

Australian/New Zealand Standard™

Dependability management

Part 3.3: Application guide – Life cycle costing



AS/NZS IEC 60300.3.3:2019

This Joint Australian/New Zealand Standard™ was prepared by Joint Technical Committee QR-005, Dependability. It was approved on behalf of the Council of Standards Australia on 5 April 2019 and by the New Zealand Standards Approval Board on 7 May 2019.

This Standard was published on 24 May 2019.

The following are represented on Committee QR-005:

- Asset Management Council
- Australian Industry Group
- Department of Defence (Australian Government)
- Engineering New Zealand
- Engineers Australia
- Independent Transport Safety and Reliability Regulator (NSW)
- Institution of Occupational Safety and Health
- National Road Carriers Association (NZ)
- New Zealand Institute of Safety Management
- Professionals Australia
- Risk Engineering Society
- Risk Management Institute of Australasia
- RiskNZ
- University of New South Wales
- University of Western Australia
- University of Wollongong

This Standard was issued in draft form for comment as DR AS/NZS IEC 60300.3.3:2019.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:

www.standards.org.au

www.standards.govt.nz

ISBN 978 1 76072 472 6

Australian/New Zealand Standard™

Dependability management

Part 3.3: Application guide – Life cycle costing

First published as AS IEC 60300.3.3—2005.
Jointly revised and redesignated as AS/NZS IEC 60300.3.3:2019.

COPYRIGHT

© IEC 2019 — All rights reserved

© Standards Australia Limited/the Crown in right of New Zealand, administered by the New Zealand Standards Executive 2019

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth) or the Copyright Act 1994 (New Zealand).

Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee QR-005, Dependability to supersede AS IEC 60300.3.3—2005, *Dependability management — Part 3.3: Application guide — Life cycle costing*.

The objective of this Standard is to establish a general introduction to the concept of life cycle costing and covers all applications. Although costs incurred over the life cycle consist of many contributing elements, this document particularly highlights the costs associated with the dependability of an item. This forms part of an overall dependability management programme as described in AS/NZS IEC 60300.1.

Guidance is provided on life cycle costing for use by managers, engineers, finance staff, and contractors; it is also intended to assist those who may be required to specify and commission such activities when undertaken by others.

This Standard is identical with, and has been reproduced from, IEC 60300-3-3:2017, *Dependability management — Part 3-3: Application guide — Life cycle costing*

As this document has been reproduced from an International Standard, a full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms, definitions and abbreviated terms	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	11
4 Concepts of life cycle costing	11
4.1 Objectives of life cycle costing	11
4.2 Application of life cycle costing	12
4.3 Factors influencing LCC.....	13
4.4 Factors related to dependability	13
5 Life cycle costing process.....	14
5.1 General.....	14
5.2 Establish the organizational context.....	14
5.2.1 Formulate the context.....	14
5.2.2 Identify alternatives	16
5.3 Plan the analysis	16
5.3.1 Define scope and objectives of the analysis.....	16
5.3.2 Define analysis tasks and identify contributing personnel	16
5.3.3 Identify constraints	17
5.3.4 Identify relevant financial parameters	17
5.4 Define the analysis approach.....	18
5.4.1 Establish rules/methodology	18
5.4.2 Select or develop an LCC model.....	18
5.4.3 Define the cost breakdown structure	19
5.4.4 Identify areas of uncertainty.....	20
5.5 Perform the analysis	21
5.5.1 Establish methods for estimating cost elements.....	21
5.5.2 Collect cost data.....	21
5.5.3 Aggregate cost per item for each stage or time period	22
5.5.4 Perform LCC and sensitivity analysis.....	22
5.5.5 Review analysis.....	22
5.5.6 Assess achievement of analysis objectives.....	22
6 Finalize the analysis	23
6.1 Identify follow-up actions	23
6.2 Document analysis.....	23
Annex A (informative) Life cycle costing and the life cycle	24
A.1 General.....	24
A.2 Typical LCC analyses	25
A.3 Committed versus actual costs.....	25
Annex B (informative) Financial concepts	27
B.1 General.....	27
B.2 Consequential costs.....	27
B.3 Warranty costs.....	28
B.4 Liability costs	28

B.5	Opportunity costs, discounting, inflation and taxation	29
B.5.1	General	29
B.5.2	Opportunity costs	29
B.5.3	Taxation	29
B.5.4	Exchange rate	29
B.5.5	Generally accepted accounting principles	29
Annex C	(informative) Application of financial evaluation techniques	30
C.1	General	30
C.2	Discounted cash flow (DCF)	30
C.3	Internal rate of return (IRR)	30
C.4	Depreciation and amortization	30
C.5	Cost-benefit analysis	30
C.6	Time value of money	31
Annex D	(informative) Cost breakdown structures by life cycle stage	32
D.1	General	32
D.2	Life cycle stage cost element	32
D.2.1	General	32
D.2.2	Concept	32
D.2.3	Development	32
D.2.4	Realization	33
D.2.5	Utilization	33
D.2.6	Enhancement	34
D.2.7	Retirement	34
D.3	Cost element explanation	34
D.3.1	General	34
D.3.2	Project management	35
D.3.3	Engineering	35
D.3.4	Producibility engineering and planning	35
D.3.5	Manufacturing	35
D.3.6	Facilities	35
D.3.7	Support and test equipment	35
D.3.8	Initial training	35
D.3.9	Initial spares and repair parts	35
D.3.10	Consumables	35
D.3.11	Contractor services	35
Annex E	(informative) Evaluating intangibles	36
E.1	General	36
E.2	Intangibles	36
E.3	Valuing methods	37
Annex F	(informative) Methods for estimating cost elements	38
F.1	General	38
F.2	Parametric cost method	38
F.3	Analogous cost method	40
F.4	Engineering cost method	40
Annex G	(informative) Example of LCC comparison	42
G.1	General	42
G.2	Simple example of LCC comparison	42
G.2.1	General	42

