MAINTAINING A SKILLED TECHNICAL WORKFORCE IN A HIGH DEMAND ENVIRONMENT

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1. SYNOPSIS

Road authorities in Australia and New Zealand are facing significant challenges in maintaining the required levels of core technical expertise. The current environment is characterised by high competition for key technical specialities such as civil engineers, an ageing workforce within road authorities, and flat growth in the number of new graduates in relevant engineering disciplines. At the same time, the requirements placed on road authorities by infrastructure owners (governments) are increasingly complex and have created a requirement for new commercial, legal and risk management skills. Together, these factors have the potential to reduce the capacity of road authorities in the future to perform their key tasks of transport infrastructure construction, maintenance and management.

In 2005 Austroads Council took a strategic decision to establish a Capability Taskforce. Its role is to assist Council in ensuring the sustainability of core technical road expertise and to provide a forum for knowledge sharing initiatives.

Since its establishment the Taskforce has undertaken research relating to the level of demand for roads-related technical expertise over the next decade. It has developed marketing materials which are designed to encourage secondary and tertiary students to select engineering as an undergraduate course and road engineering as a career. A review has been completed which identifies gaps across post graduate courses in core technical competencies required by the road industry. A knowledge-sharing forum comprising member authorities and professional engineering associations has been established to exchange approaches relating to capability building, staff attraction and retention, and maintaining technical knowledge as older staff retire.

2. AUSTROADS MEMBERSHIP

Austroads membership comprises the six state and two territory road transport and traffic authorities and the Australian Department of Transport and Regional Services in Australia, the Australian Local Government Association and Transit New Zealand. It is governed by a council consisting of the chief executive officer (or an alternative senior executive officer) of each of its eleven member organisations:

- Roads and Traffic Authority New South Wales
- Roads Corporation Victoria
- Department of Main Roads Queensland
- Main Roads Western Australia
- Department for Transport, Energy and Infrastructure South Australia
- Department of Infrastructure, Energy and Resources Tasmania
- Department of Planning and Infrastructure Northern Territory
- Department of Territory and Municipal Services Australian Capital Territory

- Australian Department of Transport and Regional Services
- Transit New Zealand
- Australian Local Government Association

3. CALL TO ACTION

In April 2005 in response to growing concerns about the current and future availability of core road technical expertise the Austroads National Office prepared a paper for consideration by the Austroads Council which outlined the initiatives and activities being undertaken by member authorities to address their technical skill shortages. Council resolved that a workshop should be conducted to further explore issues associated with skill shortage. The workshop was to identify actions required to improve levels of core technical expertise, from local and national perspectives.

The workshop was conducted in June 2005 and proposed a number of approaches which could assist in building and retaining technical capability:

- Monitor the skills required by road authorities and evaluate their current availability
- Market and promote careers in the road industry
- Collaborate with educational institutions to increase the size of the pool of potential applicants for positions in road authorities
- Collaborate with industry on initiatives to address skills and shortages across the road industry and also across the broader construction and mining sectors
- Develop closer links with professional bodies to promote careers in the road industry, and
- Promote best practice across the road authorities through joint projects and information sharing.

After the workshop, the Austroads Council agreed to four key actions:

1. Undertake a national workforce study to assist road authorities to identify and address future skill requirements
2. Develop a national marketing plan to promote careers in road authorities
3. Explore the development and delivery of postgraduate courses for road authority staff.
4. Develop a best-practice approach amongst road authorities through sharing and jointly developing techniques and initiatives for addressing skill shortages.

The first three of these were to be the subject of formal research/investigative projects, the fourth was to be addressed though information-sharing, workshops, professional networks and the like. The research was intended to form a basis for actions by each member authority to build and retain core capability as well as to provide sound data for the development of strategies at industry, education and government level.

Council formed a Capability Task Force to oversee these matters. The Task Force is to concentrate on the key technical capabilities required by road authorities, but its brief does not include generalised skills such as finance or information technology. Task Force membership includes each member authority and representation from local government, industry and professional engineers' associations.

