

NEW ZEALAND SURVEYED

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SUMMARY

Professional Surveying in New Zealand has a relatively short history compared with other British colonies extending back a short 175 years. Nevertheless it has been able to draw on decades of early surveying experience, practice and learning from these colonies. It was also preceded by centuries of empirical Polynesian surveying craft and lore. This geographic and locational capability bestowed great benefits on the growth and development of Maori and subsequently the European exploration and settlement of New Zealand. Kupe was the first known Polynesian navigator to visit New Zealand over one thousand years ago. His stories of these large southern Islands then led to successive migrations of Polynesian settlers to New Zealand to establish its Maori settlement. The early European navigators surveyed and charted the New Zealand coastline in 17th and 16th century. Tasman mapped the West Coast of both islands in 1642 to a good standard where he had a clear view of the coastline and land form. It was left to Cook however to identify that there were two main islands and the Strait now named after him.

The early New Zealand surveyors faced some major physical perils and adversity which they overcame with courage, perseverance and stoicism. They were a special breed of hardy and outdoor men who faced the frontier conditions with dedication and tenacity. As New Zealand developed its governance and settlement infrastructure the challenges for surveying steadily increased to meet requirements for land settlement and the continued intensification and diversity of land use. However, in the young colony the surveying performance was very patchy. Despite the sound knowledge and skills of the core of the professional colonial surveyors the surveying standards feel badly in its early years. Surveying suffered from poorly trained surveyors and patchwork and low standard surveys. Most settlements were marked by a combination of poor practice, lack of basic skills, dependence on running surveys, the isolation of the settlements and the decentralisation of surveying authority to Provincial Government. The years leading up to 1875 were marked by poor quality survey work unconnected to other work or any overarching survey system of survey control.

However the centralisation of surveying authority in 1876 led to a rationalisation of surveying and the inauguration of national systems. Following this there has been a continued improvement in surveying capability and its contribution to the New Zealand economy and its international trading activity. This included early adoption meridional circuits to rationalise the errors of plane surveying, followed by a triangulation network throughout the country. The innovation of chaining in catenary, early adoption of

Electronic Distance Measurement (EDM), GPS, and computers in surveying to materially improve the efficiency and effectiveness of all aspects of surveying activity. Thus the strong historic surveying capability developed relatively early after settlement became a significant enabler in the exceptional and sustained economic growth of New Zealand over the last 175 years. As each improvement in productive land use developed, through intensification and diversification, surveying services and infrastructure facilitated its rapid introduction and commercial viability through the steady growth of the colony to independence and economic sustainability. The lessons from the New Zealand surveying history provide relevant learning's for the modern survey profession in developing its capabilities and role in the demanding years ahead.

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PREAMBLE

The title of New Zealand Surveyed given to my paper is an expansive one and it implies a broad definition and consideration of surveying throughout New Zealand's history. I have therefore referred to the wide company of explorers, navigators and surveyors who have contributed to surveying New Zealand. Although the title of my paper could reflect a surveying perspective of the past, and of a passive and reactive nature the reality is quite different. The history of surveying in New Zealand is a story of many centuries of overcoming adversity and Herculean challenges. Of adapting and innovating to make a critical contribution to the settlement and development of the New Zealand economy which remains relevant today? These qualities, although now in different proportions but still with some degree of exploration remain vital today for New Zealand's future development. The history of surveying in New Zealand is one of the remarkable contributions of positional and locational services to social and economic development. This is true for all jurisdictions but in New Zealand the contribution of surveying has been particularly quick acting and effective. The rate of land use change and economic development has been sustained at a remarkably steep rate of economic growth since early European settlement.

