Report prepared for
Consulting Surveyors National

Surveyors and the value of cadastral integrity

December 2016

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Executive summary

The Cadastre

The cadastre is a valuable record of property boundaries, and records property ownership, entitlements and restrictions under the Torrens title system. The cadastre records extents of land rights and interests and connects them to the Certificate of Title each time dealings are registered or new titles are created. The Certificate of Title therefore provides the foundation for land valuation and transfer of property ownership.

Confidence in the land tenure system flows through to an assurance that the registered proprietor on the Certificate of Title is the owner of land described. *Confidence of the land tenure system therefore underpins the efficiency of the Australian economy, especially the financial sector. Critical to the accuracy of cadastral data that forms the basis of a confident financial sector is the licensed surveyor.*

In addition, although positions of boundaries are not covered by the State's guarantee of title, confidence in boundaries is a critical element in public perception of guaranteed title. The community relies on the land administration system to provide a tangible and physical expression of title accurately marked on the ground without dispute. The cadastral boundary system therefore supports title by facilitating the efficient physical definition of title boundaries (and other rights and interests) by surveyors. It also operates in reverse, whereby allowing physical rights to be legally registered on title.

These linkages within the land tenure system highlight the importance of maintaining what is known as the 'integrity' of the cadastre – that is, the reputation of the cadastre and the level of confidence that society has in its accuracy, quality and completeness.

Furthermore, physically delineated boundaries and datasets containing a record of interests in land are integral to economic activity for:

- fiscal purposes – e.g. valuation and taxation
- legal purposes – e.g. conveyancing
- assistance in the management of land and land use – e.g. town planning and administrative purposes.

Key findings – the benefits of licensing surveyors

Industry estimates that in Australia, approximately 2,700 active cadastral surveyors (of approximately 3,000 total surveyors) performed 338,800 surveys in 2015-16. The accuracy of those surveys is vital to continuing confidence in economic activity, especially in the financial sector.

Cadastral surveyors must undertake their responsibilities in accordance with legislative requirements varying between the states. While nuances exist between the states, requirements to be qualified as a cadastral surveyor across Australian jurisdictions follow a common framework.

Government regulation of the surveying profession provides an element of certainty to the accuracy of the survey data. Without regulation there are a range of economic incentives that will result in the deterioration of the cadastre over time.

In this report we estimate, the magnitude of risk to cadastral integrity of inaccurate cadastral data sets due to a deregulated surveying profession. In present value terms (over ten years), maintenance of licensing in the surveying profession generates estimated benefits:

- of approximately **$926.8 million** by avoiding the deterioration of the cadastre. In the absence of regulation, unqualified surveyors would impose costs or externalities on future surveyors by failing to provide the information necessary to re-establish boundaries with minimal costs.
- ranging from **$85.6 - $171.3 million** in avoided investigations. Inaccurate surveys would create expensive investigations and disputes while simultaneously undermining the confidence of the society in its Certificate of Title system.

Such estimates understate the total benefits of licensing as there are other avoided costs for which quantification is not possible. These include, for example:

- cost-savings resulting from avoiding an increase in professional indemnity insurance premiums. The challenge of obtaining and maintaining insurance and the significant increases in price of insurance due to the costs of 'making good' rather than ensuring that the costs do not arise in the first place
- reduced litigation costs because:
  - licensing is seen as evidence of expertise, without which costly court time would be devoted to demonstrating surveyors' bona fides
  - courts currently assume boundaries are correct, whereas in a deregulated environment this would likely be a contested position
- the benefits of using licensed surveyor's skills and expertise on the highly valuable and all important Crown surveys and mining leases surveys throughout Australia. These surveys underpin State development, agriculture and the Mining Industry
- avoidance of risks to the economy arising from uncertainty in land boundaries. Property datasets accurately delineating land are a significant element of the Australian market economy, which would be exposed to increased risks in a deregulated environment. While such risks may be small, the value at risk is significant:
  - significant value is tied up in land - Australian land valued at approximately $4,722.2 billion (ABS, 2015)
  - land values underpin land taxation revenues collected by State and Local Government. In 2014-15, total taxes on property represented 56 per cent of total State and Local Government taxation revenue, valued at $45,203 million (ABS, 2016a).
  - small businesses disproportionately rely on financing provided by loans secured against the family home.

Cadastral surveying deals with surveying activities relating to property boundary definitions and certain associated rights. It involves the physical determination of dimensions, areas and position of rights associated with land properties. Licensing provides a critical nexus to standards of operation and is a bedrock of existing regulatory arrangements. Any suggestion of the removal of regulation within this profession ensures the increasing risk of a threat to the very confidence of the Australian land tenure system which supports the efficiency of the Australian economy.

Contents

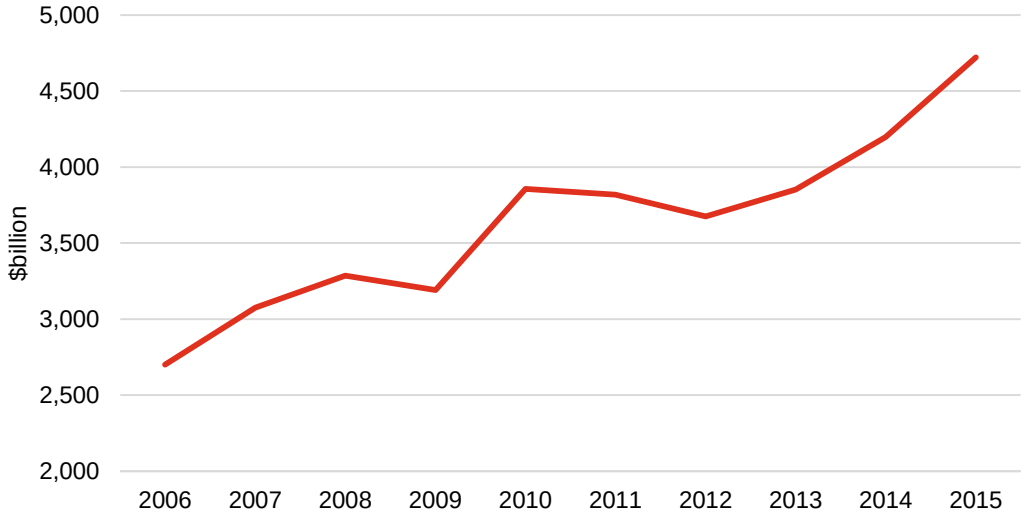
1 The importance of land to the Australian economy

1.1 Value of land in Australia

Land has long been an important asset of any economy. In addition to the value it holds by providing natural resources and habitats, land is also forms the basis of many economic and commercial activities.

According to the Australian Bureau of Statistics, Australian land values have been steadily increasing over the last ten years (see Figure 1). In 2015, total Australian land was valued at approximately $4,722.2 billion (ABS, 2015).

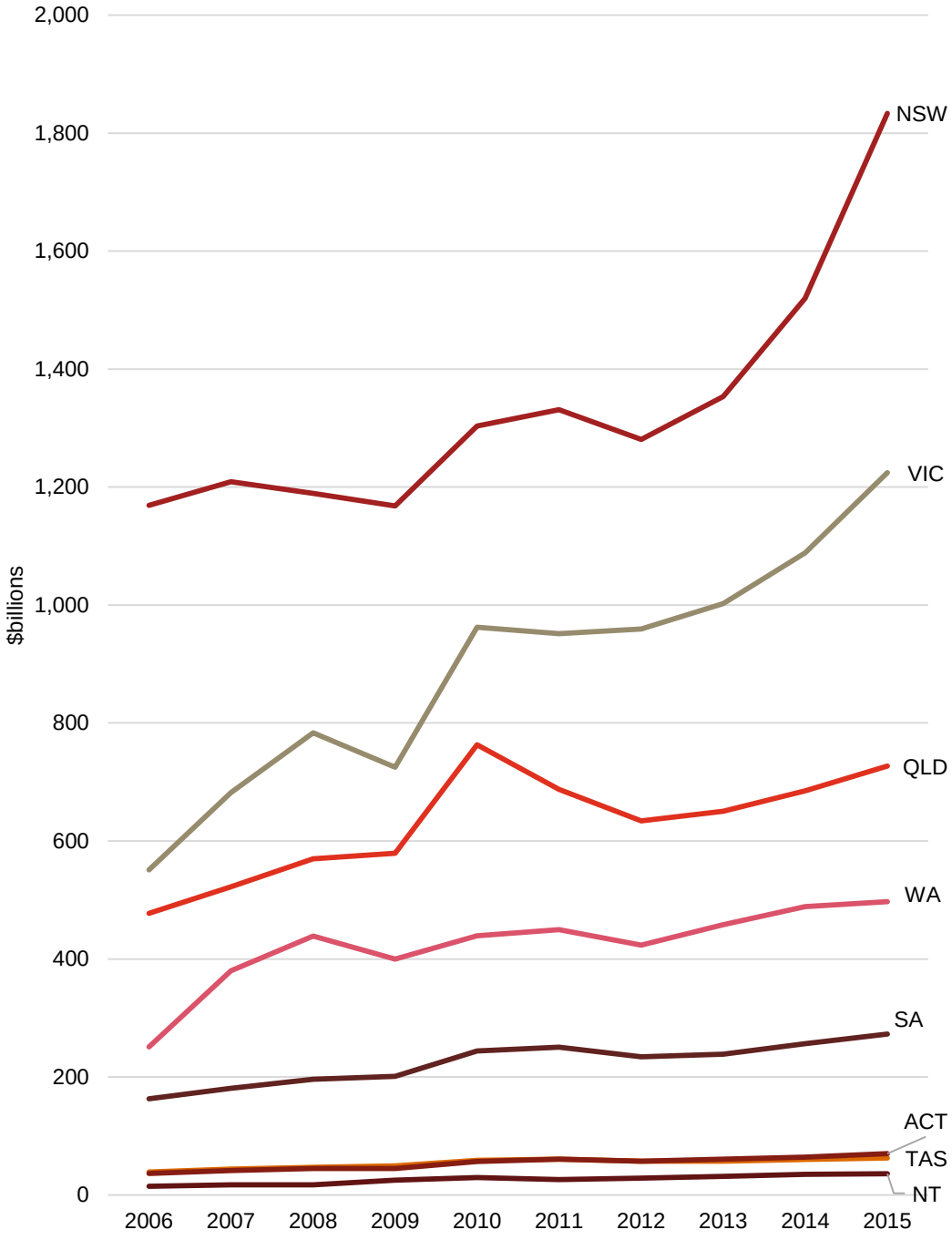
Figure 1: Total Australian land values, nominal (2005-2015)



Source: ABS

At the state level, land values (as distinct from, say, house prices) have experienced differential overall growth over the last decade (see Figure 2).

