BTE Publication Summary

A Review of Transport Research in Australia

Information Paper

In December 1986, the Australian Transport Advisory Council (ATAC) sought the assistance of the Bureau of Transport Economics in undertaking a review of transport research in Australia. The aims of the resulting study carried out by the Bureau were to identify the nature and extent of current Australian transport research, to assess priority areas for future research and to address coordination issues pertinent to delivery of an effective research effort. Following consideration at the December 1987 meeting of ATAC the results of the review are to be used as a basis for discussion at a seminar on transport research to be convened early in 1988.







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Information Paper 25

A Review of Transport Research in Australia

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FOREWORD

In December 1986, the Australian Transport Advisory Council (ATAC) sought the assistance of the then Bureau of Transport Economics (BTE) in undertaking a review of transport research in Australia, to establish whether transport research programs were addressing important issues in transport, across all modes and without duplication. The Bureau surveyed prominent organisations and individuals in the transport field to identify the nature and extent of their 1986-87 transport research program. This Paper presents the results of that survey and an assessment of priority areas and coordination issues for future research.

An earlier version of this Paper was considered at the December 1987 meeting of ATAC, where it was agreed that the Paper be used as a basis for discussion at a seminar on transport research being convened by the Bureau early in 1988.

The survey was designed and carried out under the guidance of Mr L. Kempen. This Paper was written by Ms L. Steadman and Mr L. Kempen. Assistance and support were provided by Mr N. Wuest, Mr P. McDonald, Mr D. Cosgrove and Mr R. Bryan. Mr W. Egan contributed to the assessment of priorities for transport research presented in Chapter 4.

> D. McLENNAN Assistant Director Financial Assessment Branch

Bureau of Transport and Communications Economics Canberra January 1988

SPECIAL NOTE

In July 1987, changes in the Commonwealth Government administrative arrangements came into effect. The major change in relation to transport was the amalgamation of the Department of Transport (DoT), the Department of Aviation (DofA) and the Department of Communications to form the Department of Transport and Communications. Following on from this change, in September 1987 the Bureau of Transport Economics became the Bureau of Transport and Communications Economics.

In this Paper, the administrative arrangements and research programs referred to are as at 30 June 1987. This is consistent with the reference period for the BTE Survey of Transport Research, which sought information for the year 1986-87.

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CHAPTER 1 INTRODUCTION

In December 1986, the Australian Transport Advisory Council (ATAC) sought the assistance of the Bureau of Transport Economics (BTE) in undertaking a review of transport research in Australia. The aims of the resulting study carried out by the Bureau were to identify the nature and extent of current Australian transport research, to assess priority areas for future research and to address coordination issues pertinent to delivery of an effective research effort. Following consideration at the December 1987 meeting of ATAC the results of the review are to be used as a basis for discussion at a seminar on transport research to be convened early in 1988.

BACKGROUND

ATAC's concerns that led to the review were related primarily to the question of obtaining the best result for research expenditure. The major catalyst for the review was the dissolution of the Australian Railway Research and Development Organisation (ARRDO) in mid-1986. The specific questions addressed in this study which were raised in the lead-up to the review are:

- . The extent to which the national transport research effort is balanced between modes. The closure of ARRDO heightened perception that there may be a lack of balance in transport research with insufficient attention being directed to rail transport.
- . Whether there are important transport issues amenable to research which are being neglected.
- . Whether there is a need for ongoing research which could be undertaken on a coordinated basis.
- . The extent to which there is duplication of research effort which could be alleviated by better coordination.

DEFINITIONS AND METHODOLOGY

In carrying out this study, the Bureau adopted a broad view of the range of activities which constitute transport research. Transport was broadly defined to refer to the movement of people and goods by all modes including, for example, the planning, creation and maintenance of infrastructure and the organisation of services, vehicles and operations. Activities which directly relate to transport (such as research into energy conservation in the transport field) were also included.

Research was defined as creative work undertaken on a systematic basis in order to increase the stock of knowledge and the use of this stock of knowledge to devise new applications. Research was taken to extend to substantial modifications to existing processes, systems, services and products and to include activities such as:

- . demonstration of both technical and commercial viability
- . feasibility studies
- policy-related studies
- . testing, standardisation, metrology and quality control
- . systematic data collection.

To obtain the necessary data, the Bureau sent questionnaires to 274 organisations and individuals involved with transport. These included Commonwealth and State government agencies, private and government-owned business undertakings, academics, and professional and representative organisations in the transport field.

In view of the ATAC context for the review, the Bureau attempted to ensure as complete a coverage as possible of transport research in the government sectors. The large number and diversity of transport organisations in the private sector precluded a complete coverage of this sector. Nevertheless, the Bureau attempted to ensure that all organisations involved in transport research to a significant degree were included. The list of organisations and individuals surveyed is given in Appendix I.

The questionnaire sought to identify the broad nature and extent of each organisation's 1986-87 program of transport research. Estimates of resources devoted to transport research were requested, together with information on research sponsorship and titles of research projects conducted during 1986-87. Respondents were also invited to comment on priorities for transport research. A copy of the questionnaire is provided in Appendix II.

STRUCTURE OF THIS PAPER

Chapter 2 provides an overview of transport research in Australia. Reference is made to previous studies of transport research and a detailed description is given of the major specific organisations and types of organisations involved in transport research. Chapter 3 draws on the results of the Bureau survey and presents a detailed analysis of the nature and extent of current Australian transport research. An assessment of priority areas and coordination issues for future research is the subject of Chapter 4. Concluding remarks are provided in Chapter 5.

CHAPTER 2 OVERVIEW OF TRANSPORT RESEARCH

Transport research in Australia is distributed across a large number of organisations within Commonwealth and State governments, the tertiary education sector and private enterprise. These include organisations involved with the planning and improvement of transport, with transport operations and with equipment manufacture. Very few organisations are recognised solely as transport research organisations.

PREVIOUS ASSESSMENTS OF TRANSPORT RESEARCH

In line with investigations of research effort in other sectors of the economy, detailed studies of research in the transport sector are a relatively recent phenomenon.

In 1977, the BTE was asked by the Australian Science and Technology Council (ASTEC) to prepare a report on research and experimental development (R&D) in the transport sector, as part of ASTEC's investigation into the state of science and technology in Australia. This report (BTE 1978) was limited by the requirement to comply with a strict definition of R&D based on the Organisation for Economic Cooperation and Development (OECD) standard definition.

Under this definition, R&D comprises 'creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications'. This definition conveys the notion that R&D activities are to be identified by an appreciable element of novelty, combined with a potential to produce results which are sufficiently general for the stock of knowledge to be recognisably increased.

BTE (1978) found that a total of some \$28 million was devoted to transport R&D in 1976-77. The effect of the restricted definition of R&D was considerable. For example, of the \$12 million expended in

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1976-77 on projects which received Commonwealth assistance under the Transport (Planning and Research) Act 1974, only 4.3 million could be attributed to R&D.

The ASTEC report (Australian Science and Technology Council 1979) acknowledged that many major problems in transport involve economic and other matters towards which a great deal of research effort is directed, and that this effort was, by definition, not included in the ASTEC considerations. Consequently, a substantial proportion of the activities generally considered to be transport research was excluded from the ASTEC review.

One of the recommendations of the ASTEC report was 'That the Australian Transport Advisory Council be invited to review methods of providing funds for R&D in transport, including the funding of external transport research by bodies such as the Australian Road Research Board'. In July 1981, ATAC agreed that the BTE should be asked to identify the sources and levels of funding of transport R&D, identify arrangements under which assistance is provided by the public and private sectors, and make a preliminary assessment of work in hand.

In carrying out this study (BTE 1982), the definition of transport research adopted was more representative of the types of activities generally considered to fall within the scope of this term. This definition was based on that used in the annual Science and Technology Statement, prepared by the Department of Science (the most recent publication is Department of Science (1986)), and comprised the OECD definition of R&D together with a range of scientific and technological activities appropriate to the transport sector. The definition of transport research adopted in BTE (1982) was broadly equivalent to that used in the current review (see Chapter 1).

BTE (1982) highlighted the diverse nature of transport research and the multiplicity of organisations involved in funding and performing transport research. In aggregate terms the total expenditure on all forms of transport research in Australia exceeded \$81 million in 1980-81, with an additional amount of almost \$4 million spent on synthetic fuels research. Some \$31 million was attributed to Commonwealth funding, \$25 million was spent by the States from their own resources, and \$2 million was spent from their own resources by national public enterprises involved in transport operations. The most recent information at that time on the private enterprise sector related to 1978-79 and covered R&D only. In that year, it was estimated that private enterprise funded transport R&D to a level of some \$21 million, including between \$2 million and \$3 million for R&D

in the context of conservation of energy associated with transport.

A draft of BTE (1982) was considered by the former ATAC Co-ordinating and General Transport (C&G) Group at its meeting in December 1981. The report was considered further by a number of sub-committees, with a view to developing proposals for funding mechanisms to ensure more effective and better coordination of transport research. However, no substantive recommendations resulted.

TRANSPORT ORGANISATIONS

At a broad level, the likely nature of transport research and the differing emphases between the various sectors can be ascertained by considering the responsibilities of the organisations involved. In this section, the major specific organisations and types of organisations involved in transport are briefly described. The classification adopted is the same as that used in the BTE Survey of Transport Research (see Chapter 3) and is illustrated in Figure 2.1.

Commonwealth Government agencies

In July 1987, changes in the Commonwealth Government administrative arrangements affected, among other things, responsibilities for The major change with respect to transport was the transport. amalgamation of the Department of Transport (DoT), the Department of Aviation (DofA) and the Department of Communications to form the Department of Transport and Communications. The Department of Housing Construction, and which also had some transport-related responsibilities, was abolished. In this Paper, the administrative arrangements referred to are as at 30 June 1987. This is in line with the intentions of the BTE survey, which sought information on transport research for 1986-87.

Department of Transport

The objective of the Department of Transport (DoT) is to promote, in accordance with Commonwealth Government policies and priorities, safe, efficient and cost effective surface transport within Australia and between Australian and overseas destinations. It advises the Commonwealth Government on national transport policies and strategies, administers Commonwealth-funded surface transport programs, regulates marine operations and promotes road and maritime safety. The BTE, which is considered separately in this section, is also part of DoT.

A number of areas in DoT (other than the BTE) carry out transport research. The most significant is the Road Safety Division, which is more widely known as the Federal Office of Road Safety (FORS). FORS is responsible for providing national vehicle safety standards and

COMMONWEALTH GOVERNMENT	JOINT COMMONWEALTH/STATE GOVERNMENT	STATE GOVERNMENT	GOVERNMENT BUSINESS	PRIVATE SECTOR	INSTITUTIONS OF HIGHER EDUCATION	ASSOCIATION AND UNIONS
Commonwealth Government	Agencies concerned with	State government agencies	Commonwealth and State	Private sector business	Institutions of higher	Association and Unions
agencies with an interest	transport issues iointly	concerned with the	opvernment agencies with	enterprises responsible	education which have formal	with an interest in
in transport issues.	funded and/or controlled	provisions of transport	an interest in transport	for transport equipment	establishments (or	transport issues
	by Commonwealth and State	operations or facilities,	issues and which are run	manufacture and supply,	individual academics)	-
Primary	government agencies.	except those operating on	on a commercial basis.	and the provision of	concerned with transport	For example
For example		a 'commercial' basis (see		transport services.	research.	
	. Australian Road	government business).	Primary			 National Association of
 Department of Transport 	Research Board		For example	Primary	For example	Australian State Road
- including Federal		Primary		For example		Authorities
Office of Road	. Australian Railway	For example, agencies	 Port operations agencies 		. Centre for Transport	
Safety, and Bureau	Research and	responsible for		 vehicle manufacturers 	Policy Analysis,	. Motorists associations
of Transport Economics	Development	nord construction	. State rall authorities		University of Wollongong	
	organisation .	. road construction	Ushan public transport	. private railways	David Applicate Descent	
. Department of Aviation		transport regulation	. orban public transport	- froight focuardang	. Road Accident Research	
Inton State Commission		· transport regulation	. uperaciona	companies	Adelaide	-
. Inter-State commission			Western Australian	companies	Aderarde	
Other		Other	-Coastal Shipping	Other	. Australian Maritime	-
For example	-	For example	Commission	For example	College	
. Commonwealth Scientific					5	
and Industrial Research		. environmental agencies	. Australian National	 petrol companies 	. individual academics	
Organisation						
-		 tourism agencies 	. Australian National Line			
. Australian Bureau of						
Statistics			. QANTAS			
. Department of Defence			. Australian Airlines			
. Department of Housing			Other			
and Construction			. Australia Post			
. National Capital			. Snowy Mountains			
Development Commission			Engineering Corporation			
. Department of						
Territories						
. National Materials					-	
Handling Bureau						

Figure 2.1 Transport organisations

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leading and co-ordinating activities to improve road user behaviour. In carrying out its work, FORS sponsors a significant amount of external research.

Department of Aviation

The Department of Aviation (DofA) is responsible for operational standards and procedures for safe conduct of flight operations, promoting measures for enhancing safety of flight, and planning and operating airport and airways facilities. It also provides advice to the Commonwealth Government on aviation policies and administration. In addition, DofA incorporates the Bureau of Air Safety Investigation, which investigates all accidents involving civil aircraft in Australian territories.

Bureau of Transport Economics

The BTE is a professional research body (attached to DoT) which reports directly to the Minister for Transport on its program of research. The overall objective of the BTE's work is to improve efficiency in the transport field. This is achieved by fostering increased understanding of the economic and other characteristics of transport, and hence allowing improved decision-making with respect to transport investment, regulation and operation.

At the Commonwealth level, these objectives are expressed by inputs to specific policy initiatives, thus providing the necessary analytical and conceptual background to developments. Such inputs may be quite formal, through defined research tasks, or informal, through continuous interaction with those more directly concerned with policy development. The BTE provides advice to a number of high-level committees associated with and including ATAC, the Transport Industries Advisory Council (TIAC) and the National Association of Australian State Road Authorities (NAASRA). Where appropriate (usually where Commonwealth interests overlap with others), the BTE's assistance is available to other levels of government and to the transport industry.

In 1986-87, the BTE's total expenditure was \$3.6 million and it had an average staffing level of 96.

Inter-State Commission

The Inter-State Commission (ISC) is provided for in the Constitution and was established in its present form in 1984 following the *Inter-State Commission Act 1975*. The ISC is an investigatory body with royal commission-type powers and its reports and recommendations are tabled in Parliament. It has no regulatory or judicial powers. The ISC investigates only interstate transport matters referred to it

by the Minister for Transport. Its major studies have included such topics as the Tasmanian Freight Equalisation Scheme and cost recovery arrangements for interstate land transport. The ISC's total expenditure in 1985-86 was \$1.3 million and it had an average staffing level of 21, not including the President and two Commissioners. In 1986-87, the average staffing level was reduced to 16.

Commonwealth Scientific and Industrial Research Organisation

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a statutory body created to carry out, on behalf of the Commonwealth, a wide range of research. Its primary role is applications-oriented research in support of major industry sectors and selected areas of community interest, with a commitment to the effective transfer of research results to users. CSIRO is organised largely according to the various branches of science and consequently there is no division or section devoted specifically to transport. Transport research or research with applications in the transport field can occur in a number of areas of CSIRO, and in particular in the Divisions of Energy Technology and Fossil Fuels.

The Department of Science (1986) estimated CSIRO 1986-87 expenditure on research into transport systems, in an engineering context, to be \$312 000 out of a total research budget of \$457 million.

Other Commonwealth agencies

A number of other Commonwealth agencies have transport or transportrelated responsibilities and are involved in transport research. The Australian Bureau of Statistics (ABS) regularly publishes transportrelated data, including information on trade, shipping and air transport, interstate freight movements, road traffic accidents, motor vehicle registrations and motor vehicle use. The results of a transport industry survey in respect of 1983-84 were released in 1986 and 1987.

The Department of Defence is responsible for the transport needs of the Australian defence force. Much of the transport-related research performed by the Department of Defence is carried out by its own Defence Science and Technology Organisation.

The Department of Housing and Construction is responsible for Commonwealth construction projects and has a large resource of engineering skills, including skills in the areas of traffic engineering and urban planning. The National Capital Development Commission is responsible for the planning, design and construction of the city of Canberra as the national capital of Australia. Studies involving transport problems are an important part of the Commission's work. The Department of Territories is responsible, among other things, for the management and administration of the Australian Capital Territory (ACT). Its responsibilities include the operation and development of the public transportation system, traffic control systems and the road network within the ACT.

The National Materials Handling Bureau (NMHB) was abolished in May 1987, but was formerly located within the Department of Industry, Technology and Commerce. Its broad charter was to improve the effectiveness of materials handling and distribution activities in Australian industry.

Commonwealth/State agencies

An unusual feature of transport research organisation in Australia is the existence of agencies which are neither Commonwealth or State agencies but are under joint control and jointly funded by the Commonwealth and State governments.

Australian Road Research Board

The Australian Road Research Board (ARRB) operates as a non-profit public company registered in Victoria. It is controlled by a Board of Directors comprising the heads of the following Commonwealth and State government departments:

Commonwealth	-	Department of Housing and Construction (until
		May 1987)
	-	Department of Transport
New South Wales	-	Department of Main Roads
Victoria	-	Road Construction Authority
Queensland	-	Main Roads Department
South Australia	-	Highways Department
Western Australia	-	Main Roads Department
Tasmania	-	Department of Main Roads
Northern Territory	-	Department of Transport and Works.

ARRB's research is directed mainly to the technical aspects of road construction and vehicle performance, as well as traffic engineering and driver behaviour. In 1985-86, ARRB's budget was \$6.1 million, of which approximately one-third was provided by DoT and most of the remainder was provided by the various State road authorities. In addition, ARRB receives income derived from contract research, an amount in excess of \$1 million in 1985-86 (Australian Road Research Board 1986). ARRB employs approximately 120 staff.

Australian Railway Research and Development Organisation ARRDO was incorporated in Victoria as a limited company in 1977. ARRDO was controlled by a Board of Directors comprising essentially the heads of the five government-owned railway systems and the Secretary to DoT.

ARRDO's role was to determine administrative, economic and technical planning strategies to improve the productivity and efficiency of the Australian railway systems. In July 1986, ARRDO was dissolved; at that time it had a staff of 33. ARRDO's budget for 1985-86 was \$1.5 million, of which DoT contributed \$600 000 and the balance was provided by the five railway systems.

State government agencies

While the structure and organisation of transport portfolios varies from State to State, each generally reflects the major responsibilities for road construction, port operations, urban public transport and transport regulation. New South Wales, Victoria, Queensland and Western Australia also have government rail authorities.

For reasons outlined in Chapter 3, the government agencies with responsibilities for the operation of transport services have been considered, for the purposes of this review, as being in the government business sector.

Government business

In addition to the State government ports and rail, bus and ferry authorities which are considered as part of the government business sector, the other significant State government transport organisation in the government business sector is the Western Australian Coastal Shipping Commission, which trades as Stateships. The broad objectives of this Commission are to provide shipping services in Western Australia in response to community needs and to facilitate the State's imports and exports. It operates services between Fremantle and other Western Australian ports, Melbourne, the Northern Territory, Tasmania and Papua New Guinea.

The Commonwealth Government is also responsible for a number of business enterprises in the transport area. The Australian National Railways Commission, which trades as Australian National (AN), is responsible for operation of Commonwealth Government railways in South Australia and Tasmania. The Australian Shipping Commission, which trades as the Australian National Line (ANL), provides shipping services in the coastal and overseas trades and operates container terminals in Melbourne, Sydney, Brisbane, Adelaide, Burnie and Launceston.

