

Life cycle (IIMM)

The time interval that commences with identifying the need for an asset and terminates with decommissioning the asset or any liabilities thereafter.

Maintenance

All actions, planned and unplanned, intended to ensure that an asset performs a required function to a specific performance standard(s) over its expected useful life by keeping it in as near as practicable to its original condition, including regular recurring activities to keep the asset operating, but specifically excluding renewal.

Note: *Maintenance also specifically excludes restoring the condition or performance of an asset following a recognised impairment event, which would be classified as either renewal or upgrading, depending on the circumstances.*

Maintenance expenditure

Recurrent expenditure as required to ensure that the asset achieves its intended useful life. Maintenance is funded through the organisation's operating budget, and such expenditure is expensed in the organisation's Statement of Financial Performance.

Maintenance objectives (IIMM)

Objectives regarding what maintenance has to achieve to ensure the assets are in the right condition to meet the needs of the organisation. Maintenance performance measures and targets are the means of assessing whether the maintenance objectives are being met.

Maintenance standards (LGIAMG)

The standards set for the maintenance service, usually contained in preventive maintenance schedules, operation and maintenance manuals, codes of practice, estimating criteria, statutory regulations and mandatory requirements, in accordance with maintenance quality objectives.

Maintenance strategy (IIMM)

Identifies the tactics and tools that will be used to deliver the maintenance plan, as well as define the maintenance roles and responsibilities.

Obsolescence (optimised decision-making guidelines)

The asset can no longer be maintained, or suffers a loss in value due to a decrease in the usefulness of the asset caused by technological change, or changes in people's behavioural patterns or tastes, or environmental changes.

Preventative maintenance

Maintenance carried out at predetermined intervals, or corresponding to prescribed criteria, and intended to reduce the probability of failure or the performance degradation of an item. Preventative maintenance is planned or carried out on opportunity.

Remaining useful life (IIMM)

The time remaining until an asset ceases to provide the required service level or economic usefulness.

Renewal

Expenditure on an existing asset that returns the service potential of the asset or expected useful life of the asset to that which it had originally.

Note 1: *Renewal can include works to replace existing assets or facilities with assets or facilities of equivalent capacity or performance capability.*

Note 2: *Expenditure on renewals is funded through the organisation's capital budget, and such expenditure is recognised in the organisation's Statement of Financial Position.*

Routine maintenance (IIMM)

Day-to-day operational activities to keep the asset operating (replacement of lightbulbs, cleaning of drains, repairing leaks, etc.) and which form part of the annual operating budget, including preventative and periodic maintenance.

Unplanned maintenance (IIMM)

Corrective work required in the short term to restore an asset to working condition so that it can continue to deliver the required service or to maintain its level of security and integrity.

Useful life (GRAP)

The useful life of an asset is the period over which an asset is expected to be available for use by an entity or the number of production or similar units expected to be obtained from the asset by an entity.

1 INTRODUCTION

1.1 Background

The poor state of operations and the maintenance of infrastructure in South Africa, not only in water services but across all sectors, are widely bemoaned. The National Treasury noted in their 2008 Intergovernmental Fiscal Review that the lack of data is a problem and detailed information on the age, value and condition of municipal assets is not available:

> *"(t)he limited sectoral information that is available does indicate that sustained under-investment in asset maintenance is having a negative impact on the quality of service"*
>
> (National Treasury, 2008a, p. 149)

Similar views are expressed in the Development Bank of South Africa's (DBSA) Infrastructure Barometer 2012 (DBSA, 2012) and in the South African Institution of Civil Engineering's (SAICE) Infrastructure Report Card (SAICE, 2011).

Although outdated, the best evidence-based assessment of the state of the operation and maintenance of municipal infrastructure is a report by the Construction Industry Development Board (CIDB) and SAICE published in 2007. The report found that the most common cause of water quality not meeting the required standard in South Africa was breakdown of plants and the length of time required to repair those plants properly. It furthermore identifies the most common causes of plant breakdown as lack of routine maintenance and faulty operating procedures. In terms of sanitation, the report references a 2004/2005 Department of Water Affairs and Forestry (DWAF) sustainability audit that found that only 53% of municipalities have adequate maintenance capacity; that few smaller municipalities have the skills to conduct effective maintenance of waterborne systems; and that 78% of municipalities have no maintenance plans for ventilated improved pit latrines.

One of the overall findings of the CIDB and Council for Scientific and Industrial Research (CSIR) report was that few municipalities put enough of their budgets aside for infrastructure maintenance.

1.2 Aims and Objectives of the Study

Within this context, assisting municipalities to determine what level of funding they should allocate to maintenance is of vital importance. It is for this reason that the Water Research Commission (WRC) has commissioned this research study[3].

In comparison with most other studies undertaken by the WRC, this is an exploratory research study. The methodology has been based largely on reviewing the literature, interviewing municipalities and other stakeholders, and doing some desktop analysis. Within this scope, the study can only draw tentative conclusions and make suggestions as to where further work is necessary.

The study has focused heavily on National Treasury's indicator that "repairs and maintenance should be 8% of the carrying value of property, plant and equipment (PPE) and investment assets" as published in Municipal Finance Management Act (MFMA) Circular 71 in January 2014. It finds that, while theoretically flawed, this indicator is probably currently sound as a very high-level benchmark for South Africa if it is used for external monitoring. For internal monitoring purposes within a municipality, benchmarks based on current replacement cost (CRC) and developed by considering the mix and condition of assets in place in the municipality will be more meaningful. Maintenance budgets should be set using a proper maintenance plan for each individual asset that is part of a broader Infrastructure Asset Management Plan that considers the full life cycle of the asset.

3 Note that the study was originally titled "Assisting municipalities to establish the allocation towards operation and maintenance". After the literature review, it was decided to focus on maintenance only.

The document is structured as follows:

- Section 2 considers definitions in the maintenance space.
- Section 3 discusses the “Back to Basics” indicator, which is based on a percentage of the total operating budget.
- Section 4 introduces the indicator in MFMA Circular 71 that is based on a percentage of the carrying value of PPE and investment assets.
- Section 5 discusses whether carrying value is an appropriate basis for this indicator.
- Section 6 introduces some possible concerns about how municipalities report maintenance expenditure, the numerator for the MFMA Circular 71 indicator.
- Section 7 considers whether 8% is the correct benchmark for the MFMA Circular 71 indicator.
- Section 8 summarises and draws conclusions.

2 DEFINITIONS

There is considerable confusion in the discourse surrounding asset management in South Africa when it comes to terminology. Apart from a few experts, terminology is often used incorrectly and interchangeably. For example, the original title of this research project refers to allocations for ‘operations and maintenance’; National Treasury’s key financial indicator in this regard relates to ‘repairs and maintenance’; while National Treasury’s 2008 Intergovernmental Fiscal Review bemoaned inadequate expenditure on ‘maintenance’. The first step towards assisting municipalities to determine the most appropriate indicator for funding allocations towards operations and maintenance would thus appear to be to clarify the definitions of the various terms used in this space.

The work being done on the City Infrastructure Development and Management System (CIDMS) through the Cities Support Programme at National Treasury to develop standard definitions related to asset management is leading the way. These definitions are given in the List of Definitions at the start of this document.

CIDMS worked with the Municipal Standard Chart of Accounts (mSCOA) team to ensure that this is the terminology applied in the mSCOA. This indication of alignment of terminology is encouraging.

Of importance for this piece of work is separating the concept of ‘maintenance’ from ‘operations’, and separating ‘maintenance’ from ‘renewal’.

2.1 What is ‘Maintenance’?

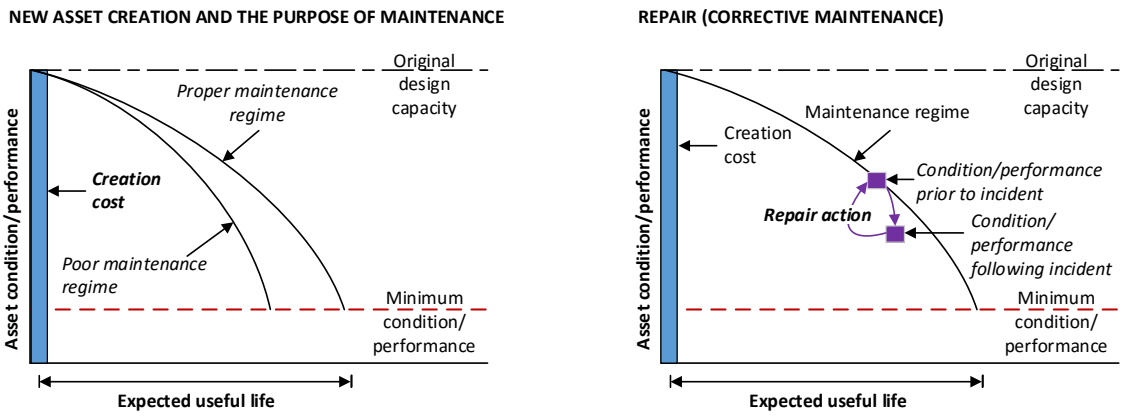
According to the CIDMS definition, maintenance is:

“All actions, planned and unplanned, intended to ensure that an asset performs a required function to a specific performance standard(s) over its expected useful life by keeping it in as near as practicable to its original condition, including regular recurring activities to keep the asset operating, but specifically excluding renewal.”

The definition notes further that:

“Maintenance also specifically excludes restoring the condition or performance of an asset following a recognised impairment event, which would be classified as either renewal or upgrading, depending on the circumstances.”

CIDMS provides the following diagram (Figure 1), which is useful to understand the purpose of maintenance. The purpose of maintenance is to ensure that an asset performs a function to a specific performance standard **over its expected useful life**.

