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TITLE: Revisions and Update: Productivity of Australian Railways 1971/72 to 1991/92

ABSTRACT: This paper revises the findings of the Productivity of Australian Railways study released by ITS in 1992. The findings were released as Research Report ITS-RR-92-1, as Working Paper ITS-WP-92-7 and as a paper published in the proceedings of the 17th Australasian Transport Research Forum. The revisions include: the inclusion of South Australia's urban passenger services, review of supply side measures of output, a revised measure of capital utilisation, and update of the database to include the latest available information for 1991/92.

The paper is in two sections: Section 1 contains an explanation of the revisions and update; while Section 2 contains the results of the revisions and update including a revision of TFP figures and models presented in ITS-WP-92-7 and tables of revised data and TFP measures.

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SECTION 1

EXPLANATION OF REVISIONS AND UPDATE

1. INTRODUCTION

Following release of a research report (ITS-RR-92-1) and working paper (ITS-WP-92-7) detailing the Institute of Transport Studies' study of the productivity of Australian railways, and presentation of results at the 17th Australasian Transport Research Forum in October 1992, several revisions have been made. These include:

- Revision of the measure of capital utilisation
- Inclusion of South Australia urban passenger train services data
- Review of the supply side output measure: introduction of carrying capacity tonne kms for freight and seat kms for passenger service
- Update of the database to include latest financial year 1991/92 data

Each of these revisions is explained below. The results of the revisions, the revised TFP figures, are presented in Section 2. Revised data tables are also included in Section 2.

2. CAPITAL UTILISATION

Two methods are available to measure use of capital in the railways: the cost recovery factor (CRF) method, and the depreciation and opportunity cost method.

Cost Recovery Factor (CRF)

For this project we originally adopted the cost recovery (CRF) method. We applied the CRF to assets existing at the beginning of the study period, using n=12.5, to represent that these assets had reached their half life. For new capital expenditure each year, the CRF used n=25 to indicate new expenditure had a full-life of 25 years.

CRF is used to produce a capital flow for assets existing at the beginning of the study period, and for assets purchased each year of the study period. Using CRF, capital flow from assets existing in July 1971 is identical for each year. However, each year's new capital expenditure produces a different capital flow, which is the same for each remaining year in the study period (for instance, capital expenditure of $47 million in 1971/72 has a flow of $4.03 million for each year in the study period, while capital expenditure of $120.3 million in 1983/84 has an annual flow of $10.32 million - all in $1971 constant).

We assumed that CRF remained constant throughout the study period, ie that the real rate of interest was 7% for investment at the beginning of the study period in 1971/72 and the same for investment at the end of the period in 1990/91.

Depreciation and opportunity cost method

The depreciation and opportunity cost (DOC) method involves taking existing capital stock at the beginning of the year, applying depreciation of 8% then adding new capital expenditure during the year to obtain end of year capital stock. An opportunity cost of 7% is then applied to end of year stock. Capital flow in any year is equal to the depreciation plus opportunity cost in that year. We assume that opportunity cost remains the same over the study period.

This method assumes that capital flow is proportional to capital stock. Service price per unit of capital is 0.15 (depreciation rate + opportunity cost rate). It is constant over time. More detailed studies vary the service price of capital over time to reflect changes in tax arrangements. We are ignoring the possibility of capital gains from new expenditure because data is not available. Technically, the value of scrapped or obsolete capital should also be included in the calculation. However this was omitted due to the very low values.

Both the CRF method and the depreciation and opportunity cost method are technically correct but produce different indications of quantities and trends in capital use. For instance, the CRF method produces a capital flow for NSW of $234.3 million in 1990/91 (in $1971), steadily increasing each year from $95.5 million in 1971/72, whereas the DOC method gives $162.5 million in 1990/91 from $115.8 million in 1971/72 (with the lowest flow in 1974/75 then increasing).

Following discussions with other rail productivity researchers, we have decided to change from the CRF method to the depreciation and opportunity cost (DOC) method of calculating use of capital in the revisions. The DOC method is more transparent than the CRF method and is more widely accepted as standard practice in Australia. For instance it is the method the Industry Commission uses for calculating capital flows.

3. SA URBAN PASSENGER TRAIN SERVICES

In the original research, we noted that urban passenger train services for South Australia were excluded from the statistics from 1977/78, the year in which Australian National assumed control of SA's non-urban passenger services and urban train services became the responsibility of the State Transport Authority (STA). This followed the convention established by the Australian Railway Research and Development Organisation (ARRDO), which was the source of the earlier data.

At the 17th Australian Transport Research Forum in October 1992 where the study's findings were presented, the omission of the urban passenger statistics was criticised. In response, the relevant data on SA has been added to the dataset.

In keeping with the original research report, the source of the SA urban data from 1977/78 is listed below. All data up to 1977/78 is sourced from ARRDO.

Inputs

Labour (number of staff): STA annual reports

Labour ($cost): Estimated from average labour expenses (including overheads) per STA employee (including buses and trams) for 1977/78 to 1984/85. STA annual reports used for 1985/86 to 1990/91

Energy (megajoules): all energy is diesel distillate, litres of liquid fuel for 1977/78 to 1982/83 estimated by ITS, 1983/84 to 1990/91 sourced from STA annual reports
Energy expenditure: STA annual reports. Data for 1971/72 to 1976/77 does not correspond to ARRDO data p. 122

Materials expenditure: 1977/78 to 1985/86 estimated by ITS, 1986/87 to 1989/90 data sourced from annual reports, 1990/91 estimated by ITS

Capital expenditure: 1980/81, 1983/84, 1985/86, 1987/88 to 1990/91 sourced from STA annual reports, remaining years estimated by ITS. Note: opening balance of capital of $30,855,941 transferred to STA on 30 March 1978. Due to the confusing presentation, capital expenditure for 1986/87 to 1990/91 was verified from Railway Industry Council working papers (mimeo)

Outputs

Urban passenger numbers: sourced from STA annual reports (passenger journeys)

Urban passenger revenue: 1977/78 to 1980/81, 1983/84, 1985/86 to 1990/91 sourced from STA annual reports; 1981/82, 1982/83 and 1984/85 estimated by ITS

Train kms: estimated by ITS from vehicle kms
Route kms: sourced from STA annual reports

Other

Labour expense per employee: estimated from average labour expenses (including overheads) per STA employee including buses and trams for 1977/78 to 1984/85, 1985/86 to 1990/91 sourced from STA annual reports

Coaching stock: sourced from STA annual report

Managerial change
1977/78: responsibility for management and operations of SA urban passengers transferred to State Transport Authority (STA), South Australia
1980/81: appointment of Mr J.V. Brown as General Manager STA

Technological change
1987/88: introduction of 3000 class diesel electric railcars

4. SUPPLY SIDE OUTPUT MEASURES

The original research used trains kms as the supply side measure of output. However, it was decided it was important to disaggregate into at least passenger and freight supply side measures.

Passenger trains: seat kms

Seat kms is the product of carriage kms and weighted average seats per carriage. Where carriage kms was not available from the statistics it was estimated by multiplying passenger train kms by the weighted average carriages per train. Data was sourced from annual reports (including statistical appendices).

Freight trains: carrying capacity tonne kms

The statistical equivalent of seat kms for freight is carrying capacity tonne kms, which is the product of wagon kms and average carrying capacity per wagon, while wagon kms is the product of freight train kms and average wagons per freight train. There was a poor correlation between freight train kms and capacity tonne kms for NSW, probably due to increasing train length and increasing average carrying capacity (per wagon). Thus carrying capacity tonne kms (CCTKM) was calculated and used as the supply side measure of freight output.

Data items were sourced from annual reports (including statistical appendices), and from the ARRDO Supplementary Paper No. 1 1981 Report on Rail.

5. SOURCE OF 1991/92 DATA

The original study results covered the period 1971/72 to 1990/91. Another year of data, for 1991/92, was added as an update when other revisions were made to the data. The source of the extra data is noted, in keeping with the previous report.

The revised and updated data tables mentioned below are reproduced in Section 2.

Inputs

Number of staff — Input Table 1

NSW	1991/92 data was from the SRA 1991/92 Annual Report (p. 77).
Victoria	1991/92 data not available (hereafter na) in PTC 1992 Annual Report. Data from 1987/88 to 1991/92 revised according to data from Peter Ferris, Australian Railway Unions in *TPW Policy Perspectives '92*.
Queensland	1991/92 data was from the Queensland Railways 1991/92 Annual Report (p. 60).
South Australia	1991/92 data was from the ANRC 1991/92 Annual Report and is total staff (excludes Made Availables) (including mainland freight, passenger and Tasrail staff) (p. 69). Data for STA (SA) rail operations na in STA 1991/92 Annual Report. STA data estimated by IDM based on p. 50 of Annual Report.

Western Australia — 1991/92 data was from the Westrail 1991/92 Annual Report (p. 65) (full-time equivalents at 30 June) and Transperth 1992 Annual Report (p. 66) (train services staff numbers at 30 June). Transperth numbers probably undercount, as proportion of corporate services not included.

Total labour expenses — Input Table 2a, b

Using the total wages, salaries and other labour expenses data, the labour expenses per employee can be calculated by dividing total costs by the total number of staff.

NSW — 1991/92 data na in SRA 1991/92 Annual Report. Supplied by IDM.

Victoria — Cost per employee derived from PTC 1991/92 Annual Report (p. 17, 36) then multiplied by number of staff.

Queensland — 1991/92 data was from Queensland Railways 1992 Annual Report (p. 45). Note updated 1990/91 labour costs in 1991/92 Annual Report.

South Australia — The 1991/92 AN Annual Report carries a footnote to its statistical series, thus: "Labour and related expenses from 1987/88 revised to make series consistent with prior years". It is also apparent that revisions were made for other reasons. It was decided for the sake of consistency with the AN 1991/92 Annual Report, to revise the ITS series.
1991/92 data from STA (SA) Annual Report (p. 85 labour expenditure train services).

Western Australia — No labour cost data in Westrail 1992 Annual Report. From Transperth 1992 Annual Report, calculate average cost per Transperth employee as expenditure on salaries and wages plus other staffing costs (p. 44) divided by actual full-time equivalent Transperth employees (p. 36) [assume that labour costs of Westrail staff are not included in Transperth labour bill]

Megajoules — Input Table 3

Two types of fuel use are quantified: diesel distillate and electricity. They have been reduced to the common measure of the Joule. Conversion factors are made common to all systems and are taken from an Energy Authority of NSW's *Energy Survey Information Sheet* (Energy Authority of NSW 1982):

- Automotive distillate: 38 Megajoules per litre
- Electricity: 3.6 Megajoules per kilowatt hour

Litres of liquid fuel — Other Table 3

NSW — 1991/92 data estimated by multiplying diesel train kms by 6.41 L/km. Seems low compared to previous years, but is due to decrease in diesel passenger train kms (due to decrease in journeys

	arising from deregulation of airlines and coach companies), and decrease in freight kms of over a third (arising from big drop in grain haulage, also longer, heavier trains).
Victoria	Supplied by IDM (based on train kms multiplied by 4.38 L/km).
Queensland	Estimated by IDM based on non-electric train kms multiplied by 5.9 L/km. There was a substantial drop in freight train kms in 1991/92.
South Australia	1991/92 data from 1992 AN annual report, p. 2 "fuel: litres per 1000 NTK" multiplied by NTK (freight). STA data estimated by IDM based on engine kms multiplied by 2.77 L/km.
Western Australia	1991/92 data from Westrail 1992 annual report, p. 30 "overall diesel fuel usage" (calculated from 2.6% decrease from previous year of 1.34 million litres). 1991/92 data from Transperth 1992 annual report, p. 13 "litres of diesel for train services", also (p. 66 - diesel). Data back to 1987/88 available on p. 66

Kilowatt hours of electricity — Other Table 4

NSW	1991/92 data estimated by multiplying kms by 20.44 kwh. 1990/91 data revised.
Victoria	1991/92 data estimated by multiplying suburban train kms by 20 kWh per km.
Queensland	Estimated by IDM based on electric train kms multiplied by 22 kWh/km.
South Australia	No electrification.
Western Australia	From Westrail 1992 annual report, see energy use table on p. 30. 1991/92 data from Transperth 1992 Annual Report (p. 66).

Energy expenditure — Input Table 4a,b

NSW	No data in SRA 1992 Annual Report. Supplied by IDM.
Victoria	1990/91 and 1991/92 data estimated by IDM.
Queensland	1991/92 data is from the Queensland Railways 1991/92 Annual Report (p. 45 distillate fuel, electricity).
South Australia	1991/92 data from AN 1991/92 Annual Report (estimated from bar chart p. 13). 1991/92 data from STA Annual Report (p. 77 distillate and oil for train services).
Western Australia	1991/92 data in Westrail 1991/92 Annual Report (p. 24) (assume it includes Transperth liquid fuel costs). No electricity costs in

Transperth annual report, so estimated by IDM based on 6.7 cents/kWh for electricity.

Materials input — Input Table 5a,b

NSW — 1991/92 data na in SRA 1991/92 Annual Report. Supplied by IDM.

Victoria — 1991/92 data na in PTC 1992 Annual Report ("Services and supplies" available for total operations, p. 36, no breakdown by operations). Estimated by IDM based on rail's share of "services and supplies", minus "services".

Queensland — 1991/92 data na in Queensland Railways 1991/92 Annual Report [only "consumables" expenditure is available, p. 45, but is much higher than previous years]. Estimated by IDM based on stores % of total consumables. 1988/89, 1989/90 and 1990/91 data revised to be comparable.

South Australia — 1991/92 data na in AN 1992 Annual Report. Data estimated using maint $ per train km from 1990/91 multiplied by 1991/92 train kms. 1991/92 data from STA 1992 Annual Report (p. materials expenditure - train services).

Western Australia — 1991/92 data from Westrail 1992 Annual Report, % of maintenance which is non-labour in previous years applied to maintenance of rolling stock, and track and structures data (p. 45). Should Transperth expenditure on rail materials be added in, or is it already included in Westrail data ?)

Capital stock — Input Table 6a,b

Capital stock for each year was calculated from the initial value of stock, annual depreciation and annual capital expenditure, as discussed previously.

Capital utilisation — Input Table 7a,b

Capital utilisation for each year was calculated from the initial value of capital in 1971/72 and capital investment in subsequent years, as discussed previously. The source of capital investment is shown below.

Capital investment — Other Table 5a,b

NSW — 1991/92 data from SRA 1991/92 Annual Report. Derived from p. 10, subtracting capital expenditure to date from cumulative expenditure.

Victoria — 1991/92 data from personal communication, PTC Finance Division

Queensland	1991/92 data from Queensland Railways 1992 Annual Report (p. 21).
South Australia	1991/92 data was from the ANRC 1992 Annual Report (p. 69). 1991/92 data from STA 1992 Annual Report (p. 67 - selected items)
Western Australia	1991/92 data was from the Westrail 1992 Annual Report (p. 35). Note that p. 43 of Transperth 1992 annual report states that "funding for the Capital Works of the Suburban Rail Service is provided and reported by Westrail", p. 23 of Transperth 1992 annual report notes expenditure on Northern Suburbs Transit System in 1991/92 was $120 million, ($68m for system infrastructure, $52m for rail car manufacture) but this is more than total capital expenditure reported in the Westrail report. Westrail excludes the $52 million for railcars, but personal communication with Capital Investment Manager suggests it should be included.

Outputs

Urban passenger numbers — Output Table 1

NSW	1991/92 data was from the SRA 1991/92 Annual Report (p. 24).
Victoria	The passenger numbers in this series are calculated using the old Metrail formula, in order to maintain comparability. Thus: "The method of calculating passenger journeys for periodicals was changed to the MURLA scale as from 1 July 1973. The periodical content in respect of journeys expressed for the year prior to this date have been adjusted to this scale" (V/Line, mimeo 1985). Major changes were apparently made to the established method of calculating periodicals in 1990/91 and 1991/92. Other changes may also have been made such as inclusion of estimates of non-paying passenger journeys (NB: all journeys in this time series are "paid journeys"). In order to maintain comparability we have maintained the existing time series and adjusted the 1991/92 passenger journey estimates accordingly. Thus, the 1991/92 journeys are an ITS estimate.
Queensland	1991/92 data from Queensland Railways 1992 Annual Report (p. 60).
South Australia	1991/92 data from STA 1992 Annual Report (p. 92 "passenger journeys"). Passenger boardings data also available - is higher.
Western Australia	1991/92 data from Transperth 1992 Annual Report (p. 66 "passenger boardings"). 1986/87 data revised according to 1990/91 annual report. (note figures would be lower if passenger journeys were used - available on p. 68 of 1991/92 Transperth annual report).Note: p. 21 of Transperth 1991/92 annual report "following

the introduction of electric trains, both patronage and service reliability showed a marked improvement ... annual patronage for 1991/92 .. increase of over 21%".

Urban passenger revenue — Output Table 2a,b

New South Wales	1991/92 data was from the SRA 1991/92 Annual Report (p. 62 "revenue from customers Cityrail group"). Should CSO payment from government to Cityrail also be included ?.
Victoria	1991/92 data na in PTC 1992 Annual Report. Estimated by IDM (based on $1.41 per journey).
Queensland	1991/92 data was from the Queensland Railways 1992 Annual Report (p. 60 "Citytrain revenue").
South Australia	1991/92 data from STA 1992 Annual Report (p. 92 Operating revenue - train).
Western Australia	1991/92 data was from the Transperth 1992 Annual Report (p. 49 "Fares - train services").

Nonurban passenger numbers — Output Table 3

NSW	1991/92 data was from the SRA 1992 Annual Report (p. 29).
Victoria	1991/92 data from PTC 1992 Annual Report (p. 16 total V/Line passenger journeys).
Queensland	1991/92 data was from the Queensland Railways 1992 Annual Report (p. 60 total Traveltrain passenger journeys).
South Australia	1991/92 data was from the ANRC 1992 Annual Report (p. 24).
Western Australia	1991/92 data was from Westrail's 1992 Annual Report (p. 65 Rail passenger journeys excluding suburban, road).

Nonurban passenger revenue — Output Table 4a,b

NSW	1991/92 data was from the SRA 1992 Annual Report (p. 29).
Victoria	1991/92 data was from the PTC 1992 Annual Report (p. 16 total V/Line revenue).
Queensland	1991/92 data was from Queensland Railways Annual Report (p. 60 total Traveltrain revenue). Explanation for large increase in revenue: "Total long distance traveltrain revenue increased substantially from $10.3 million in 1990/91 to $21.9 million in 1991/92 due to QR receiving reimbursement for pensioner concessions for the first time" (p. 60 QR annual report).

South Australia — 1992 data was from the ANRC 1992 Annual Report (p. 69 "revenue from passenger service").

Western Australia — 1991/92 data from Westrail 1992 Annual Report (p. 14, 15 country rail revenue + interstate revenue, excludes road). 1990/91 data adjusted to exclude road.

Net tonne kilometres of freight — Output Table 5

NSW — 1991/92 data was from the SRA 1992 Annual Report (calculated as Freight Rail employees multiplied by NTK per freight employee, p. 19).

Victoria — 1991/92 data was from the PTC 1992 Annual Report (p. 21).

Queensland — 1991/92 data was from the Queensland Railways 1991/2 Annual Report (p. 59).

South Australia — 1991/92 data was from the ANRC 1992 Annual Report (p. 69).

Western Australia — 1991/2 data was from Westrail's 1992 Annual Report (p. 65).

Freight revenue — Output Table 6a,b

NSW — 1991/92 data was from the SRA 1992 Annual Report (p. 45). 1990/91 data revised according to 1991/92 report (p. 45, 65).

Victoria — 1991/92 data was from the PTC 1992 Annual Report (p. 15).

Queensland — 1991/92 data was from the Queensland Railways 1991/2 Annual Report (p. 59).

South Australia — 1991/92 data was from the ANRC 1992 Annual Report (p. 69). Note: early data not the same as time series data in 1992 Annual Report.

Western Australia — 1991/92 data was from the Westrail 1992 Annual Report (p. 65).

Train kilometres — Output Table 7

NSW — 1991/92 data na in SRA 1992 Annual Report. Supplied by IDM.

Victoria — 1991/92 data was from PTC 1992 Annual Report (p. 21).

Queensland — 1991/92 data was from Queensland Railways 1992 Annual Report (p. 61).

South Australia — 1991/92 data was from AN 1992 Annual Report (p. 69 freight train kms + passenger train kms) (note data on p. 68 includes Tasrail data), plus data from STA 1992 Annual Report (p. 92 vehicle kms -

train figure divided by three to get train kms, according to previous year's relationship).

Western Australia — 1991/92 data was from Westrail 1992 Annual Report (p.65), plus data from Transperth 1992 Annual Report (p. 66 traffic kms - train).

Carrying capacity tonne kms - freight trains — Output Table 8

To calculate carrying capacity for freight trains, need to know wagon kms (freight train kms times average no. of wagons per train) and average capacity per wagon. Wagon data na in annual reports.

Data for all states estimated by IDM.

Seat kilometres - passenger trains — Output Table 9

Seat kms is the product of carriage kms and weighted average seats per carriage. 1991/92 data na in annual reports.

Data for all states estimated by IDM.

Other data

Route kilometres — Other Table 1

NSW — 1991/92 data na in SRA 1992 Annual Report. 1990/91 data is used.

Victoria — 1991/92 data was from PTC 1992 Annual Report (p. 20 lines trafficable -railway - (route kms)).

Queensland — 1991/92 data was from Queensland Railways 1992 Annual Report (p. 61).

South Australia — 1991/92 data was from AN 1992 Annual Report (p. 69), plus data from STA 1992 Annual Report (p.92 kms of route service - train).

Westrail — 1991/92 data was from Westrail 1992 Annual Report (p. 65), plus data from Transperth 1992 Annual Report (p. 66 unduplicated route kms - train). Or are suburban lines already included in Westrail total ? Transperth kms added onto data from 1987/88.

Labour costs per employee — Other Table 2a,b

Discussed previously.

Litres of liquid fuel — Other Table 3

Discussed previously.

Kilowatt hours electricity — Other Table 4

Discussed previously.

Capital expenditure — Other Table 5a,b

Discussed previously.

