

# A Ridgy Digital Cadastre

**Fred de Belin**

City of Ryde

[fdebelin@ryde.nsw.gov.au](mailto:fdebelin@ryde.nsw.gov.au)

## ABSTRACT

*In preparing a digital cadastre on the scale of a Local Government Area like the City of Ryde, it is easier to construct by fixing the street pattern first. The City of Ryde has 850 streets, with merely a handful of new streets being created since 1972. By far the majority of streets created in Ryde occurred after 1900, with the beginnings of residential suburban subdivision, when the previous rural landscape was altered and obliterated. It has been a practice in surveying to hide or leave any measurement differences and ambiguities in the road reservation. This practice creates small pockets of cadastre which may be stable within themselves, but do not tie well to other pockets. This in itself can lead to variance in street width, bends in formerly straight streets, drifts and uncertainties as to where the true street boundary is. The purpose of this paper is to describe how City of Ryde intends to right these uncertainties and to increase the size of these small cadastral pockets to much larger areas (say 600 m by 200 m), which closely represents the portion sizes of Ryde's first Crown Grants. Hand in hand with this street re-definition goes the stable, reliable and long-lasting marking of the street fix.*

**KEYWORDS:** Road marks, digital cadastre, street definition, subdivision.

## 1 INTRODUCTION TO A DIGITAL CADASTRE

Some of the first land grants in the Territory of New South Wales were in the Ryde district from 1792, along the northern shore of the Parramatta River (Figure 1). This map is essentially Ryde's first cadastre, consisting only of portion numbers, grant areas and names of the grantees.



Figure 1: Essentially Ryde's first cadastre.

How the original portion corners were first marked is unclear. However, some plans from the early 1800s do mention stakes and trees. For example, the original boundary survey for the Town of Parramatta, in 1834, described corners being indicated by stakes, trees, tree stumps and natural features such as creek centreline, river bank and ridge line. Thus, parts of the early cadastre had corners which were well fixed in the ground and unlikely to move. Obviously, the margin of error was large (e.g. a tree with a diameter of 1 metre) when compared to today's wont to have corners defined to 10 millimetres!

The boundaries of these first grants became legally established through long-term fencing occupation, and although the accuracy of their dimensions was suspect, they gradually acquired modern survey accuracy by later survey (usually at a time of subdivision or Primary Application after 1881-82). The placing of survey reference marks was the next step towards stabilising the cadastre. Clearly, any reference mark cut in bedrock had a great chance of remaining rigidly in the place where it was sited, and had the potential to lock down the cadastre and prevent any movement of the cadastre (some background information can be found, e.g., in de Belin, 2017).

The placing of substantial marks such as stone alignment posts and concrete block reference marks, followed by reference marks placed into concrete and a system of Map Grid of Australia (MGA) coordinated marks on public record in the Survey Control Information Management System (SCIMS), lulled the surveying industry into thinking that the cadastre would be locked down and stable.

If the system of reference marks and SCIMS marks is stable, then it is a logical progression to say that lot corners can be stable, and a further logical progression to say that the lot corners could have unique coordinate values – a rigid digital cadastre – where corner re-instatement is a straightforward and repeatable process. Whatever could go wrong?

## **2 HOW RIGID IS THE CURRENT CADASTRE?**

It has been a practice in surveying to hide or leave any measurement differences and angular ambiguities in the road reservation (for some background information, refer to, e.g., de Belin, 2015). This practice creates small pockets of cadastre which may be stable within themselves, but do not tie well to other pockets. In order to achieve a stable cadastre over a large area, a different approach needs to be taken.

City of Ryde is attempting to regain the streets, to reposition the streets into their original intended position and then lock them into this position. Future surveys will then have a better chance of achieving some conformity when it comes to street definition and subsequent lot boundary definition. The City of Sydney has a consent rule where any street definition has to conform to the City's accepted definition. A plan will not proceed until complete agreement and consent is achieved.

This paper focuses on two examples, each with a different development history, from two different areas within the City of Ryde:

- Boyce Street, Ryde (Figure 2), a precinct 600 m by 400 m, comprising 290 lots.
- Eltham Street, Gladesville (Figure 3), a precinct 700 m by 700 m, comprising 374 lots.