INTRODUCTION

The genesis of surveying in New Zealand begins with the first Polynesian navigators, explorers and settlers. The earliest record we have is of Kupe visiting New Zealand estimated as just over 1000 years ago. He sailed around the coastline taking back a wealth of information on this distant southern land to "Hawaiki". We still have his legacy in the Maori settlers that followed him and the many currently used place names he bestowed around New Zealand coastline. The achievements of those early Polynesian navigators are particularly impressive because of the vastness of the Pacific Ocean over which they had to navigate and explore with traditional knowledge and skills. Maori oral history records a "fleet" of some 10 canoes each having a strong connection to various Maori Iwi¹. Many other canoes also arrived although the 10 mentioned above are the most commonly referred to in Maori oral history. These Maori settlers and their progeny explored and recorded the location of resources, hazards, exploits and happenings. Thus their use of place names was a very significant technique for recording a wealth of geographical and historic information. Thus, by the time of European settlement there was a collective geographical and cultural mind map of the whole country and well established patterns of occupation and land use rights. Although this information was not in "hard copy" it served well as an invaluable record of the location of all the geographic

¹ Tribal

information important to Maori society. The medium for this oral mapping was a composite layer of stories of geographic features and events all over the country told from different tribal perspectives representing many common features and events and faithfully passed on from generation to generation. The interpretation of this oral information needs special understanding and may seem more difficult than paper records. However it does share many similar ambiguities and integrity and is a valuable and only source of times past. The blending of geographical and other information greatly enhances the value of the whole store of Maori information and lore even though it is framed in variable stories and metaphors. For example the stories of journeys and exploits of ancestors provide valuable navigation, geological, topographical and natural resource and customary information for current and future generations.

Maori geographical information also provided a useful base for the European exploration and settlement of New Zealand and the build up of charts and maps on New Zealand topography and hydrography. The early European navigators visited (de Servile 1769, du Fresne 1772,) surveyed and charted the New Zealand coastline in 17th and 16th century. Tasman mapped the West Coast of both islands in 1642 to a good standard, where he had a clear view of the coastline and land form. However he was not close enough to identify that there were two main islands and it was left to Cook in 1769 to determine this and to discover Cook Strait. However, Cook did not identify the third island and it was Smith an American sealer who identified Stewart Island and Foveaux Strait in 1804. Whalers and sealers during this period explored and exploited various parts of the New Zealand coastline. In 1826 D'Urville charted the north of the South Island and the East Coast of the North Island. Captain Stokes in the HMS Acheron undertook the first detailed surveys of the NZ Coastline followed by Commander Drury in the HMS Pandora between 1840 and 1853. Other navigators also charted or visited the New Zealand coastline including Captain Fitzroy (later Governor) with Charles Darwin aboard the Beagle.

EUROPEAN SETTLEMENT AND SURVEYING GOVERNANCE

In 1814 New Zealand was proclaimed as a dependency of New South Wales. At the time this had no governance impact. It did lead however, to sending the Chaplain of New South Wales Rev Samuel Marsden to New Zealand and the subsequent establishment of an Anglican missions from in 1816 onwards.. In 1823 and 1828 Westminster established legislation extended jurisdiction of New South Wales to all British subjects in New Zealand. Subsequently James Busby was appointed British Agent in 1835. The first professional surveyor was Thomas Florance He arrived in 1834 and settled with his wife in the Bay of Islands and did some survey work there. He then moved to Auckland where he assisted with some of the first surveys of Auckland. An 1840 report by Captain Dawson for the Colonial Office “Surveying Considered with Reference to New Zealand and the Colonies Generally” provided an up-to-date review of the state of surveying for those taking on this function in New Zealand. Dawson drew heavily on the Australian experience. In 1840 Lieutenant Governor Hobson arrived in New Zealand with Acting

Surveyor General, Felton Mathew, Cooper the Collector of Customs and a Police Chief. It is of interest that these three foundation public servants all had functions related to settling land, deriving revenue and maintaining law and order. The position and role of Surveyor-General was established in the Royal Instructions of 1840. At that time New Zealand was still a dependency of New South Wales and it has been speculated that the Governor in Chief in Sydney released those who were more dispensable from his point of view.

