Enquiry into the role of Smart ICT in the design and planning of infrastructure.

The Institute of Public Works Engineering Australasia, Queensland Division (IPWEAQ) is pleased to provide the attached submission to the House of Representatives Standing Committee on Infrastructure and Communications Inquiry into the role of Smart ICT in the design and planning of infrastructure.

Introduction

IPWEA Queensland is a professional organisation providing member services and advocacy for those involved in the planning and delivery of public works and engineering services to the community. Our members represent practitioners in state and local government as well as private industry. It is a Division of the Institute of Public Works Engineering Australasia, which now includes New Zealand.

IPWEA Queensland has more than 600 members who operate in a variety of roles including engineers, technicians, public works directors, contractors, consultants, managers and other technical staff and managers.

Members work in and are recognised by local government, public and private sector organisations as professional, respected and reliable.

IPWEA Queensland helps to improve the quality of life of local communities by:

- Promoting excellence in the delivery of sustainable public works and services;
- Facilitating the development and exchange of ideas, information and technology;
- Fostering the personal, career and skills growth of its members;
- Advancing public works engineering and services issues on the public agenda.

IPWEAQ has for many years been involved in the provision of technical documents and provision of training for skills development of its members for the improvement of the local government industry both on a state and national basis. IPWEA Queensland produces best practice methods, manuals, templates, drawings and procedures to help improve industry standards and reduce duplication and inconsistencies across the industry.

IPWEAQ takes pride in the process it uses to develop and maintain our peer reviewed standard documents. Importantly, we strive to involve a range of industry stakeholders from across the state (and nationally where required) to cover rural as well as developed areas and to take account of different climatic conditions.
Publications include:

- Standard Drawings
- Lower Order Road Design Guide
- Complete Streets
- Queensland Urban Drainage Manual
- Supervisors Handbook

Each of these publications seeks to achieve consistency of data and standards across Councils, in Queensland and nationally.

However the Standard that is of particular importance to this enquiry is ADAC (Asset Design As Constructed) - developed in conjunction with local government agencies and IPWEA Queensland. The aim of ADAC is to improve the standard and quality of asset information including the process for delivery and round tripping of asset information.

IPWEA Queensland would be pleased to provide more information to the Committee if required. Please Contact Ross Guppy, Technical Products Manager, on 07 3632 6804 or rguppy@ipweaq.asn.au for more information.

Yours sincerely,

Leigh Cunningham
Chief Executive Officer
Where did ADAC come from?
ADAC commenced as a regional collaboration project involving three adjoining councils located on Queensland’s Sunshine Coast, each experiencing a significant growth in urban developments. All three local authorities were becoming increasingly challenged in managing the rising levels of donated infrastructure and the inconsistent standards and formats it was being supplied in. Their goal was to develop a robust framework for the efficient and standardised capture, delivery and use of public works asset data.

What is ADAC?
ADAC is a process that was initially established to define the information required by local government at the time of plan sealing, when the works constructed by developers must be approved, and the donated assets taken into the local government asset systems. It also supports the internal (capital) works of local government, allowing the as constructed information from that process to be uploaded into asset management and GIS systems. This information is supplied electronically, allowing automated upload.

The ADAC project was initiated in 2006 and supports the efficient transfer of “As Constructed” asset information from the land development industry to councils and vice versa. The process is designed to capture detailed data on new civil infrastructure assets including water, sewerage, drainage, roads and open space as well as survey-accurate cadastral information.

The project, which was originally conceived and operated by a number of member councils in South East Queensland under a regional collaboration model, has continued to grow in scale and maturity. The ADAC project has now linked with the IPWEA Queensland Division and IPWEA-NAMS to facilitate further expansion of the ADAC product at a national level and is being rolled out using a subscriber-based business model for asset owners.

ADAC is a set of tools supported by IPWEA that make the exchange of standardised asset information easier between asset designers, constructors and owners. With the increasing take-up of the ADAC process, major commercial providers of Survey, Design, GIS and Asset Management Systems now provide ADAC configurations ‘out of the box’.

