

A CO-ORDINATED APPROACH TO ASSET DATA CAPTURE

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Abstract

Following years of road, drainage & park construction without accurate asset information, Noosa Council is now facing the massive task of gathering and updating electronic asset data for entry into new generation GIS(Geographic Information Systems) and Asset Management systems.

Previous asset data capture methods employed at Noosa have been mainly paper based with some basic mapping and have produced asset datasets with relatively poor accuracy.

Extracting reliable asset information and producing maps using layer overlay techniques for appropriate asset management with spatially incorrect data containing deficient attribute information has proved very difficult.

The commitment to fund 'As Constructed' surveys following project completion has been lacking, leaving gaps in many corporate asset datasets. On the other hand, developers have been required to supply 'As Constructed' asset data.

This paper offers an all encompassing solution for gathering electronic asset data on both the backlog of historical assets owned by Council and those built each financial year by Council, and donated to Council. The paper also details how Council's working in co-operation in a regional approach, can achieve a uniform solution to similar problems for the benefit of the Private Sector, Community and Council's alike.

Key Words: Asset, DGPS, Electronic, Digital, Co-ordinated, SUNROC, AutoCAD, Motorcycle, As Constructed, Noosa, PARMMS, Asset Map, RapidMap

Introduction

All Local Authorities have obligations to report on the public infrastructure assets owned and maintained using the funds provided by rate paying constituents.

The use of electronic technology to capture, store and interrogate data about Council assets is quickly superseding the collation of information using paper based (hard copy) methods.

Over recent years there has been significant improvement in field and office computing hardware and software to properly cater for

this shift to electronic asset data capture and management.

To manage what can be a huge volume of electronic asset data entering Council through various portals a co-ordinated and vigilant approach is required.

In addition to our pavement management system using PARMMS (Pavement Management Services P/L) the Works Directorate at Noosa Council are taking an innovative approach to meet the challenge of collecting the mass of electronic data which represents other asset groups constructed over many years of operation.

Procedures are also being updated to enforce standards for the capture of data (in the correct format) produced by ongoing asset construction from 2 key sources.

1. Assets donated to Council from external sources (consultants).
2. Assets built internally by Council's Capital Works Program (day labour).

Noosa Council has recently established alliances with Caloundra City and Maroochy and Caboolture Shire Councils to further co-ordinate the collection of electronic asset data.

Asset Data Requirements

Asset Data is required to satisfy a range of obligations including:

- Financial statutory requirements (regular asset revaluations)
- Formulation of budget programs to adequately maintain Council's public infrastructure using a life cycle approach.
- Professional and private customer enquiries regarding public utilities and infrastructure.
- Risk Management

Data processing to fulfil these requirements is now handled in an electronic environment through the use of Geographic Information Systems (GIS) and Asset Management software.

WEB based software has now developed to provide Internet access to Geographic Information Systems so that customers may perform enquiries relating to public infrastructure assets from their home or work PC.

These systems rely on accurate electronic data to produce the maps and databases which will facilitate the future of e-business for Noosa Council.

THE CHALLENGE - CAPTURING HISTORICAL ASSET DATA

A number of approaches can be implemented to capture electronic asset data accumulated during many years of infrastructure construction.

At Noosa, a data capture solution was required to satisfy the following objectives:

- Produce spatially accurate (sub 1m) electronic asset data for use in Council's GIS (MapInfo).
- Provide correct electronic attribute information for all types of assets (i.e. type, size, length)
- Facilitate condition rating of assets for a major asset revaluation.
- Fit into budget constraints.

The solution had to provide the flexibility required to capture road, drainage and parks assets without a change in approach.

A cost benefit analysis was conducted using the shire's urban areas (some 266km road and 193 parks) as a test to establish which of the following data capture alternatives was most suitable.

