

Bearing Fruit: 20 Years of Property Information Management

Ed Garvin

Executive Chairman, OMNILINK
edg@omnilink.com.au

ABSTRACT

The then Department of Education, Properties Directorate resolved in 1992 to undertake the development and implementation of an IT system to manage all 2,400 of their school campuses. In 1994, OMNILINK was originally a sub-contractor to DIGITAL then Compaq on the first and second rounds of initial development of the Asset Management System (AMS), involved in the data management. The data capture was managed by the former Public Works Department and undertaken by contractors, of which OMNILINK's sister company Lockley Garvin & Partners was one. OMNILINK was contracted to prepare the specification for data capture, which is still largely used. Since the initial development, OMNILINK has been incessantly engaged by the Department to provide data management and system maintenance services and has also provided further development of AMS. This paper outlines the processes involved in data capture as well as the functionality of the system. It also provides a brief description of a cut-down version of the system called AssetWhere™ and its associated software, which OMNILINK developed and implemented for use in organisations with large property holdings.

KEYWORDS: *Property management, data capture, system development.*

1 INTRODUCTION

With Building Information Modelling (BIM) receiving great attention in the last few years, especially in relation to 'smart cities', the role of the surveyor has not had a great deal of attention. With modern technology such as terrestrial laser scanners, hand-held scanners, LiDAR, UAVs and side-view aerial photography, the surveyor will play an increasingly important part in the initial and ongoing data capture. Surveyors need to be aware that there are great opportunities to contribute to these important databases and be prepared for these.

This paper provides a case study of a data capture program that populated a large property asset management system (another name for BIM), the system itself and smaller systems. A discussion regarding asset information value to highlight what value exists in the surveyor's role with these programs follows.

2 NSW EDUCATION

The Property Directorate of the Department of Education & Communities (DEC) is responsible for over 3,500 campuses of primary and high schools and TAFE colleges throughout New South Wales (NSW). Just the built component of these properties has been

valued at \$28 billion, and an assumption to double this figure to allow for land values would not be unreasonable. So the total value of the Department's properties in 2014 can be assumed to be in the vicinity of \$60 billion.

Prior to 1992, the records for all these properties were paper-based and held in various places. Under the sponsorship of the then Deputy Director-General, Jan McClelland, a proposal was agreed upon to bring these paper-based records into a functional digital system. Planning commenced for writing specifications for the system. Prior to the NSW resolution, the Victorian Department had devised, produced and installed their Schools Asset Management System (SAMS) and NSW reviewed this in their investigations. The functionality of SAMS was limited, and the NSW plan was to extend this. A modular approach was formulated, representing the various responsibilities of the Directorate. Further detail on these will be provided later in this paper.

Proper management of real property assets requires knowledge of the location of these assets, what physical items have been built upon land and their relationship with other sites, within their own site and the site's relationship with its community, transport and other facilities and government services. Best practice required that representations of these items and their relationships together with other related information such as demography, student and staff locations and transport schedules be recorded and stored in a geospatially related database with a graphical user interface. Geographic Information Systems (GIS) integrated with relational database systems provided such a platform.

It is a testament to the planning and project management of the NSW Asset Management System (AMS) that the system has largely remained as planned in the past 20 years. OMNILINK has an ongoing role to manage all the school and TAFE data and to maintain the system with links to other DEC systems, system revisions and upgrades. The NSW Department of Education and Training received a Prime Minister's Award for Excellence in Government for the AMS system in 2000.

3 DATA CAPTURE

Data collection and integration applies to the initial and complete capture process as well as the ongoing data maintenance capture process due to property asset changes, removals and additions. This applies to spatial data that captures room, building, site and infrastructure layout. The required accuracy for dimensions and location of property assets will determine the data capture process.

DEC has outsourced the data capture to NSW Public Works who in turn use a panel of private sector survey firms to undertake the work either directly to them or through a building contractor who is constructing additions to or refurbishment of a school or TAFE or constructing a new campus. The choice when planning AMS was to capture data by survey or to utilise existing site and building drawings as the base plans. The decision to undertake the capture by survey was known to be a more expensive exercise but has yielded benefits in that all room and building areas are known to survey accuracy. This in turn allows more facility in planning additions and valuation of school property. Another major benefit of knowing room areas was the considerable saving in cleaning contracts. The Victorian Department, which captured data from architectural drawings (some of which were over 100 years old), saved the entire cost of the development and implementation of their system from these savings.

Prior to any capture being undertaken, Education and Public Works recognised the need to prepare data capture specifications. OMNILINK was engaged to undertake the consultancy to prepare this document and these have been in use with minimal fundamental revisions to date. The specifications were required to capture attribute and location data in an orderly manner for later input into the database, to provide accuracy standards for measurements, to specify data format and to assist with quality assurance. The specifications are very detailed and differentiate between point (small features), line and polygon (larger features) data for both buildings and site (Gillam, 1992).

Site features include the overall site layout, internal main access roads, car parks, sports facilities, assembly areas, bubblers, gas and fuel tanks, plants and sheds. Building features include major buildings, demountable buildings and rooms, which are defined as any space within a building including most cupboards, such as fire and electrical, ramps and corridors. Locational accuracy is generally 90% or 95% and dimensions are captured to 95% or 99% (Gillam, 1992).

Each building and each room within a building is allocated a unique identification number by the surveyor together with building and room usage and room name (if any). Other attributes to be captured include the materials of construction and treatment of walls, roofs, floors and ceilings, ceiling heights, security details, ventilation, heating, sink and toilet details and many others. The field capture data is processed by Public Works then transmitted to DEC for integration into AMS by OMNILINK.

The initial data capture commenced in 1996 with high schools, then primary schools followed by small rural schools. Schools for the whole state were captured by a panel of eight surveying firms over a period of about one year. TAFE capture was undertaken later. The time taken is remarkable for its brevity, given the scale of the work, and Public Works is to be congratulated for its project management of this stage. Current capture is still undertaken by a panel of surveying firms that was enlarged at the time of the 'Building the Education Revolution'.

4 AMS OVERVIEW AND DESCRIPTION

The initial system provided three basic modules (i.e. sites, facilities and spatial) based upon the migration of legacy systems that mainly dealt with assets from a purely financial and inventory basis. A geospatial view of assets was always seen as core to the system and has continued to be integrated to all business functions within the system. The system was later extended with three more modules that focussed on specific business units within the Directorate: planning, maintenance and demountables. AMS is now one of the largest spatially integrated systems within NSW Government and was also adopted for use within the NSW Emergency Information Coordination Unit for the management of a buildings database within the Sydney CBD.

The AMS project has evolved over the last 20 years from originally being focussed on strategic management requirements to now being a key integral part of many operational and tactical systems within the Properties Directorate. Many business functions of the Department are now solely conducted using AMS. Since its inception it is estimated that AMS has saved the Department in excess of \$25 million and delivered operational efficiencies of equal or even greater magnitude.

AMS supports the asset management activities of the Properties Directorate within the DEC. The modules within AMS are:

- Sites – legal and administrative aspects of property asset management including acquisition, disposal, merging and valuation.
- Facilities – covers the details of building and rooms including elements which provide information on the asset that make up the rooms such as fixtures, external and internal materials, roof structures, etc.
- Spatial – a fully integrated set of information and functions that are available from within all AMS modules, i.e. the ability to always ‘provide a picture’. Over 50 layers of spatial data are available within the system, showing details down to every room in every building on every site. Demountables and site-based structures are also shown within the system.
- Planning – provides support for the process of school and TAFE planning, including demographic analysis, catchment creation, enrolment data, entitlements and future projections.
- Maintenance – covers all building and plant maintenance information of all schools based on a series of contracts. This includes condition assessment data that is updated annually. It provides reporting tools to allow for analysis of past, current (actual vs. estimate) and future (budgeting) purposes.
- Demountables – provides support for both the management and operational tasks of demountable buildings that includes allocation of buildings based on school needs and entitlements, production of work orders for site preparation, transportation and delivery of buildings and is interfaced with the maintenance and planning modules. A spatial analysis tool provides shortest-path analysis for input into transport costs.
- Program Management, Minor Works – management of all aspects of capital works under \$3 million. It covers the process from initial request through project specifications, construction and completion and has an extranet interface to NSW Finance & Services that has 300 users registered on AMS who can update the progress of any minor works project. This keeps all parties up to date and has removed the need to follow up for progress and status reports.
- AMS on the Web – provision of a simple Intranet browser-based system that provides each principal and TAFE property manager with a view of their school/college and includes maps/plans of all school assets.
- Numerous interfaces to other DEC business systems including financial and asset condition.

OMNILINK provides a data management and support role for the AMS system and is responsible for all data updates (spatial and aspatial). Data is updated at various frequencies including instantaneously (via database replication) to weekly, monthly, quarterly and annually. OMNILINK also provides a spatial data management role that includes brokering external datasets (e.g. ABS, PSMA, NSW LPI, NearMap).

4.1 Technical Data and Information

The AMS system is based on a Unix/Windows platform utilising Oracle and Esri ArcGIS Server as the core enabling technologies. The system supports the following data volumes listed against the key data items of sites (property), building, floor (level), room, elements.

- AMS Oracle database (40 GB).
- GNAF database (4 GB).
- Spatial database (40 GB).

- Sites 3,525 – includes pre-schools, schools, TAFE colleges and other DEC sites.
- 3,680 amenities.
- 23,283 buildings.
- 6,287 demountables.
- 382,894 rooms.
- 2,981,218 elements.
- Over 2,165 registered users.

The AMS spatial system is based on a platform of the NSW cadastre with all sites shown in their true geographic location. Other themes of spatial information include:

- Administrative DEC – layers showing DEC boundaries for operations.
- AMU regions.
- Catchment boundaries – primary, secondary, etc.
- TAFE institutes.
- Australian Bureau of Statistics – 5 census periods are held to allow for trend analysis.
- Electoral boundaries – LGA, state and federal.
- Postcodes.
- Suburbs and localities.
- Road centrelines – used for route determination of demountable buildings.
- BING aerial and road layers.
- Bushfire hazard zones.

5 THE DEC AMS SYSTEM

The home screen provides an overview and allows navigation to other modules and tasks (Figure 1).

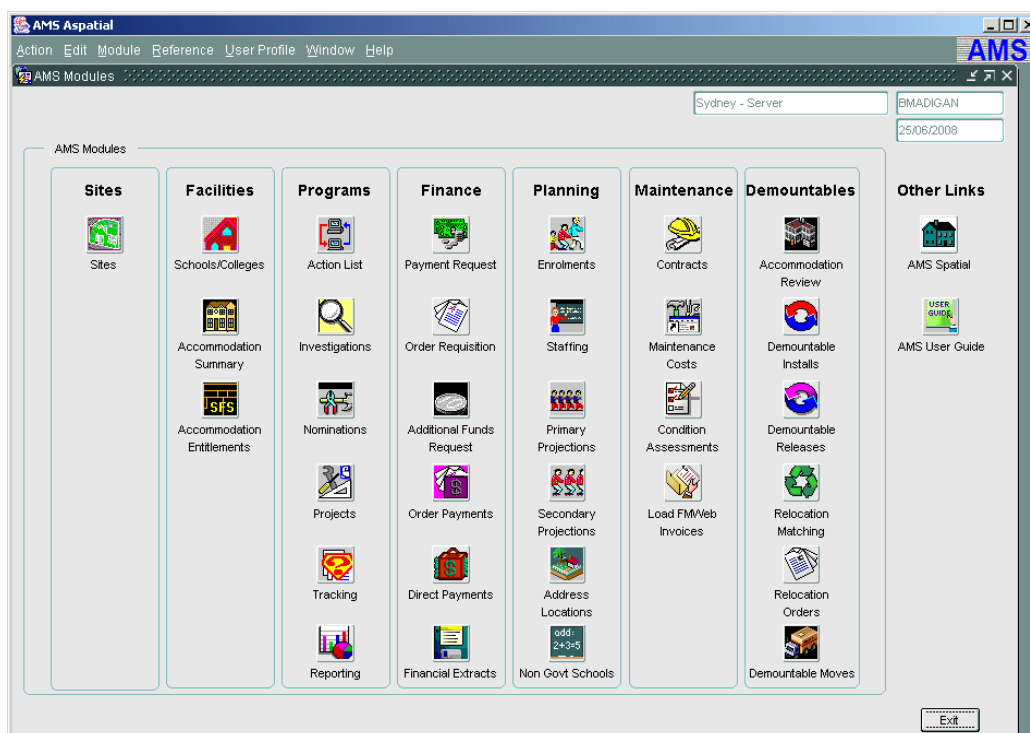


Figure 1: AMS home screen, allowing navigation to other modules and tasks.

