Tollway Lease Area Boundary Delineation

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ABSTRACT

The Roads & Traffic Authority won the Public Sector category of the ISA/CSA Excellence in Surveying Awards 1998 with its entry "Tollway Lease Area Boundary Delineation Projects". This Award was sponsored by the Association of Public Authority Surveyors.

The successful completion of boundary delineation of tollway lease areas is highly dependent on teamwork across elements of the public sector and partnering between the public and private sectors. It clearly demonstrates that the future for government surveyors lies not in direct competition with the private sector but in being able to work together with it to provide a greater benefit to society than either would be able to achieve individually.

This "project team" approach has provided a service which is highly valued by the Authority and contributes significantly to the integrity of the State cadastral framework. Expertise in surveying, combined with a knowledge of land law, broad experience in a specialised field of land definition for tollway purposes and an ability to develop innovative solutions to challenging problems have promoted the surveying profession amongst government organisations, private companies, allied professional bodies and the general public. It has provided these groups with an enhanced appreciation of the role of the registered surveyor as an expert in property survey and related issues.

THE AUTHOR

Mark Thomas Gordon graduated with first class honours in surveying from the University of New South Wales in 1977 and was registered as a surveyor in the following year. His career with the Department of Main Roads/ Roads & Traffic Authority has seen service in Goulburn, Glen Innes, Tamworth, Lithgow, Sydney and Parramatta. From 1993 to 1997 he was the Authority's Property Survey Coordinator for the Sydney Region. Mark's current position is the Authority's Acting General Manager, Geomatics. This position has functional responsibility for geomatics personnel Statewide and is also in charge of a multi-disciplinary (surveying, road design, goetechnical science, laboratory) team of 120 staff at the Sydney Technical Services Office, Parramatta. This business is operated on a commercial basis and has a turnover of $14 million per annum.

EXECUTIVE SUMMARY

The Roads and Traffic Authority of New South Wales (RTA) is a government organisation which has recognised the value of partnership between the public and private sectors whilst retaining and developing the higher level skills of its staff to provide leadership in its area of operation.

This paper highlights the paradigm shift in the nature of services supplied by government surveyors by concentrating on the role of one RTA project surveyor as a manager of the process and a technology leader in the development of new and innovative methods of work. This provides distinct and measurable benefits for the surveying profession as a whole and, in this particular example, strengthens the cadastral fabric for the benefit of the State of New South Wales.

The Authority acknowledges that the traditional "surveying" role of the government surveyor is diminishing but maintains that there is a recognisable distinction between the work of the private surveyor and that of the surveyor employed by the statutory authority. In realising that the private sector of the surveying industry cannot extend itself to the total depth of knowledge required by every existing or potential client, the Authority has retained, in-house, its cadastral surveying expertise which has been developed over many decades. The retention of this accumulated knowledge is essential if the Authority is to continue its role in developing leading edge, innovative solutions to challenges in property surveying and land delineation for roadworks.

In large linear infrastructure projects such as tollways, the private sector demands a certain level of advice and knowledge and depends on the government sector to provide it. The Authority has recognised that it needs to retain people who are able to guide the private sector construction companies so they, too, can make informed decisions which ensure that their project is not unnecessarily delayed or compromised. Surveying is only one aspect of this advice but it is an integral part of the process.

This paper demonstrates that the future for government surveyors lies not in direct competition with the private sector but in being able to work together with them to produce an integrated package. The Authority contends that both sectors - public and private - need to be able to recognise their unique contribution to the industry and to build upon their own expertise so that *together* they may provide a greater benefit to society than they would otherwise be able to do individually.

INTRODUCTION

The concept of private tollways was devised by the State government to fast track the expansion of the major road network in the Sydney metropolitan area. The philosophy involves the lease of land to enable private consortia to build motorways and, following the completion of construction, for the consortium to collect a toll, for a specified number of years, from motorists who use the roadway. At the expiry of the lease period, the motorway reverts to public ownership.