Three Commonwealth-owned business entities are concerned with air transport. The function of QANTAS Airways Limited is to develop and operate international air services as the Australian flag carrier. The Australian National Airlines Commission, which trades as Australian Airlines, provides domestic air services. The *Federal Airports Corporation Act 1986* was proclaimed to commence on 13 June 1986 and provides a charter for the Corporation to develop, maintain and operate selected airports and airport facilities on a self-supporting and more commercial basis than had previously been the case.

Private sector

Private sector business enterprises are responsible for most transport equipment manufacture and supply. They also provide a considerable proportion of transport services, particularly in the areas of freight forwarding, road freight transport, rail haulage of minerals and bus and coach services. Consequently, transport research in the private sector would be expected to focus on technological research to reduce costs and improve products, and market research to establish and improve services.

A large number of consultancy firms in the private sector are involved in conducting transport research for government and private sector clients. In the BTE Survey of Transport Research, however, consultants were not approached directly. Nevertheless, organisations included in the survey were asked to identify the recipients of sponsored external research.

Institutions of higher education

Specific transport disciplines are not reflected in the organisational and degree structures of institutions of higher education to any significant extent. Most specifically, the University of Wollongong maintains a Centre for Transport Policy Analysis, the University of Adelaide has a Road Accident Research Unit and there is an Australian Maritime College in Launceston. Transport engineering as a recognised discipline attracts some post-graduate research, in particular at Monash University and the University of New South Wales. Other universities have various types of arrangements which provide some emphasis on transport research, occasionally under direct sponsorship arrangements.

On an individual basis, a number of academics are recognised as experts in transport-related fields such as transport economics and transport engineering. In addition, many staff of academic institutions are, from time to time, involved in transport research funded by outside organisations, including Commonwealth and State government agencies.

Associations and unions

There is a wide range of associations and unions which coordinate and represent the interests of various groups concerned with transport. The associations and unions approached in the BTE survey are listed in Appendix I.

Although it might be considered appropriate to include them in the private sector, the motorists' associations in each State have been included as associations for this review. These organisations provide extensive insurance services, technical advice and other services to private motorists. They also act as lobby groups on behalf of their members in the areas of road funding, road safety and transport regulation.

Another significant transport association, which arguably might be regarded as a Commonwealth/State entity, is the National Association Australian State Road Authorities (NAASRA). of The member organisations NAASRA State of are those government agencies represented on the Board of ARRB, together with one Commonwealth Government agency. In early 1987, DoT replaced the Department of Housing and Construction as the Commonwealth member.

NAASRA's principal objective is to provide a central organisation where, by cooperative effort, a uniform approach to the development and improvement of the national road system can be achieved. NAASRA is supported by a number of committees and working groups drawn from the member organisations.

SOURCES OF FUNDS FOR TRANSPORT RESEARCH

In addition to resources for research provided by organisations described in the previous section, there are a number of potential avenues whereby agencies or individuals may obtain additional funds for transport research. However, there is no longer a formal mechanism for joint Commonwealth/State funding of research covering all modes of transport, as was the case under the former Transport Planning and Research (TP&R) Program.

Transport Planning and Research Program

The TP&R Program was established in 1974 with the passing of the *Transport (Planning and Research) Act 1974*. The Act was introduced to provide assistance to the States' programs of planning and research into roads and urban public transport. For approved projects, two-thirds of the funds were provided by the Commonwealth, with the States contributing the remaining one-third and being responsible for project implementation. Activities funded under this Act included research into urban transport planning, traffic engineering, road construction techniques, data collection and urban rail.

In 1977 the Act was superseded by the *Transport Planning and Research* (*Financial Assistance*) Act 1977. The scope of this Act was extended to include planning and research into all modes of land transport and the interface between land transport and other transport modes. Under the 1977 Act, the Commonwealth contribution towards project funding was reduced from two-thirds to one-half, beginning in the 1978-79 financial year.

As part of a review of Commonwealth Government functions, Commonwealth assistance to the States for transport planning and research under the *Transport Planning and Research (Financial Assistance) Act 1977* was terminated at the end of the 1980-81 financial year.

Australian Land Transport Program

The Australian Land Transport (Financial Assistance) Act 1985 incorporates a number of funding initiatives for land transport, with the major element being the provision of financial assistance to the States and the Northern Territory for road construction and maintenance. There is also provision for a limited investment program to upgrade interstate railways.

Under the Act, funds are available for recognised bodies to carry out research. To date, this provision has only been used to provide the Commonwealth contribution to ARRB and ARRDO and to fund external research through FORS.

National Energy Research, Development and Demonstration Council

The National Energy Research, Development and Demonstration Council (NERDDC) advises the Commonwealth Minister for Resources and Energy on development and coordination of a national program of energy research, development and demonstration and recommends support for individual energy research projects. Funds are provided through an annual appropriation to the Department of Resources and Energy and by a coal research trust account funded by a levy on coal production. In

1984-85, project grants totalling \$1.9 million were made through the coal research trust account and project grants totalling \$13.9 million were made through the departmental appropriation. Of this \$13.9 million, \$1.3 million was for projects concerned with conservation of energy in the transport field.

Industry Research and Development Board

The Industry Research and Development Board is a statutory Commonwealth body which administers the Grants for Industry Research and Development (GIRD) Scheme. It is responsible for determining, at the request of the Commissioner for Taxation, whether particular activities constitute research and development for the purposes of 150 per cent taxation concessions.

In 1986-87, \$1.8 million was provided under the GIRD Scheme for transport research and development projects. Details of the nature of the taxation concession claims are not available due to confidentiality requirements.

COORDINATION ARRANGEMENTS

Some of the organisations already described carry out coordination functions. At the national level, there are also a number of formal consultative arrangements in place to facilitate coordination of transport research by bringing together representatives from the various sectors. The major consultative bodies are:

- The Australian Transport Advisory Council (ATAC) comprises Commonwealth, State, and Territory Ministers responsible for transport, roads and marine matters. The New Zealand Minister of Transport is also represented on the Council as an observer member. ATAC's primary role is to review and coordinate various aspects of transport policy, development and administration. ATAC is supported by an extensive structure of committees.
- The Aviation Industry Advisory Council (AVIAC) is chaired by the Minister for Aviation and comprises the chairpersons of the major airlines and aviation associations and the Secretary to DofA. AVIAC provides advice to the Minister on aviation industry matters.
- . The Transport Industries Advisory Council (TIAC) comprises senior representatives from transport authorities, industry, user groups, unions and academic institutions. The Council advises the Minister for Transport on national transport issues.

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- . The Australian Road Freight Transport Advisory Committee (ARTAC) comprises representatives of all sectors of the road freight industry and others with relevant specialist expertise. Membership of ARTAC is drawn from TIAC membership.
- The Maritime Services Advisory Council (MSAC) comprises representatives from Commonwealth Government bodies, industry and maritime unions. The Council considers a range of maritime operational issues.

NAASRA, in close cooperation with ARRB, oversights the coordination of a range of activities, including a number of aspects of research and development. There are several working groups under the NAASRA umbrella with specific responsibilities for both coordination and/or execution of specific work programs or projects, such as pavement management systems, pavement research and vehicle limits.

In the rail transport area, there are two other significant bodies with a coordinating role. The Railways of Australia (ROA) Committee comprises the chief executives of the five government-owned rail systems. ROA is responsible for coordination of intersystem activities, allocation and control of intrasystem freight rolling stock, servicing the intersystem requirements of freight and passenger clients, overseas promotion and national public relations. ROA coordinates some technical rail research. ROA also includes the National Freight Group and the Interstate Passenger Services Group, which aim to ensure high levels of service and competitiveness in their respective fields.

The Railway Industry Council (RIC) comprises an independent chairman, four government members, four rail system members and eight union members. Neither Queensland Railways nor the Queensland Government participate in RIC. The terms of reference for RIC require it to develop and recommend to governments, rail management, unions and employees, a medium and long term strategy to improve the viability and competitiveness of the rail industry.

CURRENT INFORMATION ON TRANSPORT RESEARCH

No comprehensive data on transport research are collected regularly. The annual Science and Technology Statement (Department of Science 1986) provides some information but is restricted to the Commonwealth Government sector. The ABS conducts regular surveys of R&D. The most recent consolidated data for all sectors of the economy (ABS 1987) relate to 1984-85. This information is restricted by the adoption of the OECD definition of R&D and consequently emphasises research on transport hardware. Nevertheless, it does provide some

indication of the extent of transport R&D relative to total R&D effort and the comparative efforts of the various sectors. In particular, it is the only source of data with good coverage of the private sector.

Table 2.1 presents estimates of total and transport R&D derived from ABS (1987). It should be noted that the sector classification is similar (but not identical) to that adopted in this study. The

	Total R&D			Transport R&D ^a			Transport R&D ^a as
Sector	(\$ mill	ion)	(per cent)	(\$'0	00)	(per cent)	of total R&D
General government			<u>.</u> ,				
Commonwealth		670	27.8	12	887	9.3	1.9
State		289	12.0	10	601	7.7	3.7
Total		959	39.8	23	488	17.0	2.4
Business enterpris	e						
Private sector		650	27.0		na	na	na
Public sector		87	3.6		na	na	na
Total		737	30.6	109	403	79.3	14.8
Higher education		668	27.7	4	666	3.4	0.7
Private non-profit		44	1.8		427	0.3	1.0
Total	2	407	100.0	137	984	100.0	5.7

TABLE 2.1 GROSS EXPENDITURE ON RESEARCH AND DEVELOPMENT CARRIED OUT IN AUSTRALIA BY SECTOR: 1984-85

a. For the general government and higher education sectors, this comprises 'R&D assigned to the socio-economic objectives of transport' plus 'conservation of energy (transportation) R&D'. For the private non-profit sector this comprises 'R&D assigned to the socio-economic objective transport'. For the business enterprise sector this comprises 'R&D concerned with transport equipment manufacture' plus 'all other R&D carried out by transport equipment manufacturing enterprises'.

Note Figures may not add to totals due to rounding.

Source Derived from ABS (1987).

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dominance of the business enterprise sector in performing nearly 80 per cent of transport R&D reflects the transport R&D emphasis on transport equipment manufacture which was noted in ASTEC (1979). The broader areas of transport research, as distinct from transport R&D, are likely to be the province of the government sectors because of their responsibilities for development, maintenance and operation of public transport systems. Another feature of Table 2.1 is the relatively low level of involvement of the higher-education sector in transport R&D.

The proportion of R&D effort devoted to transport (5.7 per cent) does not compare favourably with the BTE (1987) estimate that the value added in a broadly-defined transport sector accounted for 9.4 per cent of Australia's gross domestic product in 1978-79. In addition, Australia's total R&D effort is considered by Department of Science (1986) to be low by international standards, with the major shortfall being in the business sector.

It should be noted that Table 2.1 indicates the extent to which the various sectors perform R&D, not the source of funds. ABS (1987) does not provide information on the source of funds for transport R&D but, of the total R&D effort, the Commonwealth Government provided 57 per cent, State governments provided 11 per cent and business enterprises provided 28 per cent.

Transport research information systems

A number of information systems are maintained to provide information relevant to transport research in Australia. These systems are focussed at the project level and assist transport researchers in keeping abreast of work in their field of interest. However, they are not particularly suited to providing a higher level indication of the distribution of research effort.

Australian Transport Research in Progress (ATRIP), Australian Transport Information Directory (ATID) and Australian Transport Literature Information System (ATLIS) are prepared by the BTE. ATRIP provides brief descriptions, progress notes and contacts for transport research projects in progress in Australia. ATID is a reference to information sets which could be of use in transport research or planning. ATLIS provides information on literature relating to all modes and aspects of transport excluding road research and road safety. The DIT library maintains the Literature Analysis System on Road Safety (LASORS), which complements ATLIS.

ARRB produces INROADS (formerly the Australian Road Research Documentation (ARRD)) which covers Australian literature related to

roads, including research in progress. This is used as a base for selecting contributions to the International Road Research Documentation (IRRD) database. All Australian research in progress contributions to IRRD and the International Road Federation are published under the title of Australian Road Research in Progress (ARRIP). There are general agreements between BTE, DoT and ARRB on the format and coverage of these databases, so as to avoid overlap and facilitate interchange of information.

CHAPTER 3 DISTRIBUTION OF TRANSPORT RESEARCH EFFORT

This chapter provides a detailed analysis of the nature and extent of current Australian transport research. It draws on the results of the BTE Survey of Transport Research. In this survey, organisations were asked to provide information on their 1986-87 programs of transport research. An organisation was considered to have a program of transport research if it conducted transport research in-house, or it sponsored external transport research, or both.

Two hundred and seventy four organisations were approached in the survey and approximately two-thirds responded. The response rate varied markedly by type of organisation, with almost all Commonwealth and State government agencies approached responding. Follow-up efforts were made to ensure that all organisations considered to be involved in transport research to a significant degree would be included.

To assist in the analysis, organisations were classified by transport area, State and sector. These classifications are incorporated in the list of organisations in Appendix I. Transport area was used to denote the primary area of modal activity or interest of the organisation. The modal categories were 'air', 'rail', 'road', 'sea' and 'pipeline'. Where the organisation's primary activity, responsibility or interest was not restricted to one mode, the transport area assigned was 'not mode-specific'. Organisations which had an interest in transport activity but which were primarily involved in some other industry (such as manufacturing) were also classified to 'not mode-specific'.

If an organisation's activities or interests were restricted to a specific State, it was assigned that State classification. Where this was not the case the organisation was classified to 'Australia'. As would be expected, all State government agencies were assigned to their particular State and most Commonwealth Government agencies were assigned to 'Australia'.

The sectoral classification was used to distinguish between the various groups involved in transport research. Organisations were classified as belonging to one of the sectors as follows: Commonwealth Government, State government, government business, private, academic, associations or unions. ARRB was considered as a separate sector in view of its joint Commonwealth/State nature. One area in which there was some degree of arbitrariness was in distinguishing between the Commonwealth Government and State government sectors on the one hand, and the government business sector on the other. The general intention was that agencies responsible for policy and regulation should be assigned to the Commonwealth or State government sectors and government-owned bodies required to operate on a commercial basis should be assigned to the government business sector. It was not practicable to apply such a definition strictly. as it would have resulted in different treatment of what are ostensibly similar organisations from State to State.

OVERALL RESULTS

A total of \$97.9 million of transport research was funded in 1986-87 by those organisations which responded to the survey. This total was, however, spread unevenly across the various research subject areas, levels of research and sectors.

Table 3.1 provides details of research funding classified by subject area and level of research, as reported by all organisations which responded to the survey. Summary information is provided in graphical form in Figures 3.1 and 3.2. Research primarily aimed at only one of the five modes (air, rail, road, sea and pipeline) was assigned to that subject area. Three other subject areas were defined as follows:

- . Intermodal: Research primarily concerned with the interface between modes of transport. This includes research concerned with terminals.
- . Multimodal: Research primarily concerned with more than one mode. This may include, for example, research into competition between transport modes. Most research into urban transport would be multimodal.
- Any mode: Research that is not mode-specific and may cover all modes. This may include, for example, research into the movement of particular commodities where several combinations of mode may be involved.

It should be noted that although the subject area and transport area classifications are very similar, subject area relates to the nature

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	Level of research								
Subject area	fi Strategic	Commercial, nancial and economic	Behavioural	Operational	[Technica]	Data collection and dissemination	Unassigned	Total	
	2 667	12 777		1 804	1 315	QAA		19 880	
Rail	2 628	5 403	146	5 093	8 683	2 345	0	24 298	
Road	4 999	1 253	4 755	3 922	14 434	10 179	0	39 542	
Sea	587	1 437	11	1 227	89	1 161	0	4 511	
Pipeline	0	0	0	75	87	0	0	161	
Intermodal	258	248	8	122	8	60	0	703	
Multimodal	1 052	287	214	1 041	256	1 111	0	3 961	
Any mode	668	216	81	48	2 611	876	0	4 499	
Unassigned	••	••	••	••	••	••	312	312	
Total	12 859	21 620	5 588	13 331	27 483	16 675	312	97 868	

TABLE 3.1 FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH: 1986-87 (\$'000)

.. Not applicable.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986~87.



Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

Figure 3.1 Distribution of funding of transport research by subject area: 1986-87

of the research being done, while transport area relates to the nature of the organisation performing the transport research.

Levels of research relate to the primary objective or reason for carrying out the research, not to details of the methodology. The six levels of research are as follows:

- . Strategic: Research which tends to be concerned with broad issues such as longer-term infrastructure planning or financing requirements; industry analyses, performance and structure; or regulation and competition.
- 'Commercial', financial and economic: Research which tends to be concerned with more specific issues like specific infrastructure investment decisions, costing and pricing, levels of service, or marketing.
- . Behavioural: Research which is primarily concerned with people in transport. It may include such issues as driver behaviour or travel characteristics.

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- Operational: Research which is primarily concerned with the operation and performance of transport systems.
- Technical: Research which is primarily concerned with vehicles, components and materials. It would include energy-related research such as testing alternative fuels and measures to improve fuel economy.
- . Systematic data collection and information dissemination: Activities which may support a wide range of transport research conducted in the same organisation or elsewhere.

The term 'funding' refers to the level of resources committed to transport research by organisations included in the survey. It represents an organisation's in-house expenditure, plus any sponsorship by it of external transport research projects, less the amount of sponsorship received.



Note Figures may not add to totals due to rounding. *Source* BTE Survey of Transport Research 1986-87.

Figure 3.2 Distribution of funding of transport research by level of research: 1986-87

As can be seen from Table 3.1, transport research in 1986-87 was largely mode-specific. Air, rail and road transport research between them accounted for 86 per cent of reported funding for 1986-87. All levels of research are represented, with emphasis on technical and commercial research, which accounted for 28 and 22 per cent of total expenditure respectively. Data collection and dissemination in support of research accounted for a further 17 per cent of expenditure.

The distribution of research across levels differed considerably among subject areas. Some of the features of this distribution are as follows:

- Almost two-thirds of air transport research was at the commercial level.
- Rail transport research was more widely spread across the levels of research. Just over one-third was considered technical while approximately 20 per cent was accounted for by each of the commercial and operational categories. Eleven per cent of total rail transport research expenditure was classified as strategic.
- Road transport research accounted for 40 per cent of total reported research. Over one-third of road transport research was reported as technical. Research at the strategic level accounted for some 13 per cent of total road transport research.
- By comparison, little research was reported in the sea transport subject area (5 per cent of total research funding) and what was reported was concentrated in the commercial, operational and data collection categories.

These characteristics are drawn together in Figure 3.3, which illustrates the relative proportions of total funding by both subject area and level of research (that is, totalled for all sectors). More detailed information by subject area and level of research for each sector is provided in Appendix III.

It should be emphasised that comparisons between funding at the various levels of transport research need to be treated with some caution. The explanations of the types of projects to be included in each level of research were necessarily imprecise and subject to interpretation by the respondent. The lack of delineation between the levels led to similar projects being recorded against different levels of research. Comparisons of funding across levels of research are to some extent distorted by these differences in interpretation.

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Table 3.2 shows total funding classified by sector and subject area (that is, totalled across levels of research). These data are reflected in Figure 3.4, while Figure 3.5 summarises total funding by sector. Of the total transport research reported, the government business sector funded 39 per cent, the State government sector 25 per cent the Commonwealth Government 15 per cent and the private sector 11 per cent. It should be noted when examining these results, however, that coverage was concentrated on the government sectors and the private sector is under-represented. In fact, figures derived from ABS data (as presented in Table 2.1) suggest that private sector funding of transport research may be of the order of seven times the level established by the BTE survey, putting total transport research at about \$160 million.

