Forecasting the Workforce Needs of the Australian Rail Transport Industry (ARTI)

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by

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Abstract

Current and emerging skills shortages within the Australian rail transport industry (ARTI) are increasingly being reported. Like many other industries, the rail sector is also having to contend with an aging workforce and further labour shortages that are likely to result from the imminent retirement of senior staff and older workers. The ARTI's heavy reliance on the skills of its personnel therefore means that such labour issues are likely to have important implications for the industry's prospective output capacity.

The development of accurate forecasting models to predict likely future trends relating to labour resources within the ARTI would therefore greatly assist the sector to anticipate its future skills needs. This paper hopes to contribute to this endeavour by presenting forecasts of future labour supply and demand within the ARTI, disaggregated by occupation. The projections are derived through a production function model which differentiates between the main occupational categories of labour as inputs, and with outputs based upon existing projections of freight and passenger transport task. Projected labour shortages and the average ages of rail workers within specific occupational groups are also determined and examined. The modelling assumptions are based on data and trends derived from primary research acquired from rail operators across the country, existing literature as well as the most recently available ABS statistics.

1 Background

The rail industry has a long standing and distinguished record of contributing to economic and social development within Australia (Hensher et al. 1994). In modern times the railways continue to be an essential component of Australia's transport system, featuring significantly in the transport of general freight, bulk commodities and passengers within states and across state boundaries. The rail transport industry (which comprises of rail operators involved in freight and/or passenger transport) is estimated to contribute 0.54% to the national GDP, representing 12.9% of output from the Australian transport industry. It is responsible for approximately 50% of the total freight tonne-kilometres moved by land transport and approximately 650 million passenger journeys annually, with the estimated passenger task being more than 11.3 billion passenger-kilometres (Productivity Commission 2006, Rail CRC 2006, Apelbaum Consulting Group 2005). In total, the Australian rail industry, encompassing rail transport, rolling stock maintenance and manufacture, consultants and signals and communications and other services, contributes 1.6% of the national gross domestic product (GDP) with an annual output of goods and services estimated to be $8 billion.

As an input into other industries, the rail industry therefore has an important influence on efficiency and competitiveness, especially in those industries with an export focus such as mining and agriculture. For example, rail freight charges constitute 15-30% of the free on board cost of coal exports in New South Wales (Productivity Commission 2000a). In total, rail contributes an estimated of $0.5 billion per year to the value of exports (Transport and Logistics Industry Skills Council [TDT] 2005). The industry is also a prominent contributor to rural and regional economies, generating substantial economic benefits through the output of goods and services worth $7 billion per annum (Rail, Tram & Bus Union [RTBU] 2004).

In recent decades, however, Australia's railway sectors have undergone significant changes. Initiatives by the Commonwealth and State/Territory Governments to promote more competition and efficiency within the rail industry have resulted in an increase in private rail activity and a decline in government ownership and management of railways (TDT 2005, Hensher et al., 1994). These deregulation policies were part of a wider microeconomic policy framework and were designed to open the rail industry to more private sector competitive forces and remove the existence of state based government monopolies (Everett 2006).

The reforms involved significant deregulation of the industry following the publication of the 1991 Industry Commission inquiry into rail transport, the 1993 Hilmer Report as well as the National Competition Policy (Everett 2006, Productivity Commission 2000a). Many of the policies that were implemented were based on a fairly broad microeconomic reform framework and involved enforcing a more commercial focus on rail operators to improve

cost recovery. The structure of railways in most Australian jurisdictions consequently changed with many of the previously integrated State rail authorities being vertically and horizontally separated. Prior to the implementation of the reforms, most railways were controlled by State specific rail organisations which managed both below and above track operations within their jurisdiction (vertically integrated) and provided a combination of urban passenger, non urban passenger and freight services (horizontally integrated). Effectively, a single government agency controlled activities such as track provision, signalling, maintenance, train operations and timetabling. The implementation of rail reforms in the 1990's however resulted in several rail networks in Australia being structurally separated (Productivity Commission 2000a).

Deregulation paved the way for the establishment of "open access" regimes which allowed competition within the rail industry by enabling competitors to have access to below track infrastructure (Productivity Commission 2000c, Everett 2006). This provision was designed to allow competition and removed the ability of state government authorities to earn monopoly rents. Following deregulation and introduction of "open access" regimes, the number of rail operators within the Australian rail industry increased from 12 in 1991 to 27 in 1999. There are presently over 30 major private rail operators in Australia compared to the 8 that existed 10 years ago (RTBU 2004).

Outcomes identified from the rail reforms introduced in the 1990's have included reduced freight rates, improvements in service quality and increased productivity (Productivity Commission 2000a, 2000c). In turn, this has been credited with enabling productivity improvements estimated to be worth more than $2 billion (RTBU 2004). The development and implementation of new technologies has also strongly contributed to productivity growth within the Australian rail industry and it is likely that this trend will continue and accelerate in the future (Rail CRC 2006). The improvements in the levels of productivity and competition experienced within the Australian rail industry have contributed to an 18% decrease in freight rates over the period spanning from 1990 to 1997 and a 30% reduction in real national freight rates from 1989 to 1998 (Everett 2006, Productivity Commission 2000b).