The alternatives and results were as follows:

- **Paper Based Method** - Mark up a paper plan in the field followed by electronic data entry in office.
Cost - \$60,000 Time – 12 months
- **Detailed Engineering Survey** - Engineering Survey Team with EDM and appropriate software.
Cost - \$160,000 Time – 18 months
- **Low Flight Aerial Photography** - Identifying assets from digital aerial photographs following by field audit (no condition rating).
Cost - \$130,000 Time – 6 months

- **Contracted GPS Survey** - Surveying contractor with team of high accuracy GPS units and operators.

Cost - \$120,000 Time – 3 months

- **Noosa Council GPS Survey** - Purchase high accuracy GPS, field computer, software and associated gear to perform asset data capture using Noosa Council staff.

Cost - \$57,500 Time – 6 months

Whilst the cost margin between a previously used **Paper Based Method** and the **Noosa Council GPS Survey** was narrow, the **Paper Based Method** fails to meet objectives (and benefits) in terms of its accuracy and time, with a major asset revaluation due. The paper based method requires assets to be plotted in the office (on PC) relative to digital cadastre which also currently contains error. This method is outdated considering the technology available for digital data capture.

The **Noosa Council GPS Survey** option is not only the most cost effective but also had other inherent advantages. Noosa Council staff will gain a greater ownership and understanding of the processes of collecting and collating electronic asset data. The ongoing auditing of assets in the field to update conditions and values will also be able to be handled in house.

DGPS Survey Equipment

GPS units vary widely in configuration, positional accuracy and cost. To perform Noosa's road, drainage and parks asset data capture a Trimble AG132 DGPS (Differential Global Positioning System) was chosen to deliver real time sub 1 metre accuracy.

This DGPS unit is capable of receiving differential correction signals from either Satellite (via an OMNISTAR subscription) or Marine Beacon to provide consistent and stable sub 1 metre positional results.

The DGPS has been combined with a WalkAbout HH3 Hammerhead field computer and Rapid Map Global's AssetMap Software

to record asset positions and attribute details including condition ratings.

The rugged Hammerhead HH3 is a pen operated computer with a Pentium III / 400 chip, 128Mb RAM, 10Gig Hard Drive, 10.4" and outdoor viewable auto backlit monochrome screen to suit harsh field conditions.

AssetMap, Rapid Asset Data Capture Software is written by Rapid Map Global specifically for the collection of electronic asset data using positional information from any GPS/DGPS.

This software was chosen as it is not only functional but runs in parallel with MapInfo, which Noosa Council uses as its GIS. All of the data captured and processed by AssetMap is stored using a MapInfo table structure making post-processing virtually non-existent.

Council entered into a partnership with RapidMap to provide enhancement suggestions and beta test new versions.

Transportation between Assets

Assets owned and maintained by the works directorate of Noosa Council exist in a variety of environments. Requirements for transportation between assets in rural areas differ from urban areas due to the distances between assets.

Although the DGPS equipment is supplied with a backpack to walk between assets for capturing data, this method was not appropriate for a project this size.

Vehicle Mounted Operation

We chose a more efficient approach to move quickly between assets by mounting the DGPS and Pen PC on a vehicle. Following testing it was evident that a 4WD vehicle (Figure 1) carrying the DGPS equipment worked well in rural areas where assets were openly accessible. A 4WD vehicle allows access to assets off the road carriageway and in wet weather conditions when other

data capture methods can not be used (walking/riding).



Figure 1 - 4WD with GPS on Bullbar

Motorcycle Mounted Operation

In contrast to rural, urban areas frequently offer confined access to assets. For example, footpaths often run between cul-de-sac's in narrow fenced alley's and most urban parks are fenced to limit vehicular activity.

For this reason, we chose to mount the equipment on a Honda CT110 (Figure 2), a step through ex Australia Post motorcycle with automatic clutch to quickly manoeuvre between assets in urban areas. This motorcycle has been designed to suit similar applications.



