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Managing for Tomorrow

Geotechnical Engineering in the Public Service

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Summary In this paper we discuss the role of public sector engineering in South Australia over the last few decades with particular reference to geotechnical engineering. Firstly the various functions of public sector engineering are enumerated. These are then illustrated by reference to the recent history of three state government departments. The effects of the recent downsizing, privatisation and corporatisation on these departments are mentioned. We discuss whether the recent changes have rendered public sector engineering incapable of performing functions we consider to be desirable. We conclude that, in a significant number of areas, this is indeed the case. Finally we recommend measures needed to enable the public sector to play its proper role.

1. INTRODUCTION

Public sector engineering has made a crucial contribution to the economic development of South Australia and to the quality of life of its people. In the last five years dramatic changes have been made to the functions performed by public sector engineering organisations and the allocation of resources to them. We are concerned that these changes have been made without sufficient appreciation of the complex role of public sector engineering and that, in consequence, there may be adverse effects in both the short and the long term which exceed the intended benefits.

In this paper we discuss the role of public sector engineering in South Australia with particular reference to geotechnical engineering. Various aspects of this role are illustrated by reference to the history of three state government departments. The effects of the recent downsizing, privatisation and corporatisation on these departments are mentioned. We discuss whether the recent changes have rendered public sector engineering incapable of performing roles which we consider to be desirable. Finally we recommend measures needed to enable the public sector to play its proper role.

2. THE ROLES OF PUBLIC SECTOR ENGINEERING

The foremost objective of public sector engineering has been the planning, implementation and management of public infrastructure. The large, complex, expensive and ongoing nature of much infrastructure has required that much of it be built by government for the benefit of all. Uncertainty of

financial return on some infrastructure, the expense and difficulty of service delivery to widespread and isolated communities has influenced the growth of the public rather than the private sector.

Public sector organisations have undertaken research and development programs to ensure the most effective use of public money for the provision and maintenance of public infrastructure. Public sector scientific and engineering organisations have undertaken research in those areas where the private sector has had little incentive and insufficient capability.

In the drive to maximise the benefits to the general public and the private sector from expenditure of public money, government engineering organisations have pursued best practice and assumed responsibility for the maintenance of engineering standards in some areas. The preponderance of government in some areas of engineering has allowed it to promulgate and enforce these standards.

As a large purchaser of goods and services government has been in a position to exert a good influence on markets and to promote economic development. By specifying that the goods it will buy meet particular standards, government has encouraged manufacturers to meet these standards. By making its own goods and providing its own services government has controlled prices, particularly in those industries with few players and in times when demand has exceeded supply.

The necessity to provide an efficient service on an ongoing basis, particularly in areas where there has

been little private sector expertise, has led government departments to train, educate and develop their professional and technical staff. With no requirement for profit making, governments have been able to support training programs at secondary, tertiary and professional levels to a greater degree than private sector organisations. Many private sector engineering companies and "high tech" industries in Australia are now staffed by people trained in the public sector.

Ample provision of public infrastructure and government finance has facilitated economic growth. Throughout the history of South Australia successive governments have taken direct measures to control the private sector and promote the economy. The actions of the Playford Liberal Government in the acquisition and redirection of the Adelaide Electric Supply Company was a prime example. Similarly the creation of the Department of Mines and Energy, with a primary responsibility for preliminary geological investigation into the mineral resources of the State, has underpinned the development of the SA mining industry.

A significant role for state government departments has been the organisation and archival storage of information for the benefit of other government departments and the private sector. Private sector engineering organisations have had less money and incentive to provide such an overarching role.

The economy of South Australia has been stimulated and supported by public sector finance, infrastructure, experience and expertise since colonial times. In the post-war period expansion of infrastructure has been largely funded and effected by government. The construction of public facilities - roads, bridges, reticulated water supply, sewage works - have largely been undertaken by federal, state and local authorities.