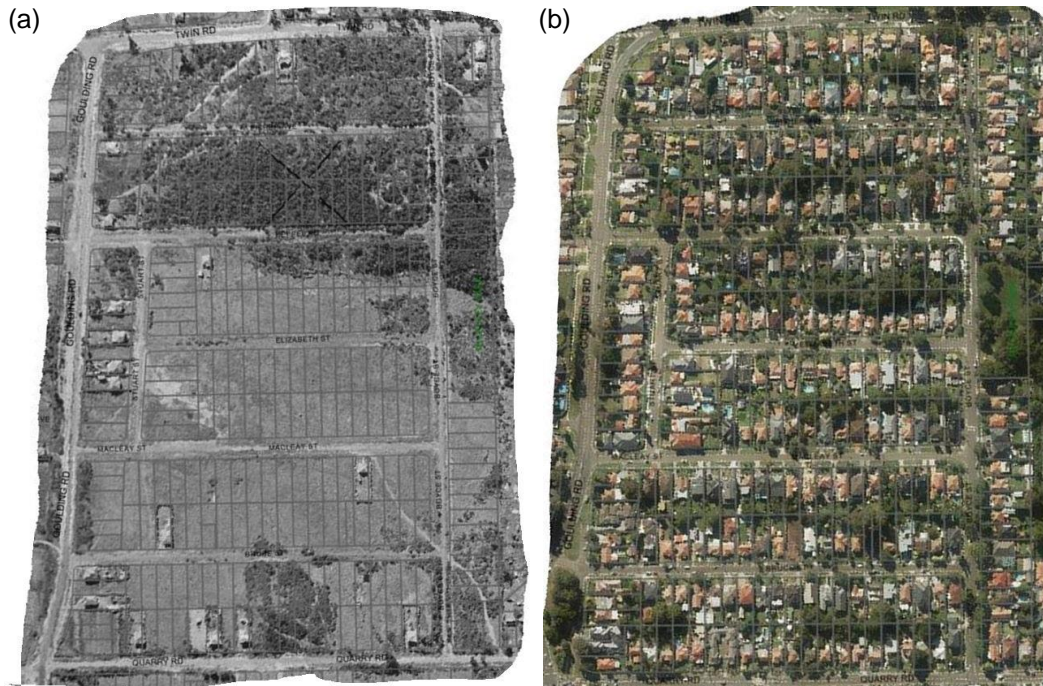


Figure 2: (a) 1943 aerial image of Boyce Street showing just 16 houses built, and (b) 2016 aerial image showing the complete development.



Figure 3: (a) 1943 aerial image of Eltham Street, Gladesville, showing almost full development, and (b) 2016 aerial image showing the complete development.

## 2.1 The Precinct around Boyce Street, Ryde

In 1789, Abraham Payne was granted 60 acres of land as Portion 38. Almost 100 years later, in 1885, C.R. Scrivener placed stone alignment posts to mark the kerb lines in the three surrounding roads: Twin Road, Quarry Road and Goulding Road (some background information on alignment can be found, e.g., in de Belin, 2014). In 1924, 45 years after alignment, Portion 38 (which had remained intact until then) was fully subdivided into two Deposited Plans (DPs) by one surveyor (Figure 4). This land forms the precinct of Boyce Street, Ryde.

