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: 2001 Organisation of information about construction works – Part 2: Framework for classification of information. It also examines the significance of classifications systems for the Australian design and construction industry, particularly with regard to digital information technologies such as Building Information Modelling (BIM).
CONTENTS

1 Introduction ........................................................................................................................................3
2 Classification - A brief overview ..........................................................................................................3
3 References...........................................................................................................................................11
4 Referenced Standards............................................................................................................................11
5 Appendix A: Terminology .....................................................................................................................12
6 Appendix B: Relationship of current information classification systems to international standards..14
7 Appendix C: Degree of parity between individual tables of Uniclass and Omniclass...............15
8 Appendix D: Uniclass and Omniclass tables .....................................................................................16
9 Appendix E: Work section Tables from Uniclass, Omniclass and NATSPEC .................................17
CLASSIFICATION SYSTEMS

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 durations. Depending on their role, each participant has different information needs and responsibilities at different times during the construction process.

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. In order to be able to classify 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.

2.2 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. Facets are usually referred to as ‘Tables’ in most of the classification systems examined later.

2.3 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.

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

2.4 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.

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2.5 Notation

Notation is a very important consideration. However, a common error is to think that choice of notation is the first step in the compilation of a classification scheme. On the contrary, it is one of the final steps. Notation provides a classification system with a short, unambiguous subject identifier facilitating quick orientation and navigation of the system.

(For fuller coverage of this topic, refer to ‘Principles of Classification’ by John Cann’
http://www.icis.org/siteadmin/rtdocs/images/5.pdf)

2.6 Primary uses of classification systems in the construction industry

Typical items assisted by an information classification system include:

- Organising reference material on construction products, technical matters, costs, etc.
- Structuring the contents of individual documents in a consistent manner.
- Co-ordinating information between individual documents found in sets of documents.
- Facilitating communications between different members of a construction project team.
- Facilitating interoperability of digital systems.

2.7 Existing classification systems for the construction industry

2.7.1 Standards relevant to construction classification systems

See Appendix B for a summary of the relationships between current classification systems and the following standards:

- ISO TR 14177 Classification of Information in the Construction Industry:

ISO 12006-2 has had the most immediate influence on the development of a number of classification systems currently being implemented in Europe (Uniclass) and North America (Omniclass). This influence is a reflection of the trend away from the separate development of incompatible systems by individual countries and the convergence of systems based on shared standards.

2.7.2 The relationship of classification systems to specifications

ISO 12006-2 is very broad in scope. It sets out a framework of Tables for classifying construction information, and recommends titles for these Tables, but generally does not detail their content or structure.

The distinction needs to be made between complete ISO 12006-2 based classification systems, such as Omniclass and Uniclass, and the individual facets or ‘tables’ of these systems, which provide a classification system within the broader framework, for a specific purpose. The ISO 12006-2 Table A.9 Work Results (by type of work) is where the classification system for specification work sections is usually located. Work sections are defined as:

‘One or several parts of a building or other facility viewed as the result of particular skills and techniques applied to particular construction products and/or elements during the construction phase. Work sections are usually executed by particular types of subcontractor or groups of operatives. The class is influenced by both inputs (the construction products used) and outputs (the parts of the building or facility constructed) and thus represents a dual concept’ – ISO/TR 14177: 1994

2.7.3 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 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 or Omniclass, used nationally for a broad range of classification purposes.

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3 Cann, J. (1997). Principles of Classification. NBS Services, UK and ICIS.
The NATSPEC classification system was amended in 2005/2006 when NATSPEC and Masterspec of New Zealand agreed to align their systems more closely. The most recent amendment was 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 civil engineering, landscaping and infrastructure works, including their maintenance and operation.

2.7.4 New Zealand (NZ)
Masterspec is New Zealand’s default standard specification system, managed by Construction Information Limited (CIL) a company owned by the New Zealand Institute of Architects, Registered Master Builders Federation and the Building Research 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 is based on the British Common Arrangement of Work Sections (CAWS) system and Uniclass (See 2.7.10 United Kingdom). CBI modified these systems to take account of 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.

2.7.5 Europe
ISO 12006-2 or its drafts have been applied in the development of the following European classification systems:

2.7.6 Denmark
ISO 12006-2 formed the basis of the Danish DBK system (Dansk Bygge Klassifikation), developed in 2006. Prior to this, a system based on the Swedish SfB system (See 2.7.9 Sweden), called BC/SfB, was used. The DBK system is part of a wider program called Digital Convergence, which focuses on introducing and implementing shared Information and Communication Technology (ICT) standards in the entire construction sector: email standards, discrepancy lists and web-based project management.¹

2.7.7 Finland
The Finnish Building 90 system developed by the Building 90 Group and the Finnish Building Centre was published in 1999. It is widely used in the Finnish engineering community.²

2.7.8 The Netherlands
The NL/SfB, or ‘Elementenmethode’, is based on SfB, and is used in the Netherlands for the classification of building elements. The Dutch building specification system, STABU², 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 STABU² system was based on a relational database.

In 2005, NL/SfB was connected to the STABU² 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.

2.7.9 Sweden
The first Swedish classification system, developed in the 1950s, was called SfB (Samarbetskommittén för Byggnadsfrågor, Co-ordination Committee for the Construction Industry). The limitations of this system in addressing new developments in the industry led to the introduction of the BSAB (Byggandets Samordning AB, Construction Co-ordination Limited) system in 1972. The Swedish Building Centre (SBC) released the latest revision of the BSAB96 system in 1999. The Swedish national building specification, the AMA, which uses the BSAB96 classification system, was revised and republished by the SBC in 2001. AMA is the abbreviation (in Swedish) for ‘General Material and Workmanship Specifications’¹⁴.