Since its inception the Task Force has established a forward program based on data gathering and analysis and information exchange, and has overseen the following activities:

3.1. Project 1: Australia and New Zealand Roads Capability Analysis 2006 - 2016

The brief given to the consultants engaged by Austroads asked them “to undertake a workforce capability analysis for member authorities on planned and forecast infrastructure development requirements in New Zealand and Australia over the next ten years”. The brief noted that “this project focuses on the capabilities of engineering skills, particularly road and bridge design, construction and maintenance, traffic management, project delivery and project management and road safety.” These are seen as core technical capabilities for all member road authorities.

In their report the consultants addressed 5 key questions:

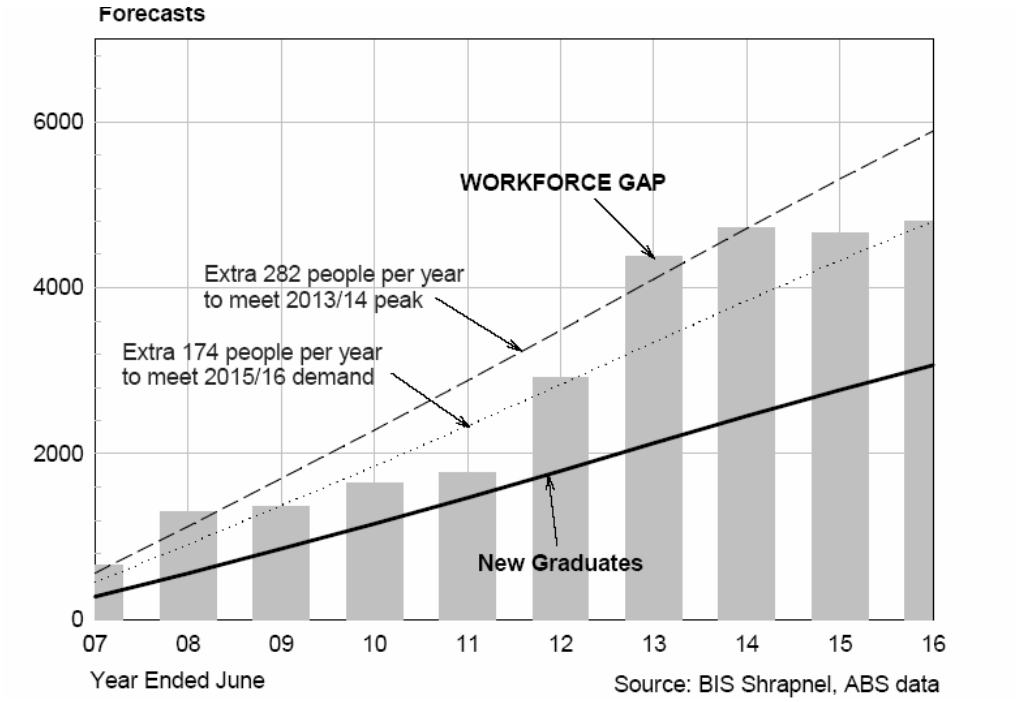
1. What is the size of the skilled engineering profession in the road sector?
2. What is the outlook for the road sector in the coming decade, in terms of construction and maintenance activity?
3. What are the skilled workforce demands implied by these activity forecasts?
4. Is there a gap between these workforce demands and the supply of skills?
5. What are the implications of this activity for the road industry?

The report presented a detailed economic analysis of projected road infrastructure activity (public and private) on a state/territory and national basis for Australia and for New Zealand. It provided an analysis of the capability of the Australian and New Zealand skilled roads workforce to meet infrastructure development requirements over the decade to 2006 - 2016.
A model was developed that translated projections of proposed and actual road construction and development over the decade 2006 to 2016 into demand for skilled labour. A projection of the current skilled roads labour supply, initially derived through census data, was added to the model. This projection was determined by the number of new graduates entering the roads sector each year and the estimated attrition of the workforce through ageing.