ADAC offers substantial benefits to all stakeholders involved in the project life cycle, and specifically “As Constructed” process chain. Land Developers’ Consultants that are responsible for preparing “As Con” plans and providing asset information on new urban developments now have a consistent approach when recording this information and supplying it to any ADAC participating councils.

ADAC is a standard data transfer format, not a software solution per se and is comprised of three components: Data Standard, data transfer mechanism, and supporting documentation.

The standard data specification has been developed by asset management practitioners and it sets out both the spatial and non-spatial data (attributes) requirements for the supported asset classes. That way you can capture them in this manner, data for your GIS and asset register at the same time and you know the two will be in synch and simultaneously imported to guarantee consistency.

The vision is that ADAC will become the industry standard for describing civil infrastructure asset design and as constructed data across a range of public and private asset classes.

The ADAC specification is endorsed by the National Asset Management Strategy (NAMS), and is the only data specification referenced in the International Infrastructure Management Manual.
Within that context, IPWEAQ has a specific commitment to support the use of open data standards for sharing information across the supply chain and improving processes in the delivery and management of civil infrastructure throughout the entire project and asset life cycle. The need for vendor-neutral (non-proprietary) data transfer mechanisms has been a driving force for members and promotes industry innovation, rather than control.

The beauty of ADAC’s open data philosophy is that you’re not tied to any one software vendor. You can use ADAC to configure any system to generate standard asset data that can be automatically validated and imported directly into Asset Management and GIS systems.

The non-proprietary XML based, data transfer mechanism is free and allows you to exchange ADAC asset data in either direction. You simply give the XML specification to your software vendors and data suppliers for them to set up their own systems to provide ADAC compliant data. Software developers are routinely provided with updates to the ADAC schema free of charge and proprietary commercial products are then developed and made available to surveyors and engineers to produce a valid XML. A number of vendors such as 12D Solutions, Safe FME, Keays & BricsCAD have already built ADAC into their products due to industry demand. Given the range of commercial products already “ADAC compatible”, end users rarely (if at all) need to buy new software if they don’t want to, nor do they have to pay any license fee to the ADAC consortium or IPWEA. Fees are only payable by utility and asset owners to contribute to the maintenance and further development of the schema such as Councils.

In addition there is a set of tools and guidelines to support consortium members in setting up and implementing ADAC. This includes data capture guidelines for surveyors, and examples of how other sites have set up ADAC.

The ADAC data file is generated from accurate survey information as this data is imported for import into the Geographical Information Systems (GIS). The use of survey accurate geospatial data allows the asset owner to comply with Quality Level A as defined by AS 5488-2013 Classification of Subsurface Utility Information. The most recent version of the ADAC Schema allows the inclusion of metadata to record the quality level within the asset management systems. Importantly, this allows asset data to be exported digitally from the utility/asset owner direct to external industry using fully automated request systems such as “Dial Before You Dig” in a survey accurate format. This eliminates data interoperability problems, prevents the need to recapture or “digitise” hard copy data and allows industry to value add on the product. The benefit of data distribution through automated request systems versus open portals is the ability for asset owners to incorporate logic, security and business rule checks prior to information being released to end users.

The full Schema is defined in a series of *.xsd files that are available from the IPWEAQ website. An ADAC XML file comprises a “root, branch and leaf” hierarchy of data elements arranged according to the ADAC schema. The Project element contains a hierarchy of subelements that describe information pertinent to the project as a whole and one further element called ProjectData, which contains a hierarchy of infrastructure types and their associated sub-elements to describe the individual feature classes such as pipes, fittings and manholes.

One ADAC XML file is able to simultaneously contain municipal infrastructure of many types such as land subdivision developments. For conceptual convenience in diagrammatic representations, and to aid the maintenance of the schema program code, these are separated into the different types of infrastructure. However, infrastructure from one area can be a used in another area. For example, the storm water end structures can be used for sewerage outfalls and water main scour headwalls, and roads might feature in a sewage treatment plant. Moreover, certain water-related customer-owned infrastructure such as drinking fountains and irrigation systems are described in the water supply area despite not being part of the mains supply system. For these reasons, the Owner and Department attributes associated with every asset are used by the receiving...
entities’ Electronic Transform and Load (ETL) software to select and group assets into the appropriate area of their asset management systems and GIS layers.