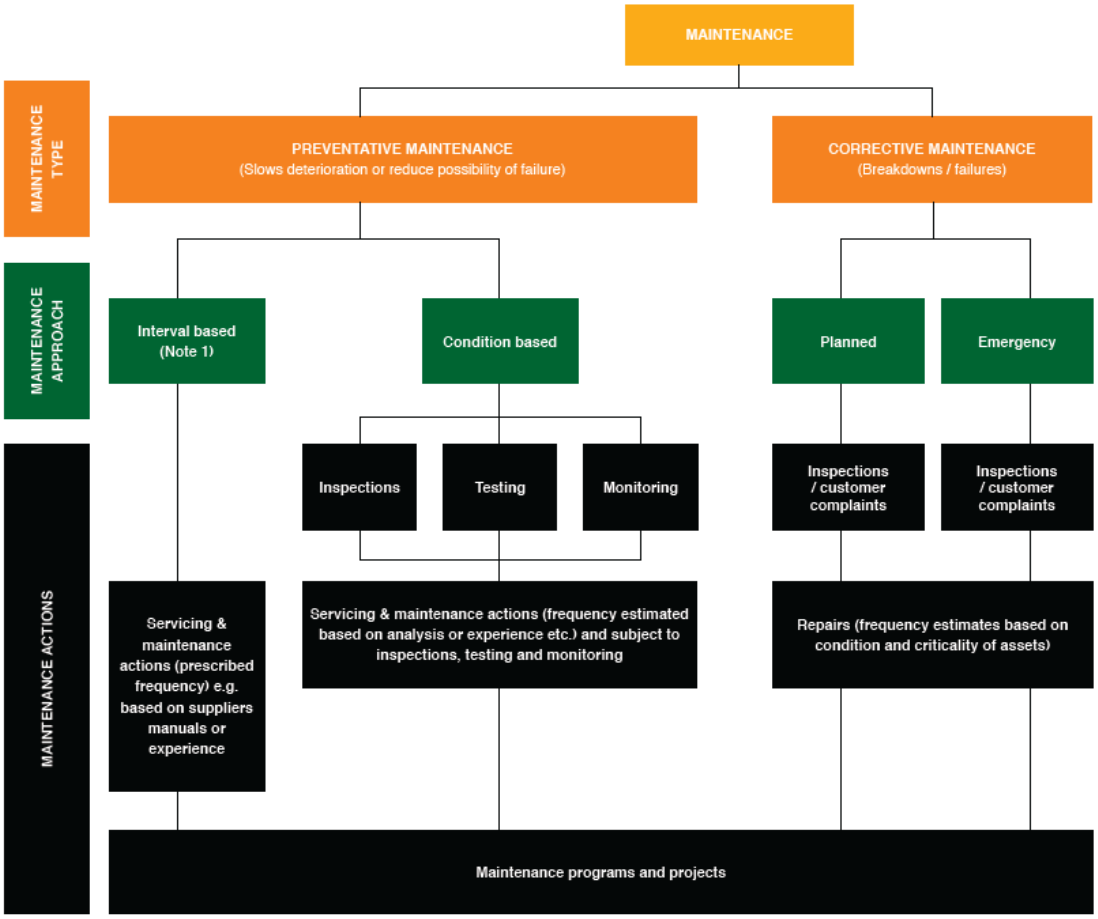


Source: mSCOA and CIDMS (2015) Slide 4

Figure 1: CIDMS diagram indicating definition of maintenance

2.2 Should We Use the Term 'Repairs and Maintenance'?

It is important to understand that under the definition of 'maintenance' as provided in the previous section, 'repairs' is a subset of activities that is classified under maintenance. This is shown in the maintenance hierarchy in Figure 2.



Source: mSCOA and CIDMS (2015) Slide 9

Figure 2: CIDMS maintenance hierarchy

In this hierarchy, repairs are activities undertaken under the category of 'corrective maintenance' in response to breakdowns or failures.

As such, it is not correct to speak about 'repairs and maintenance'. This terminology has largely fallen away in asset management literature. The correct approach is to speak of maintenance and to assess the proportion of maintenance that is corrective (repairs). The goal is to keep corrective maintenance low by establishing a sound plan of preventative maintenance.

2.3 What is 'Operations'?

The CIDMS List of Definitions does not include a definition for 'operations', but Van Zyl (2014) provides a useful definition stating simply that operations are:

"activities necessary to deliver the service"

(Van Zyl, 2014, p. 3)

As such, 'operations' is what a water services business does on a day-to-day basis to keep infrastructure running and provide services. Asking for benchmarks or guidance on financial allocations to operations is essentially asking, "What should it cost to run a water service?" There may be validity in that question, of course, but there are myriad factors that affect cost, which include not only fundamentally institutional form, technology choice and levels of service provided, but also factors such as asset age and condition, topography, geographic size of municipality, coastal or in-land location and distance from urban centre.

Several previous studies have attempted to define benchmark costs for operating municipal water services with limited success (FFC & SALGA, 2015; MBI, 2013a; MBI, 2013b). They have encountered difficulty in obtaining data that is sufficiently detailed to do sound analysis. All note that there is a wide range of factors that affect the allocation required for operations and that a 'one-size-fits-all' cost benchmark is simply not appropriate.

2.4 Should Financial Allocations to Operations Be Assessed Separately from Maintenance?

There appears to be some ongoing discussion currently regarding whether maintenance should be considered separately from operations, or whether financial allocations should be made jointly to 'operations and maintenance'. In one municipal interview, the interviewee was under the impression that mSCOA did not separate operations from maintenance (an incorrect understanding according to our discussions with National Treasury officials involved in the roll-out of mSCOA). There was unconfirmed anecdotal mention that CIDMS is considering dropping the separation and assessing 'operations and maintenance' jointly rather than operations separately from maintenance.

The majority view expressed in the municipal interviews and at the workshop, where the findings of this study were discussed, is that it is important to understand operations separately from maintenance when running a water services business. Thus, an indicator of the adequacy of maintenance expenditure specifically, separately from operations, is important.

2.5 What is 'Renewal'?

From the CIDMS definition, renewal is:

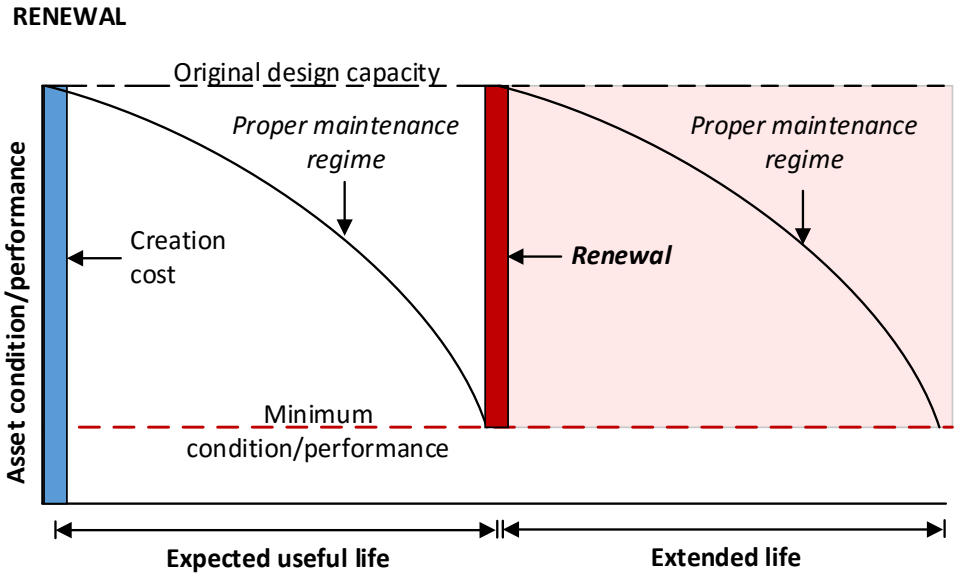
"Expenditure on an existing asset which returns the service potential of the asset or expected useful life of the asset to that which it had originally."

CIDMS provides two supporting notes:

*"**Note 1:** Renewal can include works to replace existing assets or facilities with assets or facilities of equivalent capacity or performance capability.*

***Note 2:** Expenditure on renewals is funded through the organisation's capital budget, and such expenditure is recognised in the organisation's Statement of Financial Position."*

Note that CIDMS has removed reference to 'rehabilitation' or 'refurbishment', which were terms used previously. This is because these activities referred to replacing 'part or component of an asset'. Under new asset management best practice, each asset component is registered as a separate asset. Thus, any capital expenditure previously called 'rehabilitation' or 'refurbishment' would now be referred to as renewal. Any operating expenditure carried out under these definitions should be maintenance. Again, a diagram is helpful to understand what renewal is (see Figure 3).