Tonnes of freight — Other Table 7

NSW	1991/92 data from the SRA 1992 annual report, p. 18
Victoria	1991/92 data from the PTC 1992 annual report, p. 15 "freight tonnes carried"
Queensland	1991/92 data from the Queensland Railways 1992 Annual Report (p. 59)
South Australia	1991/92 data from the PTC 1992 annual report, p. 69 - does this include Tasrail ?
Western Australia	1991/92 data from the Westrail 1992 annual report, p. 65 "tonnes carried: paying goods"

Locomotives — Other Table 8

NSW	1991/92 data from the SRA 1992 annual report, p. 63 "train stock: locomotives (total fleet)"
Victoria	1991/92 data from the PTC 1992 annual report, p. 18, "motive power: diesel locos and rail tractors"
Queensland	1991/92 data from the Queensland Railways 1992 Annual Report (p. 62)
South Australia	1991/92 data from the AN 1992 annual report, p. 32, 69 "mainline and shunt locos" does this include Tasrail locos ?, is not consistent with earlier data
Western Australia	1991/92 data from the Westrail 1992 annual report, p. 20 (is probably lower because shunting locos are not included). 1989/90 and 1990/91 data revised according to 1990/91 annual report.

Wagons — Other Table 9

NSW	1991/92 data from the SRA 1992 annual report, p. 20, 63 "train stock: Freight Rail wagons".
Victoria	1991/92 data from the PTC 1992 annual report, p. 18 "freight rollingstock".
Queensland	1991/92 data from Queensland Railways 1992 Annual Report (p. 62 freight business rollingstock + service stock).
South Australia	1991/92 data from the AN 1992 annual report, p. 69 "freight rollingstock (revenue earning) and service stock (non revenue earning)" does this include Tasrail ?
Western Australia	1991/92 data from the Westrail 1992 annual report, p. 20 (excludes privately owned wagons)

Coaching stock — Other Table 10

NSW	1991/92 data from the SRA 1992 annual report, p. 63 "train stock: passenger cars".
Victoria	1991/92 data from the PTC 1992 annual report, p. 18 "passenger rollingstock: carriages, brake and power vans".
Queensland	1991/92 data from Queensland Railways 1992 Annual Report (p. 62 passenger business rollingstock).
South Australia	1991/92 data from the AN 1992 annual report, p. 69 "passenger cars", plus data from STA 1992 Annual Report p. 38 "total rail cars".
Western Australia	1991/92 data na from the Westrail 1992 annual report (previous year's data is used), plus data from Transperth 1992 annual report (p.24 "train fleet 1991/92")

Train kms per employee — Other Table 11

Is calculated from data in other tables (train kms and employees).

CPI — Other Table 12

Updated using Australian Bureau of Statistics data on CPI indices.

SECTION 2

RESULTS OF REVISIONS AND UPDATE

This section contains:

Revised ITS-WP-92-7

A Comparative Assessment of the Productivity of
Australian Railways 1971/72 to 1991/92

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Abstract

There is a growing interest in the establishment of suitable measures of the overall performance of government business enterprises, particularly railways, which are a major recipient of government subsidy. They must improve their performance and become more cost efficient. Any policy designed to reduce costs must consider the implications of resultant actions on the overall productivity of a business. We propose the use of the total factor productivity index as an appropriate reference benchmark to enable each railway to evaluate the productivity implications of any change to the operating and managerial environment. Using ITS's rail database, total factor productivity indices are derived annually from 1971/72 to 1991/92 for the 5 major rail systems in Australia and sources of variation are identified.

Keywords: Performance measurement, total factor productivity, benchmarking, railways

The Australian rail systems have a recognised historical contribution to the economic and social development of Australia. With the advent of alternative passenger and freight transport opportunities provided by the medium of road systems, since the 1960s the railways have suffered a major decline in market share and failed almost nationally to adopt a pro-active marketing strategy to stem the decline. The burden on the State steadily increased with the subsidy reaching a peak in the late 1980s. During a large part of the 1970s the subsidy was justified as a recognition of the social value of public transport, and became the greatest single item of expenditure by State governments. By the mid 1980s some State governments (notably in NSW) commenced a program of major reform in government trading enterprises (GTEs) to find ways of reducing the level of subsidy. The fundamental question to address became the identification of an enterprise's overall cost structure and ways in which this could be changed in order to establish cost efficient practice. In NSW a benchmark approach has been adopted in which international comparisons are used to identify better ways of running a railway of comparable activity. A distinction was created between commercial services and non-commercial services. Governments replaced the concept of subsidy with the idea of a community service obligation (CSO). A "subsidy" would be paid only if an identified non-commercial activity was deemed by the Minister of Transport to have the status of a CSO.

To date governments have tended to treat all non-commercial services as CSOs, tantamount to a "business as usual" scenario. The greatest change however is occurring in the restructuring of GTEs, with efforts to improve the cost efficiency of enterprises. One of the challenges facing GTEs and government monitoring agencies is in establishing suitable measures of improvement. It is clear that one aim is to improve the productivity of the combined set of factor inputs used to produce the output of the enterprise - we need procedures capable of establishing preferred mixes of inputs required to produce a given level of output at minimum cost.

There are three key "indicators" of a business's success: productivity, profitability, and the rate of return on assets. A productivity measure such as total factor productivity (TFP) reports how well a transport firm does at turning inputs (labour by type - management, drivers, mechanics etc., fuel, capital etc.) into outputs (e.g. tonne kilometres). Profitability is the result of the relationship between productivity, market power, regulatory controls and the choice of markets to serve. Treasuries increasingly require measures of the real rate of return on invested capital and TFP in their performance portfolio. A railway may be the most productive in a cost efficiency sense, yet may have lower profits than another railway because of the differences in revenue streams attributed to market power. Getting costs down does not guarantee long run profits (and/or minimum subsidy). There is a need to develop demand or market indicators (often called measures of service effectiveness) to identify how effective the supply side level of output (such as train kilometres or train hours in service) is in producing demand side output (such as passenger kilometres, tonne kilometres, or revenue).

This paper argues for the adoption of a performance assessment portfolio (PAP) which uses an index of gross total factor productivity (TFP) as a reference benchmark (and a possible targeting index) and a mechanism for disaggregating the gross measure in such a way that we can identify the sources of composition and hence variation both within a GTE over time and between GTEs at a point in time. The allowance for these sources of variation enables us to derive a residual or net TFP measure. With some governments considering linking changes in prices charged for services to productivity gains, the need for a rigorous measure of performance is clear.

The paper is organised as follows. The next section presents the TFP measure, followed by a description of the approach developed to compile a database suitable for measuring TFP. Data has been collected on an annual basis (1971/72 to 1991/92) for the 5 Australian public rail systems. The empirical indices are summarised together with a number of interesting components of the index. This is followed by an investigation of sources of variation in

gross TFP, to provide some important insights into the role of scale, density, technology, management and excess capacity. Some important insights are obtained on the role of technology and management in explaining variations in productivity over the last 21 years across all Australia's rail systems.

1. Gross total factor productivity and performance measurement

The essential elements of performance measurement are:

(i) To set out in a simple way the reasoning behind the need to adopt a particular approach as the preferred way of establishing a reference benchmark for comparisons within a rail business and between it and other GTEs and private businesses. TFP is one such benchmark index.

(ii) To set out the data requirements necessary to obtain meaningful quantitative measures of overall performance at desirable levels of disaggregation (for example, the line, line cluster, depot and division).

(iii) To quantify the overall performance measure within the railway.

(iv) To map the overall index of performance to a large number of partial measures and contextual/operational factors (e.g. network configuration, operating environment, composition of working time - normal and penalty) to establish suitable procedures to assist management in implementing change which is consistent with improving overall productivity.

Total factor productivity is the amount of aggregate output produced by a unit of aggregate input (Diewert 1989). Railways produce more than one type of output (e.g. urban and non-urban passengers, and freight activity) and use various types of inputs both of an elemental nature within generic classes of inputs (e.g. types of labour - drivers, mechanics, inspectors, managers) and generic categories (e.g. labour, fuel, capital, non-labour maintenance). TFP is an index number which combines multiple outputs and multiple inputs through a

weighting procedure which accounts for the contribution of inputs to costs and outputs to revenue.

The base values in the TFP formula can be defined as the values for a particular year and system, say New South Wales in 1971/72, or alternatively set to the average values, defined over the years and railways in the database. The average values across all observations in the data set were chosen as the base values. This formulation originally developed by Caves et al. (1982) enables comparisons between railways which are independent of the railway or year chosen as the base and gives the index appeal in benchmarking.

$$(1) \qquad \ln\left[\frac{TFP_k}{TFP_b}\right] = \frac{1}{2}\sum_i (R_{ki}+\overline{R}_i)(\ln Y_{ki}-\overline{\ln Y_i}) - \frac{1}{2}\sum_i (R_{bi}+\overline{R}_i)(\ln Y_{bi}-\overline{\ln Y_i}) - \frac{1}{2}\sum_n (W_{kn}+\overline{W}_n)(\ln X_{kn}-\overline{\ln X_n}) + \frac{1}{2}\sum_n (W_{bn}+\overline{W}_n)(\ln X_{bn}-\overline{\ln X_n})$$

where

k = each individual observation, k = 1, ..., K

b = base observation (average of all observations)

i = outputs, i = 1, ..., I

n = inputs, n = 1, ..., N

R_i = revenue shares of total outputs $\quad \overline{R}_i$ = arithmetic mean of revenue share

W_n = cost shares of total inputs $\quad \overline{W}_n$ = arithmetic mean of cost shares

$\ln Y_i$ = unit measure of output $\quad \overline{\ln Y_i}$ = geometric mean of unit measure

$\ln X_n$ = unit measure of input $\quad \overline{\ln X_i}$ = geometric mean of unit measure

Partial measures of performance such as total cost per passenger kilometre (a measure of unit cost) are simple to compute but by their construction fail to recognise the role of each input in the establishment of total cost. Given that each type of input has a different

influence on the costs of servicing passenger kilometres, it is desirable to establish a procedure to track (understand) what happens when we change one input in respect of its influence on the need for other inputs and hence the overall change in total cost (Hensher 1991).

Many partial measures of performance such as train driver paid hours per 1,000 train kilometres and total cost per labour hour have at least two main problems. They consider only a subset of the inputs used by the railway and sometimes only a subset of the outputs. To the extent that a railway may increase productivity with respect to one input at the expense of reducing the productivity of other inputs, then partial measures will inaccurately portray the overall gains/losses in productivity (Talvitie and Obeng 1992). Partial measures also often fail to take into account the nonhomogeneous nature of the inputs and outputs (Windle and Dresner 1992). For example with total cost per labour hour, the total number of employees is used as a measure of labour input despite the fact that the addition of a train driver hour may not have the same impact on productivity as the addition of a station cleaner or mechanic.

2. The data set: Australia's railways

Like any measure requiring quantitative information on inputs and outputs, there are very real challenges in the establishment of meaningful data. Measuring inputs and outputs requires aggregation of data. For instance, measuring labour input requires the aggregation of various categories of employees such as drivers, inspectors, mechanics, managers, administration staff etc. which may be complicated by the mix of casual and full time employees, while the measurement of output requires the aggregation of various services such as suburban and intercity passenger services, and freight services. The aggregation of the inputs and outputs can be achieved relatively painlessly if the accounting systems are in sufficient detail to enable the retrieval of data from the "bottom up" beginning at the train service level (as distinct from the "top down").

The ideals of a bottom up data approach had to be compromised in this first stage development of a TFP index. Given the aim to compare all railways in Australia, the level of permissible disaggregation was limited. Ongoing research (DeMellow and Hensher in progress) concentrated on the NSW railways is enabling us to adopt a more detailed disaggregation of all inputs and outputs, and thus test the adequacy of TFP indices derived from more aggregate definitions of inputs and outputs identified from annual reports. The current contribution typifies the quality of data generally available from all rail systems in Australia which has been used in previous studies such as the Industry Commission (1990) and Bureau of Industry Economics (1992). Using archival material, we have expanded the data to include a large number of descriptors of changes in technology and management which may have contributed to explaining variations in gross TFP. The full extent of the data set is documented in Hensher et al. (1992).

The database contains annual data (based on the financial year) for each state's rail system (New South Wales (NSW), Victoria, Queensland, South Australia (SA) and Western Australia (WA)) for a twenty one year period from 1971/72 to 1991/92. 1971/72 is a significant choice as a base year since financial deficits started to appear in railway accounts in a significant way in the early 1970s. For the years 1971/72 to 1983/84, the data has been sourced, with variations, from an Australian Railways Research and Development Organisation (ARRDO) Information Paper titled *Rail Transport Performance Indicators* (ARRDO 1986). However compilation and publication of comparative statistics ceased when ARRDO was wound up in 1987. Data for the remaining quarter of the study period (1984/85 to 1991/92) was thus mostly obtained from Annual Reports and their supporting documents. Occasionally where data items were unavailable from other sources, they were estimated based on physical relationships between variables.

Annual reports are summary documents for public consumption and often do not contain detailed descriptions or explanations of terms used in the report. There is lack of information on the definition of terms — e.g. what is included in "labour costs", does it

include on-costs or not ? A major difficulty in the compilation of data particularly from Annual Reports is the inconsistency of definitions. This includes inconsistency *within* systems over the 21 year period where the reporting term remains the same but its meaning changes or the term changes but it continues to refer to the same item, as well as inconsistency of terms and definitions *between* systems.

While the organisational structure of service provision has remained the same over the study period in some states (Westrail in Western Australia, and Queensland Railways in Queensland), in others, a number of different organisations have provided services. Thus in the database and analysis, Australia's rail systems are referred to by state, rather than by organisation. Australian National which operates in several states is referred to as South Australia's rail system because it assumed control of SA's nonurban services and is based in South Australia's capital city, Adelaide.

Four inputs were used in the calculation of the input index: labour, energy, materials and capital. Two output indices were calculated: a demand-side measure of output based on urban passengers, nonurban passengers and net tonne kilometres of freight (equivalent to final demand), and a supply-side measure of output defined as seat kms for passengers and carrying capacity tonne kms for freight (equivalent to intermediate demand).

Expenditure on each of the input items (labour, energy, materials and capital) and revenue from each of the output items (urban passengers, nonurban passengers and net tonne kilometres of freight) is necessary to calculate cost and revenue shares used to weight each of the inputs and outputs in the respective indices. Revenue shares are used as a proxy for the cost elasticity of output weights. Ongoing research is identifying the adequacy of this assumption. All revenue and expenditure data used in the calculation of the indices is in 1971/72 dollars. Data items in $current were converted to $constant 1971/72 using the CPI index as a deflator. The data items for each of the indices are explained in the following section.

2.1 Inputs

Labour: The unit measure for the labour input is the average number of staff employed during the year. Definitions in available sources range from "total staff employed at end of year," "average staff employed throughout the year", and "full-time equivalent number of staff". Expenditure on labour, used to calculate cost shares for the unit measures of inputs, includes wages and salaries as well as on-costs (such as superannuation, long service leave and recreation leave). It is often difficult to determine what on-costs, if any, are included in data described as "labour costs per employee" or "total wages, salaries and labour expenses".

Energy: The unit measure for the energy input is joules. The two types of fuel usage, diesel distillate (in litres) and electricity (in kilowatt hours), were converted to the common measure of megajoules. Energy expenditure includes all forms of energy such as motor spirit, kerosene, coal and LPG, however distillate and electricity predominate. Some energy usage and expenditure data was estimated by ITS.

Materials: The data item expenditure on materials (excluding fuel which is counted separately) is equivalent operationally to the cost of maintenance (non-labour). It was calculated in different ways for different systems, depending on data availability. Definitions used included total maintenance costs minus expenditure on maintenance labour; operating expenses: stores and materials; and operating expenses: services and supplies minus an estimate for services. In the absence of a unit measure for materials (as for labour and energy), total expenditure was used.

Capital: Capital is one of the most difficult inputs to measure correctly, given that the book value rarely coincides with its economic value. Furthermore some capital is arguably not pertinent to the provision of rail services (e.g. the "ownership" of land inherited from the past which is rented out to a non-transport activity) and hence should not be included in financial statements concerned with establishing the sourcing of inputs required to produce

transport outputs. For this analysis, the depreciation and opportunity cost (DOC) method was used to calculate annual capital flows. The DOC method was chosen over the Cost Recovery Factor approach because it is more transparent and is more widely accepted as standard practice in Australia. Capital flow is assumed to be proportional to capital stock and is calculated as the depreciation of existing capital stock at the beginning of each year plus the opportunity cost of end of year capital stock (existing stock plus new capital expenditure). A depreciation rate of 8% and opportunity cost of 7% were used. The possibility of capital gains from new expenditure was ignored because data was not available. Technically, the value of scrapped or obsolete capital should also be included in the calculation, however this was omitted because of the very low values.

2.2 Outputs

Passengers: Passenger numbers are divided into urban and nonurban, in recognition of the two distinct markets for passenger services. Trip length data for all systems is either unavailable or too unreliable to convert the number of passengers to passenger kilometres.

Freight: The tonne kilometre, representing the haulage of one tonne over one kilometre, is the most accurate reflection of the freight transport task. Net tonne kilometres refers to the weight of the goods carried.

The supply side measures of output used were: for passengers, seat kms (calculated as carriage kms multiplied by weighted average seats per carriage) and for freight; carrying capacity tonne kms (calculated as wagon kms multiplied by wagon capacity in tonnes).

2.3 Other variables

Route kilometres is a useful variable to measure the effect of the size of each system's network. Other productivity studies (e.g. Freeman et al. 1987) have found network size is an important determinant of TFP. Another useful measure is track kilometres, but data was not available for all systems.

Train kilometres is another supply side measure of output. Train kilometres per employee is an universally used partial (simple) productivity measure. However it has an in-built bias toward those systems with substantial passenger services.

Major organisational and managerial changes in each rail organisation over the 21 year period were identified. The variables are dummy variables, taking the value of 1 for each year that the change is relevant in a particular system while all other years and systems take the value of 0. For instance, David Hill's term as Chief Executive of the NSW State Rail Authority from July 1981 to November 1986 is recorded as a 1 for the years 1981/2 to 1984/5 in NSW and as a 0 for all other observations.

Over 60 technological change variables were identified in several categories including rollingstock, permanent way, electrification, signalling and telecommunications, and office automation. The technological change variables are also dummy variables. For each innovation, the value 1 is recorded in the year in which it was introduced to each system and for every year afterwards through to 1991/92.

3. Productivity results: gross total factor productivity and its components

3.1 Best and worst performers on gross TFP

Interpretation of a state's performance varies according to whether the demand side or supply side based TFP index is analysed. The gross TFP indices are shown in Figures 1 and 2. Based on the demand side measure, Queensland has the highest TFP throughout the 21 year period, except for the early years up to 1974/75 when South Australia performed best. Of all the systems, Queensland uses its inputs best to carry passengers and freight. Queensland Rail, however, is also best at using its inputs to produce seat kilometres and carrying capacity tonne kms, as it had the highest TFP based on the supply side measure of

output. The large amount of movement of bulk commodities gives Queensland (and Western Australia) a comparative advantage over the other State systems.

Victoria is consistently the worst performer in using its inputs to produce both freight tonne kilometres and passenger kilometres, as well as seat kilometres and carrying capacity tonne kms over the entire 21 year period. NSW was the second-worst on both measures of output up to 1986/87, when it moved to the second-best position on the supply-side measure of output.

3.2 Overall change in productivity

Queensland's demand side measure of TFP has almost trebled between 1971/72 and 1991/92, while the two poorest performers, NSW and Victoria doubled productivity. Overall increases in supply side productivity were much lower except for Queensland. The best performer, Queensland, almost doubled its TFPs value as did NSW. SA improved continuously up to 1985/86 but then declined with a short-lived improvement in 1988/89. Victoria remained almost unchanged throughout the 1970s but declined in the early 1980s led by a continuing recovery up to a level similar to the 1970s.

3.3 Constancy of performance

It is interesting to note the constancy of the 5 systems' rankings in productivity over the twenty one year period. Since 1976/77, the rankings of the systems on TFP (demand side based) have remained the same: Queensland 1 (most productive), South Australia 2, Western Australia 3, New South Wales 4, and Victoria 5 (least productive). The rankings based on the supply side based TFP index have not remained the same. Since 1976/77: Queensland 1, South Australia and Western Australia jockeying for second place until 1988/89 when NSW took over, and Victoria remaining the worst throughout.

Despite the constancy of rankings on the demand side measure of output, there is variation in the relative levels of TFP, as evident in Figures 1 and 2. For instance, the difference in

TFPd between NSW (4th ranked) and Victoria (5th ranked) was constant during the 1970s but has increased since 1984/85. In contrast Queensland had a higher level of TFPs than NSW in 1971/72 through to 1984/85, but the difference between the two states has been increasing since then.

3.4 Input and output indices

Analysis of the input and output indices can explain the pattern of productivity changes evident in Figures 1 and 2. The components of TFPd and TFPs, the output and input indices, are shown for each state in Figures 3 to 7. Indices of the individual components of the input and output indices (such as labour, megajoules or urban passengers carried) would be necessary to determine in more detail why TFP has changed.

The input index for each state has generally shown a downward trend over the 21 year study period. Victoria, SA and WA have shown a steady reduction in the use of inputs, while Queensland's use increased substantially up to 1986/87 and then started declining substantially. NSW was fairly constant to to the mid 1980s and then declined significantly. The output index (demand side) has generally been increasing for Queensland and NSW, although it has fluctuated for the other rail systems, sometimes quite markedly (e.g. SA and WA). The output index (supply side) in most states has followed the demand-side output index well, except in WA after 1985/86 where the divergence is very large. In recent years NSW, WA and SA have experienced noticeable downward trends in the supply side output index. Levels of productivity have increased in general over time, with overall growth in TFPs lower than TFPd growth (except for Queensland).

An increase in gross TFP can be due to change in either the input or output index, or to change in both indices. For instance, NSW's increase in TFPd from 1982/83 is attributable partly to an increase in output (demand side) and partly to a sharp decrease in inputs from 1986/87 onwards. However Queensland's large increase in TFP (demand side) from the early 1980s is related primarily to the output index which almost doubled in value from

1982/83 to 1990/91, even with inputs increasing up to 1986/87 and then declining thereafter.

South Australia's consistently high levels of TFPd are attributable to on-going increases in output (a noticeable dip in 1982/83) and declines in the input index from 1977/78 through to the last year. Western Australia's large increase in TFPd from 1985/86 was due to a significant decline in inputs and an increase in the output index.