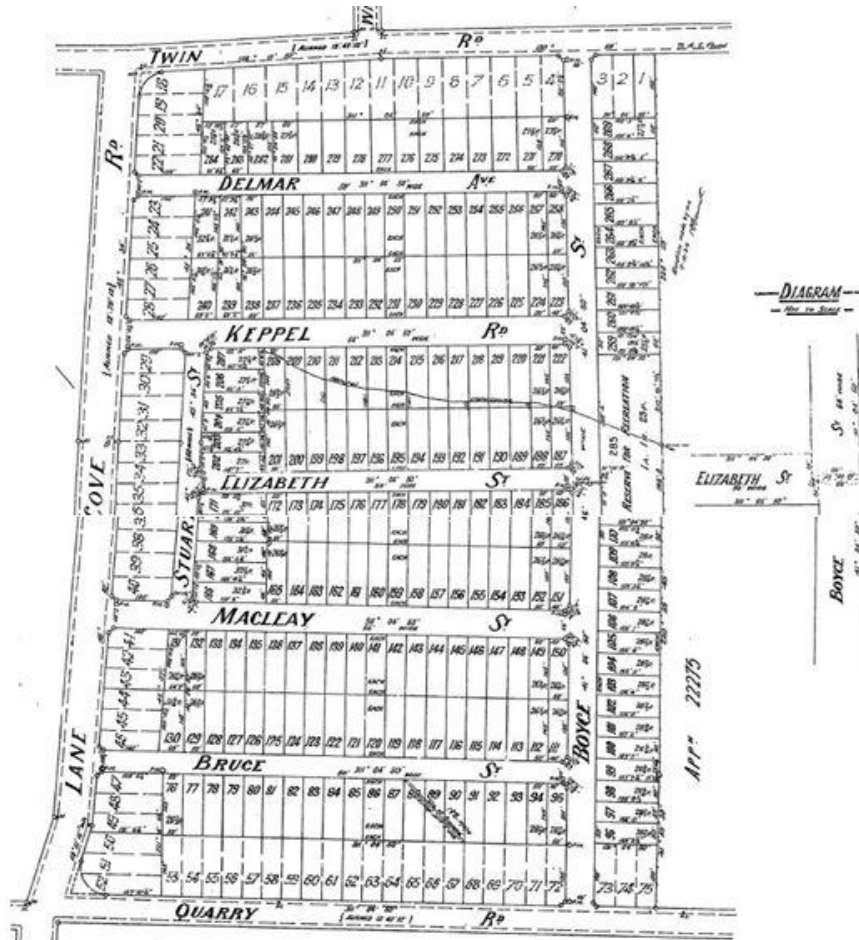


Figure 4: DP12670 and DP12999 (both 1924), which fully subdivided Portion 38.

DP12670 and DP12999 (both 1924) used those same stone alignment posts to define the surround of the subdivision and to establish the land available for subdivision – an example of street alignment occurring *before* the residential subdivision. The subdivision surveys in 1924 created seven new streets, whose boundaries were marked by the placing of concrete block reference marks. Any original concrete block reference marks found can help establish the streets in their original positions. The presence of a dense ring of established SCIMS marks (8 PMs and 11 SSMS) surrounding the precinct of Boyce Street, together with three already found concrete blocks from 1924 (Figure 5), should ensure that the street fix is consistent. A further bonus would be the finding by City of Ryde of any other remaining concrete block reference marks, which are currently hidden by concrete footpaths. This task is about to commence. When the subdivision is fully tied to MGA, it will be rigidly in place and each lot able to be safely and fully coordinated.

Plans of survey presently lodged electronically with NSW Land Registry Services (LRS) via LandXML must match with existing MGA. Some will say that streets *are* being fixed in the modern day and are already tied to MGA, but just how reliable and consistent are these street definitions? Since 1924 in the Boyce Street precinct, 22 DPs have appeared: 16 plans of survey and 6 compilations.

Plans of survey up until 1997 maintained everything parallel and at right angles in accordance with the 1924 subdivisions. Plans of survey in 2000 and 2004, however, introduced a swing of 30" into one street, which removed the parallelism. Admittedly, a swing of 30" does not amount to much over a distance of 350 m (i.e. 50 mm over the length of the street), but it does set a



precedent by making the streets no longer parallel. A further plan of survey in 2007 missed a 70 mm step (Figure 6) in Boyce Street altogether and joined end to end, while another plan of survey in 2016 also missed this step and created instead a bend in Boyce Street of 1' 10".

