NATSPEC// Construction Information

TECHreport TR02

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Information classification systems and the Australian construction industry

This NATSPEC TECHreport provides an overview of the use of classification systems for organising construction information for various purposes. It outlines the relationship of existing national systems, including NATSPEC, to ISO 12006-2: 2015 *Organisation of information about construction works – Part 2: Framework for classification of information*. It also examines the significance of classification systems for the Australian design and construction industry, particularly for digital information technologies such as Building Information Modelling (BIM).

CONTENTS

Notes on changes in classification systems since the initial publication of this TECHreport in 2008.

- Some classification systems have changed significantly, e.g. Uniclass 2015.
- More infrastructure elements have been included in a number of systems.
- Influences of change include:
    - Changes to ISO 12006-2 between the 2001 and 2015 editions including modelling of compositional relationships.
    - ISO/IEC 81346, particularly on Danish and Swedish systems.
    - Increasing adoption of digital technologies including Building Information Modelling (BIM) and Digital Engineering (DE).
    - Increasing recognition of the value of classification as a means of organising and managing construction information.
    - National BIM programs.
    - International and national BIM standards.

Amendments to the 2008 TECHreport included this edition

- References to CI/SfB in comparisons of classification systems have been removed.
- Detailed comparisons of Omniclass and Uniclass Tables have been removed because, with the release of Uniclass 2015, the disparity between the two systems makes comparison at the level previously used of little value.
- Sections on buildingSMART standards such as IFC, IFD, IDM and MVD have been removed.
- Large parts of the section on classification systems for the Australian construction industry have been removed because they relate to a 2008 project that was never completed.
- Content about the uses and practical application of classification systems has been added.
- Some clauses renumbered.

REFERENCES AND REFERENCED STANDARDS

1 INTRODUCTION

1.1 The need for classification systems in the construction industry

The built environment is the most salient physical product of human society, requiring enormous collaborative effort. Collaboration on this scale entails extensive exchanges of information between large numbers of people for extended periods of time. Depending on their role, each participant has different information needs and responsibilities at different times of a built asset's life cycle.

Even the most rudimentary project relies on the participants being able to create, communicate and find relevant information at the appropriate time. The larger the scale of the project, and the greater the number of participants, the more essential it becomes to use methods and systems able to handle the associated complexities of information exchange. Classifying information in a consistent way, agreed by all participants, facilitates clear communication of intent and reduces the incidence of misunderstanding, conflict, and wasted resources. This is particularly important in the construction industry because the parties involved usually change from project to project.

2 CLASSIFICATION – A BRIEF OVERVIEW

2.1 Classification schemes

In essence, classification simply means the grouping together of like things according to some common quality or characteristic. This automatically implies the separation of the unlike.[1]

Before classifying a collection of subjects, it is at first necessary to define the purpose of the classification. Then the properties of interest to the classification may be distinguished, and finally the subjects can be sorted into classes with regard to the chosen properties.

2.1.1 Faceted classification

Here, each item is comprehended from multiple conceptual perspectives, or facets. The Oxford Dictionary defines facet as 'one side of a many-sided body'. Individual subjects are classified by describing them by the appropriate combination of each facet.[1] Facets are usually referred to as 'Tables' in most of the classification systems examined later.

2.1.2 Hierarchical or enumerative classification

A hierarchy, as used in classification, is a series of classes or groups in successive subordination; for example; Literature / English literature / English poetry / Early English poetry, etc. Thus, each subject class, (for example, English poetry) falls into a subgroup of a larger group (English literature), which in turn forms part of an even larger group (Literature). Such a classification scheme is created by a process of division, according to certain characteristics. As the process of division continues the hierarchical classification lists or 'enumerates' complex subjects. This may be contrasted with a faceted approach, which would list 'English' and 'poetry' as separate concepts, but not as a complete subject. In a properly designed hierarchical classification each subject should have only one place where it fits into the scheme.[1] Note that even in faceted systems, the subject within each facet is organised hierarchically.

Rather than becoming preoccupied with the abstract intricacies of any given scheme, the guiding principle for ordering subjects should always be how helpful it is likely to be for most of its intended users.[2]

2.2 Characteristics of classification schemes

2.2.1 Consistent terminology

Different people may use different terms to describe the same item, and individuals may use different terms to describe the same item on different occasions. For day-to-day purposes this might not cause any problems, but within a classification scheme this can cause confusion. For this reason, classification schemes usually rely on agreed definitions of terms and consistent usage, otherwise known as controlled language.

2.2.2 Notation

Notation refers to the short alphabetical, numerical or alphanumeric code applied to items in a classification system to identify facets and express the hierarchical relationships of their content.

While notation is a very important consideration, it should not be mistaken for the system itself. It is easy to think that choice of notation is the first step in the compilation of a classification scheme – in fact, it is one of the final steps. Notation provides a classification system with a short, unambiguous subject identifier facilitating quick navigation of the system. It also makes the system machine-readable.

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[1] Hunter, J.E. (1988). *Classification Made Simple*. Gower, Aldershot.

[2] Foskett, A. C. (1996). *The Subject Approach to Classification*. Library Association Publishing, London.

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For fuller coverage of this topic, refer to 'Principles of Classification' by John Cann'[3] https://icis.org/wp-content/uploads/2017/10/1997-06_Paper.Principles_of_Classification.pdf

2.3 Benefits of classification systems in the construction industry

Using classification systems to manage construction information facilitates:

- filing and retrieval of information on construction products, technical reference material, costs, etc.
- structuring the contents of individual documents in a consistent manner.
- co-ordinating information between individual documents found in sets of documents.
- communications and collaboration between members of a project team by providing a common language.
- interoperability of digital systems.
- organising BIM object libraries.
- searching for objects or items of a similar type in models.
- aggregating similar objects or items in models for the purposes of measurement, analysis, monitoring, etc.
- benchmarking measured values for assets of a similar type.
- exchanging and integrating asset information.
- standardising and consolidating reporting on items of interest.
- decision making about whole-of-portfolio investments.

2.4 Standards relevant to construction classification systems

Most construction information classification systems are based on the principles of ISO 12006-2 *Building Construction – Organization of information about Construction Works – Part 2: Framework for Classification* and *Part 3: Framework for Object-oriented Information*. This influence is a reflection of the trend away from the separate development of incompatible national systems and the convergence of systems based on shared international standards. See Appendix B for the relationship of Uniclass 2015 (UK) and Omniclass (North America) to ISO 12006-2.

ISO 12006-2:2015 *Building construction – Organization of information about Construction Works – Part 2: Framework for Classification of Information*

ISO 12006-2 defines a framework for the development of built environment classification systems and recommends a set of classification tables and their titles for a range of construction object classes according to particular views, e.g. buildings, construction elements, spaces. It also defines each class and shows how they are related to each other.

ISO 12006-2 does not describe a complete operational classification system. It is a framework level standard written for developers of classification systems with the aim of providing the basis for harmonising local classification systems. Several national classification systems applied the 2001 edition of the standard. The lessons learnt from these implementations have been applied to the 2015 edition.

A significant influence on the 2015 edition of ISO 12006-2 was the increasing application of Building Information Modelling to procurement and construction processes which relies on an object-oriented approach to data. One of the goals of revising the standard was to move it from classifying document based information to object-based data, and align it more closely with the approach found in ISO 12006-3 - Building Construction - Organization of Information about Construction Works - Part 3: Framework for Object-Oriented Information and buildingSMART standards such as Industry Foundation Classes (IFC).

The clearest expression of this in the 2015 edition is the recognition of the need for classification systems used by the construction industry to be able to model hierarchical compositional relationships in addition to the usual classification relationships, i.e. part-of relationships as well as type-of relationships.

[3] Cann, J. (1997). *Principles of Classification*. NBS Services (UK).