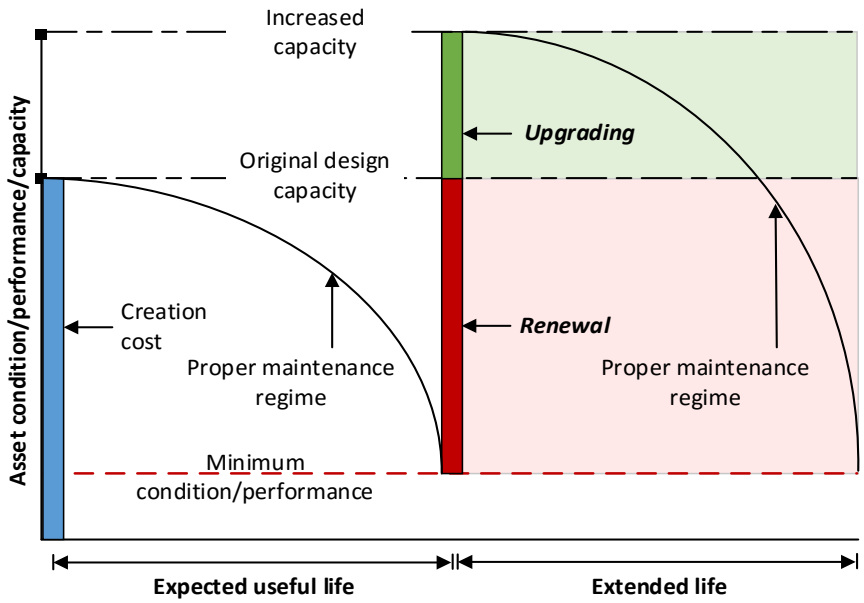


Source: mSCOA and CIDMS (2015) Slide 6

Figure 3: CIDMS diagram indicating definition of renewal

A key distinguishing factor between maintenance and renewal is that maintenance ensures that an asset reaches its expected useful life; while **renewal extends the useful life**. Without sound maintenance, the functionality of the asset will be depleted before its expected useful life is reached. It will have to be renewed sooner: so, life cycle planning within integrated asset management is in many ways intended to ensure that the optimal mix of maintenance and renewal is achieved.

Although not strictly of concern for this paper, further confusion is caused because renewal is often associated with some upgrading: in other words, a single capital project is often undertaken that both upgrades and renews an asset. Figure 4 clarifies that 'upgrading' is not related to the useful life of the asset in any way, but refers to capital expenditure to increase the capacity or performance of an asset.



Source: mSCOA and CIDMS (2015) Slide 6

Figure 4: CIDMS diagram indicating definition of upgrading as distinct from renewal

2.6 Continued Confusion About Maintenance and Renewal

Although the above definitions seem clear, there is still some confusion in literature. Most notably is an undated National Infrastructure Maintenance Strategy (NIMS) document that provides benchmark maintenance budgets stating that:

> *"In the context of this document maintenance embraces planning, budgeting and implementation of repair, planned maintenance, rehabilitation and replacement of infrastructure to achieve an optimal level of service provided by the infrastructure."*

(NIMS, undated)

This definition does not assist with separating the concepts of 'maintenance' and 'renewal'. In fact, it is likely to cause further confusion. As the document is undated, it is possible that it is quite old.

3 MAINTENANCE AS A PERCENTAGE OF THE OPERATING BUDGET

The Cooperative Governance and Traditional Affairs (CoGTA) Back to Basics programme uses an indicator of 7% of the operational budget to maintenance as an indicator of adequate maintenance[4]. It notes that this indicator will be considered within an approach that supports the development and implementation of comprehensive infrastructure and maintenance plans by municipalities.

An indicator based on a percentage of operating budget is not theoretically sound. Firstly, it can be influenced by the budgets for other expenditure items. Consider Municipality A and Municipality B in Figure 5. They are the same size, have the same infrastructure in place and spend the same amount on maintenance. But Municipality B has a bloated overhead structure. As a result, Municipality B's expenditure on maintenance as a percentage of the operating budget is lower than Municipality A's, even though they spend the same amount.

4 According to http://www.cogta.gov.za/?testimonials=%E2%80%8Bdelivering-basic-services#more-98, accessed 19 September 2016.

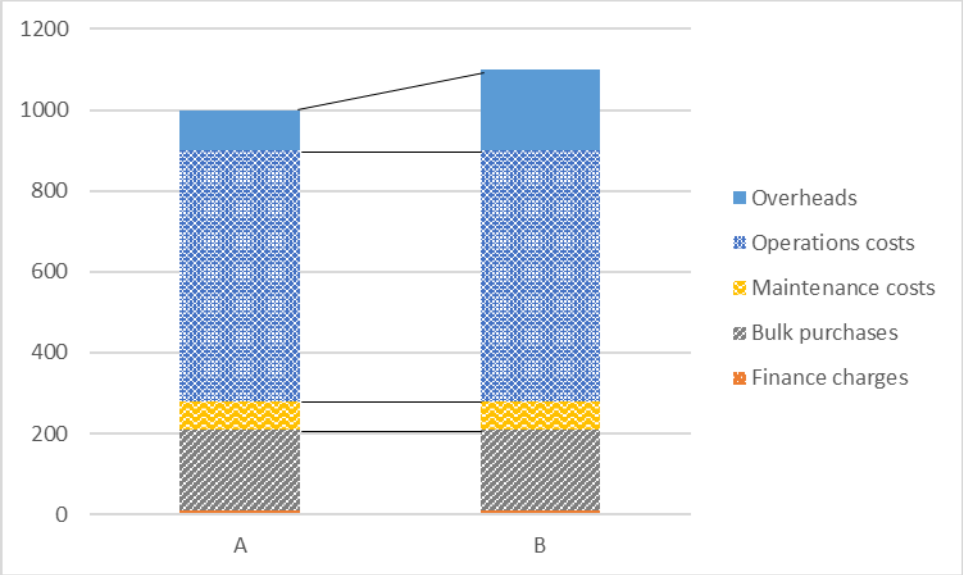
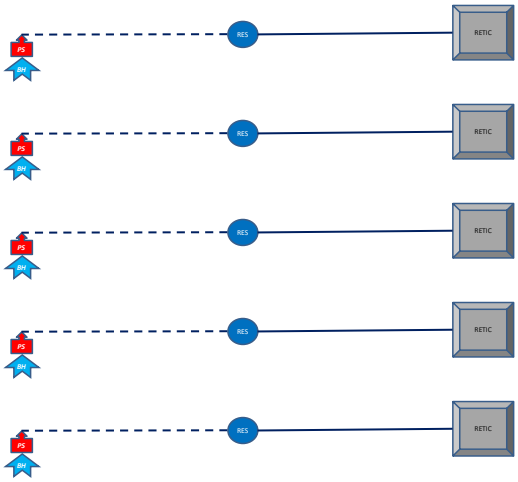
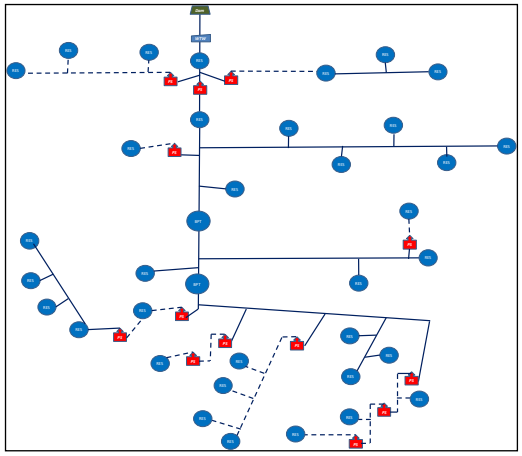


Figure 5: Sample figure showing why maintenance as a percentage of operating budget is not a sound indicator

Secondly, the maintenance allocation is not linked to the extent or nature of the assets in any way. Consider Municipality A again, but compare it now to Municipality C. Municipality A provides water through several stand-alone groundwater-based local water schemes. Municipality C provides a service to the same number of households but uses a single large regional surface water scheme. It is possible that both Municipality A and Municipality C have the same total budget and same expenditure on maintenance. They would thus perform equally well under the Back to Basics indicator, but this does not consider the different nature and complexity of the two schemes that they run. Is it appropriate for these two schemes to have the same maintenance expenditure?



Municipality A: several stand-alone local groundwater schemes



Municipality C: a single regional surface water scheme

Source: Gibson (2011) p. 4-5

Figure 6: Diagrammatic representations of two water schemes with differing complexity

In sum, an indicator that links maintenance expenditure to the total budget is not theoretically sound. Instead, an indicator should consider the extent and nature of the assets being maintained.

4 MAINTENANCE AS A PERCENTAGE OF CARRYING VALUE OF PPE

In January 2014, the National Treasury published MFMA Circular 71, which provides a set of uniform financial ratios and norms for municipalities and municipal entities in accordance with section 216 (1)(c) of the Constitution and section 2 of the MFMA.

Circular 71 includes an indicator of adequacy of maintenance expenditure, which is defined as:

$$\frac{Total\ Repairs\ and\ Maintenance\ Expenditure}{PPE\ and\ Investment\ Property\ (Carrying\ Value)} \times 100 \geq 8\%$$

This indicator is a significant improvement on the Back to Basics indicator that considers the proportion of the total budget. However, Boshoff (2015) argues that the ratio will lead to a shortfall in budgeting and spending on maintenance for three reasons:

- The proposed norm of 8% is an arbitrary figure.
- The yardstick of carrying value is wrong. The carrying value of an asset decreases as the asset depreciates. This means you are taking 8% of a smaller and smaller carrying value each year as the assets age, thus decreasing the allocation to maintenance. In reality, as assets age, the maintenance allocation should increase. This problem could be addressed by using CRC instead of carrying value.
- PPE and investment properties are not the total immovable asset portfolio of a municipality. Heritage assets are included in the immovable asset portfolio and require maintenance, but they are not included in PPE and investment properties. This means there is a maintenance cost that the municipality is not including in the 8%.

This report will explore the first two points in further detail. Before doing so, however, it is useful to look at performance to date on the indicator as it stands.

4.1 Performance on Maintenance Indicator Ex MFMA Circular 71

Municipalities report on repairs and maintenance expenditure as a percentage of the carrying value of PPE and investment property in Table A9 of the Municipal Budget Reform Reporting (MBRR) standard budget formats, commonly known as the ‘A tables’. An A table is an Excel™ spreadsheet. Municipalities must provide a summary of their asset registers broken down by asset class as well as repairs and maintenance expenditure by asset class. The asset classes considered are:

- Infrastructure, further broken down in to road transport, electricity, water, sanitation and other.
- Community assets.
- Heritage assets.
- Investment property.
- Other assets, further broken down into agricultural assets, biological assets and intangibles.