4. Analysis of variations in total factor productivity

4.1 Possible sources of variation

Although the gross measures of TFP are useful indicators of the overall annual performance of each railway, a comparative assessment across time and railways must take into account the different operating environments. The differences between systems in TFP may be purely related to economies of scale and density, quality of management, suitable technologies, or composition of services.

Some of these sources of variation are under the control of the rail enterprise, while others may be under the control of government or simple dictates of market forces. Although some factors may be outside the enterprise's control, it is likely that enterprises can do much more to improve the input set required to service the two interpretations of output. The strength of competing modes can influence the drawing power of the railways, a factor which is clearly not directly related to inefficient use of inputs. However the railways, through union power and other factors, may have failed to adjust their input set in response to their market position. Future research needs to develop TFP in the context of a market equilibrium model or even a market disequilibrium model, possibly using switching regression (Greene 1990).

The residual component of gross TFP remaining after accounting for operating environment differences can be compared directly. If as we will see in our empirical work, the unexplained component is very small, we are in a good position to understand what features of the operating environment are explaining significant variations in gross TFP, and the extent to which deviations from national "best practice" can be reduced by appropriate action. It is within this performance assessment portfolio (PAP) framework that TFP is most valuable as an operational tool for the railways, in contrast to its role as a monitoring and bargaining tool of regulators.

4.2 Modelling sources of variation

The set of TFP measures have been derived from a time-series-cross-section database. Data in this configuration have some specific characteristics which can if not handled properly cause misleading inference. In particular the data set is long enough in time to produce the possibility of different stochastic processes applying to different cross-section units (i.e. heteroscedasticity or unequal variances associated with the unobserved influences). The small number of cross-section units is not a serious concern. The application of ordinary least squares (OLS) regression is not typically valid. OLS treats the data as if it were a pooled set of independent observations with the classical statistical properties for the error variance-covariance matrix of constant variance and zero covariance between all pairs of observations (i.e. homoscedasticity).

In the assessment of sources of differences in gross TFP we evaluated a number of specifications for the error variance-covariance matrix. Commencing with (i) the OLS assumption of homoscedasticity, we then allow for (ii) the variances to vary across the railways (i.e. cross-sectional or railway-specific heteroscedasticity). Then (iii) we relax the entire error matrix set and allow for free correlation between the railways at a point in time together with the railway-specific heteroscedasticity. The only assumption imposed in (i)-(iii) is that (iv) the observations are uncorrelated over time. By allowing for one-lag

autocorrelation which is either (v) invariant with each railway or (vi) allowed to vary across railways, we are able to evaluate important sources of model misspecification.

The final set of models reported in Tables 1 and 2 are the outcome of evaluating nine combinations of error variance-covariance and autocorrelation. A log-linear specification of the TFP function is estimated, which is dual to a log-linear neo-classical total cost function (Freeman et al. 1987). The Lagrange multiplier (LM) test, asymptotically equivalent to the likelihood ratio test, is used to test the null hypothesis of homoscedasticity, using a chi-square critical value of 5 percent. Heteroscedastic models use a feasible generalised least squares estimator (Greene 1990).

4.3 Explanation of models

A number of final models are reported. It is not possible to include all the statistically significant variables associated with each generic source of variation in gross TFP in a single equation due to both degrees of freedom and high partial correlation. Given the sensitivity of the TFP index to the definition of output and the debate as to whether a supply side (TFPs) or demand side (TFPd) measure of output should be used (Applebaum and Berechman 1991, Hensher 1992), we report the findings using both measures.

The first TFPd model evaluates a number of management and technological effects. The hypothesis of homoscedasticity was rejected at 95% confidence on the LM test. Railway-specific autocorrelation, varying from -0.06 for Victorian rail to 0.85 for WA rail, has been accounted for. Six technologies and five management effects have a statistically significant influence in explaining the variation in gross TFP. The first TFPs model also found that the homoscedasticity hypothesis was rejected at 95% confidence; with the railway-specific autocorrelation varying from 0.73 for QLD rail to 0.98 for Victorian rail.

Table 1 Explaining productivity variation: model results

(Estimated parameters, with t-statistics in brackets)

Explanatory Variables	TFPd (S2,R2)	TFPs (S2,R2)
Constant	-0.0728	-0.0491
	(-2.82)	(-0.785)
Technology:		
Extra long flat freight wagons and containers	-0.1596	
	(-3.65)	
Permanent way: automated points and turnouts	0.0486	
	(1.68)	
Major extensions of electrification	0.1680	
	(3.81)	
Centralised Train Control signalling		0.0561
		(1.62)
Fibre optics		0.0757
		(2.27)
New electrification		0.3205
		(3.82)
Management:		
VIC: Planning services reformed as a Branch	-0.4166	
	(-7.03)	
QLD: Era of RG Read as Commissioner of Q'land Railways	0.2529	
	(2.97)	
QLD: Financial Assistance Act 1979	0.2723	
	(4.49)	
SA: Australian National full control over SA (nonurban) and Tasrail	0.1976	
	(4.63)	
SA: Era of RM King as Managing Director of Australian National	0.3344	
	(6.52)	
Goodness of fit statistics:		
Lagrange Multiplier (S0, R.)	14.18	13.28
Critical value (.95)	18.31	9.49
Log-likelihood	107.03	115.51
OLS R-squared	0.77	0.54

Note: the LM test statistic is the value from the S0 model associated with the R-model selected above.
S2,R2: S2 = groupwise heteroscedastic and correlated; R2 = railway-specific autocorrelation

Table 2 Explaining productivity variation: model results

(Estimated parameters, with t-statistics in brackets)

Explanatory Variables	TFPd (S0,R2)	TFPs (S0,R2)	TFPd (S2,R2)	TFPs (S2,R1)
Constant	-0.59564	-0.5740	-0.2238	-0.2812
	(-3.71)	(-4.47)	(-3.83)	(-3.80)
Output index	0.6014	0.7964		
	(7.37)	(14.58)		
Freight revenue share	0.2130	0.1077		
	(1.20)	(0.59)		
Net tonne km per route km	-0.0725	-0.0849		
	(-1.30)	(-1.63)		
Year dummy variables:				
1972/73	0.0122	0.0035	0.0091	0.0163
	(0.82)	(0.26)	(0.44)	(0.60)
1973/74	0.0423	0.0244	0.0663	0.0806
	(2.16)	(1.33)	(2.29)	(2.11)
1974/75	0.0309	0.1216	0.0571	0.0805
	(1.42)	(0.58)	(1.63)	(1.75)
1975/76	0.0327	0.0161	0.0636	0.1161
	(1.39)	(0.69)	(1.60)	(2.22)
1976/77	0.0429	0.0214	0.0837	0.1248
	(1.74)	(0.87)	(1.92)	(2.17)
1977/78	0.0086	-0.002	0.0457	0.1287
	(0.34)	(-.78)	(0.97)	(2.08)
1978/79	0.0103	-0.0028	0.0512	0.1094
	(0.40)	(-0.11)	(1.02)	(1.67)
1979/80	0.0604	0.0134	0.1616	0.1504
	(2.15)	(0.48)	(3.06)	(2.18)
1980/81	0.0629	0.0159	0.1757	0.1498
	(2.19)	(0.56)	(3.18)	(2.08)
1981/82	0.0688	0.0306	0.1856	0.1860
	(2.34)	(1.05)	(3.24)	(2.49)
1982/83	0.0482	0.0301	0.1140	0.1905
	(1.63)	(1.03)	(1.92)	(2.47)
1983/84	0.0723	0.0331	0.1992	0.2101
	(2.33)	(1.07)	(3.26)	(2.65)
1984/85	0.1184	0.0669	0.2938	0.3145
	(3.48)	(2.02)	(4.69)	(3.86)
1985/86	0.1344	0.0850	0.3554	0.3958
	(3.72)	(2.43)	(5.54)	(4.76)
1986/87	0.1773	0.1191	0.3783	0.3853
	(4.70)	(3.27)	(5.77)	(4.54)
1987/88	0.2218	0.1546	0.4506	0.4292
	(5.53)	(4.02)	(6.74)	(4.97)
1988/89	0.2834	0.2090	0.5175	0.5137
	(6.45)	(4.88)	(7.61)	(5.85)
1989/90	0.3293	0.2380	0.5792	0.5168
	(7.15)	(5.17)	(8.37)	(5.81)
1990/91	0.3564	0.2648	0.5930	0.4958
	(7.89)	(5.78)	(8.44)	(5.50)
1991/92	0.4163	0.3146	0.6483	0.4935
	(9.10)	(6.61)	(9.10)	(5.41)

Continued ...

Explanatory Variables	TFPd (S0,R2)	TFPs (S0,R2)	TFPd (S2,R2)	TFPs (S2,R1)
Railway firm-specific dummy variables:				
Victoria	0.1857	0.2838		
	(1.63)	(3.98)		
Queensland	0.4169	0.5089		
	(3.81)	(9.04)		
Western Australia	0.8613	1.1172		
	(6.03)	(12.08)		
South Australia	0.8099	1.0107		
	(6.47)	(14.79)		
Goodness of fit statistics:				
Lagrange Multiplier (S0, R.)	9.88	6.67	2.94	7.71
Critical value (.95)	9.49	9.49	18.31	18.31
Log-likelihood	215.60	221.83	230.48	-155.20
OLS R-squared (adjusted)	0.95	0.96	0.28	0.19

Note: the LM test statistic is the value from the S0 model associated with the R-model selected above.
S2,R2: S2 = groupwise heteroscedastic and correlated; R2 = railway-specific autocorrelation
S0,R2: S0 = homoscedastic; R2 = railway-specific autocorrelation
S2,R1: S2 = groupwise heteroscedastic and correlated; R1 = common autocorrelation

Managerial change: The managerial variables identify some of the key players in the last 21 years whose involvement has had a statistically significant impact on the variations in gross TFP. This confirms the importance of good management practices: in particular, the major changes in Queensland following the appointment of R. Read as Commissioner in 1988/89; and a succession of initiatives with Australian National commencing with the formation of the Australian National Railways Commission in 1975/76 followed by their takeover of the South Australian Railways and Tasmanian Railways in 1978/79.

The management effect in SA has impacted primarily on the way inputs are used to "produce" market power, in contrast, for example, to the impact on efficient train kilometres in WA. AN is seen as being a leader in better management practice associated primarily with good strategic and corporate planning, generally good relations with government and the unions, successful computerisation, a strong commercial orientation and sound cost practices. The attempts to improve performance by reform of planning services in Victoria in 1975/76 appears to have contributed in a negative way to TFPd.

Technological change: The impact of technological change comes through strongest in major developments in signalling, electrification, the introduction of automation to various track related activities, fibre optic development, and the incremental technological improvements in rail freight wagon design. The positive sign for the impact of electrification associated with TFPd accords with the view that it has had a "sparks effect" on patronage and freight. Major electrification occurred in extensions of metropolitan systems: from Sutherland to Waterfall in NSW in 1979/80; from Dandenong to Packenam in Victoria in 1974/75, and from Gladstone to Blackwater in Queensland in 1986/87. Complete lines were introduced such as the Eastern Suburbs railway in Sydney (1978/79), the Melbourne Underground Loop (1980/81) and the first section of the Brisbane suburban system (1979/80). Further discussion of the role of technology is given in Hensher et al. (1992).

Average growth rates: The last two columns of Table 2 are the results with only a constant and time-specific dummy variables (with 1972 set to zero). For TFPs the selected model is S2R1 in contrast to the majority of models being S2R2. The assumption of common autocorrelation between the five railways is valid in this instance, with all correlations in the range 0.946 to 0.999. The year-specific dummy variable estimates represent the deviations of the natural logarithm of TFP, averaged over all railways, from the 1971/72 logarithm of TFP. The average annual rate of growth during the 21 year period is 3.196% for TFPd and 2.386% for TFPs. After accounting for the level of output, the composition of output (approximated by revenue shares), the average rate of growth of TFP during the time period 1971/72-1990/91 changed from 3.196% to 2.021% for TFPd and from 2.386% to 1.556% for TFPs.

The inclusion of the output scale, composition and network effects for TFPs affects the profile of autocorrelation such that the railway-specific correlation changes from approximately constant (S2,R1) to a variation from 0.79 to 0.98 (S2,R2). This variation is attributable to Westrail; the other operators have autocorrelations varying from 0.959 to

0.981. The 2.021% figure can be compared to the 2.4% figure for Canadian National and Canadian Pacific (Freeman et al. 1987, 193).

Density effects: The first set of models in Table 2 include the time-period dummy variable, firm-specific effects and the scale, composition and network effects. Net tonne kilometres of freight per route kilometre is used as our best proxy for the density of traffic over the network, provided we assume that the average train weight has increased imperceptibly over time. Full details justifying this measure are set out in Hensher et al. (1992). A useful distinction is made between economies of scale and economies of density. The latter occurs if unit costs fall when output growth is within a network, in contrast scale economies occurs when output growth is due to expansion of the network. Under the demand-side definition of output, we have evidence of economies of density of 2.508, in contrast to 4.911 for the TFPs specification. The negative and significant sign for net tonne kilometres per route km suggests that TFP is lower when the same level of output is served in a larger network. There are strong overall scale economies for TFPd (= 2.12) and for TFPs (=3.467). This tells us that the railways on average have been securing additional seat kms and carrying capacity tonne kms at proportionally lower input costs. Additional passenger and freight traffic has on average also been obtained for a smaller proportional increase in input costs.

Firm specific effects: The firm-specific effects are revealing. Relative to the State Rail Authority of NSW (with TFP set equal to 1), for TFPd, Victoria = 1.20, Queensland = 1.52, West Australia = 2.37 and South Australia = 2.25. The equivalent results for TFPs are 1.33 (Victoria), 1.66 (Queensland), 3.06 (WA) and 2.75 (SA).These results, based on a model which excludes the management and technology effects identified in the two models reported in Table 1, confirm the important contribution of management in the relative success of Westrail and Australian National in particular. The five TFP firm-specific residuals represent a purer measure of economic efficiency after netting out the effects of scale, composition of output, and network characteristics. We further investigated the

impact of disequilibrium in the capital stock, and found evidence of excess capital. The high partial correlation between capital stock and output d (r = .77), output s (r = .93) and net tonne kms per route km (r = .83) prevented inclusion of a capital stock variable in the models in Tables 1 and 2. In the absence of these three effects, the capital stock variable is statistically significant and negative, suggesting over-capitalisation.

5. Conclusions

The empirical assessment of the productivity of all Australian rail systems has highlighted the usefulness of a single composite index for establishing a benchmark of "best national practice". Furthermore, by isolating the sources of variation in the gross measure of total factor productivity, we have been able to identify the extent of difference remaining in the residual or "pure" measure of productive efficiency. Allowance for differences in scale, density, output composition and excess capital still produces discernible differences in the relative productivity of different railways; however a significant amount of the remaining difference can be explained by particular innovations in technology and management practices. Most notably, there is strong evidence that Australian National and Queensland Rail have benefited substantially by good management direction, giving these railways a productive edge over the other rail systems.

The continuing research program (DeMellow and Hensher, in progress) is developing a more disaggregated set of inputs and outputs as well as evaluating alternative ways of measuring the rail network to incorporate both its size and shape. In addition, we are developing an empirical capability for estimating a total cost function in order to derive alternative weights for output (notably replacing the revenue share weights with a cost elasticity with respect to output weight), and to include deviations from marginal cost pricing, shadow pricing of inputs (Brunker 1992), and regulatory constraints on fare setting. Given the growing importance of productivity measurement for both improved

decision-making within the rail enterprises and for ongoing monitoring of performance by regulators, the importance of the topic is only now beginning to be appreciated fully.

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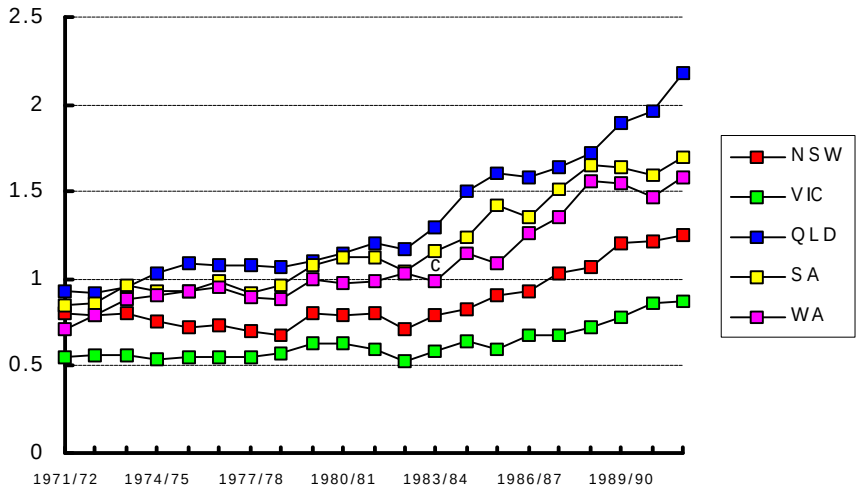

Figure 1: TFPd (final demand)

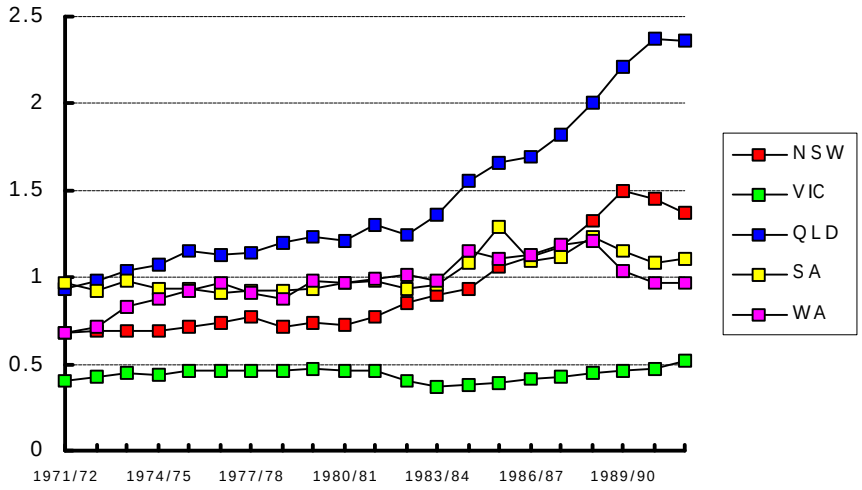

Figure 2: TFPs (intermediate demand)