The opportunities were not lost on Acting Surveyor General Felton Mathew. Although he appears to be grumpy and disaffected, he was acutely aware of the economic opportunities of the new territory. This is borne out in his following statement before departure from Sydney where he had been the surveyor for the City of Sydney.

“I never met a man so sanguine as Cooper (Collector of Customs) is, of the success of our New Zealand undertaking. He says it is a tide in our affairs, which is sure to lead on to fortune and has embraced his present situation with precisely the same feeling as myself – namely to hold no faith with the scoundrel Government which has used us so vilely but, to make use of them for our own purposes and throw them off as soon as it suits our convenience.....I have made up my mind to buy as much land as I can possibly find money to pay for and if that does not prove a fortune for me in four or five years I am much mistaken.”

Felton Mathew witnessed the preliminary negotiations that led to the Treaty of Waitangi that led to the establishment of the new colony in 1841. He selected a temporary seat of Government at the old Russell in the Bay of Islands and then Auckland as the capital city. Presumably his temper did not improve as although he was required to undertake critically important work for the new Colony he was faced with great difficulties through shortage of staff and instruments. His planning was subject to much adverse criticism although the pattern still evident in central Auckland today indicates he had good ideas in advance of his time. He was not in office that long and was superseded by Ligar in 1841. Felton Mathew subsequently held the position of Postmaster General.

The first permanent appointment to Surveyor General was Charles Ligar which was made by the Colonial Office in 1842. Ligar was a man of good community and surveying standing. Much of his work took him all over the colony. This included acquiring land from Maori and he finalised the disputed land purchases near Blenheim after the Wairau incident². He was a Colonel in the New Zealand Militia. He walked from Wellington to Auckland up the western side of the North Island in 1846 exploring the possibility of an overland route. He was later involved in the selection of the chosen route. The difficulties of communication prevented Ligar as Surveyor General from controlling the New Zealand Company Surveyors in New Munster and two separate and diverse survey

² This was a major incidence caused by the surveyors surveying land which the Maori the ownership of which was disputed by Maori. The subsequent attempt to arrest the Maori Chief by and armed posse from Nelson ended in tragedy with 4 Maori and 22 Europeans killed.

systems began to develop. Ligar did examine surveyors to maintain an adequate standard of survey performance. Ligar was a Commissioner of Land Claims from 1846³. He was a member of the Legislative Council of New Ulster from 1848 until its replacement by Provincial Government in 1853⁴. Each Provincial Government had a separate survey department and chief surveyor. There was no central authority and communication between provincial centres was very difficult. The result was the development of various surveying systems and standards. After the establishment of Provincial Government in New Zealand in 1853 Ligar undertook various surveying functions until Provincial Governments took over surveying and the disposal of “waste lands”. He left the position of Surveyor General in 1856 when it was disestablished. The position of Surveyor General was not to be re-established until 1876 with the abolition of the Provinces. Ligar moved to Victoria in 1857, and took charge of the survey Department from 1858 until 1869 as Surveyor General. He was the first permanent appointment of Surveyor General of Victoria in 1858 where he contributed to developing a sound basis for surveying there. In 1870 the Victorian Government asked for a set of Thomson’s (then Chief Surveyor Otago Province) maps and a description of his methods⁵. Casey the Victorian Minister of Lands visited Otago to obtain further information and this resulted in Victoria changing to the system in 1874.

In 1841 a Deeds Registration Ordinance was issued followed by a Conveyancing Ordinance in 1842. Registration was not however made compulsory by this ordinance and there was widespread dissatisfaction with it. A concurrent notice with the 1841 Ordinance to land claimants contained the first survey instructions and attempted to set a standard for surveying. The Conveyancing Ordinance of 1842 established a basis for holding and transferring land in New Zealand. By the time that the Provincial Government was established in 1853 there were already some substantial differences in survey practice around the various New Zealand settlements. Survey standards were set by the Surveyor General as well as by instructions from the Provincial Government. For example Thomas Humphries Chief Surveyor for Taranaki provided detailed guidance for theodolite, circumferenter, chains and field books. The Land Registration Act of 1860 did little to improve things and it was mainly restricted to the town of Auckland.