5.1 Sites

The sites module allows input, query and reporting on sites, lots and leases (Figures 2-8). AMS incorporates legal and administrative aspects of property asset management. A legal description for every land parcel together with an outline of each landholding is located within the road centreline network for the state. The land planning zones for each DEC owned and adjacent parcels are also stored and displayed for every site. The location of the sites has a reasonable absolute accuracy together with facilities recorded and located on the site.

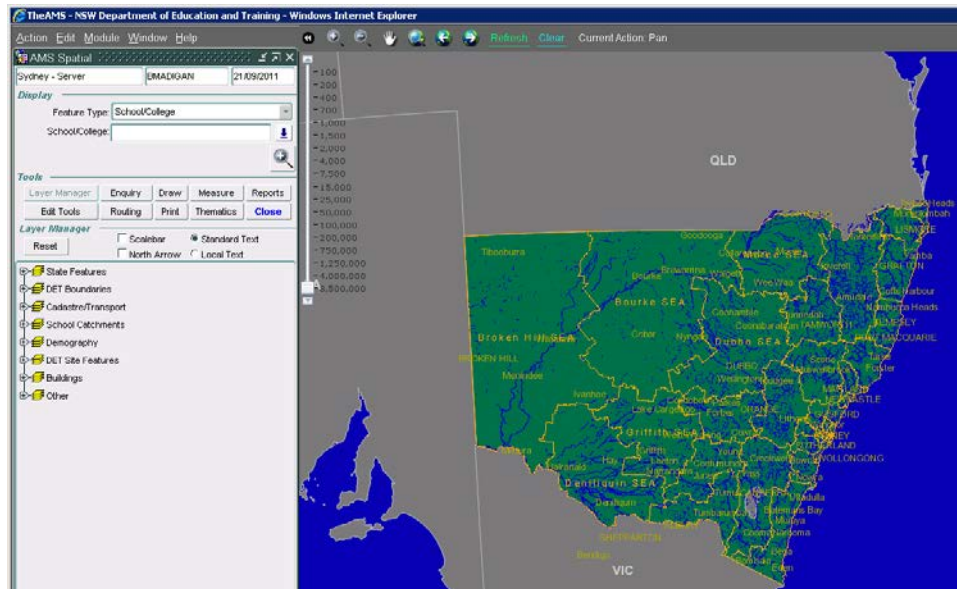


Figure 2: AMS spatial interface showing School Education Areas – the spatial entity used for many asset management functions, responsibilities and contracts.

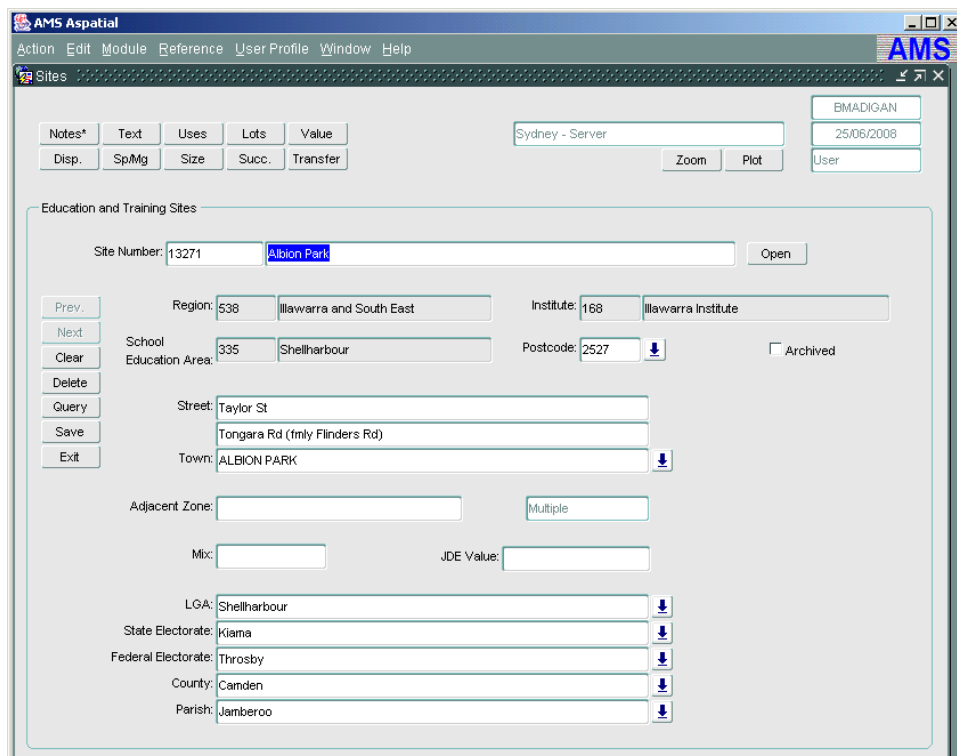


Figure 3: Sites module, a key module for spatial integration, providing the basis for land acquisition and disposal.

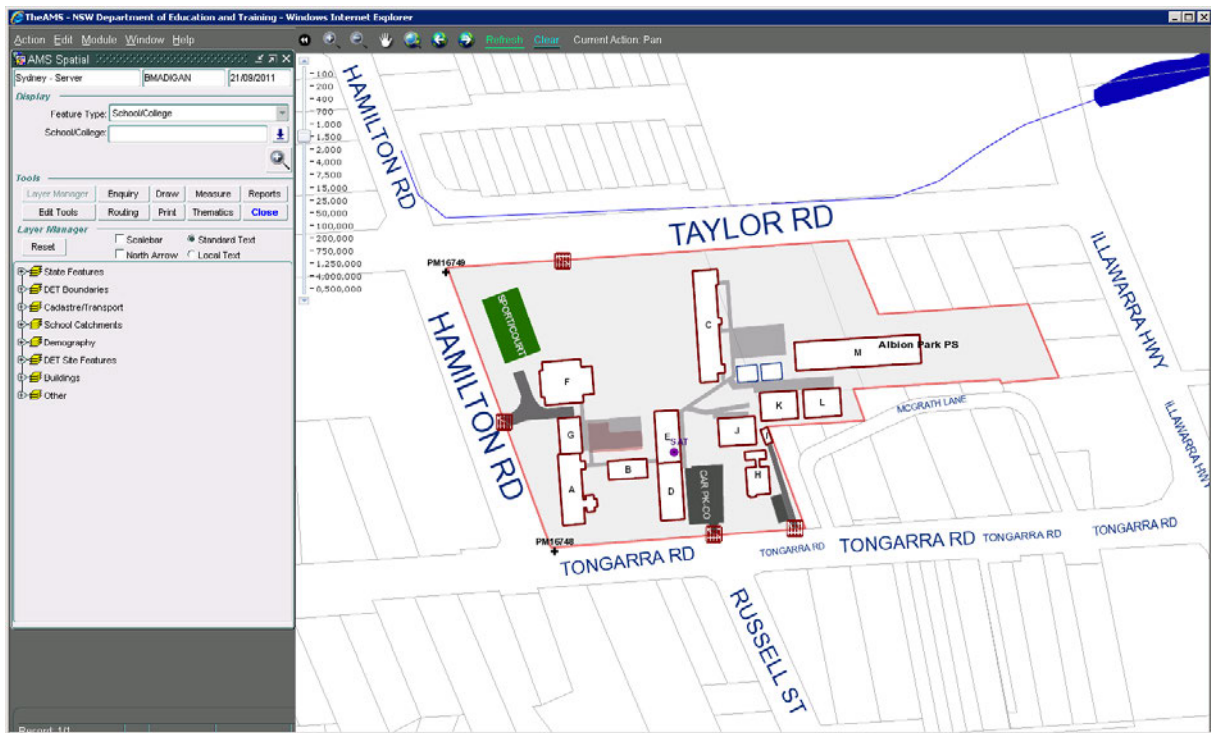


Figure 4: Detailed display of a school showing base layers of cadastre, site, buildings and sports facilities.

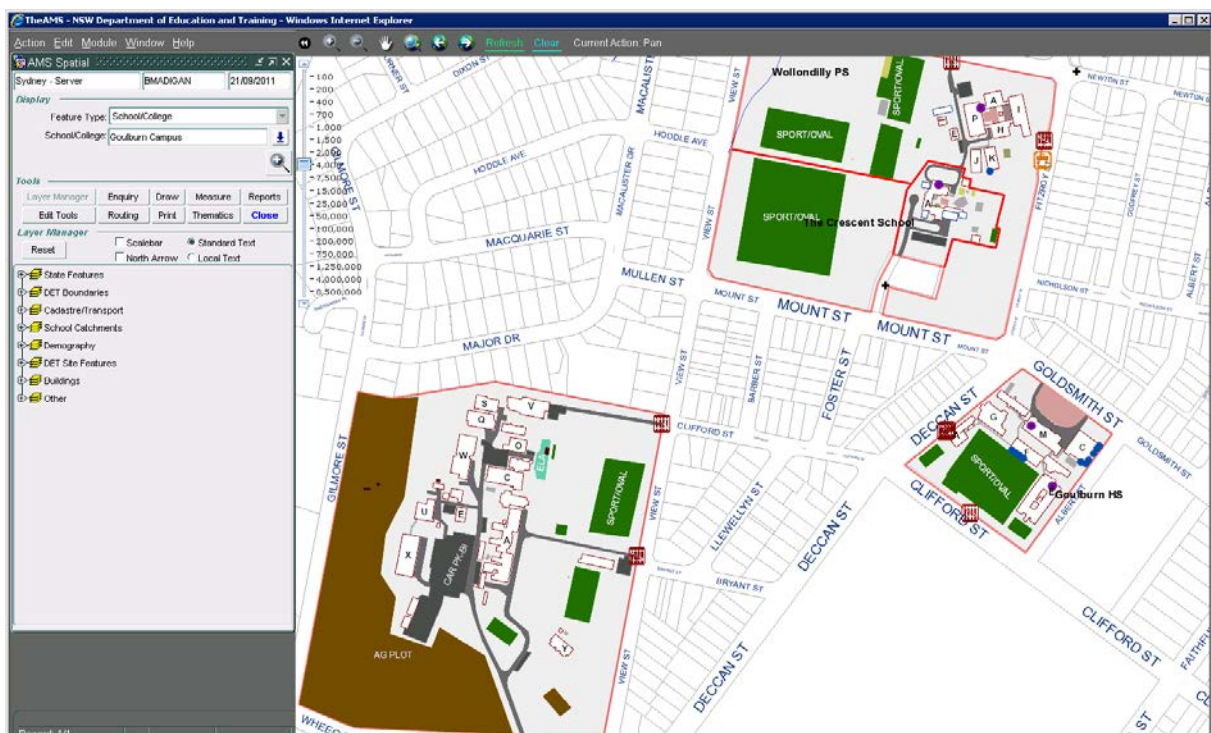


Figure 5: Display of a multi-site campus (Goulburn High School) including agricultural plot (northern site).