Another consequence of the reform process and resulting labour productivity growth has been a large scale reduction in employment in the rail industry. Employment fell by around *one half* between 1991 and 2001. The Productivity Commission estimated that the number of full time employees in the rail industry decreased from 88500 in 1986 to 36500 in 1998 (2000c). Analysis of ABS Census data (see section 3) also shows a halving of employment in the rail transport industry between 1991 and 2001. Other factors believed to be responsible for the decline in demand for rail labour include increased competition from alternative transport modes; increased contracting/outsourcing of rail operations and the redefining of labour arrangements with greater emphasis on multitasking or multi-skilling.

The Australian rail transport sector is currently facing significant constraints with regard to the availability of appropriately skilled and trained labour to meet its growth potential. Even more alarming is the fact that the situation is likely to worsen dramatically in the next two decades. As policy-makers have begun to grapple in earnest with the potential implications of an ageing Australian population on labour supply and productivity, the extraordinary run of strong economic growth since the early 1990s has reduced Australia's unemployment rate from being over 10% throughout 1992 and 1993 to currently being less than 5%. As a consequence, concern about emerging shortages of skilled labour and the constraints this may be placing on further economic growth has become widespread, as evidenced in policy statements, current political debate and frequent media reporting on the 'skills crisis'.

The Australian rail industry is a prime example of an industry facing recruitment difficulties associated with a tight labour market. However, the synopsis of skills shortages in the rail sector is far more unique and complex than that of a generally tight labour market. On the one hand, the industry has undergone a lengthy period of restructuring that has seen total employment in rail transport fall by roughly half in the decade spanning from 1991 to 2001. From this perspective, the industry might be expected to be immune to some extent from the effects of rapidly growing aggregate labour demand. On the other hand, the long term reduction in the rail workforce has reduced the need to actively cultivate sources of new entrants and to minimise wastage among existing workers. This has exacerbated the ageing of the rail workforce. Further, where employment and growth opportunities are popularly seen to be strongest in emerging technology based occupations and industries, such

as the information technology and telecommunications sector, and in tertiary services, such as health, business administration and other technical services, the rail industry suffers from being viewed as an 'old economy' sector, reducing its attraction to school leavers and graduates from post-secondary education and training.

To secure the future of the rail industry and its contribution to Australia's ongoing economic development, both industry and policy makers need to respond to these challenges with a degree of expediency. As an initial part of that response the Centre for Labour Market Research (CLMR) with support from the Planning and Transport Research Centre (PATREC), undertook research to develop projections of the future workforce demands of the rail sector. The modelling used to generate the projections is based on existing forecasts of the passenger and freight loads. Full details of the modelling methods, assumptions and results are set out in Section 3.

2 Current structure of the Australian rail industry

The Australian rail industry is very diverse in nature. The industry consists of suppliers, track access corporations, rail operators, (including those specialising in heritage, tourist, freight, passenger transport) and a diversity of other companies covering all sectors of the industry (TDT 2005). Although there are around 250 firms that are listed as being apart of the Australian rail industry, approximately 10 large rail enterprises dominate the majority of the operating and infrastructure sectors.

The majority of the companies in the Australian rail transport industry are profitable private enterprises that operate in monopolistic domestic markets (RTBU 2004). Each sector of the rail industry has unique and different corporate and community objectives (TDT 2005). Urban and passenger rail service providers offer a range of community transport services that are largely financed by a combination of government funding and passenger fares. In contrast freight and track access providers are predominantly commercial organisations focussed on making profitable rates of return and being corporately accountable for their capital investments and capital stock. Most of the organisations that were principally focused on in this study include those that are associated with one or more of the following sectors within the Australian rail Industry;

Providers of Rail Infrastructure Access

These organisations either lease or own the track they control and thus administer track access to other parties. The category also includes companies that are involved in the provision of signaling and communications. In some Australian states rail access providers own and control major rail yards and sidings used for the assembling, maintenance and repair of trains. In addition, many of these organisations may also be responsible for controlling train movements to ensure that trains that may be sharing the same track are separated, thereby effectively securing "train control". Such organisations may solely specialise in the provision of rail infrastructure access which would mean that they are 'vertically separated'. Alternatively, these organisations may be 'vertically integrated' meaning that they have ownership of train operating services in conjunction with being rail infrastructure access providers (Affleck Consulting 2003).

Rail Train Operators

These organisations can be broadly classified as being involved in "Private Railways" or "Public Railways" within the Australian rail industry. The Private Railway group includes a small number of train operators whose rail services are not available for hire and reward (Affleck Consulting 2003). These rail operators often have operations integrated with the extraction, refining and transportation of natural resources and minerals. Public railway operators offer rail services for hire and reward. These rail operators may thus be owned by both private and public sector entities. Train operators may also be categorised according to whether they are involved in the transportation of freight or passengers or a combination of both. Rail operators are referred to as being "horizontally integrated" enterprises if they are involved in the operation of both passenger and freight rail services (Affleck Consulting 2003).

Passenger train operators specialise in the provision of commuter, regional and/or tourist train services for the transportation of passengers within metropolitan areas, between capital cities and regional areas and also across states and territories. Commonly inter-urban service and urban commuter operators also manage and control ticketing, passenger stations and reservation systems (Affleck Consulting 2003).