¹ Digital Convergence website: http://www.digitalkonvergens.com/
2.7.10 United Kingdom (UK)
The most recent construction information classification system to be implemented in the UK is Uniclass (Unified Classification for the Construction Industry) driven by developments in ICT and international standards for classification systems. The first edition of Uniclass was published in 1997.

Uniclass is a faceted system designed within the parameters of ISO TR 14177. [3] A number of pre-existing classification systems, used for specific purposes, were also incorporated into its 15 Tables; for example:

- CI/SfB (Construction Index/SfB), a derivation of the Swedish SfB system. It forms the basis for table D.
- CAWS (Common Arrangement of Work Sections for building works), developed in 1987, was adopted by the National Building Specification (NBS), the Standard Method of Measurement of Building Works (SMM7), and the National Engineering Specification (NES). Until recently CAWS formed the basis of Uniclass Table J Work sections for buildings. (See Appendix E for a summary of Table J). This Table is currently under review.
- CESMM3 (Civil Engineering Standard Method of Measurement) forms the basis of Uniclass Table K Work sections for civil engineering works.
- EPIC (European Product Information Cooperation) Construction Product Grouping (CPG) - or EPIC for short, a common European classification system for construction products, was first published in 1994. EPIC forms the basis of Uniclass Table L Construction products.
- UDC (Universal Decimal Classification) system, a derivation of the US Dewey decimal classification system forms the basis of Uniclass Table Q Universal decimal Classification (see Appendix D for a list of Tables). [3]

Uniclass notation consists of a single capital letter followed by zero or more digits, except Tables J and K, which have two initial capital letters to allow the incorporation of the CAWS and CESMM3 codes. The notation is hierarchical; for example D21, D22, D23, etc. are always subclasses of D2. A number of signs: + / : (colon) < > are used to combine simple class numbers for complex subjects and define relationships of subjects.

2.7.11 North America
The most recent construction information classification system to be implemented in North America is Omniclass. 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. The majority of the 15 Omniclass Tables were published in 2006.

Omniclass is a faceted system designed within the parameters of ISO 12006-2 and ISO 12006-3. Also, Omniclass freely adapted and used Uniclass in its development, and therefore shares many of the Uniclass legacy documents – for example, both use EPIC as the basis of their construction product Tables. The most significant points of departure include:

- The adoption of Masterformat as the basis of Omniclass Table 22 Work results. In the same way CAWS is used in the UK, 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) and Construction Specifications Canada (CSC). The most recent edition was published in 2004.
- 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. These systems are characterised by their function without identifying the technical or design solutions that may comprise them. 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).

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).

2.8 A comparison of existing classification systems

2.8.1 Comparison of Uniclass and Omniclass

- While both systems are based on ISO 12006-2; or its precursor, ISO TR 14177; and there is generally parity between the Tables in each system, each places them in a slightly different order, and each splits or combines some Tables differently. Uniclass adds an extra Table Q, based on the UDC system; for classifying subjects not covered elsewhere in the system.

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CLASSIFICATION SYSTEMS

- There is a high degree of parity between Tables based on the same source documents, for example, Uniclass Table L Construction products and Omniclass Table 23 Products, which are both based on EPIC. With Tables based on different source documents, we see significant differences in their internal order (see Appendix C for an assessment of the relative parity of Tables in the two systems).
- Omniclass classifies subjects in more detail and information is more clearly presented. This is probably a reflection of the fact that Omniclass was published 9 years after Uniclass, giving Omniclass the opportunity to build on the work of Uniclass.
- Omniclass does not appear to provide an index like Uniclass.
- Omniclass is more readily available - the Tables and supporting documents can be downloaded directly from the web at no cost. The Uniclass manual can only be purchased from RIBA bookshops. Also, there is more evidence of on-going support and development for Omniclass, especially in the guise of Masterformat, than Uniclass. Although there have been recent revisions to Uniclass, and a number of Tables are now under review, it has not been republished since the first edition of 1997 - not insignificant considering the changes that have occurred in the construction industry during this period.

2.8.2 Comparison of Uniclass Table J and Table K and Omniclass Table 22.
These work section Tables are used as the basis of comparison of the classification systems used by the NBS (Uniclass) and the American Institute of Architect's MASTERSPEC (Omiclass) specifications, and as potential influences on Australian specification classification systems.

2.8.3 Preliminary assessment
- Omniclass groups work sections for buildings and worksections for civil engineering works together. Uniclass splits these into separate Tables J and K (see Appendix E).
- Omniclass documents many more subdivisions of each Table than Uniclass.
- Uniclass Table J, Work sections for buildings has an internal structure much closer to the Australian approach used by NATSPEC than Omniclass' Table 22 Work results. Table J more closely matches the overall sequence of items, and grouping of items. Omniclass Table 22; Division 10 Specialties, for example, groups a number of items together which, by Australian conventions, would be located in a variety of locations. This could very well be because Australian construction and subcontracting practices derive much more from English models than North American.
- The structure and notation of Uniclass Tables J and K is very simple, making it more readily comprehensible and easier to navigate. The downside is that it would be more difficult to assign a unique place or notation to items being classified.
- The structure and notation of Omniclass Table 22 are highly subdivided, which makes it easy to find a unique place for many different items, but also makes it difficult to navigate quickly. Although good reasons are given for the notation system, the six digit format is not very user-friendly, though the amended format adopted by Masterformat 2004 has improved legibility. While the difference might not seem that great when viewing Tables in isolation, the larger codes from each Table would become very unwieldy if combined with codes from other Tables - the basis on which faceted systems are designed.
- Omniclass Table 22 provides dedicated maintenance and operation worksections at the beginning of each division - a very useful feature that corresponds to AUS-SPEC worksections recently incorporated into NATSPEC. Most of the previous comments have been directed at the intrinsic qualities of each system, but issues such as access and availability, which impact on their adoption, also need to be taken into account. In this regard, Omniclass is more readily available, and appears better maintained and supported.