A tollway is a road or proposed road, declared by Order of the Minister and published in the Government Gazette, designed to facilitate the movement of traffic. The length of tollway is not a Public Road for the purposes of the Roads Act nor the Local Government Act, although the provisions of the Traffic Act apply to the toll work as if it were a public street. Any public road declared to be a tollway ceases to be a public road by virtue of the declaration.

Prior to the M4 Western Motorway, the only recent tollways which had operated in New South Wales had been built by the Government and did not require the registration of a lease. However, private toll works in Australia date back to 1802, when the governor commissioned free settler Andrew Thompson to construct the first bridge over South Creek at Windsor. In return for this service, Andrew Thompson was entitled to collect a toll from the colonists using the bridge for a period of fourteen years. Neither Andrew Thompson nor his bridge survived the lease period. In April 1811 the first toll gates on a road were erected on the road between Sydney and Parramatta. One hundred and eighty years later, they were back.

The tollway lease is required to be registered at the Land Titles Office (LTO). The task of the project surveyor in modern tollway projects is to prepare the land to be subject to the tollway lease in a form suitable for lodgement at the LTO. This paper describes the activities required to achieve this objective and outlines the innovative approach taken. Many of the methods devised were not previously used for cadastral surveying in New South Wales and resulted in strengthening the cadastral framework in the vicinity of the tollways.

INVOLVEMENT OF THE SURVEYOR IN THE PROJECT

The M4 Western Motorway was the first time that the Roads & Traffic Authority had leased land to a private company to build an integral part of the road network. The solicitors for the M4 Motorway had originally requested copies of all Titles of land to be subject to the lease, and it was their intention to burden each of these Titles. It was not until they physically viewed the sheer volume of Titles (450) to be affected by the lease and recognised that there were 'challenges' in regard to Old System land and public roads affected by the tollway declaration that they instructed the Authority to determine a method which would simplify the lease process. The Authority turned to its surveying personnel for leadership in this task.

The M4 Tollway (project cost: $246m) was quickly followed by the M5 South Western Motorway ($380m), the Sydney Harbour Tunnel ($683m), the M2 Hills Motorway ($650m) and the M7 Eastern Distributor ($700m). Although not a tollway, the M5 East Motorway has presented its own variety of 'challenges' and thus is included in this paper.

The M2 Hills Motorway, for example, was the largest tollway project undertaken by the Roads and Traffic Authority. Although only directly affecting 250 privately owned properties due to a 1950s road corridor reservation, the $650 million project extended

for 21 kilometres between Old Windsor Road at Baulkham Hills and Epping Road at North Ryde. A total of $1.2 million has been spent on surveys and works associated with the preparation of land in a form suitable for lease for the M2 Hills Motorway.

The process of preparing tollway land for lease purposes is both long and complicated. As an indication of the amount of time involved, work by the project surveyor on the M4 Motorway commenced in April 1990 and the issue of the last tollway Title occurred in August 1992. Survey work on the M2 Hills Motorway commenced in July 1995 and Auto Consol Folios are expected to be issued by December 1999.

The project surveyor's task is to:

- identify the land required for tollway purposes through the interpretation of construction plans;
- manage the survey of the boundaries using both in-house and contract personnel;
- provide advice on complex boundary issues to the Authority, the tollway company, solicitors, public utility authorities and the general public;
- examine Titles and other forms of land tenure to ensure the validity of the Authority's Title;
- determine innovative solutions to problems which have a real potential to affect the viability of the project, particularly in terms of timeframe;
- confirm that the tollway construction is contained within the agreed boundaries.
- draft the request for Auto Consol Titles and validate these Titles against the lease area.

CHALLENGE TO THE PROFESSIONAL SURVEYOR

The challenge for the professional surveyor in tollway definition lies in the coordination of a variety of tasks in order to meet stringent time, cost and quality constraints. The registered surveyor must be able to respond immediately to requests for expert information on boundary and surveying issues and produce innovative solutions to problems in a limited time period. The surveyor must be able to work effectively with other professionals in order to meet project requirements.