Figure 2: Total state land values, nominal ($)

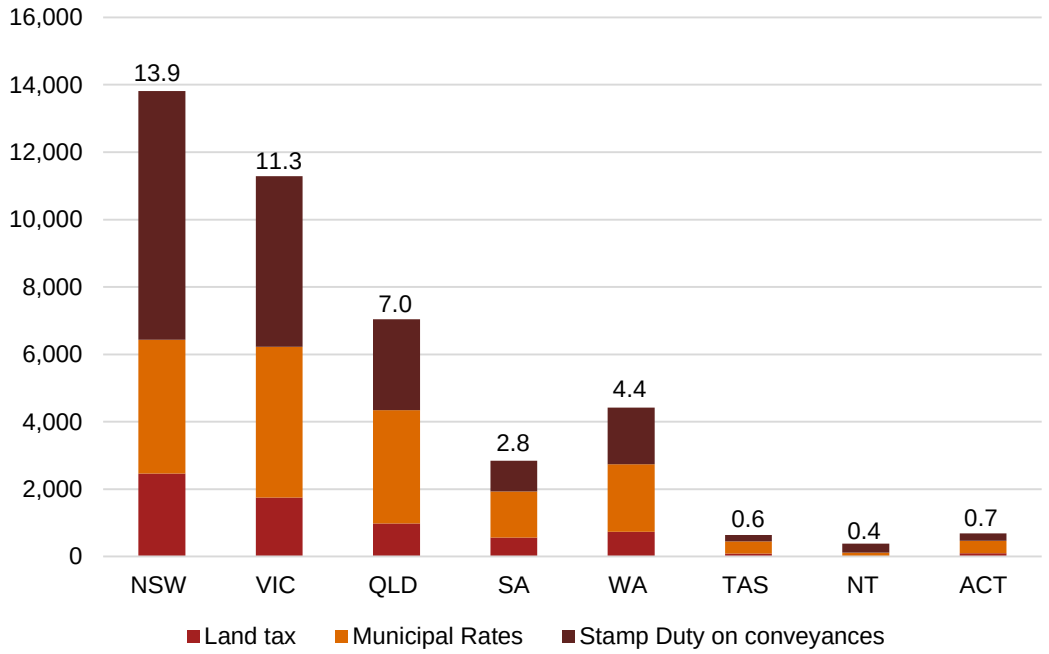


Source: ABS

Further, there were 242,258 mortgages held in Victoria and 281,055 in New South Wales (DELPW, 2016; LPI, 2016). The Reserve Bank of Australia (RBA) reported a total housing credit aggregate of $1,572.6 billion in owner-occupier and investor housing in 2015-16 (RBA, 2016).

In Australia, land values underpin land taxation revenues collected by State and Local Government. Based on data from the ABS, in 2014-15, total taxes on property represented 56 per cent of total State and Local Government taxation revenue, valued at $45,203 million (ABS, 2016a). Figure 3 provides a summary of the key sources of land based State and Local Government revenue.

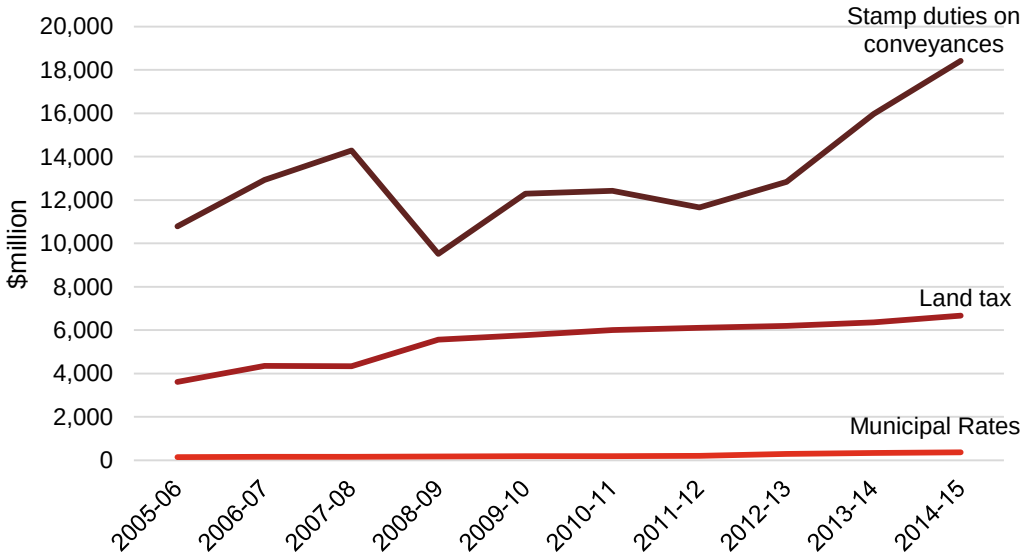
Figure 3: Key Australian land based tax revenues (2014-15)



Source: ABS

In particular, land (as compared to property prices) is a stable and reliable source of income for State and Local Governments. Figure 4 highlights that there is a stable growth trend of land based tax revenue as compared to other more volatile property based revenues like stamp duty (ABS, 2016b).

Figure 4: Key sources of property based revenue 2005-06 to 2014-15 (State and Local Government)



Source: ABS

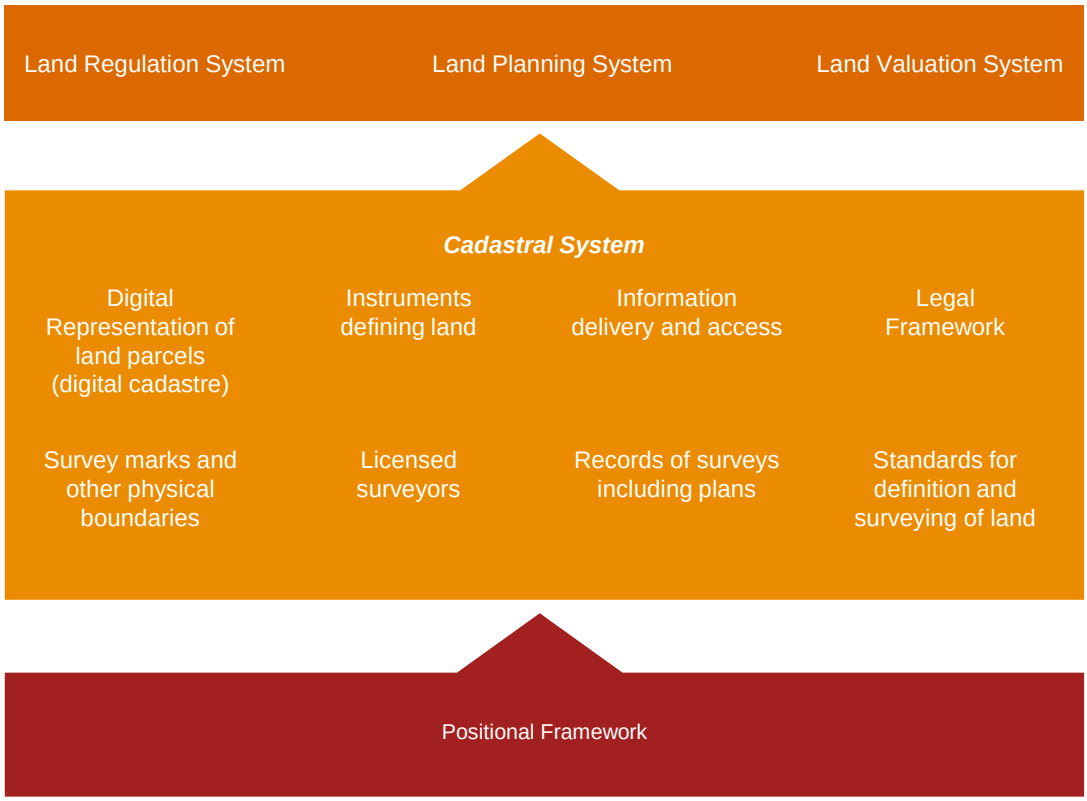
1.2 How the cadastral system supports the value of land

1.2.1 What is the cadastral system?

The cadastre is a valuable record of property boundaries, and records property ownership, entitlements and restrictions under the Torrens title system. The cadastre records extents of land rights and interests and connects them to the Certificate of Title each time dealings are registered or new titles are created.

Working in concert with land registration systems, the land planning system, and the land valuation system, the cadastre is a critical enabler of economic activity. These elements work together to ensure that land and real property can be accurately and reliably identified in a consistent manner. Figure 5 summarises the elements of Australia's cadastral system (ICSM, 2015, p. 8).

Figure 5: Australia's cadastral system



Source: Intergovernmental Committee on Surveying and Mapping (2015)

Central to the cadastral system is the digital representation of lands divided into parcels. Each parcel of land is assigned a unique identifier that includes location reference numbers as derived from title registrations, survey plan numbers, and parcel numbers of geographic coordinates (Williamson, 1985, p. 116).

The cadastre itself has multiple practical uses throughout the economy and society. It is central to land valuation and subsequent taxation collected by government, provides security of tenure to the land title holder, and has an important role in the sustainable development of land.

The cadastral system provides confidence in the land tenure system so that property owners, financial institutions, and governments can ultimately base their property and finance decisions on the assurance that the registered proprietor on the Certificate of Title is the owner of the land described.