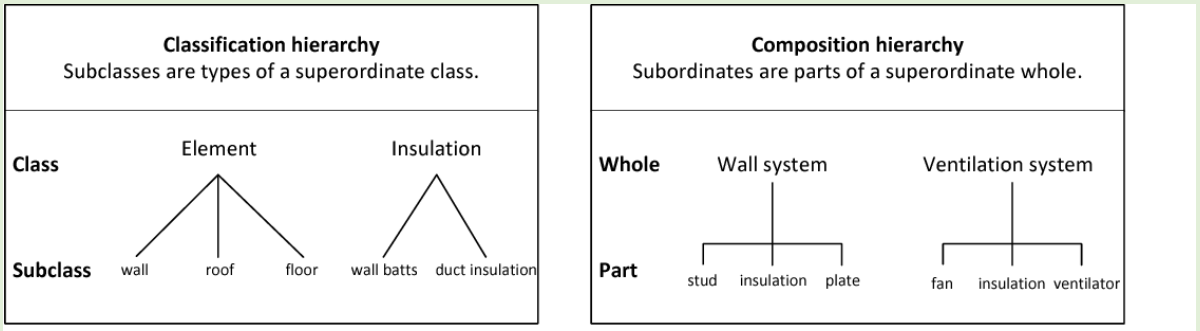

Figure 1. Illustration of a classification hierarchy and a composition hierarchy [ISO 12006-2, figure 2]

Classification terminology

Many of the terms used in this TECHreport are defined in ISO 12006-2. Refer to Appendix A for a list of them.

2.5 The relationship of classification systems to specifications

The distinction needs to be made between complete ISO 12006-2 based classification systems, such as Omniclass and Uniclass 2015, and the individual facets or Tables of these systems, which provide classifications of items of interest within its broader framework. The ISO 12006-2 Table A. 12 *Work Results* is where the classification system for specification work sections is usually located. ISO 12006-2 defines Work Result as:

A view of a construction result by type of work activity and resources used. A construction result is a construction object which is formed or changed in state as the result of one or more construction processes using one or more construction resources.

Work results usually correspond to individual construction systems built or assembled by a particular trade.

3 EXISTING NATIONAL CLASSIFICATION SYSTEMS

3.1 Australia

NATSPEC, the pre-eminent master building specification in Australia, is based on a classification system developed by its founder, Bryce Mortlock, in 1989. NATSPEC notation consists of numerical codes of up to four digits. The notation is hierarchical – for example 0311 *Concrete Formwork* is a subclass of 031 *Concrete,* which in turn is a subclass of 03 *Structure* (see Appendix E for a summary). There is currently no unified construction information classification system, similar to Uniclass 2015 or Omniclass, used nationally for a broad range of classification purposes.

The NATSPEC classification system was amended in 2005/2006 when NATSPEC and Masterspec of New Zealand agreed to align their systems more closely. Another significant amendment took place in 2007, when a large number of new worksections were introduced following the incorporation of AUS-SPEC, a master specification system used nationally by state and local government bodies for documenting small scale civil engineering, landscaping and infrastructure works, including their maintenance and operation.

Information on the NATSPEC National Classification System and resources to assist its implementation can be found at www.natspec.com.au/resources/national-classification-system

3.2 New Zealand (NZ)

Masterspec is New Zealand's market leading standard specification system, managed by Construction Information Limited (CIL) a company owned by the New Zealand Institute of Architects and the Registered Master Builder's Association. In 1998 CIL took over the work of a previous construction industry organisation and adopted the Coordinated Building Information (CBI) national classification system as the basis for organising Masterspec.

CBI was originally based on the 1987 British Common Arrangement of Work Sections (CAWS) system. CBI modified these systems to take into account local construction customs and practices, and to incorporate a four-level numeric notation that can be used to co-ordinate specification data as well as drawings, product data and research information. Visit https://masterspec.co.nz/CBI-Overview/7125/

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3.3 Denmark

Current system: Cuneco Classification System (CCS), was introduced in 2012 by the Cuneco Centre for Productivity in Construction and is now maintained by Molio - Byggeriets Videnscenter. The classification system is one of the five Cuneco tools for structuring building information to facilitate exchange between construction stakeholders. The others are Identification, Properties, Level of information and Measuring rules.

While CCS and the Swedish CoClass systems have tables aligned to ISO 12006-2, they have diverged from systems such as OmniClass and Uniclass 2015 through the incorporation of principles described in ISO/IEC 81346. See a description of ISO/IEC 81346 concepts and principles in the box at the end of this section.

Past systems: The first Danish system, called BC/Sfb, was based on the Swedish SfB system (See 2.7.9 Sweden). The DBK system (Dansk Bygge Klassifikation), developed in 2006, was based on ISO 12006-2 and created as part of a wider program called Digital Convergence which focused on introducing and implementing shared Information and Communication Technology (ICT) standards across the entire construction sector. Visit www.molio.dk/vaerktoejer/ccs

3.4 Finland

Current system: The Talo (Finnish for Building) 2000 classification system, published by the Building Information Foundation, is widely used across the Finnish construction industry in building specifications, bills of quantities, cost estimates, and for cost control.

Past systems: The development of Finnish classification systems started in the 1960s. Successive versions designated Talo 70, Talo 80 and Talo 90 have been published every decade since.

3.5 The Netherlands

The NL/SfB 2005, or 'Elementenmethode', is based on SfB, and is used in the Netherlands for the classification of building elements. As the NL/SfB system was developed during the analogue era, it is not ideally suited to digital systems. However, this has not prevented it from being widely applied on BIM projects. The Dutch building specification system, STABU^2, is produced by STABU, which is the abbreviation (in Dutch) for the 'Foundation for a National Standard Building Specification'. STABU was founded in 1975 and produced its first specification in 1986. From its earliest stages, the STABU^2 system was based on a relational database.

In 2005, NL/SfB was connected to the STABU^2 system, making it possible to reorganise work sections to building elements and vice versa. The next proposed development is to link the classification of elements to performance specifications, allowing users to start developing their specifications early in the design process.

Civil engineering works are specified using the RAW specification system. RAW is the abbreviation for 'Standard Conditions of Contract for Works of Civil Engineering Construction', published by the Centre for Research and Contract Standardisation in Civil and Traffic Engineering (CROW). RAW specifications do not use a formal classification system, but are broadly based on work sections and product groups. Visit www.bimloket.nl/NL-SfB

3.6 Sweden

Current system: CoClass was introduced in 2016: Like the Danish CCS system, CoClass has tables aligned to ISO 12006-2, but also incorporates principles derived from ISO/IEC 81346. See a description of ISO/IEC 81346 concepts and principles in the box at the end of this section. Visit https://coclass.byggtjanst.se/login

Past systems: The first Swedish classification system, developed in the 1950s, was called SfB (Samarbetskommittén för Byggnadsfrågor, [Co-ordination Committee for the Construction Industry]). The next system, BSAB (Byggandets Samordning AB, Construction Co-ordination Limited) was introduced in 1972. The Swedish Building Centre (SBC) released the next revision, BSAB 96, in 1999. The Swedish national building specification, the AMA, which uses the BSAB 96 classification system, was revised and republished by the SBC in 2001. AMA is the abbreviation (in Swedish) for 'General Material and Workmanship Specifications' [4]. CoClass is based on BSAB 96 and will progressively replace it.

3.7 United Kingdom (UK)

Current system: Uniclass 2015 was prepared by the National Building Specification (NBS) as part of an Innovate UK research competition to develop a Digital Toolkit for BIM, won by their parent company RIBA Enterprises in 2015. Uniclass 2015 is a key part of the UK government's suite of tools and processes underpinning Level 2 BIM requirements. Visit www.thenbs.com/our-tools/uniclass-2015

Past systems:

2014: Construction Project Information Committee (CPIC) passed its intellectual copyrights in Uniclass, including its development work in Uniclass 2, to the UK government to allow the system to be further developed for use with BIM.

[4] McGregor, C. (2001) *A description and comparison of national building specifications*. International Construction Information Society.

