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ABSTRACT

The New Zealand government has released the new national infrastructure meta-data standards. The new national standards, like any set of standards are a group of documents that need to be interpreted and understood by all stakeholders before they can be implemented successfully. Different interpretations between the council and as-built creators concerning what information is actually required and acceptable can lead to misunderstandings and confusion.

The adoption of the new national standards may lead to increased processing cost and risk:

- Councils and as-built creators require time and experience to learn what is required in regards to data collected and formatting requirements.
- Increased rates of omissions and errors in submitted as-built information will lead to costly submission redo's if errors found of potentially bad data entered into council systems if not discovered.
- Database systems may need updating to handle the new required information.

This paper discusses how the as-built industry in New Zealand need to embrace as-built information systems that allow for an easy to understand, standardized, concrete view of the national infrastructure meta-data standard requirements. A standardised view of the as-built requirements will minimize misunderstandings and simplify the communication between as-built creators and councils of what those new requirements are and how well the information supplied meets those requirements. This in-turn minimises the likelihood of submitting and accepting as-built documents which contain errors and omissions.

Additionally, councils who adopt the new national infrastructure meta-data standards often will need to incorporate changes to their back-end Geographical Information Systems (GIS) and Asset Management Systems (AMS) to allow for the recording and storage of the information contained in the new standards. This paper will also discuss how as-built information systems that have the ability to output GIS and AMS data files give councils the ability to map changes in the data collected in the as-built to existing tables and fields in council's backend GIS and AMS systems. Potentially, providing options to allow incorporating the new standards without necessitating costly and difficult changes to those council's back-end data systems.

This paper will discuss the empirical evidence and feedback supplied from councils in New Zealand who have experienced adapting to the use of as-built information systems. How after receiving validated, formatted and standardized as-builts in the form of GIS and AMS data files, these councils have saved valuable time, effort and resources in processing those as-builts. This paper will also discuss how the many benefits of incorporating as-built information systems for councils also extends to the consultant/developer submitting the as-built. This paper will discuss how they can more easily understand exactly what information is expected in the as-built, the information they enter is validated and formatted by the as-built software. Additionally, the paper

discusses how using as-built information systems has saved the consultant/developer time and effort while eliminating costly as-built redo's.

KEYWORDS

National Infrastructure Meta-Data Standards, As-builts, As-built Software, GIS, AMS

PRESENTER PROFILE

Scott Ferguson is an as-built specialist who has been involved with councils and consultants for many years in streamlining as-built processes. He is an as-built automation evangelist who enjoys engaging with people in how to improve the as-built process.

Professionally, Scott has been developing software applications for many years. He is the Software Architect and Senior Product Developer at A2K Technologies for the blackbox22 software application.

Scott lives in the Waikato and enjoys a rural lifestyle. In his spare time, he likes hooning about in his tractor and pushing cows around the paddock.

1 INTRODUCTION

New Zealand is continuing to grow rapidly and understanding infrastructure resources in order to make informed policy and investment decisions is more important than ever.

Wide spread adoption of the new national meta-data asset standards by councils in New Zealand is an important step in being able to increase asset manager's ability for analytical analysis of the nation's three waters infrastructure and is needed to assist in making those policy and investment decisions.

Without awareness in how to successfully implement this type of wide scale standards change, council adoption of the new standard may present significant challenges for council, particularly when accepting as-built documents.

The most significant challenge will be aligning the new standard's requirements with the knowledge and abilities of the as-built suppliers in their respective areas.

Most councils in New Zealand already struggle dealing with processing submitted as-built documents. Due to the nature of the as-built information being received, the lack of consistency in the information, combined with errors and omissions contained in the documents, councils must process as-built documents manually into their database systems in a time consuming process, one asset at a time. At times, processing a single as-built can take days to complete.

A blanket introduction of new meta-data standard requirements will likely lead, in the near term, to an increase in errors and mistakes due to different interpretations and misunderstanding with the as-built suppliers as they come to terms with the new expectations described in the standard documents. This will put even more strain on councils as they struggle to re-educate the as-built suppliers in how to properly deliver as-built documentation.