1.2.2 Land management systems

Digital cadastral datasets work jointly with the land documentation system. Conceptually, there are two systems for managing land transactions: the recording system and the registration system.

The recording (or deed) system is a framework for determining land ownership. In this system, the role of government is limited to recording land transactions, which does not (in itself) guarantee ownership of land, and the rights to land are on a collection of documents demonstrating ownership.

In cases of dispute, ownership is determined by the courts. Thus, title insurance plays an important role to remediate loss of title claims due to unrecorded or faulty documents. The recording system is similar to the approach used in many US states.

One of the arguments in favour of maintaining a recording system relates to minimising the role of government in land management (Miceli et al, 2002, p. 566). Historically in the US, it was viewed as a mechanism to limit the ability of government to take possession of land by redefinition of land boundaries.

In the Australian registration system, the government is responsible for issuing certificates of title when property is bought and sold and the certificate of title is the authoritative determination of ownership. Title insurance does not play a significant role in the Australian system as compensation for faulty registration information is collected from public funds like registration fees (Arrieta, 2012, p. 222). Other potential claims for faulty surveys can be made through the professional indemnity insurance of licensed surveyors.

The Torrens system is an example of a registration system and is used in many Commonwealth countries around the world.

Arguably, the Torrens system was developed to overcome the limitations and risks inherent in recording systems; it represents a comparatively more efficient means of maximising security of title and minimising costs where boundary disputes arise.

1.3 The value of reliability

Estimating the value of the integrity of the cadastre and its contribution to land values is inherently difficult to measure because there is no revealed market for the value of a reliable cadastre.

There is evidence to suggest that the market places a value on certainty, particularly as it relates to the reliability of property boundaries. Since there is no revealed market for the value of the cadastre, other case studies are useful to understanding the contribution that certainty and reliability plays in the property market.

A 2002 study analysed the land management system in Cook County, Illinois. Cook County operates both a parallel recording system as well as a registration system. Cook County provides a natural economic experiment because there are few examples of two systems, the recording and registration (Torrens) systems co-existing together.[1]

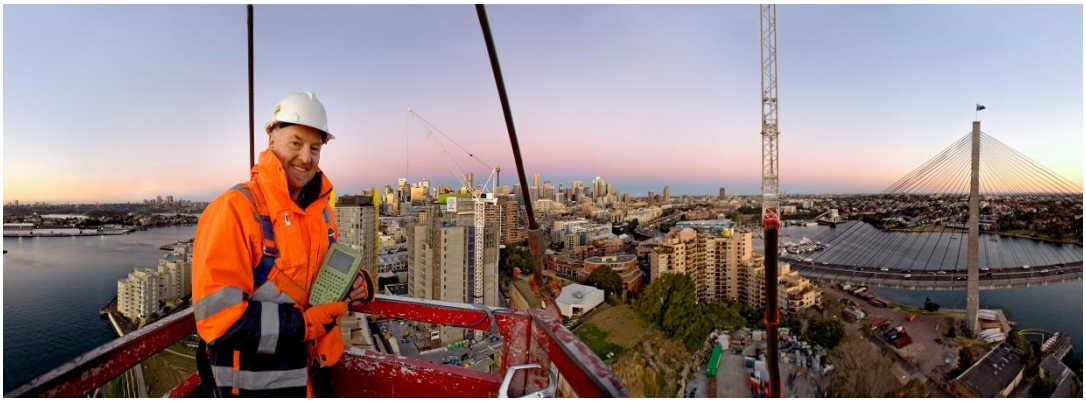
The Cook County experience reveals useful insights about the Torrens system as a means of eliminating duplication and overlap, and ensuring the reliability of a 'single source of truth' with respect to land records through the cadastre. In particular, the study found evidence to suggest that the Torrens title system (e.g. a centralised and regulated systems for managing land) has a positive impact on land values and property prices with higher land prices and greater security of land tenure (Miceli et al, 2002, pp. 565-582).

[1] We note that the two systems co-existed in Victoria from 1862 to 1999. Victoria's accelerated title conversion program from the mid-1980s illustrates the desire to eliminate the recording system in that state.

1.4 Challenges in maintaining reliability

To the lay person, it can seem counter-intuitive to suggest that the boundaries of land are 'not where they should be'. People tend to observe, and respect, man-made boundaries like fences. Over time, these can almost become accepted regardless of whether they are correct or not and do not represent a problem.

For many surveyors, the processes of re-establishment can be as much an art as it is a science. A re-establishment is the process of reinstating previously surveyed property boundaries. This is because it is not always possible for a surveyor to provide the 'correct answer' as there is room for interpretation and opinion in relation to survey evidence (Victorian Government, 2009, p. 1).



For example, the Victorian Government, in its advice and guidance materials for surveyors, highlights the following point:

> *Although surveying in general requires the precise determination of distances and angles, cadastral surveying also involves the interpretation of this information to re-establish title figures. Re-establishment is therefore in many cases a surveyor's personal opinion due to the absence of old marks, or where old marks still exist, the disclosure of survey differences or errors in earlier surveys. Because of this it is difficult to lay down firm policies to solve every case likely to occur, and thus it is more practical to treat every case on its merits, employing certain basic principles.'*
>
> *Frank Robinson, surveyor and chief draftsman, Traverse*
> *cited in Principles of Re-Establishment – Guidance Note 4, 2009*

However, mistakes can (and do) happen for a number of reasons:

- surveyors could have used poor surveying techniques
- there were mistakes in previous survey work or there was a lack of quality control
- there have been changes to regulations or other classifications over time
- surveys could contain errors
- construction work may not comply with survey work
- adjoining surveys determined inappropriate boundaries and were later relied on by other survey work.

In order to establish a defensible boundary, cadastral surveyors must be skilled in spatial measurement and hold relevant qualifications, as well as experience to make decisions.

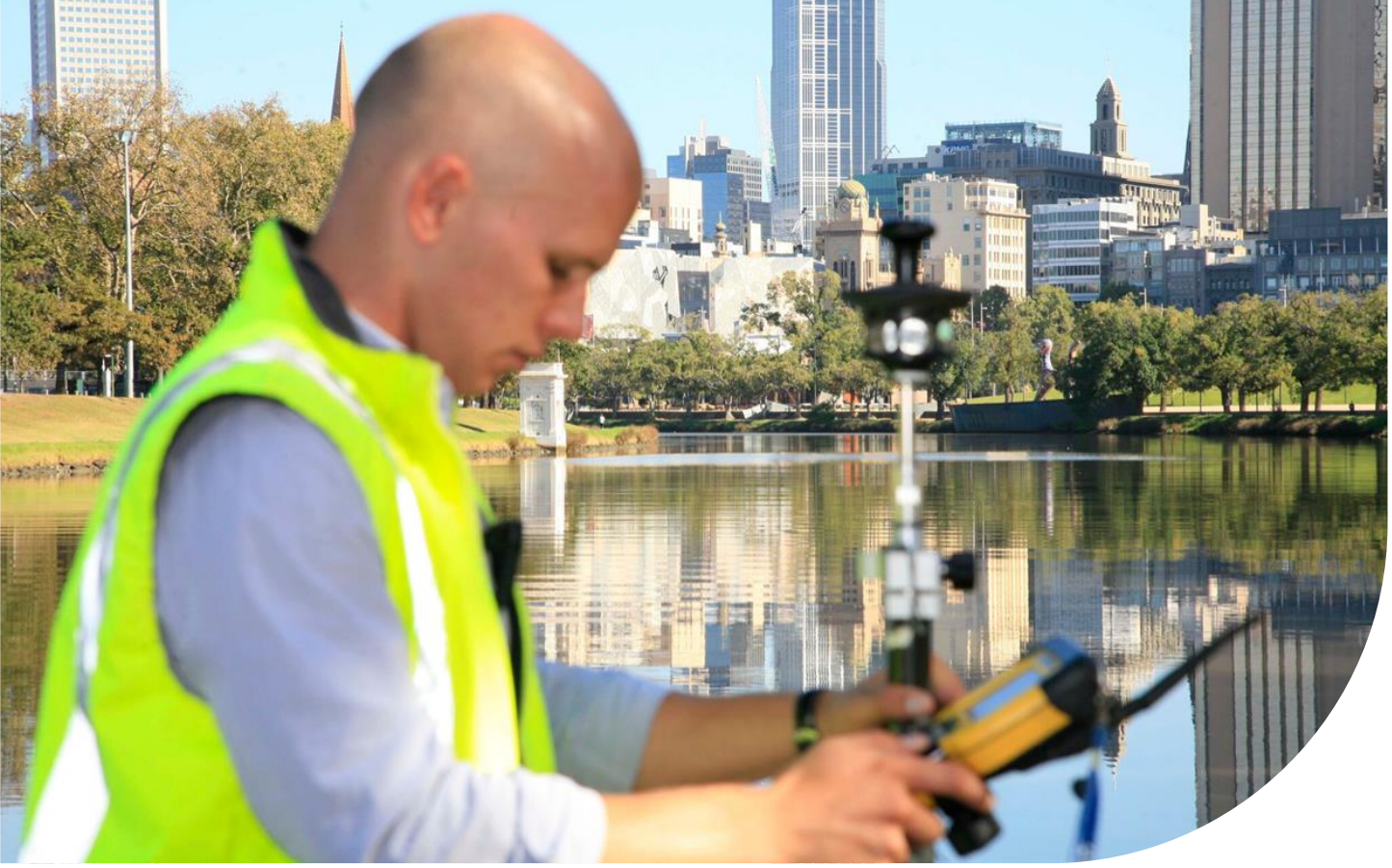
Licensed cadastral surveyors are appropriately qualified to understand this potential for error, analyse this and apply error minimisation strategies in order to overcome potential risks (Colin Shipp, 2012).

The surveyor should not only consider the relevant information relating to the survey for which re-establishments are being made, but also previous surveys and surveys surrounding the relevant parcel of land. It is in this planning stage that the surveyor identifies the physical marks placed from the previous survey to be located in the field.