Table 3.2 also indicates that five of the eight sector categories were predominantly involved in road transport research in 1986-87. Modespecific research was more concentrated than non-mode-specific research in terms of the distribution across sectors. Perhaps not unexpectedly, among those organisations which responded to the survey, the Commonwealth Government performed most sea transport research, State governments most road transport research and government business most air and rail transport research.

The distribution of funding by each sector reveals a concentration in specific subject areas. Around 65 per cent of Commonwealth Government funding went to road transport and any mode research. State government organisations spent over 90 per cent of their research budgets on road transport research, while approximately 45 and 40 per cent of government business sector funding was on air and rail transport research respectively. Private sector expenditure was dominated by rail transport research (approximately 75 per cent). Road transport research was the main interest of the academic and associations sectors.

More detailed analysis was done in relation to air, road, rail and sea transport research, in terms of the distribution of research tasks and the types of issues being addressed. The concentration of modespecific research in organisations classified to the corresponding modal transport area is quite significant, although varying somewhat across the modes. Conversely, in general little research is done in subject areas outside organisations' own transport areas. This explains, at least in part, the relative lack of research effort addressing intermodal and multimodal issues.

An indication of the nature of the issues being addressed by research can be gained from the titles of the projects reported in the survey.

					Subject	area				
Sector	Air	Rail	Road	Sea	Pipe- line	Inter- modal	Multi- modal	Any mode	Un- assigned	Total
Commonwealth Government										
BTE	287	239	1 614	446	0	86	257	719	0	3 648
Other	1 354	214	4 816	1 571	0	20	665	2 546	0	11 185
Total	1 641	453	6 430	2 017	0	105	922	3 265	0	14 832
ARRB	0	0	5 571	0	0	56	0	. 0	0	5 627
State government	165	118	22 599	94	0	89	1 044	605	238	24 953
Government business	17 056	15 413	1 669	1 371	0	241	1 619	546	10	37 926
Private sector	942	8 231	539	763	161	150	198	6	0	10 990
Academic	19	19	797	30	0	11	149	78	64	1 165
Associations	57	32	1 921	211	0	42	21	0	0	2 284
Unions	0	32	17	25	0	8	8	0	-	90
Total	19 880	24 298	39 542	4 511	161	703	3 961	4 499	312	97 868

TABLE 3.2 FUNDING OF TRANSPORT RESEARCH BY SECTOR AND SUBJECT AREA: 1986-87 (\$'000)

- Rounded to zero.

Note Figures may not add to totals due to rounding.

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Figure 3.3 Funding of transport research by subject area and level of research: 1986-87

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Commonwealth Government ARRB State government Government business Private Air Rail Academic Road Sea Associations 💮 Other Unions 15 20 25 30 35 10 40 5 0 Funding (\$m)

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Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

Figure 3.5 Distribution of funding by transport research by sector: 1986-87

A list of these projects, categorised by sector, subject area, level of research and State, is given in Appendix IV.

AIR TRANSPORT

Just over 90 per cent of air transport research was funded by aviation organisations, and those which responded to the survey did not fund any research in other subject areas. Government airlines funded over 80 per cent of total air transport research. Some 64 per cent of research was at the commercial level. Table 3.3 provides details of air transport research funding.

Table 3.4 indicates the levels of research carried out in-house. Comparison with the information on funding (in Table 3.3) reveals that government airlines carried out almost all their own research, while private airlines and other aviation organisations spent only around 80 per cent and 50 per cent of their respective research program budgets

32 TABLE 3.3 FUNDING OF TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND LEVEL OF RESEARCH: AIR TRANSPORT SUBJECT AREA, 1986-87

Level of research Data collection Commercial, Organisational financial and and Total economic Behavioural Operational Technical dissemination category Strategic Air organisations 16 344 Government airlines 1 976 11 966 151 1 286 714 252 687 Private airlines 201 259 133 0 0 93 1 054 89 61 340 560 Other air organisations 4 0 18 085 Total 2 181 12 225 373 1 347 1 054 905 Other organisations 287 41 160 63 22 BTE 0 0 19 Academic 11 5 0 0 0 3 13 1 489 434 387 0 394 260 Other 1 794 Total 486 552 0 457 260 39 2 667 12 777 373 1 804 1 315 944 19 880 Tota]

(\$ '000)

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

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TABLE 3.4 IN-HOUSE TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND LEVEL OF RESEARCH: AIR TRANSPORT SUBJECT AREA, 1986-87

			Level	of research			
Organisational	C fin	ommercial, ancial and			D	ata collection and	
category	Strategic	economic	Behavioural	Operational	Technical	dissemination	Total
Air organisations							
Government airlines	1 976	11 966	144	1 286	714	252	16 337
Private airlines	176	219	48	0	0	93	537
Other air organisations	4	0	0	0	0	545	549
Total	2 156	12 185	192	1 286	714	890	17 423
Other organisations							
BTE	41	160	0	63	0	22	287
Academic	13	15	9	0	0	5	42
Other	434	387	0	394	18	13	1 247
Total	488	562	9	457	18	41	1 575
Total	2 645	12 747	201	1 743	732	931	18 999

(\$'000)

Note Figures may not add to totals due to rounding.

 $\stackrel{\omega}{\sqcup}$ Source BTE Survey of Transport Research 1986-87.

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in-house. Almost all of the external research was at the technical and behavioural levels.

RAIL TRANSPORT

Tables 3.5 and 3.6 provide information on funding of rail transport research and research funded by rail organisations. More than 95 per cent of rail transport research reported for 1986-87 was funded by rail organisations, while only around 10 per cent of their total research budget was spent on research other than rail transport. Government railways funded over 60 per cent of rail transport research. The State Transport Authority in Victoria (which trades as V/Line) was responsible for over 80 per cent of the rail-funded research into other subject areas. Research coordinated by ROA accounted for just over 4 per cent of technical rail transport research funding.

Expenditure on rail transport research carried out in-house by organisations which responded to the survey is shown in Table 3.7. Table 3.8 details expenditure by rail organisations on in-house research into all subject areas. These tables indicate that overall, in-house expenditure and funding for rail organisations in total were almost equal. More than 85 per cent of rail transport research performed by the academic sector was externally sponsored. Most of this work was at the technical level.

Reported expenditure on rail transport research at the strategic level was about half that at each of the commercial and operational levels. However, in comparing expenditure on strategic research between rail systems and with other levels of research, it should be noted that the estimates reported for this level of research were particularly influenced by the respondent's interpretation of the concept of strategic research. Specifically, there was some disagreement as to the extent that the corporate planning process could be considered as strategic research. The differences in the levels of strategic research reported may largely reflect these differences in interpretation.

Commercial and operational research together accounted for over 40 per cent of total rail transport research. AN, V/Line and the State Rail Authority of New South Wales (SRA) were the largest contributors to commercial research, while V/Line accounted for over half the operational research. The commercial projects reported, in the main, represented market and cost research by government railways. The operational projects were varied, covering such topics as scheduling, service evaluation and train performance.

TABLE 3.5 FUNDING OF TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND LEVEL OF RESEARCH: RAIL TRANSPORT SUBJECT AREA, 1986-87

(\$'000)

			Leve1	of research			
Organisationa1	Commercial, financial and					Data collection and	
category	Strategic	trategic economic		Operational	Technical dissemination		Total
Rail organisations							
Government railways							
AN	806	2 360	4	642	155	122	4 089
SRA	384	1 087	125	419	575	1 292	3 882
V/Line	735	1 583	0	2 611	560	560	6 049
QR	102	73	0	0	16	115	306
Westrail	180	105	16	91	88	120	600
ROA ^a	0	0	0	0	389	0	389
Total	2 208	5 208	145	3 763	1 783	2 208	15 314
Non-government railways	24	84	0	1 192	1 572	39	2 911
Other rail organisations	5 16	9	1	38	5 205	3	5 273
Total	2 247	5 301	146	4 992	8 560	2 251	23 498

			(\$'000)					
	- <u> </u>		Leve1	of research			- —	
Organisational	Commercial, financial and				Ε	Data collection and		
category	Strategic	economic	Behavioural	Operational	Technical	dissemination	Total	
Other organisations		······································						
BTE	176	4	0	0	0	60.	239	
CSIRO	0	0	0	0	123	0	123	
Academic	16	2	0	0	0	0	19	
Other	188	96	0	100	0	35	419	
Total	380	102	0	100	123	95	800	
Total	2 628	5 403	146	5 093	8 683	2 345	24 298	

⇔ TABLE 3.5 (Cont.) FUNDING OF TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND LEVEL OF RESEARCH: RAIL TRANSPORT SUBJECT AREA, 1986-87

a. Includes research by government railway systems which is coordinated by ROA and funded by the systems.

Note Figures may not add to totals due to rounding. *Source* BTE Survey of Transport Research 1986-87.

TABLE 3.6 FUNDING OF TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND SUBJECT AREA: RAIL TRANSPORT ORGANISATIONS, 1986-87

~	Subject area										
Rail transport organisational category	Air	Rail	Road	Sea	Pipeline	Intermodal, multimodal and any mode	Unassigned	Total			
Government railways											
AN	0	4 089	0	0	0	69	0	4 158			
SRA	0	3 882	0	0	0	0	0	3 882			
V/Line	0	6 049	366	0	0	1 211	10	7 636			
QR	0	306	0	0	0	0	0	306			
Westrail	0	600	0	0	0	0	0	600			
ROA ^a	0	389	0	0	0	0	0	389			
Total	0	15 314	366	0	0	1 280	10	16 971			
Non-government											
railways	0	2 911	25	0	108	0	0	3 044			
Other rail											
organisations	0	5 273	104	0	0	. 17	-	5 393			
Total	0	23 498	495	0	108	1 297	10	25 408			

(\$'000)

a. Includes research by government railway systems which is coordinated by ROA and funded by the systems.

Rounded to zero.

Note Figures may not add to totals due to rounding.

 $\frac{\omega}{2}$ Source BTE Survey of Transport Research 1986-87.

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TABLE 3.7 IN-HOUSE TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND LEVEL OF RESEARCH: RAIL TRANSPORT SUBJECT AREA, 1986-87

			Leve1	of research			
Organisational	Commercial, financial and				D	ata collection and	
category	Strategic	economic	Behavioural	Operational	Technical	dissemination	Total
Rail organisations Government railways				· ···· , · · ·			
AN	806	2 360	4	642	155	122	4 089
SRA	384	594	. 35	419	375	1 292	3 099
V/Line	735	1 583	0	2 611	560	560	6 049
QR	102	73	0	0	16	115	306
Westrail	180	105	16	91	88	120	600
ROA ^a	0	0	0	0	214	0	214
Total	2 208	4 715	55	3 763	1 408	2 208	14 357
Non-government railways	24	24	0	1 166	1 057	39	2 310
Other rail organisation	s 16	289	1	88	6 155	3	6 553
Total	2 247	5 028	56	5 017	8 620	2 251	23 220

(\$'000)

TABLE 3.7 (Cont.) IN-HOUSE TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND LEVEL OF RESEARCH: RAIL TRANSPORT SUBJECT AREA, 1986-87

		Level of research									
Organisational	C fin	ommercial, ancial and			D	ata collection and					
category	Strategic	economic	Behavioural	Operational	Technical	dissemination	Total				
Other organisations		<u> </u>				 					
BTE	176	4	0	0	0	60	239				
CSIRO	0	0	0	0	117	0	117				
Academic	18	6	0	19	96	0	140				
Other	211	82	0	126	0	35	454				
Total	405	92	0	146	213	95	949				
Total	2 652	5 120	56	5 162	8 833	2 345	24 169				

(\$'000)

a. Includes research by government railway systems which is coordinated by ROA and funded by the systems.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

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TABLE 3.8 IN-HOUSE TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND SUBJECT AREA: RAIL TRANSPORT ORGANISATIONS, 1986-87

			Sub	oject area				
Rail transport organisational category	Air	Rail	Road	Sea	Pipeline	Intermodal, multimodal and any mode	Unassigned	Total
Government railways						. <u></u>		
AN	0	4 089	0	0	0	69	- O	4 158
SRA	0	3 099	0	0	0	0	0	3 099
V/Line	0	6 049	366	0	0	1 211	10	7 636
QR	0	306	0	0	0	0	0	306
Westrail	0	600	0	0	0	0	0	600
ROA ^a	0	214	0	0	0	0	0	214
Total Non-government	0	14 357	366	0	0	1 280	10	16 013
railwavs	0	2 310	5	0	108	0	0	2 424
Other rail		-				-	-	
organisations	0	6 553	104	0	0	17	-	6 673
Total	0	23 220	475	0	108	1 297	10	25 110

a. Includes research by government railway systems which is coordinated by ROA and funded by the systems.

- Rounded to zero.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

(\$'000)

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Technical research was the most significant area of rail transport research, accounting for over one-third of reported rail transport research funding. Typical technical topics reported included research concerned with track buckling, the wheel/rail interface and sleepers (concrete and steel).

Data collection research was widespread, and revolved around topics such as ticketing, and freight and passenger movements.

A comparison of the list of reported rail transport research projects with the last research program of the former ARRDO (given at Appendix V) suggests that some areas of research which might have been pursued by ARRDO have not yet been taken up. This applies particularly to research targetted at Australian railways at a national level.

ROAD TRANSPORT

Table 3.9 indicates that reported road transport research was a little less concentrated than air and rail transport research, with only 74 per cent being funded by road organisations. On the other hand, the research carried out by road organisations which responded to the survey was composed almost entirely of road transport research.

Table 3.10 shows the levels of road transport research carried out inhouse. Comparing these figures with Table 3.9, it can be seen that, in total, the in-house research expenditure by road organisations was about 12 per cent less than the funding provided by those organisations. In particular, State government road organisations in New South Wales and Victoria spent considerably less in-house than they funded. On the other hand, ARRB's in-house expenditure was around 17 per cent greater than the funding it provided.

Road was the predominant area of transport research undertaken by the academic sector. Approximately half of the sector's road transport research was externally sponsored. Most of this sponsorship was directed at the strategic and behavioural levels of research.

State government road organisations and ARRB between them contributed just over two-thirds of total road transport research funds. Seventy per cent of this amount was at the technical and data collection levels.

Around 13 per cent of reported road transport research funding was at the strategic level. Of this, approximately one-third was contributed by State government road organisations, while the BTE accounted for over 20 per cent. Many projects were reported on topics such as

TABLE 3.9 FUNDING OF TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND LEVEL OF RESEARCH: ROAD TRANSPORT SUBJECT AREA, 1986-87

(\$'000)

-			Level	of research			
Organisational	fi	Commercial, nancial and			Ĺ	Data collection and	
category	Strategic	economic	Behavioural	Operational	Technical	dissemination	Total
Road organisations				i =		-	
ARRB	10	0	193	518	4 661	190	5 571
State government	1 620	422	3 075	2 035	8 023	6 211	21 384
Other road	`						
organisations	1 582	23	324	173	84	95	2 281
Total	3 212	444	3 591	2 725	12 767	6 496	29 236
Other organisations					a.	-	
BTE	1 145	153	0	. 0	0	317	1 614
Academic	66	20	135	124	225	8	578
Other	576	636	1 029	1 072	1 442	3 358	8 113
Total	1 786	808	1 164	1 197	1 667	3 683	10 306
Total	4 999	1 253	4 755	3 922	14 434	10 179	39 542

Note Figures may not add to totals due to rounding.

TABLE 3.10 IN-HOUSE TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND LEVEL OF RESEARCH: ROAD TRANSPORT SUBJECT AREA, 1986-87

			Level	of research			
Organisational category	C fin Strategic	Commercial, ancial and economic	Behavioura]	Operational	L Technical	Data collection and dissemination	Total
Road organisations	<u> </u>						
ARRB	0	0	190	524	5 615	190	6 518
State government Other road	1 031	236	2 547	1 484	6 048	5 597	16 943
organisations	1 537	23	483	173	86	97	2 399
Total	2 569	259	3 219	2 180	11 749	5 883	25 859
Other organisations							
BTE	1 121	153	0	0	0	317	1 591
Academic	129	65	445	192	279	9	1 118
Other	488	614	744	622	1 264	3 171	6 903
Total	1 738	832	1 189	814	1 543	3 497	9 612
Total	4 307	1 090	4 408	2 994	13 292	9 381	35 471

(\$'000)

Note Figures may not add to totals due to rounding.

 $\stackrel{\bullet}{\omega}$ Source BTE Survey of Transport Research 1986-87.

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freight, traffic management, taxis, and road funding. Little work appears to have been carried out on road network analysis and cost recovery.

Commercial research was least reported, mainly consisting of some economic analysis by government (including government business) organisations. This is understandable, given the survey's emphasis on government activity. The remaining levels of research were reasonably well covered, both in terms of the types of organisations funding the research and the scope of the projects being undertaken. The possible exception was private motoring, since there was a strong emphasis at all levels on commercial road traffic.

SEA TRANSPORT

Sea transport research was the least concentrated in terms of organisations performing the research, and sea transport organisations reported the most diversified research programs. Such organisations funded less than half the reported sea transport research, while almost 20 per cent of their total budget was spread across the remaining subject categories. Tables 3.11 and 3.12 provide a breakdown of sea transport research funding and funding by sea transport organisations. Tables 3.13 and 3.14 give similar details for in-house research.

Commonwealth Government organisations not assigned to the sea transport area accounted for just under half of the reported sea transport research funding. Government business organisations in the sea transport area (basically ports) accounted for approximately another 30 per cent, mostly at the operational level of research.

Only around 56 per cent of the sea transport research budget of sea transport organisations was spent on in-house research. In particular, government business expenditure on in-house operational sea transport research represented only 35 per cent of its funding for this type of research. At the total level, only 65 per cent of the commercial research budget was spent in-house by organisations included in the survey.

Sea transport research was widely dispersed across the levels of research. Commercial, operational and data collection research were the most prevalent, each accounting for approximately 25 to 30 per cent of sea transport research funding. High-level research in the sea transport area was well represented and notably was undertaken by all types of organisations.

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TABLE 3.11 FUNDING OF TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND LEVEL OF RESEARCH: SEA TRANSPORT SUBJECT AREA, 1986-87

Level of research Commercial, Data collection Organisational financial and and Total category Strategic economic Behavioural Operational Technical dissemination Sea organisations 53 1 367 Government business 30 142 0 1 135 8 Other sea 698 organisations 530 11 43 11 13 91 1 178 19 65 2 065 Total 120 672 11 Other organisations 86 446 BTE 260 101 0 0 0 17 24 Academic 3 0 3 0 0 664 0 47 70 993 1 976 Other 204 50 70 1 095 2 446 467 764 0 Total Total 587 1 437 11 1 227 89 1 161 4 511

(\$'000)

Note Figures may not add to totals due to rounding.

 $\frac{1}{27}$ Source BTE Survey of Transport Research 1986-87.

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TABLE 3.12	FUNDING OF 1	TRANSPORT	RESEARCH	ΒY	ORGANISATIONAL	CATEGORY	AND	SUBJECT	AREA:	SEA	TRANSPORT
	ORGANISATION	NS, 1986-8	37								
					(\$ 000)						

		Subject area										
Sea transport organisational category	Air	Rail	Road	Sea	Pipeline	Intermodal, multimodal and any mode	Unassigned	Tota				
Government												
business Other sea	0	48	48	1 367	0	129	0	1 593				
organisations	53	76	11	698	50	66	0	953				
Total	53	125	59	2 065	50	194	0	2 546				

Note Figures may not add to totals due to rounding.