Asset managers will be aware of the likelihood of increased time and effort required to adopt to changing asset standards. Without an implementation plan to address these issues combined with council's resource constraints, some asset managers may delay making a decision to adopt the new standards until they are confident in its successful deployment.

This paper will discuss how councils in New Zealand have adopted as-built software to help them eliminate most of the as-built processing issues associated with adopting new standards. The introduction of as-built software has eliminated confusion and any ambiguity as to the information required by council when submitting as-built documents. The as-built software currently in use by as-built suppliers is able to validate the information to ensure its appropriateness before the data is submitted to those councils. The software will format the data so it conforms to the council's expectations every time.

The as-building software is then able to compile the validated, formatted as-built information into database ready files that once submitted to council, are able to be populated in the database in a process that takes just minutes.

By providing asset managers with a proven means of easily adopting the new national meta-data standard will mean a quicker uptake of the standard across New Zealand.

2 NEW NATIONAL STANDARDS ARE RELEASED

Over many years' various regions across New Zealand, independent of one another, developed their own infrastructure asset standards, asset terminology and other infrastructure information requirements. This has made large scale macro comparisons, analysis and decision making between the disparate regions difficult.

The newly released Asset Metadata Standard provides a common understanding of the meaning or semantics of the asset data. This will help to align any differences in use or interpretation of asset meta-data across the many different regions in New Zealand.

As regions implement the national metadata standard, asset managers will enjoy the benefits of having a common specification for asset data. The specification supports good stewardship of their asset information in regards to data creation, storage and collection. By incorporating a common standard for asset data across regions this will allow for significantly increased analytical capabilities of asset managers in making evidence-based investment decisions.

Once incorporated, the increase in analytical capabilities will greatly assist relevant stakeholders with making informed policy decisions; nationally, across regions and locally. Additionally, it will assist in prioritising appropriate levels of investments and funding around the country; nationally, regionally and locally. As New Zealand continues its rapid growth and development, infrastructure asset policy and funding decisions will continue to play a vital role for the foreseeable future. This in-turn makes the wide spread adoption of the new national meta-data standard an important step forward for the future of the nation.

2.1 ASSET STANDARD IMPLEMENTATION ISSUES

While the broad adoption of the new national meta-data standards will bring many long-term benefits across New Zealand, the finer details concerning how councils can successfully implement the standard has not been thoroughly discussed in great detail. It is assumed councils will need to work through / discover individually the best methods to implement these changes themselves.

Many councils are already spending considerable time and effort to process as-builts created by as-built suppliers for their current asset specifications. Introducing wide spread change to the asset specification without a creditable implementation plan on how to successful roll-out those changes to the as-built suppliers can leave some asset managers wondering what is the best way to proceed. There is also risks that without an implementation plain which is ready to be utilised by asset managers, the speed at which asset managers are willing / able to adopt to the new standards may not meet expectations.

2.2 COUNCIL AND AS-BUILT SUPPLIER ISSUES

The greatest struggle most councils have in relation to the asset standards is with efficiently processing the as-built information into their systems. Councils and asset managers are heavily reliant on as-built suppliers ability to submit as-built documents that consistently conform to the asset requirement of the council. Malformed submitted as-built documents with missing and / or errant data cause considerable time delays and extended effort for councils as they struggle to input the information into their internal systems.

As-built suppliers normally want to produce as-built documents that contain exactly what is required by the council. When as-built documents are returned from council for further clarification or correction the as-built supplier needs to invest more time and effort on the as-built documents and typically cannot charge the client for the extra effort.

Additionally, most as-built suppliers receive their final payment from the client after the as-built document receives the OK from the council. Any delays in receiving that OK work directly against their own best interest.

While it would be easy to pass the responsibility for malformed, improper as-built submittals solely onto the as-built suppliers, who actually are motivated to supply property formed as-builts but are unable to consistently do so. Instead, the root causes at the centre of this issue can be spread amongst several factors:

- The types of as-built documents submitted (DWG's and PDF's).
- The necessity to interpret the asset specification.
- The experience and abilities of the as-built creator.