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A Uniclass 2 Beta search tool can be found at www.cpic.org.uk/uniclass1 and a PDF of all Tables can be downloaded from www.cpic.org.uk/uniclass1/2013-9-29_Uniclass1.4(Legacy%20Release).pdf

2013: Uniclass 2 published by CPIC.

2011: The revision of ISO 12006-2:2001 commences. This influences the development of Uniclass and other classification systems at the time. The revised standard was published in 2015.

2006: Uniclass Working Group established to update Uniclass. This included adopting a more consistent structure across the Tables and making it more suitable for use with digital applications.

1997: The first edition of Uniclass (Unified Classification for the Construction Industry) published was a faceted system designed within the parameters of ISO TR 14177. [3] and derived from a number of pre-existing classification systems such as CI/SfB.

3.8 North America

Current system: Omniclass is a faceted system designed within the parameters of ISO 12006-2 and ISO 12006-3. The majority of the 15 Omniclass Tables were first published in 2006. The most recently revised Tables were published in 2013. A group of volunteers from organisations and firms representing a broad cross section of the construction industry recognised a need for classifying construction subjects, the increased use of electronic information technology, and the expanding focus on the complete life cycle of construction. Omniclass freely adapted and used the 1997 edition of Uniclass in its development, and therefore shares many legacy documents with it. The most significant points of departure include:

- The adoption of MasterFormat as the basis of Omniclass Table 22 *Work results*. MasterFormat is the pre-eminent means of organising commercial and institutional construction specifications, such as MasterSpec, in North America. It is published in by the Construction Specifications Institute (CSI). The most recent edition was published in 2004. Visit www.csiresources.org/standards/masterformat
- The adoption of UniFormat as the basis of Omniclass Table 21 Elements (including designed elements). UniFormat provides a standard method of arranging construction information, organised around the physical parts of a facility called systems and assemblies. It is used for formatting documents on project scope, quality, cost and time, such as cost estimates or reports (see Appendix D for a list of Tables). [5] The most recent edition of UniFormat was published in 2010. Visit www.csiresources.org/standards/uniformat

Omniclass notation consists of numerical codes, generally of six digits. These can be extended by adding more digits after a decimal point. The notation is hierarchical (see Appendix E for a summary of Table 22). Visit www.csiresources.org/standards/omniclass.

ISO/IEC 81346 ISO 81346 *Industrial systems, installations and equipment and industrial products – structuring principles and reference designations*

ISO 81346 describes a system for organising information about constructed assets or installations, and the many components from which they are assembled. The Parts of most interest to the AECO industry are:

- Part 1: *Basic rules*
- Part 2: *Classification of objects and codes for classes*
- Part 12: *Construction works and building services*

Traditional faceted classification systems look at the components of construction from a number of perspectives resulting in the same component appearing in more than one Table, e.g. a door can appear in the elements, work results and products Tables, and have a different notation in each.

ISO 81346-based classifications adopt an object-based view of components and adopt a different strategy to classifying them. Instead of including a large number of subclasses of doors, for example – with a correspondingly large number of notation enumerations – a smaller set of parent classes is adopted and subclasses are differentiated by adding properties to them.

This approach has a number of advantages when managing information about items over the whole design-construction-operation lifecycle, particularly when using object-based BIM applications. It means a single notation can applied at the outset and suffixes added, as required throughout the project, to differentiate it from other items. This stability means items do not have to be reclassified and reinterpreted by stakeholders at different stages of the project.

[5] OCCS Development Committee. (2019) *OmniClass Introduction and User's Guide – Edition: 2.1, 2019-02-22 Release*. Construction Specifications Institute Inc.

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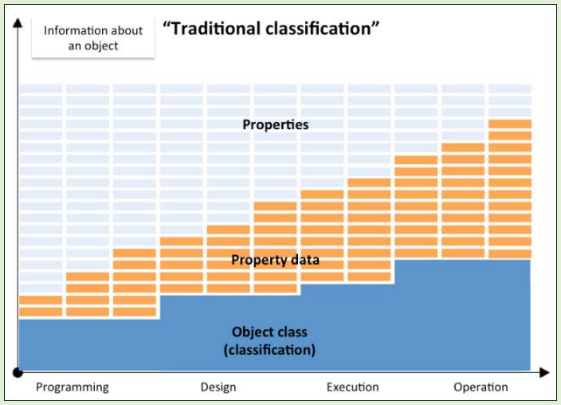
Uniformat Classification	Revit Category
No classification	
B - Shell	
B20 - Exterior Enclosure	
B2030 - Exterior Doors	
B2030100 - Glazed Doors & Entrances	Doors
B2030110 - Exterior Glazed Doors - Aluminum	Doors
B2030120 - Exterior Glazed Doors - Steel	Doors
B2030130 - Exterior Glazed Doors - Wood	Doors
B2030200 - Solid Exterior Doors	Doors
B2030210 - Exterior Solid Doors - Aluminum	Doors
B2030220 - Exterior Solid Doors - Steel	Doors
B2030230 - Exterior Solid Doors - Wood	Doors
B2030300 - Revolving Doors	Doors
B2030400 - Overhead Doors & Roll-up Grilles	Doors
B2030410 - Overhead Doors	Doors
B2030420 - Roll-up Grilles	Doors
B2030500 - Door Wall Opening Elements	Doors
B2030900 - Other Exterior Doors	Doors
C - Interiors	
C10 - Interior Construction	
C1020 - Interior Doors	
C1020100 - Interior Doors	Doors
C1020110 - Interior Doors - Metal	Doors
C1020120 - Interior Doors - Wood	Doors
C1020200 - Interior Door Frames	Doors
C1020210 - Interior Door Frames - Metal	Doors
C1020220 - Interior Door Frames - Wood	Doors
C1020300 - Interior Doors with Frames	Doors
C1020310 - Interior Metal Doors with Metal Frames	Doors
C1020320 - Interior Wood Doors with Metal Frames	Doors
C1020330 - Interior Wood Doors with Wood Frames	Doors

OmniClass lists 211 types of doors

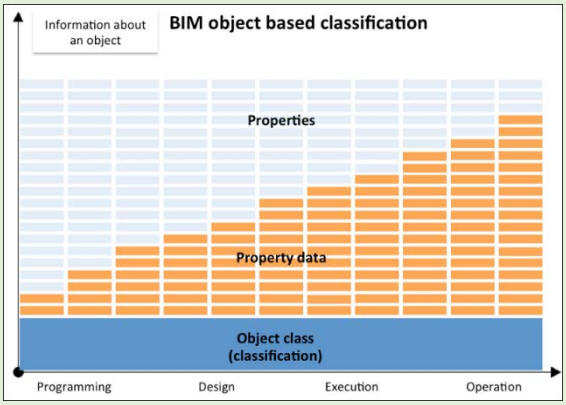
- 18 in Table 21 Elements
- 66 in Table 22 Work results
- 127 in Table 23 Products

Cuneco Classification System and CoClass (ISO 81346 based) lists one type of door with the option to add many properties

(Other related objects include hatches, gates and large doors, e.g. garage doors)



A typical or traditional classification with different classification tables for different participants and purposes and specialized subtype classes incorporating more and more properties embedded in the code.



An object-oriented, generic and stable classification with one entry class that is used all through the lifecycle combined with an increasing number of properties.

Aspects

In ISO 81346 the many components – physical and non-physical – that comprise constructed assets are referred to generically as objects. Using the principles for structuring objects described in the standard allows even very large sets of information about complex installations to be handled efficiently.

To do this, the ISO 81346 system looks at objects or systems from multiple perspectives called aspects:

- The function aspect is used to highlight the functional relationships between components independently of products, physical solutions or the location of the object, e.g. support, protection, control, distribution.
- The product aspect is used to highlight the constructional (assembly) relationships between components (tangible products) independently of where the product is located and which function it fulfils, e.g. beam, cladding, sensor, duct.
- The location aspect is used to highlight the relationship between components either spatially or relative to other components in a system, e.g. site, level, room, return air system No. 2.