**Key Drivers for Business Change**

Councils are responsible for the planning and management of a broad range of public assets including roads, footpaths, stormwater systems, parks and all manner of associated furniture and improvements. In some states, councils may also be responsible for the planning and management of public water and sewerage systems.

The vast majority of these important assets are "contributed or donated" to councils via the land development process as a part of new sub-divisions. Councils, even those with low to moderate levels of growth, can potentially receive many millions of dollars of new assets annually. There are no better examples than areas with large industry growth such as Gladstone on the Queensland coastline who have adopted ADAC to address this very problem.

Historically, hardcopy ‘As Constructed’ plans are submitted to local authorities at the completion of each major stage of a development. The collection of asset data on this new civil infrastructure is then actioned through scrutiny of the supplied plans. This approach is recognised as both time consuming and potentially prone to human errors.

The ADAC process allows for all relevant details associated with the donated assets to be captured accurately and consistently in an electronic manner. The capture process is undertaken according to a predefined asset data model during creation of the “As Constructed” plans. The information is provided to councils in digital form and can be used to create relevant GIS layers and support the automated population of other backend systems such as asset management databases.

The digital format enables rapid valuation of assets and computerised checking of the supplied information against any pre-defined business rules, saving time and money. The information can then be used in the development of necessary operations, maintenance and renewal plans along with cash flows identified for budgeting forecasts. The ADAC process can also be applied to internal capital works where the scale of works or expenditure thresholds necessitates the provision of “As Constructed” information.

The ADAC process can be implemented partially or completely, depending on the needs and maturity of the organisation. There is no need to change or upgrade existing information systems and implementation can be staged to gain specific benefits and ease any impact on existing associate processes. It is also noted that ADAC processes and systems apply equally well to larger utility organisations, including regional or state water authorities.

**Typical Benefits**

Through subscription and with the effective implementation of adopted parts of the process, ADAC can provide the following benefits to a receiving organisation such as a council or utility:

- Significant time and resource savings in the processing of “As Constructed” data;
- Improved consistency and accuracy of detailed asset data provided to council;
- Ability to perform “rule-based” quality control checks on the supplied asset data ensuring completeness and integrity;

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• Capability for automated uploading of asset data to GIS, asset management databases and other tools;
• Transparency of asset registration and valuation processes, resulting in improved corporate governance;
• Capacity to reconcile individual donated trunk assets with infrastructure agreements;
• Potential to “round-trip” asset data and related information to external customers in a consistent format;
• Access to a network of other ADAC user councils and forums that can provide support in leveraging and value-adding to asset registration processes and other associated asset management activities;
• A framework allowing relevant software vendors to understand and support the immediate and practical needs of their users;

Benefits from ADAC Design Lodgement
The benefits gained through the widespread adoption of ADAC for as-constructed lodgement are further amplified by the adoption of the standard for submission of design documentation. This is particularly true for Council Development Assessment functions, whose gains from as-constructed lodgement alone are relatively modest.

These benefits include:

• Consistent data exchange format enables integration of existing asset information into the engineering design process;
• Improved existing asset information quality provides greater confidence in data provided by Council;
• Potential for automated engineering checks of design data, benefiting both developers and Council development assessment processes;
• Significant gains in the efficiency of as-constructed assessment by automated comparison with approved ADAC design data;
• Ability for Councils to easily integrate proposed works into forward asset planning decisions.
• Benefits from ADAC As-constructed Lodgement

Benefits to Land Developers
The potential benefits to Land Developers in adopting the ADAC standard include:

• Consistent approach to preparing as-constructed information for expanding number of participating Councils. There are currently 24+ council and asset owners subscribed to ADAC as per Appendix B;
• Potential for ADAC-XML data to be produced directly from the surveying process eliminating duplication of effort;
• Improved quality and timeliness of existing asset data provided by Councils;
• Lower costs if built into business processes;
• Validation of ADAC-XML data prior to lodgement;
• Faster acceptance of as-constructed data; and
• Earlier sealing of plans.