Knowledge of Relevant Legislation

The surveyor must possess an intimate knowledge of the legislation which affects both the tollway process and the land to be subject to the lease. This legislation includes the Surveyors Act & Regulations, Roads Act 1993, Conveyancing Act and the Land Acquisition (Just Terms Compensation) Act 1991. Individual tollways either affected or required their own specific legislation with which the project surveyor needed to be well acquainted: Sydney Harbour Tunnel (Private Joint Venture) Act 1987, Centennial Park and Moore Park Trust Amendment (Eastern Distributor) Act 1997, Royal Botanic Garden & Domain Trust Act and the Centennial Park and Moore Park Trust Act.

The Centennial Park and Moore Park Trust Act does not permit the Trust to sell, dispose or lease (including through the compulsory acquisition process) of its land without an Act of Parliament. In order to gain entry to Moore Park lands for the Eastern Distributor, an amendment Act was therefore required to overcome the statutory prohibition and allow the project to proceed. The land required from the Park was categorised into three parts:

- temporary occupation for work sites and compounds
- temporary acquisition for by pass roads
- permanent acquisition for tollway purposes

The project team was required to precisely define these areas from the concept design plans. These areas were quoted in the Cabinet Minute which accompanied the draft Bill and, in spite of changes to the design which will inevitably occur, must be adhered to in the final lease document.

The Sydney Harbour Tunnel (Private Joint Venture) Act 1987 was unique in that it compulsorily acquired public land for nil compensation based on survey plans undertaken before construction had commenced. Changes to the tunnel design during construction and an adjustment of maintenance responsibilities required the re-survey of the tollway on both sides of the harbour. An examination of Titles revealed that the project affected individual Titles which comprised the approaches to the Harbour Bridge: "residential size" land and "roads" which dated prior to the construction of the Bridge in 1932. Easements for services, requiring interpretation of complex construction plans and cooperation with the private survey firm of Hard & Forester, the surveyors of the Sydney Harbour Tunnel, needed to be created prior to excess land being returned to its original owner. It was also discovered that the title to the North Pylon of Sydney Harbour Bridge was the remainder of a Government Gazette notification: a new Title, based on a deposited plan, was required to enable the registration of a lease for an electricity substation.

Sound Knowledge of Survey Practice

The project surveyor also requires expert knowledge of survey practices and procedures in order to provide advice to both internal RTA property surveyors and survey contractors. These contract survey firms are often unfamiliar with the requirements of the Authority, particularly in regard to stratum acquisition and stratum easements.

The project surveyor also needs to guarantee the continuing integrity of the cadastre by planning that property survey marks and information which would be obliterated by construction are surveyed prior to the commencement of construction. Property surveyors were instructed to link these marks to permanent survey stations outside the areas affected by works so that the boundaries could be re-established when construction is complete. These permanent survey stations provide the link between the former boundaries and the new tollway boundaries, thereby guaranteeing the continued integrity of the cadastre.

Although not a requirement of the tollway project, the Authority's surveyors recognised that each survey along the route of the tollways should be connected to both the Integrated Survey Grid and to the surveys abutting either end of its length. This produces a continuous ISG-based cadastral base which is checked and confirmed by the compiled plans which form the basis of the auto consolidated Title. The benefits to the cadastral framework in having connections from property boundaries to the State geodetic network over a ribbon length of, say, 22 kilometres in the case of the M2 Hills Motorway cannot be over-estimated.

Examination and Interpretation of Titles

Titles to existing land affected by the tollways are often complex. The RTA required the project team to confirm the ownership of land and to ensure that encumbrances on the Title did not affect the ability of the Authority to lease the land to the tollway company. The project surveyor is also required to assess the validity of Title so that the Authority is cognisant of each person who holds an interest in every parcel of land it requires to purchase.

Prior to the consolidation process which results in the issue of auto consolidation Folios, the project surveyor again needed to examine each Title affected by the tollway to ensure that it was in the Authority's ownership.