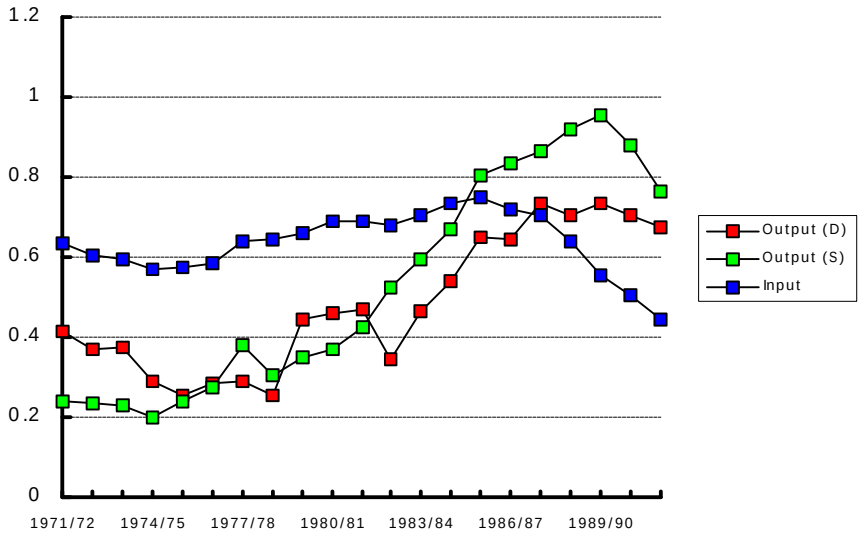

Figure3:Input and output indices for NSW

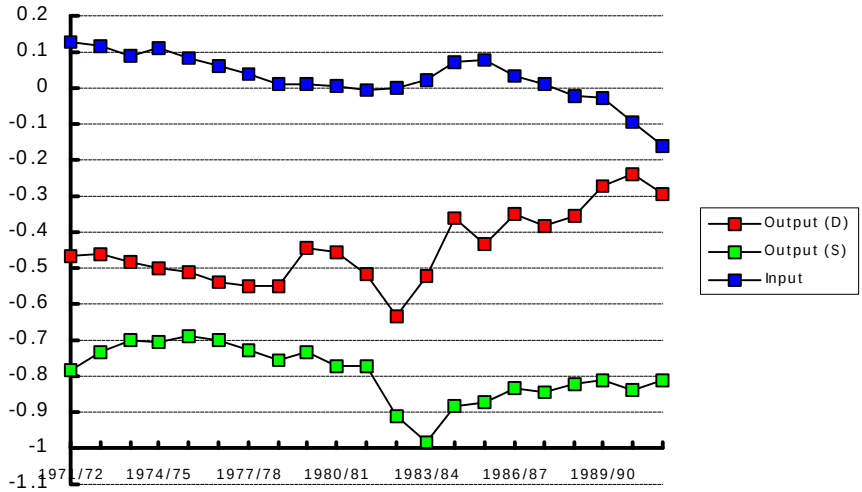

Figure 4: Input and output indices for Victoria

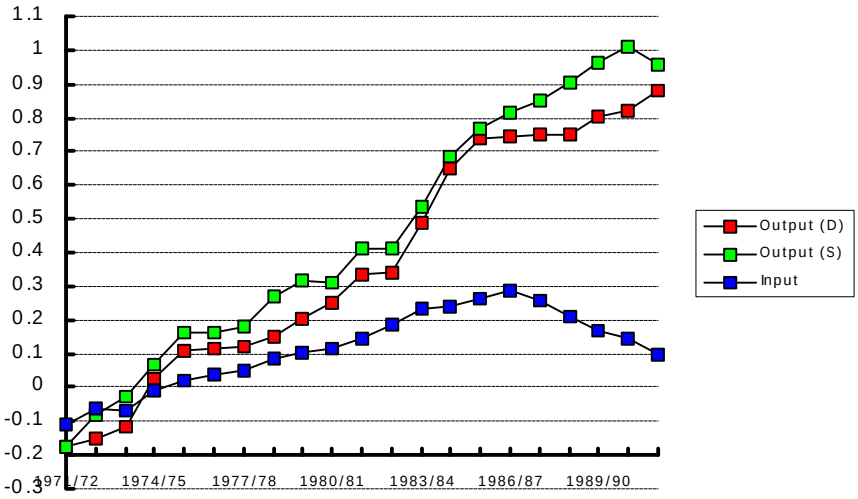

Figure 5: Input and output indices for Queensland

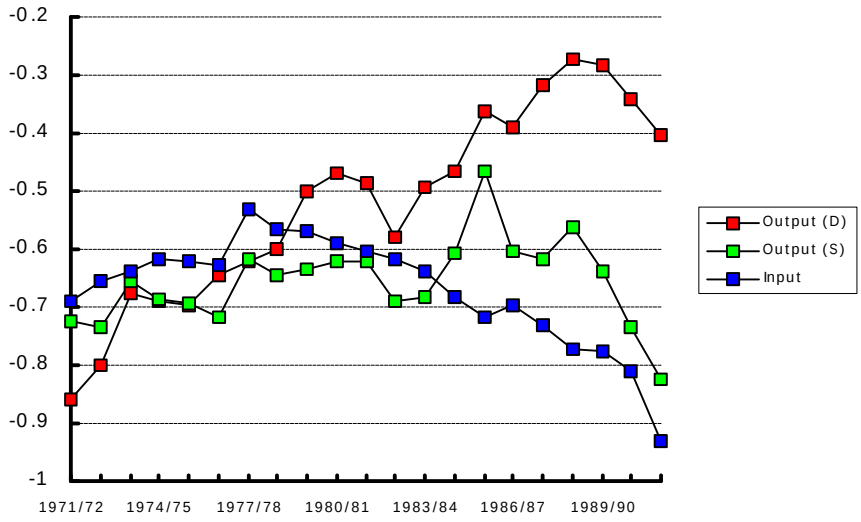

Figure 6: Input and output indices for South Australia

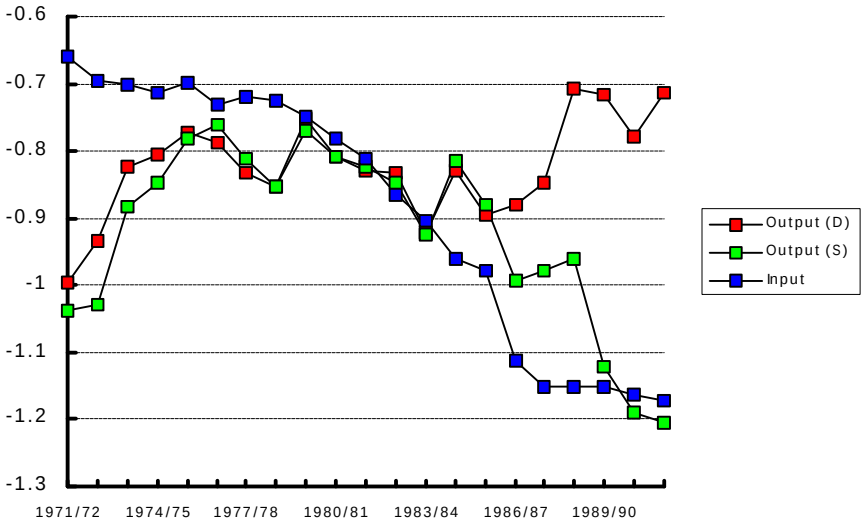

Figure 7: Input and output indices for Western Australia

Additional material

The following tables in the original working paper were deleted from the journal article due to the local content and level of detail. They are reproduced here, including any managerial and technological change variables added in 1991/92. The full tables with years the changes were introduced are reproduced in the revised data tables section.

Table 1 Summary of managerial and organisational change variables

STATE	MANAGERIAL AND ORGANISATIONAL CHANGES
New South Wales	Public Transport Commission formed; Shirley era; Reiher era; Granville train disaster; Hill era; traffic branch reorganised; Johnson era; Sayers era
Victoria	Bland report; Victorian Railways Board formed; Gibbs era as Chair of VRB; planning services reformed; traffic branch reorganised; organisation structure investigation; traffic branch permanently split; Gallagher era as GM of VRB; State Transport Authority formed; Fitzmaurice era as MD of STA; Public Transport Corporation formed (Stoney era)
Queensland	Hooper era as Transport Minister; Urban Public Transport Act 1974; Lee era as Commissioner; Goldston era as Commissioner; Tomkins era as Transport Minister; Financial Assistance Act 1979; Mendoza era as Commissioner; management reorganisation; Sheehy era as Commissioner; major management reorganisation; Read era as Commissioner
South Australia	Australian National Railways Commission formed; Smith era as Chair of ANRC; ANRC full control of SA and Tasrail; Williams era as GM of ANRC; Marks era as Chair of ANRC; distinction between commercial and non-comm. services; Williams era as Chair of ANRC; King era as GM of ANRC
Western Australia	Pascoe era as Commissioner; McCullough era; WA Transport Policy (Stage 1); joint venture with Total Western Transport; major top management changes; Gill era; major reorganisation

Table 2 Summary of technological change variables

TYPE OF CHANGE	INDIVIDUAL CHANGE VARIABLES
Rollingstock	
Main line locomotives	81 class diesel; BL class diesel; DL class diesel; electric
Long distance passenger trains	XPT; N class; refurbished Ghan; Australind
Interurban passenger trains	Double decked; other improved
Double decked suburban trains	First generation; improved; Tangara
Single decked suburban passenger trains	Improved
Freight wagons	Extra long flat wagons and containers; other flat wagons and containers; high capacity bulk; specialised BFW wagon; specialised steel wagon; specialised S pack
Bogies	High speed
Couplers	High strength/high capacity
Maintenance	Wheel profiling; in-situ wheel reconditioning
Locotrol	
Innovations	Tri-bo locos; driver training simulators; on-train diagnostic equipment; low speed control equipment; creep control equipment; adhesion improvement equipment; chopper controls; radio controls
Permanent way	
Track (rail bed)	Paved (Macgregor) track; noise control devices (rubberised beds, cologne eggs); geodetic fabrics for seepage control
Track (sleepers)	Concrete sleepers
Track (fastenings)	Pandrol clips and electric rail fastenings
Track (rail)	Continuous welded rail; glued insulated rail joints; head hardened rail; metricated rail profiles
Related infrastructure	Armco culverts; automated points and turnouts; automated ballast cleaning, sledding, tamping; automated track laying; automated weighbridges; overhead cranes
Other	Integration of stations into high rise developments; rail grinder
Electrification	New electrification; major extensions; AC electrification
Signalling, safety & telecommunications	Centralised Train Control signalling; radio control systems; fibre optics; train order systems; advanced TG and Bi-directional SIGS; passenger information systems; automatic ticketing
Office automation	Mainframe computers; rail CAD, TIMS, RICS, real time RS control

Total Factor Productivity Results

List of Tables

- TFP (demand side and supply side based), annual change in TFP, and input and output indices
- Input indices: unit measures of inputs and cost of inputs
- Output indices (demand side): unit measures of outputs and revenue from outputs
- Output indices (supply side): unit measures of outputs and revenue from outputs

TFP, annual change in TFP, and output and input indices (1971/72 = 100)

State	Year	TFPd	%change in TFPd	TFPs	% change in TFPs	Outputs (D)	Output (S)	Inputs
NSW	1971/72	.8047		.6740		.4160	.2388	.6333
NSW	1972/73	.7889	-1.96	.6905	2.45	.3704	.2371	.6074
NSW	1973/74	.8022	1.68	.6949	.63	.3754	.2318	.5958
NSW	1974/75	.7551	-5.87	.6923	-.37	.2877	.2009	.5686
NSW	1975/76	.7261	-3.84	.7180	3.71	.2534	.2421	.5735
NSW	1976/77	.7389	1.76	.7321	1.97	.2840	.2747	.5865
NSW	1977/78	.7032	-4.83	.7692	5.06	.2890	.3786	.6410
NSW	1978/79	.6762	-3.84	.7103	-7.65	.2545	.3037	.6457
NSW	1979/80	.8052	19.07	.7322	3.07	.4436	.3485	.6603
NSW	1980/81	.7936	-1.45	.7260	-.84	.4604	.3715	.6916
NSW	1981/82	.8026	1.14	.7662	5.53	.4717	.4253	.6916
NSW	1982/83	.7145	-10.98	.8576	11.93	.3438	.5264	.6800
NSW	1983/84	.7871	10.17	.8962	4.51	.4658	.5956	.7052
NSW	1984/85	.8227	4.52	.9352	4.34	.5414	.6696	.7366
NSW	1985/86	.9039	9.88	1.0583	13.17	.6485	.8061	.7495
NSW	1986/87	.9259	2.42	1.1189	5.73	.6445	.8339	.7215
NSW	1987/88	1.0277	11.00	1.1726	4.80	.7333	.8651	.7059
NSW	1988/89	1.0658	3.71	1.3221	12.75	.7041	.9195	.6403
NSW	1989/90	1.1994	12.53	1.4976	13.28	.7349	.9570	.5531
NSW	1990/91	1.2206	1.77	1.4521	-3.04	.7044	.8780	.5051
NSW	1991/92	1.2528	2.64	1.3755	-5.27	.6727	.7662	.4474
VIC	1971/72	.5518		.4013		-.4671	-.7858	.1274
VIC	1972/73	.5595	1.38	.4268	6.37	-.4617	-.7324	.1190
VIC	1973/74	.5629	.61	.4540	6.38	-.4841	-.6991	.0905
VIC	1974/75	.5428	-3.58	.4423	-2.59	-.5010	-.7057	.1101
VIC	1975/76	.5523	1.77	.4634	4.77	-.5130	-.6886	.0806
VIC	1976/77	.5478	-.82	.4654	.43	-.5393	-.7025	.0625
VIC	1977/78	.5561	1.52	.4647	-.14	-.5483	-.7279	.0385
VIC	1978/79	.5689	2.30	.4643	-.09	-.5517	-.7549	.0124
VIC	1979/80	.6341	11.46	.4739	2.07	-.4430	-.7342	.0126
VIC	1980/81	.6291	-.78	.4594	-3.06	-.4566	-.7711	.0068
VIC	1981/82	.6012	-4.44	.4665	1.55	-.5170	-.7706	-.0082
VIC	1982/83	.5315	-11.58	.4023	-13.77	-.6343	-.9129	-.0023
VIC	1983/84	.5804	9.20	.3666	-8.87	-.5216	-.9810	.0225
VIC	1984/85	.6479	11.63	.3834	4.58	-.3591	-.8837	.0750
VIC	1985/86	.5983	-7.65	.3871	.95	-.4346	-.8702	.0790
VIC	1986/87	.6800	13.64	.4200	8.52	-.3527	-.8344	.0330
VIC	1987/88	.6756	-.65	.4259	1.41	-.3832	-.8445	.0090
VIC	1988/89	.7175	6.21	.4496	5.56	-.3545	-.8219	-.0225
VIC	1989/90	.7831	9.14	.4560	1.43	-.2712	-.8118	-.0267
VIC	1990/91	.8648	10.43	.4746	4.06	-.2376	-.8377	-.0923
VIC	1991/92	.8746	1.13	.5214	9.87	-.2924	-.8096	-.1583
QLD	1971/72	.9340		.9386		-.1783	-.1735	-.1101
QLD	1972/73	.9139	-2.16	.9793	4.34	-.1519	-.0828	-.0619
QLD	1973/74	.9548	4.48	1.0405	6.25	-.1149	-.0289	-.0686
QLD	1974/75	1.0322	8.11	1.0754	3.36	.0253	.0663	-.0064
QLD	1975/76	1.0940	5.98	1.1533	7.24	.1112	.1640	.0214
QLD	1976/77	1.0833	-.98	1.1306	-1.97	.1181	.1609	.0381
QLD	1977/78	1.0774	-.54	1.1424	1.04	.1234	.1820	.0489
QLD	1978/79	1.0690	-.78	1.1992	4.98	.1537	.2686	.0869
QLD	1979/80	1.1026	3.14	1.2327	2.79	.2029	.3144	.1052

State	Year	TFPd	%change in TFPd	TFPs	% change in TFPs	Outputs (D)	Output (S)	Inputs
QLD	1980/81	1.1423	3.60	1.2147	-1.46	.2498	.3113	.1168
QLD	1981/82	1.2089	5.83	1.3072	7.61	.3356	.4138	.1459
QLD	1982/83	1.1651	-3.63	1.2496	-4.40	.3409	.4110	.1881
QLD	1983/84	1.2920	10.89	1.3585	8.72	.4888	.5390	.2326
QLD	1984/85	1.5008	16.16	1.5578	14.67	.6476	.6849	.2416
QLD	1985/86	1.6026	6.79	1.6540	6.18	.7381	.7696	.2664
QLD	1986/87	1.5796	-1.44	1.6905	2.21	.7457	.8136	.2885
QLD	1987/88	1.6359	3.57	1.8158	7.41	.7480	.8523	.2558
QLD	1988/89	1.7228	5.31	2.0079	10.58	.7518	.9049	.2079
QLD	1989/90	1.8878	9.58	2.2165	10.39	.8060	.9665	.1706
QLD	1990/91	1.9588	3.76	2.3758	7.19	.8182	1.0112	.1459
QLD	1991/92	2.1800	11.29	2.3664	-.40	.8782	.9602	.0989
SA	1971/72	.8441		.9658		-.8581	-.7234	-.6886
SA	1972/73	.8648	2.45	.9230	-4.43	-.8008	-.7357	-.6555
SA	1973/74	.9620	11.25	.9817	6.36	-.6771	-.6568	-.6384
SA	1974/75	.9304	-3.28	.9347	-4.79	-.6895	-.6849	-.6173
SA	1975/76	.9260	-.47	.9292	-.59	-.6965	-.6931	-.6197
SA	1976/77	.9822	6.06	.9128	-1.77	-.6453	-.7186	-.6273
SA	1977/78	.9127	-7.08	.9176	.53	-.6216	-.6162	-.5302
SA	1978/79	.9664	5.88	.9247	.78	-.5994	-.6435	-.5652
SA	1979/80	1.0747	11.21	.9389	1.53	-.4984	-.6335	-.5705
SA	1980/81	1.1283	4.99	.9701	3.32	-.4699	-.6210	-.5906
SA	1981/82	1.1243	-.35	.9818	1.21	-.4861	-.6215	-.6032
SA	1982/83	1.0403	-7.47	.9305	-5.23	-.5778	-.6893	-.6173
SA	1983/84	1.1580	11.32	.9589	3.05	-.4926	-.6813	-.6393
SA	1984/85	1.2428	7.32	1.0798	12.61	-.4657	-.6063	-.6831
SA	1985/86	1.4232	14.51	1.2858	19.07	-.3634	-.4649	-.7162
SA	1986/87	1.3569	-4.66	1.0943	-14.89	-.3898	-.6048	-.6950
SA	1987/88	1.5136	11.55	1.1202	2.36	-.3179	-.6190	-.7324
SA	1988/89	1.6468	8.80	1.2333	10.10	-.2731	-.5623	-.7720
SA	1989/90	1.6397	-.43	1.1492	-6.82	-.2817	-.6371	-.7762
SA	1990/91	1.5981	-2.54	1.0802	-6.01	-.3421	-.7337	-.8109
SA	1991/92	1.6929	5.93	1.1114	2.89	-.4048	-.8256	-.9313
WA	1971/72	.7148		.6853		-.9950	-1.0371	-.6593
WA	1972/73	.7878	10.22	.7151	4.34	-.9325	-1.0294	-.6940
WA	1973/74	.8861	12.47	.8327	16.45	-.8220	-.8841	-.7011
WA	1974/75	.9104	2.74	.8732	4.86	-.8059	-.8476	-.7120
WA	1975/76	.9296	2.11	.9204	5.41	-.7717	-.7816	-.6987
WA	1976/77	.9472	1.90	.9712	5.51	-.7864	-.7614	-.7322
WA	1977/78	.8921	-5.82	.9106	-6.24	-.8329	-.8124	-.7188
WA	1978/79	.8801	-1.35	.8786	-3.51	-.8521	-.8538	-.7244
WA	1979/80	.9961	13.18	.9787	11.39	-.7525	-.7701	-.7486
WA	1980/81	.9719	-2.43	.9714	-.75	-.8091	-.8097	-.7807
WA	1981/82	.9810	.94	.9887	1.78	-.8298	-.8220	-.8106
WA	1982/83	1.0345	5.45	1.0185	3.01	-.8316	-.8472	-.8655
WA	1983/84	.9824	-5.04	.9791	-3.87	-.9218	-.9251	-.9040
WA	1984/85	1.1412	16.17	1.1570	18.17	-.8285	-.8148	-.9606
WA	1985/86	1.0859	-4.85	1.1026	-4.70	-.8954	-.8802	-.9779
WA	1986/87	1.2617	16.19	1.1278	2.29	-.8801	-.9922	-1.1125
WA	1987/88	1.3540	7.31	1.1899	5.50	-.8480	-.9772	-1.1511
WA	1988/89	1.5600	15.21	1.2115	1.82	-.7066	-.9594	-1.1513
WA	1989/90	1.5455	-.93	1.0319	-14.82	-.7165	-1.1204	-1.1518
WA	1990/91	1.4692	-4.93	.9735	-5.67	-.7793	-1.1910	-1.1641
WA	1991/92	1.5827	7.73	.9684	-.52	-.7127	-1.2040	-1.1719

Note:
Output (D): Demand side output, based on urban and nonurban passengers, and ntkms of freight.
Output (S): Supply side output, based on passenger trains seat kms and freight trains carrying capacity tonne kms.

Input indices - unit measures of inputs and costs of inputs (1971/72 = 100)

State	Year	Labour	Labour cost index	Megajoules	Energy cost index	Materials	Capital	Capital cost index
NSW	1971/72	100.00	100.00	100.00	100.00	100.00	100.00	100.00
NSW	1972/73	99.01	106.68	98.05	91.40	76.94	98.04	98.04
NSW	1973/74	95.11	118.29	100.67	86.27	97.89	95.68	95.71
NSW	1974/75	92.26	122.62	101.15	105.79	93.38	93.59	93.57
NSW	1975/76	90.60	119.07	108.43	113.14	115.99	93.16	93.08
NSW	1976/77	92.08	130.03	117.03	115.94	109.52	94.21	94.09
NSW	1977/78	97.39	130.41	121.75	135.66	128.51	97.00	96.80
NSW	1978/79	95.84	124.80	134.08	138.34	130.00	100.73	100.55
NSW	1979/80	94.90	125.33	143.32	192.35	145.84	103.77	103.61
NSW	1980/81	96.95	130.11	144.50	256.29	162.73	107.15	106.95
NSW	1981/82	95.14	143.96	146.54	265.35	160.42	111.46	111.23
NSW	1982/83	92.99	138.30	133.48	282.53	152.39	115.82	115.61
NSW	1983/84	93.87	131.97	144.42	322.16	157.46	121.01	120.73
NSW	1984/85	95.43	131.78	152.59	332.08	165.18	127.03	126.75
NSW	1985/86	94.61	127.54	168.24	365.16	163.29	132.28	132.04
NSW	1986/87	88.88	121.14	163.12	310.19	154.49	136.83	136.59
NSW	1987/88	84.58	124.48	165.29	316.24	157.68	140.57	140.38
NSW	1988/89	76.28	121.65	162.45	283.17	136.79	141.41	141.36
NSW	1989/90	66.44	109.48	147.64	259.02	118.80	140.45	140.37
NSW	1990/91	61.28	104.22	143.83	252.49	108.00	140.46	140.35
NSW	1991/92	56.36	101.55	113.82	236.18	100.50	140.90	140.80
VIC	1971/72	100.00	100.00	100.00	100.00	100.00	100.00	100.00
VIC	1972/73	99.34	108.54	99.45	94.87	111.89	95.24	95.23
VIC	1973/74	97.20	118.06	97.68	92.84	105.61	90.67	90.67
VIC	1974/75	100.02	131.34	97.52	88.77	118.37	87.50	87.41
VIC	1975/76	96.64	129.40	95.50	111.28	116.26	85.72	85.64
VIC	1976/77	93.99	122.46	99.04	108.89	123.91	83.90	83.83
VIC	1977/78	91.78	120.06	99.96	132.93	120.14	81.87	81.81
VIC	1978/79	89.63	117.25	94.47	138.90	114.56	80.22	80.13
VIC	1979/80	87.60	114.85	98.25	188.04	143.29	78.85	78.77
VIC	1980/81	85.08	117.63	95.98	228.69	144.41	82.75	82.30
VIC	1981/82	81.29	120.40	95.40	233.07	133.73	88.80	88.56
VIC	1982/83	80.50	126.69	90.26	245.89	131.62	93.82	93.42
VIC	1983/84	79.61	146.77	92.93	264.69	124.39	105.85	105.12
VIC	1984/85	81.68	147.45	89.74	275.01	130.47	118.90	118.39
VIC	1985/86	79.60	132.06	89.31	259.63	132.85	124.58	124.31
VIC	1986/87	72.30	122.77	85.04	236.67	132.90	127.30	126.98
VIC	1987/88	68.27	111.61	79.53	237.83	137.29	128.71	128.52
VIC	1988/89	64.27	112.19	76.25	218.05	146.27	127.81	127.64
VIC	1989/90	63.84	102.35	76.37	215.86	143.18	126.61	126.44
VIC	1990/91	58.53	94.30	73.17	195.52	122.66	123.67	123.62
VIC	1991/92	54.21	90.24	69.21	171.83	108.95	118.68	118.67
QLD	1971/72	100.00	100.00	100.00	100.00	100.00	100.00	100.00
QLD	1972/73	99.59	107.09	109.02	99.82	212.22	102.24	102.40
QLD	1973/74	99.08	120.71	110.69	92.47	179.36	102.43	102.57
QLD	1974/75	103.60	145.92	121.62	110.83	248.86	103.75	103.84
QLD	1975/76	105.75	149.03	127.48	137.52	272.76	106.53	106.58
QLD	1976/77	108.03	145.81	126.97	154.08	271.00	108.80	108.92
QLD	1977/78	108.31	148.57	128.34	192.82	287.16	110.57	110.66
QLD	1978/79	112.55	146.69	140.62	260.29	286.97	115.82	115.73
QLD	1979/80	110.43	149.27	143.63	384.07	343.73	122.62	122.63