It is encouraging to note that despite the differences between British and North American systems, in broad terms, they have more in common than they have ever had in the past - largely because of the adoption of ISO 12006-2.

2.9 Current trends in the construction industry impacting on classification systems

2.9.1 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).

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2.9.2 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. 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.

The International Alliance for Interoperability (IAI) is the most active organisation promoting interoperability in the construction industry. It is a worldwide alliance of construction industry organisations, comprising 12 international chapters from 21 countries representing over 550 private industry and government organisations. 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.

2.9.3 IFC, IFD, IDM and MVD
One of the key strategies of BuildingSMART is the promotion of the Industry Foundation Classes (IFC), a specification for a neutral data format to describe, exchange and share information typically used within the building and facility management industry sector. BuildingSMART have developed and maintained the IFC and facilitated its implementation through mission programs which offer industry-wide forums to identify, test, review, recommend and implement ways delivering quality buildings and services to the facility owner.

The IFC data model consists of definitions, rules, and protocols that uniquely define data sets which describe capital facilities throughout their lifecycles. IFC is the only non-proprietary, open global data model specification available, and in 2002 it became the international standard, ISO/PAS 16793. Software applications supporting IFC are able to exchange data with other applications that support IFC. See http://www.iai-international.org

BuildingSMART has been working with its member organizations and major CAD vendors to put the standard in place. The latest release of the standard, IFC 2x specifies over several hundred object types and related concepts, which support the core exchange needs of the building industry. Two of the world’s largest CAD vendors, Autodesk and Bentley, have both developed BIM solutions (Revit Architecture and Bentley Architecture respectively), which support IFC. Many BIM-associated applications, like those for thermal or structural modelling, are appearing with IFC capability.

Another important interoperability program is the development of the International Framework for Dictionaries (IFD) Library, an object terminology library for the building construction industry. The name is used both for the IFD Library and for the organisation running and maintaining it. The simplest description of IFD Library is that it is a kind of dictionary of construction industry terms that must be used consistently in multiple languages to achieve consistent results - this will enable reliable automated communications between applications.

The structure of IFD is given in ISO 12006-3, which is an EXPRESS model with a short explanation of its purpose and use. (See Appendix A) The first implementations of this standard were the Norwegian BARBi library and the Dutch LexiCon by STABU. Other implementations include EDIBATEC in France. In 2006, on behalf of BuildingSMART, STABU and BARBI combined their efforts on the IFD. The IFD Library is compatible with IFC. See http://dev.ifd-library.org/

The three pillars of the BuildingSMART initiative are IFC, IFD and the Information Delivery Manual (IDM). While IFC is about HOW data is exchanged and IFD defines WHAT is exchanged, IDM is about information requirements, defining WHICH information to share WHEN. The IDM/MVD (model view definition) approach (also an ISO standard in development) forms that specification. IDM regulates the controlled flow of information in and out of a BIM. It’s like a contract defining which information will flow, defined by whom, and when. A MVD is more like a subset of the IFC model representing the information of interest to a user, or user group, for a particular purpose.

2.9.4 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.

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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. 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.

2.9.5 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.

2.10 Classification systems for the Australian construction industry

2.10.1 The current position

The need for a comprehensive, widely adopted information classification system for the Australian construction industry has become imperative with the emergence of increasingly data-based applications such as BIM.

The adoption of ISO 12006-2 enables mapping between localised classification systems which have developed worldwide. 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.

2.10.2 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 national system. It corresponds to the Work Result/Work Process Tables of ISO 12006-2. Few other classification systems exist that immediately suggest themselves as the basis of the other remaining Tables.

The least-effort approach to creating an ISO 12006-2 compliant classification system for Australia would be to simply incorporate the NATSPEC classification into the Work Result/Work Process Table of an existing system such as Uniclass or Omniclass. While expedient, it is unlikely that this would be as well suited to local requirements as a more comprehensive approach.

2.10.3 Requirements statement

With this in mind, any amendment or adoption of a new classification system for the Australian construction industry should meet the following requirements:

- ISO 12006-2 and ISO 12006-3 based.
- Provide high functionality for core needs focusing on the co-ordination of information in all forms of construction documents used throughout the construction process.
- Based on BuildingSMART and open standards to ensure interoperability.
- Facilitate a forward migration path, accommodating current work practices and tools, and anticipating future likely developments in work practices and tools.
- Extensible, making provision for expansion of capabilities.
- Adaptable, allowing individual users to use the parts they require without being obliged to understand the whole system.
- Tailored to the digital environment that most practitioners work in, linking it to CAD, BIM, word processing, email and internet browser applications.

2.10.4 Guiding principles for a classification system development program

- Prioritise development goals according to the immediacy of need.
- Maintain a strategic perspective to avoid closing off future development options.
- Apportion effort on the basis of expected benefits.