Knowledge of Contracting Procedures

The project surveyor requires the ability to manage and coordinate large cadastral survey contracts. It is essential that those private practice survey companies involved in the definition of the lease areas have confidence in the RTA contact officer and remain personally assured that probity is guaranteed.

Due to the extent of the tollway projects, contracting out involved competitive tendering among preselected survey companies. The Authority conducted pre-tender meetings at which the extent of the project and its requirements were outlined. Tenders were called and were assessed using the weighted criteria of the ACEA Guidelines for Tender Assessment. Detailed records of the process were retained to ensure probity and to respond to any concerns regarding risk.

It was important for the Authority to retain a good rapport with the contracted survey firms and to be able to answer any problems which may arise. In order to meet entry requirements, the project surveyor extended the Authority's quality system for cadastral survey to include contract survey firms as the Authority could not afford the extra time involved should a plan be requisitioned by the Land Titles Office. The private sector companies were receptive to this idea and the concept of "teamwork" was strengthened.

Ability to Read and Interpret Construction Plans

Through vast experience with the RTA and road construction projects, the project surveyor requires the ability to read and interpret complex road construction plans in order to determine the effect of construction on the land affected by tollways and the adjoining lands. This is particularly important for plans dealing with subterranean features such as rock anchors, the lateral extent of which cannot be determined through field inspection.

Communication Skills

In dealing on behalf of the Authority with solicitors, other State and local government organisations, the tollway companies, public utility authorities, private landowners and the Land Titles Office, the project surveyor must be equipped with excellent oral and written communication skills and appropriate negotiation skills.

Examples of this contact are as follows:

- Solicitors for the both the Authority and the tollway company need to be informed about complex boundary issues prior to the commencement of the project so that they can execute the "Project Deed". This instrument binds the participants until the lease takes effect. The project surveyor assesses the work needed to prepare the land in a form suitable for lease and provides an estimate of the time required. He also examines the elements of the Project Deed pertinent to survey requirements and provided appropriate comment which will sufficiently protect the Authority's interests. For example, as the final boundaries depend on the final physical position of the tollway, the lease cannot be signed on the day the tollway is opened to traffic. In the example of the M2 Hills Motorway, a timeframe of eighteen months after this date is required to have the land in a form suitable for lease.

  The responsibilities of the Authority and the tollway company in regard to survey must be clearly and unambiguously stated in the Project Deed so that each is aware of what the other needs to provide. It is the task of the RTA project surveyor to ensure this.

- One landowner on the M2 Hills Motorway was concerned that the construction was encroaching onto his property. The rear boundary between his property and the motorway was the southern bank of Devlins Creek. The RTA project team had provided the tollway company with ISG boundary coordinates for the entire length of the motorway. These coordinates had not been used in this area as Devlins Creek was a natural boundary and surveyors from the tollway company found what they believed was physical evidence of the back corners of the property. Field inspection by the RTA survey team revealed that the physical position of the Creek had moved over time and that the tollway company's assumption that the current bank of the Creek was the boundary was incorrect. As Devlins Creek is subject to flash flooding, the landowner's assertion was upheld.

- As a tollway is not a public road, the rights of public utility companies to enter the land to maintain their services needs to be formalised through easements. The project surveyor's task is to liaise with each of these public utility authorities, including Sydney Water, AGL and Telstra to ensure that their right to service their utilities is not compromised. At the same time, these rights must not result in the closure of the tollway as the interests of the tollway company must also be taken into consideration. Legal rights are often complex: for example, on the Eastern Distributor, the "lid" of the road tunnel adjacent to the Supa Centa is to be used to support the sides of the tunnel which absorb the thrusts generated by a water main which wraps underneath the tunnel structure. An easement for support, with stringent terms and conditions, will therefore need to be created over the tunnel roof to ensure that it is not disturbed. The definition of this easement and the acceptance of the terms and conditions as they relate to survey is the responsibility of the project surveyor.

- Regular meetings are necessary with the tollway company to ensure that any changes in construction are reflected in the final boundaries. Tollway companies are often unaware of the ramifications of certain actions, and their decision to install rock anchors under adjoining private property to support walls and cuttings was an example of where the project surveyor needed to explain the process to gain legal entry to these adjoining lands, without significantly compromising their timetable.