- The type aspect highlights the membership of a group of objects to a class of objects sharing a common set of properties, not specific instances of objects, e.g. doors, electrical systems, offices.

In practice, using a single aspect is the most common use case. However, using multiple aspects can provide valuable additional functionalities. Multiple aspects 'triangulate' the object and allow its relationship to other objects in an assembly or system to be very clearly and accurately described in ways not possible with a single aspect.

Structure of classification systems based on ISO 81346

Tables in traditional classification systems arrange classes of items in a hierarchical order of specialisation: types are subdivided into subtypes, and so on, in accordance with given aspects. In practice, it can be difficult to select a single aspect/principle of specialisation that can be consistently applied to all items. Classes of doors, for example can be subdivided by mode of operation (swinging, sliding), material (timber, metal), form of construction (flush panel, framed), etc. The many subtypes and permutations that need to be identified generally results in long and complex tables. For similar reasons, consistency within and between tables is also difficult to achieve.

Systems based on ISO/IEC 81346 are structured differently. They rely on a smaller group of Functional Systems, Technical Systems and Components – items corresponding roughly to the Elements, Work results/Systems and Product Tables of ISO 12006-2 based systems – and differentiate them by assigning different properties to them, e.g. A door is always designated as a door but subtypes are defined by their properties. The ISO/IEC 81346 designation or classification notation reflects this: Additional notations are appended to the initial/root notation as the item is progressively defined throughout the design and documentation process. This results in a more stable and recognisable designation over the life of a project. In comparison, it is usually necessary to completely change the notation in non-ISO/IEC 81346 systems over the life of the project as the item is classified as an Element, Work Result/System or Product for different purposes by each stakeholder. As described in more detail below, the ISO/IEC 81346 notation system is also quite different to the others in appearance and function.

4 A COMPARISON OF OMNICLASS, UNICLASS, CUNECO AND COCLASS SYSTEMS

4.1 Overview

All these systems are multi-facet or multi-table classification systems aligned to ISO 12006-2.

OmniClass and Uniclass followed a similar development path in that they were both assembled from pre-existing single table systems. As Uniclass has been through more development iterations than OmniClass (Uniclass 1997, Uniclass 2, Uniclass 2015), it is – as one would expect – more integrated and consistent.

Cuneco Classification System (CCS) and CoClass have had a number of national predecessors – CCS was preceded by the DBK and BC/SfB systems; CoClass was preceded by the BSAB and SfB systems. While CCS and CoClass have similar tables aligned to ISO 12006-2 as OmniClass and Uniclass, they have diverged from these systems in a fundamental way through the incorporation of principles derived from ISO/IEC 81346.

4.2 Comparison of Uniclass 2015 and Omniclass

4.2.1 Availability

Excel files of tables for both systems can be readily downloaded online at no cost. OmniClass tables are also available as PDF files. Uniclass 2015 can be browsed or searched via an online tool. See www.thenbs.com/our-tools/uniclass-2015.

4.2.2 Content and scope

OmniClass covers some sectors in great detail but not others. Uniclass 2015 does not match OmniClass detail in some sectors but covers buildings, civil and landscape works, transport and utilities infrastructure and process engineering more evenly and consistently within Tables. It includes plenty of spare locations to add more entries.

4.2.3 Structure of Tables

Uniclass 2015 is a more consistent and integrated system than Omniclass; a reflection of the fact that it was effectively created from scratch and could build on the lessons of previous systems.

The internal structure of Uniclass 2015 Tables follow a more consistent pattern because the basis of specialisation has been more consistently applied. As a result, the hierarchical organisation of the notation system is more consistent in Uniclass 2015. These hierarchical patterns are also applied more consistently across Tables, facilitating the multifaceted classification of items. This consistency makes patterns in the organisation of the system more recognisable for users.

4.2.4 Alignment of tables

Being both based on ISO 12006-2; there are recognisable similarities between the Tables in each system. However, each places them in a slightly different order, and splits or combines some of them differently. The Systems Table in Uniclass 2015 is not found in ISO 12006-2 but it sits in a similar position as the Work Results Table between the Elements and Products Tables.

4.2.5 Ongoing development

Uniclass 2015 is updated more frequently. It also appears easier for Uniclass 2015 stakeholders to request changes and extensions to the system than OmniClass. Direct channels are available for providing feedback and shaping the system's development.

4.3 Comparison of OmniClass/Uniclass and CCS/CoClass

4.3.1 Introduction

For this comparison OmniClass is grouped with Uniclass 2015, and CCS is grouped with CoClass because each pair represents two distinct approaches to classification. Because CCS and CoClass have been developed in parallel and incorporate principles from ISO/IEC 81346, the differences between them is much less than those between OmniClass and Uniclass 2015. For this reason, CCS has not been compared with CoClass in this document.

4.3.2 Structure

See notes under *Structure of classification systems based on ISO 81346* in the ISO 81346 feature box at the end of Section 2.8.

As OmniClass and Uniclass 2015 represent a more established approach to classification, they will be more recognisable to most industry stakeholders. However, in some regards, CCS and CoClass systems – when implemented – are easier to grasp. To illustrate: instead of listing multiple types of doors across a number of tables, with different notations in each table, as found in OmniClass/Uniclass, CCS/CoClass lists a single type – door – and differentiates subtypes of doors by the properties assigned to them, e.g. swinging, sliding, timber, metal, interior, exterior, fire-rated or not. The advantage of this arrangement is that the initial, or root, notation for door remains unchanged throughout a project. Details of the door are progressively defined during the design, documentation, procurement and operational phases of a project simply by adding or amending relevant properties. This approach is well suited to BIM processes.

4.3.3 Notation

For many people the most salient feature of a classification system is the notation or coding used to identify and order individual items within it. In this regard, OmniClass'/Uniclass' largely numerical notations reflect the hierarchical ordering of items familiar to regular users of classification systems. CCS/CoClass notations are based on the three-part Reference Designation System (RDS) described in ISO/IEC 81346 which is both human and machine readable. When implemented in a basic way these notations consist of relatively simple one, two or three letter codes. More sophisticated implementations providing advanced functionalities such as making it possible to identify an individual item and its precise location/relationship to other items within a project, however, result in notations which, for many, will not be readily interpretable at first sight, e.g. -D1.AE1.BE1.ULE3.

The complexity of the notation system may not represent the sort of disadvantage it once would have. When classification systems were only available in printed form, their usefulness relied heavily on their users becoming reasonably familiar with their structure and notations. The increasing scale and granularity of classification systems means that fewer potential users are likely to become as intimately familiar with them as past systems. The reality is that nowadays for classifications systems to be widely adopted and used, they have to be incorporated in commonly used digital tools. When ISO/IEC 81346 based systems are well integrated, their advantages become more obvious and their complexity becomes less of an issue.

5 CURRENT TRENDS IN THE CONSTRUCTION INDUSTRY IMPACTING ON CLASSIFICATION SYSTEMS

5.1 The impact of information and communication technology (ICT)

ICT has had a profound impact on the working methods of the construction industry. ICT is well suited to the fluid and dynamic environment of design and management processes, compared to traditional paper-based methods. Developments in communications, such as the internet, have also significantly improved the ability to access and distribute information.

The concept of Building Information Models (BIM) is one ICT application to emerge recently that is likely to have significant implications for the construction industry (See Appendix A on BIM).

5.2 Interoperability

With respect to software, the term interoperability is used to describe the capability of different programs to exchange data via a common set of exchange formats, to read and write the same file formats, and to use the same protocols. Interoperability relies on software developers adopting agreed standards when creating their applications.[6]

Interoperability is facilitated by standards being open, their specification public, and without restrictions in their access or implementation. It improves communications, maintains the integrity of data, and reduces the prevalence of conflicting and ambiguous information which leads to construction errors, defects and wasted resources. Interoperability is crucial to realise the full potential and benefits of ICT, including applications such as BIM.

buildingSMART International is the most active organisation promoting interoperability in the construction industry. It is a worldwide alliance of construction industry organisations, comprising 20 international chapters. It is dedicated to bringing about coordinated changes for the improvement of productivity and efficiency in the construction and facilities management industry. Australia and New Zealand joined as a chapter in 1997. The IAI now operates under the name buildingSMART International.