TABLE 3.13 IN-HOUSE TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND LEVEL OF RESEARCH: SEA TRANSPORT SUBJECT AREA, 1986-87

	Level of research									
Organīsational category	Commercial, financial and Strategic economic		Behavioural	D Operational Technical		ata collection and dissemination	Total			
Sea organisations										
Government business Other sea	30	121	0	395	8	48	601			
organisations	92	390	11	43	11	13	560			
Total	122	511	11	438	19	60	1 161			
Other organisations										
BTE	242	101	0	0	Ω	86	120			
Academic	23	29	0	23	30	17	420			
Other	195	293	0	32	37	990	1 547			
Total	460	423	0	54	67	1 093	2 097			
Total	582	934	11	492	86	1 153	3 258			

(\$'000)

Note Figures may not add to totals due to rounding.

TABLE 3.14 IN-HOUSE TRANSPORT RESEARCH BY ORGANISATIONAL CATEGORY AND SUBJECT AREA: SEA TRANSPORT ORGANISATIONS, 1986-87

_(\$ '000)											
·····	Subject area										
Sea transport organisational category	Air	Ra i I	Road	Sea	Pipeline	Intermodal, multimodal and any mode	Unassigned	Tota			
Government business Other sea	0	48	. 48	601	0	59	0	757			
organisations	53	71	11	560	0	67	0	761			
Total	53	120	59	1 161	0	126	0	1 518			

Note Figures may not add to totals due to rounding.

The sea transport research projects reported reveal considerable interest in the efficiency and effectiveness of sea transport in Australia. Notably this is contrary to the lack of this type of analysis in the projects listed for other subject areas. Projects such as the efficiency of the Australian fleet, port pricing and productivity, foreign exchange earnings (in relation to sea transport), waterside strategy and Australian shipping costs are well represented, especially in the Commonwealth Government and academic sectors. Generally, the research undertaken by State governments was aimed more at local issues.

SPONSORSHIP

Table 3.15 provides details of sponsorship given and received by organisations which responded to the survey, by sector and subject area.

Some \$13 million was provided by organisations included in the survey as sponsorship of external transport research programs. The Commonwealth Government and combined State governments contributed around 30 and 40 per cent of this amount respectively, largely for road research.

A broad analysis of the types of organisations to which the funds were provided was carried out. Categorisation of the recipients was highly subjective and accordingly detailed results are not included in this Paper; however the analysis did indicate that funds were very widely distributed. The organisations which were included in the survey were those considered the most likely to have a significant program of transport research, and yet only around 30 per cent of the sponsorship granted went to other organisations which responded to the survey. Most of the remaining 70 per cent was provided to what could loosely be described as consultants. State government organisations and academics were also major recipients.

Organisations in the survey reported receiving a total of approximately \$6 million in sponsorship for transport research. It follows from the analysis mentioned above that roughly 60 per cent of this amount would have come from organisations included in the survey. Academics received approximately 20 per cent of the total sponsorship received, mostly for road projects. ARRB also received a considerable amount (around 16 per cent of the total) for road research. Of total sponsorship, around 28 per cent went to the private sector for research into rail transport.

	Sponsorship	Subject area									
Sector		Air	Rail	Road	Sea	Pipe- line	Inter- modal	Multi- modal	Any mode	Un- assigned	Total
Commonwealth	given	747	11	1 398	423	0	0	249	1 287	0	4 115
Government	received	0	. 0	115	0	0	0	0	830	0	945
ARRB	given	0	0	70	0	0	0	0	0	0	70
	received	0	0	1 017	0	0	0	0	0	0	1 017
State	given	0	0	4 868	0	0	. 0	0	133	0	5 002
government	received	0	53	580	0	0	15	110	209	218	1 185
Government	given	7	958	7	766	0	100	298	0	0	2 136
business	received	0	0	0	0	0	0	0	0	0	0
Private sector	r given	150	1 079	96	164	50	0	6	0	0	1 545
	received	0	1 744	0	0	0	0	0	0	0	1 744
Academic	given	0	0	0	0	0	0	0	0	0	0
	received	24	121	710	100	19	49	119	114	5	1 261

TABLE 3.15 SPONSORSHIP OF TRANSPORT RESEARCH BY SECTOR AND SUBJECT AREA: 1986-87 (\$'000)

Sector	Sponsorship	Subject area									
		Air	Rail	Road	Sea	Pipe- line	Inter- modal	Multi- modal	Any mode	Un- assigned	Total
Associations	given	0	0	91	0	0	0	0	0	0	91
	received	0	0	39	0	0	0	0	0	0	39
Unions	given	0	0	0	0	0	0	0	0	0	0
	received	0	0	0	0	0	0	0	0	0	0
Total	given	904	2 047	6 531	1 353	50	100	553	1 420	0	12 958
	received	24	1 918	2 460	100	19	64	229	1 153	223	6 191

TABLE 3.15 (Cont.) SPONSORSHIP OF TRANSPORT RESEARCH BY SECTOR AND SUBJECT AREA: 1986-87 (\$'000)

Note Figures may not add to totals due to rounding.

CHAPTER 4 TRANSPORT RESEARCH PRIORITIES AND COORDINATION

The assessment of priority areas for transport research in this chapter is based on the responses obtained to the BTE survey and on the Bureau's own assessment and understanding of transport research demands and priorities. This material is therefore primarily intended to stimulate a further discussion and debate.

In considering these comments it is also important to bear in mind the major changes that are taking place in the general research community in Australia (and overseas). There is ample evidence of mounting pressure for researchers to 'justify' their claims for funds and resources. Transport research is, of course, not immune from these pressures and there is evidence of changes in research planning and management which reflect these pressures. There is every reason to expect that pressures for change will continue, if not increase.

In view of the governmental context of this review, the scope of possible priority areas for transport research has largely been restricted to areas of concern to Commonwealth and State governments as a whole, rather than, for example, dealing with issues specific to a particular State. In other words, the focus is on 'national' issues. This does not mean that the areas need be ones where the Commonwealth Government has specific responsibility. For example, urban public transport has national significance through its level of resources consumption, funding requirements and geographic distribution, but is generally the responsibility of individual State governments. Transport operations which impact on other issues of national concern (for example, international trade) might also be considered as national issues regardless of the size and scope of the operations themselves.

The transport research community needs to ensure that it is in a position to justify its activities in the context of broad national interest.

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COMMENTS FROM RESPONDENTS TO BTE SURVEY

Respondents to the BTE survey were invited to comment on priorities for transport research. Many respondents did not provide comments, and some of the comments received were quite specific to the functional responsibilities of the organisations concerned. Nevertheless, a significant number of comments addressed national issues. The following areas for transport research were cited (no ranking is intended):

- efficiency and performance of public transport organisations, particularly with respect to government railway and urban public transport deficits;
- strengths and weaknesses of the land transport modes in meeting current and projected market demands (particularly for freight);
- . effects of shore-based shipping costs on trade competitiveness;
- efficiencies and costs of all sectors of transport as they effect export capacity;
- potential trade benefits through development of air and sea transport;
- . competitiveness of coastal shipping;
- . port pricing, efficiency, productivity and investment;
- . costs and benefits of alternative road investments;
- . cost recovery in road and rail transport;
- road use charging mechanisms;
- uniformity of regulations, dimensions and weight limits for road vehicles;
- technological development (especially in rail transport) to reduce costs;
- . current and projected fuel use patterns;
- . safety aspects of vehicle design;
- road safety education;
- . environmental impacts (especially for road traffic); and
- . development of systems to provide vehicle drivers with real-time information on the status and performance of road networks.

A number of comments related to pervasive problems of inadequate data. Comments supportive of the need for an academic centre for transport research, particularly in relation to multimodal issues, were also received.

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SUGGESTED PRIORITY AREAS

In addition to focussing on national issues, the Bureau has taken into account a number of other pertinent factors in assessing priority areas for transport research. These include the economic significance of the various areas of transport, the importance of any problems or opportunities in those areas, the relevance of research and the potential for returns on research investment.

Figure 4.1 shows estimates of the significance of various parts of the transport system in terms of annual turnover. The figures draw, in part, on ABS (1986) supplemented by in-house BTE estimates and should only be regarded as indicative. There is not necessarily any direct link between turnover and the level of research effort, and Table 4.1 confirms that there is very little consistency in this particular area. For example, air transport research comprises 22 per cent of all mode-specific research, whereas air transport represents only 8 per cent of total turnover. Corresponding figures for rail transport

	Mode/subject area										
						Other					
						transport					
					Other	research					
					transport	subject					
	Air	Rail	Road	Sea	activities	areas ^a	Total				
Turnover ^b	3 955	4 080	29 515	7 725	1 455		46 720				
Research ^C	19.9	24.3	39.5	4.5		9.6	97.9				
Ratio ^d	0.5	0.6	0.1	0.1	••		0.2				

TABLE 4.1 COMPARISON BETWEEN TURNOVER AND LEVEL OF RESEARCH, 1986-87 (\$ million)

 Includes research subject areas: pipeline, intermodal, multimodal, and any mode.

b. Figures represent BTE estimates for 1983-84 inflated to 1986-87 levels by rise in consumer price index (factor of 1.236).

c. Represents only that research identified in the BTE Survey of Transport Research 1986-87.

Research as per cent of turnover.

Not applicable.

Note Figures may not add to totals due to rounding.

Sources BTE estimates. BTE Survey of Transport Research 1986-87.



Figure 4.1 Relative magnitude of Australian transport activities: 1983-84

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are 27 per cent and 9 per cent. Road transport is, on the surface, relatively balanced, with 45 per cent of mode-specific research and 63 per cent of total turnover. However, three-quarters of this turnover relates to passenger transport, while the proportion of road transport research devoted to passengers is much lower. Finally, sea transport involves 17 per cent of total turnover, but only 5 per cent of modespecific research effort.

As noted above, these figures cannot be interpreted as giving any substantive indications of where research priorities might be. In fact it is clear that there are no substantive grounds to expect that there should be a consistent relationship between research expenditure and sector turnover. Many other factors would need to be taken into account to come to a firm view on research priorities and expenditure levels.

A well structured national research program would give emphasis to those areas where the application of research effort would be likely to achieve an improvement in performance in areas of national importance, given the economic and social climate prevailing today and expected over the next ten years. This relatively simple goal is not easy to address because of the pervasive nature of transport in the economy and the many complex interactions and linkages characteristic of transport. None the less, the very process of seeking to articulate priorities and strategies can be helpful in ensuring that resources devoted to transport research are targeted on major issues.

The major purpose of this review is to help assess whether this goal is currently being achieved. As a first step, the Bureau compared the research priorities suggested by respondents (see previous section) to the actual research projects reported in the survey (listed in Appendix IV). The detailed results of this comparison are not presented here, and in any case are largely subjective by nature. However, the general observation was that there was not a good correspondence between the two lists. All of the priorities suggested by respondents are being addressed to some extent, but not in a coherent and integrated way.

As an initial basis for discussion the following paragraphs suggest some of the elements which could be included in national transport research priorities.

Strategic research

Current research at a strategic level is limited in virtually all areas. This may be to some extent a reflection of a relatively lengthy period of limited change in transport strategy itself.

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There is evidence that community and government attitudes are shifting in favour of major structural changes in transport. Hence, it might be appropriate to accord higher priority to research programs at the strategic level. Some of the basic elements of such programs could be as follows:

- . frameworks and appropriate objectives for transport policy;
- . future levels of transport infrastructure investment of all types;
- . regulation and deregulation strategies for all forms of transport;
- appropriate pricing and cost recovery strategies for transport services;
- . future service levels for urban public transport;
- resources devoted to private motoring;
- 'transport chain' issues (with a view to ensuring efficient internal and external interfaces); and
- . public ownership and equity in transport systems.

Commercial, financial and economic research

Commercial, financial and economic research is largely undertaken within transport operating agencies or firms, and is usually geared to their particular corporate strategies. While this may be appropriate, there could be cases in which such localised strategies do not mesh well with broader public interests. For example, profit maximisation strategies for an enterprise may not be consistent with community expectations of service levels or market competition. This can be of particular concern in the case of publicly-owned operating agencies, and suggests that there may be a case for increased national interest in carefully selected research at the commercial level.

The type of research which could be of interest in this context is mainly directed to providing a framework within which research and planning internal to particular agencies can take place. It could also be used to encourage more complete integration of the objectives of transport operating agencies and those of their owners.

Several areas of research priority within these general guidelines can be identified. These are as follows:

- pricing and financing for publicly-provided transport infrastructure and services (and for private services in cases involving apparent market failure);
- improved methods of forecasting and marketing;

- commercial implications of organisational and structural changes aimed at improving efficiency;
- . improved costing procedures and accounting methods;
- . strategies for developing better integrated fare and rate structures and revenue collection methods; and
- . broad implications of the introduction of advanced technology.

Behavioural research

Behavioural research in the transport field has declined markedly in recent years, partly as a result of the shift away from large scale city transport studies. One result of this is that strategic and commercial decisions are being made on the basis of behavioural assumptions and parameters which may be out of date.

Movements towards restructuring of transport operations lend an impetus to renewed priority for behavioural research as a whole. In addition, concerns about the use of dated assumptions should encourage greater interest, at least in those areas which have direct relevance to investment and financial analysis. Both effects are encompassed in the following list of possible priorities:

- revised central behavioural 'values' (such as travel time and demand elasticities);
- . freight shipper reactions and preferences;
- behavioural characteristics of managerial and organisational groups (and especially regulatory agencies);
- behavioural research extension to assess the cost-effectiveness of programs based on behaviour modification; and
- community views and preferences regarding different types of transport services.

Operational research

Research in operational fields appears to have become progressively more sophisticated, and the introduction of new techniques has been widespread. Identification of future priorities is made difficult by this, and by the fact that research at this level is, by its nature, quite specialised and widespread.

In terms of national programs, it does not appear appropriate to attempt to identify particular subject areas for priority. However, there are major concerns that operational strategies in transport are not always well aligned with broader strategic directions. Hence, it may be useful to promote consideration of broader issues when

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conducting research into operational issues. Possible research priorities to achieve these objectives are as follows:

- candidates for cost reduction through adoption of available advanced technology;
- realistic and consistent procedures and benchmarks for determining best practice in transport operations; and
- resolving multiple-objective (social, economic, and so on) conflicts in transport operation.

Technical research

Even more than in the case of operational research, research at the technical level is characterised by high variation in nature and scope. The situation with this type of research is that a large amount is performed, but there is very little coordination. This is not surprising, given the extremely broad base of such work.

From a national program point of view, there would seem to be a case for dealing with technical research in two ways. The first involves research aimed at solving immediate technical problems, and generally appears to be conducted satisfactorily. The second involves research directed towards the development or introduction of new techniques, and is an area requiring careful management in today's climate of resource constraint. This latter form has traditionally been relatively uncoordinated in Australia (although not elsewhere), and there is a need to ensure that it is placed in an appropriate economic and institutional framework. Accordingly, the following suggested priorities relate largely to technical research in the field of transport innovation:

- . gearing of technical research to overall strategy requirements;
- review of current technical research to identify the extent to which it has appropriate objectives;
- infrastructure and vehicle design standards in an economic and operational context; and
- . basic cost functions for transport activities.

Data collection

The general situation with transport data collection appears to remain much as it has always been. There is a high incidence of ad hoc activity and very little indication of an overall strategy to develop an improved transport data base. These problems have been compounded by the rapid emergence of management information systems and automated data collection devices. The result is a proliferation of information (now more commonly in private hands) with very little consistency in formats and structure. The following potential priorities are suggested:

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- identification of central statistical and other information requirements for transport planning purposes;
- standardisation of both codes and formats for key data sources (for example, waybills); and
- . central data base for transport information.

COORDINATION

The BTE Survey of Transport Research was primarily aimed at obtaining information about the transport research expenditure patterns of individual organisations. Accordingly, it did not yield indications of the degree of coordination undertaken, except in the rare case of organisations with specific coordination responsibilities. The following views on current coordination arrangements are therefore based more on general observation than on any comprehensive source of factual information.

Formal research coordination arrangements covering more than one organisation appear to exist only in limited cases. With respect to the activities covered in the survey, the following coordination mechanisms were observed:

- . The role of ROA in coordinating some (mainly technical) research in the rail systems as a whole.
- Role of NAASRA/ARRB in coordinating aspects of road related research.
- . Relatively loose arrangements for Commonwealth/State cooperation in the field of road safety research.

Given the broad range of transport research and the pervasive influence of transport in the economy, it might be expected that there would be greater evidence of coordination of research effort in Australia. However it could be argued that the relatively low level of activity is unlikely to result in any significant overlap or duplication of effort, and does not give rise to the need for 'coordination' in the traditional context. On the other hand it is also possible to argue that the limited level of resources devoted to transport research means that it is even more important to ensure that those resources are properly focussed on priority issues and that areas of major concern are not neglected. Such concerns might be even

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more important at the strategic level where it is often more difficult to precisely specify research projects.

Consequently, it might be argued that there is a need for a creative and innovative approach to the fundamental issue of determining the size and shape of the transport research program in Australia. This survey provides some useful input to that process. An agreed statement of a national transport research 'goal' would also be helpful in the critical issue of assessing research priorities and strategies.

CHAPTER 5 CONCLUDING REMARKS

The BTE Survey of Transport Research 1986-87, within the limitations of coverage and scope, provided a 'snapshot' of the nature and extent of transport research in Australia. Organisations which responded to the survey reported funding approximately \$98 million of transport research in 1986-87. By way of contrast, \$37 800 million turnover was estimated for the transport industry for 1983-84.

Research was found to be largely mode-specific, with the road transport subject area accounting for 40 per cent of expenditure, rail transport 25 per cent and air transport a further 20 per cent. Research at the technical and commercial levels was the most prevalent, representing 28 per cent and 22 per cent of expenditure respectively.

The survey results reveal that transport research is not particularly coherent or consistent in terms of the types of projects being undertaken. There would appear to be little research which is aimed at strategic issues, and although considerably more is being performed into operational and technical issues, there is a relatively low level of coordination. A comparison of research effort and turnover for the various sectors confirms the view that there is no essential link between research effort and level of economic activity.

Whether the current emphasis in Australian transport research reflects the 'right' mix of subject areas and levels of research is open to debate. There are a range of factors that need to be taken into account in identifying priority research areas and in particular, it is important to have an overall research objective or goal to set the context. Simply addressing 'problem areas' may not be constructive if the 'problem' largely results from the lack of will to impose solutions already identified. In other words, there is a need to consider the likely 'pay off' for research in both a practical and analytical sense.
As to the distribution of funds across levels of research, an equal distribution is considered inappropriate, while an equitable distribution is difficult to determine. It may be that technical research is more expensive than strategic research for example, and that this should be reflected in the distribution of funds across levels. However, the most equitable distribution can not be determined simply, and there seems to be no clear cut 'optimal ratio' for funding across levels of research.

Against this background, priority areas for a national program of transport research are not easily discerned, and the task of setting priorities at this level is currently not being performed. To some extent, priorities need to flow from statements of policy, and the development of a comprehensive transport research policy aimed at issues of national importance would help overcome the past and present difficulties in identifying priorities. A national research policy would also help to identify the optimum level of coordination for transport research.

Some areas of transport research are less amenable to coordination. This applies particularly to research carried out at the commercial level, or in commercially sensitive areas such as air transport. However, coordination is possible and desirable at other levels and in other areas, for example technical rail transport research or behavioural research in the road transport subject area. Coordination in the broad sense offers the opportunity to maximise returns on research expenditure by articulating a common aim and enabling important gaps and overlaps in research to be identified. To date, Australia has implemented relatively few formal coordination arrangements and there is an opportunity to develop an innovative approach to coordination which would focus on facilitation and information rather than control.

