RTSA

Railway Technical Society of Australasia

RAILWAY ENGINEERING PROFESSIONAL FORMATION AND DEVELOPMENT

FIRST EDITION

THE INSTITUTION OF ENGINEERS, AUSTRALIA

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FOREWORD

The Railway Technical Society of Australasia presents this publication as a contribution to the railway industry. The aim is to assist by raising awareness, within the railway industry, of the importance of the technology input and by pointing the way towards the encouragement of the development of that input.

As in the case of the earlier companion publication "Railway Engineering Competency Profiles", the central purpose is to empower those who occupy positions from which they may influence the maintenance and development of the human skills relevant to Railway Engineering. It needs to be more widely recognised that the human skills that are inseparable from the technological base of the railway industry are of prime importance for its long-term viability.

Railway Engineering can be absorbing and rewarding because of its multi-disciplinary nature, because of the challenges it can provide and because of the inherent compatibility of the railway industry with the priorities of today. These priorities include, in particular, social and environmental responsibility. For practitioners to be expected to keep pace in such circumstances they must be afforded appropriate opportunity for their continuing professional formation and development.

There should be a future of expanding opportunity for Railway Engineering. We must make sure that the railway industry is well prepared. It is hoped that this publication will provide insight as to practical ways and means.

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Introduction

1 The former National Committee on Railway Engineering (NCRE) of The Institution of Engineers, Australia (IEAust) published the booklet entitled "Railway Engineering Competency Profiles", in 1998. The purpose was to promote both undergraduate and postgraduate education in subject matter directly relevant to Railway Engineering.

2 The Railway Technical Society of Australasia (RTSA), successor to the NCRE, has the same purpose. To take the initiative further, the RTSA has prepared this publication to assist the stake-holders in the rail industry to put the practical implementation of engineering skills development into perspective.

Vision

3 In pursuing this matter, the vision of the RTSA has focussed upon solving the problem of creating competent and productive practitioners in the field of professional Railway Engineering in the current age of industry disaggregation. As described in "Railway Engineering Competency Profiles", opportunities for the induction and training of engineers and other technical staff in railways have reduced in their availability and altered in their nature.

4 It is hoped to assist influential people in both academia and the railway industry to see opportunities for bolstering the intellectual capital invested in the railway industry in Australia. The technology input is considered vital to the on-going success of the industry. It is also hoped to assist and empower individual practitioners to take responsibility for their own professional formation and development.

Discussion

5 There has been consideration of the possibility of the registration of engineers working in connection with railways. However, observations of recent railway reorganisations indicate that the direct involvement of engineers in a railway enterprise may not be assured. Further, advice from IEAust has indicated that a very good case as to why railway professional engineers would need to be registered would have to be presented before such a proposal would receive serious consideration.

6 It is considered that the focus should be upon encouraging railway industry employers to recognise the true value of involving professional engineers, even if only to achieve competent customer status, when procuring equipment, supplies and associated technical services. Efforts directed solely towards the introduction of registration, perhaps as a form of compulsion, may not be greatly effective in bringing about the desired betterment of the industry. It is recognised, however, that this does not preclude the possibility that the registration of professional practitioners in Railway Engineering may eventually occur.

7 As already indicated, the philosophy of the RTSA is inclined more towards empowerment rather than towards the implementation of structured recognition of formal qualifications. In conformance with this approach, this publication represents an endeavour to define routes of professional formation within the railway industry as it exists today, in

Australia. The immediate goal is to suggest ways in which participants may better themselves by pursuing broadening experience and learning.

8 It is noted that a further avenue for providing needed investment in railway engineering human resources would be the introduction, by employers, of graduate engineer training programs if this, also, could be encouraged. The latter outcome could be based within individual enterprises or there could be programs taking the form of joint training schemes sponsored via industry groups.

9 The relevance of the options detailed in the IEAust report, released in 1999, on Engineering Rail Sector Growth are recognised and should be kept in mind. These hinge upon the development of a consensus, amongst the stakeholders (rail enterprises, governments, professional bodies, practitioners and training institutions), such that the needs would be addressed to good effect.

Professional Engineers in the Railway Industry

10 The nature of the railway industry of today is such that its engineering staff must understand both the traditional and more modern technologies. Additionally, the wider social, commercial and environmental issues which become critical when providing services in the public arena impinge more than ever in the complex circumstances of today.

11 A systems approach to railway engineering is essential. Only when a multiplicity of technologies and resources are carefully brought together to form a systematic whole can the expected transportation services be delivered.

12 Examples of traditional, specialised technologies vital to railways might be the management of wheel/rail interaction, railway bridge design, railway signalling and interlocking and electric traction power control. Modern advances have transformed each of these. Advanced wheel profiling, in-service wheel profile monitoring and roll-through conditioning, concrete construction, computer and radio-based signalling and safeworking and solid state power control are all examples of railway technologies at the leading edge. The well-rounded railway engineer must seek to equip himself to be able to deal with the whole range of technologies, which go to make up a modern railway.