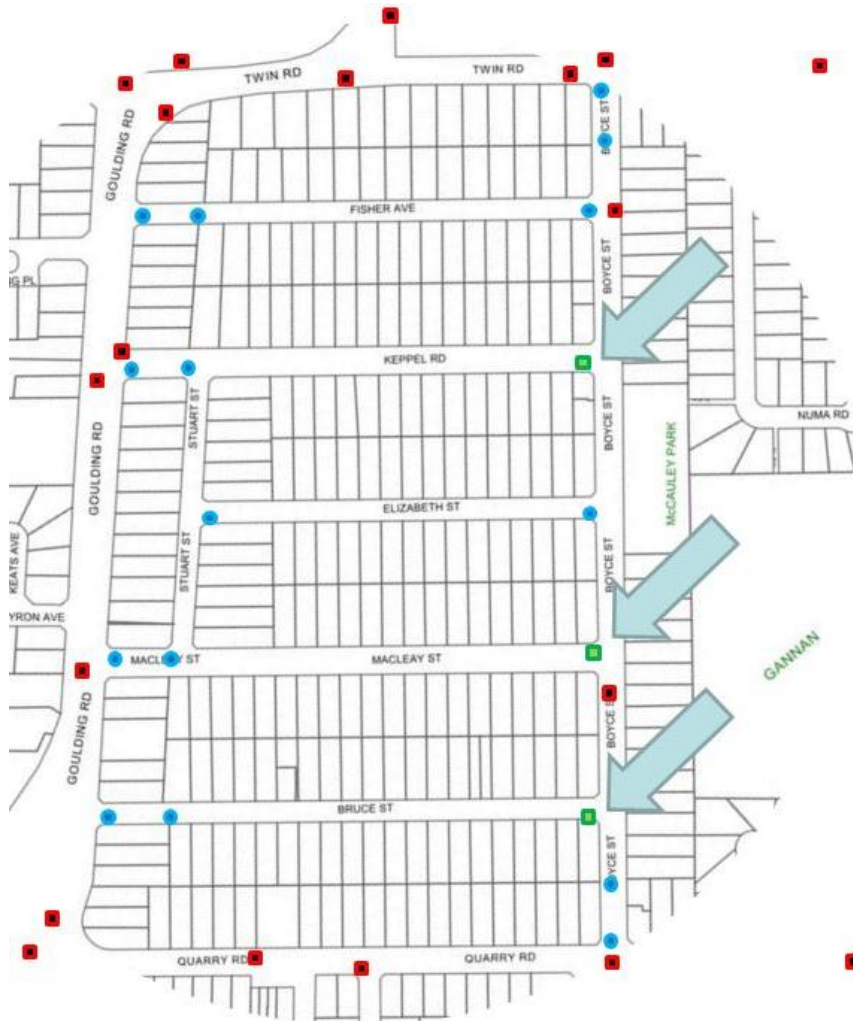


Figure 5: Current cadastral map, showing 18 concrete block reference marks (3 found) and 19 SCIMS marks.

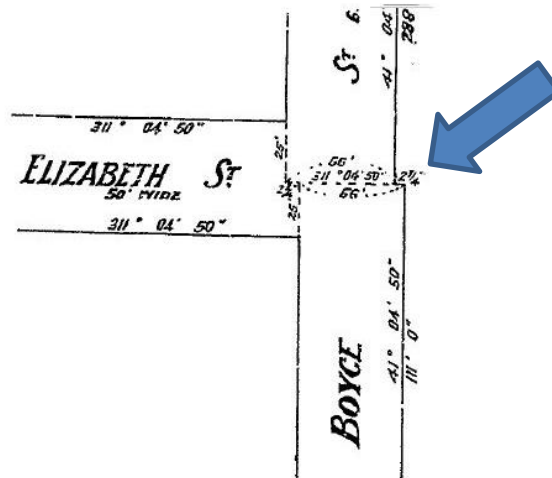


Figure 6: The diagram in DP12999 (1924), which shows that a 70 mm step in Boyce Street was created.

Since 1993, in the Boyce Street precinct, 18 lots have been newly created or re-surveyed with direct connection to the MGA system of coordinates (Figure 7). This translates to coverage of just 6% in 25 years! At this point in time, the cadastre of the Boyce Street precinct is at risk of having errors introduced across the whole precinct and these errors becoming established. City of Ryde is in a commanding position to halt this propagation of errors, to re-establish the original street fix and to complete the coordination of the remaining 94%.



Figure 7: Current cadastral pattern showing the 18 lots already connected to MGA.

## 2.2 The Precinct around Eltham Street, Gladesville

DP679 (1881) was a very early residential subdivision in Gladesville (Figure 8), where there remains not a single original subdivision mark. It should be noted that no reference marks were required to be placed in this period. This DP forms the basis of the precinct around Eltham Street, Gladesville.

Nine new streets were created. Of particular interest at this point is that DP679 (1881) has some serious, patent miscloses (Figure 9). All the bearings and angular relationships hold true, but the distances display differences much greater than the order of accuracy indicated on the DP (plan dimensions are shown to 25 mm).

Alignment plan H4-2110 (Figure 10) was requested by Council in the early 1890s. All streets were aligned, with Pittwater Road (formerly Bridge Road) having a kink removed – an example of street alignment occurring *after* the residential subdivision.