Geotechnical engineers have been crucial for these civil engineering works.

Public sector engineering and geotechnical engineering are now significantly affected by changes in government policy. A comparative analysis of three state government departments - Mines and Energy, The Department of Transport, and SA Water - serves to illustrate the development of public infrastructure and the changes brought about by the current economic and political climate.

3. THE DEVELOPMENT OF GEOTECHNICAL ENGINEERING IN THE S. A. PUBLIC SECTOR

3.1 The Department of Mines and Energy SA

The Department of Mines and Energy, SA (MESA), originally the Department of Mines) came into being in 1894, in response to perceived failure of the mining industry to regulate itself and in recognition of the

newly promulgated idea that mineral wealth belongs to the public. (O'Neil, 1995) This idea is still encapsulated in its 1994 Mission Statement, "To generate wealth and jobs for the community by supporting the responsible development of the State's minerals, petroleum and groundwater, and the efficient use of energy." (MESA Ann. Rept., 1994/5). The table below illustrates the benefits to the State of this department and its obvious effectiveness and efficiency. While government expenditure in 1994/5 dollars has diminished by 28%, the value of mineral production has increased 109% and royalties by 170%.

Table 1. Changes in the Department of Mines and Energy, South Australia.

Financial Year	1981/82	1994/95	Change
Number of Staff	426	303	- 28%
Budget	\$27m*	\$19.5m	+ 63%
Mineral Value	\$558m	\$1165m	+ 109%
Royalties	\$19.1m	\$51.5m	+ 170%

(* Note \$27m = \$27 million in 1994/5 dollars)

A recent example of the importance of MESA in promoting economic development is the South Australian Exploration Initiative (SAEI). In recognition of the role to be played by the mineral industry in aiding economic recovery in South Australia, the government announced in 1991/2 a major injection of seed funds. Over the next three years a total of \$19.9 million was spent as follows:

- \$2.4 million to encourage the establishment of value adding industries based on advanced mineral processing.
- \$17.5 million for mineral and petroleum exploration, to encourage companies to spend more on exploration in SA.

Company expenditure on Exploration Licences (EL's) in 1994 was \$20.2 million, the highest level since 1986. A record number of EL's were granted during 1994. "The increase in activity is directly attributed to the SAEI" (MESA Ann. Rept. 1994/5, p50). This increase is expected to continue and is improving the prospects of new mineral discoveries. By 1994/5 the direct value of mineral production was \$1.2 billion. There is a lag of a few years before increased exploration expenditure leads to new mines (and other associated major infrastructure and development) and is reflected in increased value of mineral production, increased employment and general stimulation of the State's economy. However, it is easy to see how spending \$20 million will result in economic returns to South Australia of many times the amount invested.

The South Australian Steel and Energy Project (SASE) is an example of the ability of government to identify projects of benefit to the State. Large resources of both iron ore and coal exist in remote locations within SA. Each of these resources has

proven uneconomic to develop alone. However, MESA recognised that with emerging technologies in smelting and processing, an opportunity existed to develop both resources together. "If the preliminary steps are completed successfully, the establishment of a major iron, steel and energy industry will bring considerable benefits of infrastructure and employment to the region." (MESA Ann. Rept. 1994/5, p2)

MESA provides information and specialist skills to other government agencies to facilitate and support responsible development. In the 1950's and 1960's MESA played a significant role in defining and demonstrating best practice in the application of the rapidly developing science of engineering geology in South Australia. The work of the Drilling Services group has for decades been the standard with which other drilling engineering groups in SA have been compared. The Geotechnical Engineering industry in the 1990's is highly mature with widespread expertise.

Hence it is not appropriate for MESA to carry out all these functions for the industry as a whole. However, the SA government must maintain sufficient expertise to ensure that 'Best Practices' are applied in geotechnical engineering for public infrastructure and development projects.