5.3 The continued relevance of classification systems

The need for information classification systems within the construction industry is more pressing today than ever. The information-rich environment of the construction industry increasingly demands appropriate classification systems.[7]

Some might argue that full text search and keywords make classification obsolete, but data needs to be organised somehow, and it is very convenient if the supplier and user of the data can use the same structure. [8]

Robust industry classification systems have the potential of forming the firm foundations necessary for realising the full benefits of BIM. There are already many existing, widely used computer applications whose full potential could be realised by the adoption of uniform classification systems.

5.4 Implementation of classification systems

ICT will have a fundamental impact on the way any new or amended information classification system will be implemented, compared to the implementation of previous paper-based systems of the past. Any classification system is now likely to be created on a computer, distributed by digital means, and used in a digital environment. It would be unrealistic to expect someone working most of the time in a CAD or word processing environment, for example, to refer to a large printed classification manual or index. The nature of classification systems suggests a database platform as their natural vehicle.

6 CLASSIFICATION SYSTEMS FOR THE AUSTRALIAN CONSTRUCTION INDUSTRY

6.1 The current position

The need for a comprehensive, widely adopted information classification system for the Australian construction industry is imperative with the increasing use of data-based applications such as BIM.

The adoption of ISO 12006-2 enables mapping between localised classification systems which have developed worldwide.[9] The increasing numbers of Australian construction industry companies operating in the global market suggest that it would make strategic sense to adopt ISO 12006-2 as the basis of any new classification system.

6.2 Development options for a classification system

ISO 12006-2 provides a framework of Tables for a faceted classification system without details about how the content of these Tables should be structured. The NATSPEC classification system is the most widely used Australian system. It corresponds to the Work Result Table of ISO 12006-2. Few other classification systems exist that immediately suggest themselves as the basis of the other remaining Tables.

7 SELECTING CLASSIFICATION SYSTEMS

7.1 Assessment criteria

- The primary assessment criteria should always be: ‘How useful will this be for users?’

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[6] Wikipedia on-line article. (2016) *Interoperability.* http://en.wikipedia.org/wiki/Interoperability

[7] OCCS Development Committee. (2019) *OmniClass Introduction and User’s Guide – Edition: 2.1, 2019-02-22 Release.* Construction Specifications Institute Inc.

[8] Howard, R. (2001) *Classification of building information – European and IT systems.* Construction Informatics Digital Library.

[9] OCCS Development Committee. (2019) *OmniClass Introduction and User’s Guide – Edition: 2.1, 2019-02-22 Release*. Construction Specifications Institute Inc.

- Alignment with existing procurement, administrative and production systems, particularly those used by primary clients.
- Scalability: The system should be able to be scaled up in response to the increasing demands that will inevitably be placed on it. A simple system may have initial appeal but cause problems later if it cannot be scaled.
- All recommendations and proposals need to be measured against their implications at the implementation stage. For example, if user requirements suggest a custom-designed software application, identify what sort of development program and costs would be associated with it, whether it is likely to be widely used, and whether the benefits will outweigh the costs.
- Specific proposals for the classification system and any associated product, such as computer applications, need to be assessed not just in terms of their production cost, but also their promotion, distribution, support and on-going development costs. That is, a whole systems approach is required to avoid the waste of significant effort. A number of classification systems have not achieved wide adoption due to insufficient promotion and support. Some systems, such as those used by construction product information suppliers, e.g. Infolink and Selector.com, are more like a collection of product categories, and are not well suited for other classification purposes.

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9 REFERENCED STANDARDS

ISO TR 14177: 1994 *Classification of Information in the Construction Industry*. (Withdrawn)

ISO 12006-2: 2015 *Building Construction – Organization of information about Construction Works – Part 2: Framework for Classification of Information*.

ISO 12006-3: 2007 *Building Construction – Organization of information about Construction Works – Part 3: Framework for Object-oriented Information.* (Under review in 2019)

ISO 6707-1: 2017 *Buildings and civil engineering works – Vocabulary – Part 1: General terms.*

ISO/PAS 16739:2005 *Industry Foundation Classes, Release 2x, Platform Specification (IFC2x Platform)*

10 APPENDIX A: TERMINOLOGY

10.1 Classification terminology from ISO 6707-1:2017

Classification: a set of concepts arranged systematically according to distinguishing properties.

10.2 Terms and definitions from ISO 12006-2: 2015

Visit the ISO Online Browsing Platform (OBP) www.iso.org/obp for definitions of the following terms.

General

- Object
- Construction object
- Construction system
- Type-of relation
- Part-of relation
- Natural environment
- Built environment
- Space
- Activity space

Construction resource

- Construction agent
- Construction aid
- Construction information
- Construction product
- Construction resource

Construction process

- Construction activity
- Construction process
- Construction process lifecycle
- Design process
- Production process
- Maintenance process
- Management

Construction result

- Construction complex
- Construction entity
- Construction element
- Built space
- Zone
- Construction result
- Construction result lifecycle
- Work result

Construction property

- Construction property

10.3 Other terms

10.3.1 BIM

BIM stands for Building Information Models or Building Information Modelling. The American Institute of Architects (AIA) has defined BIM as "*a model-based technology linked with a database of project information*", and this reflects the general reliance on database technology as its foundation. [10] While BIM incorporates the 3D modelling capabilities of earlier software, its real power is derived from the fact that individual objects representing component parts of the total model have data files associated with them. In traditional CAD systems 3D objects were graphical entities only, such as lines, arcs and circles. With BIM systems the data file associated with each object in the model can hold information on a large number of attributes, such as weight, structural, thermal and acoustic properties, power requirements, heat and light output, cost, manufacturer's details and maintenance requirements. In addition, relationships to other objects, beyond simply spatial ones; such as constraints and rules of interaction; can be defined.

BIM is called a rich model, because all objects in it have properties and relationships and this information can be mined for data. [11] Quantities and shared properties of materials can easily be extracted. Scopes of work can be isolated and defined. Simulations can run to determine the structural, thermal and acoustic behaviour of a proposed building. BIM can be used to demonstrate the entire building life cycle, including the processes of construction and facility operation.

BIM provides the potential for a virtual information model to be shared by the whole design team (architects, surveyors, consulting engineers, and others), allowing all parties to work on a single, up-to-date model – a concept

[10] CRC Construction Innovation. (2007) *Adopting BIM for facilities management – Solutions for managing the Sydney Opera House*. CRC Construction Innovation.

[11] Royal Australian Institute of Architects. (2007) *Towards Integrated Practice – A Rapid Tour*. (2007) RAIA conference paper.

APPENDIX A: TERMINOLOGY

called integrated practice. This information model can also be passed on to contractors, facility managers, etc so that they can extract information of interest to them. The major benefit of a BIM is that individuals with different information needs can filter out the bulk of information not relevant to their needs, while still knowing it has been co-ordinated with the total model, and is up-to-date at the time of inquiry.

10.3.2 Express

A conceptual schema language which provides for the specification of classes belonging to a defined domain, the information or attributes pertaining to those classes (colour, size, shape etc.), and the constraints on those classes (unique, exclusive etc.). It is also used to define the relations which exist between classes and the numerical constraints applying to such relations.

10.3.3 Object oriented programming

A type of programming in which programmers define not only the data type of a data structure, but also the types of operations (functions) that can be applied to the data structure. In this way, the data structure becomes an object that includes both data and functions. In addition, programmers can create relationships between one object and another. For example, objects can inherit characteristics from other objects.

One of the principal advantages of object-oriented programming techniques over procedural programming techniques is that they enable programmers to create modules that do not need to be changed when a new type of object is added. A programmer can simply create a new object that inherits many of its features from existing objects. This makes object-oriented programs easier to modify.