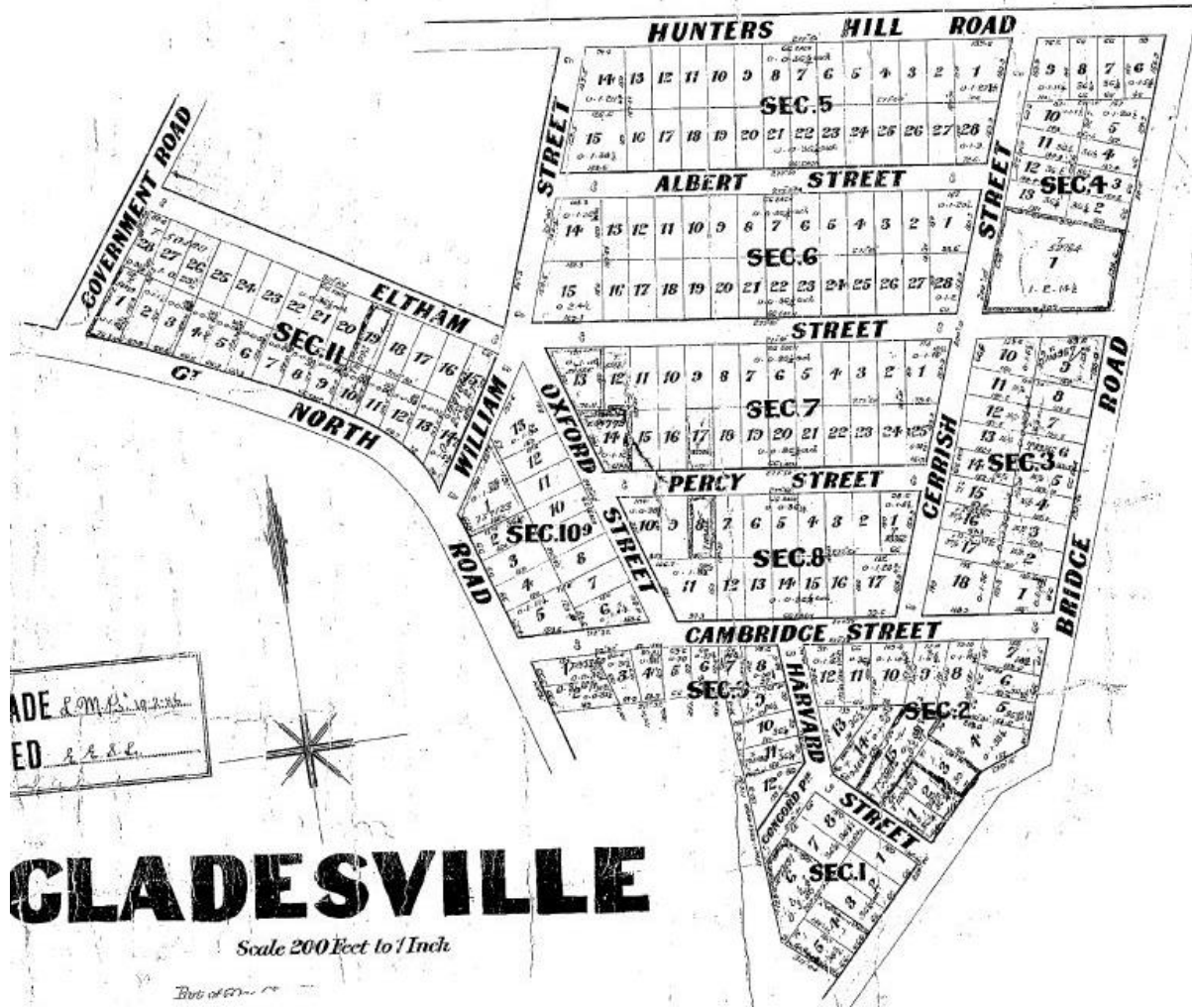


Figure 8: DP679 (1881), showing the first subdivision pattern.

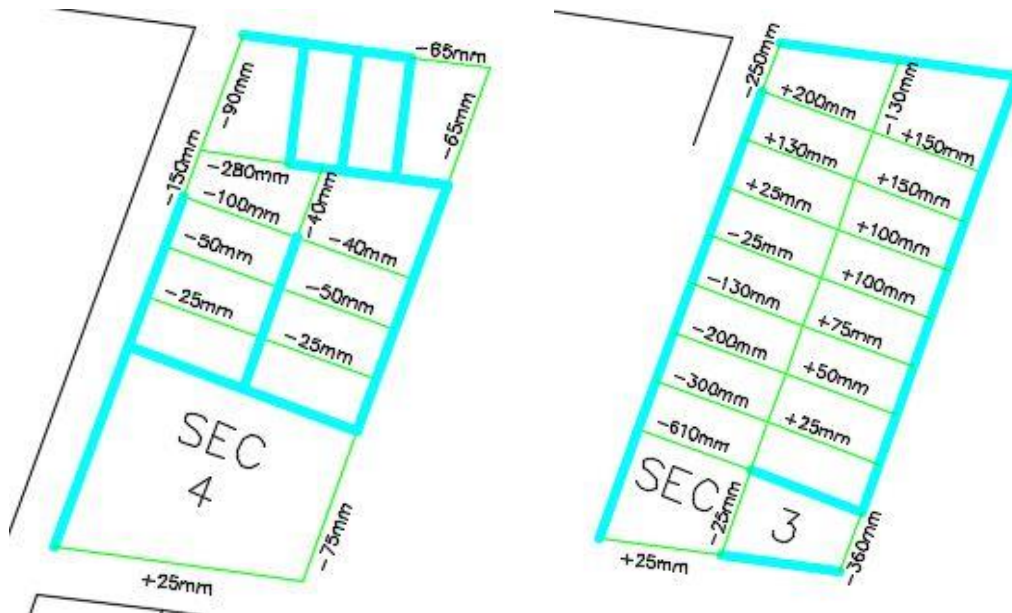


Figure 9: Two Sections of DP679 (1881), showing some discrepancies in dimension.