Most as-built documents are submitted to council in the form of CAD drawings (.dwg) and PDF documents. Neither of these two document types lend themselves to easily transferring information from one system to the another. Nor can they help validate the as-built information that is being supplied or provide transparency and clarity to the as-built suppliers as to the proper format of the documents.

Instead as-built suppliers need to use their understanding of the *intent* of asset standard documents to create CAD drawings and pdfs which are used as models and images to represent the assets in the as-built. Any additional information required by the asset standard is attached to the documents or provided separately. This type of workflow naturally leads to a wide variability in the types and quality of the as-builts received by

council as each as-built creator may have a different understanding of the requirements and intent of the asset standard and possess varying skill levels and abilities to create useable models in CAD and pdf.

Due to this variability in quality and reliability along with the fact the data is presented in the form of CAD drawings and pdf's, most councils find themselves using manual keyboard data entry to enter the as-built data into their systems one asset at a time. It is not unusual for an asset team member at council to take two or more days to enter the as-built information for a single as-built. In fact, it is not uncommon to have a troublesome as-built document take more than a week to fully process.

2.3 ADOPTION OF NEW STANDARDS BRINGS SHORT-TERM PAIN

Most asset managers are already entirely aware of these data entry issues and the root cause for them. However, until recently there were not a lot of viable solutions to address them.

When the new national meta-data standards are ushered in by council, this can present even more challenges to asset managers who need to:

- Inform all as-built suppliers of the asset standard changes.
- Ensure the as-built suppliers understand what changes are to be made.
- Ensure the as-built suppliers are able adopt to the changes.
- Ensure the as-built suppliers consistently remember to adhere to the changes and are motivated to do so.

Updating the council's asset specification to align with the national meta-data standard will initially lead to greater confusion, misinterpretation and errors in the supplied as-built documents until the as-built supplier and council staff get accustomed to the new data requirements. This in-turn will lead to greater levels of time and effort spent by councils and as-built suppliers as all parties get used to the changes. Many councils in New Zealand are currently struggling to process their as-builts in a timely and efficient manner. Therefore, introducing change that will, at least in the beginning, cause even more effort and strain on their system may lead to greater delays in implementing the new national standard as councils seek to identify the best way forward.

3 AS-BUILT SOFTWARE

Until recently there hasn't been many solutions to these types of issues regarding the complications around creating and processing as-built documents. This is why councils have been struggling for several decades with processing as-builts. These issues have only been exacerbated as the amount of meta-data that is being collected has increased. Unaware of the benefits of next generation as-built software and without seeing a way to address these issues directly, most asset managers have accepted that processing as-builts is time consuming, expensive and the related issues are unavoidable.

As-builting software has been around in one form or another for many years. Typically, as-built software has been portrayed as bespoke or custom built and so would work for a particular organisation or only in certain circumstances. However, some applications have continuously developed over time and have proven to be very flexible, highly configurable and can be employed by multiple councils, with each council implementation having its own unique specification, validation and output.

There are councils in New Zealand, such as Tauranga City Council, Watercare and others who are currently utilising as-built software to overcome most of the issues with processing as-builts. These council process relatively large amounts of as-built documents and were motivated accordingly to seek a solution. Each council separately recognised the value offered by utilising as-built software to streamline and improve their as-built processing. To be utilized to its *full* potential as-built software should provide measurable benefits to both councils and as-built suppliers. To do so, provides the best chance for long-term success and adoption. The best as-built software recognises this as its fundamental purpose and therefore delivers high value to the council as a whole.

Benefits to Council:

- Receive only standardised as-builts.
- Greatly reduce the time needed to process as-builts, from days to hours (or less).
- Reduce or eliminate call backs and redo's
- Consistent conformity of council asset specifications.
- Greater confidence in correctness of spatial and attribute data.
- Eliminate need to constantly teach as-built suppliers how to format as-built.
- Reduce complexity for the asset team in processing as-builts.