Key findings:

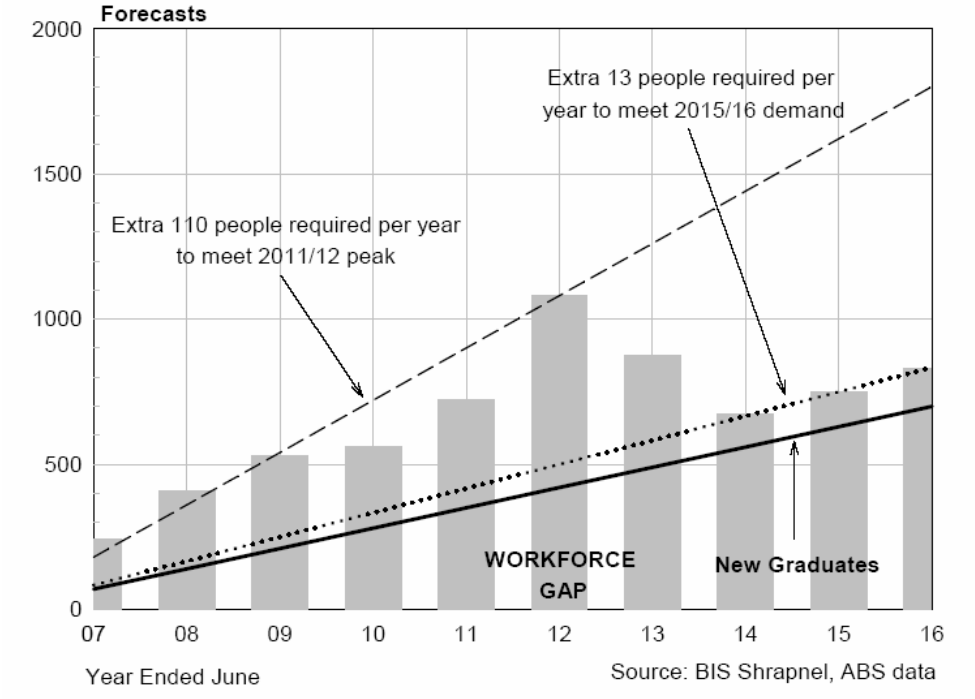
The major finding of the report is that future skilled labour supply in Australia and New Zealand will not be enough to meet predicted skilled labour demand in the roads sector, based on forecast road construction, maintenance and other road management activity, and taking into account labour lost through workforce attrition largely as a result of ageing. Anticipated flat growth in the number of new graduates entering the roads sector will exacerbate this problem. As a consequence, in theory, a capability deficit will arise.

Graph 1: Australia – total roads workforce gap and graduate supply



Graph 1 shows that for Australia, the peak year for skilled labour demand in the road sector is expected to be 2013/14. The technically skilled labour supply will need to be boosted by around 2,250 persons (or 282 persons per annum) on top of the existing domestic graduate stream to meet this demand. In order to meet the 2015/16 skilled labour demand, supply will need to be augmented by around 1,740 persons (or 174 persons per annum).

Graph 2 – New Zealand – total roads workforce gap and graduate supply



Graph 2 shows that for New Zealand to meet the peak year (2011/12) demand, the skilled labour supply will need to be boosted by 660 persons on top of the existing graduate stream, or around 110 persons per annum. However, given a weaker projection for New Zealand roads activity over the latter years of the forecast period, supply would need to be boosted by around 133 persons in total to meet the forecast road industry demand by 2015/16.

The report suggested that, in practice, either labour demand will fall back to meet the constrained level of labour supply - implying that future roads activity will need to be cut back or foregone - or measures will be put in place that will boost labour supply to meet current expectations of future roads activity.

The report also found that:

- If the labour supply is not boosted, around $AUD880 million worth of potential road construction and maintenance work will be foregone in Australia in 2007/08, rising to over $AUD2.7 billion per annum over 2012/13 and 2013/14 (in 2003/04 constant prices). Across the decade to 2015/16, over $AUD14 billion in road works will be foregone. The impact on the broader economy (including 'multiplier effects' and indirect costs caused by inadequate infrastructure such as congestion, increased travel times and accidents) is likely to be greater still.

- The capability of the skilled roads workforce to meet projected demand varies between states and territories, and through time. Over the next five years, it is expected that total road sector (i.e. public plus private sector) demand growth will be strongest in Queensland, but relatively weak in New South Wales and Victoria. In the five years to 2015/16, however, demand growth is expected to be strongest in New South Wales, Victoria and Western Australia.

- For both Australia and New Zealand, if peak year demand were to be met purely through hiring new graduates, this translates into a need to more than double the current level of civil engineering and related undergraduate enrolments, given existing flows of graduates into the roads sector and the lag between enrolment and completion of undergraduate degrees. Alternatively, strategies would need to be implemented to increase the road sector's share of the available graduate pool.