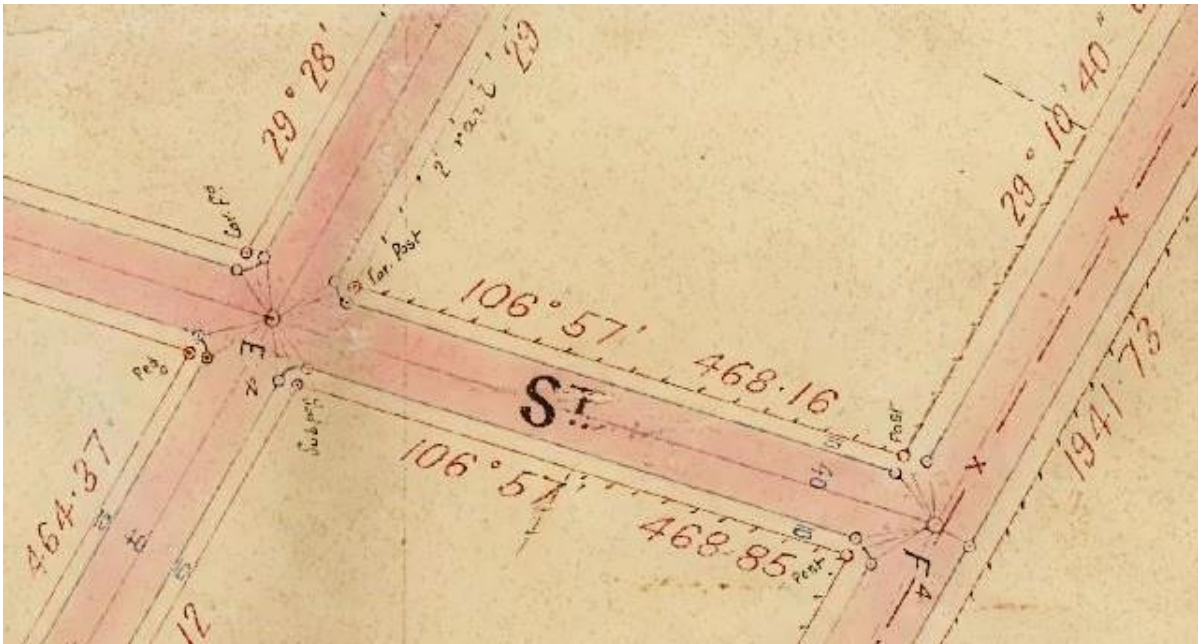


Figure 10: Detail from Alignment Plan H4-2110 (1896).

A visit to State Archives was undertaken in order to obtain copies of the field notes of Surveyor F.J. Gregson, who carried out the alignment survey H4 in 1892. The field notes (Figure 11), which are very accurate, enabled plotting of where the stone alignment posts were placed.