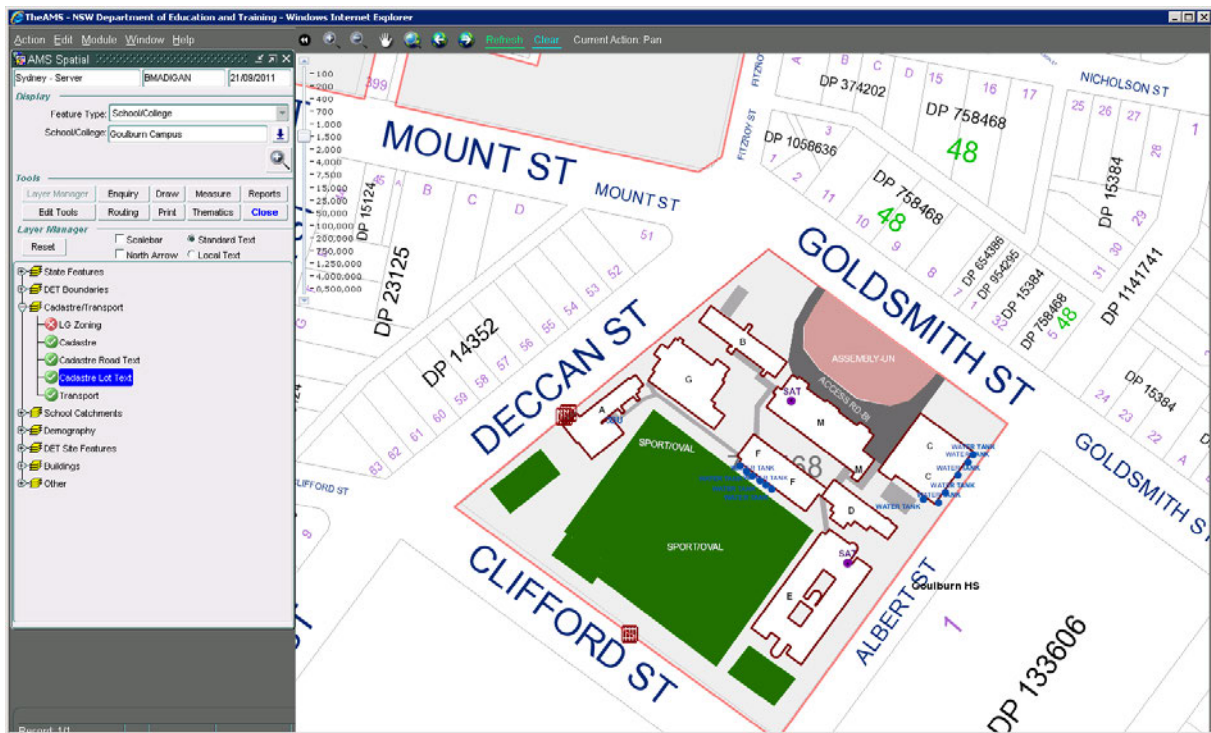


Figure 6: Detailed site plan of Goulburn High School.

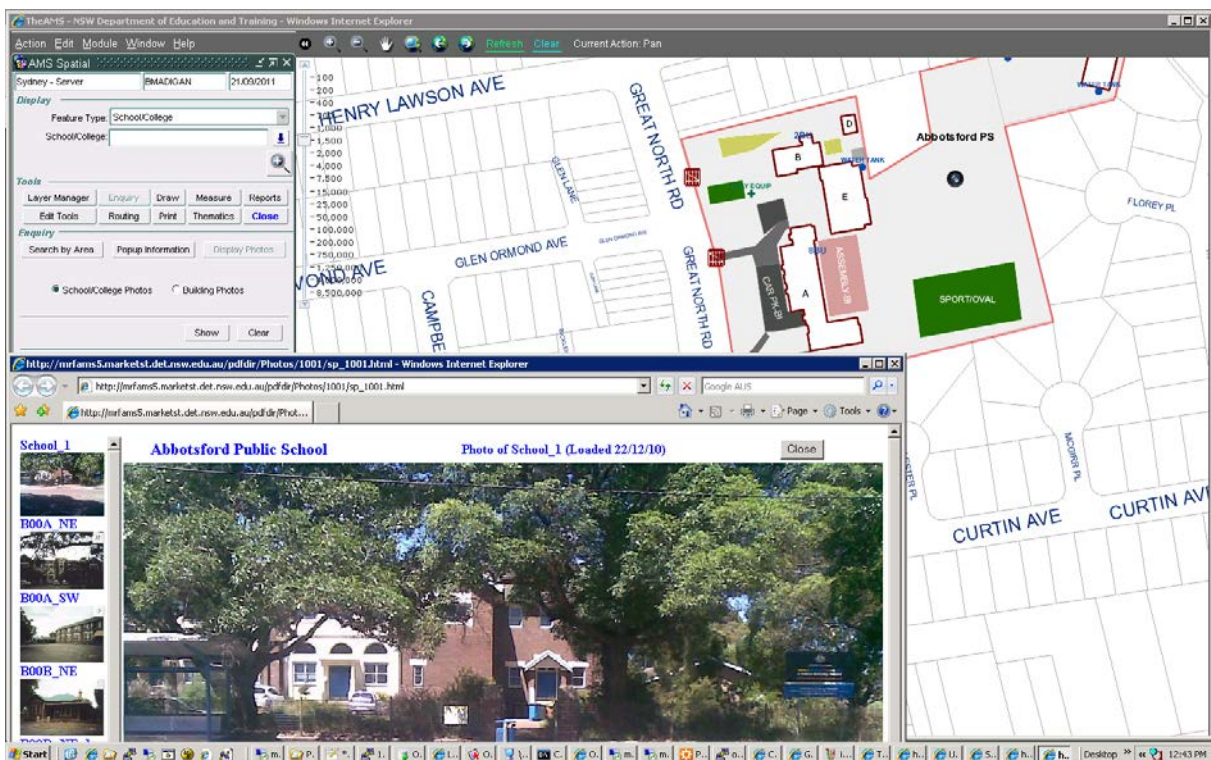


Figure 7: Photo tool linked to site features and locations.

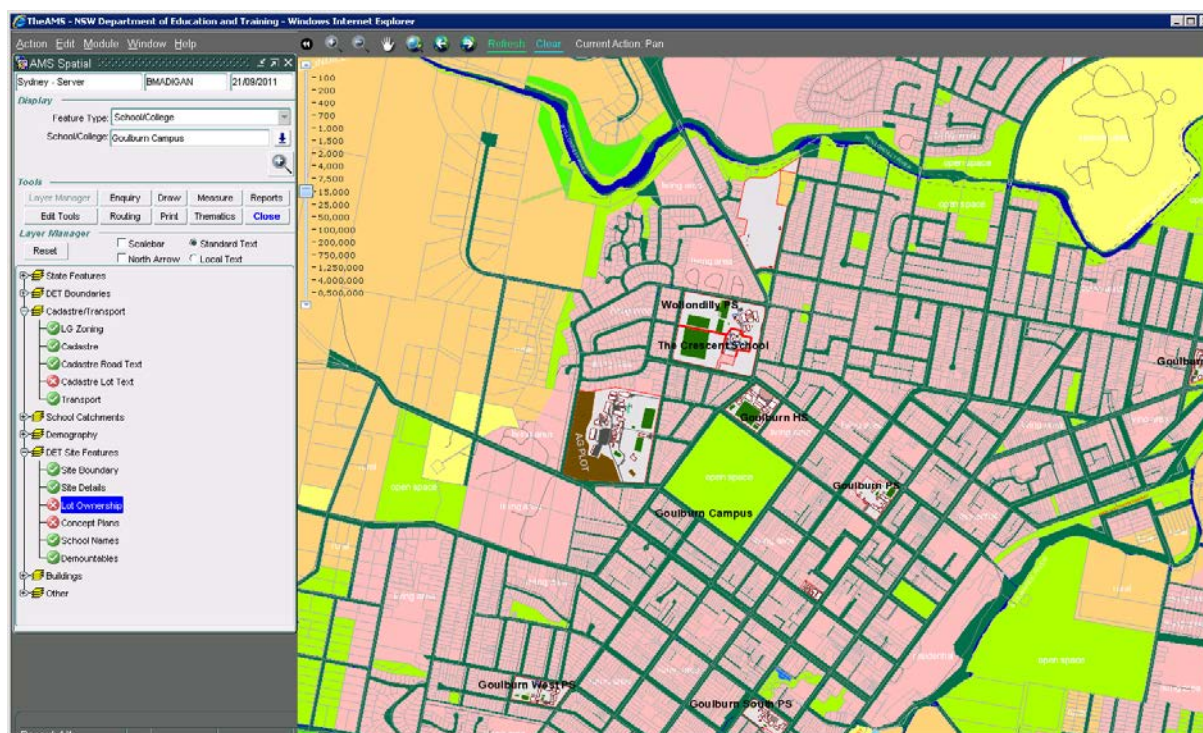


Figure 8: Using the cadastral data provided by NSW LPI, the Department can display attributes including tenure which can provide inputs to acquisition and site expansion activities.

5.2 Facilities

The facilities module records the details of buildings and rooms including elements which provide information on the asset that make up the rooms such as fixtures, external and internal materials and roof structures (Figures 9-12). All building footprints, site features such as plant and play equipment and floor plans are recorded for every building on every site. These details are kept current by data forwarded by the school or by surveying consultants on a regular basis. This AMS module allows input, query and reporting on facilities (in DEC's case, schools and TAFEs).

DEC classes all entities relevant to each facility as 'components'. The current component classes are buildings, rooms, demountables and amenities. Amenity is a broad classification ranging from sheds to playgrounds. The attributes of these are classed as 'elements' and include details such as internal materials and fittings. In addition to physical assets, the facilities module also encompasses functionality of each facility. This includes enrolment details (past, present and anticipated). AMS was initially primarily an 'asset management system', so the system groups components by functionality for reporting and spatial display purposes. Another facet of functionality can be capacity. This is approached in terms of both 'entitlement' (i.e. how much each facility has been budgeted or resourced) and 'capacity' (i.e. how much each component has been designed to facilitate).

AMS Aspatial
Action Edit Module Reference User Profile Window Help
Accommodation Summary (Rooms by Building)

Report Export Sydney - Server BMADIGAN 25/06/2008

Accommodation Summary (Rooms by Building)

School Education Area: Muswellbrook School/College: 1003 Abermain Public School Open

Building ID	Room ID	Official Room Use	Accom. Code	Local Reference/Door Name	Size	Teaching Spaces	Current School Usage
B00A	R0001	Movement			36.81		
B00A	R0002	Home Base			50.68	1	
B00A	R0003	Practical Activities - 1hb			2.87		
B00A	R0004	Home Base			53.65	1	
B00A	R0005	Home Base			53.72	1	
B00A	R0006	Movement			3.88		
B00A	R0007	Study Annexe		Assistant Principal	11.07		
B00A	R0008	Interview		Interview Room	10.5		
B00A	R0009	Principal		Principal	26.4		
B00A	R0010	General Storeroom		Storeroom 2	16.46		
B00A	R0011	Movement		Abermain Public Scho	14.41		
B00A	R0012	Duplicating Workroom			30.7		
B00A	R0013	Clerical Office		Clerical Office	8.87		
B00A	R0014	Sick Bay			6.17		
B00A	R0015	Entry Vestibule			9.36		
					65	1676.24	10

Record: 1/1

Figure 9: Facilities module showing room use, size and indicating which areas are for teaching – key input to entitlement calculations in the planning module.