Repairs and maintenance expenditure as a percentage of the carrying value of PPE and investment property is then calculated using a formula on Table A9.

It is notable that although MFMA Circular 71 was only published in January 2014, the indicator has appeared on Table A9 for several years prior to 2014. The number of municipalities reporting on repairs and maintenance expenditure has, however, increased significantly in recent years as shown in Table 1.

Table 1: Number of municipalities reporting on repairs and maintenance as a percentage of carrying value of PPE and investment assets

	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Number of municipalities reporting >0						
A	1	1	1	8	8	8
B1	0	2	2	15	15	17
B2	1	1	2	18	19	20
B3	3	8	13	76	74	77
B4	4	4	7	36	42	39
C1	0	0	1	17	16	16
C2	1	0	2	13	13	12
Total	**10**	**16**	**28**	**183**	**187**	**189**
Percentage of municipalities reporting >0						
A	13%	13%	13%	100%	100%	100%
B1	0%	11%	11%	79%	79%	89%
B2	4%	4%	7%	67%	70%	74%
B3	3%	7%	12%	69%	67%	70%
B4	6%	6%	10%	51%	60%	56%
C1	0%	0%	4%	74%	70%	70%
C2	5%	0%	10%	62%	62%	57%
Total	**4%**	**6%**	**10%**	**66%**	**67%**	**68%**

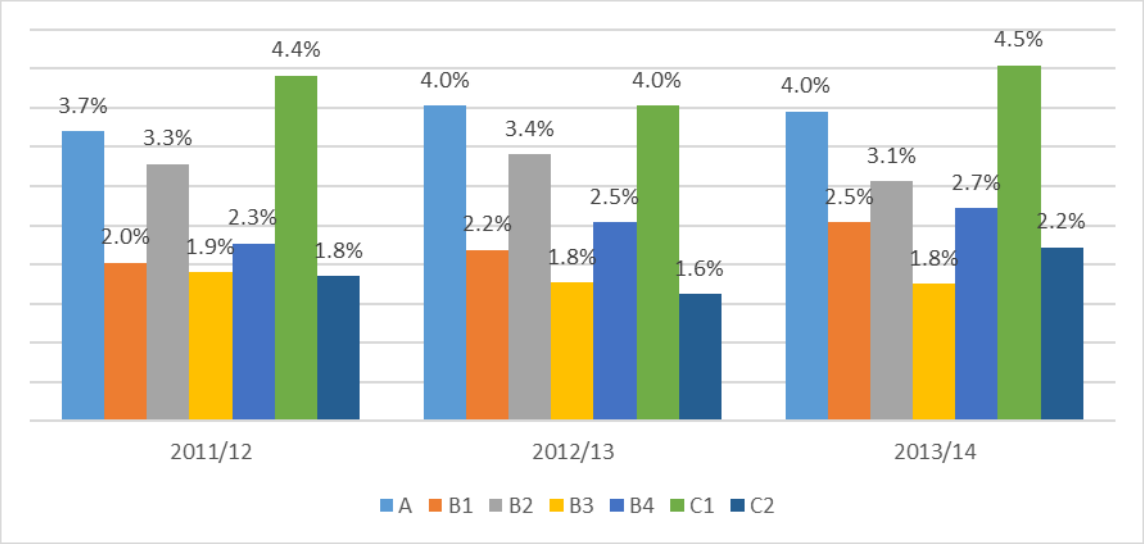
Source: Author's own calculations ex data from National Treasury MBRR Table A9

The data on the indicator is rather 'messy' with some entries obviously incorrect. A total of 22 municipalities in 2011/12, 15 in 2012/13 and 16 in 2013/14 reported expenditure on repairs and maintenance that was more than 12% of the carrying value of PPE and investment assets. This is 150% of the target and, while proper statistical analysis was not undertaken, it is very likely that these are outliers and a result of incorrect data entry into the spreadsheet. One municipality in each of 2012/13 and 2013/14 showed negative values for the ratio.

Figure 7 plots average performance per municipal sub-category over time on the MFMA Circular 71 ratio. The data set is that with all entries greater than 12% and less than 0% removed.

It is clear that on average, municipalities are spending substantially less than 8% of the carrying value of their PPE and heritage assets on repairs and maintenance. There were only six municipalities in 2013/14 that reported the ratio to be greater than 8% but less than 12%[5]. There is no clear increasing or decreasing trend in the ratio on average.

5 These were GT483, KZN 293, KZN294, DC48, DC9 and DC1.



Source: Author's own calculations ex data from National Treasury MBRR Table A9

Figure 7: Repairs and maintenance as a percentage of carrying value of PPE and heritage assets per municipal sub-category for 2011/12, 2012/13 and 2013/14[6]

5 CRC AS A BASIS FOR AN INDICATOR

One of the concerns expressed in Boshoff (2015) is that carrying value is not a sound basis for an indicator of the adequacy of maintenance expenditure. The cause for concern is that carrying value declines as the asset ages while maintenance needs in fact increase. This is unpacked further below.

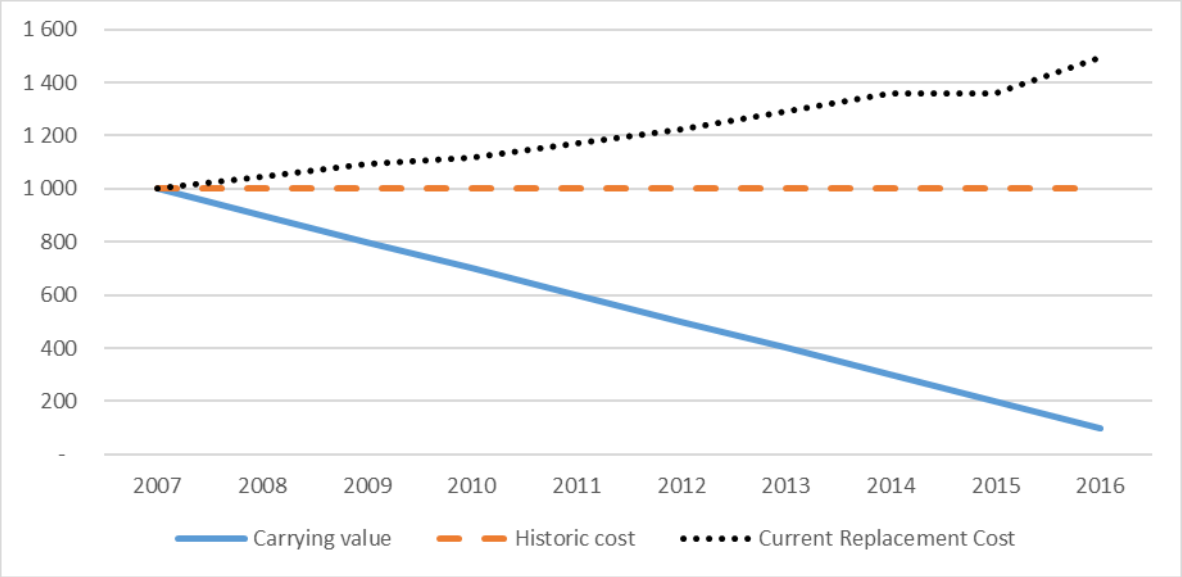
Understanding some further definitions will be helpful at this point:

- **Historical cost** is the original cost of an asset at the date on which it was purchased. This is the amount that the municipality paid for the asset on the date that they bought it.
- **Carrying value** is the historical cost less any accumulated depreciation. In other words, it is an accounting measure of the value of the asset that remains after it has been 'used up' over time as measured by depreciation.
- **Current Replacement Cost or CRC** is the market value of an asset at the current date. It is what a municipality would pay to buy a new asset today.

5.1 Carrying Value for a Single Asset

It is clear that the carrying value of an individual asset declines over time as that asset is depleted. Its historical cost remains fixed. Its CRC, however, increases over time due to inflation. The relationship between these three values is shown in Figure 8, which shows that the carrying value for a single asset decreases over time as the asset life (10 years in the example above) is depleted. Required maintenance calculated as a percentage of carrying value will thus also decrease.

6 Data is taken from the MBRR budgets available on National Treasury's website. The most recent year available at the time of writing this report is the 2015 MTREF, which shows audited financial results up to 2013/14.



Source: Author's own indicative calculations

Figure 8: Indicative historical cost, carrying value and CRC for a single asset over time

5.2 Maintenance Needs with Declining Asset Condition

In fact, maintenance needs increase as an asset ages and its condition declines. Table 2 provides some indicative figures for the increase in maintenance required as assets reach poor or very poor condition.

Table 2: Indicative increase in maintenance needs with decline in asset condition

Component type	Additional percentage	
	Poor	Very poor
Pump	5	10
Motor	10	20
Steel pipe	15	25

Source: CIDMS (2016) Slide 18

As can be seen from Table 2, the increase in maintenance required varies with the asset type, with some assets showing a more significant increase in maintenance required than others.

5.3 Carrying Value for a Portfolio of Assets

The concern in Boshoff (2015) about the disjuncture between actual maintenance needs over time and maintenance needs calculated as a percentage of carrying value *for a single asset* is clear from the discussion above. However, the situation is slightly less clear for a portfolio of assets. With proper renewal, the carrying value of a portfolio of assets will not decline in a linear manner but will be 'topped up' periodically as assets are renewed as shown diagrammatically in Figure 9.

Assets are written off at their historical cost and replaced at their CRC, and so, with sound renewal, the carrying value of the portfolio as a whole will remain close to CRC. The profile in Figure 9 is likely to be more 'spiky' in a small municipality with a relatively small asset base where renewal is thus more periodic, and less 'spiky' in a large municipality with a relatively large asset base where assets or asset components are renewed regularly.