11 APPENDIX B: RELATIONSHIP OF SOME CLASSIFICATION SYSTEMS TO ISO 12006-2 AND ISO 81346

Table 1 - Relationship of some current classification systems to international standards

ISO 12006-2:2015			OmniClass North America		Uniclass UK		Cuneco (CCS) Denmark	CoClass Sweden	ISO 81346
Table reference and class		Classified by	Table reference		Table reference		Reference	Reference	Reference
A.2	Construction information	Content	36	Information	FI	Form of information	A104 Document Management (metadata)	-	-
A.3	Construction product	Function or form or material or any combination of these	23	Products	Pr	Products	Components	Components	Components (Inherent function of object) (Part 2, Tables 2, 3)
			41	Materials					
A.4	Construction agent	Discipline or role or any combination of these	33	Disciplines	Ro	Roles	A104 Document Management (metadata)	-	-
			34	Organisational roles					
A.5	Construction aid	Function or form or material or any combination of these	35	Tools	TE	Tools and Equipment	Equipment	-	-
A.6	Management	Management activity	32	Services	PM	Project Management	A104 Document Management (metadata)	-	-
A.7	Construction process	Construction activity or construction process lifecycle stage or any combination of these	31	Phases	-	-	A104 Document Management (metadata)	-	-
A.8	Construction complex	Form or function or user activity or any combination of these	-	-	Co	Complexes	-	Construction complex	-
A.9	Construction entity	Form or function or user activity or any combination of these	11	Construction entities by function	En	Entities	Construction entity	Construction entity	-
			12	Construction entities by form					
A.10	Built space	Form or function or user activity or any combination of these	13	Spaces by function	SL	Spaces/ locations	Built spaces/User spaces	Space	Spaces (Part 2, Table 4)
			14	Spaces by form					
A.11	Construction element	Function or form or position or any combination of these	21	Elements (including designed elements) (UniFormat)	EF	Elements/ functions	Functional systems Technical systems Components	Functional systems Constructive systems Components	Functional systems (Part 12, Table A.1) Technical systems (Part 12, Table A.2)
A.12	Work result	Work activity and resources used	22	Work results (MasterFormat)	Ss	Systems *	-	-	-
A.13	Construction Property	Property type	49	Properties	-	-	Classes of Properties	Properties	-
-	-	-	-	-	Ac	Activities	-	-	-
-	-	-	-	-	Zz	CAD	-	-	-
-	-	-	-	-	-	-	-	Landscape information	-

12 APPENDIX C: UNICLASS AND OMNICLASS TABLES

12.1 UNICLASS 2015 TABLES

A full list of tables in Uniclass 2015.

Table	Edition and publication date
Co - Complexes	v1.11, Published July 2020
En - Entities	v1.17, Published July 2020
Ac - Activities	v1.12, Published July 2020
SL - Spaces/ Locations	v1.17, Published July 2020
EF - Elements/ Functions	v1.6, Published July 2019
Ss - Systems	v1.19, Published July 2020
Pr - Products	v1.19, Published July 2020
TE - Tools and Equipment	v1.7, Published January 2020
PM - Project Management	v1.9, Published July 2020
Zz - CAD	v1.0, Published July 2015
FI - Form of Information	v1.3, Published January 2020
Ro - Roles	v1.3, Published January 2020

12.2 OMNICLASS TABLES

A full list of Tables in Omniclass.

Table	Status	Release date
Table 11 - Construction Entities by Function	Pre Consensus Approved Draft	26/02/2013
Table 12 - Construction Entities by Form	Pre Consensus Approved Draft	30/10/2012
Table 13 - Spaces by Function	National Standard	16/05/2012
Table 14 - Spaces by Form	Released	28/03/2006
Table 21 - Elements (includes Designed Elements)	National Standard	16/05/2012
Table 22 - Work Results	National Standard	16/05/2012
Table 22 - Work Results	Pre Consensus Approved Draft	25/08/2013
Table 23 - Products	National Standard	16/05/2012
Table 31 - Phases	Pre Consensus Approved Draft	30/10/2012
Table 32 - Services	National Standard	16/05/2012
Table 33 - Disciplines	Pre Consensus Approved Draft	30/10/2012
Table 34 - Organizational Roles	Pre Consensus Approved Draft	30/10/2012
Table 35 - Tools	Draft	28/03/2006
Table 36 - Information	National Standard	16/05/2012
Table 41 - Materials	Pre Consensus Approved Draft	30/10/2012
Table 49 - Properties	Pre Consensus Approved Draft	30/10/2012

13 APPENDIX D: WORK RESULTS TABLES FROM UNICLASS, OMNICLASS AND NATSPEC

13.1 UNICLASS 2015

13.1.1 Table Ss – Systems – Level 1

Note: For practical purposes the Systems Table acts as a Work Results Table in the Uniclass 2015 system.

Code	Title
Ss_15	Earthworks, remediation and temporary systems
Ss_20	Structural systems
Ss_25	Wall and barrier systems
Ss_30	Roof, floor and paving systems
Ss_35	Stair and ramp systems
Ss_37	Tunnel, shaft, vessel and tower systems
Ss_40	Signage, fittings, furnishings and equipment (FF&E) and general finishing systems
Ss_45	Flora and fauna systems
Ss_50	Disposal systems
Ss_55	Piped supply systems
Ss_60	Heating, cooling and refrigeration systems
Ss_65	Ventilation and air conditioning systems
Ss_70	Electrical systems
Ss_75	Communications, security, safety, control and protection systems
Ss_80	Transport systems

APPENDIX D: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

13.2 OMNICLASS

13.2.1 Table 22 – Work Results – Level 1

22-01 00 00	General requirements
22-02 00 00	Existing Conditions
22-03 00 00	Concrete
22-04 00 00	Masonry
22-05 00 00	Metals
22-06 00 00	Wood, Plastics, and Composites
22-07 00 00	Thermal and Moisture Protection
22-08 00 00	Openings
22-09 00 00	Finishes
22-10 00 00	Specialties
22-11 00 00	Equipment
22-12 00 00	Furnishing
22-13 00 00	Special Construction
22-14 00 00	Conveying Equipment
22-21 00 00	Fire Suppression
22-22 00 00	Plumbing
22-23 00 00	Heating, Ventilating, and Air - Conditioning (HVAC)
22-25 00 00	Integrated Automation
22-26 00 00	Electrical
22-27 00 00	Communications
22-28 00 00	Electronic Safety and Security
22-31 00 00	Earthwork
22-32 00 00	Exterior Improvements
22-33 00 00	Utilities
22-34 00 00	Transportation
22-35 00 00	Waterway and Marine Construction
22-40 00 00	Process Integration
22-41 00 00	Material Processing and Handling Equipment
22-42 00 00	Process Heating, Cooling, and Drying Equipment
22-43 00 00	Process Gas and Liquid Handling, Purification, and Storage Equipment
22-44 00 00	Pollution and Waste Control Equipment
22-45 00 00	Industry-Specific Manufacturing Equipment
22-46 00 00	Water and Wastewater Equipment
22-48 00 00	Electrical Power Generation

APPENDIX D: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

13.3 NATSPEC

13.3.1 Worksection (Work Results) classification

00 PLANNING AND DESIGN (AUS-SPEC)

0010 Quality requirements for design
0012 Waterfront development
0013 Bushfire protection (Design)
0021 Site regrading
0022 Control of erosion and sedimentation (Design)
0041 Geometric road design
0042 Pavement design
0043 Subsurface drainage (Design)
0044 Pathways and cycleways (Design)
0051 Geometric rural road design – sealed
0052 Geometric rural road design – unsealed
0053 Rural pavement design – sealed
0054 Rural pavement design - unsealed
0061 Bridges and related structures
0071 Water supply - reticulation (Design)
0072 Water supply - pump stations (Design)
0074 Stormwater drainage (Design)
0076 Sewerage systems - reticulation (Design)
0077 Sewerage systems - pump stations (Design)