Figure 2 - Motorcycle mounted with DGPS

The DGPS and batteries are locked in a box on the rear carryall, the antenna slots into an adjustable rear frame and the pen computer is mounted on the handlebars for ease of operation by the rider (Figure 3).



Figure 3

A digital camera is also linked to the Pen PC via a USB cable. Digital images are taken and downloaded in the field into AssetMap for association with particular assets.

The AssetMap software has enough flexibility to enable every asset to be captured in one pass of each street or park. Linear features such as kerb or footpath can be tracked using different options and can be extended following the collection of any offset point features like signs or drainage pits.

Field - Office Asset Data Transfer

Using a software package (AssetMap) which captures field data in a format native to Council's GIS (MapInfo) has had advantages. Once captured, the data needs only to be copied to Council's corporate computer network to be accessible via any MapInfo terminal.

Appendices A & B are screenshots from MapInfo and show asset data captured with the DGPS in areas of Tewanin. Both maps are straight copies of the field data and have been produced using MapInfo in about 15mins.

Appendix A has the kerbs and footpaths thematically mapped (standard MapInfo function) to depicted kerb types and footpath widths by colour. The digital images linked to assets in the field are also hotlinked to the asset objects in MapInfo for enhanced asset identification.

The asset data collected from the field using the DGPS, Pen PC and AssetMap once

downloaded becomes a powerful asset management tool using MapInfo and Asset Management Software.

DIGITAL DATA SUBMISSION - CAPTURING DATA FOR NEW ASSETS

Noosa Council has been pro-active in its approach to gathering digital 'as constructed' data for services and cadastral parcels donated to Council by developers subdividing land.

Since 1995 development conditions have stipulated that digital 'as constructed' data (in the correct format) must be supplied to Council prior to a development being placed 'On Maintenance'.

To ease the burden of providing electronic asset data Noosa Council freely supplies any developer's consultant a small software application called the '*Asbuilt Data Utility*' for detailing 'as constructed' services and cadastre.

Asbuilt Data Utility

Designed originally to suit AutoCAD Release 12 the '*Asbuilt Data Utility*' is a software application written in LISP, AutoCAD's native programming language.

The '*Asbuilt Data Utility*' was developed in-house to automate the detailing of water, sewer and drainage infrastructure. The utility produces standard layering, linework and annotations with stored attribute data for each asset. The data is in a standard format suitable to Noosa Council for transfer to MapInfo.

Noosa Council also maintains its own DCDB (Digital Cadastral DataBase) so the '*Asbuilt Data Utility*' caters for the input of newly created land parcels for insertion into the DCDB.

The '*Asbuilt Data Utility*' has been re-written (at least 3 times) to suit each new release of AutoCAD through to the previous version, AutoCAD Map 2000 Release 4. Noosa Council has recently purchased the current

version of AutoCAD (Map 5) requiring a further re-write of the '*Asbuilt Data Utility*'.

Unfortunately for Council's Works Directorate the '*Asbuilt Data Utility*' focuses on the capture of digital data for services and cadastre, excluding a large portion of assets for roads and parks.

It is estimated that around \$10,000 would need to be spent to make the '*Asbuilt Data Utility*' to be fully compliant with the latest release of AutoCAD and give it the extra functionality required to collect more asset information.

The utility has worked well over time to gather information on new services (donated to Council) but is now below par in terms of the asset data it delivers, particular for roads and park infrastructure.

As Constructed vs Design

Typically electronic 'as constructed' asset data has been difficult to obtain for projects designed and built by Noosa Council as part of the capital works program.

Currently 'as constructed' surveys are only performed for projects where drainage construction differs from that shown on the design plans. This means that there is a minimal amount of electronic 'as constructed' data returning to the office for upload to GIS and asset registers.

Following advice from other Local Authorities this does not seem to be a problem unique to Noosa Council rather than an inherent internal issue for many Councils.