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CLASSIFICATION SYSTEMS

- Make any system only as complex as it needs to be to satisfy user requirements.
- Borrow from, or adapt, existing systems as much as possible - Do not reinvent the wheel.
- Recognise the constraints of local resources for developing systems compared to larger countries - monitor programs elsewhere to avoid duplication of effort.
- Co-operate with CIL (New Zealand) where this is to the advantage of the industry in both countries.
- Monitor the development of systems elsewhere to assess whether industry standards are emerging, and to ascertain when they have reached sufficient maturity to warrant adoption or incorporation into the local system.
- Adopt an open collaborative approach. Apart from the benefits of a wide range of inputs, this would encourage widespread adoption and support - the ultimate measure of a system's success. Contributors would need to be aware that this entails relinquishing intellectual property rights to the project group.

2.10.5 Assessment criteria
- The primary assessment criteria should always be: ‘How useful will this be for users?’
- 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 only achieved limited adoption due to insufficient promotion and support - for example, the Co-ordinated Classification System (CCS). Other systems, such as those used by construction product information suppliers, such as Infolink and Selector.com, are structured for a web-based environment, and are not necessarily suitable for other classification purposes.

2.10.6 First steps undertaken by NATSPEC to develop an Australian classification system

On the 29th April, 2008, NATSPEC hosted an informal discussion group in Melbourne on classification systems and their relationship to BIM with representatives from architectural and engineering practices. The purpose was to assess the current state of development in this area, and to discuss likely trends and ways of responding to them. A number of points were agreed:

- There was a mandate to make necessary changes to address anticipated developments.
- That steps needed to be taken in this direction straight away because of uncertainty about how long it would take for international standards to be formally adopted.
- Not to try to solve everything at once, but to take cost-effective steps in the right direction.
- The immediate requirement was to develop a consistent indexing/tagging system that provided a correlation between items on drawings, specification clauses and material and product information.

In response, NATSPEC has made the following recommendations:

- Comply with the framework for classification of construction information provided by ISO 12006-2. The reason for adopting this standard is that it has already been adopted by North America and a number of European countries. Not only does this provide a number of potential models for an Australian system, but it is more likely to facilitate the exchange of information between national classification systems and interoperability between ICT applications like BIM.
- Adopt NATSPEC classification for the Work results and Work processes Table of the proposed classification system.
- Expand listings in the NATSPEC classification to include items suggested by the construction industry.
- Outline a number of key tables including those for Elements, Work results and Work processes, Products and Materials.
3 REFERENCES


Digital Convergence website: http://www.digitalkonvergens.com/


4 REFERENCED STANDARDS


APPENDIX A: TERMINOLOGY

5.1 Classification terminology from ISO TR 14177: 1994

**Classification**: a set of concepts arranged systematically according to chosen characteristics or criteria.

**Classification class**: a high-level unit within a classification expressing a main concept.

**Class definition**: a formulation of the essential characteristics of a classification class which draws a clear boundary between it and other classification classes.

**Classification item**: a single defined concept, unique within a classification class.

**Classification notation**: a system of codes expressing the arrangement of a classification.

**Classification term**: a designation of a classification class or classification item by a linguistic expression.

5.2 Object class terms from ISO 12006-2: 2001

**Construction agent**: human participant in the construction process.

**Construction aid**: material construction resource not intended for incorporation in a permanent manner in a building or other construction entity.

**Construction complex**: two or more adjacent construction entities collectively serving one or more user activity function.

**Construction entity**: Independent material construction result of significant scale, serving at least one user activity or function.

**Construction entity lifecycle stage**: period of time in the lifecycle of the construction entity identified by the overall character of the construction process, which occurred within it.

**Construction entity part**: solid (as distinct from liquid or gaseous) material part of a construction entity having physically delineated boundaries.

**Construction information**: information used to support one or more construction processes.

**Construction object**: object of importance to the construction industry.

**Construction process**: process which transforms construction resources and construction results into construction results.

**Construction product**: material construction resource intended for incorporation in a permanent manner in a building or another construction entity.

**Construction resource**: construction object used in the construction process to achieve a construction result.

**Construction result**: construction object which has formed or changed in state as the result of one or more construction processes, utilising one or more construction resources.

**Designed element**: element for which the work result(s) have been defined.

**Element**: construction entity part which in itself, or in combination with, other such parts fulfils a predominating function of the construction entity.

**Management process**: construction process with the purpose of planning, administering or assessing.

**Object**: any part of the perceivable or conceivable world.

**Project stage**: period of time in the duration of construction project, identified by the overall character of the construction processes which occur within it.

**Space**: three-dimensional, material construction result contained within, or otherwise associated with, a building or other construction entity.

**Work process**: predominant construction process, which results in a work result.

**Work result**: construction result achieved in the production stage, or by subsequent alteration, maintenance or demolition processes.
5.3 Other terms

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. 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. 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 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.

5.4 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.

5.5 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.