- Rising public sector funded roads activity is projected to be the main driver of skilled roads labour demand growth over the coming decade. In Australia, the anticipated workforce gap facing the public sector is expected to peak in 2014/15 at around 2,600 persons driven by rising construction, maintenance and other road management requirements and accelerating workforce attrition. For New Zealand, the public sector workforce gap is expected to range between 300-400 persons between 2010/11 and 2015/16. This gap will need to be met by hiring new graduates, from net migration or net transfer of skills from other industries, or by increasing the utilisation of the private sector roads workforce.

- While the scope of the report is limited to the decade to 2015/16, present modelling indicates that the capability deficit in the roads sector will increase further in subsequent decades as the bulk of the existing workforce moves into key retirement age brackets. This means that it is likely that labour supply will need to be augmented by an even greater amount than that considered here to meet demand requirements beyond 2015/16.

3.2. Project 2: Professional Development for Road Engineering: Phase 1

The purpose of this project was to set the strategic direction for the development of professional capability across road engineering. The report also provided data pointing to a reduction in the number of road related units within university undergraduate civil engineering programs which contributes to the skill shortage and places additional requirements on employers to train graduates to satisfactory skill levels.

The scope of the project included:

- Identification of the specialist technical transport capabilities required by road authorities
- Evaluation of the targeted engineering disciplines' existing postgraduate programs for their suitability by the road infrastructure sector
- Analysis of gaps between required capabilities and current postgraduate program offerings
- Recommendations on postgraduate programs to be developed, including proposed delivery strategies.

Key findings:

The focus for this project was on the post graduate education component of continuing professional development for the key engineering disciplines involved in the delivery of road and bridge infrastructure. Analysis of the existing undergraduate engineering programs revealed that the fundamentals to the profession are being taught across the programs, although there is considerable content variation. However, the analysis has also revealed that more than half of the programs do not contain courses that develop capabilities directly related to highways or roads.

Analysis of existing postgraduate programs has shown that engineering foundations provided in undergraduate programs is continuing to be built upon, with opportunities to study in specific areas. However, there would be a greater benefit if industry-focused development drove the make-up of postgraduate course work. For the road infrastructure sector, focused postgraduate studies around disciplines from road, bridge and traffic design, construction and maintenance, to project management and contract management would promote accelerated capability development opportunities. If these opportunities are driven by a common and consistent national approach, the entire road and transport industry would reap significant short and long term benefits

The key recommendations of the report are as follows:

1. Strategies should be developed to ensure that that existing engineering postgraduate programs support the road infrastructure sector in the areas of:
   (a) Road design
   (b) Bridge design
   (c) Traffic design
   (d) Pavement design
   (e) Road construction and maintenance
   (f) Bridge construction and maintenance
   (g) Estimating
   (h) Environmental management
   (i) Traffic management

(j) Traffic modelling
(k) Transport planning
(l) Hydraulic engineering
(m) Asset management
(n) Project management
(o) Contract management
(p) Transport infrastructure economics.

2. A range of postgraduate education programs for the areas identified above should be developed, subject to the outcomes of a business case presented to the Austroads Council for approval, highlighting the development program, course priorities and funding options.

3. The development of the program of postgraduate programs and the coordination and management of their delivery should be provided by a centralised function, suitably positioned and experienced to undertake such a function, on behalf of Austroads.

4. The program of engagement with universities should be increased with a view to form a partnership model between the universities and Austroads and the road infrastructure sector at large to ensure support for and delivery of the program of postgraduate programs.

5. Negotiations should be formalised with universities to build a model for combining road engineering graduate certificate/diploma programs, irrespective of where they were undertaken, to form accredited post graduate qualifications (such as masters degrees) in road engineering.

6. Austroads and its member authorities should commit to a range of postgraduate education programs in road engineering that would be used to form part of each authority's continuing professional development and employment programs.

7. Austroads should maintain a watching brief on national higher education policy and on proposed changes to undergraduate degree programs.

3.3. Project 3: Development of marketing materials

Austroads commissioned a consultant to develop a targeted marketing campaign to address the skills shortage in road engineering for road authorities in Australia and New Zealand. The campaign responded to the findings of the capability analysis in project 1 (Australia and New Zealand Roads Capability Analysis 2006 – 2016), that the supply of skilled labour in both countries would need to be boosted to meet forecast road industry demand by 2015/16.