AMS Aspatial
Action Edit Module Reference User Profile Window Help
Accommodation Entitlement Profile

Toilets Demountables Zoom Plot Sydney - Server BMADIGAN 25/06/2008

School: 4601 Aldavilla Public School Open

☒ Include Demountables

Actual Class Groups: Primary: 10 Secondary: 0
Projected Class Groups (5 Years): Primary: 8 Secondary: 0
Specified Class Groups: Refresh Primary: Secondary:

Administration Canteen Communal Hall Early Childhood Kiln Learning Unit Library Outdoor Learning Pre School Services

Room Usage	No Of Rooms	Size	Room Count	Building	Room	Size	Official Room Use	School Room Use
Clerical Office	1	23	1	B001	R0008	17.42	Clerical Office	
Community Clinic	0		0					
Deputy Principal	1	13	2	B001	R0002	12.50	Deputy Principal	
				B001	R0003	12.36	Deputy Principal	
Disabled Toilet	1	6	1	B002	R0003	5.08	Disabled Toilet	
Duplicating Workroom	1	23	1	B001	R0005	20.12	Duplicating Workroom	
Entry Vestibule	1	9	1	B001	R0007	15.80	Entry Vestibule	
Interview	1	13	1	B001	R0006	12.35	Interview	
Principal	1	13	1	B001	R0004	16.64	Principal	
Security Store	1	14	2	B001	R0015	17.50	Security Store	
				B003	R0005	2.00	Security Store	
Sick Bay	1	9	1	B001	R0011	8.86	Sick Bay	
Sick Bay - Shower/Toilet	1	7	0					
Teachers Aide Special Ed	1	13	0					

3 Under Entitlements 3 Over Entitlements 3 Significantly Under Sized Room 3 Under Size Room Consideration 3 Over Size Room Consideration

Report Export Exit

Figure 10: Comparison of entitlements to actual facilities. Such data assist with forward budgeting and program management activities.

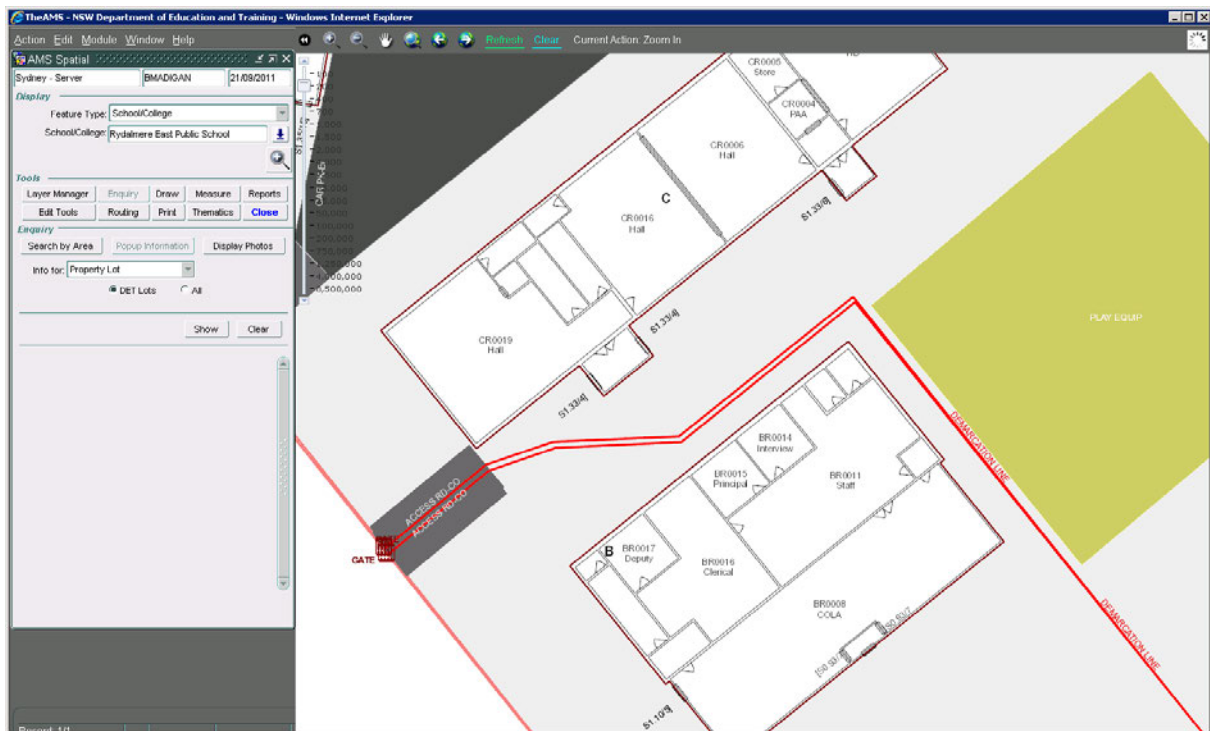


Figure 11: Detailed display of building facilities including access points and door swings – this level of spatial information is a highly valued input to Department activities including emergency evacuation, refurbishment and basic room usage.

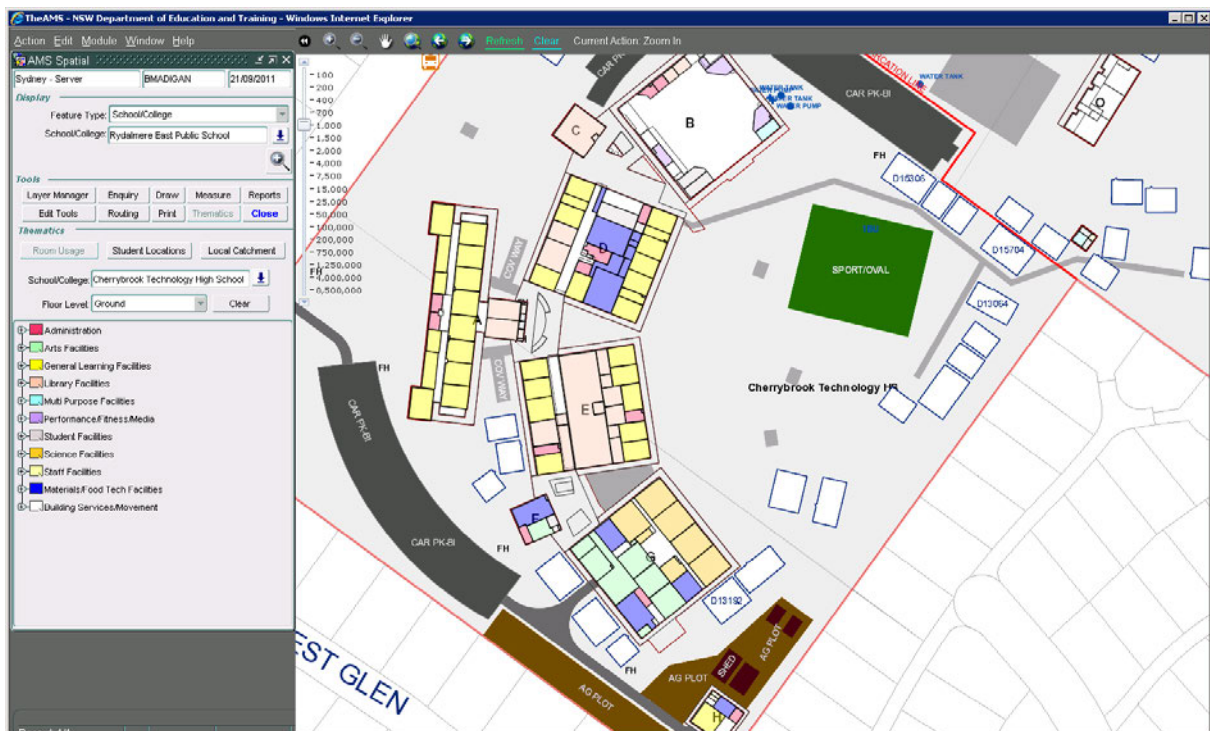


Figure 12: Room usage thematic map.

5.3 Programs

The AMS program module provides a capability for the cradle-to-grave management of capital works projects using the Program Management Module (PMM). This module is at the

core of the current allocation of funding for all new school projects and was used extensively during the 'Building the Education Revolution' (BER). The PMM module caters for projects up to \$3 million. During the BER, PMM managed in excess of 6,000 projects under the BER funding model with a future capacity to cater for projects expected to amount to a total spend of \$1.4 billion.

An overview of the PMM module is as follows:

- Action list – 'my tasks for the day'.
- Nominations – typically provided by a school.
- Investigations – conducted by the DEC.
- Projects – the running of the Capital Works Project, i.e. DEC and Public Works staff.
- Tracking – 'status' of projects.
- Reporting – 'where are we up to'.

All of these activities exist within a 'process tree' with levels of security, access and authority. Digital signatures are used to track who has been responsible/involved within a project. Access and security is fully configurable and even caters for staff absence or higher duty appointments for periods of time.

Reporting is part of PMM from an internal DEC measurement perspective and includes such reporting levels as school, project, state and budget for activities such as:

- Nominations.
- Commitment/expenditure.
- Budgets and budget projections.
- Project milestones and progress including:
 - Milestone complete within requested time.
 - Milestone due with requested time.
 - Milestone completed late.
 - Milestone due and late.

Formats used are standard text formatted reports as well as bar graphs, pie charts and other display tools.

5.4 Finance

This module interfaces directly with DEC's SAP financial system as well as the maintenance, programs and demountable modules.

5.5 Spatial

This is a fully integrated set of information and functions that are available from within all AMS modules – an ability to always 'provide a picture'. Over 50 layers of spatial data are available within the system. Details down to every room in every building on every site are included. Demountables and site-based structures (e.g. gas tanks, bubblers and play equipment) are also located and shown within the system. The surveyed dimensions of every site have been compiled and recorded spatially in the GIS. All structures are located within each site.

5.6 Planning

This module provides support for the process of school and TAFE planning, including demographic analysis, catchment creation, enrolment data, entitlements and future projections (Figures 13-18). The planning module has a high spatial information component and allows users to spatially create areas of interest based on other spatial entities. The spatial relationship between schools in terms of access, distance and student profile are also key business inputs for school planners.

Included data originate from many sources including proposed re-zoning, transport and housing forecasts from the Department of Planning, development approvals and development control plans from councils, 'live births' from Medicare, industry and occupation projections from Access Economics and census data from the Australian Bureau of Statistics.

5.7 Maintenance

The maintenance module covers all maintenance information of all schools. Maintenance is undertaken by a panel of contractors who are responsible for all repairs, regular activity and reporting activity to DEC. The module records all maintenance activities undertaken by the panel. Each campus is inspected annually for condition assessment and the module also records this data as it is updated. It also provides reporting tools to allow for analysis of past, current (actual vs. estimate) and future (budgeting) purposes. The annual maintenance budget for DEC properties is currently in excess of \$200 million.