For Survey Consultants, the benefits include:

• Use of field equipment and/or survey software to directly output ADAC-XML;
• Incorporation of ADAC-XML design data to provide attribute information, and to immediately highlight deviations;
• Recording of survey metadata into each surveyed point; and
• Eliminated need to draft as-constructed data into drawings for submission.

Benefits to Councils and Asset Owners
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For participating authorities, the key benefit lies in the quality, accuracy and timeliness of asset data. These are achieved through:

- Improved quality and accuracy of asset data provided;
- Ability to apply rule-based engineering and other quality checks to ensure conformance of as-constructed data with engineering criteria and rules, and check completeness of networks;
- Automated loading of asset data into GIS and asset management systems, eliminating human key-in errors, and freeing resources for other tasks. Existing councils are reporting drastic reductions in human labour for asset register data entry. As an example, a typical 25 lot subdivision can be fully populated to the asset register and GIS system in less than 30mins, a task that used to take about 4 days;
- Improved corporate governance through more robust asset registration and valuation processes;
- Greater accuracy of financial records;
- Faster turnaround of approval decisions;
- Greater consistency between Councils, enabling greater sharing of asset information and tools;
- Improved network modelling of water, wastewater and stormwater assets; and
- Use of a common standard and tools for registration of internal works.

- "Automatic Load" routines can transfer data from ADAC electronic file format to Spreadsheets, Databases, GIS, Asset Management and Financial Systems in a streamlined and repeatable manner saving time and significant human labour depending on the amount of incoming information at a particular organisation.
- The asset valuation can be automated and simplified. By applying unit rates to the ADAC data, component values and aggregated costs can be quickly calculated.
- Financial registration processes are transparent and auditable, resulting in improved corporate governance.

All groups within an organisation, including Development Assessment, Asset Management and Spatial Information services benefit to varying degrees from the adoption of the standard. These benefits combine to improve the asset creation process for the community as a whole. Cost savings for the development industry and asset owners will result in lower infrastructure costs and improved affordability.

**Current Trials**

South Australia is undertaking an ADAC Implementation Benefits trial. The aim of this research project is to investigate the options for Developers, Designers, Surveyors and South Australian Councils to implement the Asset Design & As Constructed (ADAC) framework and data specification for fast digital lodgement of infrastructure asset design and as-constructed data.

In a broad sense, this project aims to create a positive and effective change management tool with regards to a solution in the market for streamlining the asset data interaction between developers, designers, consultants, construction companies, surveyors and Council field staff and officers.

The project seeks to research the identified potential 'ADAC implementation challenges' faced by South Australian Councils. Furthermore, the project aims to provide options for local implementation through three (3) case studies involving land divisions regulated by Local Government – also referred to as “pilot sites”.

The light council pilot site has been initiated and the data translation systems configured. As designed drawings have updated with ADAC data and tested for compliance with the ADAC schema. In addition ADAC drawing XML (data) exports have been created and testing is underway. We expect to have most findings from all pilot sites in draft format around March 2016.
SEQ Water Supply and Sewerage Design & Construction Code – Case Study

One of the key deliverables of the SEQ Code is the need for a common standard for the submission of design and as-constructed information. This Asset Information Specification details the requirements of the SEQ Service Providers (SEQ-SPs) with respect to the quality, type, format and completeness of information to be submitted by project proponents and their agents.

The submission of an ADAC XML file detailing the approved design is advantageous to both the relevant SEQ-SP and to the project proponent alike. For the SEQ-SP, it enables the entry of the design information into a proposed-works layer of its Geographical Information System (GIS) and when the as-constructed ADAC XML file is subsequently submitted, it permits machine automated checking by comparing the two XML files. For the project proponent, it reduces the likelihood that problems with the as-constructed XML will delay acceptance of the infrastructure upon completion.

The final as constructed handover drawings must comply with the ADAC specification. Therefore it is highly recommended that design drawings also comply with the ADAC specification so as to minimise the need for redrafting (or multiple conversions) of drawings.