Benefits to Suppliers:

- Greatly increase transparency of requirements.
- Reduce time and complexity in compiling as-built.
- Automatically format output to council's specification.
- Improve certainty in amount of time it will take to create as-built.
- Reduce or eliminate call backs and redo's
- Improve time to receive final OK from council.

Even with a fully implemented national meta-data standard across the entire country, each participating council will very likely still have unique characteristics particular to them that they will need to be captured in the as-built software. Any as-built software that is to be useful for New Zealand needs to be highly configurable and adaptable enough to work with the unique aspects of each council.

3.1 MANDATING ASSET STANDARD

Once the council has gone through the process of thoroughly examining the new meta-data infrastructure standards and understanding how they can be applied to their particular set of requirements, the council's asset standard documents will need to be updated / published by the council. If councils then wish to adopt an as-built software platform to promote an easy adoption of the meta-data standards in their area, the first step councils need to undertake is to mandate that all as-built information be provided in as per the published asset standard documents.

Some councils have not yet generated a strict mandate that as-builts are to be supplied to them according to their standards. Many asset managers have assumed it was a hard ask considering the current state of the as-built documents supplied to council and the lack of software tools available to assist the as-built suppliers to create documents that conformed to the standard.

Over the last five or more years some organisations such as Tauranga City Council, Watercare Limited have demonstrated the very successful adoption of as-built solutions

that substantially facilitates the compilation and submission of as-built documents in conjunction with as-built suppliers. The as-built solutions simultaneously delivered standardised, formatted, validated as-built data in the form of data files that these organisations are able to process in minutes.

Until the supply of as-built data is mandated to conform to the council’s asset standard and as-built tools are available that can be used to generate as-builts to that standard, asset managers may find it difficult to persuade as-built suppliers to update the own processes to improve the state of the as-built documents that are provided.

3.2 IMPLEMENTATION

Once the updated standards are published as-built software integrators can then configure their as-built software so it conforms to the asset standard.

In other words, the as-built software should be able to “consume” the asset standard documentation and use this information to understand what information to display to the as-built creators.

For an example, when the as-built creator is compiling the as-built, the software will display the information to be supplied in a Windows dialog in the form of textboxes and the drop down controls. See **Figure 1**:

Fitting Properties	
Category	Water
Asset Type	Fitting
Asset Name	BEND1
Point Name	BEND1
Easting	501119.384
Northing	6983461.457
Elevation / RL	29.720
Rotation	0
Unit Type	Bend
Material	PolyVinylChloride
Lining	Unlined

- PolyVinylChloride
- Acrylonitrile Butadiene Styrene
- PolyVinylChloride
- Polyethylene
- Ductile Iron
- Mild Steel

Figure 1: As-built Input Form

Using Windows dialogs to display the asset meta-data to the as-built creator will greatly increase the transparency of the information that is required to be collected.

In Figure 1 above, note the use of drop down controls. These types of controls limit the range of valid values to as-built creator can select form. This helps to prevent typos/misspellings or supplying errant information the council is unable to process. Mistakes like these, once discovered by the council, would often have the asset team member halt processing of the as-built while they informed the supplier of the error and then waited for clarification.

3.3 VALIDATION

With councils that do not use as-built software the council’s asset team have to spend much time indirectly teaching the as-built supplier the correct way to format the malformed as-built documents that are supplied to them. This is primarily done when the asset team member generates documentation to inform the as-built supplier of any issues discovered and what is required to correct them. This type of activity can consume a great deal of the asset team members time.

Good as-building software needs to be able to validate information as it is entered into the system. The best as-built systems are those that can validate the information as it is being entered. This notifies the as-built creator immediately of any issues in the data as they are entering it.

Validating the information as it is entered has the advantage of providing a huge increase in transparency in exactly what information is required and how well the user is doing in providing that information.

In **Figure 2** below, the software is informing the user that there are two properties that are marked as 'required' but do not contain information. The user should fix this issue before sending the completed as-built to the council.

When the as-built is validated on the user’s computer before the data is sent to the council this effectively eliminates the time and efforts councils spend in hunting for mistakes in as-built information. The as-built software can very quickly check each of the values entered to ensure that the required data is present and also that it’s logical for the type of data being entered.