Knowledge of the Ownership of Roads

Title to roads is a complex issue which requires examination by an appropriately experienced professional surveyor. For example, land between the fences of public streets is not necessarily public road vested in Council. This land may include:

- roads remaining in an early Title following private subdivision;
- Crown Roads;
- land owned by the Roads and Traffic Authority.

As the Authority must acquire all lands within the tollway boundary, including roads severed by the tollway, knowledge of the ownership of roads is paramount to ensuring that compensation for acquisition is paid to the correct owner. It is the project surveyor's task to be able to interpret information from the Land Titles Office in order to determine the true status and ownership of roads affected by the tollway.

METHODOLOGY ADOPTED

The base methodology developed by the project surveyor and adopted in all tollway projects is as follows:

1. Apply to the Land Titles Office for agreement to the concept of using auto consolidation folio Titles to define the lease area of the tollway.
2. Declare the tollway by Order of the Minister, in the Government Gazette.
3. Determine the extent of properties to be affected by the proposed motorway.

4. Obtain Title details of all the land to be affected by the motorway, including roads.
5. Examine the Titles for errors and encumbrances and request amendments where necessary.
6. Acquire or lease all lands necessary to provide entry to commence construction. This involves survey using both in-house and contract resources, and is particularly important for Crown Land.
7. Obtain the construction plans from the tollway company and agree on the location of final boundaries. The agreement to boundaries requires negotiation skills as each participant often has conflicting requirements.
8. Liaise with public utility companies to determine which of their services within the lease area need to be contained within an easement.
9. Complete the survey of agreed boundaries using both in-house and external resources.
10. Field confirmation that the agreed boundaries contain all the lands occupied by the toll works and undertake additional survey work where necessary.
11. Register the plans of survey at the Land Titles Office.
12. Compulsorily acquire lands required for the tollway.
13. Convert Old System lands to Torrens Title through application to the LTO.
14. Prepare plans of consolidation to reduce the number of Lots affected by the lease.
15. Request the issue of Auto Consol Folio(s) for land and stratum.

All except numbers 2, 6 and 12, above, directly involved management of the process by the project surveyor; all required his involvement at a high level. Most of these issues are described or commented upon elsewhere in this paper.

Teamwork in the use of contract resources to assist in the execution of surveys and preparation of plans of survey is an important part of the task, given the limited timeframes both to grant entry to commence construction and to complete the tollway boundary definition in preparation for the issue of the Auto Consol Titles. Resources are not available within the Authority to complete this work in the time available, and the cooperation of the private sector is essential if the Authority is to meet its commitments. The project surveyor must therefore be adept at contract administration and being able to obtain teamwork from not only government personnel with the Authority and at the Land Titles Office but the private sector as well. Working together in this manner demonstrates the importance of the roles of both public and private sectors to produce an integrated package. By recognising their own particular talents, their place in the industry and by using their individually developed expertise, they provide a benefit, directly for the project and indirectly for the profession as a whole.

INNOVATION

All motorway projects have demanded a high level of innovation to achieve the objectives of the government. Often a restricted timeframe and the individual nature of projects result in different solutions being required in each instance.

Use of the "Auto Consol" Folio

The Land Titles Office had developed the concept of "auto consolidation folios" to provide for a single Title which encompasses adjoining Lots in the same ownership. In 1990, the Authority's Property Survey Coordinator believed that this could be applied to the 'tollway' concept and obtained the permission of the Land Titles Office to use an auto consol folio to reduce the number of Titles subject to the tollway lease. This facilitated the definition of the tollway and reduced it to a form which could be easily understood.

Progress has been made over the years of tollway definition in that the Land Titles Office will now permit the use of a single Auto Consol Folio to encompass both land and stratum areas whereas on earlier tollways two separate Folios were required, to define "land" and "stratum".