The inauguration of the Land Transfer Act 1870 introduced the present system of land registration on based on that initiated in 1857 by Sir Robert Torrens in South Australia. This replaced the Deeds system with the issuance of a Certificate of Title with all documents and registers open to the public. This Act through its adoption of the Torrens

³ The New Zealand Government Act of 1846 provided for the classification and sale of Crown Lands and for land registration under the Deeds system by Central Government.

⁴ The New Zealand Constitution Act of 1846 set up two provinces in New Zealand New Ulster (north of Patea) with the remainder including the South Island being the Province of New Munster.

⁵ This was presumably about how to manage the accumulated displacement of plane surveys through the use of meridional circuits.

system opened up the role of private surveyors in undertaking land transfer surveys. With the Abolition of Provinces in 1876 there was a need for a national survey and land administration organisation and the Department of Lands and Survey was established by the Land Act 1877. The first Surveyor General was the former Chief Surveyor of Otago J.T.Thomson. He was then followed by 20 Surveyors General up to the present New Zealand Surveyor General, Don Grant.

NEW ZEALAND SURVEYING

The challenges

The physical nature of New Zealand and its southern weather and storms presented immense and perilous obstacles to the early surveyors. The country was mountainous and dense vegetation covered some two thirds of the country at the time of European settlement. There was heavy rainfall with high winds and low temperatures. Permanent and seasonal streams and rivers traversed the land with frequent deep intersections with the coastline making coastal travel dangerous. The dangers of river crossings were ever present and drowning was so common it was considered a natural cause of death rather than being an accident. The coastline itself was hazardous as evidenced by the number of shipwrecks that have occurred on it over the years. In addition the fact that the purchases of Maori land were often in dispute or that land was confiscated from the Maori, the surveyors had much difficulty and opposition in undertaking their work.

Nevertheless these intrepid men explored and surveyed the new land providing infrastructure for settlement and development. This involved the layout of cities and towns, roads and railways and the survey and subdivision of estates, stations and farms throughout New Zealand. The establishment of rail tracks over long distances through difficult and broken country was particularly challenging. Rochfort for example walked from Wellington to Auckland to reconnoitre the main trunk route. His task was most difficult in getting the gradual gradients from the central North Island plateau and by his need to traverse the remote King Country area where European presence was greatly resented by the Maori. On being threatened with death for trespassing by Maori Rochfort's courage in facing that penalty so impressed the Maori War Chief that he did not proceed with his intended execution. The outcome was that when built, the alignment of the track approximated Rochfort's route never departing from it by more than a short walk. That the gradients proved too steep on the rise to the central North Island plateau does not detract from the Rochfort's feat. Eventually an innovative engineering solution was required to make the route practicable. This resulted in the Raurimu Spiral where trains now climb a spiral cross-over to achieve the required gradient in the short distance available.

The surveyors

The first surveyors were largely men who had their education in England with some having previously served in other colonies including Malaya and New South Wales.

Surveyors were initially subject to some oral examinations on taking up practice in New Zealand by senior colleagues. By and large these were highly conscientious men who enjoyed the experience of the outdoors and of opening up new land and who bore the privations and risks patiently and with fortitude. For many the harsh conditions shortened their lives and some cases cost them their lives from exposure, attack by Maori, drowning, robbery and misadventure. This pantheon of early surveyors selected and laid out the settlements of Auckland, New Plymouth, Napier, Wellington, Nelson, Christchurch, Dunedin and Invercargill. Often having to compromise with plans designed in England that assumed the settlement sites was all flat land. Mein Smith for example was criticised in the early Wellington settlement for not being guided by the contours in laying out roads. The early surveyors' roles and interests included engineering, construction, geology, reconnaissance and alignment of road and railway routes, ship construction etc. Their acceptance for surveying Crown Land came from their prior qualifications and experience and an examination at first by the Surveyor General and subsequently by the Provincial Chief Surveyors. The establishment of Provincial Government gave each a degree of autonomy and the survey systems grew in an uncoordinated way. However there was a national Inspector of Surveys whose main responsibility was the control of surveys of Maori land. At this time some minor triangulation was begun for the purposes of unifying the individual survey systems. This was accompanied with the appointment of the first Geodetic Surveyor, Stephenson Percy Smith.