An attempt has been made in this Paper to provide a basis for discussion of these issues, which currently face transport at the national level. It should be of some assistance in identifying the decisions which need to be made and the action which needs to be taken towards a more effective program of transport research for Australia.

APPENDIX I ORGANISATIONS INCLUDED IN BTE SURVEY OF TRANSPORT RESEARCH 1986-87

The organisations and individuals listed in this appendix were approached in the BTE Survey of Transport Research for information on their 1986-87 programs of transport research. The participants are listed under the sector and transport area classification to which they were assigned in the survey.

COMMONWEALTH GOVERNMENT SECTOR

Air

Department of Aviation Aeronautical Research Laboratories Government Aircraft Factory

Not mode-specific

Australian Bureau of Statistics Australian Meat and Livestock Research and Development Corporation Bureau of Agricultural Economics Bureau of Industry Economics Bureau of Resource Economics Bureau of Transport Economics Commonwealth Scientific & Industrial Research Organisation Dairy Research Council Department of Defence, Defence Science and Technology Organisation Department of Housing and Construction Department of Industry, Technology and Commerce Department of Primary Industry Department of Resources and Energy Department of Sport, Recreation and Tourism Department of Territories Department of Trade Department of Transport Department of the Treasury Industries Assistance Commission

Industry Councils Secretariat Industry Research and Development Board Inter-State Commission National Materials Handling Bureau

Australian Capital Territory National Capital Development Commission

AUSTRALIAN ROAD RESEARCH BOARD

Road

Australian Road Research Board

STATE GOVERNMENT SECTOR

Road

New South Wales Department of Main Roads Department of Motor Transport Ministry of Transport, Road Freight Transport Industry Council Traffic Authority of NSW

Victoria Road Traffic Authority Road Construction Authority

Queensland Main Roads Department

South Australia Highways Department

Western Australia Main Roads Department

Tasmania Department of Main Roads

Sea

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Northern Territory
Department of Ports and Fisheries
Department of Transport & Works, Marine Division
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Not mode-specific

New South Wales Department of Environment and Planning Ministry of Transport, State Transport Study Group NSW State Pollution Control Commission

Victoria

Grain Elevators Board Ministry of Transport Victorian Tourism Commission Ministry of Planning and Environment

Queensland Department of Transport

South Australia Department of Transport

Western Australia Department of Transport Western Australian Tourism Commission Working Party on Energy Use in Transport

Tasmania Transport Tasmania

Northern Territory Department of Transport and Works

GOVERNMENT BUSINESS SECTOR

Air

```
Australia
Australian National Airlines Commission (Australian Airlines)
Qantas Airways
```

Rail

Australia Railways of Australia Australian National Railways Commission (Australian National)

New South Wales

State Rail Authority of NSW

```
Victoria
State Transport Authority (V/Line)
```

Queensland Queensland Railways

```
Western Australia
Westrail
```

Road

```
Queensland
Brisbane City Council, Transport Division
```

Sea

```
Australia
Australian Shipping Commission (Australian National Line)
```

New South Wales Newcastle Port Board Maritime Services Board Port Botany Port Kembla

Victoria Marine Board of Victoria Port of Melbourne Authority

Queensland Department of Harbours and Marine Port of Brisbane Authority

South Australia Department of Marine and Harbors

```
Western Australia
Department of Marine and Harbours
Western Australian Coastal Shipping Commission (Stateships)
```

```
Northern Territory
Darwin Port Authority
```

Not mode-specific

Australia Australia Post

Appendix I

New South Wales Snowy Mountains Engineering Corporation Urban Transit Authority

Victoria Metropolitan Transit Authority

South Australia State Transport Authority

Western Australia Metropolitan (Perth) Passenger Transport Trust

PRIVATE SECTOR

Air

Australia East West Airlines Ansett Transport Industries

Rail

```
Australia
    BHP Railways
    Comenq
    Melbourne Research Laboratories
    Very Fast Train Joint Venture
  Queensland
    Comalco Railway
  Western Australia
    CRA
    Goldsworthy Railway
    Hamersley Iron
    Mount Newman Railroad
    Robe River Railroad
  Tasmania
    Emu Bay Railway Co
Road
 Australia
    Brambles Industries
    Dunlop Olympic Tyres
```

```
Ford Motor Company, Research Centre
Linfox Transport Group
Mitsubishi Motors
Nissan Motor Company
Holden's Engine and Components Co
Holden's Motor Co
Toyota Manufacturing Australia
```

Sea

```
Australia
Ampol, Research and Development Department
BHP Transport
CRA (Dampier Salt)
```

Not mode-specific

```
Australia
 BP Australia
 CSR
 Mobil Oil Australia
 Shell Co Australia
 TNT Australia, Energy Resources
 Australian Iron and Steel
 AWA Research Laboratory
 Blue Metal Industries
 Caltex Oil Australia
 Esso Australia
  ICI Australia Operations
  Independent Grocers Co-operative
 Orbital Engine Company
 Overseas Containers Australia
 Seabridge Australia
 W G Hicks
 Central Research Laboratories
 Jennings Industries
 Mayne Nickless Transport Services Group
 Repco Corporation
 ACTA Shipping
```

Victoria Hamelex Equipment

Western Australia Western Mining Corporation

ACADEMIC SECTOR

Road

```
South Australia
University of Adelaide, Road Accident Research Unit
Dr J A McLean
```

Sea

```
Tasmania
Australian Maritime College
Mr B Lewarn, Senior Lecturer (Sea Transport)
```

Not mode-specific

```
New South Wales
 Macquarie University
     Mr P W Abelson, Senior Lecturer
     Prof D A Hensher (Economics)
     Dr P Gilmour
      Assoc Prof L W Johnson (Economics)
      Prof L Sandercock
 University of New South Wales
      Dr J A Black (Transport Engineering)
      Prof H L Westerman (Town Planning and Transport Engineering)
      Dr R M Conlon
      Prof H J Goldsmid
      Prof R W Woodhead
      Mr J A Zerby, Senior Lecturer (Economics)
 University of Newcastle
      Prof C A Tisdell (Economics)
      Prof R Telfer, Head, Department of Education
      Prof R Sanson-Fisher, Head, Discipline of Behavioural Medicine
      Mr B S Heaton (Civil Engineering)
 University of Sydney
      Prof B Fisher (Agricultral Economics)
      Prof G Mills (Economics)
 University of Wollongong
     Prof L C Schmidt
     Dr H Bendall
     Dr P G Laird
     Dr R Robinson, Director, Centre for Transport Policy Analysis
```

```
Victoria
  Chisholm Institute of Technology
      Mr K T Solomon (Highways and Traffic Engineering)
 La Trobe University
      Dr A S G Lubulwa (Economics)
 Monash University
      Prof N W Murray (Civil Engineering)
      Dr W Young
      Dr M A P Taylor
      Prof W H Melbourne
      Assoc Prof T Triggs
      Prof K W Ogden
 Royal Melbourne Institute of Technology
      Mr J A Clements, Principal Lecturer (Economics)
      Mr P Hooper, Senior Lecturer (Economics)
 University of Melbourne
      Dr D Mansell
      Prof P N Joubert
      Dr N R Norman, Reader in Economics
      Dr H Watson
      Dr A Lovegrove
Oueensland
 Brisbane College of Advanced Education, Business Research Centre
      Dr P A Cassidy
 James Cook University

    Dr L C Wadhwa, Assoc Prof (Civil and Systems Engineering)

 Queensland Institute of Technology
     Mr R Bange
 University of Queensland
     Dr M Sheehan
     Prof C J Apelt (Civil Engineering)
     Assoc Prof T Grigg (Management)
     Dr R L Pretty
     Dr R Ashton (Psychology)
     Dr B Smithurst (Medicine)
```

Appendix I

South Australia South Australian Institute of Technology Mr R J Taylor, General Manager, Techsearch Inc University of Adelaide Dr T Mules, Senior Lecturer (Economics) Mrs A Arnold Dr G Dandy, Senior Lecturer (Civil Engineering) Mr A J Fisher (Economics) Mr N J Thomson (Economics) Western Australia Curtin University of Technology Mr B Generowicz Dr P A Howat, Principal Lecturer (Community Health) Murdoch University Dr R McKay Dr P Newman University of Western Australia Dr P McLeod Dr A A Landauer, Honorary Fellow Prof K Clements Tasmania Tasmanian State Institute of Technology Dr G D'Este Australian Capital Territory Australian National University Dr P J Forsyth Dr M Neutze Not known New South Wales Macquarie University Mr C M Stone Dr R Homel New South Wales Institute of Technology Dr K Faulkes University of New England Prof J R Burton

```
University of New South Wales
      Prof D J H Corderoy
      Prof H M Irvine
      Prof P Neville
  University of Newcastle
      Prof Roberts
  University of Sydney
      Prof G Starmer
Victoria
  La Trobe University
      Dr L Cahill
  Monash University
     Mr K V Richardson
      Dr K Trace
      Dr C A Gannon
     Mr C Trengone
      Prof I B Donald
      Prof P Grundy
      Mr R H Grzebieta
  Royal Australian College of Surgeons
      Dr G Trinca
  Royal Melbourne Institute of Technology
      Dr A Holzer
      Mr K C Mavin
  Swinburne Institute of Technology
      Mr I Freshwater
      Mr Sandie
      Mr P Xavier
  University of Melbourne
      Dr D Bennett
      Prof B L Cole
      Dr R King
      Prof Lawson
     Dr G Rose
Queensland
  Griffith University
     Dr A L Brown
```

Appendix I

```
Queensland Institute of Technology
       Dr B Brown
   University of Queensland
       Prof H F Kolsen
       Dr K J Bullock
       Dr G E Docwra
       Prof C Margerison
 South Australia
    University of Adelaide
       Dr S Richardson
       Dr M J S Hirst
       Dr J Crowley
       Dr K E Moxham
   University of Western Australia
       Mr G C Reynolds
 Tasmania
   Tasmanian State Institute of Technology
       Dr P Curro
    University of Tasmania
       Mr A Hocking
 Australian Capital Territory
    Australian National University
       Dr H Hill
       Dr C C Kissling
       Dr P J Rimmer
        Dr H W Dick
       Dr C Findlay
    Canberra College of Advanced Education
        Mr J McMaster
ASSOCIATIONS SECTOR
Air
 Australia
    Aircraft Owners and Pilots Association of Australia
    Regional Airlines Association of Australia
    General Aviation Association
```

Road

```
Australia
Australian Automobile Association
National Association of Australian State Road Authorities
Australian Asphalt Pavement Association
Australian Road Transport Federation
Federal Chamber of Automotive Industries
Long Distance Road Transport Association
```

New South Wales National Roads and Motorists' Association, Technical Department

Victoria Royal Automobile Club of Victoria

Queensland Royal Automobile Club of Queensland

Sea

```
Australia
Australian Chamber of Shipping
Australian Shippers' Council
Association of Australian Port and Marine Authorities
Association of Employers of Waterside Labour
```

Not mode-specific

```
Australia
Australian Institute of Petroleum
Chartered Institute of Transport
Australian Institute of Energy
Association of Consulting Engineers Australia
Australian Council of Local Government Associations
Cement and Concrete Association
Institution of Engineers Australia
National Farmers Federation
```

UNIONS SECTOR

Air

```
Australia
Australian Federation of Air Pilots
```

Appendix I

Rail

Australia Australian Railways Union Australian Federated Union of Locomotive Enginemen National Union of Rail Workers

Sea

Australia Seamen's Union of Australia Waterside Workers Federation of Australia Merchant Service Guild

Not mode-specific

Australia

Australian Council of Trade Unions Federated Storeman and Packers Union Transport Workers Union

APPENDIX II BTE SURVEY OF TRANSPORT RESEARCH FORM

This appendix contains a copy of the form used to obtain information on the 1986-87 transport research program of those organisations and individuals which were included in the BTE Survey of Transport Research 1986-87.

transport economics

REVIEW OF TRANSPORT RESEARCH 1986-87

Address label

Office use	
Form number	
	<u></u>
Sector	
-	
Transport area	
State	

At the request of Federal and State Ministers with responsibility for transport, the Federal Bureau of Transport Economics (BTE) is conducting a review of transport research in Australia. Your assistance in this review is appreciated. Please carefully read the Instructions and Definitions, and complete the questionnaire. A duplicate copy is provided for your records.

Federal Bureau of Transport Economics GPO Box 501 CANBERRA ACT 2601

DETAILS OF PERSON COMPLETING THIS QUESTIONNAIRE

Name:

Position in organisation:

Telephone number: (....)......Area Code

INQUIRIES: If you have any queries regarding the completion of this questionnaire, please contact Mr Norm Wuest by telephone on Canberra (062) 679715.

INSTRUCTIONS AND DEFINITIONS

Please carefully read these instructions and definitions before completing the questionnaire.

Outline of information being sought

The purpose of this questionnaire is to identify the broad nature and extent of your organisation's 1986-87 program of transport research. Your organisation is considered to have a program of transport research if it conducts transport research in-house or it sponsors external transport research or both.

Do not be deterred by the size of the questionnaire as many parts of it will not be applicable to any given organisation.

For your **total** transport research program you are asked to provide staff-years of effort, salaries, other recurrent expenditure, capital expenditure, and value of any sponsorship received or provided during 1986-87.

You are also asked to record resources devoted to the program of transport research in terms of eight possible subject areas and six possible 'levels' of research. Most organisations should be able to adequately describe their programs of transport research in a relatively few subject area and level-of-research combinations. For each of these **components** of the transport research program you are asked to provide, where applicable:

- . estimates of in-house resources used;
 - non-salary recurrent expenditure;
 - capital expenditure;
 - staff-years of effort;
- . details of any sponsorship received;
- . details of any external research sponsored; and
- . a list of transport research projects.

You are also invited to provide any explanatory comments that may assist in understanding the nature of your organisation's program of transport research and to offer any comments you may care to make on priorities for transport research.

Transport research

A broad view is taken of the range of activities that constitute transport research in order to include those activities which would normally be considered to be 'applied' or 'operations' research.

Transport is broadly defined to refer to the movement of people and goods by all modes and includes the planning, creation and maintenance of infrastructure and the organisation of

services, vehicles and operations. Activities that directly relate to transport (such as research into energy conservation in the transport field) should also be included.

Research is defined as creative work undertaken on a systematic basis in order to increase the stock of knowledge and the use of this stock of knowledge to devise new applications. For the purpose of this review, research is taken to extend to substantial modifications to existing processes, systems, services and products and includes activities such as:

- . demonstration of both technical and commercial viability;
- . feasibility studies;
- policy-related studies;
- . testing, standardisation, metrology and quality control; and
- . systematic data collection.

Subject areas

A traditional modal-based classification is used in this questionnaire. Research that is primarily aimed at only one of the five modes, Air, Rail, Road, Sea and Pipeline, should be assigned to that subject area. Research into transport by conveyor systems should be included in the Pipeline category. The remaining three subject areas are:

- . Intermodal: Research primarily concerned with the interface between modes of transport. Includes research concerned with terminals.
- Multimodal: Research that is primarily concerned with more than one mode. This may include, for example, research into competition between transport modes. Most research into urban transport would be multimodal.
- Any mode: Research that is not mode-specific and may cover all modes. This may include, for example, research into the movement of particular commodities where several combinations of mode may be involved.

Levels of research

Levels of research relate to the **primary objective** or reason for carrying out the research, not to details of the methodology. The levels of research to which you are asked to allocate your research program are: strategic research, 'commercial' financial and economic research, behavioural research, operational research, technical research, and systematic data collection and information dissemination.

The levels of research are defined as follows:

Strategic research

Strategic research tends to be concerned with broad issues such as:

- longer term infrastructure planning or financing requirements;
- industry analyses, performance and structure; or
- regulation and competition.

'Commercial' financial and economic research

Such research tends to be concerned with more specific issues like:

- specific infrastructure investment decisions;
- costing and pricing;
- levels of service; or
- marketing.

Behavioural research

Such research is primarily concerned with people in transport. It may include such issues as:

- driver behaviour; or
- travel characteristics.

. Operational research

Operational research is primarily concerned with the operation and performance of transport systems.

. Technical research

Technical research is primarily concerned with vehicles, components and materials. It would include energy-related research such as testing alternative fuels and measures to improve fuel economy.

. Systematic data collection and information dissemination

Such research focuses on data collection and information dissemination activities which may support a wide range of transport research conducted in the same organisation or elsewhere.

Please note that the level of research is intended to reflect the primary organisational aim in carrying out that element of the transport research program. It is not intended to reflect the spectrum of activities that might make up any individual research project. For example, a specific strategic research or behavioural research project may involve considerable data collection activities. However, the element 'Systematic data collection and information dissemination' is intended to cover only those research activities for which the collection and dissemination of information is the **primary** aim of the project.

Time period

Information relating to financial year 1986-87 is sought. If actual expenditure or resource data are not available please supply estimates based on budgeted figures.

Sponsorship

Details of transport research sponsorship are requested to ascertain the scope of organisations involved in transport research and to avoid problems of double counting.

Sponsorship must involve some degree of monetary transfer. If, for example, a government organisation carries out some transport research at the request of another government organisation, and no transfer of funds occurs, this would **not** constitute sponsorship.

In most cases, sponsorship will involve the specific granting or receiving of funds to carry out (or assist in carrying out) specific transport research projects.

Resource units

For transport research conducted in-house, details of recurrent expenditure, capital expenditure and staff-years for 1986-87 are sought.

Capital expenditure

Include only capital expenditure wholly or primarily in support of your organisation's transport research program.

Overheads

Where transport research accounts for only a small proportion of an organisation's activities, the overheads attributable to transport research may be ignored. However, if the overheads attributable to transport research can be readily identified they should be included as recurrent expenditure.

Level of accuracy

It is anticipated that the accounts of most organisations will not be structured in a way to readily identify the data sought in this questionnaire (in particular, estimates of non-salary recurrent expenditure and staff-years at a transport research program element level). If this is the case in your organisation, please provide indicative estimates.

Question 1	Does your organisation conduct transport re	esearch in-house?
	Yes 🗌 go to Question 2	
	No 🗌 go to Question 4	
Question 2	Please provide estimates of total resour research by your organisation in 1986-87.	ces devoted to in-house transport
	Staff-years of transport research effort	
	Recurrent expenditure: salaries	\$
	other	\$
	Capital expenditure wholly or primarily in support of transport research	\$
Question 3	Was any sponsorship received in 1986-87 to of transport research?	support your organisation's program
	Yes Please indicate total sponsorship received	\$
	No	
Question 4	Did your organisation sponsor any external	transport research in 1986-87?
	Yes Please indicate total sponsorship granted Go to Question 5	\$
	No If your answer to Question 1 was to Question 10. Otherwise go to Q	'No' please go uestion 5.