Generally all projects built by Council have been based on construction plans produced using AutoCAD. In lieu of not receiving an 'as constructed' survey and following advice from field staff that a project has been built '*as per plan*' the AutoCAD construction plans become the next best source of digital asset data.

Even if there are some changes to the construction plans, they can be amended and the data used for asset extraction. However,

the information required is not attributed with asset details and is never in a standard format ready for transfer to MapInfo.

Ideally it would be preferable to use the '*Asbuilt Data Utility*' when drafting the design plans to make asset information (incl. attributes) a resident of the digital construction plans from creation.

However, the utility was only designed for use when detailing 'as constructed' information and uses very simplistic linestyles and symbols to represent services. Unfortunately the presentation of this data falls short of the quality required for detailed construction plans and the utility is not being used for this reason.

Following consultation with other regional Councils it is hoped that a utility can be produced to perform such functions and now unified solution is on the horizon.

SUNROC and Caboolture Shire Council - The Co-ordinated Approach to Digital Asset Data Capture

A meeting with other Sunshine Coast Councils in July 2001 revealed that the same general problems are experienced across the board in the capture of digital asset data.

Caloundra City Council and Maroochy Shire Council currently use a set of routines developed by CCC and Cardno MBK 8 years ago while Caboolture Shire Council uses manual methods to obtain data.

The outcome of the meeting was that a general agreement was reached to structure a uniform set of routines and processes to gather digital asset data from both internal and external sources.

This agreement was the basis by which the SUNROC (Sunshine Coast Region of Councils) and Caboolture Shire Council group was formed for the creation of a uniform model for digital data submission across the Sunshine Coast Region.

Regular meetings are held to discuss issues and to date formal acceptance of the asset

data structure has been achieved, including attributes and data types.

As there are no routines currently available on the market the group has begun negotiations with a consultant to develop a new software application for capturing digital asset data.

Design and As Constructed Application Routines

The new software application routines currently under development (Appendix C) will be written using the Visual Basic programming language. This format is suitable to run with the latest release of AutoCAD, which still seems to be the benchmark in CAD software for the generation of construction plans.

Using AutoCAD means that there are no changes to software requirements for consultants submitting electronic asset data to Noosa Council. The new application routines will be provided free of cost with minimal training to consultants to supersede the '*Asbuilt Data Utility*' currently in use.

The new application routines will have enhanced layer control, linetypes and symbology to promote its use in both the 'as constructed' and design environments. It has been a focus of the group that the routines are able to be used during design plan drafting for the inclusion of asset objects.

The use of the application routines in the design process will see significant savings in time and money in the generation of digital asset plans.

SEQROC - Approach to Digital Data Submission

A recent SEQROC consultant investigation into this process, confirmed considerable cost savings for both the Private Sector and Council using a uniform standard for the presentation of digital data. The investigation also acknowledged that a regional approach to gain uniformity of this information may be the best working solution across South-East

QLD. Many of the SEQROC members are observing the progress of the SUNROC and Caboolture Design and "As Constructed" Data Applications Routines group.

Conclusion

Noosa Council's approach to historical asset data capture using DGPS technology is proving to be fast, flexible and effective in the field.

Alternating between rural and urban asset data surveys the project is now progressing well with significant regions in each environment now complete. The project commenced in March 2002 is due for completion by the end of December 2002.

The DGPS equipment, Pen PC and AssetMap software are consistently producing sub 1m results (absolute) in positional accuracy providing excellent representation of asset data in the office environment.

The SUNROC and Caboolture Shire Council working group has also proved to be an excellent forum in dealing with the supply of digital asset information. Significant inroads have been achieved into establishing a standard uniform model for the submission of digital asset data across the Sunshine Coast.

The immediate future should see the SUNROC consultant commence full development of the Design and 'As Constructed' application routines for implementation by December 2002. Some minor alterations may also be required to in-house MapInfo routines used to electronically transfer this data to Council's GIS and asset registers.