Professional Formation

13 Professional formation is the necessary process of personal development, which bridges the gap between initial academic qualification and full professional status. Professional formation is derived from achievements in professional practice and other forms of skills extension. Details of applicable standards and acceptable routes of professional formation are set out in the relevant publications of IEAust, such as the following:

- "National Generic Competency Standards" for Stage 2 Professional Engineers, Engineering Technologists and Engineering Associates and for the Advanced Stage Engineer; and
- "Endorsed Graduate Development Program Incorporating Continuous Professional Assessment".

14 Work-place training played the dominant rôle in the railway industry for more than a century. The current transition to desegregated, focussed railway enterprises, not able to provide a broad range of training opportunities, has reduced the viability of work-place training. Programs and practices, which compensate must be developed if the progress of the railway industry is not to be impeded by a shortage of seasoned railway professional engineers.

15 Experience shows that if a shortage of skilled professionals does develop, those that are in practice tend to become overloaded. There arise the risks that the work will be delayed or deferred, to the detriment of the industry. Where a vacuum develops, it tends to be filled from overseas. Either overseas practitioners come into the country (not a bad thing, as they tend to import new skills) or, less advantageously, the work is exported.

Continuing Professional Development

16 Continuing Professional Development is the on-going process of personal development which creates and maintains professional status. Details of the requirements for and of applicable methods of continuing professional development are set out in the relevant publications of IEAust, such as:

- "Guidelines (for a) Chartered Professional Engineer (CPEng) applying for College Membership and Professional Registration (listing on the National Professional Engineers Register)".

Railway Engineering Professional Formation and Development

17 Whilst the generic requirements for professional formation and continuing professional development for practitioners in Railway Engineering do not differ from those applicable in other areas of practice, industry-specific suggestions as to approaches to the fulfillment of the requirements should be of assistance. These should encourage a vocational view of Railway Engineering without becoming a source of limitation or of coercion.

18 The National Generic Competency Standards of IEAust define both core units and elective units for competency. Each unit has elements and each element has performance criteria. The core units are common to Professional Engineers, Engineering Technologists and Engineering Associates. These core units are:

- Engineering Practice;
- Engineering Planning and Design; and
- Self-management in the Engineering Workplace.

19 For the Advanced Engineer, there are separate core units:

- Engineering Leadership;
- Business Outcomes; and
- Leadership of Engineering Practice.

20 For the three categories Professional Engineer, Engineering Technologist and Engineering Associate, the elective units are substantially common. For Professional Engineers and Engineering Technologists, the elective units are:

- Engineering Business Management;

- Engineering Project Management;
- Engineering Operations;
- Materials / Components / Systems;
- Environmental Management;
- Investigation and Reporting; and
- Research and Development and Commercialisation.

21 For the category of Engineering Associate, the elective units are:
- Engineering Business Management;
- Engineering Project Management;
- Engineering Operations;
- Source and Estimate Materials;
- Environmental Management;
- Change and Technical Development; and
- Technical Sales and Promotion.

22 The Appendix, hereto, consists of a listing of possible industry-specific personal and professional development opportunities relevant to practitioners of Railway Engineering. It is arranged in relation to the core units and elective units of the IEAust National Generic Competency Standards.

Rail Industry Organisations

23 The railway industry in Australia is becoming increasingly diverse. That diversity is illustrated by the railway industry categorisations appearing in the 1999 IEAust publication:
- "Engineering for Rail Sector Growth".

24 The listing of railway industry activities, below, is based on the categorisations of the publication:
- Track ownership;
- Railway operation;
- Rolling stock manufacturer and/or maintenance;
- Track construction and/or maintenance;
- Signals and communications manufacture and/or maintenance;
- General products and services supply;
- Consulting – track, infrastructure and facilities;
- Consulting – planning and operations;
- Consulting – rolling stock;
- Research – technical and non-technical;
- Education and training;
- Franchising and regulation;
- Policy Development;
- Operation of associations – industry, professional and employer;
- Other – finance, rail media, user groups, etc..

25 In the vertically integrated railway organisations of the past, most, if not all, of the activities listed above were carried out by those within the organisation. Accordingly,

practitioners with initiative could gain a breadth of experience not available in many organisations, today.

26 Clearly there is a need for formalised interchange between the organisations that make up the industry. It is recognised that such interchange will require resources for its orchestration and it will require vision and understanding to overcome possible concerns as to the proprietorship of commercial and technical information. There are considerable challenges involved.

27 Two ways of achieving interchange present themselves. Either interchange can be between organisations (lecturer visits, mentoring, RTSA Chapter activities) or it can be achieved by exchanging employees, on secondment. The exploration of these and other options is to be encouraged. Innovation will be required to overcome reluctance on the part of some who may concentrate on what they may see as the empowerment of possible competitors, thus overlooking the ultimate benefit for the business environment of the railway industry, as a whole.