# Appendix B: Relationship of Current Information Classification Systems to International Standards

(Refer Appendix A for some definitions)

<table>
<thead>
<tr>
<th>Class</th>
<th>ISO 12177:1999</th>
<th>Code</th>
<th>Table ref.</th>
<th>Table title</th>
<th>ISO 12177:2001</th>
<th>Code</th>
<th>Table ref.</th>
<th>Table title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Elements</td>
<td>Function or user activity</td>
<td>A.2, A.8</td>
<td>A.2, A.8</td>
<td>Principles of specialization</td>
<td>A.2, A.8</td>
<td>A.2, A.8</td>
<td>Principles of specialization</td>
<td></td>
</tr>
<tr>
<td>3. Constructions</td>
<td>Function or user activity</td>
<td>A.4, A.5</td>
<td>A.4, A.5</td>
<td>Principles of specialization</td>
<td>A.4, A.5</td>
<td>A.4, A.5</td>
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<tr>
<td>4. Facilities</td>
<td>Function or user activity</td>
<td>A.6, A.7</td>
<td>A.6, A.7</td>
<td>Principles of specialization</td>
<td>A.6, A.7</td>
<td>A.6, A.7</td>
<td>Principles of specialization</td>
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### Table Title: Characteristics of the Information Classification Systems

<table>
<thead>
<tr>
<th>Element</th>
<th>Function or user activity</th>
<th>Type of work</th>
<th>Work process</th>
<th>Work result</th>
<th>Work sections for civil engineering works</th>
<th>Work sections for civil engineering works</th>
<th>Work sections for civil engineering works</th>
<th>Work sections for civil engineering works</th>
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</thead>
<tbody>
<tr>
<td>A.8</td>
<td>Construction entity</td>
<td>A.9</td>
<td>J</td>
<td>K</td>
<td>L</td>
<td>M</td>
<td>N</td>
<td>Q</td>
</tr>
<tr>
<td>A.8</td>
<td>Construction entity</td>
<td>A.9</td>
<td>J</td>
<td>K</td>
<td>L</td>
<td>M</td>
<td>N</td>
<td>Q</td>
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<tr>
<td>A.8</td>
<td>Construction entity</td>
<td>A.9</td>
<td>J</td>
<td>K</td>
<td>L</td>
<td>M</td>
<td>N</td>
<td>Q</td>
</tr>
<tr>
<td>A.8</td>
<td>Construction entity</td>
<td>A.9</td>
<td>J</td>
<td>K</td>
<td>L</td>
<td>M</td>
<td>N</td>
<td>Q</td>
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### Table Title: Relationship between Current Information Classification Systems and International Standards

<table>
<thead>
<tr>
<th>Uniclass (UK)</th>
<th>GeniClass (North America)</th>
<th>Classification by form function</th>
<th>Construction stage</th>
<th>Construction requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.10</td>
<td>B.10</td>
<td>C.10</td>
<td>D.10</td>
<td>E.10</td>
</tr>
<tr>
<td>A.11</td>
<td>B.11</td>
<td>C.11</td>
<td>D.11</td>
<td>E.11</td>
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<tr>
<td>A.12</td>
<td>B.12</td>
<td>C.12</td>
<td>D.12</td>
<td>E.12</td>
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<tr>
<td>A.13</td>
<td>B.13</td>
<td>C.13</td>
<td>D.13</td>
<td>E.13</td>
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### Table Title: Classification of Information

<table>
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<th>A.15</th>
<th>A.16</th>
<th>A.17</th>
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<tr>
<td>Environment</td>
<td>Construction products</td>
<td>Construction materials</td>
<td>Construction activities</td>
<td>Construction processes</td>
</tr>
<tr>
<td>Type of medium</td>
<td>A.14</td>
<td>A.15</td>
<td>A.16</td>
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<td>Source Documents (other than ISO TR 14177)</td>
<td>Omniclass (North America)</td>
<td>Source Documents (other than ISO 12006-2 and Uniclass)</td>
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<td>---------------------------</td>
<td>--------------------------------------------------------</td>
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<td>A</td>
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<tr>
<td>B</td>
<td>Subject disciplines</td>
<td>52 Services</td>
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<td>Medium</td>
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<tr>
<td></td>
<td></td>
<td>53 Disciplines</td>
<td>AIA Information Classification System</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>54 Organisational roles</td>
<td>AIA Information Classification System</td>
<td>Medium</td>
</tr>
<tr>
<td>D</td>
<td>Facilities</td>
<td>11 Construction entities by function</td>
<td>IBC, ICC, UBC &amp; other building code occupancy classifications, AICDS</td>
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</tr>
<tr>
<td>E</td>
<td>Construction entities</td>
<td>12 Construction entities by form</td>
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<tr>
<td>F</td>
<td>Spaces</td>
<td>13 Spaces by function</td>
<td>CSA &amp; ICC space definitions, AICDS</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14 Spaces by form</td>
<td></td>
<td>Medium</td>
</tr>
<tr>
<td>G</td>
<td>Elements for buildings</td>
<td>21 Elements (including designed elements)</td>
<td>Uniform, ASTM E1557, UNIFORMAT II, various ASTM ‘format’ documents</td>
<td>Medium</td>
</tr>
<tr>
<td>H</td>
<td>Elements for civil engineering works</td>
<td>22 Work results</td>
<td>Masterformat 2004 Edition</td>
<td>Low</td>
</tr>
<tr>
<td>J</td>
<td>Work sections for buildings</td>
<td>CESMM3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Work sections for civil engineering works</td>
<td>EPIC</td>
<td>Masterformat</td>
<td>High</td>
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<td>L</td>
<td>Construction product</td>
<td>23 Products</td>
<td>EPIC, Masterformat</td>
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<tr>
<td>M</td>
<td>Construction aids</td>
<td>56 Tools</td>
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<td>Medium</td>
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<tr>
<td>P</td>
<td>Materials</td>
<td>41 Materials</td>
<td>HAC, CINBE Construction Indexing Manual</td>
<td>Medium</td>
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<tr>
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<td>Universal Decimal Classification (UDC)</td>
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</tbody>
</table>