The majority of rail freight operators in Australia are engaged in the commercial transportation of cargo, most commonly primary agricultural products and mineral resources. Often rail freight operators own and manage major rail yards and sidings. These serve numerous functional purposes including allowing for the provisioning and fuelling of trains. The rail yards and sidings also provide a base for the storage, assembly and en route management of trains (Affleck Consulting 2003). In addition, many freight operators also own and control intermodal freight terminals. There is a prevailing trend for freight operators to be increasingly integrated into multimodal and logistics entities (Rail CRC 2006).

Maintenance and Other Related Service Providers

These organisations are involved in the assembly, repair and maintenance of rolling stock including the overhaul of passenger carriages, locomotives and wagons. Rail enterprises classified within this category may also be involved in the hire and lease of wagons and locomotives. It also includes organisations involved in the provision of services related to the development, maintenance and inspection of rail track and other rail infrastructure, as well as of signaling and communications systems. A small subsection of enterprises classified in this group are also responsible for providing services related to the training and recruitment of specialised rail personnel (Affleck Consulting 2003).

3 Modelling future workforce needs

In 2007 we conducted a modelling exercise of the future supply and demand of rail workers based on employment data by industry and occupation from the 2001 Census and forecasts of output in the rail industry through to 2020. The same methodology is followed to update those supply and demand forecasts with the benefit of the 2006 Census data that has since become available. This section sets out the modelling approach; provides an analysis of the accuracy of the model and sensitivity to the assumptions by comparing our employment forecast for 2006 to the actual Census data, and presents new forecasts out to 2020.

3.1 Overview of the model

The model takes a 'tops down' approach of starting with forecasts of aggregate output of the rail sector, and working backwards to derive the labour requirements by occupation to meet that demand. To highlight potential skill shortages, these demand projections are contrasted with the likely supply of workers by occupation under a 'business as usual' scenario which takes into account the profile of the existing rail workforce, assumes a continuation of recent entry rates by occupation for the industry and applies age, gender and occupation specific net-retention rates derived from the Census data. The model therefore requires both demand and supply projections by occupation.

3.1.1 A model of labour demand in the rail industry

To illustrate the approach taken to forecasting labour demand, assume initially that there is just one homogenous output from the rail industry, which we denote Y, produced by homogenous units of labour, X. In any one period, t, then output per worker (or labour productivity) is defined by;

$$(1) \qquad l_t = \frac{Y_t}{X_t}$$

Given there is data on both output and employment in a base year it is possible to determine labour productivity. Forecasts for future output, combined with assumptions regarding changes in labour productivity, are then used to generate a forecast of total employment in each period. The distribution of employment by occupation is also known for the base year. Forecasts for employment by occupation are then derived from the forecasts of aggregate employment based on assumptions relating to the change in occupational distribution.

The basic forecasting approach is therefore straightforward. It is deriving the most plausible assumptions regarding labour productivity and the occupational distribution of employment that is more involved. It is also necessary to take account of the fact that the rail industry produces more than one type of output. The model differentiates between passenger and freight task. The data sources and the basis for each assumption are detailed below, with the resulting projections presented in Section 3.3 below.

Output forecasts

The model differentiates between freight and passenger outputs for the rail industry. Recent data and forecasts for each are taken from existing published sources. Projections for the freight task are taken from BTRE (2006), and passenger task from Apelbaum Consulting Group (2007). However, data on employment is not disaggregated between the provision of freight and passenger services in each year. For relating trends in output to employment, it is therefore necessary to translate the projected changes in the freight and passenger tasks into changes in a 'composite' index of output.

In their 2006 report *Freight measurement and modelling in Australia*, the BTRE provides forecasts of the total Australian rail freight task by single year to 2020. The task is predicted to grow by around 2.2% per annum between 2003 and 2020; increasing from 161 billion tonne-kilometres in 2003 to 234 billion tonne-kilometres in 2020 (2002, Table 1.4). Data and projections on the passenger task are provided by Apelbaum Consulting Group's publication "Australian Rail Transport Facts 2007". This contains estimates of total actual passenger kilometres (including light rail, urban and non-urban passenger) up to 2005, and forecasts to 2015 (2007: Table D1-2). To take the projected series out to 2020, we assume that the forecast trend growth rate between 2010 and 2015 continues to 2020. Under this assumption, passenger task is forecast to increase from 11.3 billion passenger-kilometres in 2005 to 13.8 billion passenger-kilometres in 2020, an average rate of growth over those 15 years of 1.4% per annum.

Total freight task is therefore projected to grow significantly faster than passenger task. In fact, the projected growth rate for freight is 50% higher than for passenger. Estimates for employment by freight and passenger available for 2003 and 2005 (ARA 2003a, ARA 2005a) show that 157 persons were employed per 1 billion tonne-kilometres of freight carried, compared to 1,422 persons per 1 billion passenger-kilometres. To generate a composite measure of output consistent with employment requirement, freight and passenger kilometres are weighted accordingly. We standardised this composite measure to equal 1 million in 1991. The projections in freight and passenger output imply a rate of growth of 1.8% per annum in weighted output from 2006 to 2020.