To continue its tasks with reduced staff levels MESA is doing more research and development via contract. The minimalist role of administering these contracts may not be enough either to keep what remains of the engineering expertise within government, to develop personnel with sufficient expertise, or to adequately assess whether best practices are being applied. In addition, reduction of staff and function represent a significantly reduced career path and hence less likelihood of attracting or retaining engineers and scientists.

3.2 SA Water

The role of the former EWS was to manage the water resources (including the River Murray), to supply water, and to collect and treat sewage within South Australia

The geotechnical unit and the soils laboratory of the EWS serviced the geotechnical needs of the department on the investigation, design, construction and maintenance of dams, pumping stations, pipelines, water filtration plants, tanks, reticulation mains, local and trunk sewers, sewage treatment plants, River Murray salinity control works, government irrigation area infrastructure, etc. The geotechnical unit and laboratory also assisted other government departments such as the Public Buildings Department and the Department of Marine and Harbours. They carried out a limited amount of specialist testing and investigation work for local consultants if they lacked the equipment or resources.

During the 1970s the geotechnical unit required up to 6 engineers, and the laboratory some 20 technical officers, to provide the services requested by its customers. The high workload and staff numbers provided good training opportunities and allowed considerable research programs to be undertaken. Staff numbers in both the geotechnical unit and the laboratory gradually reduced as the construction programs of the EWS and other government departments wound down (and local consultants became more capable of meeting their needs for quality control testing etc). Later when the water resources management functions were transferred to the Department of Environment & Natural Resources, and as government irrigation areas began to be progressively divested to the growers numbers were reduced even further. By 1995 the geotechnical unit was down to one experienced Level 4 engineer, and the laboratory to two very experienced technical officers. In the decade to 1995 the number of engineers employed by EWS reduced by 42%, from 225 to 130, the largest percentage decrease in any state water authority in Australia (APESMA, 1995).

Corporatisation in July of 1995 brought with it a strong commercial approach and a focus on "core business" only - i.e. the provision of water and wastewater services to the people of South Australia. In January 1996 a largely French/British consortium took over the operation of the water filtration and supply, and sewage collection and treatment systems for inner metropolitan Adelaide under a 1.5 billion dollar, 15 year contract. The net costs and the national balance-of-payments disbenefits of this contract are intended to be offset by requiring the contractor to "generate significant economic benefits for South Australia" by set of measures specified in the contract (SA Water 1995), for example,

- opening up the huge Asia Pacific water infrastructure market to SA firms
- transfer knowledge and skills to local companies thereby raising their independent export capabilities

It remains to be seen whether the predicted benefits eventuate and exceed the balance-of-payment disbenefit. It also remains to be seen whether it is possible to encourage by contract a private company not only to give much work it could do itself to other private companies in the same industry, but also to train their staff. In fact there is already concern being expressed by a State government minister about the loss of training opportunities caused by cuts to the public sector (Advertiser 1996).

The Build-Own-Operate (BOO) schemes are proposed for future infrastructure development, such as the water filtration plants for the River Murray towns. The use of BOO schemes will lead to even more

reductions in the engineering and technical expertise within SA Water

It is also expected that about half of the 130 remaining engineering staff will be made "redundant" by these changes and that SA Water will no longer have any staff with major expertise in geotechnical engineering.

This represents a loss to the State of South Australia of hundreds of years of engineering experience and a catastrophic reduction in the in-house ability of the State to plan, implement and manage its water supply. And this in the driest State of the driest continent!

How will the remaining engineers fulfil all the roles mentioned above? Will they be performed by the private sector firms, particularly if they reduce profitability? Can all these roles be specified and enforced by contract? Will the private operators implement improved technologies for the benefit of the public..... how will we know?

The expertise existing in SA Water could have been combined with that from the private sector and used to generate income for the state from water supply projects in Asia. This option would preserve or even enhance public sector engineering expertise.