**Acronym key:**
- AACE = American Society of Civil Engineers
- AIA = American Institute of Architects
- AICDS = Appraisal Institute Commercial Data Standards
- ASTM = American Society for Testing and Materials
- CAWS = Common Arrangement of Works for Building works
- CESMM3 = Civil Engineering Standard Method of Measurement 3rd Edition
- CSC = Construction Specifications Canada
- CSI = Construction Specifications Institute
- EPIC = European Product Information Cooperation
- GSA = General Services Administration
- ISBC = International Building Code
- ICC = International Code Council
- UBC = Uniform Building Code

**Table Parity:** Generally means the tables have similar content, but they are arranged in a different order. Omniclass has more comprehensive listings of subjects.
APPENDIX D: UNICLASS AND OMNICLASS TABLES

8 APPENDIX D: UNICLASS AND OMNICLASS TABLES

8.1 UNICLASS TABLES
Below is a full list of tables in Uniclass.

A Form of information  
B Subject disciplines  
C Management  
D Facilities  
E Construction entities  
F Spaces  
G Elements for buildings  
H Elements for civil engineering works  
J Work sections for buildings  
K Work sections for civil engineering works  
L Construction products  
M Construction aids  
N Properties and characteristics  
P Materials  
Q Universal Decimal Classification (UDC)

8.2 OMNICLASS TABLES
Below is a full list of Tables in Omniclass, released in 2006, showing their status.

<table>
<thead>
<tr>
<th>Table</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 11 - Construction Entities by Function</td>
<td>Released</td>
</tr>
<tr>
<td>Table 12 - Construction Entities by Form</td>
<td>Released</td>
</tr>
<tr>
<td>Table 13 - Spaces by Function</td>
<td>Released</td>
</tr>
<tr>
<td>Table 14 - Spaces by Form</td>
<td>Released</td>
</tr>
<tr>
<td>Table 21 - Elements (includes Designed Elements)</td>
<td>Conditional Draft</td>
</tr>
<tr>
<td>Table 22 - Work Results</td>
<td>Released</td>
</tr>
<tr>
<td>Table 23 - Products</td>
<td>Draft</td>
</tr>
<tr>
<td>Table 31 - Phases</td>
<td>Released</td>
</tr>
<tr>
<td>Table 32 - Services</td>
<td>Released</td>
</tr>
<tr>
<td>Table 33 - Disciplines</td>
<td>Released</td>
</tr>
<tr>
<td>Table 34 - Organizational Roles</td>
<td>Released</td>
</tr>
<tr>
<td>Table 35 - Tools</td>
<td>Draft</td>
</tr>
<tr>
<td>Table 36 - Information</td>
<td>Draft</td>
</tr>
<tr>
<td>Table 41 - Materials</td>
<td>Released</td>
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<tr>
<td>Table 49 - Properties</td>
<td>Draft</td>
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</tbody>
</table>
### APPENDIX E: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

#### 9 APPENDIX E: WORK SECTION TABLES FROM UNICLASS, OMNICLASS AND NATSPEC

##### 9.1 UNICLASS

<table>
<thead>
<tr>
<th>Table J - Work sections for buildings (concise form)</th>
<th>Table K - Work sections for civil engineering works (concise form)</th>
</tr>
</thead>
<tbody>
<tr>
<td>J A Preliminaries/General conditions</td>
<td>KA General items</td>
</tr>
<tr>
<td>J B Complete buildings/structures/units</td>
<td>KB Ground investigation</td>
</tr>
<tr>
<td>J C Existing site/buildings/services</td>
<td>KC Geotechnical and other specialist processes</td>
</tr>
<tr>
<td>J D Groundwork</td>
<td>KD Demolition and site clearance</td>
</tr>
<tr>
<td>J E In situ concrete/Large precast concrete</td>
<td>KE Earthworks</td>
</tr>
<tr>
<td>J F Masonry</td>
<td>KF In situ concrete</td>
</tr>
<tr>
<td>J G Structural/Carcassing metal/timber</td>
<td>KG Concrete ancillaries</td>
</tr>
<tr>
<td>J H Cladding/Covering</td>
<td>KH Precast concrete</td>
</tr>
<tr>
<td>J I Pipework - pipes</td>
<td>KI Pipework - fittings and valves</td>
</tr>
<tr>
<td>J J Waterproofing</td>
<td>JJ Pipework - manholes and pipework ancillaries</td>
</tr>
<tr>
<td>J K Linings/Sheathing/Dry partitioning</td>
<td>JK Pipework - laying and excavation ancillaries</td>
</tr>
<tr>
<td>J L Windows/Doors/Stairs</td>
<td>KL Structural metalwork</td>
</tr>
<tr>
<td>J M Surface finishes</td>
<td>JL Piping and excavation ancillaries</td>
</tr>
<tr>
<td>J N Furniture/Equipment</td>
<td>JN Miscellaneous metalwork</td>
</tr>
<tr>
<td>J O Building fabric sundries</td>
<td>JO Timber</td>
</tr>
<tr>
<td>J P Paving/Planting/Fencing/Site furniture</td>
<td>JP Piles</td>
</tr>
<tr>
<td>J Q Disposal systems</td>
<td>JQ Piling ancillaries</td>
</tr>
<tr>
<td>J R Roads and paving</td>
<td>JR Mechanical heating/Cooling/Refrigeration systems</td>
</tr>
<tr>
<td>J S Transport systems</td>
<td>JS Mechanical systems</td>
</tr>
<tr>
<td>J T Ventilation/Air conditioning systems</td>
<td>JT Tunnels</td>
</tr>
<tr>
<td>J U Electrical supply/power/lighting systems</td>
<td>JU Brickwork, blockwork and masonry</td>
</tr>
<tr>
<td>J V Communications/Security/Safety/protection systems</td>
<td>JV Electrical supply/power/lighting systems</td>
</tr>
<tr>
<td>J W Electrical supply/power/lighting systems</td>
<td>JW Electrical supply/power/lighting systems</td>
</tr>
<tr>
<td>J X Structural metalwork</td>
<td>JX Miscellaneous work</td>
</tr>
<tr>
<td>J Y General engineering services</td>
<td>JY General engineering services</td>
</tr>
</tbody>
</table>