Labour productivity and aggregate employment

Although composite output *increased* by one-third between 1991 and 2001, total employment in the rail industry *decreased* by 47% as a result of extensive restructuring. However, that restructuring seemed to have largely run its course by 2001. Composite output increased by 2.4% per annum between 1991 and 1996 while employment fell by almost 10% per annum. Between 1996 and 2001 output grew by 3.5% per annum while employment fell 2.8% per annum. The net effect of this was labour productivity growing by 13.0% per annum between 1991 and 1996 and by 6.5% per annum between 1996 and 2001. In all, output per worker increased by an astonishing 250% in those 10 years. Between 2001 and 2006, however, composite output grew at a rate of 3.1% per annum while employment increased by 0.3% per annum, from a total of 28,875 workers in 2001 to 29,383 in 2006. This meant an increase in labour productivity over the most recent inter-censual period of 2.8% per annum, a figure much more in line with long run averages in the economy. The assumption regarding future developments in labour productivity are critical to the projected estimates for labour demand. Given that the phrase of

restructuring and rationalisation evident during the 1990s seems to have largely been finalised, we assume a trend rate of growth in labour productivity of 2% per annum from 2007 onwards. Considering that this 'trend' will embody some further industry restructuring, reforms to work practices and job redesign, technological change and economies of scale as the level of output increases, the assumption of a 2% per annum growth in labour productivity seems reasonably conservative. Despite this, the projected increases in output results in total employment remaining virtually unchanged for the remainder of this decade and slowly declining to 28,600 in 2020, from its level of 29,383 in 2006. This slight decline in aggregate employment contrasts to an increase in output over the same period of 28%.

Employment by Occupation

Having generated estimates for aggregate employment, estimates of employment by occupation then require an assumption regarding the occupational composition of employment. Past data is available on a consistent basis by ASCO categories from the 1996, 2001 and 2006 Censuses. As table 3.1 shows, there was significant change in occupational composition between 1996 and 2001, including growth in the share of managers, professionals, and associate professionals, a decline in the share of employment for tradespersons and a significant decline in the share of labourers and related workers. However, the occupational structure remained more constant between 2001 and 2006, but shows a continued general trend of 'up skilling' of the rail workforce (or possibly a greater degree credentialism).

Table 1: AUS- Employment shares by occupation, Rail and All industries, 2006

	Rail Industry					All Industries
	1996 share (1)	2001 share (2)	2006 share (3)	Change in share (2)-(1) % pts	Change in share (3)-(2) % pts	2006 Share
1. Managerial	2.9%	4.9%	5.7%	2.0%	0.8%	9.2%
2. Professionals	4.9%	7.4%	9.7%	2.5%	2.3%	19.6%
3. Associate Professionals	6.4%	8.7%	8.8%	2.3%	0.1%	12.2%
4. Tradespersons	14.2%	11.0%	11.0%	-3.2%	0.0%	12.3%
5. Advanced Clerical & Service Workers	1.5%	1.8%	1.7%	0.3%	-0.1%	3.2%
6. Intermediate Clerical & Service Workers	10.6%	11.4%	9.9%	0.8%	-1.5%	17.2%
7. Intermediate Production & Transport Workers	31.7%	31.5%	30.2%	-0.2%	-1.3%	8.2%
8. Elementary Clerical, Sales & Service Workers	12.9%	13.6%	15.0%	0.7%	1.4%	9.6%
9. Labourers & Related Workers	15.0%	9.8%	8.0%	-5.2%	-1.8%	8.5%
Total	100.0%	100.0%	100.0%			100.0%

To arrive at a distribution for 2011, consistent with the approach for labour productivity, we first assume that the structural reform process had largely run its course by 2001, but that the trend of up skilling continues at half the rate of change that occurred between 2001 and 2006. We also take into account information collected in the in-depth interviews with rail operators conducted in 2006 on what changes they expected in their workforce in the coming five years. Based on a general consensus of the views expressed across operators, occupational groups are assigned further changes in their share of either +1, +0.5, 0, -0.5 or -1 percentage points by 2011, with the compositional change occurring linearly for the years in between. From 2011 onwards, changes in occupational shares are based on estimates of the effect of scale on employment demand. In the in-depth interviews, respondents were asked to indicate how employment within each occupational category would change if there

was a 50% increase in output. The average responses are used to provide an estimate of the elasticity of employment with respect to output (remember that this impacts upon shares only – aggregate employment is already determined through projected output and labour productivity). We believe these economies of scale effects will be important and can be justified because increases in output in the rail industry are likely to lead to a higher scale of operation for existing operators rather than new operators entering the market, due to low marginal costs and falling average costs with output levels. These estimated elasticities range from a low of between a 6 to 8% increase in employment for professionals, clerical and sales workers and managers resulting from a 50% increase in output, to a high of a 36% increase in employment for intermediate transport and production workers (which includes drivers, controllers and signallers, other plant and machine operators).

3.1.2 A model of labour supply and population ageing

Projections of labour supply by occupation are calculated separately by occupation, age and gender starting from the base year of 2006, the most recent year that such detailed data is available. The projections require assumptions to be made regarding the number of persons recruited to the rail industry at entry-level, and net retention rates. The trends in employment in the rail industry cannot be used as a realistic guide for these assumptions because of the significant restructuring and labour shedding that occurred between 1991 and 2001. As discussed above, employment in the rail industry stabilised somewhat between 2001 and 2006, and our output and employment projections show rail employment remaining relatively constant from 2006. However, it is still likely that recent trends for the economy as a whole will provide a better yardstick for future retention rates in the rail industry, rather than rail specific ones.