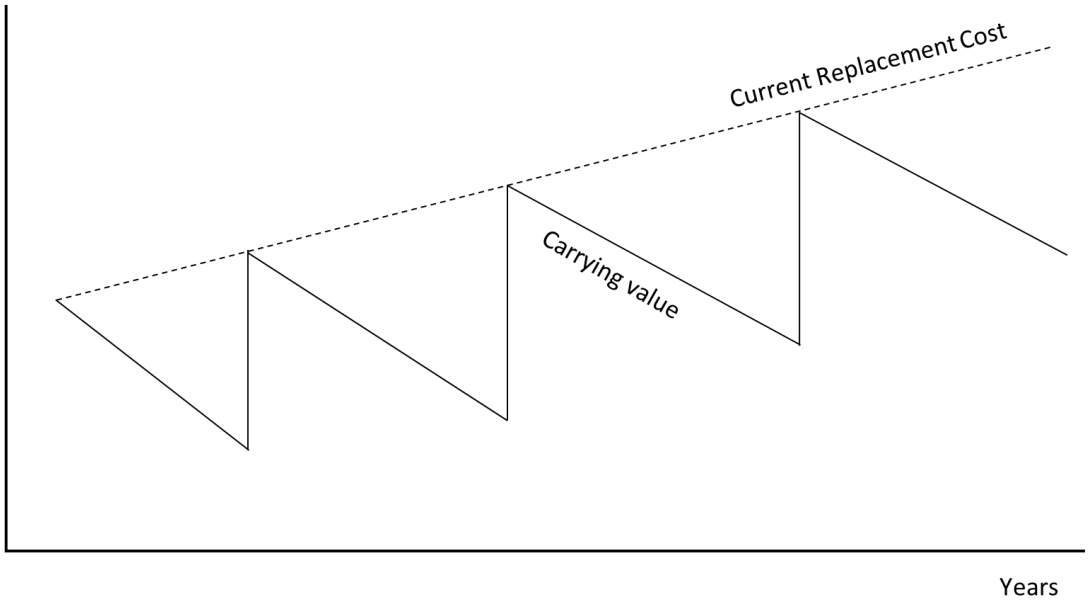
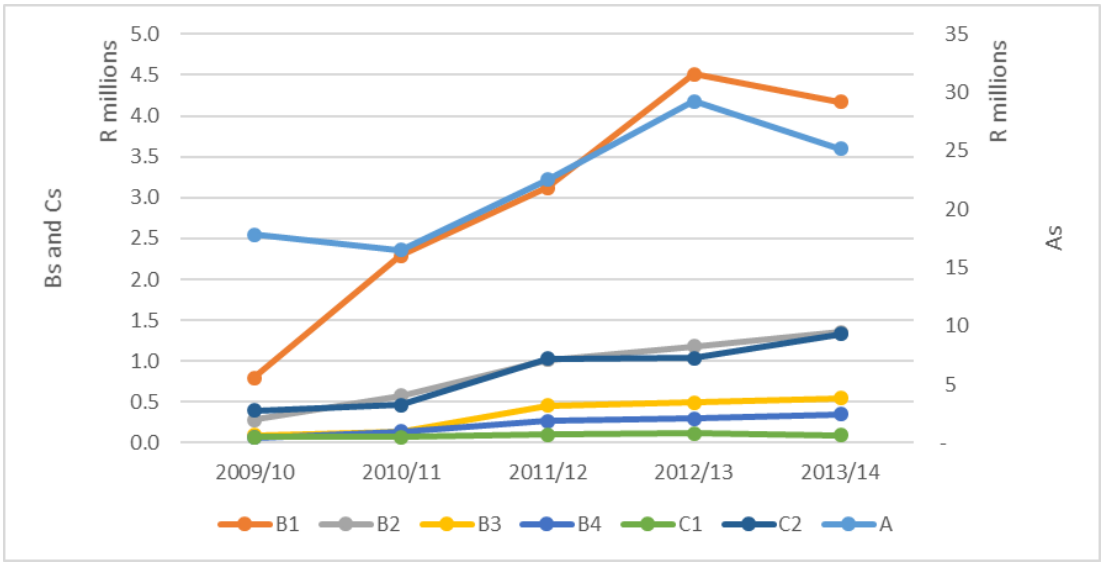


Figure 9: Diagrammatic indication of impact of renewal on the carrying value of an asset portfolio

In the case of the asset portfolio represented in Figure 9, the carrying value does not decline completely linearly and so required maintenance calculated using the MFMA Circular 71 ratio will remain comparatively steady. The concern about actual maintenance needs increasing over time, however, remains.

Of course, the above is valid *only if assets are renewed adequately*. Most evidence indicates that asset renewal is completely underallowed for by South African municipalities and so the carrying values of historical asset portfolios decline over time. It is not possible to assess this based on data because the expansion of asset bases obscures any trends in historical assets. To put this more clearly, municipalities are expanding their asset bases so rapidly that it is not possible to see from data on their asset registers whether the carrying values of historical assets are declining. This can be seen in Figure 10, which shows trends in the total value of municipal assets as reported in the asset registers on Table A9 of the MBRR formats.



Source: Data from National Treasury MBRR Table A9

Figure 10: Carrying value of municipal assets per municipal sub-category, 2009/10 to 2013/14

As with the figures on the maintenance ratio in Figure 7, Figure 10 should be viewed with some caution due to the possible unreliability of the data entered by municipalities into Table A9. If the data is correct, then it shows a steady increase in the carrying value of municipal asset portfolios over time.

5.4 Existing Benchmarks for Maintenance Needs as a Percentage of CRC

There are several sources of data on benchmarks for maintenance needs as a percentage of CRC. The most referenced is the Department of Provincial and Local Government's (dplg) Guidelines for Infrastructure Asset Management in Local Government 2006-2009 (dplg, 2006). Annexure D of the document provides indicative annual budgets for both operations and maintenance separately, as a percentage of CRC. The recommended percentages for maintenance for water supply and sanitation are shown in Table 3.

Table 3: Indicative network annual maintenance budgets ex dplg (2006)

Network	Asset	Maintenance (% CRC)
Water Supply	Dams	0.25
	Boreholes	5.7
	Civil Structures and Pipework (Water Treatment Works)	0.9
	Civil Structures and Pipework (Pump Stations)	0.5
	Civil Structures and Pipework (Reservoirs)	0.7
	Mechanical Plant	4.6
	Electrical Plant	2.3
	Bulk Water Pipelines	0.5
	Reticulation	1.5
	Treatment package plants	3.3
Sanitation	Civil Structures and Pipework (Sewage Treatment Works)	1.4
	Works)	
	Civil Structures and Pipework (Pump stations)	0.5
	Mechanical Plant	4.6
	Electrical Plant	2.3
	Bulk Pipelines	0.5
	Reticulation	1.5

More recently, the Department of Water and Sanitation (DWS) released a Cost Benchmarks for Water Services Projects, 2016 document that also provides benchmarks for maintenance expenditure, shown in Table 4.

Table 4: Annual maintenance costs as percentage of CRC ex DWS (2016)

COMPONENT	Annual maintenance cost as % of Replacement Value		
	low	high	recommended
boreholes	7.00%	10.00%	7.00%
diesel	8.00%	10.00%	8.00%
electric	4.00%	6.00%	4.00%
solar	4.00%	6.00%	4.00%
wind	6.00%	8.00%	6.00%
hand	8.00%	15.00%	8.00%
dams	0.10%	0.25%	0.25%
buildings	0.25%	0.50%	0.50%
roads & bridges	0.50%	0.75%	0.75%
line reservoirs	0.25%	2.00%	1.00%
service reservoirs	0.25%	2.00%	1.00%
WTW -civil	0.25%	1.00%	0.50%
WTW -mechanical & electrical	4.00%	7.00%	4.00%
pump station -civil	0.25%	1.00%	0.50%
pump station -mechanical & electrical	1.50%	4.00%	4.00%
bulk pipelines	0.10%	0.50%	0.50%
reticulation	1.00%	3.00%	2.00%

The DWS benchmarks provide a range of values from low to high with a recommended option. In several cases, the DWS values differ from the dplg values with 'electrical plant' probably the most notable. The DWS document does not separate 'electrical plant' and 'mechanical plant'. Both are given a recommended value of 4% of CRC for maintenance; while in the dplg guideline, the maintenance for electrical equipment is suggested at 2.3%.

Note that the NIMS (undated) Infrastructure Maintenance Budgeting Guideline also provides benchmarks for maintenance as a percentage of CRC. However, as noted previously in Section 2.6, the definition of maintenance here includes rehabilitation and replacement. Thus, the benchmarks are substantially higher.

Table 5: Annual maintenance budgets as percentage of CRC ex NIMS (undated)

Type of infrastructure	Average Annual Maintenance Budget as % of Replacement Cost	Key Assumptions	Replacement or Major Rehabilitation over and above the Annual Maintenance Budget requiring specific capital budget
Bulk water storage	4-8%	Mostly for periodic repair of electrical and mechanical works, storm damage repair, routine maintenance and periodic maintenance	every 30 to 50 years
Water treatment works	4-8%	Mostly for electrical and mechanical equipment	every 20 to 30 years
Water reservoirs	2-3%	Generally low maintenance mostly of telemetry and electrical equipment, storm damage repair, pipe work repair, safety and security, routine maintenance and periodic maintenance	every 20 to 30 years
Water reticulation	4-8%	Mostly for telemetry and pumping equipment, emergency leak repair and ongoing leak repair due to degradation, storm damage repair	every 20 to 30 years
Sewage treatment works	4-8%	Mostly for electrical and mechanical equipment, storm damage and periodic maintenance.	every 20 to 30 years
Sewer reticulation	4-8%	Mostly for pumping equipment, emergency leak repair and ongoing leak repair due to degradation, blockage removal, storm damage repair,	every 20 to 30 years

5.5 Maintenance Needs for Some Indicative Systems

Maintenance needs were calculated for two indicative systems to demonstrate the application of these benchmarks and also the impact of using carrying value and not CRC as the basis for estimation. The indicative schemes chosen were taken from Gibson (2011) and are a single regional scheme and 34 stand-alone schemes, each serving 34 villages with the same design consumption.