Out in the field, historical practices mean that survey marks may be represented by old pegs, trees, post holes, building corners or fences that are not easily distinguishable (see Figure 6). The surveyor should consider all available evidence when re-establishing boundaries including all documented measurements, bearings, offsets and angles, as well as re-illustrate this detail in a field book upon completing a survey (Victorian Government, 2009b, p. 4).

Figure 6: Example of a survey mark – *Survey marks out in the field are often not easily distinguishable to the untrained eye.*

Source: Provided by Consulting Surveyors National



2 The importance of surveying in preserving the value of land

2.1 Cadastral surveyors

Central to the cadastral system are licensed surveyors. Cadastral surveyors are the professionals who carry out the task of defining and demarcating boundaries between parcels of land (FIG, 1995). Examples of services that cadastral surveyors perform include:

- property subdivisions – a survey that establishes the boundaries of new parcels within a larger property
- 'strata' subdivisions – a survey that establishes the boundaries of new parcels within built form
- re-establishments – a survey that re-establishes boundaries to verify their position relative to occupation or to assist in development of the land
- identification surveys – a survey that identifies the boundaries of an existing property
- location certificates – a survey that confirms that the description of land used in property documentation is uniquely identifiable
- detail or contour surveys – a survey of a property to locate physical features and levels to derive contours.

In order to keep a reliable register of the measurements and boundaries of land, the title registration authorities maintain and preserve the databases that contain information on land parcels, tenure, and value.

Due to the importance of the cadastral system to the property market, cadastral surveying has historically been a regulated profession. Across Australian States, cadastral surveyors are registered with a regulatory body subject to the satisfactory completion of relevant qualifications, and maintenance of Continuing Professional Development.

Cadastral surveyors must undertake their responsibilities in accordance with legislative requirements varying between the states. While nuances exist between the states, requirements to be qualified as a cadastral surveyor across Australian jurisdictions follow a common framework. Generally, an individual must:

- complete a relevant degree (e.g. four-year degree in surveying or geomatics) or recognised qualification
- complete some form of practical training to meet competency standards and legal training in the State of practice as legal errors leave the title exposed (2 years)
- maintain currency (i.e. pay annual registration fees, fulfil continuing professional development (CPD) requirements).

As an example, in New South Wales, a candidate surveyor must hold or be enrolled in studies toward a recognised qualification, gain a Certificate of Competency and have passed board examinations. In addition to this, under *Surveying and Spatial Information Regulation 2012* (NSW), the surveyor must comply with the CPD requirements as formally determined by the Board of Surveying and Spatial Information.

Similarly, for example, in Victoria, the Surveyors Registration Board has approved specific university degrees from the University of Melbourne and RMIT as providing adequate qualifications to become a licensed surveyor.

Internationally, countries including Denmark, Switzerland and New Zealand have also set out qualifications for licensing surveyors (see Appendix B).

2.2 Cadastral surveying

2.2.1 Surveying activity

State governments across Australia record and report statistics, in varying degrees of detail, relating to the lodgement of plans and major dealings in land and property. However, getting a view into surveying activity is very difficult.

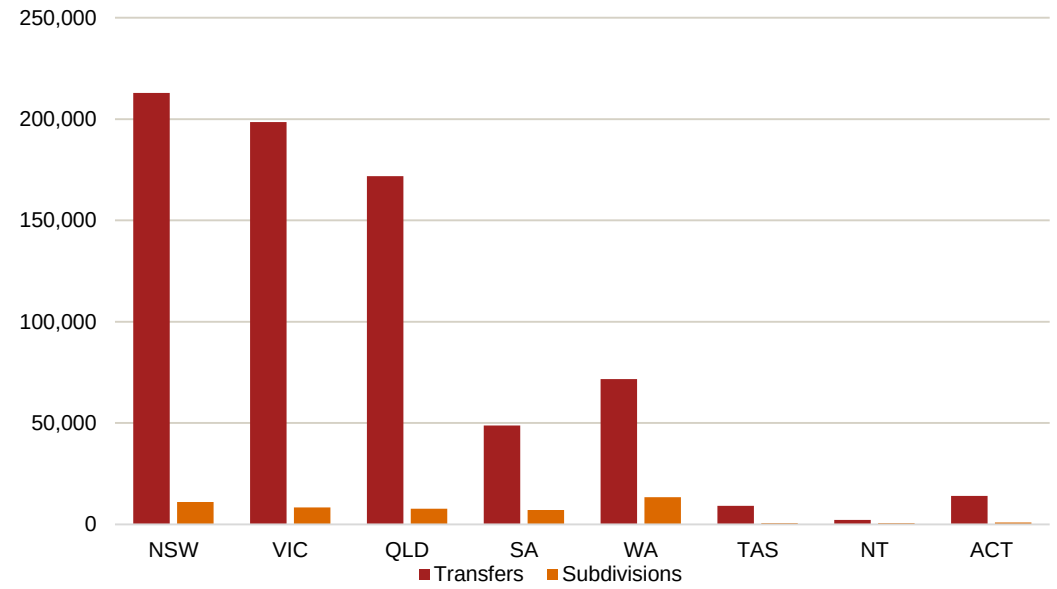
Government land registration information captures data concerning land transactions but does not necessarily isolate surveying activity. As a proxy, two measures that are reliable, readily available, and related to surveying activity are land transfers and subdivisions.

For example, transfers in title refer to the number of times an individual's share or ownership of land changes hands. In some case, buyers or seller might request a survey be conducted to ensure there are no problems with the boundaries.

Similarly, subdividing land in most instances requires an authorised survey to ensure the new (smaller) parcels of land correctly align within the old lot boundaries. Figure 7 summarises land transfer and sub-division registration by State.

Surveying services are also required to establish boundaries for subdivisions in built form. For example, subdivisions in residential apartment towers will attract the services of qualified surveyors.

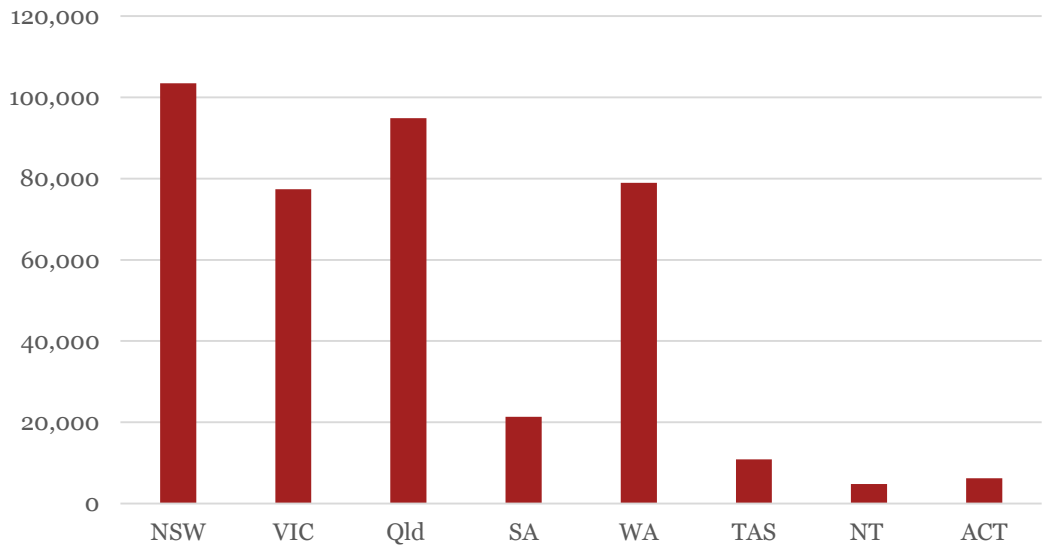
Figure 7: Land transfer and sub-division registration by State



Source: NSW, VIC, QLD, WA state land/property offices, PwC

Through consultation with industry, it is estimated that in Australia, 2,700 cadastral surveyors (of approximately 3,000 total surveyors) will be actively providing surveying services at any time. It is estimated that each surveyor performs roughly three surveys a week for 48 weeks of the year. This establishes that approximately **388,800 surveys** were performed in Australia in 2015-16.

Figure 8: Cadastral surveying activity (2015-16)