The integration of all of these digital processes will ensure Noosa Council is placed in a healthy position when it comes time to make asset and mapping data available over the internet in a e-business environment. Benefits will also be reaped with the ease at which data can be interrogated and compiled to suit major asset

revaluations and general life cycle asset management.

References

Information is available for the DGPS, associated equipment and software from the following suppliers:

RAPID MAP GLOBAL, Suite 5, 2 Research Avenue, Bundoora Vic 3083, Australia
<http://www.rapidmap.com.au/>

TRIMBLE - Global Positioning Systems
<http://www.trimble.com/aggps132.html>

WALKABOUT COMPUTERS
http://www.walkabout-comp.com/home_low.html

Appendix A - Road Infrastructure Asset Data

The screenshot displays the MapInfo Professional interface with a road infrastructure map. The map shows a network of roads including 'TROON CT' and 'FURNESS DR'. Various road assets are visible, such as different kerb types, footpaths, and signs. A legend on the right side of the map provides details for these assets.

KERB TYPE LEGEND

- Barrier K&C
- Barrier Kerb
- Bitumen Edge
- Concrete Invert
- Concrete Spoonrain
- Drive Over K&C
- Flush
- Garden Edge
- Mountable Kerb
- Semi-Barrier Kerb

TRAFFIC ISLAND KERB TYPES

- Barrier Kerb (5)
- Drive Over K&C (1)
- Mountable Kerb (187)
- Roundabout (9)

FOOTPATHS BY WIDTH

- 1.2 (170)
- 1.8 (2)
- 2 (160)

Info Tool

POLE_ID: SI200000557
 REFERENCE: SD200000680
 IMAGE: WSUNSETVGV
 CATEGORY: REG
 A_CODE: R2-3 (L)
 B_CODE:
 C_CODE:
 D_CODE:
 A_SIGNTYPE: Keep Left
 B_SIGNTYPE:
 C_SIGNTYPE:
 D_SIGNTYPE:
 Size: 450x600
 SizeCode: A
 FACEMAT:
 FACECOND: -1
 PLATEMAT: Aluminium

Suns...