The State of Early New Zealand Surveying

Settlement and Provincial Government

The surveying performance during 22 years of decentralisation was substandard with many poorly trained and performing surveyors who caused the need for frequent re-survey and aroused much criticism. The rapid population growth and the extravagant demand for land exceeded the resources of the young colony and the good standards of the surveyors of early settlement were eroded over the succeeding years. The overall performance of surveying towards the end of Provincial Government was very low in all Provinces but Otago/Southland. There was increasing evidence of serious shortcomings and inadequacies in the pioneering period and the situation was reported to a conference of Provincial Chief Surveyors in 1875. A considerable variation in systems, methods and quality among the different Provinces was evident. A number of different standard lengths were being used for surveys in each Province⁶. In 1878 a standard chain was laid out in Wellington and provincial standards were compared. These differences were small and too long in every case and it was considered not expedient to fix a New Zealand standard at that stage.

⁶ It is of interest to note that at the 8th Australian Interstate Conference of Surveyors in 1948 the issue of several states with varying standards of length was discussed.

The quality of surveying at that time occasioned much criticism for example Ruoff notes,

“Unfortunately, many of the early surveys were hurriedly and rudely done, such as the compass surveys in Poverty Bay. Sometimes, as in Nelson for example, an almost impossible project was planned on paper in Whitehall and somehow applied on the ground.”

Subsequently a report was commissioned by Government on the state of surveys in the Colony by Major Palmer of the United Kingdom who was in New Zealand to observe the transit of Venus. Palmer was particularly scathing about the state of surveys in New Zealand. He felt that many of the surveyors were,

“utterly ignorant of the commonest rudiments of sound scientific surveying” and “their work was done in a vague and slovenly style”.

He condemned the standard of survey work as wanting system and accuracy and the sloppy granting of land particularly in Auckland. He noted that Otago/Southland as having 60% of the trustworthy surveys while all sections in Auckland needed some degree of revision. He recommended centralising survey operations under a Surveyor General, the development of a national triangulation system, a uniform system of record maps and examination of surveyors.

Centralisation in a National Lands and Survey Department

The establishment of a national survey department and survey examination began the development of strong governance and led to a major lifting in survey performance and standards. This was steadily improved over the years to accommodate new techniques and increasing demands for speed and accuracy and good record keeping. In 1874 the first Board of Examiners was established to examine the qualifications of applicants for licenses to survey as required under the Land Transfer Act 1870. This Act was a major advance in the establishment of surveying in New Zealand on a systematic basis. It also introduced the role of private surveyors in New Zealand a domain previously that of surveyors contracted to Government. It was then followed by the centralisation of surveying in the Department of Lands and Survey in 1876. This resulted in a major reorganisation of surveying with the establishment 12 land districts and 28 meridional circuits. In 1896 the control of the land surveying profession was put under the control of the New Zealand Survey Board. A meeting was held with the other Survey Boards of New Zealand and the Australian Colonies in Melbourne in 1896. This meeting and follow-up considerations lead on to the long history between Australia and New Zealand in applying reciprocity for recognition of surveying qualifications in both countries. The New Zealand Institute of Surveyors was established in 1888 and now has a long record of administering the professional organisation of surveying in New Zealand. This was supported by statutory responsibility from 1938 to 2002 in its role as providing an annual practising certificate for all land surveyors in New Zealand. Up until the establishment of the establishment of the New Zealand Geographic Board in 1946 surveyors had a free hand in naming the places, features, blocks and streets they surveyed. The naming ranged

from the classical, through bishoprics, Maori names, names from their country of origin, the imaginative the mundane and the obvious.