##### 9.2 OMNICLASS

#### 9.2.1 Table 22 - Work Results - Table of Contents

- 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 Furnishings
- 22-13 00 00 Special Construction
- 22-14 00 00 Conveying Equipment
APPENDIX E: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

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 Control Equipment
22-45 00 00  Industry - Specific Manufacturing Equipment
22-48 00 00  Electrical Power Generation

9.3 NATSPEC worksection classification list

00 PLANNING AND DESIGN (AUS-SPEC)
  0011 Development and subdivision of land
  0012 Waterfront development
  0013 Bushfire protection
  0021 Site regrading
  0041 Geometric road layout
  0042 Pavement
  0043 Subsurface drainage (Design)
  0044 Pathways and cycleways
  0061 Bridges and other structures
  0071 Water supply - reticulation and pump stations (Design)
  0074 Stormwater drainage (Design)
  0075 Control of erosion and stormwater management
  0076 Sewerage systems - reticulation and pump stations (Design)

01 GENERAL
  0111 Specification cover sheet
  0112 Tendering cover sheet
  0113 Amendment sheet
  0115 Referenced documents
  0120 Information for tenderers (AUS-SPEC)
  0121 Tendering
  0121 Conditions of tendering (AUS-SPEC)
  0122 Tendering (Interior and alterations)
  0123 Tender submission documents (AUS-SPEC)
  0130 Contract preparation model (AUS-SPEC)
  0131 Preliminaries (Generic)
  0133 Preliminaries (Generic interior and alterations)
  0138 Multiple contracts
  0141 Preliminaries - ABIC MW-1
  0142 Preliminaries - ABIC SW-1
  0143 Preliminaries - AS 2124
  0144 Preliminaries - AS 4000
  0145 Preliminaries - AS 4905
  0146 Preliminaries - AS 4902
  0147 Conditions of contract (AUS-SPEC)
  0152 Schedule of rates – supply projects (AUS-SPEC)
  0153 Schedules - period supply and service (AUS-SPEC)
  0154 Contract schedules for parks and recreation areas (AUS-SPEC)
  0155 Contract schedules for buildings and facilities (AUS-SPEC)
  0156 Contract schedules for road reserves (AUS-SPEC)
  0160 Quality (Design) (AUS-SPEC)
  0161 Quality (NATSPEC)
  0162 Supply quality plan (AUS-SPEC)
  0163 Contractors quality plan (AUS-SPEC)
  0164 Parks and recreation area management plan (AUS-SPEC)
  0165 Buildings and facilities maintenance plan (AUS-SPEC)
  0166 Road reserve management plan requirements (AUS-SPEC)
  0169 Green star – office as built submissions
  0171 General requirements
  0172 General requirements (Interior and alterations)
  0173 General requirements (Mechanical)
  0174 General requirements (Hydraulic)
  0175 General requirements (Electrical)
  0176 Technical specification for supply (AUS-SPEC)
APPENDIX E: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

02 SITE
0201 Demolition
0202 Demolition (Interior and alterations)
0221 Site management
0222 Earthwork
0223 Service trenching
0224 Stormwater - site
0240 Landscape - gardening
0241 Landscape - walling and edging
0242 Landscape - fences and barriers
0243 Landscape - water features
0250 Landscape - gardening
0251 Landscape - soils
0252 Landscape - soft surfaces
0253 Landscape - planting
0254 Irrigation
0255 Landscape - plant procurement
0256 Landscape - establishment
0257 Landscape - roadworks and street trees (AUS-SPEC)
0261 Landscape - furniture and fixtures
0271 Pavement base and subbase
0272 Asphaltic concrete
0273 Sprayed bituminous surfacing
0274 Concrete pavement
0275 Segmental pavers - mortar bed
0276 Segmental pavers - sand bed
0277 Pavement ancillaries
0281 Bushfire perimeter tracks (AUS-SPEC)
0292 Masonry walls (AUS-SPEC)
0293 Crib retaining walls (AUS-SPEC)

03 STRUCTURE
0301 Piling
0310 Concrete - combined
0311 Concrete formwork
0312 Concrete reinforcement
0313 Concrete post-tensioned
0314 Concrete in situ
0315 Concrete finishes
0316 Precast concrete
0317 Tilt-up concrete
0318 Shotcrete
0319 Minor concrete works (AUS-SPEC)
0321 Monolithic stabilised earth walling
0322 Earth block walling
0323 Straw bale
0331 Brick and block construction
0332 Stone masonry
0333 Stone repair
0334 Block construction
0335 Brick construction
0341 Structural steel
0342 Light steel framing
0343 Tensioned membrane structures
0344 Steel - hot dip galvanized coatings
0345 Steel - protective paint coatings
0346 Structural fire protection systems
0381 Structural timber
0382 Light timber framing
0383 Flooring and decking