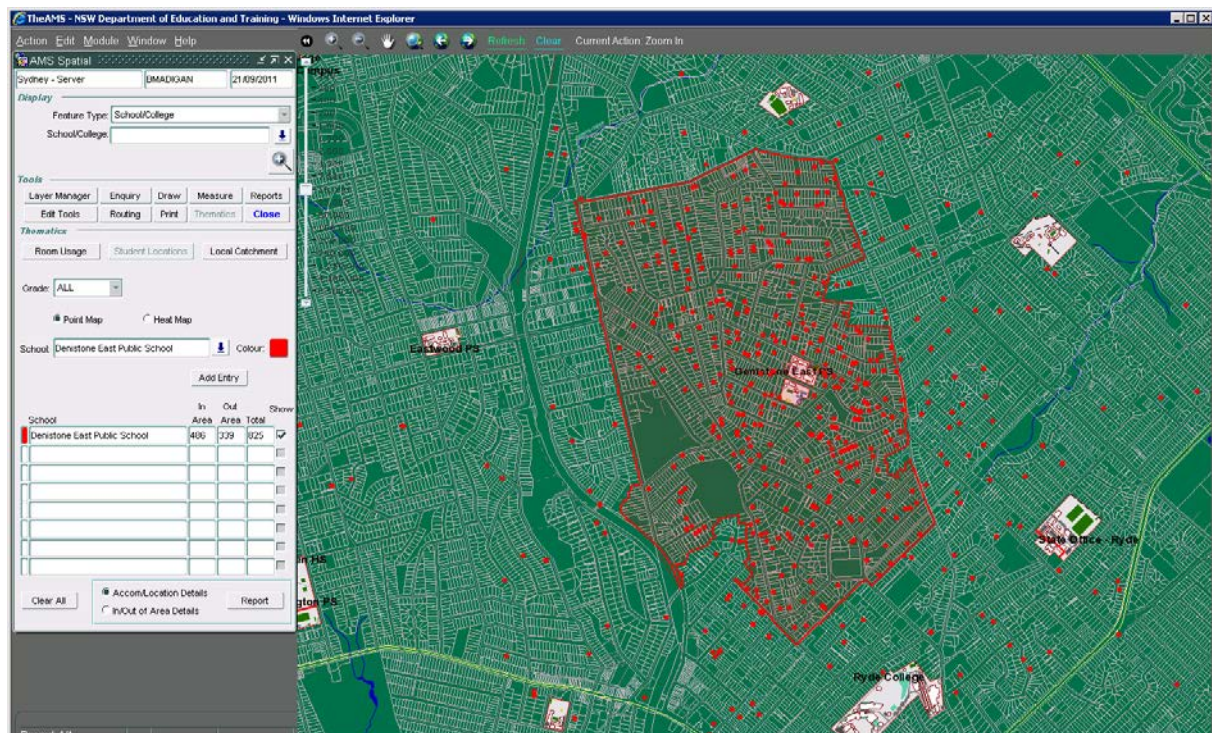


Figure 13: Location of student address details – used for 'in' and 'out' of catchment analysis within the planning module of AMS.

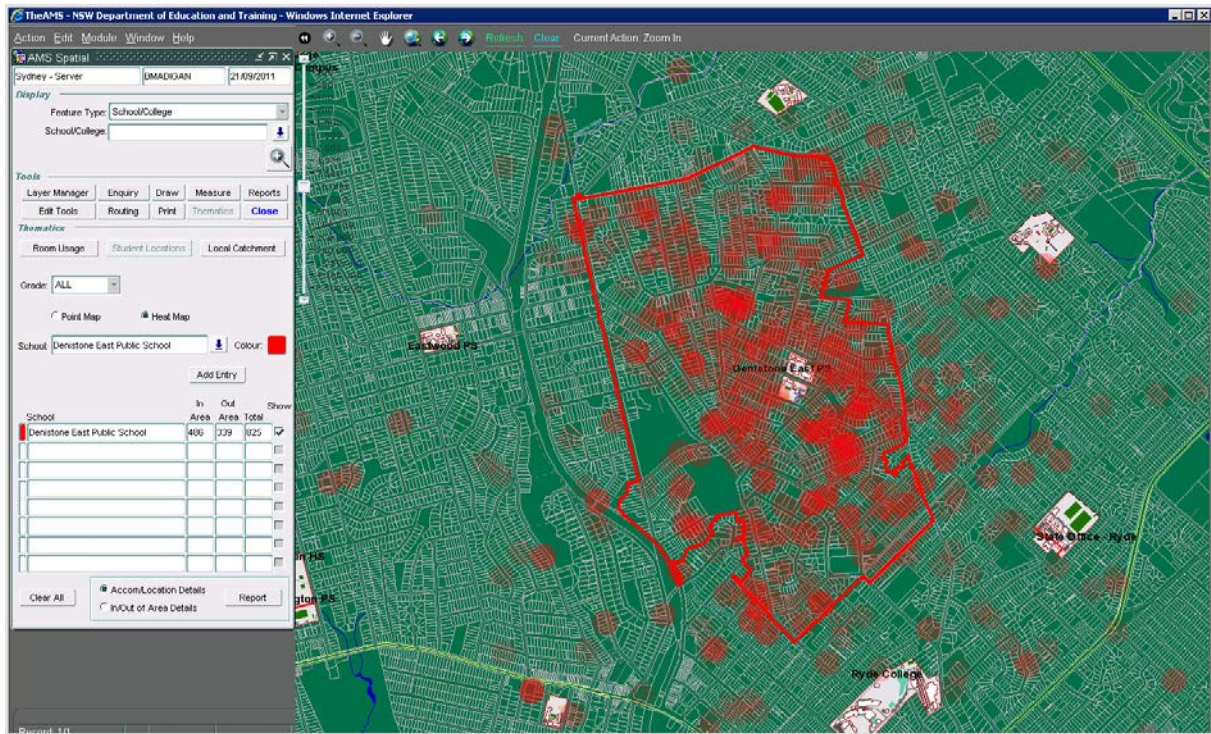


Figure 14: Facility for checking if a new student is located within an existing school catchment. This function also includes an interface to Google Maps.

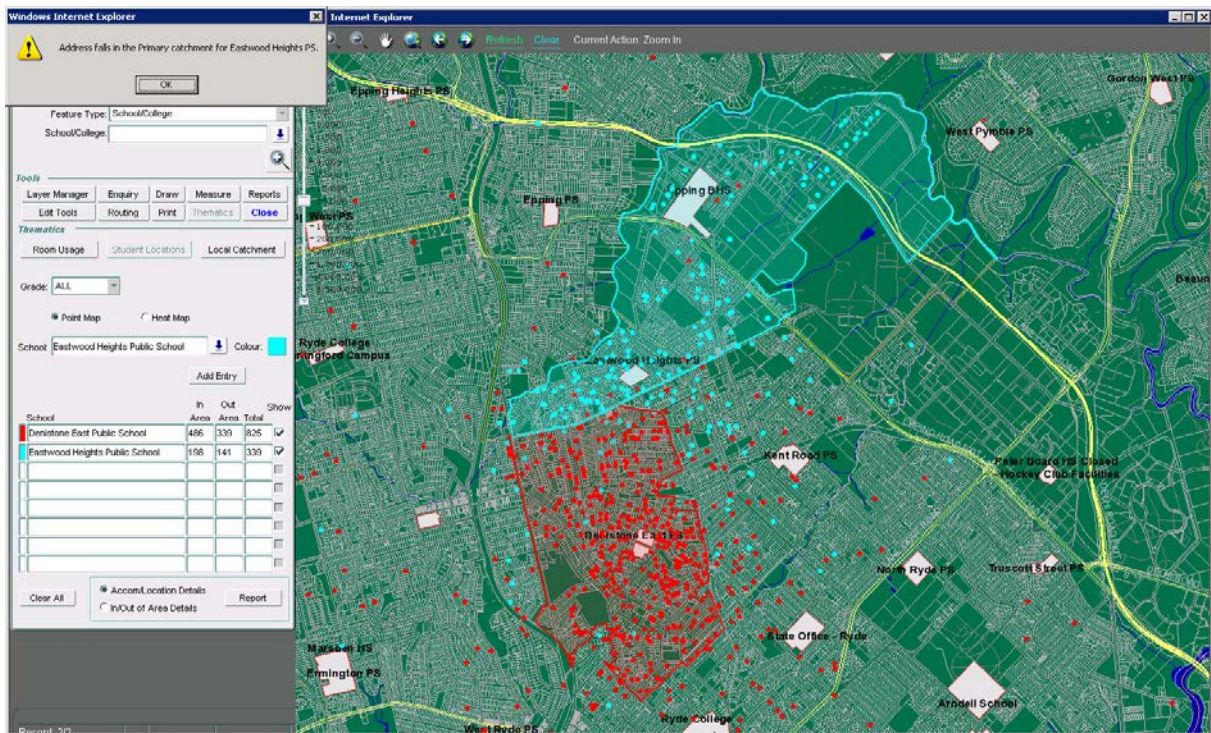


Figure 15: Linking of student address to a school catchment.

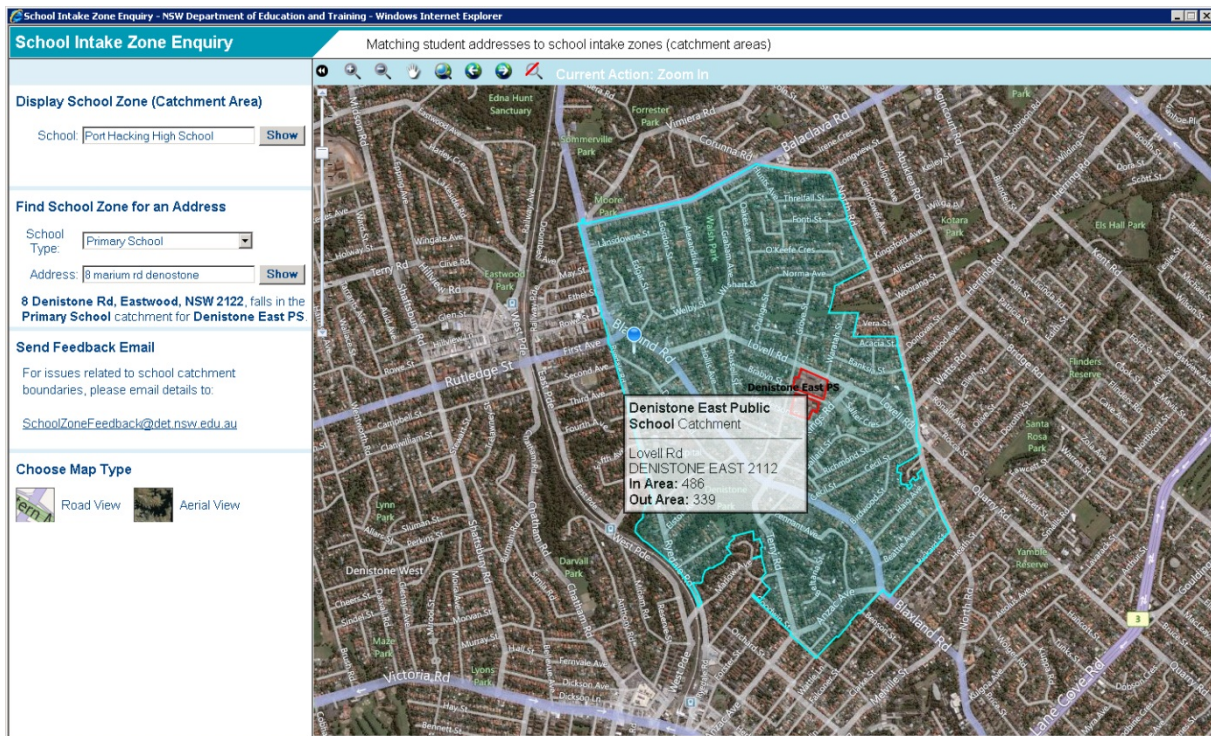


Figure 16: School intake zone enquiry – ‘internet accessible’ (integrated with Bing Maps).