Question 5 Please indicate which of the following subject areas are covered by your organisation's program of transport research. (Tick appropriate boxes)

(a)	Air	Yes	complete Q6(a)	and Q7(a)
		No		
(b)	Rail	Yes	complete Q6(b)	and Q7(b)
		No		
(c)	Road	Yes	complete Q6(c)	and Q7(c)
		No	, ,	
(d)	Sea	Yes	complete Q6(d)	and Q7(d)
		No		
(e)	Pipeline ¹	Yes	complete Q6(e)	and Q7(e)
		No		
(f)	Intermodal ¹	Yes	complete Q6(f)	and Q7(f)
		No		
(g)	Multimodal ¹	Yes	complete Q6(g)	and Q7(g)
		No		
(h)	Any mode ¹	Yes	complete Q6(h)	and Q7(h)
		No		

1. Refer to definitions on page 3.

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Question 6 Please provide a summary breakdown of your organisation's program of transport research into the subject areas indicated in Question 5. (Note that a more detailed breakdown is requested in Question 7)

	Expendit	ture				
Subject area	Non-salary recurrent ¹	Capital ²	Staff- years	Sponsorship received	External research sponsored	
(a) Air	\$	\$	· · · · · · · · · · · · · · · · · · ·	\$	\$	
(b) Rail	\$	\$		\$	\$	
(c) Road	\$	\$		\$	\$	
(d) Sea	\$	\$		\$	\$	
(e) Pipeline	\$	\$		\$	\$	
(f) Intermodal	\$	\$		\$	\$	
(g) Multimodal	\$	\$		\$	\$	
(h) Any mode	\$	\$		\$	\$	
Resources not assigned to specific subject area	\$	\$		\$	\$	
Total Should agree	\$	\$		\$	\$	
with		Question 2		Question 3	Question 4	

Research conducted in-house

1. Recurrent expenditure which supports more than one subject area may be split pro-rata or identified separately whichever is more convenient.

2. Include only capital expenditure wholly or primarily in support of the specified element of the research program.

ω	Question 7	Please provide a detailed breakdown of your organisation's transport research activity (as reported in Question 6) into the levels
ω		of research, separately for each subject area covered.

	(i) How much in-house?	research was co	onducted	(ii) Was received	any sponsorship for this research?	(iii) Did your organisation sponsor any external research in this area?	
	Non-salary		Staff	(Attach list if space insufficient)			
Level of research ¹	expenditure	expenditure ²	years	Amount	Organisation	Amount	Organisation
. Strategic	\$	\$		\$		<u> </u>	<u> </u>
. 'Commercial' financial				\$		\$	
and economic	\$	\$ <u>. </u>		\$ \$		\$	
. Behavioural	\$	\$		\$ \$		\$\$	·
. Operational	\$	\$		\$ \$		\$	
. Technical	\$	\$		\$		\$	
 Systematic data collection & information dissemination 	\$	\$		\$ \$ \$		\$ \$	
Total (Air) (should agree with Question (6a)) \$	\$		\$		\$	

COMMENTS Please provide any comments which may assist in understanding the nature of research carried out in this area.

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SECTION	7(b)	RAIL
---------	------	------

	(i) How much research was conducted in-house?			(ii) Was any sponsorship received for this research?		(iii) Did your organisation sponsor any external research in this area?	
Level of research ¹	Non-salary recurrent expenditure	Capital expenditure ²	Staff- years	Amount	(Attach list) Organisation	if space insu t	Organisation
. Strategic	\$	\$		\$		\$	
. 'Commercial' financial and economic	\$	\$		\$ \$ \$		\$ \$	
. Behavioural	\$	\$		\$ \$		\$\$	
. Operational	\$	\$		\$ \$		\$	
. Technical	\$	\$	<u> </u>	\$		\$	
 Systematic data collection & information dissemination 	\$	\$		\$ \$		\$ \$\$	
Total (Rail) (should agree with Question (6b))	\$	\$	·	\$		\$	
 Please refer to definitions of 2. Include only capital expendit the specified element of the COMMENTS Please provide any comm the nature of research 	f levels of re ure wholly or research progr ents which may carried out ir	esearch on page primarily in s ram. / assist in und h this area.	s 3 and 4. upport of erstanding				

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SECTION 7(c) ROAD

	(i) How much in-house?	research was co	onducted	(ii) Was received	any sponsorship for this research?	(iii) Did any extern	your organisation sponsor al research in this area?	
	Non-salary	Capital	Staff	(Attach list if space insufficient)				
Level of research	expenditure	expenditure ²	years	Amount	Organisation	Amount	Organisation	
. Strategic	\$	\$		\$		\$		
. 'Commercial' financial and economic	\$	\$		\$ \$		\$ \$		
. Behavioural	\$	\$		\$ \$		\$\$		
. Operational	\$	\$		\$ \$		\$		
. Technical	\$	\$		\$		\$		
. Systematic data collection & information dissemination	\$	\$		\$ \$		\$\$		
Total (Road) (should agree with Question (6c)) \$	\$		\$		\$		

- 1. Please refer to definitions of levels of research on pages 3 and 4.
- 2. Include only capital expenditure wholly or primarily in support of the specified element of the research program.
- **CONMENTS** Please provide any comments which may assist in understanding the nature of research carried out in this area.

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SECTION 7(d) SEA

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	(1) How much in-house?	research was co	onducted	(11) Was received	any sponsorsnip for this research?	(iii) Did your organisation sponsor any external research in this area?	
1	Non-salary recurrent	Capital 2	Staff~		(Attach list	if space insu	fficient)
Level of research	expenditure .	expenditure	years	Amount	Organisation	Amount	Organisation
. Strategic	\$	\$		\$		\$	
. 'Commercial' financial				۶ <u> </u>		\$	
and economic	\$	\$		\$ \$		\$	
. Behavioural	\$	\$		\$ \$	<u>.,</u>	\$	
. Operational	\$	\$		\$ \$		\$	
. Technical	\$	\$		\$		\$\$	
. Systematic data collection				¥		¥	
& information dissemination	\$	\$ <u>-</u>	<u></u>	\$ \$		\$	
Total (Sea)							
(should agree with Question (6d)) \$	\$		\$		\$	
 Please refer to definitions of Include only capital expendit the specified element of the COMMENTS Please provide any commute the nature of research 	of levels of re ture wholly or research progr ments which may carried out in	search on pages primarily in su am. assist in unde this area.	3 and 4. apport of erstanding				

Appendix II

	(i) How much in-house?	research was co	onducted	(ii) Was received	any sponsorship for this research?	(iii) Did any exterr	your organisation sponso al research in this area
	Non-salary	Capital	Staff_		(Attach list	if space insu	fficient)
Level of research ¹	expenditure	expenditure ²	years	Amount	Organisation	Amount	Organisation
. Strategic	\$	\$		\$ \$		\$\$	
. 'Commercial' financial and economic	\$	\$		\$ \$		\$\$	
. Behavioural	\$	\$		\$ \$		\$	-
. Operational	\$	\$	<u> </u>	\$ \$		\$ \$	
. Technical	\$	\$		\$		\$	
. Systematic data collection & information dissemination	\$	\$		\$ \$		\$ \$	
Total (Pipeline) (should agree with Question (6e)) \$	\$		\$		\$	
 Please refer to definitions Include only capital expenditions the specified element of the) of levels of re ture whoily or research prog	→ esearch on page primarily in su ram.	s 3 and 4 upport of	>		\$	

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SECTION 7(f) INTERMODAL

93

	(i) How much in-house?	research was co	onducted	(ii) Was received	any sponsorship for this research?	(iii) Did your organisation sponsor any external research in this area?	
Level of research ¹	Non-salary recurrent expenditure	Capital expenditure ²	Staff- years	Amount	(Attach list	if space insut	fficient) Organisation
. Strategic	\$	\$		\$		\$	
. 'Commercial' financial and economic	\$	\$		\$ \$		\$ \$	
. Behavioural	\$	\$		\$ \$		\$\$	
. Operational	\$	\$		\$ \$		\$\$	
. Technical	\$	\$		\$		\$	
. Systematic data collection & information dissemination	\$	\$		\$ \$		\$\$	
Total (Intermodal) (should agree with Question (6f)) \$	\$		\$		\$	
 Please refer to definitions Include only capital expendition the specified element of the COMMENTS Please provide any commute nature of research 	of levels of re ture wholly or research progr ments which may carried out in	search on pages primarily in su am. assist in unde this area.	s 3 and 4. upport of erstanding				

Appendix II

SECTION 7(g) MULTIMODAL

	<pre>(i) How much research was conducted in-house?</pre>			(ii) Was any sponsorship received for this research?		(iii) Did your organisation sponsc any external research in this area		
Level of research	Non-salary recurrent	Capital 2	Staff-	(Attach list if space insufficient)				
. Strategic	\$	\$	years	\$	organisation	Amount	organisation	
. 'Commercial' financial	ss	\$		\$ \$		\$ \$\$		
	· · ·	•		\$	·····	\$		
. Behavioural	\$	\$		\$ \$		\$ \$	<u></u>	
. Operational	\$	\$		\$ \$		\$		
. Technical	\$	\$		\$		\$		
 Systematic data collection & information dissemination 	\$	\$		\$ \$		\$ \$		
Total (Multimodal) (should agree with Question (6g)) \$	\$		\$		\$		
 Please refer to definitions of Include only capital expendit the specified element of the COMMENTS Please provide any commute nature of research 	of levels of re ture wholly or research progr ments which may carried out ir	esearch on pages primarily in su ram. v assist in unden n this area.	s 3 and 4. upport of erstanding		· · · · · · · · · · · · · · · · · · ·			

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SECTION 7(h) ANY MODE

95

(i) How much research was conducted in-house?			(ii) Was received	any sponsorship for this research?	(iii) Did your organisation sponsor any external research in this area?		
Non-salary recurrent expenditure	Capital expenditure ²	Staff- years	Amount	(Attach list Organisation	if space insu Amount	fficient) Organisation	
\$	\$		\$		\$		
\$	\$		\$ \$ \$		\$ \$		
\$	\$		\$ \$		\$\$	·····	
\$	\$		\$ \$		\$		
\$	\$		\$		\$		
\$	\$		\$ \$		\$ \$		
) \$	\$		\$		\$		
of levels of re cure wholly or research progr ments which may carried out ir	esearch on pages primarily in su ram. assist in unden this area.	s 3 and 4. upport of erstanding					
	<pre>(1) How much in-house? Non-salary recurrent expenditure \$\$ \$\$ \$\$ \$\$ \$</pre>	<pre>(1) How much research was co in-house? Non-salary recurrent Capital 2 \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$\$ \$\$ \$\$\$ \$\$ \$\$ \$\$ \$\$ \$</pre>	<pre>(1) How much research was conducted in-house? Non-salary recurrent Capital Staff- expenditure expenditure² years \$\$\$\$ \$\$\$\$\$\$\$</pre>	(1) How much research was conducted (11) Was received in-house? received Non-salary Staff- expenditure expenditure ² \$	(1) How much research was conducted in-house? (11) Was any sponsorship received for this research? Non-salary recurrent Capital 2 years (Attach list \$	(1) How much research was conducted in-house? (11) Was any sponsorship received for this research? any extern any extern cervent capital 2 Staff-expenditure expenditure? years (Attach list if space insurption of the space insurption	

Appendix II

Question 8 For each subject area and level of research combination (eg. 'Air-Operational') covered by your organisation (in Questions 7(a) to 7(h)) please provide a list of project titles that contributed to the research activity reported. (Attach list if space insufficient.)

Subject area and level of research Titl

Title of project

	<u> </u>		
 - <u></u>			
 	<u> </u>		
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Question 9	Is the distribution of your organisation's research effort in 1986-87 between the various subject areas and levels of research (as shown in Questions $7(a)$ to $7(h)$) broadly typical of the research activity in recent years?								
	Yes 🗌 go to Question 10								
	No 🗌 Please provide explanatory comments below								
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Question 10 Please provide any additional comments which may assist in understanding the nature of your organisation's research effort, and any comments you wish to make on priority areas for transport research.

Thank you for your assistance.

APPENDIX III FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH FOR EACH SECTOR, 1986-87

The tables in this appendix provide detailed information on funding of transport research by subject area and level of research for each sector, as reported by respondents to the BTE Survey of Transport Research 1986-87.

TABLE III.1 FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH: COMMONWEALTH GOVERNMENT SECTOR, 1986-87

(\$'000)

Subject area	Level of research							
	Commercial, financial and			<u> </u>	L			
	Strategic	economic	Behavioural	Operational	Technical	dissemination	Unassigned	Totai
Air	41	160	89	167	600	584	0	1 641
Rail	265	4	0	0	123	61	0	453
Road	1 384	197	519	412	572	3 346	0	6 430
Sea	367	551	0	15	32	1 052	0	2 017
Pipeline	0	0	0	0	0	0	0	C
Intermodal	20	86	0	0	0	0	. 0	105
Multimodal	368	111	0	89	0	353	0	922
Any mode	89	0	0	0	2 546	629	0	3 265
Unassigned	••	••	••	••	••	••	0	C
Total	2 535	1 109	608	683	3 873	6 025	0	14 832

.. Not applicable.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

BTCE Information Paper 25

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TABLE III.2 FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH: BUREAU OF TRANSPORT ECONOMICS^a, 1986-87

	Level of research									
	Commercial, financial and				Ĺ	Data collection and				
Subject area	Strategic	economic	Behavioural	Operational	Technical	dissemination	Unassigned	Total		
Air	41	160	0	63	0	22	0	287		
Rail	176	4	0	. 0	0	60	0	239		
Road	1 145	153	0	0	0	317	0	1 614		
Sea	260	101	0	0	0	86	0	446		
Pipeline	0	0	0	0	0	0	0	0		
Intermodal	0	86	0	0	0	0	0	86		
Multimodal	119	0	0	89	0	48	0	257		
Any mode	89	0	0	0	0	629	0	719		
Unassigned	••	••	••	••	••	••	0	0		
Total	1 830	503	0	153	0	1 162	0	3 648		

(\$	'000)	

a. Figures for BTE are also included in Commonwealth Government sector.

.. Not applicable.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

TABLE III.3 FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH: AUSTRALIAN ROAD RESEARCH BOARD, 1986-87

Subject area	Level of research									
	C fin Strategic	Commercial, pancial and economic	Behavioura1	Operational	L Technical	ata collection and dissemination	Unassigned	Total		
Air	0	0	0	0	0	0	0	0		
Rail	0	0	0	0	. 0	0	0	0		
Road	10	0	193	518	4 661	190	0	5 571		
Sea	0	0	0	0	0	0	0	0		
Pipeline	0	0	0	0	0	0	0	0		
Intermodal	56	0	0	0	0	0	0	56		
Multimodal	0	0	0	0	0	0	0	0		
Any mode	0	0	0	0	0	0	0	0		
Unassigned	••	••	••	••	••		0	0		
Total	66	0	193	518	4 661	190	0	5 627		

(\$'000)

.. Not applicable.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

TABLE III.4 FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH: STATE GOVERNMENT SECTOR, 1986-87

(\$'000)

	Level of research									
	Commercial, financial and				D	ata collection and				
Subject area	Strategic	economic	Behavioural	Operational	Technical	dissemination	Unassigned	Total		
Air	62	104	0	0	0	0	0	165		
Rail	56	0	0	63	0	0	0	118		
Road	1 821	466	3 560	2 281	8 370	6 101	0	22 599		
Sea	4	89	0	1	-	0	0	94		
Pipeline	0	0	0	0	0	0	0	0		
Intermodal	11	63	8	8	0	0	0	89		
Multimodal	391	20	137	97	100	299	0	1 044		
Any mode	501	33	61	8	0	3	0	605		
Unassigned	••						238	238		
Total	2 845	774	3 765	2 457	8 471	6 403	238	24 953		

Rounded to zero.

.. Not applicable.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

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TABLE III.5 FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH: GOVERNMENT BUSINESS SECTOR, 1986-87

Subject area	Level of research									
	fi. Strategic	Commercial, nancial and economic	Behavioural	Operational	[] Technical	Pata collection and dissemination	Unassigned	Total		
Air	2 266	12 086	151	1 576	714	264	0	17 056		
Rail	2 227	5 222	145	3 795	1 783	2 242	0	15 413		
Road	112	481	17	261	373	425	0	1 669		
Sea	30	142	0	1 139	8	53	0	1 371		
Pipeline	0	0	0	0	0	0	0	0		
Intermodal	51	89	0	33	8	60	0	241		
Multimodal	107	137	59	756	117	443	0	1 619		
Any mode	65	183	0	10	58	231	0	546		
Unassigned	••		••	••	••	••	10	10		
Total	4 858	18 340	372	7 569	3 061	3 718	10	37 926		

(\$'000)

.. Not applicable.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

BTCE Information Paper 25

Subject area	Level of research									
	C fin Strategic	commercial, ancial and economic	Behavioura1	Operational	L Technical	ata collection and dissemination	Unassigned	Total		
Air	252	412	133	51	0	93	0	942		
Rail	27	160	0	1 228	6 777	40	0	8 231		
Road	5	61	7	293	162	12	0	539		
Sea	93	566	0	28	38	39	0	763		
Pipeline	0	0	0	75	87	0	0	161		
Intermodal	90	0	0	60	0	0	0	150		
Multimodal	124	0	0	65	5	4	0	198		
Any mode	3	0	0	2	2	0	0	6		
Unassigned	••	••	••	••	••	••	0	0		
Total	594	1 199	140	1 801	7 070	187	0	10 990		

TABLE III.6 FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH: PRIVATE SECTOR, 1986-87 (\$'000)

.. Not applicable.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

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	Level of research									
	C fin	Commercial, mancial and		Data collection and						
Subject area	Strategic	economic	Behavioural	Operational	Technical	dissemination	Unassigned	Total		
Air	11	5	0	0	0	3	0	19		
Rail	16	2	0	0	0	0	0	19		
Road	66	20	294	124	284	8	0	797		
Sea	5	5	0	3	0	17	0	30		
Pipeline	0	0	0	. 0	0	0	0	0		
Intermodal	0	-	0	11	0	0	0	11		
Multimodal	51	5	18	28	34	12	0	149		
Any mode	10	0	21	29	6	12	0	78		
Unassigned	••	••	••	••	••	••	64	64		
Total	158	37	333	195	324	53	64	1 165		

106 TABLE III.7 FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH: ACADEMIC SECTOR, 1986-87 (\$'000)

Rounded to zero.

Not applicable. ••

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

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Subject area	Level of research									
	C fin Strategic	Commercial, ancial and economic	Behavioural	Operational	D Technical	Pata collection and dissemination	Unassigned	Total		
Air	36	11	0	11	0	0	0	57		
Rail	21	5	0	5	0	0	0	32		
Road	1 593	23	165	33	12	95	0	1 921		
Sea	63	85	11	42	11	0	0	211		
Pipeline	0	0	0	0	0	0	0	0		
Intermodal	21	11	0	11	0	0	0	42		
Multimodal	11	5	0	5	0	0	0	21		
Any mode	0	0	0	0	0	0	0	0		
Unassigned	••		••		••		0	0		
Total	1 745	139	176	107	23	95	0	2 284		

TABLE III.8 FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH: ASSOCIATIONS SECTOR, 1986-87 (\$'000)

.. Not applicable.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

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	Level of research									
	Commercial, financial and				Data collection and					
Subject area	Strategic	economic	Behavioura]	Operational	Technical	dissemination	Unassigned	Total		
Air	0	0	0	0	0	0	0	0		
Rail	16	9	1	1	1	3	0	32		
Road	8	5	1	1	-	2	0	17		
Sea	25	0	0	0	0	0	0	25		
Pipeline	0	0	0	0	0	0	0	0		
Intermodal	8	0	0	0	0	0	0	8		
Multimodal	0	8	0	0	0	0	0	8		
Any mode	0	0	0	0	0	Ö	0	0		
Unassigned	••	••	••	••		••	-	-		
Total	57	22	2	2	1	5	_	90		

TABLE III.9 FUNDING OF TRANSPORT RESEARCH BY SUBJECT AREA AND LEVEL OF RESEARCH: UNIONS SECTOR, 1986-87 (\$'000)

Rounded to zero.

.. Not applicable.

Note Figures may not add to totals due to rounding.

Source BTE Survey of Transport Research 1986-87.

APPENDIX IV LIST OF TRANSPORT RESEARCH PROJECTS

The following transport research projects were reported by organisations which responded to the BTE Survey of Transport Research 1986-87. Projects are classified by sector, subject area, level of research and State. Projects are listed under the name of the reporting organisation.