Table 6: Specification of indicative schemes used for calculations

	Regional Scheme	**34 Stand-alone Schemes**
Villages	34	1
Households per village	200	200
Design consumption	60 ℓ/c/d + peak factor (× 1.2) and provision for losses (× 1.1)	
Dam	1	0
Water treatment works	1 (2.84 Ml/day)	0
Boreholes	0	1
Bulk pipelines	106 km (50-200 mm)	3 km (50 mm)
Pump stations	13 (various 2-50 kW)	1 (5 kW) (diesel)
Reservoirs	34 + 2 break pressure tanks	1
Reticulation	68 km	2 km

Source: Gibson (2011) p. 5

The CRCs of these schemes were estimated using the cost benchmarks published in DWS (2016), and maintenance costs of each component estimated using the benchmarks in the same document.

The calculations in Table 7 show that the total maintenance need for the systems is 1.4% in the case of the regional scheme and 1.6% in the case of multiple stand-alone schemes. The primary difference between the two schemes is the proportion of the CRC that is mechanical and electrical; which is 5% for the single regional scheme and 9% for the multiple stand-alone schemes.

Mechanical and electrical assets have higher maintenance needs than civil assets. Thus, the overall maintenance requirement for the many stand-alone schemes is higher than for the single regional scheme. This demonstrates that the nature of the asset under consideration should be a factor when determining required financial allocations for maintenance. While the CRC of the regional scheme is higher, its required maintenance is lower.

Table 7: Calculation of maintenance expenditure required for schemes using cost benchmarks ex DWS (2016)

		CRC (R'000)		Maintenance required as percentage of CRC	Annual maintenance cost (R'000)	
		Many schemes	**Regional scheme**		**Many schemes**	**Regional scheme**
Groundwater	Electrical	9 030		4.0%	361	–
	Borehole establishment	12 187		0.5%	–	–
Water treatment works	Conventional		10 243	1.6%[7]	61	–
Pump station	Energy source	949	1 204	4.0%	–	159
	Mechanical pump	356	1 096	4.0%	38	48
	Pump pipework	324	1 472	0.5%	14	44
	Pump switchgear		1 204	4.0%	2	7
	Pumphouse building	8 921	3 411	0.5%	–	48
Bulk pipeline	uPVC/HDPE	16 671	41 044	0.5%	45	17
Reservoir	Ground reservoir	13 478	13 478	1.0%	83	205
Water reticulation	Yard connection	50 053	50 053	2.0%	135	135
Total per scheme		**111 970**	**123 206**		**1 740**	**1 664**
Total as percentage of CRC					**1.6%**	**1.4%**

In calculating how this maintenance need will change over time, it was assumed that maintenance required will increase by 5% when the assets reach poor condition and by a further 5% (in other words, 10% in total) once they reach very poor condition.

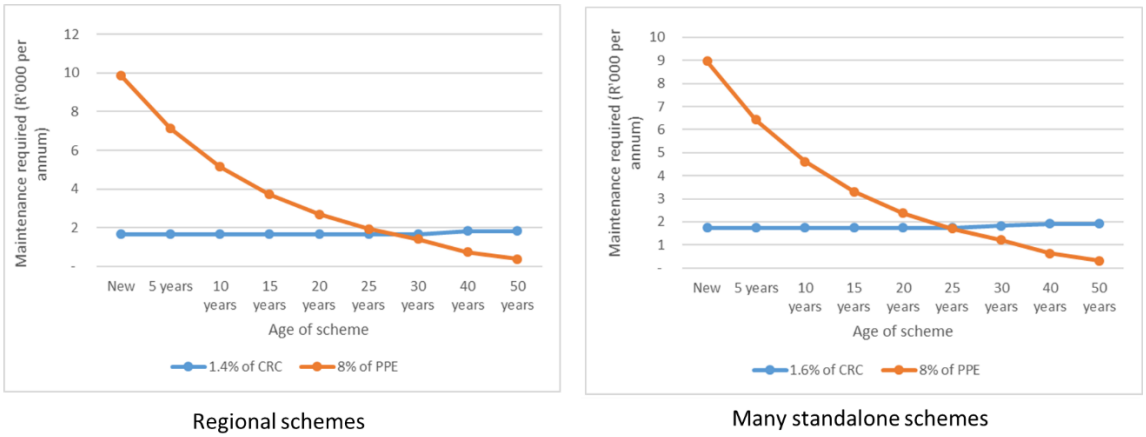
The carrying value of the assets was calculated based on the assumed estimated useful lives and annual deprecation indicated in Table 8.

7 DWS (2016) suggests 0.5% maintenance for the civil component of a water treatment works and 4.0% for the electrical. It was assumed that about 30% of the CRC of the water treatment works is electrical.

Table 8: Estimated useful lives and calculation of annual depreciation for scheme components

		Estimated useful lives	Annual depreciation cost (R'000)	
			Many schemes	Regional scheme
Groundwater	Electrical	25	361	–
	Borehole establishment	25	203	–
Water treatment works	Conventional	60	–	207
Pump station	Energy source	50	38	48
	Mechanical pump	25	14	44
	Pump pipework	25	5	25
	Pump switchgear	60	–	48
	Pumphouse building	25	178	68
Bulk pipeline	uPVC/HDPE	50	333	821
Reservoir	Ground reservoir	50	270	270
Water reticulation	Yard connection	50	1 668	1 668
Total per scheme			**3 072**	**3 199**
Total as percentage of historical cost p.a.			**2.7%**	**2.6%**

The 8% benchmark was applied to the carrying value calculated on the basis of this annual depreciation to determine the maintenance required over time. The results of these two estimates of maintenance needs are shown in Figure 11.



Regional schemes

Many standalone schemes

Figure 11: Maintenance need for indicative regional scheme and many stand-alone schemes using 8% of carrying value of PPE compared to benchmark percentage of CRC

It is very clear from the figure above that the MFMA Circular 71 benchmark (8% of PPE) results in an estimate of maintenance need that declines as the scheme ages, while the estimate based on percentage of the value of CRC with a modification for asset condition in fact rises slightly over time.

The fact that the MFMA Circular 71 benchmark significantly overestimates the maintenance need when the assets are new but, underestimates it when they are old is discussed further in Section 7.

5.6 Why was CRC not Used as the Basis for the MFMA Circular 71 Indicator?

In discussions with National Treasury about developing the indicator in Circular 71, they indicated that they were aware of the concern regarding using carrying value as the basis for the indicator, rather than CRC. The issue is availability of data to measure CRC. Most municipalities do not value their assets on this basis, and they are not required to report on CRCs in financial statements or MBRR budget formats. This means that data on the CRC of assets is not readily available for use in an indicator. While carrying value is flawed, it was regarded as a sufficiently good interim indicator, until data for a stronger indicator becomes available (*pers. comm.,* Thalitha Cossa, National Treasury, 30 May 2016).

This point is very valid. In the discussions with municipalities for this project and in other work with municipalities, it was determined that municipalities are often unable to report on the CRCs of their assets. The reason provided is usually that obtaining CRC estimates is costly and that it will not be sufficiently helpful to justify the effort[8]. In discussions with asset management experts at engineering consulting firms, however, the view was expressed that understanding the CRC of assets is key to establish a sound Infrastructure Asset Management Programme.

5.7 Determining CRC

So how is a CRC estimate established?

The starting point is a sound asset register down to at least asset type but ideally to component level; in other words, how many kilometres of PVC pipe of a certain diameter are there in the municipality? Establishing an asset register can certainly be an onerous exercise upfront, but it is an absolutely critical element of a sound Infrastructure Asset Management Plan. It is not possible for a municipality to manage its assets without knowing what the assets are.

The asset components must then be costed and this is where further complexity can reside. Engineering consulting firms typically apply unit rates (rate per kilometre of pipe, in the example above) based on recent tender values gathered from engineering contractors. Some engineering consulting firms update these unit rates annually, while others do an exercise to update the values every three to five years and apply an inflator to the values in between.

What inflator to use?

The South African Forum for Civil Engineering Consultants (SAFCEC) publishes a contract price adjustment factor (CPAF) quarterly in its State of the Industry reports. The CPAF is based on data sourced from Statistics South Africa including P0141 – Consumer Price Index (CPI) Table; P0141 – CPI Additional Tables; and P0151 – Contract Price Adjustment Provisions Work Groups and Selected Materials Indices.

Table 9: CPAF ex SAFCEC for 2010 to 2018

2010	2011	2012	2013	2014	2015	*2016*	*2017*	*2018*
2.30%	4.70%	4.50%	5.70%	5.30%	−0.03%	*10.00%*	*3.00%*	*5.20%*

Italicised numbers are forward projections

8 This is not a direct quote but is PDG³s interpretation of interviews conducted for this project and of views expressed during other work.

This factor is probably weighted most heavily to civils infrastructure. It is possible to develop a factor that better reflects municipal infrastructure as a whole, and it is our understanding that some of the engineering consulting firms have done so.

Variability in unit costs

There are several reasons why unit costs might vary from municipality to municipality. The DWS cost benchmarks document (DWS, 2016) provides some factors for adjusting unit costs.