The approach taken can be illustrated as follows. Note that the Census data on employment by occupation has been collated by 5-year age groups — 15-19 year olds, 20-24 year olds, and so on to 60-64 year olds. Persons 65 and over make up the final category. Note also that the Census is taken every five years. Thus all persons who were in the 25-29 year age group, for example, in the 2001 Census, must have been in the 30-34 year age group for the 2006 Census. It is thus possible to calculate the net retention rate from one Census to the next. This is a 'net' rate in that it that it represents the balance between wastage rates (leaving the labour force through retirement, disability, temporary non-participation in the labour force or workers changing to a different occupation, out-migration) and entry rates (new entrants, people returning from outside the labour force, people entering the occupation from a different occupation, inward migration).

These net retention rates from 2001 to 2006 are calculated separately by occupation (at the major group level), age and gender for all Australian workers. As would be expected, the net retention rates vary significantly by gender and age. They are very high for 20-24 years olds as persons from the 15-19 cohort enter the labour market. Beyond that they decline steadily over the life cycle for males, such that for 45-49 years olds there is net wastage. They range from +11.3% for 20-24 year olds to -31.8% for 55-59 year olds. For women, there is a peak at around 13% as women in their early 40s re-enter the labour force, with net wastage occurring from age50-54 on. The proportion of people employed in lower skilled and manual occupations also falls with age. Using the profile of employment by occupation, age and gender for the rail industry in the 2006 base year, it is then a simple mechanical matter to generate the projected workforce profile every fifth year from 2011 onwards, with the intervening years estimated through linear interpolation. The strength of this approach is that it explicitly takes into account the older average age of the rail workforce, as well as its specific gender and occupational distributions.

The remaining assumption needed to complete the forecasting exercise relates to the number of new recruits at entry level. Given that employment levels in the rail industry are estimated to be very similar for 2011 as for 2006, it seems reasonable to assume that the training and recruitment levels will also have remained roughly constant. In each occupational group in the rail industry, the number of 20-24 year olds in 2006 is much higher than the number of 15-19 year olds. Therefore it is assumed that the number of employees in the age group 15-19 and 20-24 is constant at the 2006 level as an estimate of the training rate in each year. This is in contrast to the alternative of holding the 15-19 year old intake constant and applying the net retention rate estimates to generate the figure for 20-24 years olds in subsequent years. This latter approach is unlikely to reflect actual

training and recruitment practices in the rail industry, particularly for more skilled occupations in which many people will not complete their qualifications until after they have turned 20.

3.2 Review of previous forecasts

Before presenting the forecasts using the 2006 data, it would be constructive to review how well the model preformed in projecting 2006 outcomes based on historical data up to and including the 2001 Census data, as reported in Mahendran, Affleck and Dockery (2007). Although we had more recent output estimates, we were essentially forecasting aggregate employment and employment by occupation five years ahead. The assumptions regarding future developments in labour productivity were critical to the projected estimates for labour demand. In all, output per worker increased by a factor of just over $2^1/_2$ in the 10 years from 1991 to 2001. We correctly argued that such a restructuring process could not continue indefinitely. Given that the rate of growth in labour productivity halved from 1991-96 to 1996-2001, we assumed a further halving of the rate of growth in labour productivity to 3.25% per annum between 2001 and 2006. In the event, it turned out the labour productivity growth decelerated even further to a rate of 2.8% per annum between 2001 and 2006, leading to a slight underestimate in total employment in the model.

The modelling was intended to forecast skills shortages, defined as the excess of projected demand over projected supply, rather than actual employment levels *per se*. As noted in the report, the resulting employment level would depend on how the economy adjusts. A shortfall in labour supply may lead to greater recruitment on the one hand, or it may lead to rail freight and passenger prices rising and services deteriorating, such that there is a substitution away from rail towards road and other forms of transport. Estimating actual employment outcomes would require a full computable general equilibrium model of the economy. By and large however, it could be anticipated that actual employment levels in 2006 should fall between the supply and demand estimates if the model performed accurately. Given the large structural changes that had occurred in the rail industry up to 2001, Table 2 shows that the forecasting model performed well in predicting the changes in both aggregate employment and employment by occupation five years ahead.

Table 2: Actual and projected employment by occupation for the rail industry

	2001	Projections for 2006		2006
	Actual	Supply	Demand	Actual
Managerial	1418	1423	1629	1671
Professionals	2136	2311	2942	2859
Associate Professionals	2520	2531	2730	2600
Tradespersons	3164	2989	3128	3228
Advanced Clerical, Sales & Service Workers	519	507	538	498
Intermediate Clerical, Sales & Service Workers	3279	3334	3242	2895
Intermediate Production & Transport Workers	9097	8516	8660	8871
Elementary Clerical, Sales & Service Workers	3925	4181	3846	4411
Labourers & Related Workers	2817	2563	1965	2350
Total	28875	28357	28679	29383

Table 3 presents two other comparisons between the model's assumptions and the actual outcomes made available through the 2006 census. The assumptions regarding occupational share within the rail industry were based on a combination of a projection of trend between 1996 and 2001 and information provided in questionnaires sent out to rail operators in the second half of 2006. It can be seen that the forecasts again performed remarkable well over such a time horizon.

