›› SURVEY AND DATABASE ERRORS (NZ)

The purpose of this paper is to describe, in non-technical terms, the sources and types of errors likely to be encountered in survey and mapping digital databases and in overlaying or integrating these data bases. These are often manifested as apparent displacements between the cadastral, topographic and image location of the same feature, such as a formed road or track or boundary fence.

METHOD AND STANDARD OF SURVEY

Early surveys, generally up to around the 1870s, were of significantly lower accuracy than more recently. The level of accuracy were typically about 1-2 metres per km and would often propagate and accumulate extensively through the very large surveys of those times. These were due to a number of factors, such as equipment, surveyor competencies, scale and difficulty of terrain, lack of other surveys, records, or trig stations to check errors and the use of reconnaissance or sketch methods of survey. Accuracies since those early times were typically around 0.2 to 0.4 m per km, although these can still accumulate significantly in large surveys of difficult terrain. Modern surveys will be better than 0.1m/km.

As well as the standard errors of the time there is also the occurrence of blunders, being very large errors or mistakes. These are random and infrequent and more likely in the older surveys, due to the above factors, and carelessness, misidentification of features or survey marks, calculation errors etc.

INTENT OF THE SURVEY

Surveys of very extensive areas often employed lower accuracy (and hence quicker and cheaper) methods of survey, on the basis of low land values and low intensity of land use, such as large forested areas, pastoral leases and some forms of easements, including Walkways, and covenants. In these types of surveys extensive use was and is made of natural features, such as rivers, lakes, coastline, ridges and bush edges, with generalized drawing of these features on the survey plan. These days much use is made of aerial photography.

Another example is the use of dashed burnt sienna lines on survey plans or cadastral record maps to indicate the intention to ensure public access over pastoral lease areas, but without any attempt to survey or to define an actual route. These would have been plotted on the survey plans in a much generalized way and could easily be

many hundreds of metres away from what over time became the recognised and used route. This practice would have been derived from the general public policy underlying land administration and settlement in NZ of ensuring public access to waterways, mountains, coasts, etc.

MAPPING METHODS AND ACCURACIES

The digital cadastral data base was principally derived by digitising maps drawn at a variety of scales and standards, at different times and using different reference systems. Some of the maps were very old and the materials on which they had been drawn had been damaged and distorted by use and storage over many years. A variety of methods were used to correct for these error sources in the digitising process but some errors were quite random and difficult to identify and correct. These types of errors are more likely in more remote areas, due to the general lack of survey activity and need to redraw or update such maps.

There will be errors in the actual digitising process due to the precision at which the digitising can be done and the scale of the original maps. This error represents 2m at a scale of 1:10 000.

In the survey and title automation process carried out by LINZ (Landonline) the cadastral data base in urban and peri-urban areas was reconstituted using the survey information from the original survey plans and recalculating coordinates within a network of trig stations and GPS surveys. The data base accuracy in most of these areas will be better than +/- 0.5 m.

The topo data base was captured by scanning the original drawings maps. As this mapping was done to a common standard nationwide it will have a high degree of consistency of plotting at about the 10-20 m level. This accuracy will diminish for generalised features such as roads, and in mountainous terrain.

ERRORS IN COMBINING DIFFERENT DATA SOURCES

These are generally due to differences in the way the survey or mapping information was initially gathered, the relative scale of the source maps and differences in reference systems used. Differences in the structure of the data and descriptions used for features may also cause some discrepancies, although these can usually be corrected.

ERRORS IN AERIAL PHOTOGRAPHY AND IMAGERY

In its raw form aerial photography and imagery will contain quite large errors, due to perspective, camera orientation and terrain. These can be corrected to provide rectified imagery or orthophotos. These corrections are relatively straight forward in gentle or flat terrain. In mountainous terrain it is more difficult to fully correct for all these errors, resulting in some residual distortion and displacement, possibly of tens

or hundreds of metres in extreme terrain.

MOVEMENT OF NATURAL BOUNDARIES (WATER MARGINS)

Much public access land is defined by reference to water margins, which are liable to movement. The law pertaining to water boundaries and the effect on adjoining land titles is complex and usually can only be applied on a case-by-case basis. For "Queen's Chains" laid out before the Conservation Act (1990) the landward boundary remains fixed so the "Queens chain" may become completely eroded away or increased in width with accretion. Even if the land is eroded away legal roads still exist and may reappear on the other side of the water body. Marginal strips laid out after 1990 are ambulatory, that is they move with the water margin and hence remain at the original width. As a general rule the landward boundaries of Esplanade reserves do not move, but Esplanade strips do move as the water margin moves.

There are some situations where water margins have been defined by stable rocky terrain unlikely to be affected by erosion or accretion. In early surveys these features may have been surveyed to low accuracies or just sketched in. Sometimes this would be on the basis that it was sufficient, for the purposes of the survey and the grant or title, to provide a generalized outline of the natural feature defining the boundary, as it would be very stable and capable of identification and location at any time in the future. The situation arises where later more accurate surveys, mapping, or imagery indicates significant movement of the feature. However it can be assumed that the boundary feature has always been where it is and the public land (Queen's Chain) remains defined by the current position of the water margin. In these cases there is no error or actual displacement; the feature has just been positioned more accurately.