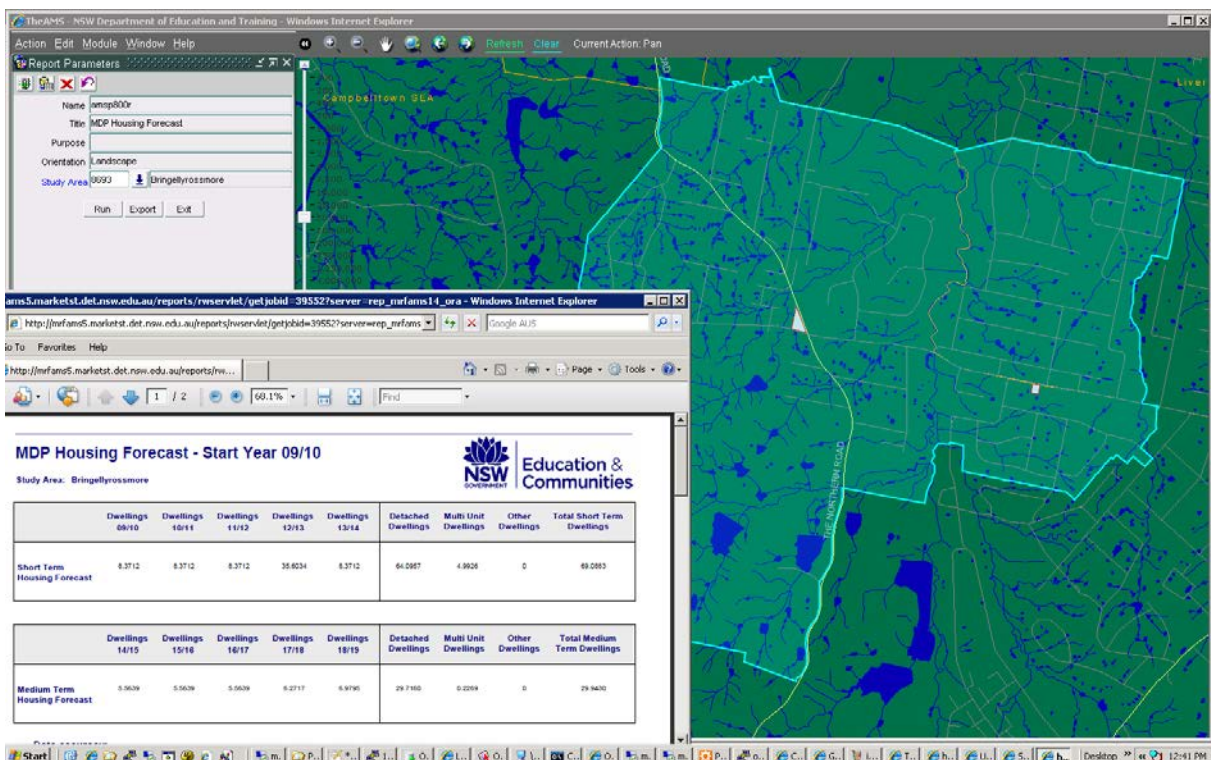


Figure 17: Metropolitan Development Plan (MDP) housing forecast for a study area.

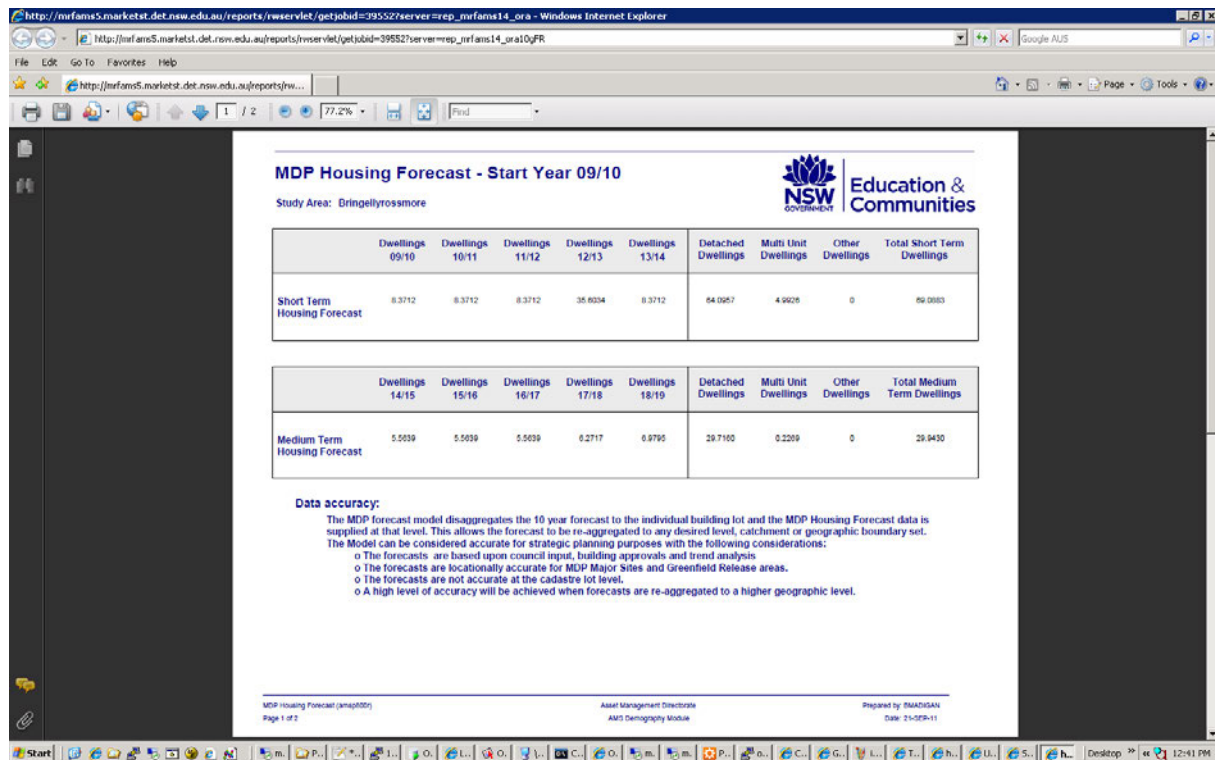


Figure 18: Metropolitan Development Plan (MDP) housing forecast for a study area detail.

5.8 Demountables

The demountables module provides support for both the management and operational tasks of demountable buildings. It provides for allocation of buildings (based on school needs and entitlements), production of work orders for site preparation, transportation and delivery of buildings including advice to crane operators, truck companies and maintenance contractors who are responsible for establishment (and re-establishment) of the site for the demountable. A tool is provided that even maps the 'swing circle' of the demountable while it is being lifted onto the site, incorporated with up-to-date aerial photos.

The spatial module allows Department staff to plan and locate demountable buildings on a site without the need for on-site inspections, resulting in further time savings and business efficiencies. This module is interfaced with the maintenance and planning modules for the purposes of maintenance. A spatial tool provides shortest-path analysis for input into transport costs and includes information on road hierarchy and bridge weights to ensure demountables are moved in the most efficient way between donor and recipient schools (Figures 19 & 20).

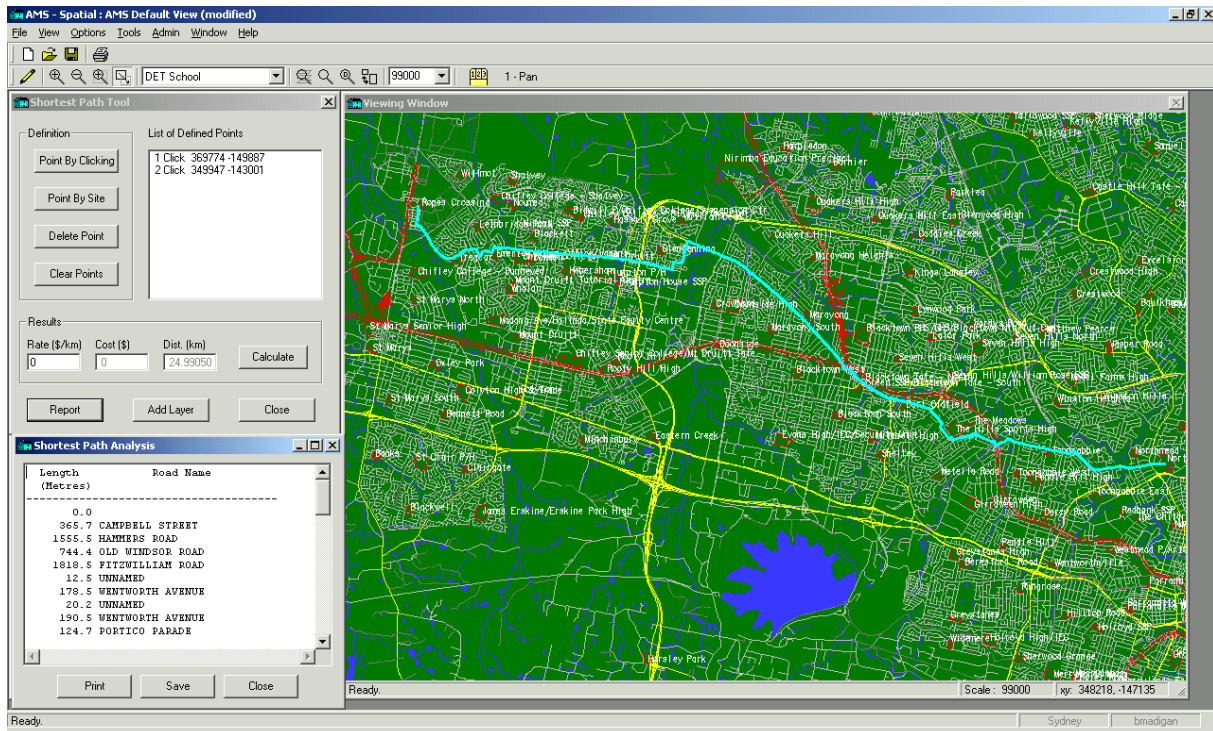


Figure 19: Shortest path between a 'donor' and 'recipient' school to assist with calculations of transport costs for demountable classrooms.