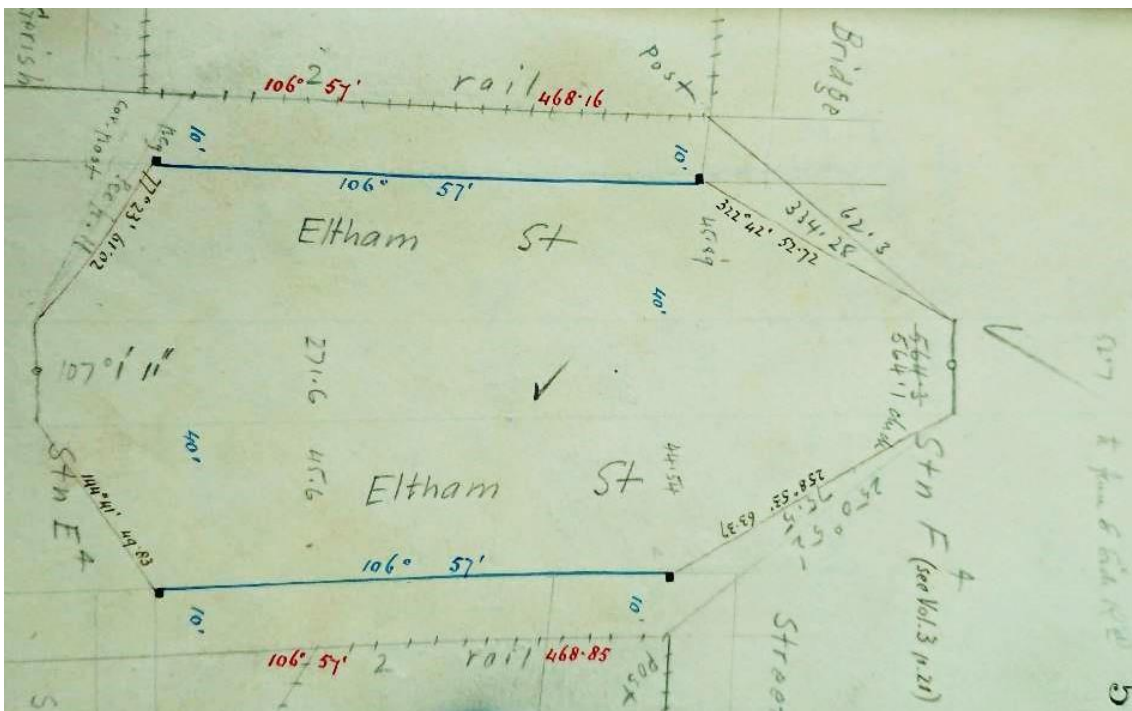


Figure 11: Detail of Eltham Street alignment from F.J. Gregson's field books (1892).

Two posts have survived (Figure 12 & 13). It is interesting to note that the stone alignment posts in this case are reduced in size and weight from the big stone alignment posts of surveyor C.R. Scrivener in 1885.





Figure 12: Stone alignment post (1892) in Pittwater Road, last referred to on DP591763 (1977).



Figure 13: Stone alignment post (1892) at the intersection of Pittwater Road and Eltham Street.

It is also possible to re-establish the alignment of the streets by inspection of all the DPs since 1887. There are 34 plans of survey (mostly prior to 1957), which placed marks or referred to monuments after finding pairs of stone alignment posts and using them to fix the street boundary. Any of these marks which have survived until now can be used to help re-establish the streets fixed by alignment. For some background information on re-establishing original corners, the reader is referred to de Belin (2018).

In DP404545 (1957), the face of an old brick wall (now rendered) (Figure 14) was made a monument for Eltham Street, which had been fixed from stone alignment posts found. In DP416690 (1959), a roofing nail in an old brick fence (Figure 15) was placed on the Eltham Street boundary after it was fixed from the same stone alignment posts. In DP370103 (1950), a section of old concrete kerb and guttering (Figure 16) was made a monument for Cambridge Street, which had been fixed from stone alignment posts found.



Figure 14: Old brick shop in DP404545 (1957), which was related to the stone alignment posts found.



Figure 15: 'Roof nail and cut' in old brick fence in DP419960 (1959), placed after Eltham Street was re-established using a pair of found stone alignment posts.



Figure 16: Section of very old concrete kerb in Cambridge Street, which was monumented (to the kerb line between stone alignment posts) in DP370103 (1950) and has been used ever since for definition.



Within and surrounding the Eltham Street precinct, 19 SCIMS marks exist (Figure 17). Everything is in place: a set of established SCIMS control marks, which can be readily supplemented! Since 1993, in the Eltham Street precinct, 50 lots have been newly created or re-surveyed with direct connection to the MGA system of coordinates (Figure 18).



Figure 17: The current cadastral map showing positions of 18 SCIMS marks.



Figure 18: The current cadastre, showing the 50 lots connected to MGA.



25 years of connecting surveys to MGA has resulted in only 13% of the lots in the Eltham Street precinct being set up for coordination. City of Ryde is once again in a commanding position to re-establish the original street pattern in the same place as the 1892 alignment survey, and to complete the coordination of the remaining 87%. The opportunity now presents itself for City of Ryde to place substantial, long-lasting marks to re-define each street and lock the streets into the modern SCIMS control marks and therefore MGA.

### 3 IN COUNTERPOINT

In counterpoint, the task becomes more and more difficult as fewer and fewer of the original marks or alignment marks are found. At Balaclava Road, in Eastwood, a precinct of 34 portions was created in 1887 (Figure 19). No alignment survey was ever carried out and no original marks have been found. However, some remnant boundaries are still evident in the current side boundaries (Figure 20). Some background information on this approach can be found in de Belin (2016). This will be a project for a later date, but it shows how surrounds of old streets can enclose a large-scale cadastre which can then be tackled at one go.