State	Year	Labour	Labour cost index	Megajoules	Energy cost index	Materials	Capital	Capital cost index
QLD	1980/81	109.92	153.87	139.60	472.27	380.73	125.72	125.89
QLD	1981/82	111.93	169.28	145.86	504.27	400.01	130.83	130.72
QLD	1982/83	114.89	168.83	143.07	550.81	402.39	145.89	145.42
QLD	1983/84	114.23	170.55	161.37	626.22	449.87	163.86	163.60
QLD	1984/85	113.45	161.60	147.01	689.79	455.15	174.18	174.27
QLD	1985/86	113.43	159.07	152.09	761.61	485.59	184.27	184.06
QLD	1986/87	109.13	148.74	148.98	702.03	584.44	199.01	198.82
QLD	1987/88	101.64	135.79	139.76	639.79	531.94	208.73	208.89
QLD	1988/89	94.57	130.97	127.68	531.46	498.14	208.59	209.07
QLD	1989/90	91.73	125.78	116.46	514.81	464.78	202.39	202.94
QLD	1990/91	90.00	120.12	118.38	484.94	444.32	195.20	195.73
QLD	1991/92	84.87	114.04	98.69	460.39	438.90	191.23	191.55
SA	1971/72	100.00	100.00	100.00	100.00	100.00	100.00	100.00
SA	1972/73	100.59	107.14	101.82	95.99	89.51	115.86	116.20
SA	1973/74	101.17	120.30	106.79	101.15	72.68	123.64	124.34
SA	1974/75	101.06	134.67	109.58	112.02	83.53	127.77	128.43
SA	1975/76	97.57	130.83	110.19	145.72	91.52	137.71	138.11
SA	1976/77	95.09	121.66	113.51	137.21	82.38	147.64	148.44
SA	1977/78	93.92	111.36	130.15	207.65	267.92	152.68	153.51
SA	1978/79	87.95	108.17	125.95	251.93	253.72	158.95	159.74
SA	1979/80	84.68	104.14	128.93	362.83	256.55	165.50	166.39
SA	1980/81	81.10	102.53	133.50	464.35	244.02	168.31	169.40
SA	1981/82	80.03	103.24	128.58	434.70	233.78	170.15	171.13
SA	1982/83	77.23	97.65	120.73	468.15	240.31	172.86	173.93
SA	1983/84	74.36	96.43	125.29	519.99	230.75	172.16	173.38
SA	1984/85	71.14	93.24	125.25	535.61	203.56	167.72	169.01
SA	1985/86	66.24	89.39	133.17	548.58	213.80	164.01	165.14
SA	1986/87	64.11	88.16	122.70	496.09	303.84	162.68	163.77
SA	1987/88	59.17	83.01	128.57	497.05	294.34	164.40	165.32
SA	1988/89	54.67	81.80	127.92	433.04	286.57	168.87	169.82
SA	1989/90	53.20	79.07	128.35	396.82	289.29	173.00	174.00
SA	1990/91	48.99	70.88	128.46	385.07	285.13	173.86	175.06
SA	1991/92	41.28	68.41	120.84	347.51	242.43	171.17	172.40
WA	1971/72	100.00	100.00	100.00	100.00	100.00	100.00	100.00
WA	1972/73	95.59	102.41	100.06	87.79	94.91	98.30	98.30
WA	1973/74	97.09	115.60	106.21	124.98	88.92	95.48	95.56
WA	1974/75	97.47	130.89	105.68	125.94	89.67	91.91	91.96
WA	1975/76	97.45	126.90	111.86	96.06	113.09	89.44	89.45
WA	1976/77	98.62	124.74	113.41	126.02	75.99	87.35	87.38
WA	1977/78	98.09	124.03	110.61	116.71	108.05	84.17	84.25
WA	1978/79	97.09	120.44	107.76	129.80	123.44	80.62	80.67
WA	1979/80	94.80	119.93	100.20	369.96	124.54	78.10	78.12
WA	1980/81	90.67	118.50	98.35	418.88	123.48	76.55	76.54
WA	1981/82	87.10	119.70	97.44	387.87	120.57	75.37	75.36
WA	1982/83	81.78	117.56	96.69	434.14	108.58	73.27	73.33
WA	1983/84	75.79	116.33	91.48	440.00	127.87	70.02	70.09
WA	1984/85	69.20	117.54	98.00	543.30	130.07	66.83	66.89
WA	1985/86	70.54	115.34	91.95	453.14	119.19	63.93	63.99
WA	1986/87	63.32	102.18	84.48	372.69	67.18	61.48	61.51
WA	1987/88	59.68	99.59	85.42	363.88	70.87	59.39	59.43
WA	1988/89	60.15	105.26	86.20	383.17	69.33	58.87	58.80
WA	1989/90	58.89	101.65	79.23	394.42	71.11	61.46	61.29
WA	1990/91	56.69	91.21	74.28	432.35	65.47	64.72	64.60
WA	1991/92	52.51	85.85	84.45	386.87	65.43	69.44	69.17

Output indices (demand side) - units of outputs and revenue from outputs

State	Year	Urban passengers		Non-urban passengers		Freight	
		Numbers	Revenue	Numbers	Revenue	NTKMs	Revenue
NSW	1971/72	100.00	100.00	100.00	100.00	100.00	100.00
NSW	1972/73	98.54	95.08	96.15	95.43	92.72	87.02
NSW	1973/74	99.27	84.69	61.19	83.37	100.51	84.17
NSW	1974/75	88.20	79.74	30.03	44.77	102.07	82.77
NSW	1975/76	81.95	77.22	27.76	44.79	99.45	78.76
NSW	1976/77	82.95	61.26	23.29	41.25	108.20	82.14
NSW	1977/78	83.15	63.20	24.86	46.40	107.30	79.65
NSW	1978/79	82.71	59.03	25.92	45.04	101.89	71.83
NSW	1979/80	94.67	70.75	33.40	49.90	123.81	85.81
NSW	1980/81	96.01	81.56	35.65	61.95	122.49	84.63
NSW	1981/82	99.55	85.57	34.45	62.76	124.33	90.83
NSW	1982/83	93.77	90.01	30.15	54.54	105.87	81.92
NSW	1983/84	91.48	90.57	24.01	56.82	129.25	91.64
NSW	1984/85	90.98	95.64	23.29	56.70	143.36	98.28
NSW	1985/86	99.25	103.72	26.17	63.66	159.51	103.18
NSW	1986/87	101.90	109.21	25.73	64.59	155.73	95.52
NSW	1987/88	112.05	123.20	27.89	62.53	164.99	85.41
NSW	1988/89	113.66	125.59	22.66	60.03	157.34	74.17
NSW	1989/90	114.73	123.54	18.71	42.23	167.13	76.66
NSW	1990/91	116.19	107.41	18.08	39.83	165.05	81.64
NSW	1991/92	112.61	107.77	16.24	31.08	160.30	82.03
VIC	1971/72	100.00	100.00	100.00	100.00	100.00	100.00
VIC	1972/73	97.88	95.61	105.72	103.33	98.54	90.54
VIC	1973/74	82.29	85.99	113.99	110.26	97.32	79.79
VIC	1974/75	84.25	75.57	125.52	105.94	96.23	79.46
VIC	1975/76	78.26	78.74	124.46	104.77	95.61	78.69
VIC	1976/77	73.41	78.72	111.33	98.33	94.71	76.30
VIC	1977/78	69.43	73.83	103.92	91.14	96.79	74.24
VIC	1978/79	66.69	71.73	102.81	93.65	97.91	74.67
VIC	1979/80	64.07	68.81	92.64	96.71	121.05	88.63
VIC	1980/81	63.14	76.90	100.48	105.54	115.32	87.53
VIC	1981/82	54.34	82.41	90.72	104.02	106.69	74.81
VIC	1982/83	59.92	84.41	104.35	109.95	76.84	53.15
VIC	1983/84	59.91	89.56	111.66	104.82	96.86	68.93
VIC	1984/85	63.23	91.50	120.16	124.42	121.02	79.17
VIC	1985/86	66.72	80.42	125.52	125.33	103.90	67.53
VIC	1986/87	69.19	86.22	132.07	126.43	109.94	61.09
VIC	1987/88	66.20	76.27	138.42	125.28	105.17	55.66
VIC	1988/89	67.99	76.29	147.32	127.29	104.76	51.48
VIC	1989/90	71.43	78.15	153.39	124.29	114.32	49.30
VIC	1990/91	70.66	85.99	155.56	118.70	115.20	44.27
VIC	1991/92	71.98	89.38	140.52	105.46	101.17	36.90
QLD	1971/72	100.00	100.00	100.00	100.00	100.00	100.00
QLD	1972/73	101.05	103.80	93.36	98.91	103.36	109.09
QLD	1973/74	106.03	97.26	97.62	92.41	107.13	100.00
QLD	1974/75	115.36	86.29	102.78	81.03	124.36	100.00
QLD	1975/76	107.50	91.42	103.92	81.72	137.76	109.09
QLD	1976/77	97.06	100.00	99.77	79.56	140.29	118.18
QLD	1977/78	91.19	91.85	96.77	74.81	142.07	109.09
QLD	1978/79	85.64	96.40	80.87	74.38	149.00	118.18
QLD	1979/80	92.78	101.12	83.77	78.85	156.36	118.18

QLD	1980/81	100.48	108.87	87.63	81.06	163.41	127.27
QLD	1981/82	107.98	122.32	93.36	87.81	178.38	145.45
		Urban passengers		Non-urban passengers		Freight	
State	Year	Numbers	Revenue	Numbers	Revenue	NTKMs	Revenue
QLD	1982/83	109.78	130.53	91.60	88.29	179.71	136.36
QLD	1983/84	118.72	148.76	100.40	91.24	209.61	172.73
QLD	1984/85	124.01	177.57	83.19	87.07	251.46	214.84
QLD	1985/86	133.34	205.09	71.38	75.38	278.91	217.20
QLD	1986/87	128.83	220.96	60.39	73.26	284.65	212.27
QLD	1987/88	148.93	276.85	72.37	79.70	281.99	187.98
QLD	1988/89	163.72	315.36	52.63	70.39	284.82	196.88
QLD	1989/90	143.28	257.86	50.65	108.35	307.95	190.59
QLD	1990/91	139.37	258.90	52.38	96.27	311.90	192.26
QLD	1991/92	132.79	256.90	56.52	158.58	337.13	193.54
SA	1971/72	100.00	100.00	100.00	100.00	100.00	100.00
SA	1972/73	99.97	100.32	107.23	103.00	106.35	94.64
SA	1973/74	99.97	92.84	123.22	115.97	121.32	96.43
SA	1974/75	92.87	85.05	119.93	103.43	120.63	91.07
SA	1975/76	93.15	77.98	108.43	109.17	120.39	87.50
SA	1976/77	94.67	75.87	103.72	97.90	128.00	89.29
SA	1977/78	92.51	55.27	80.49	128.86	134.01	95.15
SA	1978/79	87.35	57.48	61.51	132.09	141.32	96.61
SA	1979/80	95.06	72.66	55.91	152.22	159.56	107.23
SA	1980/81	106.94	77.96	54.07	164.88	164.08	112.17
SA	1981/82	103.34	88.73	52.62	167.94	162.35	110.65
SA	1982/83	99.67	96.11	39.08	180.77	152.33	96.31
SA	1983/84	97.62	104.94	39.15	186.96	168.15	106.22
SA	1984/85	87.99	140.14	33.95	182.16	177.43	113.45
SA	1985/86	99.85	166.72	35.30	199.41	198.96	116.11
SA	1986/87	91.35	151.43	36.02	186.82	193.96	108.76
SA	1987/88	66.96	151.08	38.63	183.78	215.42	112.68
SA	1988/89	70.13	161.33	38.36	187.93	226.96	114.11
SA	1989/90	68.90	153.72	42.58	215.86	226.67	105.70
SA	1990/91	59.92	131.90	32.17	170.99	216.91	95.99
SA	1991/92	54.23	116.47	21.54	120.63	207.37	83.28
WA	1971/72	100.00	100.00	100.00	100.00	100.00	100.00
WA	1972/73	103.18	100.31	107.43	103.45	106.90	92.73
WA	1973/74	104.93	104.40	118.86	115.59	120.36	101.82
WA	1974/75	92.65	92.89	112.57	107.72	123.81	107.27
WA	1975/76	84.64	72.33	74.86	101.49	131.87	114.55
WA	1976/77	74.22	72.96	70.86	93.26	131.47	107.27
WA	1977/78	82.19	68.81	66.00	85.65	123.93	107.27
WA	1978/79	81.98	69.12	66.86	84.57	121.20	106.96
WA	1979/80	66.04	50.19	66.00	77.47	137.21	109.43
WA	1980/81	60.23	52.33	65.43	86.47	130.19	104.16
WA	1981/82	61.18	58.24	62.57	88.63	127.32	110.48
WA	1982/83	61.58	59.81	62.86	86.88	127.15	105.20
WA	1983/84	81.06	88.73	60.29	78.24	113.20	96.67
WA	1984/85	86.11	93.63	56.13	85.01	125.51	108.10
WA	1985/86	89.81	93.89	59.62	89.30	116.15	95.88
WA	1986/87	95.37	97.50	61.14	86.70	117.81	87.07
WA	1987/88	91.67	93.88	74.00	101.79	121.91	82.75
WA	1988/89	91.67	90.79	92.27	117.13	141.56	87.40
WA	1989/90	82.41	82.26	95.97	125.95	141.29	82.11
WA	1990/91	74.07	86.30	88.24	97.91	132.91	77.97
WA	1991/92	89.81	94.92	76.57	80.64	141.47	83.66

Output indices (supply side) - units of outputs and revenue from outputs

State	Year	Passengers		Freight	
		Seat kms	Revenue	CCTKMs	Revenue
NSW	1971/72	100.00	100.00	100.00	100.00
NSW	1972/73	94.66	95.21	100.50	87.02
NSW	1973/74	90.80	84.21	102.19	84.17
NSW	1974/75	88.73	66.93	100.96	82.77
NSW	1975/76	99.39	65.34	102.80	78.76
NSW	1976/77	103.71	53.93	108.37	82.14
NSW	1977/78	104.80	57.04	122.27	79.65
NSW	1978/79	97.63	53.90	112.88	71.83
NSW	1979/80	106.79	63.11	116.83	85.81
NSW	1980/81	111.18	74.37	116.86	84.63
NSW	1981/82	127.61	77.21	120.74	90.83
NSW	1982/83	134.80	77.02	133.85	81.92
NSW	1983/84	139.53	78.21	146.55	91.64
NSW	1984/85	139.86	81.37	161.62	98.28
NSW	1985/86	143.63	89.05	190.65	103.18
NSW	1986/87	145.30	92.86	195.15	95.52
NSW	1987/88	159.51	100.97	193.68	85.41
NSW	1988/89	161.72	101.57	204.44	74.17
NSW	1989/90	153.86	93.75	221.58	76.66
NSW	1990/91	143.92	82.65	206.86	81.64
NSW	1991/92	146.52	79.67	178.05	82.03
VIC	1971/72	100.00	100.00	100.00	100.00
VIC	1972/73	112.52	97.38	100.90	90.54
VIC	1973/74	115.36	91.56	102.65	79.79
VIC	1974/75	125.18	82.54	101.60	79.46
VIC	1975/76	126.86	84.71	102.37	78.69
VIC	1976/77	122.48	83.22	101.38	76.30
VIC	1977/78	112.39	77.80	102.34	74.24
VIC	1978/79	102.16	76.75	102.73	74.67
VIC	1979/80	98.30	75.21	112.30	88.63
VIC	1980/81	100.18	83.47	103.23	87.53
VIC	1981/82	101.28	87.36	97.31	74.81
VIC	1982/83	91.76	90.27	73.21	53.15
VIC	1983/84	72.52	93.06	79.61	68.93
VIC	1984/85	88.60	99.05	85.87	79.17
VIC	1985/86	84.46	90.72	87.47	67.53
VIC	1986/87	81.60	95.44	89.49	61.09
VIC	1987/88	78.22	87.51	89.79	55.66
VIC	1988/89	77.87	87.98	90.82	51.48
VIC	1989/90	79.72	88.73	89.72	49.30
VIC	1990/91	79.78	93.49	81.95	44.27
VIC	1991/92	79.00	93.07	81.26	36.90
QLD	1971/72	100.00	100.00	100.00	100.00
QLD	1972/73	94.12	101.20	111.51	109.09
QLD	1973/74	92.73	94.68	118.91	100.00
QLD	1974/75	93.18	83.50	131.72	100.00
QLD	1975/76	92.25	86.26	147.02	109.09
QLD	1976/77	91.32	89.14	146.41	118.18
QLD	1977/78	90.40	82.79	150.18	109.09
QLD	1978/79	89.46	84.70	165.47	118.18
QLD	1979/80	94.09	89.28	173.51	118.18

QLD	1980/81	94.98	94.09	172.52	127.27
QLD	1981/82	95.87	103.98	193.20	145.45
		Passengers		Freight	
State	Year	Seat kms	Revenue	CCTKMs	Revenue
QLD	1982/83	95.83	108.08	193.53	136.36
QLD	1983/84	102.32	118.19	220.25	172.73
QLD	1984/85	96.81	129.47	260.00	214.84
QLD	1985/86	97.13	136.15	286.45	217.20
QLD	1986/87	99.98	142.46	300.90	212.27
QLD	1987/88	105.37	172.08	318.05	187.98
QLD	1988/89	99.90	185.17	340.86	196.88
QLD	1989/90	94.40	178.41	368.38	190.59
QLD	1990/91	91.56	172.47	387.96	192.26
QLD	1991/92	95.09	204.65	369.08	193.54
SA	1971/72	100.00	100.00	100.00	100.00
SA	1972/73	98.51	101.95	98.87	94.64
SA	1973/74	100.72	106.94	108.01	96.43
SA	1974/75	98.78	96.26	104.83	91.07
SA	1975/76	99.40	96.99	103.76	87.50
SA	1976/77	89.84	89.30	102.31	89.29
SA	1977/78	90.33	100.13	115.21	95.15
SA	1978/79	77.34	102.96	114.53	96.61
SA	1979/80	71.69	121.16	117.53	107.23
SA	1980/81	75.27	130.94	118.41	112.17
SA	1981/82	73.85	137.01	118.95	110.65
SA	1982/83	65.42	147.72	113.18	96.31
SA	1983/84	57.55	154.94	116.76	106.22
SA	1984/85	61.45	165.76	126.08	113.45
SA	1985/86	64.18	186.65	148.83	116.11
SA	1986/87	61.96	173.00	126.71	108.76
SA	1987/88	57.26	171.01	126.14	112.68
SA	1988/89	56.75	177.54	135.38	114.11
SA	1989/90	55.70	191.60	125.57	105.70
SA	1990/91	46.49	155.73	115.01	95.99
SA	1991/92	39.07	119.01	105.58	83.28
WA	1971/72	100.00	100.00	100.00	100.00
WA	1972/73	101.75	102.04	100.59	92.73
WA	1973/74	104.10	110.55	118.37	101.82
WA	1974/75	100.98	101.05	123.93	107.27
WA	1975/76	103.03	88.37	133.15	114.55
WA	1976/77	102.35	84.13	136.35	107.27
WA	1977/78	101.45	78.07	128.83	107.27
WA	1978/79	98.69	77.62	123.39	106.96
WA	1979/80	77.79	65.20	139.60	109.43
WA	1980/81	81.39	71.11	132.90	104.16
WA	1981/82	83.71	74.96	130.59	110.48
WA	1982/83	91.71	74.70	125.49	105.20
WA	1983/84	105.08	82.96	112.87	96.67
WA	1984/85	96.09	88.89	129.45	108.10
WA	1985/86	94.83	91.37	120.46	95.88
WA	1986/87	90.27	91.56	106.77	87.07
WA	1987/88	90.73	98.23	108.54	82.75
WA	1988/89	91.46	105.28	110.66	87.40
WA	1989/90	95.68	106.29	91.33	82.11
WA	1990/91	89.29	92.69	85.15	77.97
WA	1991/92	100.01	87.07	82.64	83.66

Note:
CCTKMs = Carrying capacity tonne kms

Revised Data Tables

List of Tables

INPUT TABLE 1 : NUMBER OF STAFF

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	43411	25970	22697	13628	10261	23193
1972/73	42983	25798	22605	13708	9808	22980
1973/74	41290	25243	22489	13768	9962	22554
1974/75	40050	25974	23514	13772	10001	22662
1975/76	39331	25098	24003	13297	9999	22346
1976/77	39973	24409	24520	12959	10119	22396
1977/78	42276	23836	24583	12799	10065	22712
1978/79	41605	23277	25546	11986	9962	22475
1979/80	41197	22749	25064	11540	9727	22055
1980/81	42089	22094	24948	11052	9304	21897
1981/82	41302	21111	25404	10907	8937	21532
1982/83	40367	20905	26077	10525	8391	21253
1983/84	40751	20676	25927	10134	7777	21053
1984/85	41427	21212	25750	9695	7101	21037
1985/86	41071	20671	25746	9027	7238	20751
1986/87	38585	18777	24770	8737	6497	19473
1987/88	36717	17730	23070	8064	6124	18341
1988/89	33113	16690	21465	7450	6172	16978
1989/90	28842	16580	20821	7250	6043	15907
1990/91	26602	15200	20428	6677	5817	14945
1991/92	24467	14079	19262	5626	5388	13764

INPUT TABLE 2A : TOTAL LABOUR EXPENSES $1971/72
(Units: $ '000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	195089	120931	103298	60098	42321	104347
1972/73	208124	131253	110624	64386	43342	111546
1973/74	230770	142775	124694	72300	48924	123892
1974/75	239219	158825	150727	80935	55393	137020
1975/76	232289	156460	153950	78627	53705	135010
1976/77	253669	148092	150617	73118	52791	135657
1977/78	254417	145187	153475	66927	52489	134499
1978/79	243472	141787	151526	65007	50971	130553
1979/80	244504	138884	154198	62584	50756	130185
1980/81	253839	142252	158948	61620	50152	133362
1981/82	280854	145595	174859	62047	50658	142802
1982/83	269813	153202	174397	58683	49751	141169
1983/84	257465	177492	176177	57954	49231	143664
1984/85	257096	178317	166927	56035	49744	141624
1985/86	248808	159699	164318	53722	48811	135072
1986/87	236333	148466	153643	52981	43243	126933
1987/88	242846	134976	140269	49886	42148	122025
1988/89	237321	135671	135294	49159	44549	120399
1989/90	213575	123776	129926	47522	43020	111564
1990/91	203319	114038	124080	42595	38601	104527
1991/92	198121	109123	117799	41116	36332	100498