Basic Tollway Definition

As private tollways were a new concept in New South Wales at the commencement of the M4 Western Motorway project, the RTA had no recourse to history in order to develop appropriate lease boundaries. After reviewing all the requirements, the basic definition of these boundaries and their limitations was entirely the domain of the project surveyor. For example, although the tollways had to be defined as a continuous length, the lease area was to be used to define the potentially contentious maintenance limits between the tollway company, local Councils and the RTA. Where the tollway passed over defined rivers and creeks, the tollway needed to be in stratum so that legal access in the creek under the tollway was not affected. Where public roads passed under the tollway, a stratum definition was also required. Bridges built over the tollway by the tollway company were included in the lease area notwithstanding that they carry local traffic.

Use of Compiled Plans to facilitate Early Entry for Subterranean Works

Eastern Distributor

The timeframe for entry provides added problems. For the Eastern Distributor, construction needs to be completed by the Sydney Olympics. In order to achieve this, entry for tunnelling was required in a timeframe which would not permit definition of the tunnel stratum by traditional survey methods over the multitude of individual inner city parcels between Woolloomooloo and Moore Park. There was no question that compulsory acquisition needed to be based on a stratum plan as the cost of total acquisition could not be funded.

An approach to the Land Titles Office resolved that a compiled stratum plan showing one Lot for the entire length of the tunnel, with no connections to either the cadastre or

the State survey control network, would be accepted for compulsory acquisition purposes only, provided that it was followed by a plan of survey showing the effect of this "flying sausage" on individual Lots.

The dimensions of the stratum Lot were based on the design of the tunnel provided by Leighton Contractors Pty Limited. This model was in MOSS format and the tunnel surface had to be approximated by planes in order to satisfy LTO requirements. This stratum was more difficult to determine than at first anticipated due to the complexity of design: double decker in some locations with on load and off load ramps coming off in different directions. The surveyor assigned to the task of defining the stratum Lot, Michael Scarfe, needed to ensure that his stratum boundaries both mirrored the MOSS design and did not encroach within an acceptable depth from either the surface under private property or basement levels.

M5 East

The original timetable for this project required the preparation of plans defining stratum lands affected by the proposed tunnel within a very limited timeframe. The final design for the tunnel was not complete and absolute boundaries were therefore unavailable. Negotiations with the Land Titles Office resulted in an agreement to define the lands by compiled plans. This involved the acquisition by the Authority of *all* land below a horizontal plane in each Title, this horizontal plane being defined on the compiled plan by an AHD level referenced to two established permanent marks. The proviso on this method was that the Authority would undertake full survey where either:

- the proposed tunnel passed under public roads
- cadastral investigation suggested that the base plan was unreliable

The Authority believes that this method will be sufficient to either confirm or improve the State cadastre in the vicinity of the proposed tunnel.

Rock Anchor Easements

Easements for rock anchors needed to be defined on the M2 Hills Motorway and the M7 Eastern Distributor. The definition of these easements requires the interpretation of construction plans and the ability to create a subterranean easement which will envelop these anchors. The rock anchors were designed at a specific 15° rake, at right angles to the cuttings or walls which they supported. Complex construction plans needed to be interpreted to determine easement boundaries which would be acceptable to the Land Titles Office.

M2 Hills Motorway

Rock anchor easements were required to encompass the rock anchors themselves and their zone of influence, to prevent their being disturbed by the owners of the land through which they passed. The rock anchors needed to be a certain depth at the boundary of the privately owned adjoining land to avoid disturbing the surface. The property owners needed to be assured that the rock anchor easement was at a sufficient depth so as not to compromise the quiet enjoyment of their property.

The Authority decided that the clearest way to demonstrate the depth of the rock anchor easement was to use the Authority's MOSS software package to calculate the difference in height between the surface land and the upper plane of the easement. This upper plane was calculated using the three dimensional coordinates of the rock anchor at the

wall and its designed rake. The difference between the surface model and the plane was then shown on a boundary model, for inspection by the property owners.