Materials developed by this project could be used by individual jurisdictions to promote road engineering as a career in their own jurisdiction. The materials need to include a range of templates and will need to be packaged in an appropriate format.

Key objectives of the project:

- Assist in increasing the number of year 12 students (in final year of secondary education) who select appropriate subjects (mathematics and sciences) which will enable them to select engineering as a career

- Assist increasing he number of engineering students in tertiary courses who select road engineering as their stream

- Promote the range of career opportunities in road authorities and the wider road industry to the target audience of final year secondary students (16-17 years of age) and tertiary students (17-22 years of age)

- Promote the range of career opportunities in road authorities and the wider road industry to the target audience

- Improve the perception of a career in road engineering

The following key messages are to be incorporated in the materials development and marketing campaign

- There are many career opportunities in road engineering industry, with competitive salaries

- Road authorities contribute to society through providing much needed infrastructure (appeal to social conscience, altruistic motives)

- The next generation of road construction professionals will have to develop innovative and sustainable road building solutions to minimise the environmental impacts of roads

- There are opportunities to work in different countries with the transferable skills gained in road engineering.

Outputs:

The consultants undertook detailed analysis of the characteristics and aspirations of the target age groups. They developed several options which were aligned to meet the objectives of the project and to appeal to the key market segments (ie, final year secondary students and students in tertiary engineering courses).

Examples of the selected campaign materials are appended (Attachment 1). These are designed to have a somewhat “nerdy” look and feel but have a distinct appeal to the target groups. The material can be customised by each jurisdiction by the inclusion of their own logo or brand, and by changing the background infrastructure image to one would be recognised locally.

Marketing materials are flexible and include posters which can be displayed in a variety of locations such as bus shelters and campus notice boards, advertising copy for publications, avant cards for distribution in cafes and social venues, inserts for hand-outs such as university orientation packs, brochures, and electronic publications. The suite of materials also includes a dedicated web site with the marketing imagery and messages,

and links to road authority web sites which can provide deeper and richer information about careers in the road sector in their own jurisdiction.

This is an exciting contemporary approach and it will undoubtedly reap benefits for authorities in the longer term. Some material has already been utilised in career advice publication for secondary students and individual authorities are expected to commence using the program later in 2007.

3.4 Information sharing between jurisdictions

The Task Force has established of a forum including all jurisdictions and key industry groups for the exchange of information and strategies aimed at attracting and retaining engineering staff. The forum also focuses on enhancing and improving staff development in key technical areas.

The Task Force has established a series of best-practice, practically-oriented seminars for human resource and technical staff in areas such as:

- Attraction and retention of key technical and engineering skills
- Implementing successful graduate programs
- Job design and competency profiling
- Knowledge retention and continuity

Additionally, through the Task Force, Austroads provides support with industry of the Centre for Pavement Engineering Education, which uses distance education to deliver post graduate courses in pavement engineering. This support includes the development and review of post-graduate subjects and associated materials. It draws significantly on research and publications sponsored by member authorities and carried out by the Australian Road Research Board. A review is underway to ascertain the benefits of extending this model to other key specialist technical areas.

4. CONCLUSION

Austroads Council has taken a proactive and strategic approach to developing and maintaining core technical capabilities in the road sector over the next decade. This approach is based on industry research which provides projections and data relating to expected levels of demand for core technical skills, and on an analysis of gaps in post graduate road engineering courses in Australia and New Zealand. The innovative marketing materials and key messages to a prospective workforce should assist in increasing demand for road engineering courses by raising the profile and appeal of road engineering as a career. Positive feedback has been received from member authorities in relation to the first knowledge sharing forum on retention, held earlier this year.

Work thus far provides a sound basis for moving forward. Future tasks will include the development of a suitable model to provide, at a national level, more comprehensive road engineering post graduate and undergraduate qualifications which better meet the requirements of the industry.

The information gathered to date will also prove beneficial in working with universities and with education policy makers in endeavouring to increase the number of engineering places offered in Australia and New Zealand, to augment the technical content of undergraduate and post graduate courses in line with road industry requirements for specialist technical skills, and to improve the delivery of and access to courses.

REFERENCES

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4. Austroads, An Engineering Skills Shortage Marketing Campaign Proposal, 2006.