The Techniques

Distance Measurement

Initial developments in techniques were incremental in relation mainly to the improvement of surveying instruments. Such improvements included replacing the Transit with a ball based vernier theodolite and then the use of 4 screw and then 3 screw theodolites. In regard to distance measurement the introduction of the steel tape was a momentous innovation. E. Fairburn is credited with the first use of the continuous steel band when surveying mining claims on the steep sides of the goldfields at Thames in 1869. He found that using a piano wire provided greatly increased efficiency in measuring distances. The Inspector of Surveys Heale followed up this experiment with recommendations for this method of measuring accurate distance and base lines in his 1971 publication "The Principles and Practice of Surveying". Heale corrected for temperature with two thermometers and while not referring to sag he noted his tension of 17 pounds on the base line kept the tape off the ground and gave excellent results in comparison with the standard chains of the time. In 1871 S Percy Smith also recorded the successful use of a steel tape measuring a base line for triangulation. He notes it was much more accurate, convenient and quicker. We in New Zealand would like to claim this as an important innovation pioneered in New Zealand. We are aware of our Australian surveying colleagues also using steel tapes but after this date. The "Surveyors Pocket Book" published in Sydney in 1886 gives the first record of this use in Australia in 1872. The piano wire was described as a horror to use according to Archie Bogle that doyen of New Zealand surveyors. The piano wire was fully replaced by the late 1880s by the flat 1/16 steel tape. Innovated in our region and a contribution to surveying all-round the world the introduction of the steel tape was shot in the arm to the effectiveness of surveying in the colonies. EDM was also quick adopted in NZ with the introduction of the radio distance measuring by Tellurometer in 1958 closely followed by distance measuring by light waves with the Geodimeter. Again the introduction of GPS in the late 1980s further boosted the efficiency of initially control surveys and this was closely followed by its application in cadastral surveys.

Triangulation

From the time of settlement there was a good appreciation of the benefits of working from the whole to the part and of the value of control through triangulation. Limited triangulation was introduced in the form of some small local efforts. Felton Mathew did use triangulation near Auckland in 1841 and it was used in Auckland in 1849 and near Christchurch. These were however inferior efforts poorly low technical merit and low accuracy. Mein Smith the New Zealand Company Surveyor considered triangulation although was precluded from using it because of the hilly terrain of Wellington. However the isolation of the settlements and the decentralisation of government in the first 35

years prevented other than such small initiatives in triangulation which were of inferior quality and local surveys were largely unconnected. The reality was that the surveys undertaken for early settlement were confined to local areas with a minimum done to meet the demand and neither scientific method or high accuracy were aspired to. There was an appreciation however of the value of triangulation to remove the problems and errors that built up in continued extension of running surveys. Heale promotes triangulation very strongly for use as a base for cadastral surveys throughout New Zealand in 1871.. He was clearly influenced by the success of this control method by the Triangulation of India (started in 1802) and the Trigonometrical Survey of England and Ireland (1840-1870). In the 1860s significant triangulation surveys were done in Wellington, Auckland and Hawkes Bay and a small area in Taranaki. All of these schemes suffered from variation in the standards of length used. Major Palmer recommended a tiered triangulation system very much along the lines that were accepted and implemented many years later. Surveyor General Thomson put priority on introducing 28 Meridional circuits he realised that general triangulation was required but saw these immediate improvements were required as the first priority. There was then a series of incremental improvement in survey control. In the following 20 years minor triangulation was surveyed across all the settlement areas and by the mid 1880s a chain of triangles extended through the length of New Zealand. Methodology, standards of accuracy, adjustment techniques continued to improve with the implementation of higher levels of triangulation culminating in the geodetic triangulation of New Zealand. In 1901 a new secondary triangulation was commenced to relate the different minor triangulation schemes. The North Island triangulation was begun in 1923 and continued to 1938 with the South Island triangulation continuing from 1938 to 1942. First order work and geodetic and astronomical observations were undertaken to provide a full geodetic triangulation of New Zealand in 1949.