Table 3: Actual and projected occupational shares and average age for the rail industry

	Occupational share			Average age		
	Actual		Projected	Actual		Projected
By Occupation (share)	**2001**	**2006**	**2006**	**2001**	**2006**	**2006**
Managerial	4.9%	5.7%	5.7%	44.0	44.9	47.5
Professionals	7.4%	9.7%	10.3%	40.3	40.4	42.2
Associate Professionals	8.7%	8.8%	9.5%	42.0	43.5	44.7
Tradespersons	11.0%	11.0%	10.9%	40.0	40.3	41.9
Advanced Clerical & Service Workers	1.8%	1.7%	1.9%	38.6	39.8	42.3
Intermediate Clerical & Service Workers	11.4%	9.9%	11.3%	41.2	42.8	44.4
Intermediate Production & Transport Workers	31.5%	30.2%	30.2%	43.0	44.6	46.3
Elementary Clerical, Sales & Service Workers	13.6%	15.0%	13.4%	39.3	41.4	42.2
Labourers & Related Workers	9.8%	8.0%	6.9%	41.9	43.6	44.3
Total	100.0%	100.0%	100.0%	41.6	42.8	44.4

Finally, Mahendran et al 2007 also noted the problem facing the rail industry of an old and rapidly aging workforce. This was largely attributed to the extended period of rationalisation up until 2001, in which firms were likely to have undertaken limited recruitment at the entry level while having to reduce their overall workforces. As a result, it was observed from the 2001 Census data that a high proportion of the workforce was due to retire in the near future, with relatively few younger workers in the pipeline to replace them. The supply side projections forecast continued rapid increases in the average ages by occupation. The 2006 census data does show the rail workforce to have aged further, but on a positive note for the industry, the increase has not been as pronounced as the projections had suggested. The mismatch was largely not so much due to higher entry level recruitment, but higher than average retention net rates in the 25 to 39 age groups, particularly among professionals, intermediate transport workers and clerical staff; combined with older workers leaving the rail industry more rapidly than was projected from economy wide trends.

3.3 The Modelling Results

The final results are shown in table 4. Total employment (demand) in the rail transport industry is forecast to rise initially to 2010 due to robust forecasts for output growth, but then to contract steadily to be around 28,600 (783 persons lower than in 2006) by 2020 as a slower rate of output growth is more than offset by the trend increase in labour productivity. In contrast, applying the retention rates observed for all industries by occupation, gender and age to the rail workforce's current profile and recruitment levels suggests the supply of workers will fall to 27,160 persons by 2020. The projected shortfall in supply relative to demand is predicted to grow steadily starting from 2007 to reach 1,441 persons in 2020.

Given total employment demand is forecast to moderate slightly we believe the output and employment demand projections are quite conservative. This suggests that the factors most likely to lead to labour shortages in the rail industry lie on the supply side. The declining supply projections result from both the assumptions used and the current profile of the rail workforce. With respect to the assumptions, addressing the shortfall will require the industry to significantly increase their entry level recruitment over 2001 levels, or else achieve much higher retention rates of older workers relative to other industries. The model indicates that entry rates to the rail industry in the 15-24 year old age groups would need to have been around 25% greater than was the case in 2006 levels to balance the demand and supply projections. The levels observed in recruitment levels in 2001 were likely to have been suppressed due to the prior periods of labour shedding, however, only a small increase (around 2.5%) was observed between 2001 and 2006. In the current climate of very tight labour markets and the resources boom, it seems unlikely that the rail industry could expand recruitment levels by the required degree necessary to avoid ongoing shortages. The option of doing so by substantially increasing the wages and conditions on offer at entry level seems unrealistic given that the degree of price competition the industry faces from other transport modes. Increases in wages at entry level will also inevitably eventually flow on to some degree to incumbent workers.

The more important supply-side factor lies in the simple reality of the ageing, male-dominated rail workforce and hence the high expected wastage rates of exiting workers over the coming 15 years. As noted in Table 3, the average age of all workers in the rail transport industry in 2006 was 42.8 years. Under the supply projections, this increases to 48.0 by 2021 (see Table 6). Although our past projections overestimated the degree of aging between 2001 and 2006 due to a more rapid rate of retirement of older workers from the rail industry than is the case for the labour force more generally, this as both positive and negative connotations for the outlook for the rail industry. On the plus side the workforce may not age as rapidly as the forecasts predict. But on the negative side, a higher rate of retirement among older workers than we have assumed means that shortages will be even more acute than predicted. Even with the hypothetical increasing of the intake of 15-24 year olds by the 25% that is required to balance the supply and demand projections, the average age of rail workers still increases to 47.0 years.