COMMONWEALTH GOVERNMENT SECTOR

Air Strategic Australia Bureau of Transport Economics Australia's domestic air cargo industry Commercial, financial and economic Australia Bureau of Transport Economics Trends and prospects for Australian international air transport Behavioural Australia Department of Aviation Speech-based hearing test for flight crew Speech-based hearing test for air traffic controllers Sunglasses and colour vision Suitability of bi-focal contact lenses for flight crew with presbyopia Pilot judgement training Operational Australia Bureau of Transport Economics Assistance with the development of airway facilities performance standards

Department of Aviation Effectiveness of electronic bird scaring devices Surface texturing of runways using water blast techniques Use of high grade polymer bitumen binders in bitumenous concrete in taxiways Department of Defence, Defence Science and Technology Organisation Air transport study Technical Australia Department of Aviation Continuing research into aeronautical safety Substantiation of extended fatigue lives for fibreglass aliders Continuing research into air navigation (Sydney University Air Navigation Group) Department of Housing and Construction Fire performance of aerobridges Fire protection of aircraft hangars Industry Research and Development Board Light utility aircraft Data collection and dissemination Australia Bureau of Transport Economics Forecasting aircraft movements at major Australian airports Forecasts of aviation activity by market segments 1985-2000 Department of Aviation Passenger and freight air traffic statistics Developing improved ways of presenting data derived from non-destructive test equipment On-going research into accident/incident database to identify underlying casual factors of different accident types and recommend remedial or preventative measures Department of Housing and Construction Measurement of supersonic aircraft noise

Rail Strategic Australia Bureau of Agricultural Economics Institutional arrangements in the Australian wheat distribution system Bureau of Transport Economics Economic, social and financial assessment of the Tasmanian rail network A comparison of Australian and overseas railway systems, their performance and policy trends Inter-State Commission Movement of salt Commercial, financial and economic Australia Bureau of Transport Economics Railway legislation and rate contracts: USA, Canada and Australia Technical Australia Department of Housing and Construction Fire performance of train seats CSIRO Bonded rail plates research Data collection and dissemination Australia Bureau of Transport Economics Intersystem rail freight movements, 1984-85 Road Strategic Australia Inter-State Commission Review of interstate registration charges Department of Transport, Road Safety Division Econometric models in road safety Crash violation study Consultancy on enforcement issues Evaluation of 90 km/hr speed limit for trucks

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Department of Housing and Construction
     The Australian roads outlook report
     Residential subdivision practices (including residential
     streets layout and pavements)
   National Materials Handling Bureau
     The use of computer systems in scheduling urban deliveries
     Just-in-time: implications for the Australian transport
     industry
   Bureau of Transport Economics
     Road studies 1986: future demand for road reconstruction
     Road studies 1986: coordination and reporting
     Road studies 1986: urban arterials
     Road studies 1986: future road status and performance -
     national highways and rural arterials
     Road studies 1986: economic assessment of road investment -
     national highways and rural arterials
     Road studies 1986: economic evaluation of rural road
     improvements
     Road studies 1986: road traffic forecasts
     Road studies 1986: road funding and financing
     Road studies 1986: local roads
     Australian car rental industry study
     The changing needs of a developing road system
     Tasmanian road freight transport industry
     Intrastate coach services in NSW: trial entry liberalisation
     Equalisation and local roads in Australia and England
     Factors influencing local government road expenditure
Commercial, financial and economic
 Australia
   Bureau of Transport Economics
     Cost of road accidents
     Road pricing for heavy vehicles
     Life cycle cost analysis of flexible and rigid road pavements
     Damage costs and expenditure recovery on Australian roads
   Australian Meat and Livestock Research and Development
   Corporation
     Reducing the effects of transport, handling and climatic
      stresses on meat quality
   Bureau of Industry Economics
     Econometric investigation of new motor vehicle demand
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Behavioural Australia Department of Territories Effect of raising heavy vehicle speed limit from 80 km/hr to 90 km/hr Effectiveness of 40 km/hr school zone speed limit Operational characteristics of mini roundabouts compared to design guide procedures CSIRO Driver information systems Department of Transport, Road Safety Division Implementation of graduated licensing Unsafe driver actions Judgement of speed Off-road driver training Community attitudes surveys Driver testing and licensing 'Out & About' evaluation Rehabilitation of drink drivers Heavy vehicle braking performance Rural speed perception studies Influence of driver behaviours on safety Evaluation of public education activities Motorcycle rider training Pedestrian safety studies Operational Australia Department of Territories Review of automated signal system Review of operational traffic characteristics of B Double units Department of Transport, Road Safety Division Child head injury model Head injuries in passenger cars WA bicycle crash study Australian Capital Territory National Capital Development Commission Parking generation Reid local area transport management study Analysis of top 20 accident locations Canberra's public transport development study

City detailed traffic study Park and ride study Technical Australia Department of Housing and Construction Road vehicle limits Load transfers in multi-axle platforms Performance evaluation of different types of sound reducing partitions Department of Transport, Road Safety Division Strength testing of helmets Post crash study of helmets Child bicycle helmet review CSIRO Fuel conservation through transport management Reduction of fuel consumption in passenger cars Alternative fuels Industry Research and Development Board Load haul dumper Self levelling suspension for semi-trailers Australian Capital Territory National Capital Development Commission Cycleway pavement performance Data collection and dissemination Australia Department of Territories Collection and analysis of traffic accident data Traffic accident system review and design Bureau of Transport Economics Road safety and the economy Passenger and freight road traffic dynamics Monitoring operational characteristics of the Australian road svstem Road construction price index Australian road financing statistics

Department of Housing and Construction Traffic noise measurements Information dissemination concerned with minimising the annoyance caused by noise sources such as that generated by road traffic

Australian Bureau of Statistics Survey of motor vehicle use Motor vehicle census New motor vehicle registrations Road traffic accidents

Department of Transport, Road Safety Division 1984-85 fatal file Occupant restraint surveys National day-to-day travel survey Evaluation of the national mass data system Analysis of risk exposure data Rural crash studies

Sea

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Strategic Australia Bureau of Transport Economics Roles and structures of Australian port organisations A study of Australian international shippers and shipping practices 1986 review of trans-Tasman shipping Department of Transport, Domestic Shipping Policy Division Waterside strategy Development of efficient Australian flag fleet Commercial, financial and economic Australia Bureau of Transport Economics Model for estimating operating costs of cargo ships Local user terminal maritime distress alerting systems FAK (Freight All Kinds) rates in liner shipping Australian Meat and Livestock Research and Development Corporation Husbandry, health and welfare of sheep prior to and during live export by sea Improving the health and welfare of sheep for export

Department of Transport, Domestic Shipping Policy Division Vessel operating costs Crewing studies Industry efficiency studies Consultancy on Australian National Line's financial performance Operational Australia Bureau of Agricultural Economics Effects of centralised shipping on the Australian meat export industry Department of Transport, Maritime Safety Division Commission into aerial spraying of oil dispersants onto oil slicks in Australian coastal waters Bureau of Transport Economics Assessment of options for sea safety systems Technical Australia Department of Housing and Construction Assessment of flame spread characteristics of lining materials Fire resistance rating of ships bulkheads Department of Transport, Maritime Safety Division Toxicity testing of national plan oil dispersants (temperate and tropical) Data collection and dissemination Australia Department of Transport, International Shipping Policy Division Shipping and cargo investigations Stevedoring statistical collections Port cargo throughput statistics Bureau of Transport Economics Marine oil spill risk Commodity stowage factors and container types in Australian liner trades Industry seminar on liner shipping

Appendix IV

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Australian Bureau of Statistics
        Shipping statistics
      Department of Transport, Domestic Shipping Policy Division
        Coastal shipping activity
        Tasmanian freight equalisation scheme
Intermodal
  Strategic
    Australia
      Inter-State Commission
        Extension of piggyback services
  Commercial, financial and economic
    Australia
      Bureau of Transport Economics
        Bulk shipping
  Operational
    Australia
      Bureau of Transport Economics
        Productivity and performance indicators: port and related
        services
        Communications systems: shore-based shipping industry
Multimodal
  Strategic
    Australia
      Bureau of Agricultural Economics
        The cost and regulation of cane harvesting practices
      Bureau of Transport Economics
       Multimodal implications of road investment
       Transport of grain: implications of alternative regulatory
        arrangements
       Transport corridors: an analysis of determinants of modal
        shares
      Department of Defence, Defence Science and Technology
      Organisation
       Military movement and support study
 Commercial, financial and economic
   Australia
      Bureau of Agricultural Economics
       Economic evaluation of the storage, handling and transport of
       Australia's grain harvest
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BAE submission to Industries Assistance Commission inquiry into fruit and fruit products A model of the Mackay sugar industry: economic effects of regulation Data collection and dissemination Australia Department of Sport, Recreation and Tourism Domestic tourism monitor International visitors survey Department of Transport, Management and Coordination Division Economic trends and indicators Forecasts of major registration levels Australian Bureau of Statistics Transport industry survey Interstate freight movements Bureau of Transport Economics Modal shares in national transport corridors Conference paper on urban transport and the taxi industry Transport productivity measurements Any mode Strategic Australia Bureau of Transport Economics Transport trade interactions Review of transport research in Australia Transport implications of just-in-time inventory techniques Commercial, financial and economic Australia Bureau of Transport Economics A framework for the consistent cost analysis of the Australian transport task Operational Australia Bureau of Transport Economics Shore-based shipping costs: transport and handling of containerised cargo Shore-based shipping costs: transport and handling of bulk cargo

Technical Australia Industry Research and Development Board Continuously variable stroke internal combustion engine Underground vehicle Catalytic converter On-board vehicle information system Dairy Research Council Membrane processing to reduce transport costs CSIRO Conversion of shale, natural gas and coal to liquid transport fuels Data collection and dissemination Australia Bureau of Transport Economics Australian Transport Literature Information System (ATLIS) Australian Transport Information Directory (ATID) Australian Transport Research In Progress (ATRIP) Production of transport indicators Development of transport indicators Assessment of transport provision in Australia Transport of Australia's minerals The role of transport in the economy Seminar on consultive forecasting Australian transport forecasting data base Development of aggregate demand forecasting capabilities AUSTRALIAN ROAD RESEARCH BOARD Road Strategic Australia Australian Road Research Board Consideration of freight transport in urban road investment Behavioural Australia Australian Road Research Board Vehicle ownership Road user information: guidance and control systems Improving traffic generation estimates Drivers' use of warning and speed control information

Unsafe driving action Design perception/reaction time for Australian roads Eye movements as a predictor of conspicuity and priority value Heavy vehicle braking performance Operational Australia Australian Road Research Board NIMPAC vehicle operating cost parameters Tracing change in vehicle population and usage characteristics Roundabout capacity and performance Field evaluation of the effects of delineation on night-time curve negotiation Visual requirements for curve negotiation Accidents: road class and socio-economic factors within the municipalities of metropolitan Melbourne Disaggregate econometric analysis of road accident data Terminal values of road traffic signs Fundamentals of road traffic analysis A time series approach to the estimation of origin-destination flows in a small area Technical Australia Australian Road Research Board Dynamic loading data acquisition system In-service acceleration and deceleration behaviour The use of rubbers and polymers in bituminous surfacing Pavement cross-section experiment: Cairns Bituminous mixes for residential streets Seasonal variation in skid resistance Lateral dynamic performance of articulated vehicles Field trials of pavement structures Pavement design: residential streets Traffic noise under interrupted traffic flow conditions Australian rainfall and runoff Performance of a full depth asphalt pavement Material properties and pavement performance Safety aspects of cross-section width standards and shoulder treatments A low cost dynamic load sensor Evaluation of bitumen antioxidants Variability of pavement and material properties Statistical specifications Development of a video vehicle detector

Flood forces on bridges Emissions and fuel consumption: cars and light trucks Thermal loadings for bridges NAASRA roughness meter calibration Guidelines for fuel savings at isolated urban intersections Prediction and extension of service life of bituminous surfacings Accelerated loading facility trial number 2: Benalla (Victoria) The addition of hydrated lime to bitumen Improvements to spray sealing practice Bitumen aggregate adhesion in spray seals Development of a high speed profilometer (Phase 1: roughness meter calibration) Axleload recording system Load transfers in multi-axle platforms with gooseneck connections Pavements management systems Structural performance of road pavements Accelerated loading facility trial number 3: Beerburrum (Queensland) Highway bridge impact Performance of compacted basaltic aggregates under repetitive loading Tribo-electric and Piezo-electric cable axle detectors Accelerated loading facility trial number 4: Prospect (NSW) Capacity and level of service on rural roads ARRB involvement in the dimensions of automobile demand (project by Macquarie University) Durability of bitumen from emulsions Dynamic signs and distraction A review of friction factors Route guidance and vehicle positioning Truck ride comfort Data collection and dissemination Australia

Australian Road Research Board Freight system data and information needs study of colonial roads C1850-1900

Intermodal

Strategic Australia Australian Road Research Board Urban transport performance measurement

STATE GOVERNMENT SECTOR

Air

Strategic

Western Australia

Department of Transport

Domestic aviation policy review: response of Government of WA Submission to the independent air fares committees Cost allocation review of Ansett and Australian Airlines International and interstate airline policies: impact on Perth Proposed KLM service to Perth: benefits for the State and the nation

Proposal for the establishment of regular airline services between Australia and Mauritius

Commercial, financial and economic Victoria Ministry of Transport Airline policy

Rail

Strategic New South Wales Ministry of Transport, State Transport Study Group Rail metropolitan passenger strategy study

South Australia Department of Transport Metropolitan rail study

Commercial, financial and economic New South Wales Ministry of Transport, State Transport Study Group Cost-benefit analysis of proposed Gulgong rail line

Operational

New South Wales

Ministry of Transport, State Transport Study Group Development of computerised rail pathing model for State Rail Authority of NSW

Victoria Ministry of Transport Computerised crew scheduling

Oueensland Department of Transport Analysis of the attitude of major Queensland railway clients to the quality and level of rail service being provided Road Strategic New South Wales Traffic Authority of NSW Identification of cost-beneficial opportunities Strategic/corporate planning Monitoring/evaluation Town centres Metropolitan parking City pedestrians Department of Motor Transport Review of policies relating to regulation of intrastate long distance bus services NSW State Pollution Control Commission Long term trends for motor vehicle air pollutant emissions and noise emissions Department of Environment and Planning Sydney Harbour tunnel: environmental impact assessment Regional environmental plan: arterial road network Department of Main Roads Nodal dynamic traffic assignment model for Sydney Computer programs to provide photogrammetric data Arterial and sub-arterial traffic management on land frontages Ministry of Transport, State Transport Study Group Development of vehicle ownership forecasting model Forecast of traffic demand on proposed Sydney Harbour tunnel Victoria Ministry of Transport Metropolitan arterial road access study South Bank study Bay links study National tennis centre Western bypass Eastern corridor road study

Road Traffic Authority Traffic management strategy: development of a methodology Monitoring arterial road operating strategy performance Camberwell/Hawthorn regional traffic study Structure plan for Ringwood district centre Traffic management futures study Futures study advisory project Pascoe Vale road corridor Dandenong district centre Evaluation of route strategies Regulatory impact statement on revised traffic regulations Speed zone index Traffic engineering guidelines for the disabled Quantified warrant development Preston-Northcote arterial route study Guidelines for the traffic assessment of development proposals Traffic management assessment: Jolimont area Oueensland Department of Transport Analysis of the taxi industry Periodic inspections of motor vehicles Evaluation of the RID (Reduce Impaired Drivers) trial Evaluation of court imposed drink driving penalties Review of strategy for pedal cyclists Main Roads Department Burdekin transport study Brisbane regional transport planning Mackay road network study Ipswich network study Toowoomba transport study Townsville and Cairns network study Gold Coast transport study review Surfers Paradise traffic study Logan City study Strategic road planning studies Urban planning techniques South Australia South Australian Highways Department Southern area review Golden Grove planning study

Network study Gepps Cross

Appendix IV

Western Australia Department of Transport Policy for road coach transport in the south-west of WA Volumetric loading Commercial, financial and economic New South Wales Ministry of Transport, Road Freight Transport Industry Council Container freight rates study Joint working party into port delays Ministry of Transport, State Transport Study Group Evaluation of impact of introducing cross-regional buses Development of revenue forecasting model for Urban Transit Authority Development of econometric models Urban Transit Authority bus operational costs Victoria Road Traffic Authority Commodity movement framework Study of road freight movements South Australia South Australian Highways Department Advance works program development Economic and financial network planning Cost analysis/cost index estimating Department of Transport Taxi industry review Behavioural New South Wales Department of Motor Transport Review of written knowledge test for learners' permits and drivers' licences Ministry of Transport, Road Freight Transport Industry Council Employment in the road freight industry Driver attitude survey Traffic Authority of NSW Research and development for campaigns Drink driving Children's television

Drug driving Fatique Seat belt and child restraint usage Heavy vehicle drivers Motorcyclists 40 km/hr zones Speed reduction ¹ School curricula Driver education Victoria Road Traffic Authority Cyclists' characteristics and cycling patterns Local area traffic precincts: children survey Rural accidents literature review Evaluation of road safety curriculum unit for secondary schools Speedzoning philosophy Speeding risk monitor Appraisal of Piezo-electric detector for speed cameras Testing of breath alcohol testing devices Oueensland Main Roads Department Accident information system Department of Transport Attitudinal survey on vehicle restraints Review of court referral programs South Australia South Australian Highways Department Accident analysis Planning and research accident data analysis Traffic data analysis: travel Planning and research traffic volume analysis Department of Transport Road safety studies Operational New South Wales Department of Environment and Planning Kurnell study: transport of dangerous goods Central Business District traffic study

Traffic Authority of NSW Residential street design Linked trips Guidelines review of State Environment Planning Policy (SEPP) 11 Kerbside parking control Building waste containers Department of Main Roads Improved monitoring of travel times in urban networks Economic indicators for installation of traffic facility devices Review of road capacity estimates (project by ARRB) Review of the design of street lighting columns and signposting supports Victoria Road Traffic Authority Review of disabled parking scheme Roadside hazard management study Eastern corridor bus delay study Bus priority evaluation SCATSIM software Development of INSECT traffic simulation model Signal linking for fairway project SCATS design for Singapore project Bicycle facilities at intersections Revision of bicycle facilities planning and development guidelines Review of pedestrian facilities Saturation flows Integration of public transport in central activities district **Queensland** Department of Transport Review of the licensing infrastructure Main Roads Department Methods and systems for road furniture Review of road vehicle limits study Experimental planting and propagation Noise and vibration investigation Road design system development Traffic simulation Vehicle path development Crash cushion research Guardrail terminal research

South Australia South Australian Highways Department Over limit vehicles strategic route Truck limits Road design standards investigation Standard bridge barriers Incas cadastral survey system Highways mapping system Urban transport studies Rural transport studies Road classification studies Implementation of Economics of Road Vehicle Limits (ERVL) study

Technical

New South Wales Traffic Authority of NSW Occupant restraint testing Motorcycle helmet performance

NSW State Pollution Control Commission Vehicle emission and fuel consumption testing: New vehicles Research programs Contract testing

Department of Main Roads Rubber bitumen seals Cationic emulsion seals Reflection cracking in asphalt overlays Stability of asphaltic concrete mixes Lateral load test on piles Trough girder decks continuity connection Approach slabs investigation Load capacity of driven piles Creep and shrinkage Earth forces on Spring Gulley culvert Elastromeric bridge bearings Plank deck tests Compactometer Pavement management systems Pavement design and materials Geotechnology Construction methods Sprayed surfacing Asphalt Concrete pavements