Eastern Distributor

The subterranean rock anchor easements on the Eastern Distributor involved narrow inner city parcels of which the side boundaries were quite often party walls. In normal circumstances, these side boundaries would need to be redefined by survey. Two problems were immediately recognised:

- gaining entry to houses to define a boundary which did not affect the surface of the land;
- the consequential distress to the residents who would be unable to understand why entry was necessary if their homes were not affected.

A solution was again negotiated with the Land Titles Office whereby the rear boundary of the easement was to be created at a set distance from the surveyed street alignment so that it could be defined in absolute terms. The complex side boundaries of the parcels could then be included by "per original" dimensions on the plan of survey

PROMOTION OF THE PROFESSION

- Each motorway has involved a consortium of private companies and financial institutions. The M4 Western Motorway was built by Statewide Roads, the M5 South Western Motorway by Leighton Interlink, the Sydney Harbour Tunnel by Transfield Kumugai, the M2 by Abigroup Obayashi and the Eastern Distributor by Airport Motorway. Each motorway has required the involvement of different large law firms. In each instance, the lease area process has had to be explained to the participants by the Authority's project surveyor. This has given these organisations a better appreciation of the complexities of the work and the value of the registered surveyor as an expert in property survey and related issues.

- In the M5 South Western Motorway, the M2 Hills Motorway and the Eastern Distributor projects, the tollway companies did not employ registered surveyors except by contract and were highly dependent on the Authority's project surveyor to provide expert advice on property survey issues.

COMMUNITY

Sensitivity to the Environment

Tollways are controversial projects which demand a high level of sensitivity from those RTA officers directly involved in regard to the natural environment.

The Natural Environment

At the pre-tender meeting with contractors and Authority staff involved in property survey work for the M2 Hills Motorway, the project surveyor advised that the area was environmentally sensitive and that the only clearing which would be tolerated was the

minimal clearing of traverse lines. Surveyors were instructed not to clear the boundaries, contrary to the Survey Practice Regulation. Reports of this instruction led to a meeting between the project surveyor and the Principal Surveyor of the Land Titles Office who agreed that the instruction was appropriate under these circumstances.

Heritage Issues

The concept of an RTA Heritage Database proved valuable in the discovery of both Aboriginal and European heritage sites on the M2 Hills Motorway. The locations of these sites were surveyed and their details recorded on a specially devised computer database. Aboriginal sites were confirmed by experts and details were provided to the Authority on condition that the location of the sites would not be made public without the permission of the local Aboriginal Land Council.

The identification of Aboriginal sites was important on the M2 route, where Crown Land was subject to a land claim which had the potential to delay the project. The design of the Motorway would be altered around significant sites in a real attempt to avoid their destruction. Early in the process, a survey mark witness shield was mistakenly identified by some interest groups as an aboriginal scarred tree. Prompt and correct identification was made by the project surveyor using Authority records.

Heritage sites have also been recorded on the routes of the Eastern Distributor and M5 East Motorway.

Protection of Surveyors

Aligned to the concept of community, the project surveyor also made use of the Institution's *Azimuth* magazine to advise our professional community that protesters were filling permanent survey mark cover boxes with slivers of glass and dirt in an attempt to delay survey work on the M2 Hills Motorway project. This affected not only those surveyors working on the M2 but also those surveyors working in its immediate vicinity.

Benefit to the Community

Tollways serve the community through the provision of fast and efficient links for through traffic, dramatically improving the movement of goods, services and people. They promote road safety by removing through traffic from local streets and reduce excess air pollution caused by "stop/start" traffic.

The work of the project surveyor in determining property boundaries and preparing the land to be in a form suitable for lease, although usually unheralded, is an integral part of the tollway process.

Integrity of the Cadastral Fabric

There is a distinct and measurable value to the community arising from the Authority's decision to link all surveys on tollways to both the State geodetic control network and to the adjacent plans of survey. This benefit is directly attributable to the status of the road as a tollway and the need to simplify the definition of the lease area upon which Title is based. There is neither the urgency nor the necessity to do this for freeways and other main roads controlled by the RTA.