Table 4: Rail workforce projections

	1996[a]	2001[a]	2006[a]	2011[p]	2016[p]	2020[p]
Rail output forecasts						
Freight (billion tonne-kms)	110.25	136.91	174.95	195.96	217.03	234.06
Passenger (billion passenger-kms)	10.12	11.40	11.58	12.77	13.32	13.84
Index of weighted output (millions)	1.12	1.34	1.56	1.73	1.88	2.00
Output per worker	33.7	46.3	53.0	58.5	64.6	69.9
Total employment (persons)	33295	28875	29383	29631	29084	28600
Occupational share						
Managerial	2.9%	4.9%	5.7%	6.9%	6.8%	6.7%
Professionals	4.9%	7.4%	9.7%	11.1%	10.9%	10.7%
Associate Professionals	6.4%	8.7%	8.8%	8.6%	8.5%	8.5%
Tradespersons	14.2%	11.0%	11.0%	10.2%	10.1%	10.0%
Adv. Clerical & Service	1.5%	1.8%	1.7%	2.1%	2.0%	2.0%
Int. Clerical, Sales & Service	10.6%	11.4%	9.9%	9.3%	9.2%	9.1%
Int. Production + Transport	31.7%	31.5%	30.2%	27.7%	28.6%	29.3%
Elem. Clerical, Sales & Service	12.9%	13.6%	15.0%	16.2%	16.0%	15.8%
Labourers & Related Workers	15.0%	9.8%	8.0%	7.9%	7.9%	7.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Demand by occupation (persons)						
Managerial	971	1418	1671	2036	1971	1918
Professionals	1618	2136	2859	3279	3164	3069
Associate Professionals	2123	2520	2600	2563	2486	2421
Tradespersons	4721	3164	3228	3021	2936	2865
Adv. Clerical & Service	498	519	498	617	596	579
Int. Clerical, Sales & Service	3516	3279	2895	2761	2668	2591
Int. Production + Transport	10558	9097	8871	8209	8316	8381
Elem. Clerical, Sales & Service	4293	3925	4411	4811	4648	4513
Labourers & Related Workers	4998	2817	2350	2335	2298	2264
Total	33295	28875	29383	29631	29084	28600
Supply by occupation (persons)						
Managerial	971	1418	1671	1689	1624	1512
Professionals	1618	2136	2859	3131	3356	3452
Associate Professionals	2123	2520	2600	2571	2476	2330
Tradespersons	4721	3164	3228	3231	3184	3095

Adv. Clerical & Service	498	519	498	501	490	469
Int. Clerical, Sales & Service	3516	3279	2895	2804	2666	2471
Int. Production + Transport	10558	9097	8871	8817	8415	7695
Elem. Clerical, Sales & Service	4293	3925	4411	4386	4302	4100
Labourers & Related Workers	4998	2817	2350	2300	2192	2035
Total	33295	28875	29383	29430	28706	27160

Table 4: Rail workforce projections (cont'd)

	1996[a]	2001[a]	2006[a]	2011[p]	2016[p]	2020[p]
Projected shortage – persons (Demand minus Supply)						
Managerial			0	-347	-347	-406
Professionals			0	-147	192	383
Associate Professionals			0	8	-9	-91
Tradespersons			0	210	248	230
Adv. Clerical & Service			0	-116	-106	-110
Int. Clerical, Sales & Service			0	42	-2	-120
Int. Production + Transport			0	608	99	-686
Elem. Clerical, Sales & Service			0	-425	-346	-413
Labourers & Related Workers			0	-35	-106	-229
Total			0	-201	-377	-1441
Projected shortage - % of projected demand						
Managerial				-17.0%	-17.6%	-21.1%
Professionals				-4.5%	6.1%	12.5%
Associate Professionals				0.3%	-0.4%	-3.7%
Tradespersons				7.0%	8.5%	8.0%
Adv. Clerical & Service				-18.8%	-17.8%	-18.9%
Int. Clerical, Sales & Service				1.5%	-0.1%	-4.6%
Int. Production + Transport				7.4%	1.2%	-8.2%
Elem. Clerical, Sales & Service				-8.8%	-7.4%	-9.2%
Labourers & Related Workers				-1.5%	-4.6%	-10.1%
Total				-0.7%	-1.3%	-5.0%

Notes: a. actual, p. projected.

Projections by occupation

The projected balances by occupation are given in the final panels of Table 4 expressed in both the number of persons and as a percentage of projected demand (a positive figure indicates a projected surplus of workers and a negative figure a shortage). The most significant shortages arise with respect to managers, advanced clerical and service workers and elementary clerical and service workers. These arise because their occupational shares are forecast to increase and because of low retention rates expected for these occupations - in the case of managers because the occupation is dominated by older males. Table 5 illustrates the importance of the age profile of the workforce in determining these projected shortages. In the case of managers the average age is projected to reach 52.5 years by 2021. By 2021 the largest shortage (in terms of the number of workers) is projected to materialise for Intermediate production and transport workers, for who the projected average age is also over 50.

Table 5: Average age by occupation, rail workforce projections

	2001[a]	2006[p]	2011[p]	2016[p]	2021[p]
Managers	44.0	44.9	47.8	50.4	52.5
Professionals	40.3	40.4	42.2	43.9	45.0
Associate Professionals	42.0	43.5	45.8	47.4	48.1
Tradespersons	40.0	40.3	41.6	41.9	41.4
Adv. Clerical & Service	38.6	39.8	41.4	42.4	42.3
Int. Clerical, Sales & Service	41.2	42.8	45.4	47.1	47.7
Int. Production + Transport	43.0	44.6	47.7	49.9	51.3
Elem. Clerical, Sales & Service	39.3	41.4	44.5	47.0	48.6
Labourers & Related Workers	42.1	43.6	46.2	47.9	48.7
Total	41.6	42.8	45.4	47.2	48.0

Notes: a. actual, p. projected.