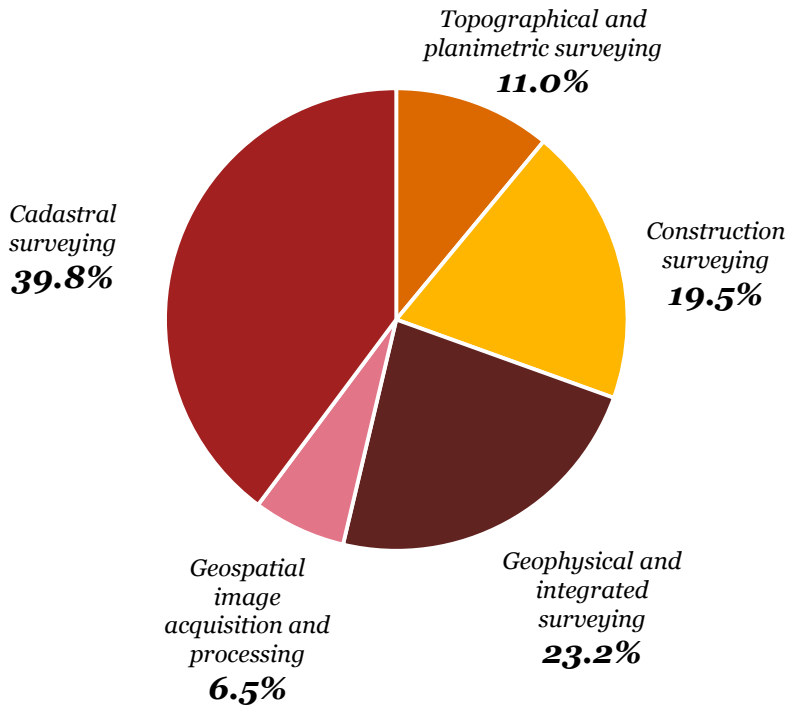


Source: PwC, Consulting Surveyors National

2.2.2 The surveying market

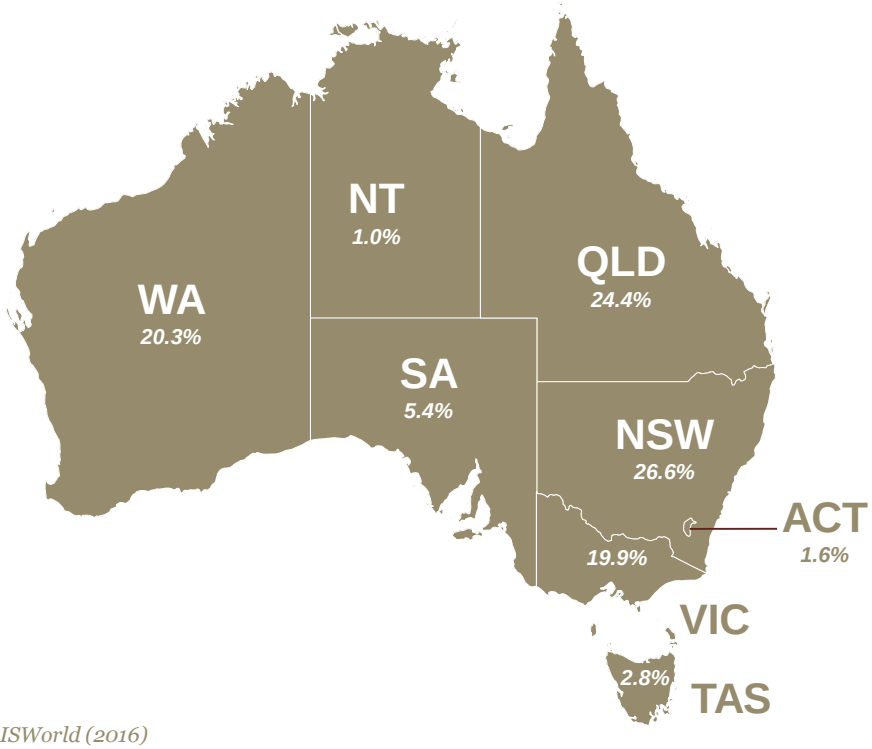
Cadastral surveying is a subset of surveying more generally and represents nearly 40 per cent of the surveying market (see Figure 9). In total, there are roughly 3,625 surveying and mapping businesses in Australia, over a quarter of which are located in New South Wales (see Figure 10) (Kelly, 2016, p. 30).

Figure 9: Industry revenue segmentation (2015-16)



Source: IBISWorld

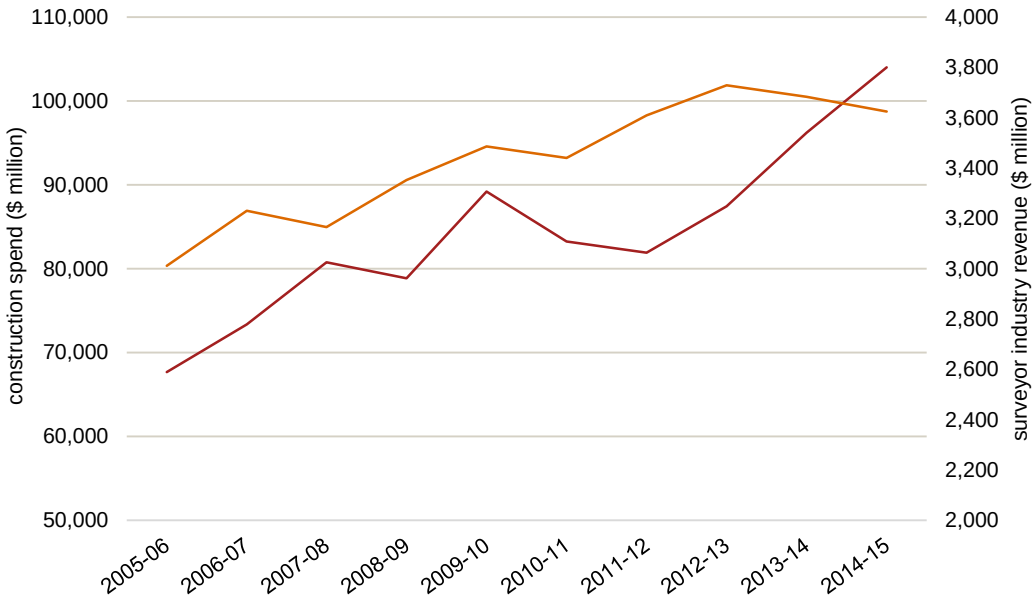
Figure 10: Surveying and mapping services, business locations (2015-16)



Source: IBISWorld (2016)

Cadastral survey industry revenues are strongly influenced by trends in construction and infrastructure. As a result, the industry is sensitive, not only to the number of construction projects, but also the relative value of work. Figure 11 summarise both Australian construction spending and industry revenues over the past 10 years (ABS, 2016c; Kelly, 2016, p. 30).

Figure 11: Total Australian construction spend (LHS - maroon) & surveyor industry revenue (RHS - orange)



Source: ABS, IBISWorld

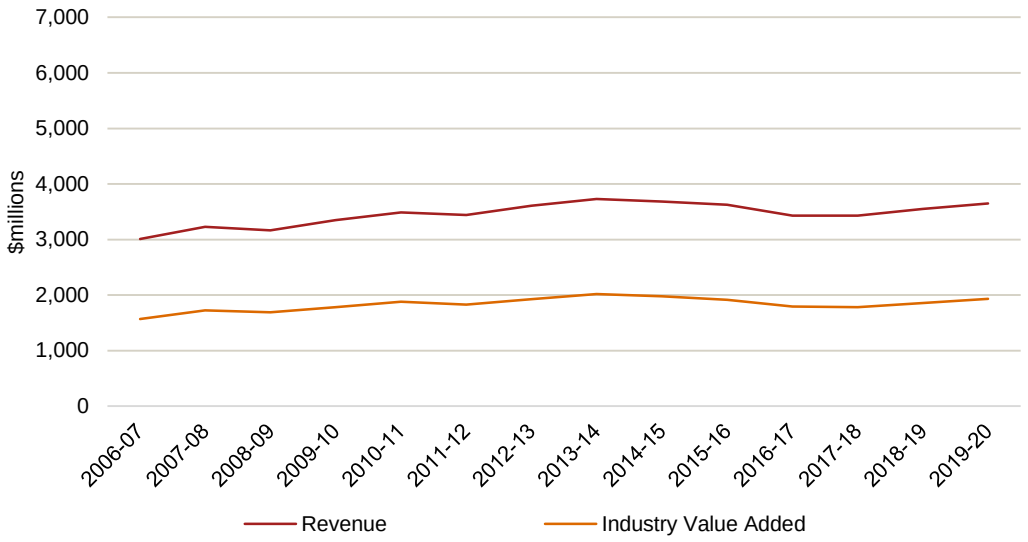
Recently, the industry has started to see a decline in investment in residential building construction (-1.8 per cent in 2015-16) (Kelly, 2016, p. 30). A significant portion of revenue in the sector is derived from surveying work undertaken in the subdivisional and residential construction sector.

Despite unstable conditions in property markets in general, demand for the cadastral industry has grown at a steady pace over the long-term.

In spite of this recent downturn, residential building investment is forecast to experience annualised growth of 1.5 per cent over five years (Kelly, 2016, p. 9). A concentration of non-residential office, retail and transport developments will also assist the recovery of demand for cadastral surveying services. Overall, industry revenue has been forecast to grow to $3.8 billion, a 1.0 per cent increase, by 2020-21 (see Figure 12).

Total wages earned in the surveying and mapping services sector as a whole in 2015-16 was approximately $1.3 billion (Kelly, 2016, p. 30).

Figure 12: Total industry revenue (forecast)



Source: IBISWorld (2016)

2.3 *Market failure and government intervention*

In normally functioning markets, prices play a role in balancing supply and demand. However, there are certain situations where price signals fail and the government steps in to restore balance. Economists call these imperfections 'market failures'. Market failures can arise in a number of situations relevant to the cadastre:

- **Public goods** are goods that are non-excludable and non-rivalrous. This means that people cannot be excluded from benefiting from a good, and that the good is not consumed when someone uses it. A common example of this type of good are things like national defence.
- **Information asymmetries** result from when market participants do not have the same information concerning costs or prices such that some participants are at a disadvantage.

These market failures are discussed in turn.

2.3.1 The cadastre as a public good

The cadastre has some characteristics of a public good, which suggests that regulation is important for correcting market failures:

- The benefits of the cadastre are non-excludable. This means that many people benefit from a reliable registry of surveying and land information. More than this, it is very difficult (if not impossible) to prevent others from benefitting or otherwise capturing the value of the benefit through price signals.
- The information contained in a cadastral register is non-rivalrous meaning that the use of this information does not negatively impact the use of other people.

Due to these factors, there is the potential for market participants to 'free ride' on the quality of the cadastre believing that there is little need for additional cadastral surveys. All market participants can have some confidence that when they buy or sell property the boundaries on the Certificate of Title relate to the actual boundaries on the ground.

In this way, the cadastre benefits a variety of stakeholders. Potential purchasers and land owners both benefit from having confidence in the integrity and reliability of the cadastral system. Governments and public administration officials benefit from the reliability of the cadastre, which contributes to sound planning and land use policies.

Additionally, there are spillover benefits (such as avoided costs to rate payers) in cases where planning or land use decisions result in a negative outcome, potentially requiring compensation. For the wider community, there is a broad need to know who owns the land, where boundaries are located, and the uses that are (or are not) permitted.

2.3.2 Information asymmetry

Establishing and maintaining the cadastre also suffers from a number of information challenges, which cannot be effectively communicated in the market place through prices.

Cadastral surveying work is both technical and complex, meaning that the average market participant does not have the required skills to form a view as to the accuracy of boundaries.