3.3 Department of Transport, South Australia

For most of its history the primary role of the Department of Transport (formerly the Highways Department) was planning, designing, building and maintaining arterial roads. At the height of its road construction period 1960 to 1970 the Department employed approximately three thousand people (Donovan, 1991). To perform this task in a cost effective way it became involved in the supply of road building materials such as crushed rock and asphaltic concrete. The Materials Section of the Department conducted research into road making materials and helped to set quality standards. The section also conducted investigations and design for bridge foundations and road pavements, identified suitable rock deposits, developed quarries and contracted the crushing and delivery of rock for rural road projects. The section also performed routine laboratory testing of soils and crushed rock. During the last decade the Materials Section has played a major role in developing laboratory test methods for determining the stiffness of crushed rock under repeated loading and has formulated a rational pavement design method which uses this data. The Materials Section has run training courses in this new technology for people from both the private and public sectors. To minimise the cost and adverse environmental impact of road pavement rehabilitation, the Materials Section, the Cement and Concrete Association of South Australia and the University of South Australia have been involved in a joint project on recycling of road pavements. The Commissioner's introduction to

1993-94 Annual Report of the Department of Transport acknowledges an Engineering Excellence Award given to the Materials Section and Pavement Technology Limited for a road pavement recycling project.

The Department is strongly involved in AUSTROADS, the national association of road transport and traffic authorities whose mission is to pursue effective management and safe use of Australia's roads. AUSTROADS achieves this by identifying and implementing world's best practice and identifying and promoting research to improve best practice.

The arterial road network in South Australia was largely completed by 1990 (Department of Transport, 1994) and the Department's role moved more towards maintaining and managing the road network. In 1993 and 1994 many of the activities of the Office of Transport Policy and Planning and the Department of Marine and Harbours were transferred to the Department of Transport and the role of the Department expanded to include the development of transport policy and planning. Service provider sections of the Department have been designated as business units operating under commercial accounting principles. Under this regime business units charge client sections for their services rather than projects and are expected to raise sufficient income to cover costs. The Department has sold off its asphalt plant and contracted out its linemarking.

In his letter to the Minister for Transport submitting his Department's annual report for the financial year 1994-95 the Chief Executive mentions a fundamental review of the Department which will involve:

- application of the funder/purchaser/provider model to the Department's activities.
- contracting out of provider functions.
- operating the remaining provider functions on a commercially competitive basis.
- projected staff reductions from 2620 at 30 June 1994 to 1300 by 31 December 1996.

Under this review the Materials Section has been reduced by more than half but will still be responsible for providing or managing the provision of most of the above services. In line with the funder/purchaser/provider model, a large proportion of the investigation and design services will be outsourced and the section will no longer do routine laboratory testing of soils and crushed rock. The section now has one full time geotechnical engineer and one geologist but no longer any in house geotechnical drilling and testing capability.

It is difficult to control the course of these changes. Although the Department wishes to retain technical engineering expertise in order to remain an informed purchaser of engineering services it has already lost a

significant number of experienced engineers. It is debatable whether the Department will be able to maintain significant engineering expertise in the service provider areas, for example engineering design, geotechnical investigation and construction, where it is intended to outsource most work. In future these areas will offer significantly reduced career opportunities for engineers

In engineering, best practice is often defined and demonstrated by the major players, that is, organisations which undertake demanding projects on an ongoing basis. In these organisations engineers are continually honing their skills. If the Department cannot maintain its expertise in some areas it will lose its ability to define and demonstrate best practice.

Although the Department does not intend to reduce its research and development activities it is difficult to see how they can be maintained at their previous levels in view of the large reduction in staff numbers. In addition the increasing time pressure on engineers resulting from the need to be commercially accountable will militate against creativity. In the last few years major reductions in staff numbers have occurred in most of the state road authorities. In view of the fact that AUSTROADS relies on the participation of engineers from the State road authorities there may be a diminution of its activities in research and development and the setting of standards.