File Edit View
 Zoom Tools Help
 Open Browse Pi
 472/699 BMP WSunse

KEEP LEFT

501,709.6 m, 7,079,124.0 m | Editing: None | Selecting: None

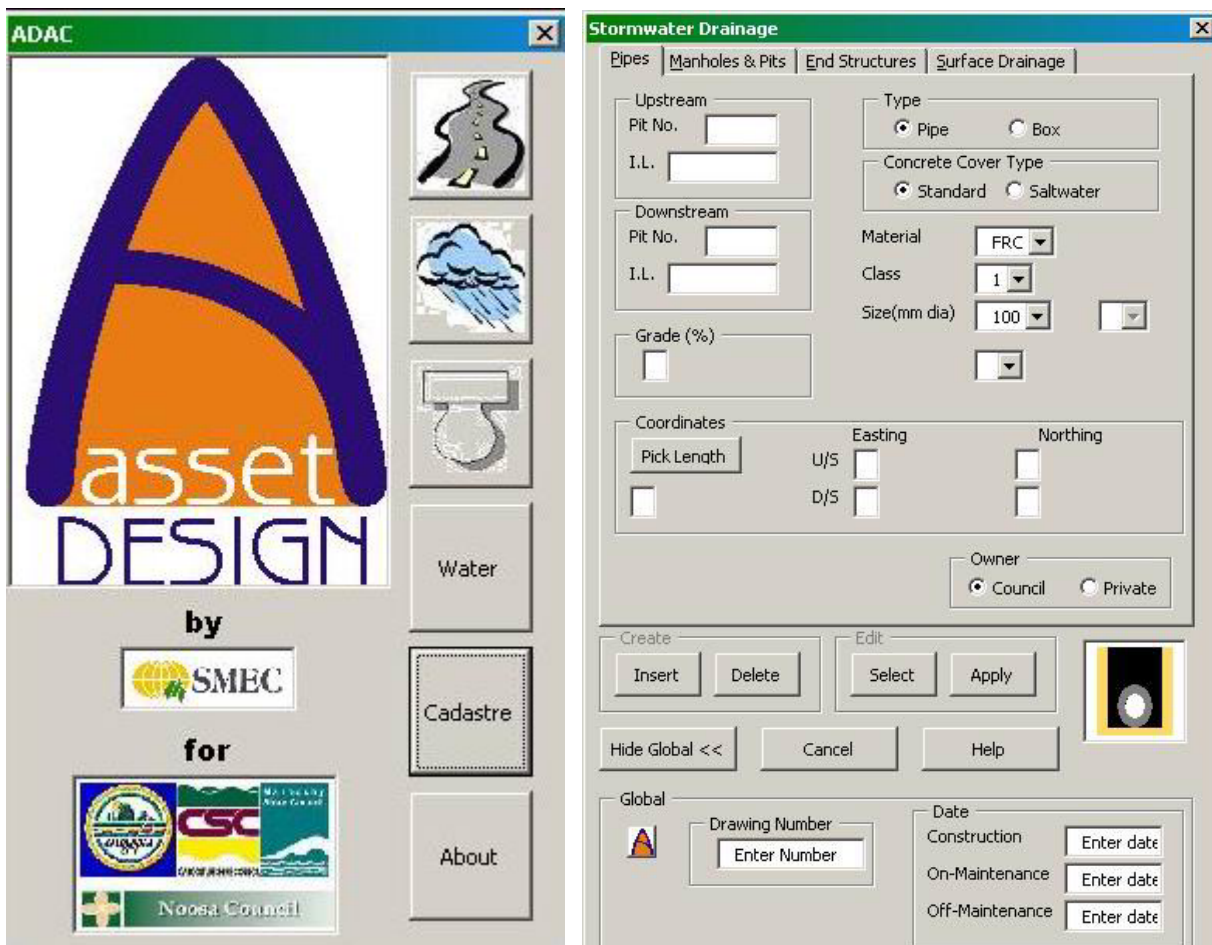
Appendix B - Park Infrastructure Asset Data

The screenshot shows the MapInfo Professional interface. The main map window displays a green-shaded area labeled 'CLAREY PARK' containing various icons for park infrastructure. An 'Info Tool' window is open on the right, showing the following data for a selected asset:

Field	Value
asset_id	SP200000076
feature	Playground
location	
type	Climbing Frame
material	Timber
number	0
enhance	
photo_id	Clarey Park Climbing Frame
length	0.0
width	0.0
area	0.0
structure	Fair
maintenan	None
weatherin	Minor
non_function	F
unsafe	F
condition	3
inspector	Chris Sturgess
insp_date	05/08/2002
street_nam	
segment_no	
reserv_nam	CLAREY PARK

At the bottom left, a photo viewer window is open, displaying a photograph of a climbing frame. The photo viewer title is 'Sunset\eng\AssetMap\Photos\c...' and the status bar shows '24/63' and the file path 'Sunset\eng\AssetMap\Photos\clmframe...'.

Appendix C - Preliminary Application Routine Panels



Author Biography



Chris Sturgess is currently employed as Asset Management Officer in the Works Directorate at Noosa Council, a position which he has held since April 2001. This role involves the capture and registration of all road, drainage and parks infrastructure into GIS and asset registers.

The major challenge faced since commencing employment with Noosa Council has been the development of digital technology for use in the collection of accurate electronic asset information.

Prior to taking up employment at Noosa Council he spent 4 years designing roads and drainage at Maroochy Shire Council and preceding that, 4 years working for a Private Engineering Practice doing engineering design for land subdivision. Chris holds an Associate Diploma in Civil Engineering and is currently studying to upgrade his engineering qualifications.

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