In many cases, buyers and sellers tend not to contest property boundaries, unless there is a pressing reason to do so. Indeed, for many buyers other factors such as location, amenities, and housing features are far more pressing decisions. Buyers may even choose to accept the boundaries of a given house if it meets their immediate needs.

While technologies such as GPS or services such as Google Maps are important tools that help make mapping and cartography more accessible, they are not sufficiently accurate or reliable to act as a viable substitute for the expertise and judgement of a professional. For example, this is particularly the case in large commercial construction projects or infrastructure project where small variances can impact the viability of a project.

There are many factors impacting on a boundary survey and it is a principle in legislation that monuments and occupations take precedence over measurements. It is for this reason that it is important that surveyors are skilled and qualified in order to reliably establish the limits to property based on the established evidence and available physical marks.

Indeed, the regulation brought by the Torrens system and the regulation of the surveying professional in establishing and maintaining a single reliable record of land boundaries and ownership rights is in direct response to the failures that result from recording systems.

3 The benefits of licensing cadastral surveyors

3.1 Avoided re-establishments

A principal benefit of licensing is that it helps to ensure quality surveys and avoid errors in the cadastre. The benefit to the economy is therefore the avoided cost of disputed boundaries down the track.

A Regulatory Impact Statement undertaken in Victoria in 2005 highlighted that having reliable marking and reports from previous surveys provide significant time and cost savings (Allen Consulting Group, 2005, p. 12). The report also noted that the degree of avoided costs depends on the nature of the problem and the complexity of the survey in question.

The report highlights that in situations where surveyors cannot rely on previous surveys or marks, there are specific and more extensive processes required to re-establish boundaries (Allen Consulting Group, 2005, p. 12).

A recent Queensland experience reveals that the relaxation of the regulatory framework has had some impact to the quality of survey work (e.g. specifically the removal of a key review process by the Titles Office). Recently-retired Queensland cadastral surveyor, Russell Christofis, stated:

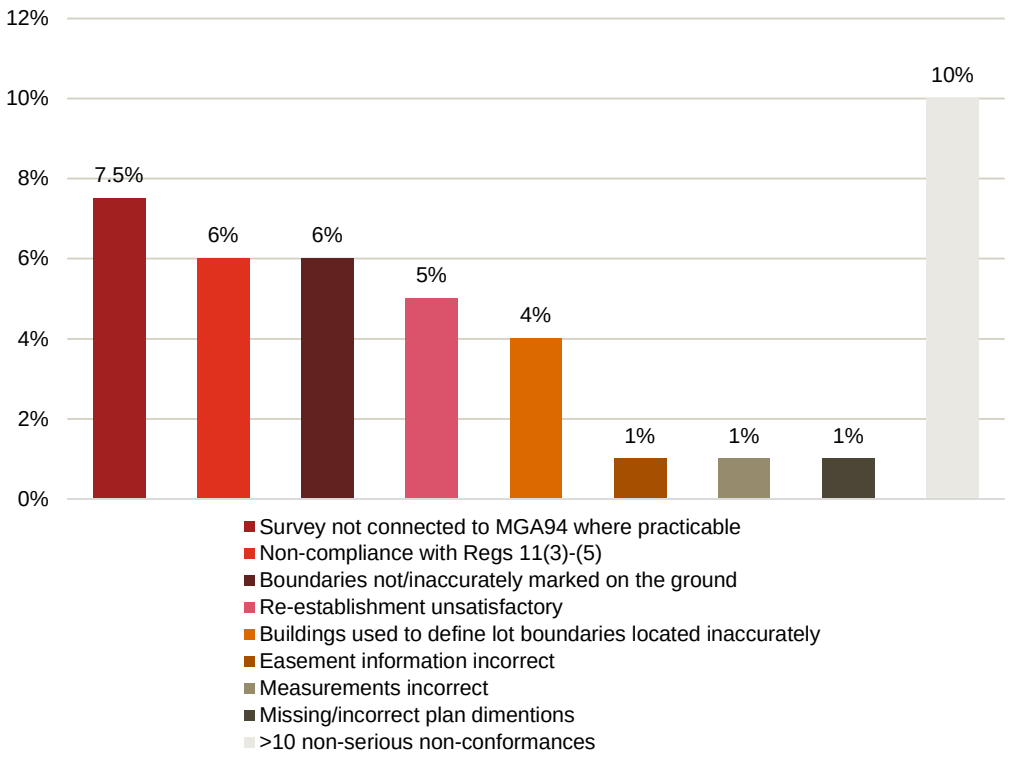
> *In Queensland, we now have two generations of surveyors who don't know what they don't know about basic reinstatement. Overlapping boundaries or gaps in the cadastre of anything from a centimetre to a few metres are now an everyday occurrence (literally every cadastral job my firm did) as the modern unknowingly unskilled surveyor adopts mathematical proportioning over a true hierarchy of evidence.*
>
> *In my opinion, the damage is now beyond repair with the majority of Surveyors just having no idea that they have no idea. The problem is worst in Brisbane where we have a lot of hills and a very old cadastre which means generally there will be more areas of excess and shortage.'*
>
> *Russell Christofis, retired cadastral surveyor,*
> *Consulting Surveyors National Bi-annual Newsletter, July 2016*

Nationally, the cadastral surveying industry estimates that survey quality rates range between 70-85 per cent of surveys being compliant with applicable standards. For example, industry regulators in Victoria reported an 80 per cent compliance rate on random audits, and a 69 per cent compliance rate overall (supplied by the Victorian Office of the Surveyor General, 2014-15).

The highest areas of non-compliance were non-serious non-conformances (10 per cent of audited surveys) followed by the survey not being connected to the Map Grid of Australia 1994 where practicable (7.5 per cent of surveys) (see Figure 13).

The relaxation of regulatory requirements could lead to additional economic costs in the form of additional (arguably unnecessary) re-establishments .

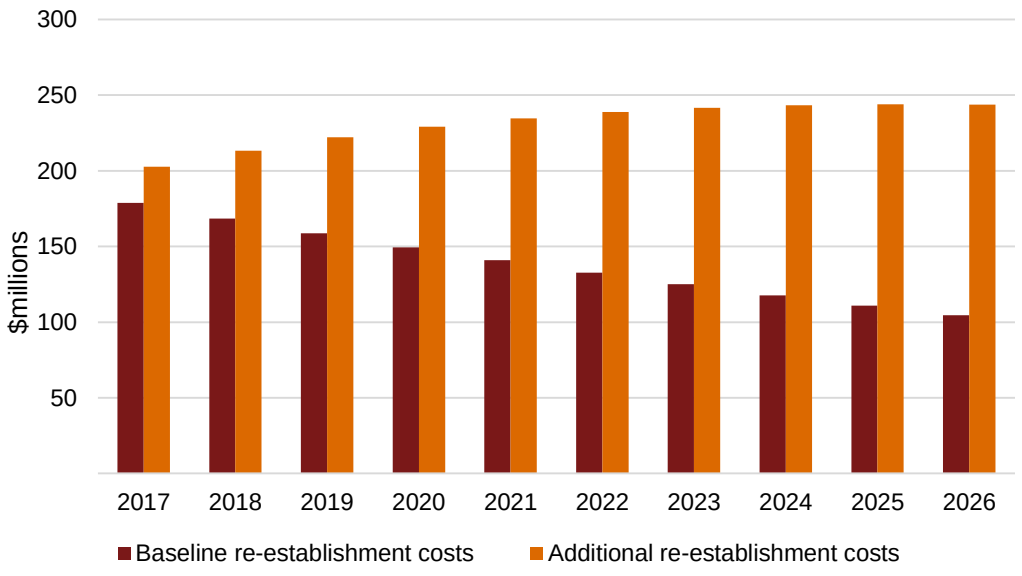
Figure 13: Areas of non-compliance, Victoria (2014-15)



Source: Office of the Surveyor-General Victoria

This approach applies the Cadastral Surveying Regulatory Impact Statement (2005) methodology, approved by the Victorian Competition and Efficiency Commission (VCEC). Based on the estimates of survey activity in section 2.2.1, an average cost per survey of approximately $3,200 and assuming an escalating non-compliance rate of an additional 2 per cent per annum, over a 10 year period, we estimate that this translates to an additional **$926.8 million** (NPV; cumulative) to correct errors to the cadastre. This represents a $93.3 million additional cost for every one percent increase added to the error escalation rate over ten years. Figure 14 summarises the additional costs over a ten-year period.

Figure 14: Additional re-establishment costs due to regulatory relaxations (discounted, 7%)



Source: PwC

3.2 Avoided investigations

In the absence of strict standards, and given the potential for market failures outlined in section 2.3, there is the incentive for market participants to otherwise 'cut corners'. Licensing thus acts as a *low cost mechanism* to ensure compliance with professional standards by restricting market access to those who meet particular criteria.

All States and Territories maintain a form of professional oversight. Broadly, authorities review not only the quality of surveyors' work, but also adherence to professional standards and practices.

For example, in 2014-15, the Surveyors Board of Victoria (2015, pp. 13, 17) reported that of its 511 registered (including non-practising) surveyors, 39 surveyors were audited, and 8 were found to be non-compliant with further professional education and training (FPET) standards. Similarly, the NSW Board of Surveying and Spatial Information (2015, pp. 18-19) reported that in 2014-15, of its 1,042 registered surveyors, 223 surveyors were audited, of which 12 were found to be non-compliant. This implies a median audit sample size of roughly 15 per cent.

Based on input provided by industry stakeholders and applying VCEC-approved methodology, relaxation of licensing requirements could potentially see additional surveyors enter the sector thereby creating additional need for industry monitoring.

Regardless of the market participants who pay for these inspections, additional inspections and oversight represent an economic cost to the system as a whole.