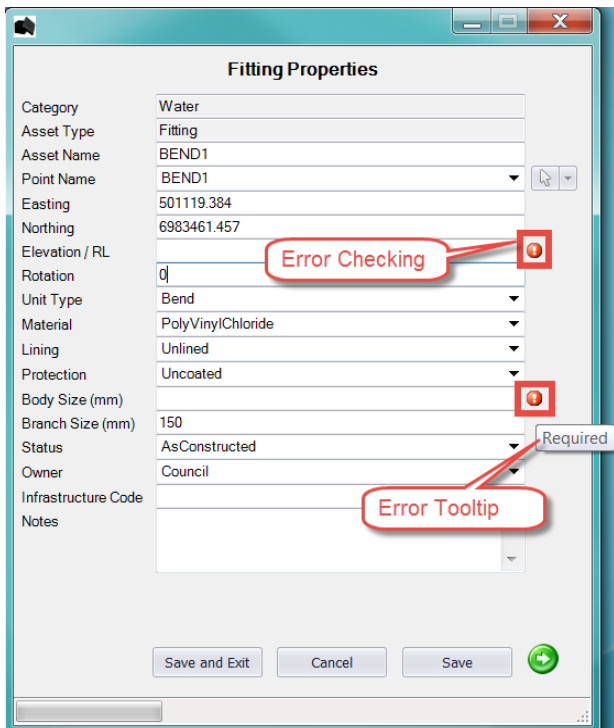


Figure 2: As-built Data Validation

3.4 RULES ENGINE

A rules engine processes one or more business rules. Each rule can validate the appropriateness of values of a particular property of the asset in the as-built. If the as-built software has a comprehensive rules engine, then it is able to use complicated validation techniques such as comparing the values of other properties of the asset. If necessary, it can examine the values of properties of other assets in the same project.

3.4.1 RULES EXAMPLES

Below is a small examples of rules that could have been articulated by an asset team at council. Each one is able to be turned into a rule that the software can use to validate particular property values.

- Check if the stormwater pipes are less than 100 metres between manholes.
- Determine if the sewer pipes are flowing in the right direction.
- Determine if principle mains have a nominal diameter greater than or equal to 100mm.
- Determine if a road subgrade material is deep enough and is of the right material.
- Check the slope of a pipe to see if it is less than 7% for any pipe that is longer than 5 metres.

With as-built software that has a sophisticated rules engine, just about *any* validation statement or action that can be articulated or performed by the asset team members when checking the as-built, can potentially be entered as a validation rule in the as-built software.

This provides a second set of eyes that can very quickly and consistently check the assets and their associated property values.

3.5 FORMATTING CAD OUTPUT

One of the major issues councils have in receiving as-built documents submitted in the form of CAD drawings is the wide variability of the ability of the as-built creator to create/deliver high quality drawings.

Even if councils publish their CAD standards, inevitable there will be some as-built suppliers who possess the knowledge and ability to create really useful CAD drawings and unfortunately some who do not.

Councils in New Zealand who have mandated the use of as-built software when supplying as-built documents to them have eliminated the inconsistent CAD drawing issue. Primarily this is due to the fact that the as-built software mandated by the council has the ability to output the features in the as-built project to a CAD file. The software has been configured using the council's prescribed CAD settings to generate the as-built features into a CAD drawing using the council's pre-defined block symbols, layer names, colours and importantly it will create mtext annotations for each asset.

During the process of annotating the assets, the as-built software will look up the values of the relative properties for each asset, and following the annotation layout prescribed by the council, it will populate those values next to the entity in the drawing.

Manually annotating a drawing will take the CAD user a considerable amount of time to complete, depending on:

- the complexity of the information in each annotation.
- The number of assets to annotate.
- The CAD skill of the user.



Figure 3: Annotations

The as-built software by comparison can quickly generate all annotations in the drawing. Drawing as many as 100 annotations in under five seconds! The time and effort saved by the as-built supplier when using this as-built software to annotate the entities in the drawing can be quite substantial.