INPUT TABLE 2B : TOTAL LABOUR EXPENSES $CURRENT

(Units: $ '000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	195069	120931	103298	60098	42321	104347
1972/73	220632	139302	117055	68254	45701	118189
1973/74	276932	171808	150021	87240	56910	148582
1974/75	332535	222702	209330	115243	76203	191203
1976/76	366998	247699	241608	125539	84315	213232
1976/77	448977	268073	270090	134925	96010	243615
1977/78	491036	288685	300980	135764	105796	264452
1978/79	508829	304259	321440	141567	111055	277430
1979/80	567241	327795	358877	150050	120843	304961
1980/81	644803	367337	404299	161286	129929	341531
1981/82	786390	415070	492358	179456	145939	403843
1982/83	844518	485811	545177	189696	157891	444619
1983/84	854793	605462	590175	200689	167084	483641
1984/85	886993	635904	585512	203429	175395	497447
1985/86	933010	617760	622755	211202	186017	514149
1986/87	968985	628363	632321	227426	181266	527672
1987/88	1070998	613096	617598	228506	189232	543886
1988/89	1132001	658291	638020	241644	214786	576948
1989/90	1102000	650757	658643	250266	224800	577293
1990/91	1100000	634015	659939	238141	211908	568801
1991/92	1090000	620189	638966	235798	201054	557201

INPUT TABLE 3 : MEGAJOULES

(Units: '000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	6448094	4174208	4556352	3267848	2470380	4183376
1972/73	6322616	4151104	4967170	3327242	2471748	4247976
1973/74	6491326	4077162	5043322	3489730	2623786	4345065
1974/75	6521944	4070620	5541312	3581006	2610638	4465104
1975/76	6991540	3986448	5808262	3600728	2763360	4630068
1976/77	7546134	4134194	5785272	3709218	2801550	4795274
1977/78	7850474	4172524	5847592	4253074	2732542	4971241
1978/79	8645606	3943256	6407180	4115818	2662128	5154798
1979/80	9241328	4101278	6544186	4213364	2475396	5315106
1980/81	9317382	4006590	6360562	4362628	2429682	5295369
1981/82	9449346	3982000	6645726	4201774	2407186	5337206
1982/83	8608766	3767528	6518760	3945388	2388528	5045394
1983/84	9312485	3879206	7352432	4094310	2259936	5379674
1984/85	9839400	3745988	6898100	4093132	2421018	5359528
1985/86	10848000	3727952	6929710	4351722	2271412	5625759
1986/87	10518000	3549680	6788000	4009798	2087036	5390503
1987/88	10657800	3319746	6367998	4201356	2110178	5331416
1988/89	10474800	3182856	5817648	4180380	2129368	5157010
1989/90	9520200	3187876	5306260	4194136	1957190	4833132
1990/91	9274291	3054406	5393996	4198012	1835020	4751145
1991/92	7339457	2888770	4496543	3948871	2086331	4151994

INPUT TABLE 4A : ENERGY EXPENDITURE $1971/72

(Units: $'000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	9158	4273	3431	1997	1245	4021
1972/73	8370	4054	3425	1917	1093	3772
1973/74	7901	3967	3173	2020	1556	3723
1974/75	9688	3793	3803	2237	1568	4218
1975/76	10361	4755	4718	2910	1196	4788
1976/77	10618	4653	5287	2740	1569	4973
1977/78	12424	5680	6616	4147	1453	6064
1978/79	12669	5935	8931	5031	1616	6836
1979/80	17615	8035	13177	7246	4606	10136
1980/81	23471	9772	16204	9273	5215	12787
1981/82	24301	9959	17302	8681	4829	13014
1982/83	25874	10507	18898	9349	5405	14007
1983/84	29503	11310	21486	10384	5478	15632
1984/85	30412	11751	23667	10696	6764	16658
1985/86	33441	11094	26131	10955	5642	17453
1986/87	28407	10113	24087	9907	4640	15431
1987/88	28961	10162	21951	9926	4530	15106
1988/89	25933	9317	18234	8648	4770	13381
1989/90	23721	9224	17663	7925	4911	12689
1990/91	23123	8354	16638	7690	5383	12238
1991/92	21630	7342	15796	6940	4817	11305

INPUT TABLE 4B : ENERGY EXPENDITURE $CURRENT

(Units: $'000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	9158	4273	3431	1997	1245	4021
1972/73	8874	4303	3624	2032	1152	3997
1973/74	9464	4774	3817	2437	1810	4460
1974/75	13507	5318	5281	3185	2157	5890
1975/76	16324	7527	7405	4646	1878	7556
1976/77	18782	8423	9480	5056	2854	8919
1977/78	23923	11294	12974	8412	2929	11906
1978/79	26522	12736	18945	10956	3521	14536
1979/80	40783	18964	30669	17372	10966	23751
1980/81	59616	25233	41215	24272	13511	32769
1981/82	68021	28393	48717	25108	13912	36830
1982/83	81099	33319	59077	30221	17153	44174
1983/84	98094	38582	71975	35959	18591	52640
1984/85	104921	41905	83013	38831	23850	58504
1985/86	125402	42915	99034	43069	21500	66384
1986/87	116469	42801	99129	42527	19450	64075
1987/88	127717	46160	96650	45467	20340	67267
1988/89	123700	45208	85990	42509	23000	64081
1989/90	122400	48493	89541	41733	25660	65565
1990/91	125100	46448	88493	42993	29550	66517
1991/92	119000	41728	85681	39800	26654	62573

INPUT TABLE 5A : MATERIALS EXPENDITURE $1971/72

(Units: $millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	25.5	14.4	5.7	5.6	8.9	12.0
1972/73	19.6	16.1	12.1	5.0	8.5	12.3
1973/74	25.0	15.2	10.2	4.1	7.9	12.5
1974/75	23.8	17.0	14.2	4.7	8.0	13.5
1975/76	29.6	16.7	15.5	5.1	10.1	15.4
1976/77	27.9	17.8	15.4	4.6	6.8	14.5
1977/78	32.8	17.3	16.4	15.1	9.6	18.2
1978/79	33.2	16.5	16.4	14.3	11.0	18.3
1979/80	37.2	20.6	19.6	14.4	11.1	20.6
1980/81	41.5	20.8	21.7	13.7	11.0	21.7
1981/82	40.9	19.3	22.8	13.2	10.8	21.4
1982/83	38.9	19.0	22.9	13.5	9.7	20.8
1983/84	40.2	17.9	25.6	13.0	11.4	21.6
1984/85	42.1	18.8	25.9	11.5	11.6	22.0
1985/86	41.6	19.1	27.7	12.0	10.6	22.2
1986/87	39.4	19.1	33.3	17.1	6.0	23.0
1987/88	40.2	19.8	30.3	16.6	6.3	22.6
1988/89	34.9	21.1	28.4	16.1	6.2	21.3
1989/90	30.3	20.6	26.5	16.3	6.3	20.0
1990/91	27.5	17.7	25.3	16.0	5.8	18.5
1991/92	25.6	15.7	25.0	13.6	5.8	17.2

INPUT TABLE 5B : MATERIALS EXPENDITURE $CURRENT

(Units: $millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	25.5	14.4	5.7	5.6	8.9	12.0
1972/73	20.8	17.1	12.8	5.3	8.9	13.0
1973/74	29.9	18.3	12.3	4.9	9.2	14.9
1974/75	33.2	23.9	19.7	6.7	11.0	18.9
1975/76	46.6	26.5	24.4	8.2	15.8	24.3
1976/77	49.4	32.3	27.7	8.6	12.3	26.1
1977/78	63.1	34.4	32.1	30.6	19.4	35.9
1978/79	69.4	35.4	34.7	31.1	24.0	38.9
1979/80	86.1	48.7	45.6	34.6	26.5	48.3
1980/81	105.4	53.7	55.2	35.9	28.5	55.8
1981/82	114.5	54.9	64.2	38.0	31.0	60.5
1982/83	121.8	60.1	71.7	43.7	30.8	65.6
1983/84	133.5	61.1	85.9	45.0	38.7	72.8
1984/85	145.5	67.0	91.0	41.6	40.9	77.2
1985/86	156.0	74.0	104.9	47.3	40.5	84.5
1986/87	161.5	81.0	137.1	73.4	25.1	95.6
1987/88	177.4	89.8	133.5	75.9	28.4	101.0
1988/89	166.3	102.2	133.9	79.3	29.8	102.3
1989/90	156.2	108.4	134.3	85.7	33.2	103.6
1990/91	149.0	98.2	134.7	89.7	32.1	100.7
1991/92	141.0	89.2	135.7	78.2	32.3	95.3

INPUT TABLE 6A : CAPITAL STOCK $1971/72

(Units: $millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	771	472	324	127	247	388
1972/73	756	449	331	147	243	385
1973/74	738	428	332	157	236	378
1974/75	722	413	336	162	227	372
1975/76	719	404	345	175	221	373
1976/77	727	396	352	187	216	376
1977/78	748	386	358	194	208	379
1978/79	777	378	375	202	199	386
1979/80	800	372	397	210	193	394
1980/81	827	390	407	214	189	405
1981/82	860	419	424	216	186	421
1982/83	893	442	472	219	181	442
1983/84	933	499	530	219	173	471
1984/85	980	561	564	213	165	496
1985/86	1020	588	597	208	158	514
1986/87	1055	600	644	207	152	532
1987/88	1084	607	676	209	147	544
1988/89	1091	603	675	214	145	548
1989/90	1083	597	655	220	152	541
1990/91	1083	583	632	221	160	536
1991/92	1087	560	619	217	171	531

INPUT TABLE 6B : CAPITAL STOCK $CURRENT

(Units: $millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	771	472	324	127	247	388
1972/73	802	477	350	156	256	408
1973/74	884	515	399	189	274	452
1974/75	1006	579	466	231	312	519
1975/76	1132	640	541	279	347	588
1976/77	1285	716	632	346	392	674
1977/78	1441	768	702	393	419	744
1978/79	1627	812	795	440	434	821
1979/80	1853	878	924	504	459	923
1980/81	2099	1008	1035	559	490	1038
1981/82	2406	1194	1193	625	536	1191
1982/83	2800	1403	1476	710	574	1393
1983/84	3104	1703	1777	757	587	1585
1984/85	3385	2000	1978	773	582	1743
1985/86	3823	2273	2261	819	601	1955
1986/87	4327	2541	2651	887	636	2208
1987/88	4784	2757	2975	956	658	2426
1988/89	5200	2925	3184	1054	701	2613
1989/90	5586	3139	3321	1157	793	2799
1990/91	5862	3243	3361	1234	877	2915
1991/92	5979	3181	3358	1246	949	2943

INPUT TABLE 7A : CAPITAL UTILISATION $1971/72

(Units: $millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	116	71	48	19	37	58
1972/73	114	67	50	22	36	58
1973/74	111	64	50	24	35	57
1974/75	108	62	50	24	34	56
1975/76	108	61	52	26	33	56
1976/77	109	59	53	28	32	56
1977/78	112	58	54	29	31	57
1978/79	116	57	56	30	30	58
1979/80	120	56	59	31	29	59
1980/81	124	58	61	32	28	61
1981/82	129	63	63	32	28	63
1982/83	134	66	71	33	27	66
1983/84	140	74	79	33	26	70
1984/85	147	84	84	32	25	74
1985/86	153	88	89	31	24	77
1986/87	158	90	96	31	23	80
1987/88	163	91	101	31	22	82
1988/89	164	90	101	32	22	82
1989/90	163	90	98	33	23	81
1990/91	162	88	95	33	24	80
1991/92	163	84	93	33	26	80

INPUT TABLE 7B : CAPITAL UTILISATION $CURRENT

(Units: $millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	116	71	48	19	37	58
1972/73	120	72	53	23	38	61
1973/74	133	77	60	28	41	68
1974/75	151	87	70	35	47	78
1975/76	170	96	81	42	52	88
1976/77	193	108	95	52	59	101
1977/78	216	115	105	59	63	112
1978/79	244	122	119	66	65	123
1979/80	278	132	138	75	69	138
1980/81	315	151	155	84	73	156
1981/82	360	179	178	94	80	178
1982/83	420	210	220	106	86	208
1983/84	465	254	266	114	88	237
1984/85	507	299	296	116	87	261
1985/86	573	341	338	123	90	293
1986/87	648	381	397	133	96	331
1987/88	717	414	446	143	99	364
1988/89	780	439	478	158	105	392
1989/90	838	471	499	173	119	420
1990/91	879	487	505	185	131	437
1991/92	897	478	504	187	142	441

OUTPUT TABLE 1 : URBAN PASSENGER NUMBERS

(Units: '000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	216507	133840	30184	12918	10800	80850
1972/73	213341	131009	30500	12914	11143	79781
1973/74	214926	110141	32003	12914	11332	76263
1974/75	190966	112757	34821	11997	10006	72109
1975/76	177421	104748	32448	12033	9141	67158
1976/77	179583	98252	29296	12230	8016	65475
1977/78	180019	92925	27526	11950	8877	64259
1978/79	179080	89258	25850	11284	8854	62865
1979/80	204961	85755	28006	12280	7132	67627
1980/81	207862	84500	30330	13815	6505	68602
1981/82	215528	72726	32592	13350	6607	68161
1982/83	203028	80197	33135	12876	6651	67177
1983/84	198065	80184	35833	12610	8754	67089
1984/85	196977	84628	37431	11366	9300	67940
1985/86	214875	89300	40246	12899	9700	73404
1986/87	220611	92600	38886	11800	10300	74839
1987/88	242589	88600	44953	8650	9900	78938
1988/89	246087	91000	49418	9060	9900	81093
1989/90	248397	95600	43248	8900	8900	81009
1990/91	251550	94570	42067	7741	8000	80786
1991/92	243800	96338	40080	7005	9700	79385

OUTPUT TABLE 2A : URBAN PASSENGER REVENUE $1971/72

(Units: $'000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	48036	26773	3472	2221	1590	16418
1972/73	45673	25597	3604	2228	1595	15739
1973/74	40683	23023	3377	2062	1660	14161
1974/75	38304	20233	2996	1889	1477	12980
1975/76	37092	21081	3174	1732	1150	12846
1976/77	29428	21076	3472	1685	1160	11364
1977/78	30359	19766	3189	1227	1094	11127
1978/79	28355	19203	3347	1277	1099	10656
1979/80	33987	18422	3511	1614	798	11666
1980/81	39176	20589	3780	1731	832	13222
1981/82	41104	22063	4247	1971	926	14062
1982/83	43238	22599	4532	2135	951	14691
1983/84	43506	23977	5165	2331	1411	15278
1984/85	45941	24497	6165	3113	1489	16241
1985/86	49825	21530	7121	3703	1493	16734
1986/87	52460	23083	7672	3363	1550	17626
1987/88	59182	20419	9612	3356	1493	18812
1988/89	60330	20424	10949	3583	1444	19346
1989/90	59348	20922	8953	3414	1308	18789
1990/91	51595	23023	8989	2929	1372	17582
1991/92	51767	23929	8920	2587	1509	17742

OUTPUT TABLE 2B : URBAN PASSENGER REVENUE $CURRENT

(Units: $'000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	48036	26773	3472	2221	1590	16418
1972/73	48422	27167	3814	2362	1682	16689
1973/74	48733	27705	4063	2488	1931	16984
1974/75	53404	28371	4161	2690	2032	18131
1975/76	58441	33370	4981	2765	1805	20273
1976/77	52054	38151	6226	3109	2110	20330
1977/78	58459	39301	6254	2490	2205	21742
1978/79	59360	41208	7100	2780	2394	22569
1979/80	78887	43480	8171	3869	1900	27222
1980/81	99507	53167	9615	4532	2155	33795
1981/82	115054	62898	11958	5700	2668	39656
1982/83	135524	71664	14167	6900	3018	46255
1983/84	144652	81789	17302	8071	4788	51320
1984/85	158699	87358	21625	11300	5249	56846
1985/86	186670	83285	26987	14557	5689	63437
1986/87	215063	97696	31573	14437	6498	73053
1987/88	261110	92746	42322	15370	6702	83650
1988/89	287629	99100	51634	17613	6960	92587
1989/90	306000	110000	45388	17980	6835	97240
1990/91	279142	128000	47809	16378	7533	95772
1991/92	284804	136000	48382	14835	8352	98475

OUTPUT TABLE 3 : NONURBAN PASSENGER NUMBERS

(Units: '000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	14161	3954	1762	913	350	4228
1972/73	13616	4180	1645	979	376	4159
1973/74	6665	4507	1720	1125	416	3287
1974/75	4253	4963	1811	1095	394	2503
1975/76	3931	4921	1831	990	262	2387
1976/77	3298	4402	1756	947	248	2131
1977/78	3521	4109	1705	735	231	2060
1978/79	3670	4065	1425	562	234	1991
1979/80	4730	3663	1476	511	231	2122
1980/81	5048	3973	1544	494	229	2258
1981/82	4879	3587	1645	480	219	2162
1982/83	4269	4128	1614	357	220	2117
1983/84	3400	4415	1769	357	211	2030
1984/85	3298	4751	1466	310	196	2004
1985/86	3706	4963	1258	322	209	2092
1986/87	3644	5222	1064	329	214	2095
1987/88	3950	5473	1275	353	259	2262
1988/89	3209	5825	927	350	323	2127
1989/90	2849	6085	892	389	336	2066
1990/91	2561	6151	923	294	309	2048
1991/92	2300	5556	996	197	268	1863

OUTPUT TABLE 4A : NONURBAN PASSENGER REVENUE $1971/72

(Units: $'000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	27776	7968	3938	3468	1944	9019
1972/73	26508	8233	3895	3572	2011	8844
1973/74	23158	8785	3639	4022	2247	8370
1974/75	12435	8441	3191	3587	2094	5950
1975/76	12442	8348	3218	3786	1973	5953
1976/77	11458	7835	3133	3395	1813	5527
1977/78	12887	7262	2946	4469	1665	5846
1978/79	12510	7462	2929	4581	1644	5825
1979/80	13860	7706	3105	5279	1506	6291
1980/81	17206	8409	3192	5718	1681	7241
1981/82	17432	8288	3458	5824	1723	7345
1982/83	15150	8761	3477	6269	1689	7069
1983/84	15783	8352	3593	6484	1521	7147
1984/85	15749	9914	3429	6317	1653	7412
1985/86	17682	9986	2968	6916	1736	7858
1986/87	17940	10074	2885	6479	1685	7813
1987/88	17367	9983	3139	6373	1979	7768
1988/89	16675	10143	2772	6517	2277	7677
1989/90	11730	9903	4267	7486	2448	7167
1990/91	11064	9458	3791	5930	1903	6429
1991/92	8634	8403	6245	4184	1568	5807

OUTPUT TABLE 4B : NONURBAN PASSENGER REVENUE $CURRENT

(Units: $'000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	27776	7968	3938	3468	1944	9019
1972/73	28104	8736	4121	3787	2120	9374
1973/74	27740	10572	4378	4853	2614	10031
1974/75	17337	11836	4432	5108	2881	8319
1975/76	19603	13215	5050	6045	3098	9402
1976/77	20268	14182	5619	6265	3297	9926
1977/78	24815	14439	5777	10784	3356	11634
1978/79	26189	16012	6213	13953	3582	13190
1979/80	32089	18188	7227	14524	3586	15123
1980/81	43703	21715	8119	17669	4355	19112
1981/82	48794	23628	9737	19400	4964	21304
1982/83	47486	27782	10869	20736	5360	22447
1983/84	52476	28490	12036	22453	5162	24124
1984/85	54403	35354	12027	22934	5827	26109
1985/86	66246	38630	11250	27188	6616	29986
1986/87	73546	42635	11874	27812	7065	32586
1987/88	76623	45343	13820	29194	8884	34773
1988/89	79500	49214	13071	32036	10978	36960
1989/90	60482	52067	21631	39424	12794	37280
1990/91	59859	52583	20164	33153	10449	35242
1991/92	47500	47759	33875	23993	8675	32360

OUTPUT TABLE 5 : NET TONNE KILOMETRES (FREIGHT)

(Units: millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	8614	3212	7332	3761	3448	5273
1972/73	7987	3165	7579	4000	3686	5283
1973/74	8658	3126	7855	4563	4150	5670
1974/75	8792	3091	9118	4537	4269	5961
1975/76	8567	3071	10101	4528	4547	6163
1976/77	9320	3042	10287	4814	4533	6399
1977/78	9243	3109	10417	5040	4273	6416
1978/79	8777	3145	10925	5315	4179	6468
1979/80	10665	3868	11465	6001	4731	7350
1980/81	10551	3704	11982	6171	4489	7379
1981/82	10710	3427	13079	6106	4390	7542
1982/83	9120	2468	13177	5729	4384	6976
1983/84	11134	3111	15369	6324	3903	7968
1984/85	12349	3987	18438	6673	4328	9135
1985/86	13740	3337	20450	7483	4005	9803
1986/87	13415	3531	20871	7295	4062	9835
1987/88	14212	3378	20676	8102	4203	10114
1988/89	13553	3365	20884	8536	4881	10244
1989/90	14397	3672	22579	8525	4872	10809
1990/91	14217	3700	22869	8158	4583	10705
1991/92	13808	3249	24719	7799	4878	10891

OUTPUT TABLE 6A : FREIGHT REVENUE $1971/72

(Units: $'000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	174886	64555	110000	56000	55000	92088
1972/73	152184	58449	120000	53000	51000	86927
1973/74	147199	51506	110000	54000	56000	83741
1974/75	144751	51293	110000	51000	59000	83209
1975/76	137741	50797	120000	49000	63000	84108
1976/77	143653	49253	130000	50000	59000	86381
1977/78	139291	47926	120000	53265	59000	83900
1978/79	125616	48204	130000	54102	58827	83350
1979/80	150062	57216	130000	60048	60188	91503
1980/81	148000	56506	140000	62613	57290	92922
1981/82	158848	48293	160000	61966	60764	97974
1982/83	143263	34311	150000	53931	57862	87874
1983/84	160273	44500	190000	59483	53167	101484
1984/85	171885	51108	236322	63532	59452	116460
1985/86	180449	43596	238920	65022	52736	116145
1986/87	167050	39436	233494	60908	47887	109755
1987/88	149376	35932	206773	63099	45511	100138
1988/89	129713	33230	216564	63900	48067	98295
1989/90	134061	31823	209652	59191	45160	95977
1990/91	142770	28578	211483	53753	42884	95894
1991/92	143454	23823	212899	46635	46011	94564