28 A scheme known as "The Engineering Passport Scheme" has been proposed to allow the secondment of railway engineers to alternative employers with the purpose of broadening their experience. Such a scheme has been discussed in the U.K. and described as "a loose arrangement between railway companies that were keen to work together to provide project based learning" (to quote the 23 June 1999 issue of the IMechE journal "Professional Engineering", Page 41). The RTSA and the Institution of Engineers, Australia, are currently studying this proposal with a view to establishing the possibilities for it in Australasia.

The State of the Rail Industry

29 There is considerable opinion that the rail industry, in Australia, has reached a definitive point in its progress. There have been decades of under-capitalisation by most former (government) owners. There are current uncertainties (and opportunities) associated with industry disaggregation of ownership (a process not complete). There are serious threats to the important railway supply segment of the industry as a result of overseas competition. Government policy continues to be influential, especially in respect of major new interstate railway projects and in respect of the on-going privatisation of government-owned railways, yet government policy (state and federal) remains ill defined.

Conclusion

30 This discussion of some ways and means, towards putting the practical implementation of professional railway engineering skills development into perspective, has been based on the premise that such is desirable for the industry. Obviously there is a range of priorities for the industry. It is suggested that the maintenance and development of the specialist engineering skills, that are central to the technology that is fundamental to the industry, should occupy a position high in the ranking of priorities if the industry is to go forward.

APPENDIX

Railway Engineering Industry-specific Professional Formation and Development

Engineering Practice

Pursue a cadetship in railway engineering.

Gain experience with more than one employer in the railway industry.

Attend railway industry body meetings and conferences.

Communicate with other railway engineers.

Supervise and/or carry out structural testing, ride testing, power consumption testing, noise testing, and brake testing.

Prepare written test reports.

Engineering Planning and Design

Gain design office experience in the rail industry.

Study the relative benefits of rail and competing modes of transport in the broad economic, social and environmental context.

Develop and maintain awareness of railway industry Standards and Codes of Practice and an understanding of their relevance in practice.

Gain consulting experience in the rail industry.

Determine the specific applicability of Standards

Determine payload characteristics.

Ascertain client needs and expectations.

Assess in-service conditions.

Assess reliability, functionality, manufacturing costs, maintenance costs, whole-of-life costs, impact on the environment and indirect costs and benefits.

Asses manufacturing strategies.

Conform to client maintenance capabilities.

Adapt designs to suit the specific application.

Prepare specifications and drawings.

APPENDIX (cont.)

Prepare tender documentation.

Self Management in the Engineering Workplace

Time management.

Self development.

External courses.

Self education.

Engineering Leadership

Contribute to community awareness of the economic, social and environmental benefits of rail transportation.

Contribute to the organisation of industry bodies such as the RTSA and ARA.

Business Outcomes

Participate in Railway Safety Accreditation processes.

Participate in Quality Assurance processes.

Participate in Customer Liaison and Technical Market Surveying.

Leadership of Engineering Practice

Prepare written recommendations, business letters and reports.

Prepare, present and publish technical papers.

Engineering Business Management

Directly supervise engineering project work in the railway industry, interacting with internal and external customers, suppliers, sub-contractors and hands-on staff.

Optimise manufacturing procedures.

Optimise maintenance procedures.

Provide technical supervision for manufacture.

APPENDIX (cont.)

Provide technical supervision for maintenance.

Carry out cost/benefit analyses on alternative types of equipment.

Provide technical support for contractual negotiations with clients, manufacturers, suppliers and unions.

Participate in mentoring in the workplace.

Assess needs for training, both in the workplace and within the profession.

Plan for the provision of opportunities for post-graduate training in railway engineering.

Develop and present training both in the workplace and such as to allow access by the wider profession.

Engineering Project Management

Gain installation and equipment commissioning experience in the railway industry.

Coordinate railway engineering design and manufacturing tasks.

Commission railway installations and equipment.

Engineering Operations

Gain manufacturing experience in the railway industry.

Develop and maintain awareness of manufacturing processes.

Gain procurement and maintenance experience in the railway industry.

Prepare procurement specifications.

Assess tender submissions.

Undertake equipment faultfinding.

Implement post-manufacture modifications as required.

Assess the economic life of installations and equipment.

Materials / Components / Systems - Source and Estimate Materials

Investigate and implement the selection of materials and components.

APPENDIX (cont.)

Develop and maintain awareness of available materials and componentry.

Develop and maintain a library of technical information, including supplier catalogues.

Develop and maintain contact with materials and equipment suppliers.

Environmental Management

Design of new railways

Decontamination

Pollution control

Investigation and Reporting

Investigate and report on alternative transportation solutions.

Investigate operational incidents and service failures, reporting on causes and recommending means for prevention.

Research and Development and Commercialisation

Participate in the testing of railway installations and equipment.

Supervise or carry out field testing.

Supervise or carry out laboratory testing.

Design prototypes.

Prepare proposals to obtain research and development support.

Translate prototype designs for production.

Change and Technical Development

Plan new services.

Assess risks.

Improve productivity.

APPENDIX (cont.)

Technical Sales and Promotion

Answer sales inquiries.

Select and apply equipment.

Participate in sales and marketing activities.

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