01 GENERAL

0110 Specification cover sheet
0111 Tendering cover sheet
0112 Multiple contracts cover sheet
0113 Amendment record sheet
0120 Pre-tendering contract preparation (AUS-SPEC)
0121 Tendering
0122 Information for tenderers (AUS-SPEC)
0123 Conditions of tendering (AUS-SPEC)
0124 Tendering submission documents (AUS-SPEC)
0125 Standard contract checklists (AUS-SPEC)
0126 Period supply and service checklists (AUS-SPEC)
0127 Commissioning - Information
0131 Preliminaries (Generic)
0133 Preliminaries (Interior and alterations)
0134 General requirements (Supply) (AUS-SPEC)
0135 General requirements (Services) (AUS-SPEC)
0136 General requirements (Construction) (AUS-SPEC)
0138 Multiple contracts
0140 Preliminaries – ABIC BW-2018C
0141 Preliminaries - ABIC MW-2018
0142 Preliminaries - ABIC SW-2018
0143 Preliminaries - AS 2124
0144 Preliminaries - AS 4000
0145 Preliminaries - AS 4905
0146 Preliminaries - AS 4902
0147 Conditions of contract (AUS-SPEC)
0148 Preliminaries – ABIC EW-1
0152 Schedule of rates (Construction)
0153 Schedules - period supply and service
0160 Quality
0161 Quality management (Construction) (AUS-SPEC)
0162 Quality (Supply) (AUS-SPEC)
0163 Quality (Delivery) (AUS-SPEC)
0164 Commissioning
0167 Integrated management (AUS-SPEC)
0171 General requirements
0172 Environmental management
0173 Environmental management (AUS-SPEC)
0181 Adhesives, sealants and fasteners
0182 Fire-stopping
0183 Metals and prefinishes
0184 Termite management
0185 Timber products finishes and treatment
0191 Sundry items
0192 Structural components
0193 Building access safety systems
0194 Door seals and window seals
0195 Tactile indicators and stair edgings

02 SITE

0201 Demolition
0202 Demolition (Interior and alterations)
0221 Site preparation
0222 Earthwork
0223 Service trenching
0224 Stormwater - site
0241 Landscape - walling and edging
0242 Landscape - fences and barriers
0243 Landscape – water features
0250 Landscape - combined
0251 Landscape - soils
0252 Landscape – natural grass surfaces
0253 Landscape - planting
0254 Irrigation
0255 Landscape – plant procurement
0256 Landscape – establishment
0257 Landscape – road reserve and street trees (AUS-SPEC)
0259 Landscape – maintenance
0261 Landscape - furniture and fixtures
0262 External sports and playground surfacing
0271 Pavement base and subbase
0272 Asphalt
0273 Sprayed bituminous surfacing
0274 Concrete pavement
0275 Paving - mortar and adhesive bed
0276 Paving - sand bed
0277 Pavement ancillaries
0278 Granular surfaces
0279 Paving - on pedestals
0281 Fire access and fire trails
0282 Pathways and cycleways (Construction)
0292 Masonry walls
0293 Crib retaining walls
0294 Gabion walls and rock filled mattresses

03 STRUCTURE

0301 Piling
0310 Concrete – combined
0311 Concrete formwork
0312 Concrete reinforcement
0313 Concrete post-tensioned
0314 Concrete in situ
0315 Concrete finishes
0318 Shotcrete

APPENDIX D: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

0319 Auxiliary concrete works (AUS-SPEC)
0321 Precast concrete
0322 Tilt-up concrete
0325 Concrete protection
0331 Brick and block construction
0332 Stone masonry
0333 Stone repair
0334 Block construction
0335 Brick construction
0341 Structural steelwork
0342 Light steel framing
0343 Tensioned membrane structures
0344 Steel - hot dip galvanized coatings
0345 Steel - protective paint coatings
0346 Structural fire protection systems
0361 Monolithic stabilised earth walls
0362 Mud brick walls
0363 Straw bale walls
0381 Structural timber
0382 Light timber framing
0383 Sheet flooring and decking
0385 Massive timber construction systems

04 ENCLOSURE

0411 Waterproofing - external and tanking
0421 Roofing - combined
0423 Roofing - profiled sheet metal
0424 Roofing - seamed sheet metal
0425 Roofing - shingles and shakes
0426 Roofing - slate
0427 Roofing - tiles
0428 Roofing – insulated panel systems
0429 Translucent roofing
0431 Cladding - combined
0432 Curtain walls
0433 Stone cladding
0434 Cladding - flat sheets and panels
0435 Cladding - planks and weatherboards
0436 Cladding - profiled and seamed sheet metal
0437 Cladding - insulated panel systems
0438 Cladding - cement board
0439 Cladding - systems
0451 Windows and glazed doors
0453 Doors and access panels
0454 Overhead doors
0455 Door hardware
0456 Louvre windows
0457 External screens
0458 Automatic doors
0461 Glazing
0462 Structural silicone glazing
0463 Glass blockwork
0466 Structural glass assemblies
0467 Glass components
0471 Thermal insulation and pliable membrane
0472 Acoustic insulation
0473 Acoustic floor underlays

05 INTERIOR

0511 Lining
0520 Partitions - combined
0521 Partitions - demountable
0522 Partitions - framed and lined
0523 Partitions - brick and block
0524 Partitions - glazed
0525 Cubicle systems
0526 Terrazzo precast
0527 Room dividers
0528 Partitions – composite systems
0531 Suspended ceilings - combined
0532 Suspended ceilings - flushed lined
0533 Suspended ceilings – ceiling units
0541 Access floors
0551 Joinery
0552 Metalwork - fabricated
0553 Stainless steel benching
0554 Handrails, guardrails, balustrades and other barriers
0571 Workstations
0572 Miscellaneous furniture
0573 Fire extinguishers and blankets
0574 Window coverings
0575 Tapestries
0581 Signage

06 FINISH

0611 Rendering and plastering
0612 Cementitious toppings
0613 Terrazzo in situ
0621 Waterproofing - wet areas
0631 Ceramic tiling
0632 Stone and terrazzo tiling
0641 Applied wall finishes
0642 Wallcoverings
0651 Resilient finishes
0652 Carpets
0654 Engineered panel flooring
0655 Timber flooring
0656 Floor sanding and finishing
0657 Resin based seamless flooring
0671 Painting
0672 Textured and membrane coatings
0673 Powder coatings

07 MECHANICAL

0700 Reference - Mechanical services
0701 Mechanical systems
0702 Mechanical design and install
0703 Mechanical design and construct (Design)
0710 Steam boilers
0711 Chillers - combined
0712 Water heating boilers
0713 Cooling towers
0714 Mechanical pumps
0715 Tanks, vessels and heat exchangers
0716 Chillers - centrifugal
0717 Chillers - water cooled screw
0718 Chillers – air cooled screw and scroll
0719 Chillers - absorption
0721 Packaged air conditioning

APPENDIX D: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

0722 Room air conditioners
0723 Evaporative air coolers
0724 Air handling plant - combined
0725 Air handling plant - built up
0726 Air handling plant - minor
0727 Air handling plant - packaged
0731 Fans
0732 Air filters
0733 Air coils
0734 Humidifiers
0735 Natural ventilation and smoke management
0736 Space heating
0741 Ductwork
0744 Ductwork insulation
0745 Attenuators and acoustic louvres
0746 Air grilles
0747 Variable air volume terminals
0748 Chilled beams
0751 Mechanical piping
0752 Mechanical piping insulation
0753 Water treatment
0754 Liquid fuels
0755 Medical gas systems
0756 Industrial gas systems
0757 Compressed air
0758 Reverse osmosis systems
0761 Refrigeration
0762 Cool rooms
0771 Automatic controls
0772 Automatic controls - minor
0773 Building management systems
0781 Mechanical electrical
0782 Mechanical electrical - minor
0784 Motors and starters
0791 Mechanical commissioning
0792 Mechanical maintenance