INPUT TABLE 6B : CAPITAL STOCK $CURRENT

(Units: $millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	771	472	324	127	247	388
1972/73	802	477	350	156	256	408
1973/74	884	515	399	189	274	452
1974/75	1006	579	466	231	312	519
1975/76	1132	640	541	279	347	588
1976/77	1285	716	632	346	392	674
1977/78	1441	768	702	393	419	744
1978/79	1627	812	795	440	434	821
1979/80	1853	878	924	504	459	923
1980/81	2099	1008	1035	559	490	1038
1981/82	2406	1194	1193	625	536	1191
1982/83	2800	1403	1476	710	574	1393
1983/84	3104	1703	1777	757	587	1585
1984/85	3385	2000	1978	773	582	1743
1985/86	3823	2273	2261	819	601	1955
1986/87	4327	2541	2651	887	636	2208
1987/88	4784	2757	2975	956	658	2426
1988/89	5200	2925	3184	1054	701	2613
1989/90	5586	3139	3321	1157	793	2799
1990/91	5862	3243	3361	1234	877	2915
1991/92	5979	3181	3358	1246	949	2943

OUTPUT TABLE 7 : TRAIN KILOMETRES

(Units: '000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	61302	33176	28560	15789	14609	30687
1972/73	60397	33059	28836	15721	13869	30376
1973/74	61341	33345	28542	15083	14817	30626
1974/75	58798	33876	30114	14629	15066	30497
1975/76	54466	33818	30813	14045	15056	29840
1976/77	57022	33489	30206	13587	15046	29870
1977/78	57416	32013	30199	17134	14796	30312
1978/79	58800	30859	32100	15738	14268	29953
1979/80	59600	30795	32589	15336	13459	30356
1980/81	56925	30615	31282	15583	12891	29859
1981/82	60142	31136	32696	15275	12981	30446
1982/83	63153	30166	30885	13958	12960	30224
1983/84	63069	30702	33303	13388	12733	30639
1984/85	66038	30794	34293	14389	13498	31802
1985/86	72033	29309	35116	15996	12664	33024
1986/87	67386	28349	35051	13933	11636	31271
1987/88	66816	27135	34099	13100	11765	30583
1988/89	64419	26696	33571	13670	11872	30046
1989/90	56843	26576	32927	12766	10912	28005
1990/91	56604	25640	31744	11976	10231	27239
1991/92	54000	24328	29509	10836	10149	25764

OUTPUT TABLE 8 : CARRYING CAPACITY TONNE KMS - FREIGHT TRAINS

(Units: millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	17650	4956	16599	8472	5990	10733
1972/73	17738	5000	18510	8376	6025	11130
1973/74	18037	5087	19738	9151	7090	11821
1974/75	17820	5035	21864	8881	7423	12205
1975/76	18143	5073	24403	8791	7975	12877
1976/77	19127	5024	24302	8668	8167	13058
1977/78	21580	5072	24928	9762	7716	13812
1978/79	19923	5091	27465	9703	7390	13915
1979/80	20621	5565	28801	9958	8361	14661
1980/81	20626	5116	28636	10032	7960	14474
1981/82	21310	4822	32068	10078	7822	15220
1982/83	23624	3628	32124	9589	7516	15296
1983/84	25866	3945	36559	9892	6761	16605
1984/85	28525	4255	43157	10682	7754	18875
1985/86	33649	4335	47547	12610	7215	21071
1986/87	34444	4435	49946	10736	6395	21191
1987/88	34185	4450	52793	10687	6501	21723
1988/89	36083	4501	56578	11470	6628	23052
1989/90	39109	4446	61146	10639	5470	24162
1990/91	36510	4061	64397	9744	5100	23963
1991/92	31426	4027	61262	8945	4950	22122

OUTPUT TABLE 9 : SEAT KMS - PASSENGER TRAINS

(Units: millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	12253	7975	1587	2205	2016	5207
1972/73	11599	8974	1494	2172	2051	5258
1973/74	11126	9200	1472	2221	2098	5223
1974/75	10871	9984	1479	2178	2036	5309
1975/76	12178	10117	1464	2192	2077	5606
1976/77	12707	9768	1449	1981	2063	5594
1977/78	12840	8964	1435	1991	2045	5455
1978/79	11962	8147	1420	1705	1989	5045
1979/80	13084	7839	1493	1581	1568	5113
1980/81	13622	7989	1507	1659	1641	5284
1981/82	15636	8077	1522	1628	1686	5710
1982/83	16516	7318	1521	1442	1849	5729
1983/84	17097	5784	1624	1269	2118	5578
1984/85	17137	7066	1536	1355	1937	5806
1985/86	17599	6736	1541	1415	1912	5841
1986/87	17803	6508	1587	1366	1820	5817
1987/88	19544	6238	1672	1263	1829	6109
1988/89	19815	6210	1585	1251	1844	6141
1989/90	18852	6358	1498	1228	1929	5973
1990/91	17634	6363	1453	1025	1800	5655
1991/92	17953	6301	1509	861	2016	5728

OTHER TABLE 1 : ROUTE KILOMETRES

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	9754	6685	9560	8208	6116	8065
1972/73	9754	6685	9560	8309	6167	8095
1973/74	9755	6657	9472	8330	6192	8081
1974/75	9756	6659	9780	8334	6075	8121
1975/76	9755	6653	9844	8338	6163	8151
1976/77	9755	6579	9796	7838	6165	8027
1977/78	9763	6364	9787	8032	5764	7942
1978/79	9820	6184	9789	7825	5770	7878
1979/80	9773	6184	9904	7628	5773	7892
1980/81	9773	5870	9932	7788	5773	7827
1981/82	9773	5812	9970	7782	5609	7789
1982/83	9883	5815	9979	7796	5610	7817
1983/84	9883	5889	10115	7622	5623	7826
1984/85	9908	5813	10231	7607	5563	7824
1985/86	9909	5591	10224	7557	5553	7767
1986/87	9909	5257	10210	7466	5553	7679
1987/88	9917	5150	10089	7323	5616	7619
1988/89	7755	5047	10050	7185	5616	7131
1989/90	7600	5196	10050	6887	5617	7070
1990/91	7600	5179	10015	6732	5617	7029
1991/92	7600	5107	10011	6679	5617	7003

OTHER TABLE 2A : TOTAL LABOUR EXPENSES PER EMPLOYEE $1971/72

(Units: $)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	4494	4657	4551	4410	4124	4447
1972/73	4842	5088	4894	4697	4419	4788
1973/74	5589	5656	5545	5244	4911	5389
1974/75	5973	6115	6410	5877	5539	5983
1975/76	5906	6235	6414	5913	5371	5968
1976/77	6346	6067	6143	5642	5217	5883
1977/78	6018	6091	6243	5229	5215	5759
1978/79	5852	6091	5932	5424	5117	5683
1979/80	5935	6105	6152	5423	5218	5767
1980/81	6031	6439	6371	5575	5390	5961
1981/82	6800	6897	6883	5689	5668	6387
1982/83	6684	7328	6688	5576	5929	6441
1983/84	6318	8584	6795	5719	6330	6749
1984/85	6206	8406	6483	5780	7005	6776
1985/86	6058	7726	6382	5951	6744	6572
1986/87	6125	7907	6203	6084	6656	6591
1987/88	6614	7613	6080	6186	6882	6675
1988/89	7167	8129	6303	6599	7218	7083
1989/90	7405	7465	6240	6555	7119	6957
1990/91	7643	7503	6074	6379	6636	6847
1991/92	8097	7751	6116	7308	6743	7203

OTHER TABLE 2B : TOTAL LABOUR EXPENSES PER EMPLOYEE $CURRENT

(Units: $)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	4494	4657	4551	4410	4124	4447
1972/73	5133	5400	5178	4979	4660	5070
1973/74	6707	6806	6671	6327	5713	6445
1974/75	8303	8574	8902	8368	7620	8353
1975/76	9331	9869	10066	9441	8432	9428
1976/77	11232	10983	11015	10412	9488	10626
1977/78	11615	12111	12243	10607	10511	11416
1978/79	12230	13071	12583	11811	11148	12169
1979/80	13769	14409	14318	13003	12423	13565
1980/81	15320	16626	16206	14593	13965	15342
1981/82	19040	19661	19381	16453	16330	18173
1982/83	20921	23239	20906	18023	18817	20381
1983/84	20976	29263	22763	19804	21484	22862
1984/85	21411	29979	22738	20983	24700	23962
1985/86	22717	29885	24188	23397	25700	25177
1986/87	25113	33465	25528	26030	27900	27607
1987/88	29169	34580	26771	28337	30900	29951
1988/89	34186	39442	29724	32435	34800	34117
1989/90	38208	39250	31634	34519	37200	36162
1990/91	41350	41712	32306	35666	36429	37492
1991/92	44550	44051	33172	41912	37315	40200

OTHER TABLE 3 : LITRES OF LIQUID FUEL

(Units: 000's)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	142213	81616	119904	85996	65010	98948
1972/73	136732	81008	130715	87559	65046	100212
1973/74	141077	78399	132719	91835	69047	102615
1974/75	138186	77090	145824	94237	68701	104808
1975/76	147230	74496	152849	94756	72720	108410
1976/77	160593	78763	152244	97611	73725	112587
1977/78	168223	81098	153884	111923	71909	117407
1978/79	188817	76012	168610	108311	70056	122361
1979/80	202224	79981	171754	110878	65142	125996
1980/81	201691	77205	165875	114806	63939	124703
1981/82	203305	75800	172798	110573	63347	125165
1982/83	179995	69777	168017	103826	62656	116894
1983/84	194496	72337	188138	107745	59472	124438
1984/85	203700	68926	170430	107714	63711	122896
1985/86	225600	69304	176525	114519	59774	129144
1986/87	215400	65560	171100	105521	54922	122501
1987/88	215100	60267	155661	110562	55531	119424
1988/89	206400	57612	133476	110010	56036	112707
1989/90	179100	58502	113970	110372	51505	102670
1990/91	179134	55937	112702	110474	48290	101307
1991/92	126918	52789	87866	103918	53498	84998

OTHER TABLE 4 : KILOWATT HOURS OF ELECTRICITY
(Units: '000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	290000	298000	0	0	0	117600
1972/73	313000	298000	0	0	0	122200
1973/74	314000	305000	0	0	0	123800
1974/75	353000	317000	0	0	0	134000
1975/76	388000	321000	0	0	0	141800
1976/77	401000	317000	0	0	0	143600
1977/78	405000	303000	0	0	0	141600
1978/79	408489	293000	0	0	0	140298
1979/80	432449	295000	4865	0	0	146463
1980/81	459201	298000	15920	0	0	154624
1981/82	476821	306000	22056	0	0	161375
1982/83	490821	310000	37254	0	0	167615
1983/84	533788	314000	56441	0	0	180846
1984/85	583000	313000	61600	0	0	191520
1985/86	632000	304000	61600	0	0	199520
1986/87	648000	294000	79500	0	0	204300
1987/88	690000	286000	125800	0	0	220360
1988/89	731000	276000	207100	0	0	242820
1989/90	754000	268000	272000	0	0	258800
1990/91	685333	258000	308700	0	0	250407
1991/92	699048	245220	321565	0	14831	256133

OTHER TABLE 5A : CAPITAL INVESTMENT $1971/72

(Units: $millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	47	15	40	34	16	30
1972/73	46	15	26	27	16	26
1973/74	38	14	28	17	9	21
1974/75	47	25	34	19	11	27
1975/76	62	24	38	32	13	34
1976/77	70	23	32	21	12	31
1977/78	90	21	36	22	7	35
1978/79	87	25	55	25	9	40
1979/80	84	22	49	24	11	38
1980/81	96	74	35	17	12	47
1981/82	102	46	63	22	12	49
1982/83	103	69	102	20	7	60
1983/84	120	116	90	14	6	69
1984/85	122	87	62	10	6	58
1985/86	116	56	94	15	6	57
1986/87	118	64	97	15	7	60
1987/88	109	46	69	22	7	50
1988/89	77	43	38	23	14	39
1989/90	82	42	30	22	22	40
1990/91	91	26	29	15	19	36
1991/92	89	20	47	13	30	40

OTHER TABLE 5B : CAPITAL INVESTMENT $CURRENT

(Units: $millions)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	47	15	40	34	16	30
1972/73	49	16	28	26	16	28
1973/74	46	16	34	20	11	25
1974/75	66	35	47	27	15	38
1975/76	97	39	60	51	21	54
1976/77	123	42	57	39	21	56
1977/78	173	42	70	44	15	69
1978/79	183	54	118	55	19	86
1979/80	194	53	113	57	26	89
1980/81	245	191	89	45	37	121
1981/82	286	130	176	63	39	139
1982/83	322	218	319	64	23	189
1983/84	400	394	301	47	19	232
1984/85	421	312	217	37	22	202
1985/86	434	216	355	57	22	217
1986/87	482	270	400	66	31	250
1987/88	481	207	303	101	29	224
1988/89	369	209	181	112	69	188
1989/90	424	221	150	116	113	205
1990/91	493	144	153	85	102	196
1991/92	490	116	253	76	167	220

OTHER TABLE 7 : TONNES OF FREIGHT

(Units: '000s)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	32320	11795.	19271	9955	13867	17442
1972/73	31038	11475	24670	9861	13706	18150
1973/74	32702	11371	25401	10675	15059	19042
1974/75	33504	11057	30208	10641	16348	20352
1975/76	31234	10803	33118	9929	17812	20579
1976/77	33940	10971	34237	10072	19003	21645
1977/78	33434	11120	34155	11599	18625	21787
1978/79	33482	11190	36542	12473	19288	22595
1979/80	39790	13453	38440	14844	21388	25583
1980/81	40471	12721	41504	14669	20271	25927
1981/82	40407	11623	43659	14011	19775	25895
1982/83	41358	8570	43706	12535	19792	25192
1983/84	46601	10486	53113	14275	19870	28869
1984/85	47911	11950	65452	15083	22085	32498
1985/86	53908	10512	73599	15232	20877	34826
1986/87	54747	10597	75169	15116	21264	35379
1987/88	54412	10901	74893	15989	21946	35628
1988/89	50188	9950	80508	16107	24294	36209
1989/90	53774	10250	82543	16157	24906	37526
1990/91	58266	9659	82965	14943	24410	38049
1991/92	58340	8492	90658	13083	25890	39293

OTHER TABLE 8 : NUMBER OF LOCOMOTIVES

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	543	361	438	321	247	382
1972/73	565	349	459	325	208	381
1973/74	568	345	475	329	208	385
1974/75	525	342	489	321	208	377
1975/76	524	350	506	322	208	382
1976/77	516	349	515	326	205	382
1977/78	514	349	523	398	205	398
1978/79	524	349	532	398	215	404
1979/80	542	348	551	397	215	411
1980/81	546	338	559	389	212	409
1981/82	554	329	573	358	215	406
1982/83	586	314	604	346	205	411
1983/84	613	311	631	348	202	421
1984/85	657	296	635	340	188	423
1985/86	672	339	635	316	175	427
1986/87	673	337	651	305	164	426
1987/88	673	330	645	305	154	421
1988/89	625	334	622	322	152	411
1989/90	599	261	645	296	156	391
1990/91	599	257	591	263	145	371
1991/92	559	251	558	190	121	336

OTHER TABLE 9 : NUMBER OF WAGONS (GOODS + SERVICE)

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	18254	21038	19834	11940	11878	16589
1972/73	17617	20610	19976	12002	11366	16314
1973/74	17008	20257	20250	12048	11213	16155
1974/75	16926	20086	20708	12177	11206	16221
1975/76	15686	19696	20766	12347	10972	15893
1976/77	14993	18629	20899	12522	10747	15558
1977/78	12540	15240	20864	15719	10478	14968
1978/79	12390	13474	20598	14830	10139	14286
1979/80	12205	12932	20992	14289	9842	14052
1980/81	12191	12568	20975	14074	9727	13907
1981/82	11737	12417	21596	13218	10146	13823
1982/83	10217	14407	22119	12336	9181	13652
1983/84	10096	12087	22384	11910	9139	13123
1984/85	9746	11787	24610	11309	9667	13424
1985/86	9352	9020	24309	10371	8202	12251
1986/87	8985	8333	22096	9181	6459	11011
1987/88	9216	6524	21011	8641	6746	10428
1988/89	9209	4236	20224	7895	5875	9488
1989/90	8664	4278	20046	7598	4828	9083
1990/91	8256	4091	18477	7437	4090	8470
1991/92	7545	3997	17049	6294	3648	7707

OTHER TABLE 10 : COACHING STOCK

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	2664	1700	1138	543	186	1246
1972/73	2558	1683	1116	524	185	1213
1973/74	2513	1670	1109	503	170	1193
1974/75	2284	1691	1102	505	167	1150
1975/76	2219	1696	1083	515	142	1131
1976/77	2169	1642	1092	510	137	1110
1977/78	2175	1554	1077	620	137	1113
1978/79	2161	1554	1110	509	137	1094
1979/80	2212	1515	1098	407	128	1072
1980/81	2152	1474	1091	429	127	1055
1981/82	2220	1456	1098	392	133	1060
1982/83	2169	1411	1084	384	135	1037
1983/84	2148	1335	955	382	121	988
1984/85	2093	1307	1158	384	131	1015
1985/86	2029	1270	1126	384	127	987
1986/87	2109	1260	1070	375	137	990
1987/88	2122	1240	1026	375	130	979
1988/89	2068	1220	918	369	178	951
1989/90	2035	1202	837	352	173	920
1990/91	2012	1192	673	341	157	875
1991/92	1881	1194	662	325	124	837

OTHER TABLE 11 : TRAIN KILOMETRES PER EMPLOYEE

	NSW	VIC	QLD	SA	WA	AVERAGE
1971/72	1412	1277	1258	1159	1424	1306
1972/73	1405	1281	1276	1147	1414	1305
1973/74	1486	1321	1269	1094	1487	1331
1974/75	1468	1304	1281	1062	1506	1324
1975/76	1385	1347	1284	1056	1506	1316
1976/77	1427	1372	1232	1048	1487	1313
1977/78	1358	1343	1228	1339	1470	1348
1978/79	1365	1326	1257	1313	1432	1339
1979/80	1447	1354	1300	1329	1384	1363
1980/81	1400	1386	1254	1410	1386	1367
1981/82	1456	1475	1267	1400	1453	1414
1982/83	1564	1443	1184	1326	1545	1413
1983/84	1548	1485	1284	1321	1637	1455
1984/85	1594	1452	1332	1484	1901	1553
1985/86	1754	1418	1384	1772	1750	1611
1986/87	1746	1510	1415	1595	1791	1611
1987/88	1820	1530	1478	1625	1921	1675
1988/89	1945	1600	1564	1835	1924	1773
1989/90	1971	1603	1581	1761	1806	1744
1990/91	2128	1687	1554	1794	1759	1784
1991/92	2207	1728	1532	1926	1884	1855

OTHER TABLE 12 : CPI INDICES

	NSW	VIC	QLD	SA	WA
1971/72	100	100	100	100	100
1972/73	106	106	106	106	105
1973/74	120	120	120	121	116
1974/75	139	140	139	142	138
1975/76	158	158	157	160	157
1976/77	177	181	179	185	182
1977/78	193	199	196	203	202
1978/79	209	215	212	218	218
1979/80	232	236	233	240	238
1980/81	254	258	254	262	259
1981/82	280	285	282	289	288
1982/83	313	317	313	323	317
1983/84	332	341	335	346	339
1984/85	345	357	351	363	353
1985/86	375	387	379	393	381
1986/87	410	423	412	429	419
1987/88	441	454	440	458	449
1988/89	477	485	472	492	482
1989/90	516	526	507	527	523
1990/91	541	556	532	559	549
1991/92	550	568	542	574	553

OTHER TABLE 13 : MANAGERIAL CHANGE VARIABLES

ID	DESCRIPTION OF CHANGE	DUMMY VARIABLE
NEW SOUTH WALES		
N1	Shirley era (head of Public Transport Commission)	NSW: 1972/73 - 1974/75
N2	Reiher era (replaced Shirley as head of PTC)	NSW: 1976/77 - 1979/80
N3	Granville train disaster	NSW: 1977/78 - 1990/91
N4	David Hill era (head of State Rail Authority)	NSW: 1980/81 - 1986/87
N5	Pat Johnson era (replaced Hill as head of SRA)	NSW: 1986/87 - 1987/88
N6	Ross Sayers era (replaced Johnson as head of SRA)	NSW: 1988/89 - 1990/91
N7	Reorganisation (to break power of Traffic branch)	NSW: 1983/84 - 1990/91
N8	Public Transport Commission commenced	NSW: 1972/73 - 1979/80
VICTORIA		
V1	Victorian Railways Board formed	VIC: 1973/74 - 1982/83
V2	State Transport Authority formed (VRB abolished)	VIC: 1983/84 - 1988/89
V3	Public Transport Corporation formed, Stoney era	VIC: 1989/90 - 1990/91
V4	Gibbs era (chairman of Victorian Railways Board)	VIC: 1973/74 - 1979/80
V5	Gallagher era (General Manager of Vic. Railways Board)	VIC: 1980/81 - 1982/83
V6	Fitzmaurice Managing Director of State Transport Authority	VIC: 1983/84 - 1988/89
V7	Dev., planning & m'ment services reformed as a branch	VIC: 1972/73 - 1990/91
V8	Bland report (recommending sweeping changes)	VIC: 1972/73 - 1977/78
V9	Investigation on organisation structure	VIC: 1977/78 - 1979/80
V10	Traffic branch split into Ops & Trans., Workshops branch	VIC: 1978/79 - 1990/91
V11	Traffic branch reorganised	VIC: 1976/77 - 1978/79
QUEENSLAND		
Q1	AG Lee era (Commissioner)	QLD: 1971/72 - 1975/76
Q2	PJ Goldston era (Commissioner)	QLD: 1976/77 - 1981/82
Q3	Hooper (Transport Minister)	QLD: 1972/73 - 1976/77
Q4	Tomkins (Transport Minister)	QLD: 1977/78 - 1979/80
Q5	DV Mendoza era (Commissioner)	QLD: 1982/83 - 1985/86
Q6	R Sheehy era (Commissioner)	QLD: 1985/86 - 1988/89
Q7	RG Read era (Commissioner)	QLD: 1988/89 - 1990/91
Q8	Management reorganisation	QLD: 1982/83 - 1985/86
Q9	Urban Public Transport Act - Fed. funds for electrification	QLD: 1973/74 - 1979/80
Q10	Financial Assistance Act 1979	QLD: 1979/80 - 1990/91
Q11	Major management reorganisation	QLD: 1986/87 - 1990/91
SOUTH AUSTRALIA		
S1	Aust. National Railways Commission	SA: 1975/76 - 1990/91
S2	ANRC full control of SA (nonurban) and Tasrail	SA: 1978/79 - 1990/91
S3	KA Smith era (Chairman of ANRC)	SA: 1971/72 - 1980/81
S4	LE Marks era (Chairman of ANRC)	SA: 1981/82 - 1987/88
S5	Dr D Williams era (Chairman of ANRC)	SA: 1987/88 - 1990/91
S6	Dr D Williams (General Manager of ANRC)	SA: 1979/80 - 1987/88
S7	Distinction between commercial and non comm. services	SA: 1982/83 - 1990/91
S8	RM King era (Managing Director of ANRC)	SA: 1987/88 - 1990/91
WESTERN AUSTRALIA		
W1	WJ Pascoe era (Commissioner)	WA: 1971/72 - 1978/79
W2	WI McCullough era (Commissioner)	WA: 1978/79 - 1987/88
W3	Dr JI Gill era (Commissioner)	WA: 1988/89 - 1990/91
W4	Major top management changes	WA: 1984/85 - 1987/88
W5	Major reorganisation	WA: 1988/89 - 1990/91
W6	Total Western Transport joint venture, freight deregulation	WA: 1982/83 - 1990/91
W7	Stage 1 of WA Transport Policy, improving road access	WA: 1980/81 - 1990/91