Table 10: Cost adjustment factors ex DWS (2016)

Factors Affecting Costs		Surface water	Ground - water	Pump stations		Water treatment	Bulk pipeline	Reser-voir	Reticulation
				Surface	Bore hole				
Project size definitions	Small	<10 mil. m^3	1-3 boreholes	<50kW	1-3 boreholes		contract		<1500 People
	Medium	10-40 mil. m^3	3-10 boreholes	50-150kW	3-10 boreholes		contract		1500-5000 People
	Large	>40 mil. m^3	>10 boreholes	>150kW	>10 boreholes		contract		>5000 People
Project size	Small	+10%	+30%	+5%	0		+5%		+5%
	Medium	0	0	0	-5%		0		0
	Large	-10%	-15%	+3%	-8%		-3%		-3%
Remoteness Location Distance from economic centre	Near (<50km)	-2%	0	0	0	0	0	0	0
	Distant (50-100km)	0	+8%	+5%	+5%	+5%	+10%	+3%	+10%
	Remote (>100km)	+1%							
	Remote (>200km)		+12%	+10%	+10%	+10%	+15%	+8%	+15%
Topography	Flat (<1% slope)			0	0	0	0	0	+2%
	Sloped (1-5% slope)			+2%	+2%	+2%	0	+2%	0
	Steep (>5% slope)			+5%	+5%	+5%	+5%	+5%	+5%
Access	None existing	+5%	+50%	+5%	+10%	+5%		+5%	
	Track existing	+12%	0	+2%	0	+2%		+2%	
	Gravel road existing	0	0	0	0	0		0	
	Paved road existing	0	0	0	0	0		0	
Clearing	Savannah (Sparse)	0					0		
	Bush	+1%					+2%		
	Trees	+2%					+5%		
Availability of contractor	High (Under quoting)	-2%	-10%	-5%	-5%	-2%	-10%	-10%	-5%
	Medium (Competitive)	0	0	0	0	0	0	0	0
	Low (Low availability)	+5%	+10%	+15%	+10%	+5%	+15%	+15%	+10%
Security	Rudimentary (Little vandalism)	0		0	0	0		0	
	Standard (Some vandalism)	0		+3%	0	+3%		+1%	
	Sophisticated (high vandalism)	+1%		+10%	+15%	+5%		+3%	
Geology	Soft						0		0
	Intermediate						30%		30%
	Hard rock						60%		60%
Land acquisition & servitudes	Public area			0		0	0	0	
	Agricultural land			+1%		+1%	+1%	+1%	
	Build-up area			+2%		+3%	+4%	+2%	
Environment type & sensitivity	low sensitivity								
	medium sensitivity								
	high sensitivity								

In discussions with Aurecon Consulting Engineers, they indicated that in their experience in estimating CRCs for municipalities, auditors pay significant attention to the unit costs used. In some cases, they had in fact brought in third parties to test the unit rates applied.

5.8 Options for Support to Municipalities in Estimating CRC

From the discussion above it should be clear that calculating the CRC is not a complex process in itself. The issue is having the data available to do so. Firstly, a municipality must have a sound asset register and know the extent and nature of its assets. Secondly, the municipality needs unit costs that can be applied to estimate the CRC of those assets.

There seems to be scope here to support municipalities by providing relatively up-to-date unit costs that can be used as benchmarks. The DWS is already doing this in their cost benchmark reports (the latest dated January 2016). A nationally agreed upon set of unit costs would also provide a starting point for municipalities to assess the costs of infrastructure in their specific circumstances.

There is further scope for developing a calculator that contains the unit costs. Municipalities could enter the extent and nature of their assets into this calculator to generate CRC estimates. The Provincial Government Western Cape already has a tool that does something quite similar to this, which was developed to support municipalities in estimating the level of development charges that they should levy.

It should be noted that such a tool would provide only a rough estimate of CRC. However, this would be a step forward from the current situation, with municipalities having no CRC estimates at all.

6 DETERMINING THE AMOUNT OF MAINTENANCE EXPENDITURE

The MFMA Circular 71 benchmark uses carrying value of PPE as the denominator and the concerns and issues with this have been discussed. In this section, potential issues with determining the level of the numerator, which is maintenance expenditure, are outlined.

6.1 Expenditure Types Considered as Maintenance

The first issue is in determining which expenditure types (subjective classification items such as those recorded on Table A4 of the MBRR budget formats) to include in maintenance. Because there is no clear generally recognised accounting practice definition of maintenance, it is left to municipalities to decide. The interviews conducted for this project showed that there is variety in the interpretation of what expenditure types should be considered to be part of maintenance.

Some municipalities interpret this to be materials only. The CRC benchmarks, however, consider this to be the full cost of maintenance as if the activity has been outsourced. This would thus include labour costs, materials, equipment, workshop costs and vehicle costs, as well as the cost of any contracts associated with maintenance.

There is definite scope to provide municipalities with clearer guidance regarding which expenditure types to consider as maintenance.

6.2 Deciding How Much of an Expenditure Item is 'Maintenance'

Even once there is clarity on which expenditure types should be included under maintenance, a municipality must still decide which portion of that expenditure to allocate to maintenance and which portion to operations, for example. There were several approaches applied even in the small sample of municipalities consulted as part of this project. These are demonstrated most clearly regarding how much expenditure on labour is allocated to maintenance. Some examples of approaches are:

- *"Assume a 40:60 split between operations and maintenance for all Water Services staff".*
- *"Specify a split between operations and maintenance for different staff functions, e.g. process controller is operations. For some, there is a split."*
- *"Activity-based costing based on job cards with detailed analysis possible down to asset level."*

The latter approach is the most sophisticated. Under this approach, staff log their time on job cards and indicate whether they were performing maintenance, what sort of maintenance, and on what asset component. This allows for very detailed analysis of how much time each staff member spends on maintaining each asset. In order to come up with a cost of that maintenance, a labour rate must be applied to the number of hours spent.

The key point here is that the accuracy of how different municipalities estimate their maintenance spend varies significantly.

6.3 Will mSCOA Create More Clarity?

The full roll-out of the mSCOA is anticipated to improve the consistency of municipal financial reporting significantly by forcing municipalities to report against a consistent chart of accounts.

The mSCOA has seven so-called 'segments'. A municipality must classify each expenditure against the respective segments.

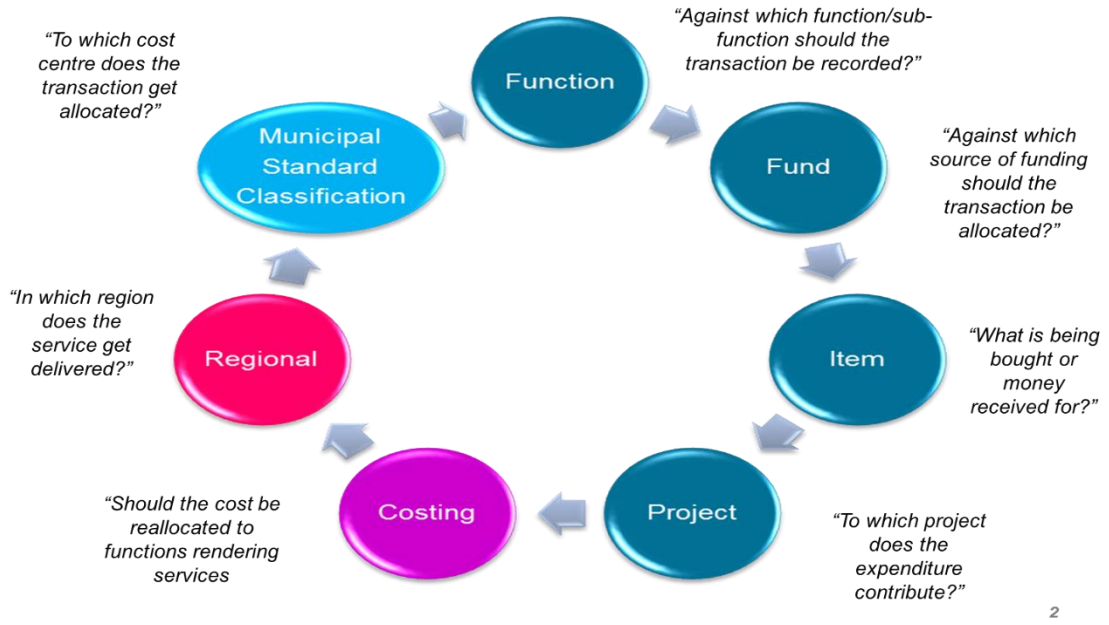


Table 11: The mSCOA segments

Maintenance falls under the 'Projects' segment, which has three operational expenditure types, namely, maintenance, municipal running costs and operational projects. Within maintenance, expenditure must be classified as being either preventative or corrective. Preventative maintenance is further broken down into interval-based or condition-based. Corrective maintenance is further broken down into planned or emergency.

The mSCOA is thus well aligned with the maintenance definitions and hierarchies outlined earlier in this report due to the engagement between the mSCOA and CIDMS teams.

The mSCOA will thus improve clarity as to the nature of maintenance being undertaken. However, municipalities must still decide which of the expenditures under the 'Item' segment must be classified as maintenance under the 'Project' segment. So, the issue of lack of clarity regarding which expenditure types to consider to be maintenance will not be resolved through mSCOA without giving improved guidance to municipalities.

The 'Costing' segment of the mSCOA is intended to improve reporting on how expenditures are reallocated. According to the mSCOA training presentations available on National Treasury's website:

"The purpose for including this segment in SCOA is to provide for the recording of full cost reflection for at least the four core municipal functions being electricity, water, waste water and waste management services, as a minimum requirement (for now)."

(National Treasury, undated).