One further caveat on the modelling is that 2006 is used as the base year and thus actual employment data are implicitly taken to represent both supply and demand (i.e. a 'balanced' labour market). This may well not be the case since with the tight labour market in that year many of the occupations may in fact already be in shortage. This is highlighted by the views expressed by rail operators in the 2006-2007 study who identified shortages amongst tradespersons, drivers and managers. Most of the respondents, including 17 of the total of 24 rail operators who were interviewed believed that they were likely to experience skill shortages in at least one occupational group in the future. Shortages of tradespersons were singled out as being a result of strong demand associated with the resources boom. Our projections suggest a surplus of tradespersons over the coming 15 years, but this may be because the figures were artificially reduced by an existing shortage in 2006.

4 Conclusion

Considering the labour shortfalls forecast to occur amongst managerial staff, labourers as well as advanced and elementary clerical, sales and service workers within the rail sector over the next 15 years, there appears to be a definite need to significantly increase recruitment within these occupational groups. According to the projections, there will also be a need for rail operators to recruit a higher number of intermediate production and transport, associate professional and intermediate clerical, sales and service personnel in the longer term due to the predicted shortages that are expected to occur within these occupational groups down the track in 2020. Based on the forecasting results, it is likely that rail operators will also require more professional staff to ease expected shortages within this occupational group that are projected to occur in the short term. With regard to Managers and intermediate and production transport workers in particular, it seems it would be prudent for rail employers to focus on attracting and retaining younger recruits, given the comparatively high projected average age of workers within these occupational groups, with the average age of employees in both these occupational groups predicted to be over 50 by 2021.

The ageing of the industry's workforce is also likely to mean more workers in the sector will face a range of health issues. This includes such things as diminished hearing, sight, reactivity, impaired movement and the increased prevalence of age related diseases such as Type 2 Diabetes. All these may adversely impede the ability of employees to work efficiently, thereby contributing to reduced productivity and other labour problems. The relevance of this is particularly pertinent to the rail transport industry due to the physical nature of the work undertaken by the majority of employees, the stringent health and safety standards that have to be met and the often high risk work environment that much of the workforce is exposed to.

Due to the high proportion of older rail workers occupying positions of seniority, their eminent departure from the workforce due to retirement or other reasons is likely to result in a substantial loss of industry experience and expertise. This is of particular concern in a number of key rail occupations and is especially pertinent considering that there is likely to be an insufficient pool of adequately experienced and skilled workers available to replace them. The loss of experienced workers will also mean there will be a lack of mentors to effectively train and develop the younger workers. A lack of effective workforce planning and training of younger rail workers by Australian rail operators can thus be identified as having contributed to the skilled labour shortage currently being experienced by the industry nationally.

In addition, the rail transport sector is now facing very tight labour market conditions brought about by the booming Australian economy. The demand for both skilled and unskilled labour within the Australian market is currently quite intense and competitive, and looks like remaining this way for some time to come. Many competing industries have already made significant progress towards ensuring their skill needs are met and so in this regard the rail industry could be viewed as being behind in developing effective strategies to tackle the issue. As other competing industries seek to improve their practices and strategies for attracting and retaining workers in the future, the challenge facing the rail sector to ensure it has an adequately qualified workforce is likely to become even more difficult. The rail industry therefore has to contend with being in the arduous predicament of having to compete for an ever declining portion of the available labour market.

The skills crisis facing the rail sector is likely to be further exacerbated by the realisation that the industry has been largely unsuccessful in attracting new recruits. The problem is also complicated by the fact that, in the past, the rail industry has enjoyed the benefits of having a very loyal, passionate and dedicated workforce who have had a largely “cradle to grave” perspective on a career in the rail industry. This combined with the prevalence of traditional rail families helped to ensure sufficient numbers of recruits could be attracted and retained to continue working within the industry on a long term basis. However in recent times with the decline in traditional rail families and the changing employment attitudes of younger workers, much of the appeal that was once associated with a career in the rail industry has been diminished.

As has been identified elsewhere, (see, for example, Department of Education, Science and Training 2006) the image of careers within the rail industry needs to be improved in order to attract young workers. Factors identified as negatively impacting on the attraction and recruitment of workers into the rail transport sector included such things as the lack of clear career pathways, the industry image (i.e. as old, dirty and unsophisticated) and specific issues relating to the employment of younger workers (such as the attitudes of most “Generation Y” employees concerning the traditionally hierarchical nature of most rail workplaces). It would also be productive for the industry to address the entrenched gender segregation that exists with regard to the major semi-skilled occupations in the sector. Currently, half of the potential supply of young workers is effectively excluded from major rail occupations, such as driver and intermediate plant operator positions, due to the almost complete domination of males within these occupations. Policies to address this imbalance are likely to include greater flexibility in working hours, combined with other family-friendly working arrangements and a visible antidiscrimination regime.

The significant amount of recruitment that is required of younger rail workers (especially in the under 25’s age group) to accommodate the demand projections for the future therefore seems particularly hard to achieve, given the current labour market conditions. Thus, the industry may need to look to other solutions, including expecting to have to pay increasingly high wage premiums to secure skilled workers in engineering and the trades, at least for the duration of the booms currently occurring in the resource, building and construction industries. However, one still senses there is a largely “business as usual” attitude amongst rail employers, albeit within a more difficult recruiting environment, rather than a sense of urgency for longer term planning to increase entry rates of younger workers into the industry. Consequently there are reasons to be concerned that the rail transport industry is not well placed to meet its future skills needs. This is especially alarming since, even if major policy reforms were implemented within the rail sector, these are unlikely to have a substantial effect on overall domestic labour supply for several years to come.

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