OTHER TABLE 14 : TECHNOLOGICAL CHANGE VARIABLES

ID	DESCRIPTION	DUMMY VARIABLE
ROLLINGSTOCK		
T1	Locos: 81 class diesel main line	NSW: 1982/83
T2	Locos: other diesel main line	VIC: 1975/76; QLD: 1972/73; SA: 1976/77; WA: 1978/79
T2A	Locos: other diesel main line BL class	SA: 1983/84
T2B	Locos: other diesel main line DL class	SA: 1987/88
T3	Locos: electric	NSW: 1979/80; SA: 1986/87
T4	Long distance passenger trains: XPT	NSW: 1981/82
T5	Long distance passenger trains: other	NSW: 1975/76; VIC: 1972/73; QLD: 1971/72; SA: 1973/74; WA: 1971/72
T5A	Long distance passenger trains: N class	VIC: 1981/82
T5B	Long distance passenger trains: refurbished Ghan	SA: 1988/89
T5C	Long distance passenger trains: Australind	WA: 1987/88
T6	Interurban passenger trains: double decked	NSW: 1971/72
T7	Interurban passenger trains: other improved	NSW: 1983/84
T8	Double decked suburban passenger trains: first generation	NSW: 1971/72
T9	Double decked suburban passenger trains: improved	NSW: 1982/83
T10	Double decked suburban passenger trains: Tangara	NSW: 1987/88
T11	Single decked suburban passenger trains: improved	NSW: 1982/83; VIC: 1972/73; QLD: 1979/80; WA: 1981/82
T12	Freight wagons: extra long flat wagons and containers	NSW: 1974/75; VIC: 1973/74
T13	Freight wagons: other flat wagons and containers	VIC: 1989/90; SA: 1975/76; WA: 1975/76
T14	Freight wagons: high capacity bulk	NSW: 1976/77; VIC: 1971/72; QLD: 1971/72; SA: 1978/79; WA: 1971/72
T15	Freight wagons: specialised	VIC: 1972/73; QLD: 1979/80; SA: 1974/75; WA: 1974/75
T15A	Freight wagons: specialised BFW wagon	VIC: 1976/77
T15B	Freight wagons: specialised steel wagon	SA: 1988/89
T15C	Freight wagons: specialised S pack	SA: 1988/89
T16	Bogies: high speed	NSW: 1976/77; VIC: 1976/77; QLD: 1976/77; SA: 1975/76; WA: 1975/76
T17	Couplers: high strength/high capacity	NSW: 1976/77; VIC: 1976/77; QLD: 1976/77; SA: 1975/76; WA: 1976/77
T18	Maintenance: wheel profiling	NSW: 1979/80; VIC: 1980/81; QLD: 1978/79; SA: 1980/81; WA: 1980/81
T19	Maintenance: insitu wheel reconditioning	NSW: 1979/80; VIC: 1980/81; QLD: 1978/79; SA: 1980/81; WA: 1980/81
T20	Locotrol	QLD: 1971/72
T21	Innovations: tri-bo locos	NSW: 1979/80; QLD: 1979/80
T22	Innovations: driver training simulators	NSW: 1984/85
T23	Innovations: ontrain diagnostic equipment	NSW: 1981/82; VIC: 1983/84; QLD: 1972/73; SA: 1983/84; WA: 1978/79
T24	Innovations: low speed control equipment	NSW: 1981/82; VIC: 1983/84; QLD: 1972/73; SA: 1983/84; WA: 1978/79

T25	Innovations: creep control equipment	NSW: 1981/82; VIC: 1983/84; QLD: 1972/73; SA: 1983/84; WA: 1978/79
T26	Innovations: adhesion improvement equipment	NSW: 1981/82; VIC: 1983/84; QLD: 1972/73; SA: 1983/84; WA: 1978/79
T27	Innovations: chopper controls	NSW: 1987/88
T28	Innovations: radio controls	NSW: 1981/82; VIC: 1982/83; QLD: 1971/72; SA: 1977/78; WA: 1984/85
PERMANENT WAY		
T29	Track (rail bed): paved (Macgregor) track	NSW: 1971/72; VIC: 1972/73; QLD: 1971/72; SA: 1985/86; WA: 1981/82
T30	Track (rail bed): noise control devices (rubberised beds, cologne eggs)	NSW: 1978/79; VIC: 1980/81; QLD: 1981/82; SA: 1979/80
T31	Track (rail bed): geodetic fabrics for seepage control	NSW: 1976/77; VIC: 1977/78; QLD: 1980/81; SA: 1978/79
T32	Track (sleepers): concrete sleepers	NSW: 1977/78; VIC: 1974/75; QLD: 1971/72; SA: 1973/74; WA: 1979/80
T33	Track (fastenings): pandrol clips and elastic rail fastenings	NSW: 1971/72; VIC: 1972/73; QLD: 1971/72; SA: 1972/73; WA: 1976/77
T34	Track (rail): continuous welded rail	NSW: 1974/75; VIC: 1974/75; QLD: 1971/72; SA: 1974/75; WA: 1978/79
T35	Track (rail): glued insulated rail joints	NSW: 1974/75; VIC: 1974/75; QLD: 1971/72; SA: 1974/75; WA: 1978/79
T36	Track (rail): head hardened rail	NSW: 1984/85; VIC: 1985/86; QLD: 1971/72; SA: 1986/87; WA: 1971/72
T37	Track (rail): metricated rail profiles	NSW: 1984/85; VIC: 1985/86; QLD: 1971/72; SA: 1986/87; WA: 1971/72
T38	Related infrastructure: armco culverts	NSW: 1971/72; VIC: 1971/72; QLD: 1971/72; SA: 1971/72; WA: 1971/72
T39	Related infrastructure: automated points and turnouts	NSW: 1984/85; VIC: 1985/86, QLD: 1981/82; SA: 1985/86; WA: 1985/86
T40	Related infrastructure: automated ballast cleaning, sledding, tamping	NSW: 1977/78; VIC: 1976/77; QLD: 1971/72; SA: 1972/73; WA: 1974/75
T41	Related infrastructure: automated track laying	NSW: 1984/85; VIC: 1976/77; QLD: 1971/72; SA: 1984/85
T42	Related infrastructure: automated weighbridges	NSW: 1974/75; VIC: 1971/72; QLD: 1971/72; SA: 1971/72; WA: 1971/72
T43	Related infrastructure: overhead cranes	NSW: 1972/73; VIC: 1971/72; QLD: 1972/73; SA: 1972/73; WA: 1972/73
T44	Other: integration of stations into high rise developments	NSW: 1978/79; VIC: 1980/81; QLD: 1981/82
T45	Other: rail grinder	SA: 1988/89
ELECTRIFICATION		
T46	New electrification	NSW: 1978/79; VIC: 1980/81; QLD: 1979/80
T47	Major extensions of electrification	NSW: 1979/80; VIC: 1974/75; QLD: 1986/87
T48	AC electrification	QLD: 1979/80
SIGNALLING, SAFETY & TELECOMMUNICATIONS		
T49	Centralised Train Control (CTC) signalling	NSW: 1981/82; VIC: 1981/82; QLD: 1971/72; SA: 1977/78; WA: 1981/82
T50	Radio control systems	NSW: 1981/82; VIC: 1980/81; QLD: 1971/72; SA: 1977/78; WA: 1984/85
T51	Fibre optics	NSW: 1987/88; VIC: 1987/88; QLD: 1986/87; SA: 1988/89; WA: 1988/89

T52	Train order systems	SA: 1981/82
T53	Advanced TG, Bi-directional SIGS	SA: 1988/89; WA: 1972/73
T54	Passenger information systems	NSW: 1975/76; VIC: 1979/80; QLD: 1979/80; SA: 1983/84
T55	Automatic ticketing	NSW: 1978/79; VIC: 1975/76
OFFICE AUTOMATION		
T56	Mainframe computers	NSW: 1975/76; VIC: 1974/75; QLD: 1973/74; SA: 1976/77; WA: 1974/75
T57	Rail CAD, TIMS, RICS, real time RS control	NSW: 1986/87; VIC: 1987/88; QLD: 1984/85; WA: 1984/85

Note: The variable has the value 1 for each state from the year noted for that state through to 1990/91. For example, the variable T1 (81 class diesel locos) has the value 1 for NSW for the years 1982/83 to 1990/91 and the value 0 for all other years in NSW and for all other states.

OTHER TABLE 13 : MANAGERIAL CHANGE VARIABLES

ID	DESCRIPTION OF CHANGE	DUMMY VARIABLE
NEW SOUTH WALES		
N1	Shirley era (head of Public Transport Commission)	NSW: 1972/73 - 1974/75
N2	Reiher era (replaced Shirley as head of PTC)	NSW: 1976/77 - 1979/80
N3	Granville train disaster	NSW: 1977/78 - 1990/91
N4	David Hill era (head of State Rail Authority)	NSW: 1980/81 - 1986/87
N5	Pat Johnson era (replaced Hill as head of SRA)	NSW: 1986/87 - 1987/88
N6	Ross Sayers era (replaced Johnson as head of SRA)	NSW: 1988/89 - 1990/91
N7	Reorganisation (to break power of Traffic branch)	NSW: 1983/84 - 1990/91
N8	Public Transport Commission commenced	NSW: 1972/73 - 1979/80
VICTORIA		
V1	Victorian Railways Board formed	VIC: 1973/74 - 1982/83
V2	State Transport Authority formed (VRB abolished)	VIC: 1983/84 - 1988/89
V3	Public Transport Corporation formed, Stoney era	VIC: 1989/90 - 1990/91
V4	Gibbs era (chairman of Victorian Railways Board)	VIC: 1973/74 - 1979/80
V5	Gallagher era (General Manager of Vic. Railways Board)	VIC: 1980/81 - 1982/83
V6	Fitzmaurice Managing Director of State Transport Authority	VIC: 1983/84 - 1988/89
V7	Dev., planning & m'ment services reformed as a branch	VIC: 1972/73 - 1990/91
V8	Bland report (recommending sweeping changes)	VIC: 1972/73 - 1977/78
V9	Investigation on organisation structure	VIC: 1977/78 - 1979/80
V10	Traffic branch split into Ops & Trans., Workshops branch	VIC: 1978/79 - 1990/91
V11	Traffic branch reorganised	VIC: 1976/77 - 1978/79
QUEENSLAND		
Q1	AG Lee era (Commissioner)	QLD: 1971/72 - 1975/76
Q2	PJ Goldston era (Commissioner)	QLD: 1976/77 - 1981/82
Q3	Hooper (Transport Minister)	QLD: 1972/73 - 1976/77
Q4	Tomkins (Transport Minister)	QLD: 1977/78 - 1979/80
Q5	DV Mendoza era (Commissioner)	QLD: 1982/83 - 1985/86
Q6	R Sheehy era (Commissioner)	QLD: 1985/86 - 1988/89
Q7	RG Read era (Commissioner)	QLD: 1988/89 - 1990/91
Q8	Management reorganisation	QLD: 1982/83 - 1985/86
Q9	Urban Public Transport Act - Fed. funds for electrification	QLD: 1973/74 - 1979/80
Q10	Financial Assistance Act 1979	QLD: 1979/80 - 1990/91
Q11	Major management reorganisation	QLD: 1986/87 - 1990/91
SOUTH AUSTRALIA		
S1	Aust. National Railways Commission	SA: 1975/76 - 1990/91
S2	ANRC full control of SA (nonurban) and Tasrail	SA: 1978/79 - 1990/91
S3	KA Smith era (Chairman of ANRC)	SA: 1971/72 - 1980/81
S4	LE Marks era (Chairman of ANRC)	SA: 1981/82 - 1987/88
S5	Dr D Williams era (Chairman of ANRC)	SA: 1987/88 - 1990/91
S6	Dr D Williams (General Manager of ANRC)	SA: 1979/80 - 1987/88
S7	Distinction between commercial and non comm. services	SA: 1982/83 - 1990/91
S8	RM King era (Managing Director of ANRC)	SA: 1987/88 - 1990/91
WESTERN AUSTRALIA		
W1	WJ Pascoe era (Commissioner)	WA: 1971/72 - 1978/79
W2	WI McCullough era (Commissioner)	WA: 1978/79 - 1987/88
W3	Dr JI Gill era (Commissioner)	WA: 1988/89 - 1990/91
W4	Major top management changes	WA: 1984/85 - 1987/88
W5	Major reorganisation	WA: 1988/89 - 1990/91
W6	Total Western Transport joint venture, freight deregulation	WA: 1982/83 - 1990/91
W7	Stage 1 of WA Transport Policy, improving road access	WA: 1980/81 - 1990/91

OTHER TABLE 14 : TECHNOLOGICAL CHANGE VARIABLES

ID	DESCRIPTION	DUMMY VARIABLE
ROLLINGSTOCK		
T1	Locos: 81 class diesel main line	NSW: 1982/83
T2	Locos: other diesel main line	VIC: 1975/76; QLD: 1972/73; SA: 1976/77; WA: 1978/79
T2A	Locos: other diesel main line BL class	SA: 1983/84
T2B	Locos: other diesel main line DL class	SA: 1987/88
T3	Locos: electric	NSW: 1979/80; SA: 1986/87
T4	Long distance passenger trains: XPT	NSW: 1981/82
T5	Long distance passenger trains: other	NSW: 1975/76; VIC: 1972/73; QLD: 1971/72; SA: 1973/74; WA: 1971/72
T5A	Long distance passenger trains: N class	VIC: 1981/82
T5B	Long distance passenger trains: refurbished Ghan	SA: 1988/89
T5C	Long distance passenger trains: Australind	WA: 1987/88
T6	Interurban passenger trains: double decked	NSW: 1971/72
T7	Interurban passenger trains: other improved	NSW: 1983/84
T8	Double decked suburban passenger trains: first generation	NSW: 1971/72
T9	Double decked suburban passenger trains: improved	NSW: 1982/83
T10	Double decked suburban passenger trains: Tangara	NSW: 1987/88
T11	Single decked suburban passenger trains: improved	NSW: 1982/83; VIC: 1972/73; QLD: 1979/80; WA: 1981/82
T12	Freight wagons: extra long flat wagons and containers	NSW: 1974/75; VIC: 1973/74
T13	Freight wagons: other flat wagons and containers	VIC: 1989/90; SA: 1975/76; WA: 1975/76
T14	Freight wagons: high capacity bulk	NSW: 1976/77; VIC: 1971/72; QLD: 1971/72; SA: 1978/79; WA: 1971/72
T15	Freight wagons: specialised	VIC: 1972/73; QLD: 1979/80; SA: 1974/75; WA: 1974/75
T15A	Freight wagons: specialised BFW wagon	VIC: 1976/77
T15B	Freight wagons: specialised steel wagon	SA: 1988/89
T15C	Freight wagons: specialised S pack	SA: 1988/89
T16	Bogies: high speed	NSW: 1976/77; VIC: 1976/77; QLD: 1976/77; SA: 1975/76; WA: 1975/76
T17	Couplers: high strength/high capacity	NSW: 1976/77; VIC: 1976/77; QLD: 1976/77; SA: 1975/76; WA: 1976/77
T18	Maintenance: wheel profiling	NSW: 1979/80; VIC: 1980/81; QLD: 1978/79; SA: 1980/81; WA: 1980/81
T19	Maintenance: insitu wheel reconditioning	NSW: 1979/80; VIC: 1980/81; QLD: 1978/79; SA: 1980/81; WA: 1980/81
T20	Locotrol	QLD: 1971/72
T21	Innovations: tri-bo locos	NSW: 1979/80; QLD: 1979/80
T22	Innovations: driver training simulators	NSW: 1984/85
T23	Innovations: ontrain diagnostic equipment	NSW: 1981/82; VIC: 1983/84; QLD: 1972/73; SA: 1983/84; WA: 1978/79
T24	Innovations: low speed control equipment	NSW: 1981/82; VIC: 1983/84; QLD: 1972/73; SA: 1983/84; WA: 1978/79

T25	Innovations: creep control equipment	NSW: 1981/82; VIC: 1983/84; QLD: 1972/73; SA: 1983/84; WA: 1978/79
T26	Innovations: adhesion improvement equipment	NSW: 1981/82; VIC: 1983/84; QLD: 1972/73; SA: 1983/84; WA: 1978/79
T27	Innovations: chopper controls	NSW: 1987/88
T28	Innovations: radio controls	NSW: 1981/82; VIC: 1982/83; QLD: 1971/72; SA: 1977/78; WA: 1984/85
PERMANENT WAY		
T29	Track (rail bed): paved (Macgregor) track	NSW: 1971/72; VIC: 1972/73; QLD: 1971/72; SA: 1985/86; WA: 1981/82
T30	Track (rail bed): noise control devices (rubberised beds, cologne eggs)	NSW: 1978/79; VIC: 1980/81; QLD: 1981/82; SA: 1979/80
T31	Track (rail bed): geodetic fabrics for seepage control	NSW: 1976/77; VIC: 1977/78; QLD: 1980/81; SA: 1978/79
T32	Track (sleepers): concrete sleepers	NSW: 1977/78; VIC: 1974/75; QLD: 1971/72; SA: 1973/74; WA: 1979/80
T33	Track (fastenings): pandrol clips and elastic rail fastenings	NSW: 1971/72; VIC: 1972/73; QLD: 1971/72; SA: 1972/73; WA: 1976/77
T34	Track (rail): continuous welded rail	NSW: 1974/75; VIC: 1974/75; QLD: 1971/72; SA: 1974/75; WA: 1978/79
T35	Track (rail): glued insulated rail joints	NSW: 1974/75; VIC: 1974/75; QLD: 1971/72; SA: 1974/75; WA: 1978/79
T36	Track (rail): head hardened rail	NSW: 1984/85; VIC: 1985/86; QLD: 1971/72; SA: 1986/87; WA: 1971/72
T37	Track (rail): metricated rail profiles	NSW: 1984/85; VIC: 1985/86; QLD: 1971/72; SA: 1986/87; WA: 1971/72
T38	Related infrastructure: armco culverts	NSW: 1971/72; VIC: 1971/72; QLD: 1971/72; SA: 1971/72; WA: 1971/72
T39	Related infrastructure: automated points and turnouts	NSW: 1984/85; VIC: 1985/86, QLD: 1981/82; SA: 1985/86; WA: 1985/86
T40	Related infrastructure: automated ballast cleaning, sledding, tamping	NSW: 1977/78; VIC: 1976/77; QLD: 1971/72; SA: 1972/73; WA: 1974/75
T41	Related infrastructure: automated track laying	NSW: 1984/85; VIC: 1976/77; QLD: 1971/72; SA: 1984/85
T42	Related infrastructure: automated weighbridges	NSW: 1974/75; VIC: 1971/72; QLD: 1971/72; SA: 1971/72; WA: 1971/72
T43	Related infrastructure: overhead cranes	NSW: 1972/73; VIC: 1971/72; QLD: 1972/73; SA: 1972/73; WA: 1972/73
T44	Other: integration of stations into high rise developments	NSW: 1978/79; VIC: 1980/81; QLD: 1981/82
T45	Other: rail grinder	SA: 1988/89
ELECTRIFICATION		
T46	New electrification	NSW: 1978/79; VIC: 1980/81; QLD: 1979/80
T47	Major extensions of electrification	NSW: 1979/80; VIC: 1974/75; QLD: 1986/87
T48	AC electrification	QLD: 1979/80
SIGNALLING, SAFETY & TELECOMMUNICATIONS		
T49	Centralised Train Control (CTC) signalling	NSW: 1981/82; VIC: 1981/82; QLD: 1971/72; SA: 1977/78; WA: 1981/82
T50	Radio control systems	NSW: 1981/82; VIC: 1980/81; QLD: 1971/72; SA: 1977/78; WA: 1984/85
T51	Fibre optics	NSW: 1987/88; VIC: 1987/88; QLD: 1986/87; SA: 1988/89; WA: 1988/89

T52	Train order systems	SA: 1981/82
T53	Advanced TG, Bi-directional SIGS	SA: 1988/89; WA: 1972/73
T54	Passenger information systems	NSW: 1975/76; VIC: 1979/80; QLD: 1979/80; SA: 1983/84
T55	Automatic ticketing	NSW: 1978/79; VIC: 1975/76
OFFICE AUTOMATION		
T56	Mainframe computers	NSW: 1975/76; VIC: 1974/75; QLD: 1973/74; SA: 1976/77; WA: 1974/75
T57	Rail CAD, TIMS, RICS, real time RS control	NSW: 1986/87; VIC: 1987/88; QLD: 1984/85; WA: 1984/85

Note: The variable has the value 1 for each state from the year noted for that state through to 1990/91. For example, the variable T1 (81 class diesel locos) has the value 1 for NSW for the years 1982/83 to 1990/91 and the value 0 for all other years in NSW and for all other states.