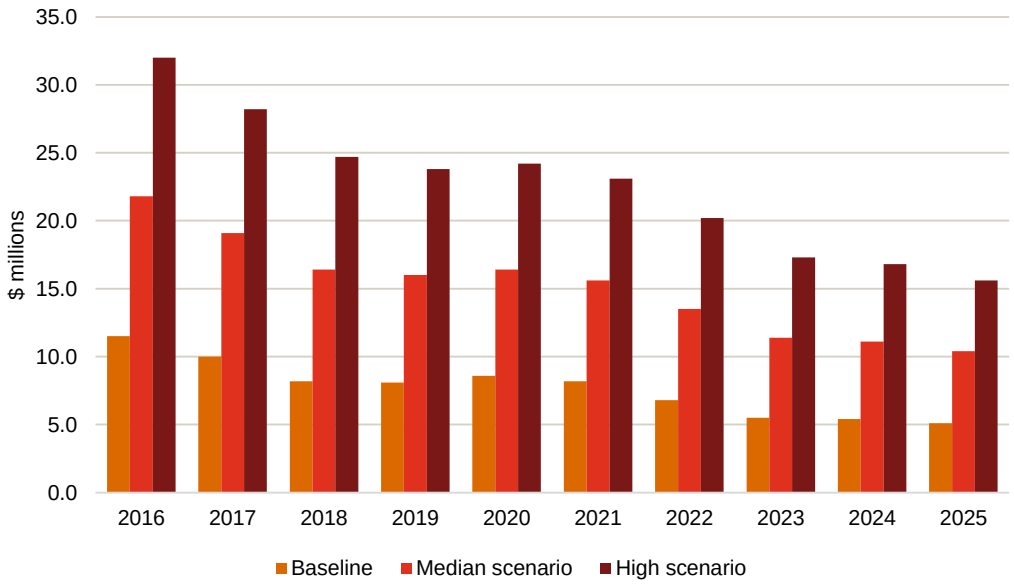
As a baseline, we estimate that there are some 3,000 licensed surveyors that may be subject to annual audit and investigations.

The average cost per investigation is estimated to be approximately $26,500. This is based on the average cost per investigation as estimated by industry, published in the 2005 Victorian Regulatory Impact Statement (estimated at $20,000). This cost has been inflated over ten years using the consumer price index as published by the Australian Bureau of Statistics. It is assumed that this cost will remained fixed over ten years of licensing, as prescribed by the methodology employed.

As a 'high point' estimate, assuming that regulations were relaxed to allow for all surveyors to perform cadastral survey work, and assuming an investigation rate of 15 per cent, this would translate to an additional $171.3 million.

Taking the median between the baseline and high point scenarios, we estimate that potential relaxation of regulations would translate to an additional **$85.6 million** in audit and investigation costs to the system broadly (e.g. financial institutions, surveyors, real estate agencies, etc). Figure 15 summarises the costs under each scenario.

Figure 15: Estimated investigation costs (discounted, 7%)



Source: PwC

3.3 Avoided professional indemnity insurance costs

Critics of occupational licensing have stated that there are generally less economically invasive means of mitigating risk, like the use of insurances (e.g. professional indemnity insurance).

In issues of boundary dispute, it is often the licensed cadastral surveyor who completed the most recent survey on the contested dimensions who must defend their professional opinion in legal courts. In this way, surveyors have a quasi-legal role in their knowledge and application of land related law, the determination of boundaries, tenure and rights. Often, surveyors will take up professional indemnity insurance to provide financial assurance against loss which may result from professional negligence or error.

Ultimately, the expansion of professional indemnity insurance to safeguard unlicensed, and often lower-skilled, surveyors will deteriorate the quality of services offered by the cadastral surveying sector (Hannah et al, 2006, p. 6). Providing professional indemnity to unlicensed surveyors may give rise to a greater risk of error and non-compliance, perpetuating a cycle of faulty surveys and Certificates of Title.

The increasing number of claims being lodged as more and more boundary and measurement errors are uncovered will put greater pressure on insurance companies to compensate for their own losses. As a result, professional indemnity insurance premiums offered in the market will be driven up for the whole surveying sector.

The end result of not maintaining cadastral surveying licensing is a market with lower costs per survey, but also lower quality services. Further, a greater proportion of the surveying sector may be taking up professional indemnity insurance, but ultimately at higher-cost premiums.

Of greatest detriment to the surveying market and cadastral surveying profession is that lower-cost and lower quality services may inevitably drive higher-cost and quality surveyors out of business (IPART, 2014, p. 243).

3.4 Other benefits

A range of other benefits are also attributable to the existence of licensed surveyors.

Firstly, licensing reduces litigation costs in a number of ways:

- licensing is seen as evidence of expertise, without which costly court time would be devoted to demonstrating surveyors' bona fides
- courts currently assume boundaries are correct, whereas in a deregulated environment this would likely be a contested position.

Secondly, the benefits of using licensed surveyors in activities are also captured in activities that do not fall within the traditional purview of regulated activities but which nevertheless use the same skills and expertise. These include, for example:

- Crown surveys – this is important because Crown land is so extensive throughout Australia (e.g. over half of NSW is Crown land) and is often in sensitive areas (e.g. foreshore in Sydney Harbour)
- surveys on mining leases – this is clearly important given the value of mining leases.

Third, as noted in Chapter 1, the accuracy of the cadastre underpins significant land value and associated transactions that rely on such valuations. That is, property datasets accurately delineating land, a significant element of the Australian market economy, which would be exposed to increased risks in a deregulated environment. While such risks may be small, as noted in Chapter 1, the value at risk is significant given that:

- significant value is tied up in land - Australian land valued at approximately $4,722.2 billion (ABS, 2015)
- land values underpin land taxation revenues collected by State and Local Government. In 2014-15, taxes on property represent between 45 per cent and 56 per cent of total State and Local Government taxation revenue (ABS, 2016a)
- small businesses disproportionately rely on financing provided by loans secured against the family home.

Fourth, the pace of modern development is aided by the increased certainty that licensing of surveyors provides. For example, major infrastructure developments cross multiple boundaries, and are often particularly sensitive from a political perspective. Licensing of surveyors provides greater confidence and certainty and hence reduces potential delays regarding boundary disputes.

4 Alternatives to licensing surveyors

It is standard practice in regulatory redesign in Australia to consider whether there are alternatives to regulation/licensing. In this instance, this report considers whether licensing can be replaced without undermining desired regulatory outcomes through insurance or advancements in technology.

4.1 Expanding title insurance

The Victorian Department of Sustainability and Environment has previously noted, *'titles are only as good as the information from which they are derived'* (Victorian Government, 2009b, p. 1). As a result, exploring alternatives to licensing should be considered within the context of managing the quality of the information that underpins Certificates of Title.

Ultimately, while the Certificate of Title protects rights to ownership, the title document does not guarantee the dimensions of boundaries and potential encroachments of these (Donnelly, 2014, p. 6).

Therefore, the role of title insurance is different under the Torrens title system and is limited to instances of cadastral error. In the case of government registration errors, most Torrens titles systems support this with a publicly funded insurance system, financed primarily from fees collected through the titles registration process. Where an error can be traced to the work of a surveyor, errors then become a matter for professional indemnity insurance.

Economic theory tells us that additional costs would be borne by the public purse or by the insurance industry. The question then becomes 1) whether those parties could transfer the cost back to the market, and 2) which mechanisms they would use.

By contrast, under recording systems, like in the US, title insurance may provide economic security to the title holder through multiple land transactions (see Box 1). However, title insurance plays a very different role than in a Torrens system. In the US, title insurance is a way of remediating errors in documentation that may arise from the transfer of deeds stored in the public record.

Box 1: US Recording System case study

Title insurance in the US Recording System

In the US, title is merely recorded with a public official; the purchaser of property must rely on the validity of the sellers claim (e.g. the corresponding documents) to that property as the true owner.

Searches of the public record are performed by an examiner in order to confirm whether a claim to title is valid. Even in circumstances where a careful search is carried out, there still may be substantial errors. Fraud and forgery, inherited property by heirs, deeds under power of attorney and technical errors in recording transfers are just some of the issues which may give rise to an invalid claim to property.

To overcome the risk of loss where faulty titles are found, purchasers of property pay premiums in title insurance. Title insurance attempts to remedy the inadequacies of the recording system by indemnifying the purchaser of property against faulty title, instead of overcoming the systemic risk perpetuated by the recording system.

The US title insurance industry has become a multi-billion dollar industry with total title industry insurance assets exceeding $8.9 billion in the first quarter of 2016, as reported by the American Land Titles Association. This represented a 10.9 per cent increase from the first quarter of 2015 and $300 million net income within that quarter alone.

Source: Johnson (1966), American Land Titles Association (2016)

4.2 Technological innovation

Additionally, critics of occupational licensing suggest that technology provides opportunities to develop new, or adopt existing, technologies and tools to improve the way surveyors collect, use and store cadastral information and hence the need for licensing is obviated. Thus, technology may offer the ability to reduce errors without the negative economic impacts associated with occupational regulation.

While technology offers many productivity benefits for the surveying industry, their wide scale application is limited for reasons discussed below.

4.2.1 The relative inaccuracy of GPS surveys

While global positioning system (GPS) technologies have resulted in greater facility in using cadastral information, they do not have the precision required to determine property boundaries or store related land management information (e.g. land tenure, rights, restrictions and responsibilities).

Technological advancements have resulted in the development of 3D/4D cadastres, real-time cadastres, and global cadastres (Bennett et al, 2010). This has permitted the development of enhanced visualisation of natural and build environments and increased connectivity between cadastral datasets.

The digital cadastre database (DCDB) has full coverage in Australia (Effenberg and Williamson, 1997, pp. 1-2). As the Australian DCDB was originally derived from paper cadastral maps, property boundaries were graphically accurate to their original representation. However, not all modern digital cadastres are survey-accurate, and the absence of licensed surveyors may see the rise of large-scale surveying errors (see Figure 16) (Bennett et al, 2010, p. 8).

Figure 16: Digital representations of cadastres should be survey-accurate

Source: Google Earth, PwC

4.2.2 The use of technology as a complement for licensing

Given these limitations, technology is best thought of as a complement, not a substitute, to the licensed cadastral surveying profession. Cadastral technologies are improving the way in which cadastral data is managed and used in the economy and society.