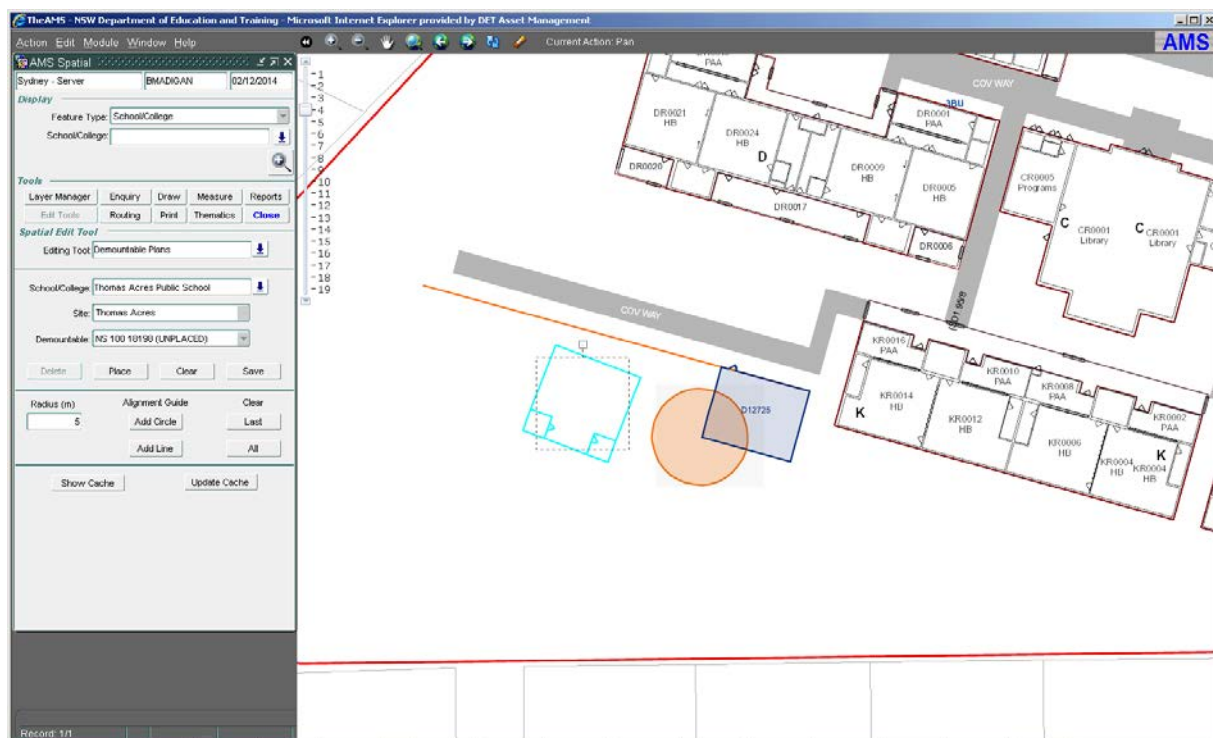


Figure 20: Example of the demountable placement tool using a predefined building module/template. Users can place the building, rotate and offset the building from existing structures and display the swing circle for the crane to allow for assessment of obstructions such as trees and overhead wires.

6 ASSETWHERE™

As a result of OMNILINK's experience with AMS, another client, Knox Grammar School at Wahroonga, advised that they needed a system to collate and display all their school property and building information. Their collection of plans covered a period of over 50 years and included survey, architectural and engineering drawings on various media and at various scales. Thus AssetWhere™ was born in 1999 as a Property Information Management System based on desktop GIS and a readily available relational database. Today OMNILINK has implemented the system in nearly 100 schools throughout Australia and New Zealand. This year has also seen its introduction into some British schools.

Version 4 of the software has just been released. It is browser-based and so can be viewed throughout campuses and on mobile devices. However, AssetWhere™ is not just for schools and educational establishments. OMNILINK has also installed the system in aged care facilities and golf courses, and is negotiating its adoption by commercial property interests. The system allows users to view all building and property information, internally and externally, in managed layers with navigation tools and the ability to point, click and extract information about the feature of interest. Layers include sub-layers of building/level/room, electrical, mechanical, telecommunication, fire, drainage, water reticulation, title information and landscaping. These layers can be viewed together in any combination (Figure 21).

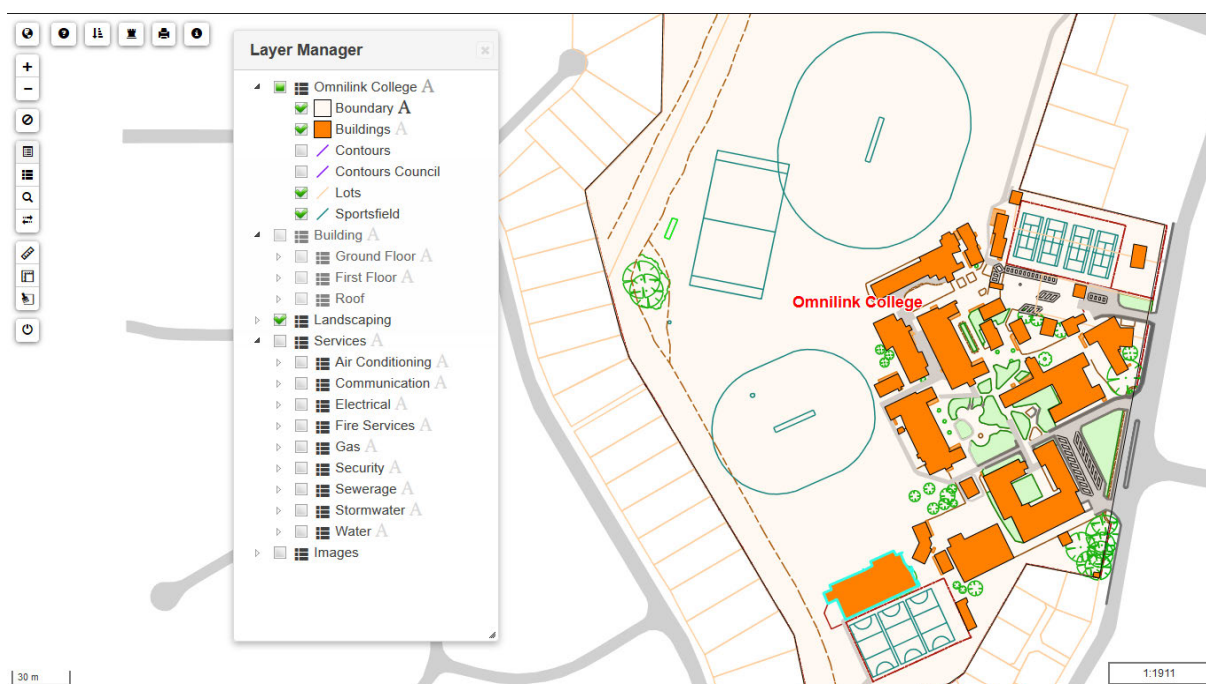


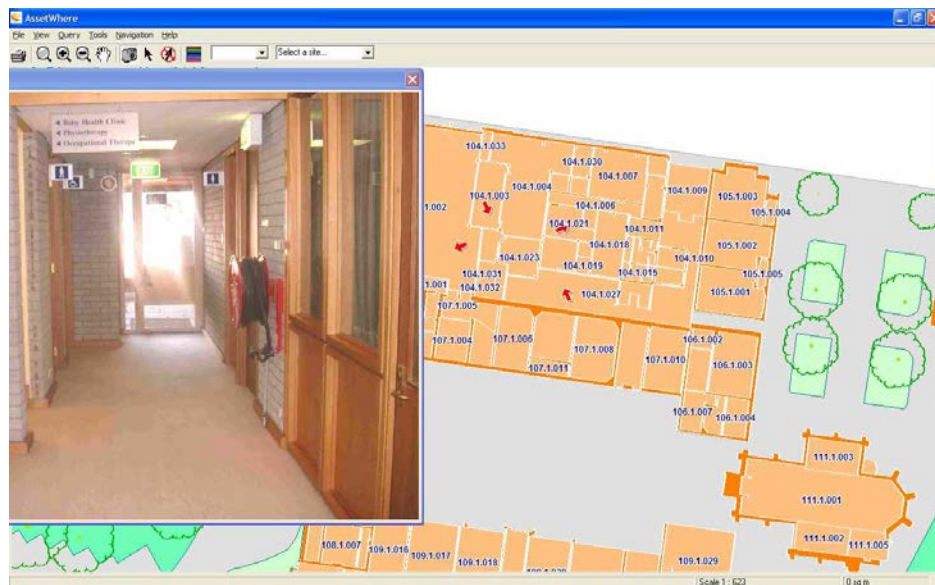
Figure 21: AssetWhere™ Version 4, showing site features and layer manager.

As the user zooms in, further detail is displayed such as services and room details. Clicking within the room allows an interface displaying room attributes (Figure 22). It is worth noting the scale display in the lower right-hand corner and the scale bar in the lower left.



Figure 22: Room detail with attribute table.

The key to the utility of AssetWhere™ is the initial collation and sorting of information and understanding of the drawings. Clients are issued with an inventory of all relevant information after consultation with managers, staff, contractors and consultants. The system links to other software – fmXpert (a facilities maintenance software package), school records systems and financial systems. Consequently, users can view the location of an asset, retrieve its maintenance and financial history with a few clicks, issue a work order for repairs and, later, track the progress and performance of the repairs and the technician. Users can also view linked photographs and documents relating to assets (Figure 23).



managers to make decisions about priorities of work from a view of an incident. For example, consider liquid seeping from a site. Is it emanating from a break in a water pipe, a drainage pipe or a sewerage pipe? Without the system, this may have required excavation to determine. Experience has shown that AssetWhere™ repays itself in the first year of implementation and has a return on investment in subsequent years of over three times.

Further to a request from one of its New Zealand clients, OMNILINK developed a geospatial routing solution, which was named StudentWhere™ although it could just as easily be known as ‘StakeholderWhere’ for reasons to be described. The software initially located anonymised student addresses for the purposes of formulating school bus routes. Another client described a need to be able to identify lower socio-economic category students for the purposes of gaining government grants and this then became a marketing tool for schools to attract students from these socio-economic districts using census data. Subsequently this tool was used to assist businesses in finding appropriate locations for their market segments. Many firms use this type of software tool to assist them in deciding where to open new stores (e.g. McDonald’s).

7 ASSET BASIS

The presented case studies highlight the importance of location to best-practice asset management. Service-oriented government departments generally require physical assets such as land and property to distribute and house these services. From a financial accounting point of view, departments are required to maintain records of these assets and their values for management and reporting. As responsible and leading employers, departments are required to maintain their physical property in safe working order. In addition, departments are caretakers of community assets and are required to keep them in a workable and possibly transferable condition.

As defined by accounting texts, an asset:

- Provides future economic benefits or services derived from its use or sale (i.e. it has value).
- Is controlled, i.e. an organisation has the capacity to gain benefit or to deny or provide benefit to others from the asset.
- Has resulted from some past transaction, internally or externally.

Thus this property information is in itself an asset for government. Given this, the asset requires protection and management, and it provides not only operational benefits but also a tool for risk mitigation. Table 1 illustrates how this is achieved.

Table 1: Risk-assurance matrix (© 2004 OMNILINK Pty Ltd – Garvin and Harkin, 2004).

Assurance	Risk
Improved process	Reinventing the wheel
Governance	Litigation
Shared learning	Knowledge hoarding (silos)
Customer retention	Customer defection
Competitive advantage	Loss of knowledge
Successful outcomes	Poor decisions
Increased efficiency	Inability to learn
Lower cost	Higher cost
Employee satisfaction	Lower productivity

8 THE DATA LIFECYCLE

Information is sourced from data. In any form, data has three broad dimensions: accuracy, currency, and efficacy. Accuracy and currency affect efficacy, but efficacy is an independent dimension that relates to fitness for purpose of the data requirements of the organisation. Accuracy relates to how close data is to the truth, and currency refers to the timeliness of the data (Garvin, 2007).