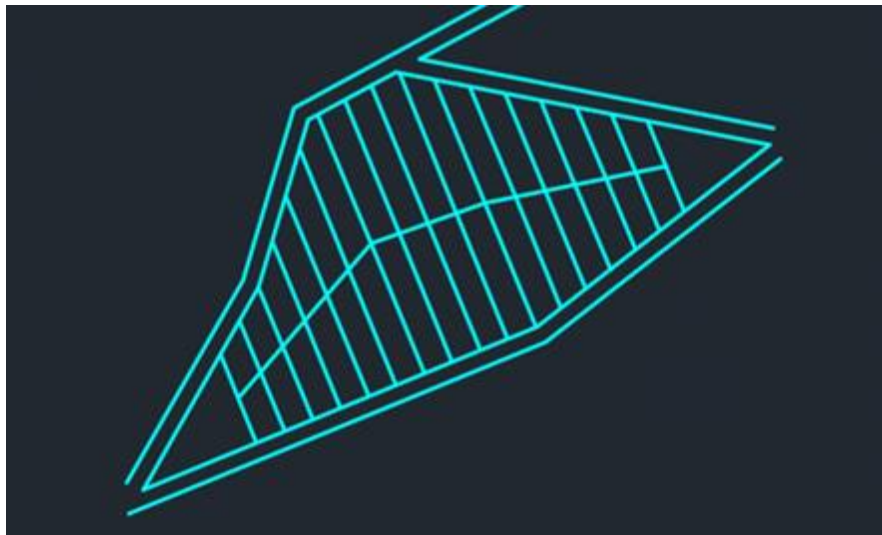


Figure 19: Crown Grants, in 1887, of 34 portions in Eastwood.

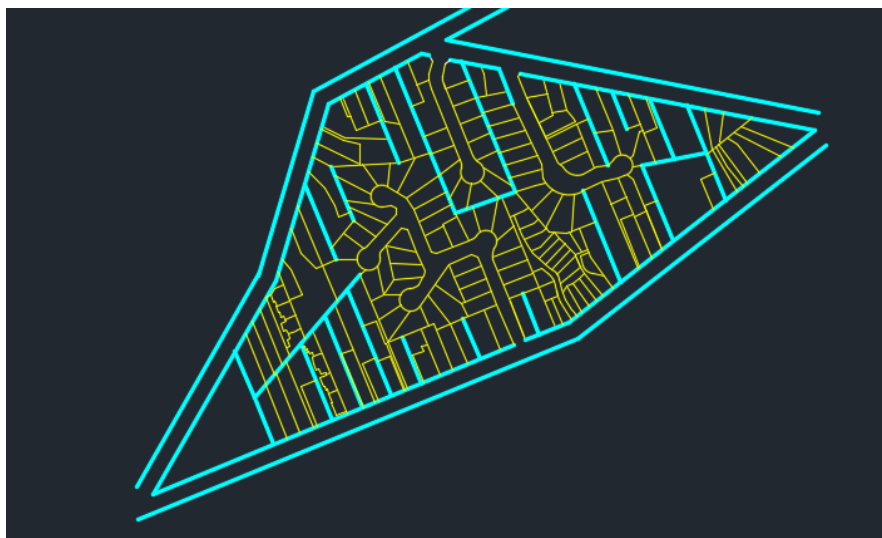


Figure 20: Current cadastre of 277 lots and remnant portion boundaries in Eastwood.

#### **4 CONCLUDING REMARKS – MAKING A CADASTRE MORE RIGID**

The most straightforward way to make a cadastre more rigid is to have an easily re-definable and easily re-instatable street pattern. Pairs of stone alignment posts served this purpose of providing reliable street definition for 70 years, until the late 1950s. Unfortunately, stone alignment posts have disappeared en masse ever since.

After highlighting the differences which are being introduced into each precinct by a number of different surveyors, the timing is right for City of Ryde to step in and redefine the streets in the Boyce Street and Eltham Street precincts. This provides a chance to arrest the swings and variations that are threatening to alter and destabilise the intention of the original subdivision.

The fact that so many of City of Ryde's streets were connected to the original stone alignment marks also means that the present cadastral pattern can accurately reflect the street boundaries from the alignment surveys of 1885 and later. The alignment surveys effectively form an accurate control network throughout that area of City of Ryde, which is not yet connected to the MGA network.

The lack of alacrity in the coordination process and its tardy progress means that 25 years has passed and barely 10% of the lots, and therefore lot corners, in the City of Ryde have connection to MGA. SCIMS marks and other special control marks will play a vital role in controlling the stability of the cadastre once the street pattern is fully connected to MGA. It would be good to think that City of Ryde could achieve such control over its streets as City of Sydney has over their streets.

#### **ACKNOWLEDGEMENT**

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