Aerial Photography

Aerial photographic techniques have proved an immense advantage for the development of surveying and mapping in New Zealand over the last eighty years. The first vertical aerial photography was undertaken by the New Zealand Air Force in 1925 and quite a lot of aerial photographic coverage was achieved in the next ten years. In 1935 Piet Van Asch produced an aerial mosaic of the Heretaunga plains in Hawks Bay for soil survey purposes. This was followed with his establishment of his private company, New Zealand Aerial Mapping, which became the pioneer in for developing aerial photography for a wide range of mapping, planning and engineering uses in New Zealand and overseas. New Zealand Aerial Mapping still operates out of its base in Hastings today and undertakes major aerial surveys in New Zealand and overseas. It is in demand internationally for its has digital camera and LIDAR technology. Thus aerial surveying became an integral part of New Zealand mapping and surveying activity demonstrating marked increases in, economy, efficiency and capability.

Metrication

A change to metric measurement in 1973 provided opportunities to effect improvements to the survey system including the introduction of black and white plans and mapping on metric scales and the introduction of the NZ Map Grid a conformal minimum scale error mapping projection.

CONTRIBUTION TO ECONOMIC DEVELOPMENT AND INNOVATIONS

The accelerated and sustained growth of the New Zealand economy and the infrastructure since European development has been remarkable in that it has risen on a steep gradient and maintained this over all the succeeding decades. When this is measured on a combination of economic scales such as stock numbers, productive land and value of primary production a consistent rate of high economic growth is evident. This development profile began from a base of virgin land with no settlement and infrastructure to that of a modern economy in 175 years. There was no slow climb up the traditional S curve but an immediate steep take-off of settlements and their associated towns, industrial and food production areas and transportation services. It is well acknowledged that the contribution of surveying was one of the major instruments in enabling and maintaining this steady and rapid growth of population and production. The reasons being that New Zealand was so quick to take off because it was able to build on the advanced base of surveying technology already established through the experience of surveying in England and the older colonies including those in New South Wales. New Zealand settlement occurred at a time when there had been a sustained period of rapid development of survey techniques and the construction of geodetic instruments. However this was also complemented by the overall proficiency, hardihood, dedication and innovation of the old New Zealand surveyors.

When studying the gradient of the development of New Zealand society and its economy at any point in time any number of critical innovations and contributions can be identified. However, from the very start surveying capability and services have been crucial in providing the positional and locational infrastructure support essential at each stage of these impetuses to development. A linear series of economic initiatives and concomitant economic development which have provided a series of boosts the New Zealand economy can be identified all of which depended on security of title and survey services support in all primary production sectors of the economy. A quick run through some of these economic “impetus” points indicates the valuable role of the survey and land title infrastructure underpinning the economy at any particular time. The introduction of the frozen meat trade in the 1870s led to a diversification from exporting of wool only to a wool and meat export trade. This diversification required the surveying of the big estates into smaller more intensive farm holdings. The introduction of cream separators in the late 1800s again leads to further diversification for smaller dairy farms. This was further enhanced by the establishment of farmer dairy cooperative dairy factories with associated intensification of farm holdings. The introduction of science in