Although an attempt can be made to minimise the price paid by the Department for a product (asphalt, for example) by the calling for tenders for supply of that product, the price paid may still be excessive if there is a shortage of the product or if there is not a great deal of competition amongst suppliers. It is worthwhile noting here the recent imposition of fines on several major concrete suppliers in Queensland for price collusion. Naturally there is greater opportunity for price control if the Department can supply most of its own product.

The Department has a strong commitment to training its employees. Training occurs formally and informally. In view of the reductions in staff numbers, possible loss of expertise in some areas and the time pressure occasioned by commercial accounting it will be difficult for the Department to maintain its level of training.

Finally, with only one geotechnical engineer remaining it will be very difficult for the Department to play any significant role in this field.

4. CONCLUSIONS & RECOMMENDATIONS

Throughout most of the 1980's Australia experienced a period of excessive inflation followed by a significant recession towards the end of the decade.

The federal government commissioned several enquiries into measures to improve general economic performance (for example, House of Representatives 1987, Hilmer 1993, Industry Commission 1994). These enquiries came to differing conclusions as to whether changing the role of public sector engineering would benefit the Australian economy.

The recession was particularly dramatic in South Australia. The disastrous lending practices of the State Bank of South Australia during the boom of the 80's, necessitated a rescue package of about \$3 billion from state coffers in 1991. The then Labor government began to review its agencies with a view to saving money. A program of significant departmental staff reductions was begun. The Liberal Party won the state election of November 1993 overwhelmingly, and immediately took steps to reduce the state's debt and to promote economic development. To provide guidance it established a Commission of Audit (Commission of Audit, 1994) which recommended large changes to the public sector. Despite considerable criticism from the Labor Opposition and others (for example Audit Commission Critique, 1994) - the program of "downsizing", "corporatisation" and "outsourcing", was begun. As a result, public sector utilities have been de-constructed and re-constructed at a drastic rate.

Between each of the government departments which have been explored in this article, there are common factors. They have all played a crucial role in the development of the State economy and the delivery of essential services to business, industry and South Australian citizens. They have all played significant secondary roles in the promotion of research and development, control of markets, "best practice" and high standards, the provision of professional career paths for engineers, opportunities for education and training at all levels from work experience for school students, technical training at the tertiary level and workplace experience for university undergraduates. With the current narrow focus upon economic efficiency and commercial accountability, these other roles played by the public sector are likely to be overlooked.

In an overview of the processes and actions which were significant causal factors in the near collapse of the State Bank of South Australia, Auditor-General, K. I. MacPherson, directed criticism towards excessive expansionary policies which had been undertaken without due prudence and caution during the 1980's. Similar concerns can be expressed towards a public sector de-construction process which may not be proceeding with sufficient prudence and caution in the 1990's.

We consider that if the public sector engineering organisations are to maintain a capability to plan,

implement and manage infrastructure in the long term, the following recommendations need to be addressed.

1. The design and construction areas of government engineering departments should be kept at a size large enough to undertake a steady stream of major projects. In this way good career paths would be ensured and technical expertise maintained. This would also ensure that the government remains an "informed purchaser" of engineering services.

2. Government engineering departments should undertake major research and development projects on a continuing basis. This would help ensure that the whole community benefits from improvements in technology.

3. The government should maintain an ability to supply a significant proportion of the engineering materials and services which it requires in those areas where both the following conditions apply:

(i) There are large sums of money or public health and safety at stake.

(ii) There are a small number of suppliers, or, for other reasons, the materials or services may not be supplied for a reasonable price or quality.

Note that it is difficult to assess quality or price of a good or service accurately without significant "hands-on", experience.

4. A cautious approach should be adopted to the deconstruction of the public sector engineering capability and the consequent loss expertise and experience. Overseas experience shows that drastic changes in government engineering capability can result in significant cost increases and reduction in quality of service.

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Disclaimer

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