3.6 CAD SOFTWARE

All or nearly all as-built documents for infrastructure assets use CAD drawings to represent the as-built assets as a model. Most as-built software will use those CAD drawings in some manner to help capture the spatial information of the asset's contained in the drawing.

However, some of the as-built software available have been created to work with only one particular brand of CAD package; such as 12D, AutoCAD, BricsCAD, etc. This can be done out of technical necessity or perhaps as a way of steering as-built suppliers to use one particular brand of CAD package over another. When given the option most councils such as Tauranga and Watercare will often mandate or recommend as-built software that is CAD package independent. This allows for as-built suppliers who have previously invested in CAD software infrastructure to continue to use their CAD product when compiling the as-built documentation without necessitating the purchase another brand of CAD software they may not be familiar with and certainly didn't anticipate having to purchase.

3.7 OUTPUTTING AS-BUILT INFORMATION

As discussed in this paper, the best as-built software will standardise as-built information, validate the information, and is able to format the information in CAD files.

The last feature mentioned in this paper is also likely the most valuable in regards to the council's infrastructure asset managers. As-built software should be able to output the validated, formatted as-built information into data files that are specifically formatted for each council's unique backend information systems, such as their GIS and AMS systems.

When councils receive validated data files formatted to work with their database systems they can use those files in conjunction with the database systems to self-populate in a process that can take just minutes to complete.

Once this self-populating feature is utilised consistently, immediately eliminated is the workflow whereby council's asset team member spends at times days pouring over each as-built document while manually entering in the asset information into the database, one asset at a time. This process also involves the asset team member simultaneously trying to find any and all of the issues in the documents. If any issues or anomalies are missed at this point, they may end up in the database as part of the permanent record for the asset.

As demonstrated by councils who current use as-built solutions to accepted database ready files, the workflows to import the as-built data involves the asset team member grabbing the submitted database files and moving them to a location where the appropriate database can start the process of automatically loading in the data. The total time for processing the as-built into the system is dramatically reduced as compare to the manually loading in the same as-built document.

3.8 UPDATING THE ASSET STANDARD

From time-to-time most asset standards need to be updated or tweaked. Being able to make changes is particularly useful when a council has recently made major updates to their asset standard, such as when they adopt the new meta-data asset standard.

Often after the initial update to the standard and when it is being used by the as-built suppliers, small issue arises and needed changes are recommended to be made. These small changes / tweaks, if implemented could improve the standard, its relevance and its usefulness to as-built suppliers and council alike. The ability to easily make these types of changes ensures the standard is kept up-to-date and useful. Standards that are not able to be updated run the risk of becoming stale and out-of-date.

When councils use as-built software to display the standard to user, one benefit appreciated by councils and as-built supplies is the ease at which changes to the specification can be communicated. The as-built suppliers need only to use the as-built software and it will display any changes to the specification as it displays the properties in the Windows forms and options available in dropdown controls. Councils may decide to issue email blast and update the standard documents to broadcast changes. When you combine the traditional methods of informing as-built suppliers of any changes along with updating the as-built software to reflect those changes, this insures all as-built suppliers will be informed of the changes and the validation engine in the as-built software will insure the as-built suppliers remember to adjust to the changes.

The most useful as-built software has the built-in ability to quite easily update the individual council specification. It is also highly useful if any changes made to the specification can be broadcast to all installations of the as-built software. This will help ensure all as-built suppliers are using the latest version.

3.9 SIMPLIFYING THE COMPLICATED

All organisations face challenges with knowledge retention for complicated processes when people move on. The more complicated the task, the more challenging it becomes when people get promoted, go on vacation or otherwise leave an organisation.

For asset managers and councils, the loss of key asset team members can mean the knowledge of as-built processing can be lost. Finding replacements can be difficult and often requires significant time and effort to train the new personal in the art of manually processing as-built documents while simultaneously looking for erroneous data in the documents and communicating with the as-built suppliers about any issues.