G.2.2	Configuration option 1	42
G.2.3	Configuration option 2	42
G.2.4	Configuration option 3	42
G.2.5	Configuration option 4	43
G.2.6	LCC calculation	43
Bibliography.....		44
Figure 1 – Life cycle costing process		15
Figure 2 – Cost breakdown structure concept		19
Figure A.1 – Typical analyses across the life cycle		25
Figure A.2 – Example of committed and actual costs		26
Figure F.1 – Potential sources of costs		38
Figure F.2 – Example of cost elements used in a parametric cost analysis.....		39
Table G.1 – Summary of LCC comparison		43

INTERNATIONAL ELECTROTECHNICAL COMMISSION

DEPENDABILITY MANAGEMENT –**Part 3-3: Application guide – Life cycle costing****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60300-3-3 has been prepared by the IEC technical committee 56: Dependability.

This third edition cancels and replaces the second edition published in 2004. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) addition of a complete analysis process;
- b) greater reference to international accounting practices;
- c) increased discussion of financial concepts.

The text of this standard is based on the following documents:

FDIS	Report on voting
56/1713/FDIS	56/1720/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60300 series, published under the general title *Dependability management*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Life cycle costing is the process of performing an economic analysis to assess the cost of an item over a portion, or all, of its life cycle in order to make decisions that will minimize the total cost of ownership while still meeting stakeholder requirements. Generally, an organization may only be able to, or need to, evaluate cost for a portion of the total life of an item. Across the life of any item, decisions involving a trade-off between current and future costs will be necessary. This trade-off process will be enhanced by defining the short and long term implications of feasible expenditure decisions.

The principal use of this document is to compare one alternative system solution to another where future cost of ownership comprising maintenance, operations, enhancement and disposal actions is significant and require a balance between the cost of acquisition and the residual unrealized risk of ownership. Such a balance is achieved by technical and monetary assessments that take into account varying outcomes of availability, reliability, maintainability and supportability. Life cycle costing can also provide essential data to develop budgetary estimates.

This document is also intended to assist those who may be required to specify, commission and manage such activities when undertaken by others.

The highest value from life cycle costing is achieved early in the life of an item when many configuration options are possible and influence on future costs the greatest. Studies have shown that life cycle costs are mostly committed and the opportunity for affordable change is progressively reduced as item detailed design is approached.

Life cycle costing comprises only expense elements, which may be tangible or intangible; revenue or value outcomes are not included. Costs comprise all expected future expenditure including financial allowance for residual risk. Value outcomes, such as revenue, are analysed in the subsequent financial or economic trade-off analysis that use the results of the life cycle cost analysis.

Analysis outcomes are often presented as a single figure representing all future expenditures at a single point in time. The analysis may also be presented as a future cost profile without inclusion of the time value of money. However, as future costs are uncertain in both approaches, the analysis may also be presented as a probability distribution to highlight any potential sensitivity of the outcome to that uncertainty.

When assessing the impacts of potential options, analysts may need to cost intangible outcomes such as safety exposure, loss of public amenity or damage to corporate image. The use of multi-attribute rank ordering or semi-quantitative matrixes are not applicable for assessing these impacts as life cycle costing has a quantitative outcome of cost, namely: life cycle cost (LCC). Many quantitative techniques, such as “willingness to pay” or “choice modelling” have been developed and are often applied to assure all direct consequences are included in the analysis.

The approach defined in this document recognizes that life cycle costing has been applied for many decades across many industries, some of which have developed their own set of terms and language. An organization may adapt the terms used in this document to their context of use to ensure that the intent of this document is achieved.

DEPENDABILITY MANAGEMENT –

Part 3-3: Application guide – Life cycle costing

1 Scope

This part of IEC 60300 establishes a general introduction to the concept of life cycle costing and covers all applications. Although costs incurred over the life cycle consist of many contributing elements, this document particularly highlights the costs associated with the dependability of an item. This forms part of an overall dependability management programme as described in IEC 60300-1 [1]¹.

Guidance is provided on life cycle costing for use by managers, engineers, finance staff, and contractors; it is also intended to assist those who may be required to specify and commission such activities when undertaken by others.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1

acquisition cost

initial cost of developing and realizing an item so it can be utilized and placed into service

3.1.2

amortization

paying off of debt with a fixed repayment schedule in regular instalments over a period of time

Note 1 to entry: Amortization is also defined as the spreading out of capital expenses for intangible assets over a specific period of time (usually over the asset's useful life) for accounting and tax purposes.

3.1.3

base date

fixed point in time set as the common cost reference

3.1.4

cost breakdown structure

framework of cost elements so that they can be distinctly defined and estimated

¹ Numbers in square brackets refer to the Bibliography.