The ADAC XML format (Schema) is a non-proprietary data specification and data transport tool written in the XML language. It can be considered as a "data dictionary" containing a library of asset data, which comprises attributes, spatial information and metadata.

The ADAC Schema is used to facilitate the collection, lodgement and retrieval of detailed cadastral and other asset information for both developer contributed and utility-provider constructed infrastructure assets relating to water, sewerage, drainage, roads and open space. For assets to be donated to, built for, or built by, the SEQSPs, the ADAC schema facilitates the semi-automatic checking, validation and uploading of asset information into the receiving entities’ computerised asset-management systems using ETL software. The generalised process for data transfer is depicted in the below Figure.

As the Schema facilitates data migration across many types of proprietary software applications, which may run on differing hardware platforms, it must be both machine and system independent. This independence allows the XML file generator to reside within the engineering drawing software, the surveying software, in a stand-alone system, or in some combination of all these to produce the final XML data file.
City of Gold Coast – Case Study

The City of Gold Coast has developed an As Constructed Data Standard that incorporates the Asset Design As Constructed (ADAC) specification, together with an ADAC XML Data Capture Guideline.

The purpose of this document is to provide practical guidelines and general assistance with respect to the creation and provision of compliant ADAC XML files. ADAC XML files are to accompany any associated bundle of “As-Constructed” plans, drawings, schedules and associated information reflecting newly constructed civil infrastructure and associated assets handed over to the City of Gold Coast.

On completion of physical works and prior to asset handover, “As-Constructed” (also known as “As-Built”) information is used to indicate the locations of infrastructure installed as a part of the physical works. The final “As-Constructed” data should accurately reflect material types, specifications and other asset-specific information. The digital ADAC XML file is a complete and detailed digital record of “As-Constructed” Plan information and is used by the City to populate its asset system.

Specific details regarding the preparation and presentation of the ADAC XML can be accessed via the Gold Coast Planning Scheme Policy 11 – Land Development Guidelines.

Once the ADAC XML file(s) are accepted by the City, they are then uploaded to various internal systems and used to assist in the long-term management of the infrastructure. The detailed asset and location data is also available to external agencies in the future via various digital formats.

Recommendations

We recommend that the Australian Government:

- Facilitate the development of a common set of standards in close consultation with industry, including public works technical staff.
- Not impose proprietary standardising data formats and details. But rather ensure the use of open source data formats. This is an important move away from proprietary-constrained data formats and will encourage innovation, promote system integration, competition and allow a level playing field.
- Ensure that the infrastructure asset owners 3D geospatial data be made available to the Australian public, by supporting initiatives such as open data portals or automated request systems such as Dial Before You Dig (DBYD).
- Ensure that this data be treated like other ‘open source’ data and be made available for Australian companies to innovate and experiment with.
- Support the implementation of collaborative pilot projects (involving the private and public sectors) and other forms of innovation or experimentation regarding harmonising data formats, storage and access.
- Consider what change management and skill frameworks are required to move employees and organisations from manual operations to a connected network of infrastructure (funding, training implications, IT implications, infrastructure upgrade and renewal, and asset management).

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- Support investigations into lowering costs and developing different business models for adoption of smart systems such as ADAC.
- Support initiatives that facilitate knowledge transfer between asset owners and external stakeholders.
Appendix A
ADAC – Getting it right first time with consistent data
Appendix B

Existing ADAC utility and asset owners

- Brisbane City Council
- Bundaberg Regional Council
- City of Charles Sturt
- Gladstone Regional Council
- Gold Coast City Council
- Gympie Regional Council
- Light Regional Council
- Lockyer Valley Regional Council
- Logan City Council
- Mackay Regional Council
- Moreton Bay Regional Council
- Port of Brisbane
- Redland City Council
- Rockhampton Regional Council
- SA Water
- Sunshine Coast Regional Council
- Toowoomba Regional Council
- Transurban
- Tweed Shire Council
- Unity Water
- Urban Utilities
- Whitsunday Regional Council
- Wide Bay Water Corporation
- Wollondilly Shire Council