Improving the Cadastre relating to Streets within the City of South Sydney

Since 1975, the consent of the City of Sydney and the City of South Sydney has been required to the definition of road boundaries within the area contained within the City of Sydney as it existed on 1 January 1949. The definition of such boundaries in the vicinity of the Eastern Distributor lies, for the most part, in individual, independent, field books held at the South Sydney Council office at Zetland. These surveyors' fieldbooks show connections to boundaries from permanent traverse stations and alignment marks, and require a high level of interpretation. Survey Manager Greg Livingstone from Council and the Authority's project surveyor reached agreement that the Council would supply copies of the fieldbooks to the Authority in return for the coordinated boundaries determined from these fieldbooks. The cadastral fabric of the area in the vicinity of the Eastern Distributor will therefore be strengthened as the fieldbook boundaries will be shown on Deposited Plans and will be connected to the state survey control network from Woolloomooloo to Moore Park. This will involve no additional cost to the community above that required for tollway boundary definition.

Cost Effectiveness

The method established by the project surveyor for providing Title to the land in a form suitable for lease produces a much simpler lease document. This produces efficiencies in the interpretation of what land is contained within the lease area and inhibits costly litigation in future years.

CONCLUSION

The involvement of the Roads and Traffic Authority in the definition and delineation of lease area lands for tollway purposes has presented the opportunity to promote the value of the professional surveyor to other professions, construction companies, utility organisations and the general public. As tollways are an extremely controversial activity, care must be taken to ensure that the surveyor acts with absolute integrity and objectivity at all times. This has been achieved.

This paper has detailed the involvement of the registered surveyor in all of Sydney's modern tollway projects. The role of the Authority's project surveyor has exemplified the reason why a government organisation should retain technical expertise in areas which directly affect its business interests. Notwithstanding this, this paper also reflects the paradigm shift in the role of the government surveyor from that of traditional "field surveying" activities to being a project manager and a leader in the development of innovative solutions which benefit both the profession and the cadastral framework.

In a large motorway project, the work of the property survey professional is often unheralded and yet the viability of the entire works is significantly dependent on his expertise and his ability to use that expertise to respond to the immediate and critical needs of the project. The investment by the Authority of $1.2 million in cadastral

definition and associated activities on the $650 million M2 Hills Motorway is testament to the recognised importance of the registered surveyor's role in ensuring the validity of Title for Sydney tollway projects.

In conclusion, the Authority contends that the achievements of its tollway project surveyor and his team provide a service which is highly valued by the Authority and contributes significantly to the integrity of the State cadastral framework. Expertise in surveying, combined with a personal interest in land law, broad experience in the specialised field of land definition for tollway purposes and an ability to develop innovative solutions to challenging problems has resulted in a system of work which is both efficient and effective.

ACKNOWLEDGMENTS

The tollway lease area boundary delineation project is one which is highly dependent on teamwork across elements of the public sector and partnering between the public and private sectors. Without this universal cooperation, the outcome would be significantly different.

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- Surveyors Leigh Finlay (Chief Surveyor, Statewide Roads), Graham Wirth (Abigroup M2 Chief Surveyor), Ross Buchan (Principal Surveyor, GHD) and Greg Livingstone (Survey Manager, South Sydney City Council)

in the tollway lease area boundary delineation process.

The RTA property survey team was led by Mark Gordon and included registered surveyors Ross McKellar, Laurie Stewart, Michael Scarfe, Alan Hawdon, Michael Rutlidge and Tim Stewart (retired). John Dwyer (Cadastral Information Services Manager), Trevor Forwood, Warren Almond, Youngsoo Kim and Arnold In provided the plan drawing support and expert knowledge in the interpretation of cadastral information issues.

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Finally, I have taken unashamed advantage of my long membership of the Institution of Surveyors Australia and its Cumberland Group to cement relationships between the public and private sector in order to further the objects of the Authority. The willingness of both public and private sector parties to contribute to schemes such as the tollway lease area boundary delineation project provides ample promise for the future of the profession and clearly demonstrates the integral role of the Institution of Surveyors, Australia.