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
0431 Cladding - combined
0432 Curtain walls
0433 Stone cladding
0434 Cladding - panels
0435 Cladding - planks
0436 Cladding - profiled sheet metal
0437 Cladding - sheet and pre-assembled systems
0451 Windows and glazed doors
0452 Window hardware
0453 Doors and hatches
0454 Overhead doors
0455 Door hardware
0456 Louvre windows
0457 External screens
0461 Glazing
0462 Structural glazing
0463 Glass blockwork
0467 Glass components
0471 Insulation and sarking membranes
0472 Acoustic insulation

05 INTERIOR
0511 Lining
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
0531 Suspended ceilings - combined
0532 Suspended ceilings - flushed lined
0533 Suspended ceilings - panel systems
0534 Suspended ceilings - tiled
0541 Access floors
0551 Joinery
0552 Metalwork
0553 Stainless steel benching
### APPENDIX E: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>0554</td>
<td>Stairs, ladders and walkways</td>
</tr>
<tr>
<td>0571</td>
<td>Workstations</td>
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<td>0572</td>
<td>Miscellaneous furniture</td>
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<tr>
<td>0573</td>
<td>Extinguishers and blankets</td>
</tr>
<tr>
<td>0574</td>
<td>Window coverings</td>
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<tr>
<td>0575</td>
<td>Tapestries</td>
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<td>0581</td>
<td>Signs and display</td>
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<td>Plastering</td>
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<td>Cementitious toppings</td>
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<td>Terrazzo in situ</td>
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<td>0576</td>
<td>Waterproofing - wet areas</td>
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<td>0577</td>
<td>Ceramic tiling</td>
</tr>
<tr>
<td>0578</td>
<td>Stone and terrazzo tiling</td>
</tr>
<tr>
<td>0579</td>
<td>Applied wall finishes</td>
</tr>
<tr>
<td>0580</td>
<td>Resilient finishes</td>
</tr>
<tr>
<td>0581</td>
<td>Carpets</td>
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<tr>
<td>0582</td>
<td>Engineered panel flooring</td>
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<td>Timber flooring</td>
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<tr>
<td>0584</td>
<td>Floor sanding and finishing</td>
</tr>
<tr>
<td>0585</td>
<td>Resin based seamless flooring</td>
</tr>
<tr>
<td>0586</td>
<td>Painting</td>
</tr>
<tr>
<td>0587</td>
<td>Textured and membrane coatings</td>
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<tr>
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APPENDIX E: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

1131 Rolled concrete subbase
1132 Mass 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
1141 Flexible pavements
1142 Bituminous cold mix
1143 Sprayed bituminous surfacing
1144 Asphalitic concrete (Roadways)
1145 Segmental paving
1146 Bituminous microsurfacing
1151 Road openings and restoration
1152 Road openings and restoration (Utilities)
1163 Rigid concrete and road safety barrier systems (Public domain)
1171 Subsurface drainage
1172 Subsoil and foundation drains
1173 Pavement drains
1174 Drainage mats
1191 Pavement markings
1192 Signposting
1193 Guide posts
1194 Non-rigid road safety barrier systems (Public domain)
1195 Boundary fences for road reserves

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

14 MAINTENANCE AND OPERATIONS - URBAN AND OPEN SPACES
1401 Technical specifications for parks and recreation areas
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
1424 Landscape - maintenance (NATSPEC)
1431 Footpath paving repairs
1432 Gravel footpath repairs
1433 Footpath and kerb ramp repairs adjacent to roadways
1441 Bituminous surfacing repairs
1442 Boat ramps maintenance
1461 Swimming enclosures maintenance
1462 Boundary fence repair
1471 Barbecues maintenance
1472 Drinking fountains maintenance
1473 Fences, rails, racks, guards and barriers
1474 Lighting maintenance
1475 Playground equipment maintenance
1476 Park furniture maintenance
1477 Sports ground facilities maintenance
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

15 MAINTENANCE AND OPERATIONS - BUILDINGS
1501 Technical specifications for buildings and facilities
1531 Floors
1532 Walls
1533 Doorways and windows
1534 Ceilings
1535 Roofing
1571 Mechanical systems
1572 Hydraulic systems
1573 Electrical systems
1581 External building surveillance
1582 Accident repairs management (Recoverable)
1583 Emergency call out
1584 Storm damage response
1585 External cleaning
1586 Internal cleaning
1587 Sanitary cleaning
1588 Windows cleaning
1589 Cleaning - blinds and fire proofing of curtains

16 MAINTENANCE AND OPERATION - ROADWAYS
1601 Technical specifications for road reserves
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 Resheeting unsealed roads
1618 Heavy patching
1619 Minor patching
1620 Pothole repair
1621 Concrete pavement repairs
1622 Concrete slab stabilization
1623 Emergency pavement repairs
1631 Edge break repair
1632 Grading unsealed shoulders
1633 Resheeting unsealed shoulders
1634 Local scour repair
1641 Kerb and channel gutter repairs
### APPENDIX E: TABLES FROM UNICLASS, OMNICLASS & NATSPEC

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<td>Carriageway delineators</td>
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<td>Roadway guard fence</td>
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<td>Road reserve regulatory, warning and standard signs</td>
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### MAINTENANCE AND OPERATIONS - BRIDGES

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### MAINTENANCE AND OPERATIONS - PUBLIC UTILITIES

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