Countries internationally have taken advantage of digital cadastres and technology to enhance the national cadastre (see Appendix B). The cadastral sector can take advantage of these advances in technology in order to meet the changing and increasingly complex needs of both the public and private sectors.

Modern expectations of the digital cadastre may no longer be met by the cadastre in its current state. Through breaking down the conceptual design elements of the future cadastre, Bennett et al (2010) examined the way technology will help to transform the cadastre in Australia:

- Survey-accurate cadastres – the multipurpose cadastre and increasing interests held in land will require more than ever that survey boundaries are accurate to reality in their visual representations.
- 3D/4D cadastres – the cadastre will no longer be a 2D map for a 3D world. The future cadastre will also incorporate height and time for a more comprehensive visual representation of real property boundaries and interests.
- Real-time cadastres – with increased connectivity and accessibility, cadastral surveyors will be able to update and access the cadastre in real-time.
- Global cadastres – the future cadastre will allow regional and global cadastral networks to be linked in order to provide accurate and timely land market information.
- Object-oriented cadastres – while the reliability of the parcel-based cadastral system will remain, future property interests may no longer fit into the traditional cadastral framework and emphasis will shift to include property objects.
- Organic cadastres – natural features of land will be represented more accurately as property interests are increasingly closer to organic environments.

Appendices

Appendix A: Data and methodology

1 Methodology

The methodology employed by this report follows the same approach used in the Cadastral Surveying Regulatory Impact Statement (2005), approved by the Victorian Competition and Efficiency Commission (VCEC).

Benefits from the costs avoided through licensing were examined over a ten year period assuming the continuation of licensing. This approach enabled modelling to account for the impact of time on the deterioration of the cadastre and the fluctuation in the number of professionals performing cadastral surveying work.

2 Data and assumptions

Data used to model the benefits of licensing cadastral surveyors was collected from publicly available data sources as well as consultation with industry. PwC extrapolated and forecasted these benefits over 10 years and made the following assumptions:

- Discount rate – PwC has assumed a 7 per cent discount rate, which is consistent with NSW Treasury (2007, p. 52) *TPP 07-5 Guidelines for Financial and Economic Appraisal*.

- Number of surveys – Taking a conservative approach, Consulting Surveyors National estimated that 2,700 cadastral surveyors (of approximately 3,000 total surveyors) will be actively providing surveying services at any time. Consulting Surveyors National estimates each surveyor performs roughly 3 surveys a week for 48 weeks of the year. This establishes that approximately 388,800 surveys were performed in Australia in 2015-16.
- Survey error rate/non-compliance rate – Consulting Surveyors National indicated that roughly 70 per cent to 85 per cent of surveys are done according to standards. We have assumed an implied error rate of 15 per cent.
  - Based on the 2005 Victorian Regulatory Impact Statement, the analysis suggests that between 73 per cent and 85 per cent of surveys were compliant, which is consistent with PwC's assumption (Allen Consulting Group, 2005, p. 8).
- Real growth rates – PwC assumed real growth rates:
  - Surveys – PwC has assumed a growth rate of 0.8 per cent. Over a 10 year period, ABS data shows a historical growth rate of 0.8 per cent. We have assumed that same growth rate over the 10 years assessment period (ABS, 2016c).
  - Surveyors – BIS Shrapnel estimates a growth rate of -2 per cent. PwC analysis has assumed a surveying workforce growth rate consistent with BIS Shrapnel analysis.
- Number of surveyors – PwC based the forecast of surveyor workforce over 10 years on analysis undertaken by BIS Shrapnel (2015, p. 40) in a report for Consulting Surveyors National.
- Average cost of survey – PwC estimated the average cost per cadastral survey to be approximately $3,200 in 2015-16, inflated from the 2005 Victorian Regulatory Impact Statement estimated cost of $2,400 per survey (Allen Consulting Group, 2006, p. 35).
- Average cost of investigations – estimated at approximately $26,500 per investigation on average in 2015-16, inflated from the 2005 Victorian Regulatory Impact Statement estimated cost of $20,000 per investigation (Allen Consulting Group, 2005, p. 14).

Appendix B: Case studies

1 Denmark

Background and context

The cadastre in Denmark is central to the Danish land title system which records ownership interests and property rights. The cadastral system provides the public and private sector with key information required for the governance and administration of land, pertaining to land tenure, value and use. The Danish cadastre is a multipurpose cadastre and therefore digital mapping is central to governance as well as for environmental concerns relating to sustainable land development (Elmstroem and Juulsager, 2015).

The Danish cadastre is maintained through a public-private model, with the Danish Geodata Agency as the central state authority monitoring and regulating private chartered surveyors.

In Denmark, cadastral surveyors perform tasks relating to the surveying and maintenance of cadastral data, including:

- determining property boundaries and submitting changes in property to the Danish Geodata Agency
- playing a role as the public authority in boundary dispute resolution
- preparing cadastral documents and gathering geographical data required for land administration, governance and infrastructure

Approach to regulation

Cadastral surveying in Denmark, and throughout much of the European Union, is a regulated profession. Due to the high level of technical skill and expert knowledge required to carry out cadastral surveying, Danish surveyors must hold the relevant professional qualifications and complete specific prerequisites, as follows:

- 5 years tertiary level study – comprised of a 3-4 year bachelors degree and a 1-2 year masters degree in surveying and cadastral science
- 2-3 years of professional practice in property surveying or cadastral administration
- state approval – usually through board examinations
- continuing professional development (CPD) – minimum of 20 hours per year

These qualification requirements and minimum professional standards are required in order to ensure that chartered cadastral surveyors have the necessary knowledge, experience and professional skills in order to maintain the defensibility and integrity of the Danish cadastre.

Lessons learned

- As public and private interests are held in land and boundary establishment, it is important that the cadastral surveyor remains an impartial authority.
- Danish regulation of the cadastral surveying profession rest on three main pillars, namely to:
    - protect the cadastre as a public good
    - maintain the quality of cadastral surveying services for consumers
    - maintain the credibility and security of property rights and interests in the cadastre.

2 Switzerland

Background and context

The Swiss cadastral system holds data relating to land ownership and rights attached to land title. The Swiss cadastre includes information on property boundaries, land cover types and the height of terrain, and location of pipes and cables for construction and zoning. The state of cadastral technology in Switzerland allows the maintenance of an up-to-date cadastre.

The Swiss cadastre enhances to capability of surveying technology and chartered surveyors to produce:

- cadastral maps which measure the location, form and content of land parcels
- base maps representing the topography of land through contour lines
- digital terrain models (DTM) which produce information of the height and form of the natural terrain and developed land
- building addresses to uniquely and unambiguously identify the postal address of a building
- AV-WMS or the Web Map Service through which cadastral surveying maps can be accessed digitally online (Federal Directorate of Cadastral Surveying, 2011).

Approach to regulation

The cadastral surveying sector in Switzerland operates under a framework of public-private partnerships (PPPs). The federal government, cantons and municipalities work hand-in-hand with the private sector to maintain an accurate and credible cadastre. The cadastre is regulated and managed by the following bodies:

- The Federal Directorate of Cadastral Surveying of the Federal Office of Topography swisstopo determines the national strategy and quality requirements for cadastral surveying.
- The cantons manage the operations of the cadastre within the specified area, as well as plan and manage the programs and tasks relating to cadastral surveying.
- Municipalities that are larger may hold authority for local cadastral surveying and standards.

In Switzerland, only licensed surveyors can undertake cadastral surveying work. These surveyors work in the private sector in surveying offices nation-wide.

As cadastral surveyors are required to work with complex geographic data and surveying technologies, all active surveyors must obtain a federal land surveyor license. In order to become licensed, cadastral surveyors must complete:

- a five-year apprenticeship as a geomatician towards a Federal Geomatics Technician Certificate
- a Bachelor of Science (Geomatics) degree from a university of applied science

- either a Master of Science in Engineering (Geoinformation Technology) from University of Applied Science Northwestern Switzerland or Master of Science HES-SO – Engineering Planning at the University of Applied Sciences Western Switzerland (minimum requirement).

Lessons learned

- Technology can aid cadastral surveyors to maintain a contemporary, accurate and accessible cadastre.
- In order to fully realise the capability of surveying technologies and surveyor's expertise, the surveying profession must be adequately trained, qualified and licensed.
- Cadastral surveys in Switzerland are legally binding documents which protect public and private property rights. Accordingly, a licensed profession provides legitimacy, security and credibility to the cadastre.

3 New Zealand

Background and context

The cadastral system in New Zealand is a land information system which records the location and interests in land, property boundaries as well as rights, restrictions and responsibilities (RRRs) attached to a parcel of land (Land Information New Zealand, 2014). In New Zealand, the cadastre records these interests and rights to freehold, leasehold, Maori and Crown land.

The cadastral surveyor in New Zealand is responsible for:

- collecting evidence for established boundaries
- interpreting evidence for the location of boundaries
- creating new or re-establishing boundaries
- preparing datasets to establish boundary evidence.

Approach to regulation

Cadastral surveying is a regulated profession in New Zealand (Cadastral Surveyors Licensing Board of New Zealand, 2013). Only licensed surveyors are perform cadastral surveyor work. In order to obtain a cadastral surveying license, an individual must:

- hold a relevant qualification in surveying meeting competencies in survey measurement, land tenure systems, land boundary definition, land information systems and regulatory compliance. The board approves specific educational qualifications which meet these competency requirements.
- undergo practical training to exhibit ability to undertake cadastral surveying tasks and produce datasets
- maintain professional practice and renew license.

Under the *Cadastral Surveying Act 2002* (NZ), unlicensed persons are not permitted to perform the tasks of cadastral surveyors, however, unlicensed individuals may work under the authority of a licensed surveyor.

Lessons learned

- The cadastre is not only a register of the location of the boundaries of land but also a register of the rights, restrictions and responsibilities of property owners. This is central to the purpose of the cadastre and the surveying profession.
- Technology should complement the work of licensed surveyors, introducing new opportunities for cost and time-savings and increased public accessibility to the cadastre.

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