farming from the 1930s led to the bringing in to production of large tracts of land and the associated need for quick and efficient survey and titling. A good example of this was the breaking in for large areas of central North Island land previously unusable because of the lack of critical trace elements. Large scale Post World War II soldier and later civilian settlement by the Department of Lands and Survey depended on the efficient and effective deployment of surveying services and a sound surveying and land title infrastructure. In the 1970s the impact of the European Community and global trading patterns required a huge readjustment to the New Zealand economy. One immediate effect of this on land holding patterns was the removal of the protection of pastoralism and the resulting unprecedented diversification and intensification of land use throughout New Zealand. This was also accompanied later by a downward adjustment of land values and the removal of all agricultural subsidies. These demanding and critical changes in economic development required adaptation and efficiency from the surveying profession and administration. This was forthcoming and was latterly supported through the introduction of digital technology and computer assisted surveying. This then led to the implementation of a fully automated survey and title transactions system in the form of the Land Information New Zealand (LINZ) Landonline system. For all of this ground breaking development the surveying structure was there and was responsive to the requirements of the time to provide fully effective and innovative of surveying techniques to meet changing social and economic demands. Without this the growth of the New Zealand economy over its recent history could not have been so rapid and efficient.

DISCUSSION

The rapid economic development of New Zealand can be attributed in part to the contribution made by surveying and surveyors over the years since European settlement. This has enabled its land and resources to be used to good advantage and to adjust to changing demands and values. From the start there was large expanding demand for land which required efficient and survey services. Our history has demonstrated that surveying services and its function is never done. However the technology, methods and techniques and the services required by the community and nation continue to change. Our history of continued adaptation and innovation is encouraging. However, the message from our history is sobering in that our viability and relevance has depended directly on our contribution to the New Zealand society and economy. Our predecessors have achieved this through their professionalism, performance and adaptation. We can learn much from surveying history as it is a continuum which continually grows as the future moves into out past. We can be sure from our history that turbulence, transformation and change will be a constant in the future for surveying in New Zealand as elsewhere in the world. The features evident in our surveying past of conscientiousness, integrity, practicality, innovation, professionalism and responsiveness are all qualities relevant for surveying today and in the future. However, the future we now face is of variable change on a scale never previously encountered. To build on our strong history the survey profession will require as never before attributes of education, technological proficiency, and openness to

new avenues of activity, responsiveness to business opportunities and challenges and broad collaboration on strategic development surveying services. Tomorrow quickly becomes today and soon today is yesterday, and that's history. There is a corollary to the oft repeated adage that: " *Those that ignore history are doomed to repeated it.*" That is that those that remember history are blessed to benefit from it.

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BIOGRAPHICAL NOTES

Bill Robertson ONZM,

Bill has had a long career in surveying and mapping. He served as Director General/Surveyor General of the NZ Government Department of Survey and Land Information for 9 years. Over recent years he has practiced as an independent consultant and has served as a consultant for NZAID, AusAID, World Bank, Food and Agricultural Organisation, Booze Allen Hamilton and Land Equity in land administration and management projects in Vanuatu, Zimbabwe, Pakistan, Cambodia, Philippines, China Albania, Thailand Vietnam, Australia and New Zealand. He has also served as a

Commissioner on the Iraq/Kuwait Boundary Demarcation Commission in 1991-1993 as a Special Consultant to the Eritrea/Ethiopia Boundary Commission, 2001-2007 a Senior Consultant to the Cameroon/Nigeria Mixed Commission, 2003-Present and as an Independent Expert for the Sudan Tribunal, 2009. He was made an Officer of the New Zealand Order of Merit in 2009 for services to Surveying.

He is a NZ Registered Professional surveyor and Fellow of the NZ Institute of Surveyors and a Fellow of the NZ Planning Institute of which he is a Past President. He is also a Past President of the Commonwealth Association of Planners. He is a foundation member of the Surveying and Spatial Sciences Institute of Australia and an Eminent Person of AURISA. He is an Honorary Fellow Otago University and holds a Diploma in Town Planning (Auckland) Master of Public Policy (Victoria) and Honorary Doctorate in Surveying (Melbourne). He is a past Chairman of NZ Aerial Mapping, Aspect North Lismore, NSW, and has been Chairman of Terralink International Limited since 2001 until the present.

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