Under the 'Costing' segment, labour, vehicles, plant and equipment costs (for example) spent in maintaining assets on behalf of other departments would be charged to those departments based on time or log sheets. As these expenditures would also be allocated under the 'Asset' segment to the asset on which maintenance is done, this will allow for very detailed reporting on maintenance down to asset level. This will certainly improve consistency of reporting. The concern is the readiness and ability of many municipalities to implement sophisticated cost allocation of this nature.

7 IS 8% THE CORRECT LEVEL FOR THE BENCHMARK?

The 8% benchmark does not have a theoretical basis and was established based on an assessment of the maintenance expenditure of a sample of South African municipalities, including district, local and metropolitan municipalities (*pers. comm.,* Thalitha Cossa, National Treasury, 30 May 2016).

The indicative analysis presented in Section 5.5 of this report provides a starting point for a rough assessment of whether 8% is an appropriate benchmark. Looking back at Figure 11, it is clear that the 8% benchmark significantly overestimates the maintenance need when assets are new and underestimates the maintenance need when assets are old. The maintenance need estimated based on 8% of carrying value is approximately equal to that estimated based on percentage of CRC when the systems are about 25 years old, or about 40% of the estimated useful life of the system as a whole is still remaining. This is confirmed in Figure 12.

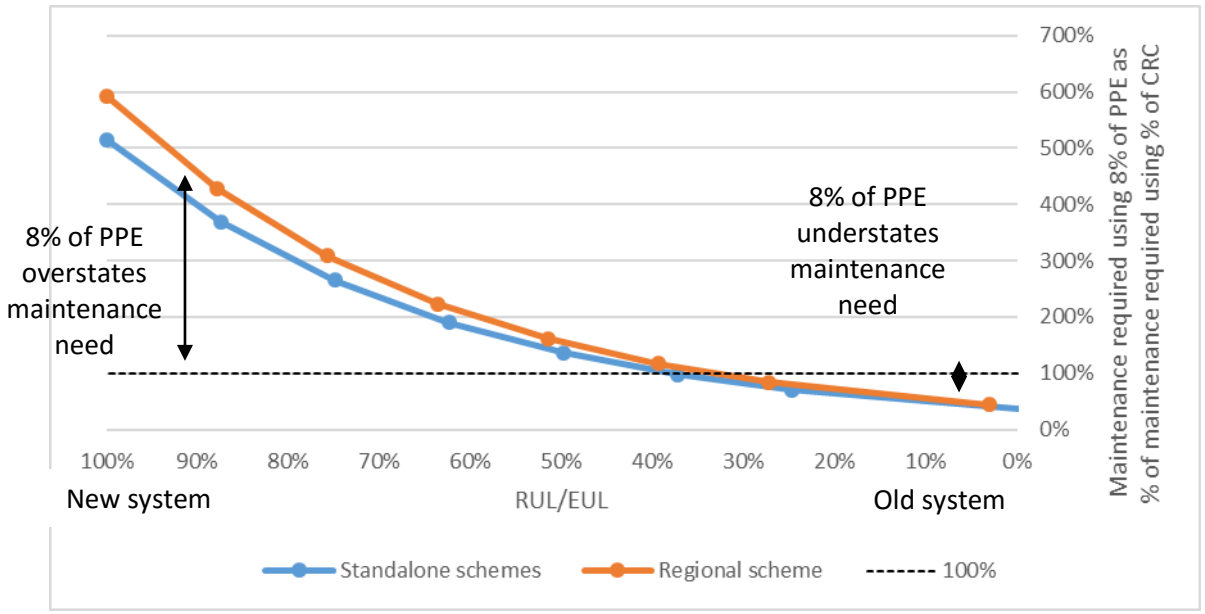


Figure 12: Chart showing point at which estimates of maintenance required based on 8% of PPE or benchmarks as percentage of CRC are equal

The vertical axis on Figure 12 shows the maintenance required as estimated using the 8% of carrying value as a percentage of the maintenance required as estimated based on the CRC benchmarks. Any value higher than 100% on the vertical axis thus indicates that the 8% benchmark overestimates the maintenance need. Any value less than 100% indicates that the 8% benchmark underestimates the maintenance need. The horizontal axis shows the remaining useful life as a percentage of the estimated useful life. A value of 100% on the horizontal axis represents a brand-new system (100% of the estimated useful life still remains) while a value of 0% represents a fully depleted system. Moving from left to right along this axis indicates systems that are increasingly old. Figure 12 shows that the maintenance need estimated based on the 8% of carrying value is 100% of that estimated based on the CRC benchmarks when the remaining useful life is about 40% of the estimated useful life.

Data from Boshoff (2015) suggests that the remaining useful life for municipal water and sanitation assets in South Africa as a whole is about 50% of the estimated useful life[9]. At 50% of estimated useful life remaining, the MFMA Circular 71 benchmark overestimates maintenance needs by between 40% (for the many stand-alone schemes) and 60% (for the single regional scheme) according to this indicative analysis. Benchmarks of 5.9% and 5.0% of the carrying value of CRC would lead to the

9 A table on page 2 of Boshoff (2015) indicates that water and sanitation assets owned by all South African municipalities have a CRC of R294 billion and a depreciated replacement cost of R147 billion, indicating that 50% of the assets have been depleted.

correct estimate of maintenance needs at 50% of estimated useful life remaining for the 'many stand-alone schemes' and 'single regional scheme' options respectively.

It is of course important to note that this finding is for these two indicative schemes only. As already noted, and as can be seen simply by comparing the findings for the two indicative schemes, the mix of assets has a significant impact on the maintenance expenditure required. In a municipality that does not provide the bulk water function, for example, and assets are thus dominated by reservoirs and reticulation, maintenance needs would be different. Thus, the point at which the MFMA Circular 71 benchmark would be accurate would be also be different.

Some summary points on the MFMA Circular 71 benchmark are appropriate here. The (admittedly very rough) analysis presented in this paper has demonstrated that the benchmark will result in declining allocations to maintenance as assets age. The benchmark significantly overstates maintenance needs when assets are new and understates maintenance needs when assets are old.

At a high level, the general indication here is that the indicator is currently overstating maintenance needs somewhat for South African municipal water and sanitation assets as a whole. This will differ between individual municipalities, however, based on the composition and age of their assets.

Having said all of that, the indicator has helped to focus attention on maintenance needs. All municipal officials interviewed for this project, both technical and financial, were aware of the 8% benchmark and of the need to increase maintenance expenditure to meet it. Given the context of under-expenditure on maintenance in South Africa, the indicator has thus performed an important purpose. The analysis presented here is not sufficiently comprehensive or robust to be used as a basis for altering the indicator (and the analysis has looked at water and sanitation only, while the indicator is used for the full municipal asset base). Rather it once again confirms the fact that CRC is a more sound basis for estimating maintenance needs than carrying value.

8 CONCLUSIONS: DETERMINING THE ALLOCATION TO MAINTENANCE

Concluding comments and observations are as follows:

There remains significant confusion about definitions and terminology in the maintenance space, and more work needs to be done to ensure consistent and clear definitions. The alignment between CIDMS and mSCOA has been a good start here.

Further clarity on what expenditure items should be considered as 'maintenance' is needed to ensure that reported expenditures on maintenance are referring to the same thing. The mSCOA alone is unlikely to address this as municipalities will need guidance on which entries under the 'Item' segment should be recorded as maintenance under the 'Project' segment.

The MFMA Circular 71's benchmark of 8% of the carrying value of PPE and investment property is a significant improvement on benchmarks based on the percentage of the municipal budget, but it does not have a theoretically sound basis. It may be adequate as an indicator for high-level monitoring by National Treasury, but should not be used by municipalities themselves to determine whether they are making adequate allocations to maintenance. When interpreting performance against this benchmark, National Treasury should consider that it overstates maintenance needs in new water and sanitation systems, but understates it in older systems. The accuracy will also differ depending on the composition of the water and sanitation assets.

For internal monitoring purposes, a benchmark as a percentage of the CRC of assets (developed individually for each municipality while considering the asset mix and condition thereof) can be used. Municipalities can be assisted to develop such benchmarks. A possible area of work includes regularly maintaining data on infrastructure unit costs that are to be used in calculating CRC estimates. DWS is already doing good work in this area, but unit costs for other sectors (electricity, roads etc.) are not as readily available. The DWS unit cost document can also be better publicised among municipalities.

There is also potential for developing a tool that can be used when doing CRC calculations in which the unit costs can be applied to data on asset extent and composition.

When determining how much should actually be set aside in the budget for maintenance each year, even a benchmark based on CRC should be considered as a starting point only. The NIMS (undated) Infrastructure Maintenance Budgeting Guideline probably states it most clearly:

> *"There is no simple formula that can be applied across the board with respect to maintenance planning … It is only by putting in place a comprehensive infrastructure asset management system focusing on efficient and effective service delivery, that adequate infrastructure maintenance can be addressed … Furthermore, it is not possible to adequately 'average' the maintenance costs of infrastructure as two components of the same infrastructure may have very different operational and maintenance costs … It is essential to treat each infrastructure asset as a separate element and plan the infrastructure maintenance accordingly."*
>
> (NIMS, undated, p. 3)

Ultimately, the only way to assist municipalities to make adequate financial allocations to maintenance is to support them in progressively implementing sound infrastructure asset management and life cycle costing.

This has been an exploratory study and conclusions are tentative, pointing to the need for further work more than anything else. This work might include:

- Providing more clarity to municipalities on what expenditures they should record as 'maintenance'.
- Developing of a CRC calculator that draws on the DWS standard unit costs to estimate CRC in a municipality.
- Developing a tool that assists municipalities to determine their required maintenance expenditure based on a benchmark for maintenance as a percentage of CRC.

Although not directly relevant to the water sector, maintaining a set of standard unit costs for all municipal infrastructure (building on the work done by DWS) would also be useful.

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