Accuracy and currency are affected by the data lifecycle (Figure 24) that involves people, processes and technology (Garvin and Harkin, 2004):

- Acquisition – the initial phase of collecting, capturing and collating the data by manual, digital or remote methods and whether it is done internally or externally, by instruction or purchased through independent suppliers.
- Integration – for textual data to interact there must be common fields in relational databases and with spatial data there also needs to be common map projections and parameters, common grid systems and origins and common scale factors to name a few. Then the data needs the ability to be brought together by the ability to access each other invisibly to the user from possibly different systems and stores.
- Maintenance – data that involves people and physical and man-made features inevitably change through natural forces, development and human intervention over different times. It therefore requires review for changes and revision, if necessary.
- Extraction – for data to become knowledge it must be revealed by querying and reporting from the appropriate data stores. This occurs programmatically and by the links and commonalities referred to above.
- Manipulation – publishing information from data requires it to be presented in a form with which users are comfortable. Reports, illustrations, graphs, charts and maps can be integrated, massaged and produced programmatically for user consumption.
- Archival – data that have become outdated or inaccurate are no longer efficacious and can be misleading and dangerous. It may have historic value and therefore needs to be retained so is retired from the current databases and held in different non-current stores for possible use in time series or other analysis. New data then replaces the old by the acquisition process.

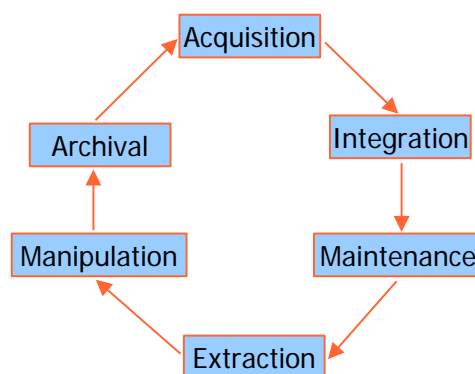


Figure 24: Data lifecycle.

9 THE VALUE OF ASSET DATA

Datasets alone have inherent financial value as an asset. Organisations are bought, sold and traded merely for the value of their data. While their datasets and information do not often

appear on their balance sheets as an identifiable item, they are included in their goodwill. Without data and information, how can organisations operate? Service providers particularly could not operate without information and data, e.g. customer and stakeholder lists, inventory and supplier lists, location details of work sites, routing and scheduling manifests, bills and accounts.

Asset data is a special subset of data. It can be more than an inventory of assets and a list of values for a balance sheet. It may contain data about the asset's condition that can assist with its written-down value, about the custodianship of the asset, about users and other stakeholders of the asset, its location and many other attributes. Its value in use includes operational, management and strategic factors. Furthermore, the value in use of data is limited if not negated if its currency is uncertain.

It is said that what cannot be measured, cannot be managed. Furthermore, one cannot manage what is not known, particularly if its location is unknown. Location is often overlooked, often assumed and is a critical factor in asset management. Location or spatial information and analysis are essential to effective asset, particularly property, management. Property and facilities management require current knowledge of where assets are located and how an asset relates to other assets and users, maintenance staff and management as well as its condition, its history, its likely failure and replacement date and its construction type, just to name a few attributes.

There is anecdotal evidence of the value of the asset management systems implemented in the Department of Education and Early Childhood Development, Victoria, SAMS and the NSW AMS. In the case of SAMS, the cost of implementation that included data capture and validation, system development, systems and data integration and final roll-out amounting to several million dollars was repaid by savings in cleaning contracts in the first year of SAMS operation and accumulated thereafter. A similar cost and benefit was experienced in NSW by cleaning savings as well as savings in demountable classroom movements and campus planning. Less enumerated benefits for both systems include the retention of corporate knowledge, risk mitigation and the ability to link asset management to other systems such as financials.

10 ONGOING ASSET DATA MAINTENANCE

Buildings and infrastructure have a design and material lifetime and are removed, refurbished and replaced. Rooms are re-organised, and service infrastructure replaced and re-routed. Standards for construction change and require additions and renovations. Normal wear and tear dictates changes. So the asset information should change with assets to maintain currency, otherwise risk occurs. Financial risk stems from extra time and charges from contractors unable to locate the asset. It could also arise from injury and compensation caused by inadvertently connecting with the wrong infrastructure resulting in explosion, electrocution or exposure to raw sewage, thereby also causing legal and reputational risk. While the likelihood of this could be assumed to be low, the consequences could be catastrophic, especially in a school environment in which the school has a distinct duty of care.

The data maintenance process requires collection and collation of data for assets that have materially changed. Material change is defined by the user but includes major changes such as new buildings, additions to and demolition of buildings and site service infrastructure

construction and minor changes including removal and addition of walls, changes to room openings and small service adjustments. The source of this data also needs to be decided on when specification for data capture is initialised. Once received by the agency responsible for storage of the information, the data is required to be validated for consistency and then integrated into the appropriate storage receptacles such as a database and/or a GIS.

Data maintenance should be undertaken by trained technical resources that include database administrators, Computer-Aided Drafting (CAD) operators and GIS analysts. Data capture for maintenance can be by on-site measurement using qualified surveying professionals or school staff or from as-built plans or sketches. There is a balance between the data capture process and the integration process. For qualified field capture as opposed to design data capture, less office procedures are required as the data has been formatted and is relatively straightforward to integrate into a system. Alternatively, capture from plans or sketches requires more intensive processing to integrate but is less expensive to capture.

10.1 Maintenance Costs

Indicative data maintenance costs for NSW include major works data updates that are required to be provided by the building contractor who must engage a surveyor from a departmental panel, adding approximately \$100,000 per annum to construction costs. The annual costs for data integration are approximately \$200,000 plus about \$800,000 for extra site surveying and CAD processing. About 300 sites are updated annually from major and minor works out of a total of 3,500 sites that include TAFE colleges as well as schools. Additionally, about another 300 sites are updated annually by maintenance contractors.

As previously mentioned, savings from asset systems in other states have amounted to millions of dollars annually from cleaning contracts alone. Add to this efficiency savings in management of portable classroom movements, school planning, property maintenance and refurbishment programs, and property administration generally. In particular, in NSW the Department has indicated that, because of the manner in which data is stored and kept current, building and site infrastructure valuation has become easier and more precise, providing a more accurate figure with less site visits and time (therefore less cost) to calculate the total. The total annual savings for valuations in NSW have been estimated to be about \$4 million.

Management of portable classroom movements is served by AMS resulting in significant savings. These 'demountables' each have a unique identifier and their location is registered against the site they currently occupy. As they are removed from a site, this data is updated, thus facilitating their management and placement in a new recipient school. Additionally, road routes between the donor and recipient sites are optimised using road centreline data that has bridge and road capacity limits stored, saving embarrassing and costly accidents and delays. AMS has eliminated a significantly manual process that was prone to entry errors and eliminated uncertainty to transport routing that cost the Department time and funds. According to an advisability study on the Asset Management System in October 1994, the Department of Education estimates savings to be \$433,500 per annum (adjusted for CPI by 70%).

School planning has also been simplified in that AMS provides a platform that displays land zones (new residential release areas in particular), housing and subdivision development approvals, population growth statistics by ABS census geographical cells and birth data on a topographical underlay to assist with location of new schools. School planners use this

integrated data to provide information to select suitable sites for new schools whereas prior to AMS, hardcopy plans and disparate data from various sources required time-consuming effort to reach their conclusions with the possibility that their choice was not as good as that which could be reached with AMS. According to the same advisability study on the Asset Management System in October 1994, the Department of Education estimates savings to be \$110,500 per annum (adjusted for CPI by 70%).

School property maintenance and refurbishment programs are also supported by AMS. This is a major budgetary item of over \$200 million per annum direct expenditure and is totally reliant on current data from the system and that reported to AMS by contractors. The current state of school buildings and infrastructure affects their valuation so this reporting activity (data maintenance) is essential to maintaining an accurate database that allows a realistic value of school property, which is currently approximately \$28 billion in NSW. This valuation in turn allows for evidence-based decision making regarding refurbishment, rebuilding or disposal. A summary of estimated savings for various activities resulting from AMS (based on the advisability study mentioned above) is shown in Table 2.

Table 2: AMS savings estimates in dollars (Clarke, 1994).

Activity	1994 savings estimates	CPI adjusted 2014 estimates
Asset management	5,000,000	8,500,000
Building code compliance	1,100,000	1,870,000
Maintenance	1,000,000	1,700,000
Demountable transport & siting	255,000	434,000
Administration productivity	227,000	386,000
Planning, review & queries	65,000	110,000
Transport claims	39,000	66,000
Ministerial briefings	26,000	44,000
Improved data reporting	22,000	37,000
Systems operating costs	17,000	29,000
Valuations	–	4,000,000
Total		17,176,000

There are also numerous intangible or unquantifiable benefits and savings such as estimates for replacement of destroyed or reinstatement of vandalised buildings, better identification of workplace health and safety issues, ready calculation of capital works nominations, better definition of school bus services and ease of review of school catchment boundaries. Additionally, there are extra benefits that emanate from ease of access to the asset information, the ability to distribute the information, the information being available to the public and the facilitated planning from these strengths that allow time savings.

10.2 Benefit vs. Cost

As indicated previously, unless asset data maintenance is ongoing for currency of the asset data, there will be a resultant lack of confidence in the system and concomitant risks that out-of-date data in the asset system will cause damage to life and property so there are significant savings from lower opportunity costs. It can also be argued that savings from data maintenance can account for much of the total savings and are possibly equal to the savings achieved from the system in total. However, for this analysis, it is assumed that the benefits from data maintenance are proportional to the number of sites that are altered annually in relation to the total number of sites. That is, 600 sites relative to 3,500 sites or 17%. For a total NSW system benefit of \$17.2 million, some of the data maintenance benefit is assumed to be a minimum of about \$2.95 million. For NSW, the total cost of data maintenance for

AMS is a maximum of about \$1.1 million. So the minimum benefit/cost ratio from NSW asset data maintenance is approximately 2.7 to 1, i.e. a return on investment of about 270%.

11 CONCLUDING REMARKS

The AMS project has evolved over 20 years from originally being focussed on strategic management requirements to now being a key, integral part of many operational and tactical systems within the Properties Directorate of the Department of Education and Communities. Many business functions of the Department are now solely conducted using the AMS system. It is a comprehensive system that facilitates the planning, project management, maintenance, financial and operational administration of every school (from one teacher schools to large multi-campus high schools) and TAFE campuses in NSW.

Since its inception the benefits realised by the Department have exceeded their original expectations through the delivery of operational efficiencies, the adoption of new asset management strategies and improved information flows. The project motto has always been “User Driven – Technology Enabled” and this approach has always resulted in an outcome of excellence that meets user and business requirements and enlarged expectations.

The system has been developed with a scalable and extensible architecture and database model that makes the addition of new data an extremely simple process. At no point during the life of the AMS project has there been a need to redesign that database model – a testament to the design of the Department and the original development team.

Geospatial enablement gives AMS extra functionality and usability. Rooms and other spaces, buildings, sites and some plant and equipment details can be readily located in relation to each other as well as to the communities these assets serve. Plans and drawings are sidelined no longer to the filing cabinet but act as essential components of the system and provide users with a real-world view of financial and management aspects of the Department’s business. Surveyors play an essential role in the whole process from initial data capture and positioning to ongoing data maintenance. Their professional skills in measurement and observation as well as their experience with buildings and drawings are essential to providing accurate attribute, dimension and locational data.

REFERENCES

- Clarke G. (1994) Advisability study – Asset Management System, Department of Education NSW.
- Garvin E.J. (2007) Spatial information and its value, MBA Project Dissertation, Sydney Graduate School of Management.
- Garvin E.J. and Harkin K. (2004) Presentation to Data Management Group, Praxa Pty Limited, OMNILINK Pty Limited.
- Gillam G. (1992) Field data capture specifications for schools and TAFE colleges, NSW Government Public Works – NSW Water Solutions.