08 HYDRAULIC

0800 Reference - Hydraulic services
0801 Hydraulic systems
0802 Hydraulic design and install
0811 Sanitary fixtures
0812 Tapware
0813 Water heaters
0814 Hydraulic pumps
0815 Boiling, chilled and filtered water dispensers
0816 Tanks
0821 Stormwater - buildings
0822 Wastewater
0823 Cold and heated water
0824 Fuel gas
0825 Rainwater storage systems
0826 Greywater systems
0827 Processed water
0828 Smartflow water management systems
0882 Hydraulic electrical - minor
0891 Hydraulic maintenance

09 ELECTRICAL

0900 Reference – Electrical services
0901 Electrical systems
0902 Electrical design and install
0911 Cable support and duct systems
0921 Low voltage power systems
0931 Power generation – engine driven
0933 Power generation - photovoltaic
0937 Uninterruptible power supply
0941 Switchboards - proprietary
0942 Switchboards - custom-built
0943 Switchboard components
0947 Power factor correction
0951 Lighting
0961 Telecommunications cabling
0962 Television distribution systems
0963 Sound systems
0971 Emergency evacuation lighting
0979 Lightning protection
0981 Electronic security
0991 Electrical maintenance

10 FIRE

1001 Fire services systems
1002 Fire services design and install
1014 Fire services pumps
1016 Fire services tanks
1030 Combined wet fire suppression systems
1031 Hydrants
1032 Hose reels
1033 Sprinklers
1041 Gaseous fire suppression systems
1051 Liquid chemical fire suppression systems
1072 Fire detection and alarms
1073 Emergency warning and intercommunication
1082 Fire services electrical – minor
1091 Fire services maintenance

11 CONSTRUCTION - ROADWAYS (AUS-SPEC)

1101 Traffic management
1102 Control of erosion and sedimentation (Construction)
1111 Clearing and grubbing
1112 Earthworks (Road reserve)
1113 Stabilisation
1121 Open drains
1122 Kerbs and channels (gutters)
1130 Rural concrete base
1131 Roller compacted concrete subbase
1132 Lean mix concrete subbase
1133 Plain and reinforced concrete base
1134 Steel fibre reinforced concrete base
1135 Continuously reinforced concrete base
1136 Cold milling of asphalt and base course
1140 Wearing course, base and sub-base - unsealed
1141 Flexible pavement base and subbase
1142 Cold mix asphalt
1143 Sprayed bituminous surfacing
1144 Asphalt (Roadways)
1145 Segmental paving
1146 Microsurfacing

APPENDIX D: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

1147 Sprayed preservation surfacing
1151 Road openings and restoration
1152 Road openings and restoration (Utilities)
1171 Subsurface drainage
1172 Subsoil and formation drains
1173 Pavement drains
1174 Drainage blankets
1191 Pavement markings
1192 Signposting
1193 Guide posts
1194 Non-rigid road safety barrier systems
1195 Rigid road safety barrier systems
1196 Boundary fencing for road reserves
1197 Street and public lighting

13 CONSTRUCTION – PUBLIC UTILITIES

1341 Water supply - reticulation (Construction)
1342 Water supply – pump stations (Construction)
1351 Stormwater drainage (Construction)
1352 Pipe drainage
1353 Precast box culverts
1354 Drainage structures
1361 Sewerage systems- reticulation (Construction)
1362 Sewerage systems- pump stations (Construction)
1391 Service conduits
1392 Trenchless conduit installation

14 MAINTENANCE AND OPERATIONS - URBAN AND OPEN SPACES

1401 General requirements – parks and open space (Maintenance)
1402 Maintenance schedules – parks and open space
1403 Parks and open space maintenance plan (PMP)
1404 Annexures to parks and open space maintenance plan (PMP)
1411 Street landscaping
1412 Grass mowing in road reserves
1413 Tree and vegetation control in road reserves
1414 Weed control in road reserves
1415 Weed control
1416 Planting of annuals and trees
1417 Care of trees and shrubs
1418 Gardens
1419 Care of grass and turf
1420 Grass mowing
1421 Native bushland
1422 Dunal areas
1423 Pest control
1431 Footpath paving repairs
1432 Gravel footpath repairs
1433 Footpath and kerb ramp repairs
1434 Bushfire perimeter track repairs
1441 Bituminous surfacing repairs
1442 Boat ramps
1461 Swimming enclosures
1462 Boundary fence repair
1471 Barbecues
1472 Drinking fountains
1473 Barriers
1474 Lighting
1475 Playground equipment
1476 Park furniture
1477 Sport ground facilities
1478 Public art
1481 Accident repairs (Recoverable)
1482 Accident repairs (Non-recoverable)
1483 Emergency call out
1484 Storm damage response
1491 Open space litter collection
1492 Open space graffiti removal
1493 Beach cleaning

15 MAINTENANCE AND OPERATIONS - BUILDINGS

1500 NATSPEC Maintenance reference
1501 General requirements - building and facility (Maintenance)
1502 Maintenance schedules – building and facility
1503 Building and facility maintenance plan (BFMP)
1504 Annexures to building and facility maintenance plan (BFMP)
1530 External works
1531 Floors
1532 Walls
1533 Doorways and windows
1534 Ceilings
1535 Roofing
1571 Mechanical systems - maintenance
1572 Hydraulic systems - maintenance
1573 Electrical systems - maintenance
1581 External building surveillance
1582 Accident repairs (Recoverable)
1583 Emergency call out
1584 Storm damage response
1585 External cleaning
1586 Internal cleaning
1587 Sanitary cleaning
1588 Window cleaning
1589 Cleaning - blinds and fire proofing of curtains

16 MAINTENANCE AND OPERATION – ROAD~~WAYS~~ RESERVES

1601General requirements - road reserve (maintenance)
1602 Maintenance schedules – road reserve
1603 Road reserve maintenance (RMP)
1604 Annexures to road reserve maintenance plan (RMP)
1611 Pavement sweeping
1612 Auxiliary work for reseals
1613 Repairs to bituminous surfacing
1614 Crack sealing
1615 Local shape correction
1616 Grading unsealed roads
1617 Re-sheeting unsealed roads
1618 Heavy patching
1619 Minor patching
1620 Pothole repairs
1621 Concrete pavement repairs
1622 Concrete slab stabilisation
1623 Emergency pavement repairs
1631 Edge break repair

APPENDIX D: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

1632 Grading unsealed shoulders
1633 Re-sheeting unsealed shoulders
1634 Local scour repairs
1641 Kerb and channel (gutter) repairs
1642 Traffic islands
1651 Clear road reserve subsoil drains
1652 Clear road reserve open drains
1671 Road reserve boundary fence repairs
1672 Road reserve fences and handrails
1673 Street seats and bus shelters
1674 Carriageway delineators
1675 Road reserve guard fences
1676 Road reserve signs
1677 Road reserve guide signs
1681 Accident repairs (Recoverable)
1682 Road reserve emergency call out
1683 Storm damage response for road safety
1684 Traffic facilities - Road traffic control
1691 Road reserve litter collection
1692 Removal of graffiti visible from roads

17 MAINTENANCE AND OPERATIONS - BRIDGES

1701 Wharves and decks maintenance

18 MAINTENANCE AND OPERATIONS - PUBLIC UTILITIES

1801 General requirements – stormwater drainage (Maintenance) [Pending publication]
1802 Contract schedules – stormwater drainage [Pending publication]
1803 Stormwater drainage maintenance plan (SDMP) [Pending publication]
1804 Annexures to stormwater drainage maintenance [Pending publication]
1841 Water supply - irrigation systems
1851 Clear open space and drains
1852 Clear open space drainage culverts
1853 Clear road reserve culverts and pits
1854 Minor repair of lined drains in road reserves
1858 Clearing of GPTS and screens
1859 CCTV inspection of drainage conduits

20 CONVEYING

2011 Lifts design and install
2012 Escalators and moving walkways
2021 Pneumatic tube systems