For as-built suppliers loss of key personal also means time and effort in finding and training new staff. Unexperienced staff who are not experience with the aspects of the asset standards or CAD document creation are one of the key reasons for submitted malformed as-built documents as discussed previously in the "Asset Standard Implementation Issues" section of this paper.

When councils mandate the use of as-built software, this can help to greatly simplify the process for everyone including the council, minimising risks and while taking some of the pressure off of the current asset staff.

Discussions around automating and simplifying as-built processing can bring up issues around feelings about job security amongst some staff, particularly the technical staff. While as-built software can provide major automation benefits, it cannot work autonomously. As-built software is a tool that provides the as-built information in a standardised, validated format. The streamlined processing of as-builts into the council's systems should greatly reduce the daily wear-and-tear on the technical team.

As-building software doesn't replace staff. Someone still needs to turn the dials and flip the switches. Good database administrators will always be a valuable asset for councils. As-building software can actually support staff allowing them to greatly simplify the process of accepting as-builts while providing greater certainty in the data. This will allow the technical team more time to work ON the as-built as opposed the working in the as-built, trying to massage the data and push it into the system.

4 CHANGES TO THE BACK-END DATABASES

When councils adopt to the new national meta-data standards they may need to adopt to new asset terminology and collect a different set of information than previously.

In order to properly store the new information council's IT staff and database administrators will need to examine their backend database systems tables and columns. The greater the update to the information that is collected the greater the likelihood of changes in the relational databases to store the new information.

Changes to relational database's tables or columns would likely need to be performed in a careful and deliberate manner to prevent unexpected results. Some councils may decide

to elicit outside expertise to minimise any potential upset and to maximise the opportunity this type of update provides.

4.1.1 MAPPING TO EXISTING TABLES

When councils use as-built software to provide database ready files, the as-built software will need to map the assets and their related properties to tables and columns in the database files. Because the software maps between the as-built data to the database tables, this provides the option for councils to adjust the mappings so any asset with a change of terminology can be mapped to the existing table for the asset.

Additionally, if there is new information collected for a particular asset the as-built software can map the new information in the as-built data to an existing column for the asset. This would only be useful if the table contains unused or has recently discontinued the use of column due to the changing requirements of the meta-data standard.

With the use of as-built software that has built-in mapping asset managers and council IT have options to store the updated and new information in existing tables and columns. This could potentially allow the council to proceed with the changes to the asset standard without having to wait on costly and potentially upsetting changes to their relational database.

5 CONCLUSIONS

The new National Meta-Data Standards are an important step forward for us as a nation. Once implemented they should provide much improved analytical capabilities to help inform decision makers regarding policy and funding decisions.

While national standards will bring benefits to the country, details surrounding methodologies how individual councils can best implement the standards has not been discussed as much.

Without a method to successfully implement these standards, council's simply introducing wide scale change to the asset standard will likely cause even more confusion and misunderstanding as to the proper compilation of as-built information by as-built suppliers. Many asset managers may delay deciding on implementing the new standard until they are confident of their ability to introduce them successfully into their area.

A few organisations in New Zealand, such as Tauranga City Council and Watercare Limited, have incorporated the use of an as-built software solution to allow them to overcome the issues surrounding the compiling and processing of as-built information.

Once these councils adopted the as-built solution and required the use of the software when as-built suppliers compiled the as-built data, they immediately realized tremendous process efficiencies and increase confidence in the quality of the as-built data.

For asset managers to be able to assured they can successfully implement the new standards while at the same time improve the way as-builts are compiled and processed they need to be able to update their systems to include the incorporation of as-built solutions.

The first step in being able to use as-built software is to first publish their as-built specification. Once the as-built standards are published as-built system integrators can then configure their as-built software so it conforms to those specifications.

Once that is completed councils need to **mandate** that all as-built data received *must* meet the requirements of the specification. Until the supply of as-built data is mandated to conform to the council's asset standard and as-built tools are available that can be used to generate as-builts to that standard, asset managers may find it difficult to persuade as-built suppliers to update the own processes to improve the state of the as-built documents that are provided.

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