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Portland cement concrete Paint: adhesives and roadmarking Automated Benkelman beam Replacement deflectograph Pavement condition rating systems Accelerated loading facility pavement trials Pavement history database Two-way radio base station voting circuit Remote monitoring of two-way radio systems Automatic toll collection coin detection High frequency radio base station Noise attenuation techniques Effects of construction on water quality and fauna Revegetation of earth and rock fill batters Sedimentation and erosion control procedures Computer aided drafting in road design Automated systems applicable to surveying and land administration Engineering survey methods Development of fibre optic lane marking systems Weigh-in-motion load limit enforcement

Victoria

Road Traffic Authority Software and hardware for in-car dashboard display Dynamic vehicle height control

Queensland

Main Roads Department Data bank of traffic signals Experimental catchments run-off investigation Bridge load spectrum Relaxation prestressing strand Earth pressure on abuttments Monitoring alkali aggregate reactivity Pile driving research Flood loads on bridge superstructure Performance of bitumen surfacings Workability of rock Assessment of stabilised materials Properties of modified binders Evaluation of engineering fabrics Assessment of quarries Construction of expansive clays Use of non-standard and marginal materials

Pavement performance studies Moisture in pavements Pavement rehabilitation Axle road studies Paving materials characterisation Performance of asphalt and sprayed surfacings Deflectulab Pavement design and management systems Accelerated loading facility

Department of Transport On-site crash investigations

South Australia Department of Transport Road design for residential street areas Evaluation of residential street management

South Australian Highways Department Port Wakefield Road pavement experiment Traffic signal equipment research Accelerated loading facility site selection Alternative road surface seals trial Deflectograph pavement analysis Cement treated pavements investigation Compression tests: rubber caps

Tasmania

Department of Main Roads Construction control and foundation investigations for bridges and buildings

Data collection and dissemination

New South Wales

Ministry of Transport, Road Freight Transport Industry Council Market survey form development and trial Analysis of truck movements through Berowra and Marulan heavy vehicle checking stations

Department of Main Roads

Systems for axle load measurement Monitoring of pavement structural conditions Monitoring of pavement roughness conditions Monitoring of pavement surface friction High speed measurement of pavement surface profile

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Traffic Authority of NSW
    Surveys of road user behaviour (speed, use of occupant
    restraints, motorcycle helmets/headlamps)
    Capture, analysis and dissemination of police reports of
    crashes
Victoria
  Road Traffic Authority
    Conversion of turning movement software on Rainbow to VAX
    Development of system specification for traffic strategies
    system
    Development of location system: phase 142
    Development of new accident data system
Queensland
  Department of Transport
    Monitor and maintenance of a fatal road crash database
    Study of bus patronage by region
    Production of traffic accident bulletins
  Main Roads Department
    Oueensland seismic risk study
    Review of secondary roads arrangements
    Improvements to road inventory system
    Data acquisition methods
    General rural planning
    Road inventory development and updating
    Improvement of Department cartography
South Australia
  South Australian Highways Department
    Accident data collection
    Traffic data collection
    Planning and research road inventory
  Department of Transport
    NERDDC commercial fleet conservation study
Western Australia
  Main Roads Department
    Weighing of vehicles in motion
    Development of road life curves and rideability control
    Road inventories: rural and urban
    Rural road statistics
    Accident data collection
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Urban trafic survey Rail traffic survey Road construction cost index

Tasmania

Department of Main Roads Road roughness measurements of the State road network

Sea

Strategic Queensland Department of Transport Evaluation of subsidies for ferries Western Australia Western Australian Coastal Shipping Commission Market research for new trade routes Northern Territory Department of Transport and Works, Marine Division Investigation into public wharf requirements: Nhulunbuy Commercial, financial and economic Northern Territory Department of Transport and Works, Marine Division Research into needs of hire and drive industry prior to framing and recommending legislation Behavioural Northern Territory Department of Transport and Works, Marine Division Research into requirements for public boat ramps Research into training needs of pleasure boat operators for boating safety purposes Technical Western Australia Western Australian Coastal Shipping Commission Ship configuration, design and economy

Data collection and dissemination Northern Territory Department of Transport and Works, Marine Division Survey of interstate fees for surveys and examinations

Appendix IV

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Intermodal
 Strategic
    Victoria
     Ministry of Transport
        Airports strategic planning
        Car/rail interchanges
 Commercial, financial and economic
    New South Wales
      Ministry of Transport, State Transport Study Group
        Study of the financial implications of introducing an
        intermodal ticket into Sydney's privately operated bus
        services
        Study of costs of Port Kembla grain terminal
Multimodal
  Strategic
    New South Wales
      Ministry of Transport, State Transport Study Group
        Development of logic mode choice model
        Study of commuter travel in Gosford/Wyong area
      Department of Environment and Planning
        Hoxton Park-Parramatta-Baulkham Hills public transport
        corridor study
    Victoria
      Ministry of Transport
        Metropolitan public transport industry plan
        Eastern corridor public transport study
    Queensland
      Department of Transport
        Transportation of oil in far western Queensland
        Transportation of livestock within Queensland
    South Australia
      Department of Transport
        Strategic planning brief
        Transport futures study
    Western Australia
      Department of Transport
        Assessment of appropriate transport policy for bulk fuel
        Assessment of appropriate travel concession policy
        Determination of policy on community transport
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Behavioural South Australia Department of Transport Adelaide household and travel survey Travel patterns Western Australia Department of Transport Review of travel needs of the aged Operational Western Australia Department of Transport Central city movement model for the identification and modelling of transport (CENCIMM) Strategies for central Perth Parking policy Technica] South Australia Department of Transport Model development Land use traffic generation study Data collection and dissemination New South Wales Ministry of Transport, State Transport Study Group Production of reports on analysis of 1981 Sydney travel survey South Australia Department of Transport Household and travel survey Western Australia Department of Transport A program of travel surveys for Perth 1985-86 Any mode Strategic New South Wales Department of Environment and Planning Employment of population inputs to metropolitan rail strategy studv

Ministry of Transport, State Transport Study Group Comprehensive study of storage, handling and transport of grain in NSW Victoria Ministry of Transport Modal activities affecting aviation Social justice strategy Transport for the disabled Urban strategy Central area access study District centre studies Oueensland Department of Transport Review of transport in far north Oueensland Regionalisation of resources South Australia Department of Transport Transport investment review analysis fellowships Western Australia Department of Transport Grain handling and transport in WA: road/rail competition Least cost paths from farm to ship Identification of port 'draw' zones Commercial, financial and economic Oueensland Department of Transport Grants Commission submission Behavioural Victoria Victorian Tourism Commission Domestic tourism monitor South Australia Department of Transport Social aspects of land acquisition Data collection and dissemination Queensland Department of Transport Transport economic indicator review for Queensland Development of Departmental corporate plan

GOVERNMENT BUSINESS SECTOR Air Strategic Australia Qantas Airways Long term resource requirements (aircraft, buildings, manpower etc) Competitor profiles Changes in the regulatory environment Australia Post Australia Post use of dedicated (charter) aircraft Commercial, financial and economic Australia Qantas Airways Pricing Product development Market research on new routes Australia Post Review of arrangements for sharing of mail conveyance between the domestic air service operators Operational Australia Qantas Airways Making Qantas more efficient and more market-oriented Technical Australia Qantas Airways Establishment of technical capabilities of aircraft and engines on offer Rail Strategic Australia Australia Post Long term strategies for mail movement between the eastern and western States Australian National Railways Commission Corporate planning

Corporate relations
New South Wales State Rail Authority of NSW General strategic research including coal/wheat transportation, general freight and passenger traffic Future line/land development Energy conservation/electrification Victoria Port of Melbourne Authority General rail terminal, Port of Melbourne V/Line Business strategy to 1990 Workshops business strategy Passenger business plan Freight business plan Strategic overview of physical works program and five year forward program to 1991-92 Oueensland Queensland Railways Corporate planning Marketing plan Western Australia Westrail Corporate planning process Wheat transportation General freight Passenger traffic Future land development Electrification Business strategy to 1992 Workshops organisation Passenger business plan Freight business plan Functional review Commercial, financial and economic Australia Australian National Railways Commission Cost recovery Salt traffic Marketing and information services

New South Wales State Rail Authority of NSW Metropolitan rail strategy study Victoria Port of Melbourne Authority Analysis of hinterland rail service/rates V/Line Rail business analysis Corridor fixed costs Efficient grain costs Queensland Queensland Railways Marketing plan Forecasting Marketing intelligence Marketing information and systems Passenger freight surveys Special operational projects: research, rationalization studies, business reviews, economic and financial evaluation Western Australia Westrail Cost recovery Piggyback traffic Grain contract Suburban passenger contract Quarrying joint venture Road transport joint venture Locomotive replacement Branch line closures Road coach franchise Economic value of changing wheel profile Use of rail grinding machine Behavioural Australia Australian National Railways Commission Random breath testing New South Wales State Rail Authority of NSW Country passenger trains survey New seat testing ('Tangara' trains)

Steam train survey Road coach customer survey Community attitudes to rail transport survey Opinions on smoking Timetable format testing Testing and monitoring of advertising campaigns Customer opinions on XPT exterior Western Australia Westrail Effect of nine day fortnight and 38 hour week Crewing levels on suburban railcars Selected voluntary severance Climate study and staff communications Participative work planning for track maintenance gangs Operational Australia Australian National Railways Commission Train scheduling Advanced train control system Grain block trains Terminal/yard rationalisation Traffic information management system Operations research and development New South Wales State Rail Authority of NSW Computer-aided timetable systems Short-term infrastucture enhancements (tracks, signals and resources) Future planning of timetables Victoria V/Line Operation of large grain block trains Locomotive rostering Carriage maintenance Wagon maintenance Simulation of train operations by computer modelling Port of Melbourne Authority Superfreighter arrangements Analysis of rail transit times (Adelaide corridor) Rail services to port terminals

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South Australia
    State Transport Authority
      Railcar driver advisory system (fuel minimization)
 Western Australia
    Westrail
      Fleeting of grain block trains
      Reduction of intermediate shunting
      Locomotive rostering
      Speed ramps modelling
      Workshops production control system
      Driver simulator
      Fuel conservation
      Computer-assisted train scheduling
Technical
 Australia
    Railways of Australia
      Rail design module
      Wheel/rail profile optimisation
      Rail grinding evaluation
      Freight bogie maintenance standards
      Wheel stress measurement
     Timber sleeper research
   Railways of Australia, Australian National Railways
      SIMCAR model enhancement
   Railways of Australia, Queensland Railways
     Track buckling study
   Railways of Australia, Westrail
     Test track
   Australian National Railways Commission
      Intelligent field terminal
      Fuel consumption analysis
      Vehicle and track tests
      Locomotive fleet planning
      5-pack skeletal container wagons
 New South Wales
    State Rail Authority of NSW
      Industrial design/investigation and technical research for new
      'Tangara' electric multiple units suburban trains
     Four wheel wagons for containers
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Appendix IV

'Tautliners' for containers Fatigue of load wagons Dynamic simulation of vehicle Driver's safety windscreen Seat materials Fibreglass fire retardency Door locks on country trains Rubber specifications Noise reduction on double deck interurban trains Train operation modelling design Melbourne Research Laboratories wheel rail profile Strain gauge of wheel stress analysis Energy conservaton: locomotive running Locomotive exhaust emission in tunnels Wheel welding Micro-alloyed wheels Lubricants for rail curves Cleaning chemicals and statutory requirements for effluents Victoria V/Line Washing of carriage exteriors Recycling of solutions and waste water treatment Atmospheric contaminants generated by welding Fuel consumption Evaluation of structural materials used in early rail bridge construction Oueensland Queensland Railways Performance of prestressed and partially prestressed concrete structures In-service behaviour of prestressed concrete railway spans Western Australia Westrail Interaction of rail and wheel and the development of new wheel profiles Bogie design and performance Alternative sleeper materials Substitutes for traditional dog spike Automatic grain unloading Aluminium grain wagons Deterioration of concrete sleepers Use of track data recording car

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Data collection and dissemination
 Australia
   Australian National Railways Commission
      Passenger reservation system
     Flectronic transmission of information
     'Alice' passenger survey
     Traffic information management system (TIMS)
 New South Wales
   State Rail Authority of NSW
     Statistical services for management information and decision-
     making including research on new information systems and
     equipment
 Victoria
   Port of Melbourne Authority
     Recording and analysing trade statistics
 Oueensland
   Oueensland Railwavs
     Computer-aided roster
     On-line leave
     Production planning system
     Elimination of consignment notes
 South Australia
   State Transport Authority
     1986 point of sale ticket survey (consultants)
     Ticket examiners on-board ticket survey
     Rail census passenger survey
 Western Australia
   Westrail
     Rolling stock control system
     Centralised passenger accounting system
     Passenger reservation system
     Train scheduling from remote locations
     Substitution of electronic mail for in-house telex
     System-wide access to personnel data
     Replacement of forms by electronic entry
     Mainframe - personal computer data transfer
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Road

Strategic Victoria Port of Melbourne Authority Outer western ring road F3-F5 Todd Road ramps on/off Westgate Freeway Internal area planning and proposed new roads Commercial, financial and economic Victoria Port of Melbourne Authority Road carrier organisational requirements Western Australia Metropolitan (Perth) Passenger Transport Trust Perth city bus junction: socio-economic evaluation Kwinana freeway contra-flow bus lane: trial phase An evaluation of bus procurement, maintenance and replacement policies and procedures Operational Australia Australia Post Interstate/intrastate linehaul operations South Australia State Transport Authority Automatic data transfer (transponders) Computerised bus berthing and despatch Selective traffic light priority Western Australia Metropolitan (Perth) Passenger Transport Trust Perth central area free transit zone Computerised roster balancing Technical Australia Australia Post Development of a vehicle for clearing street posting boxes South Australia State Transport Authority Electronic fuel monitoring Emergency radio call system LPG bus demonstration program

Western Australia Metropolitan (Perth) Passenger Transport Trust Evaluation of alternative fuel: CNG Data collection and dissemination Victoria Port of Melbourne Authority Recording and analysing trade statistics South Australia State Transport Authority 1986 point of sale ticket survey (consultants) Bus inspectors on-board ticket surveys Bus passenger load checks Sea Strategic Victoria Port of Melbourne Authority Planning for future berthing facilities South Australia Department of Marine and Harbors Grain ports SA: analyse data on present and future ship size distribution in grain export from SA, combined with production forecasts and existing port capabilities to establish future port needs Port Adelaide berth utilisation: establish extent of berth redundancy in inner harbour Western Australia Western Australian Coastal Shipping Commission Market research for new trade routes Northern Territory Darwin Port Authority Research on cost-benefits of exporting frozen meat through Darwin Road/rail centralisation Commercial, financial and economic Victoria Port of Melbourne Authority Evaluation of shipping development proposals

Appendix IV

South Australia Department of Marine and Harbors Petroleum products Port Adelaide: technical and commercial investigation including risk analysis for proposed new petroleum products berth Marketing analyses and strategies Western Australia Western Australian Coastal Shipping Commission Market research for expanding existing trade routes and cargo support Northern Territory Darwin Port Authority Research into development of timber as a catalyst import cargo to develop shipping services and utilise the land-bridge concept Operational Australia Australia Post Use of ferry service ('Abel Tasman') between the mainland and Tasmania New South Wales Newcastle Port Board Ship simulator studies Oueensland Port of Brisbane Authority Wave climate: ship motion studies for access channels to the Port of Brisbane Analysis of sand movement into the channel section of the Port of Brisbane to quantify annual operating costs Analysis of vessel motions related to wave climate to predict windows of time for safe passage of deeply laden vessels Department of Harbours and Marine Weipa access channel siltation study Gladstone Harbour model Navigation aids piles driven in deep water: oscillation study Dalrymple Bay coal terminal expansion study Western Australia Western Australian Coastal Shipping Commission Operational methodology

Extension of services to Papua and New Guinea Extension of services to circumnavigate Australia Northern Territory Darwin Port Authority Market research into cargoes available to be diverted through Darwin given certain regular shipping services Determination of future infrastructure requirements and options to meet demands Technical Western Australia Western Australian Coastal Shipping Commission Ship configuration design and economy Data collection and dissemination Victoria Port of Melbourne Authority Recording and analysing trade data South Australia Department of Marine and Harbors Collection and summarising of data for the Department's shipping information system Intermodal Strategic

Australia Australia Post Consideration of interstate surface mail transfer centre, Victoria

Australian National Railways Commission Royal Commision on grain

Victoria

Port of Melbourne Authority Future rail/road transfer

Northern Territory

Darwin Port Authority

Research into requirements of fishing industry to move base to Darwin

Appendix IV

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Commercial, financial and economic
    Australia
      Australian National Railways Commission
        Piggyback traffic
    New South Wales
      Newcastle Port Board
        Port strategy development study
        Oil-seed export proposal
        Cement clinker import proposal
        Optical fibre proposal
    Northern Territory
      Darwin Port Authority
        Evaluation of port charges throughout Australia to predict
        future revenue
  Operational
    Australia
      Australian National Railways Commission
        Oil transfer facilities options
        Fuelling facilities options
    Victoria
      Port of Melbourne Authority
        Rail/port coordination
        Container transit time studies
 Technical
    Victoria
      Metropolitan Transit Authority, Melbourne
        Bicycle facilities at railway stations
  Data collection and dissemination
    Western Australia
      Department of Marines and Harbours
        Port statistics and cargo movements
Multimodal
  Strategic
    Victoria
      Metopolitan Transit Authority, Melbourne
        Metropolitan public transport industry plan (METPLAN)
        MTA business plan
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Commercial, financial and economic
  Australia
    Australia Post
      Brisbane-Cairns linehaul arrangements
  Western Australia
    Metropolitan (Perth) Passenger Transport Trust
      Service criteria study
  South Australia
    Department of Marine and Harbors
      Analysis of performance of Port of Melbourne/interstate rail
      for container movements
Behavioural
  South Australia
    State Transporty Authority
      Before and after study: effect of fare changes
      (10 August 1986)
  Western Australia
    Metropolitan (Perth) Passenger Transport Trust
      Perth travel surveys, 1986
Operational
  Australia
    Australia Post
      Movement of mail between: Melbourne and Tasmania, Sydney and
      Adelaide and Sydney and Perth
  Victoria
    Metropolitan Transit Authority, Melbourne
      Redesign of bus services (REDBUS)
    Port of Melbourne Authority
      Delivery systems between Tasmania and mainland
  Western Australia
    Metropolitan (Perth) Passenger Transport Trust
      Evaluation of new integrated ticketing system for Transperth
      Public transport information in Perth
Technical
  Victoria
    Metropolitan Transit Authority, Melbourne
      Redesign of bus services (REDBUS)
      Eastern corridor public transport study (ECOPT)
      Proof of payment ticketing systems
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Appendix IV

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Data collection and disemination
    Victoria
      Metropolitan Transit Authority, Melbourne
        System usage monitoring
    Western Australia
      Metropolitan (Perth) Passenger Transport Trust
        Peformance indicators
Any mode
  Strategic
    Victoria
      Port of Melbourne Authority
        Forward development planning
    South Australia
      State Transport Authority
        Strategic options
  Operational
    Australia
      Australia Post
        Numerous ad-hoc type projects including international mail
        conveyance (rates, appropriate service/means)
        Examination of intrastate road mail contracts
        Remote air service operations
PRIVATE SECTOR
Air
  Commercial, financial and economic
    Australia
      Ansett Transport Industries
        Costing and price marketing
      East West Airlines
        Strategic evaluation of the airline market with regard to
        commercial implications
  Behavioural
    Australia
      East West Airlines
        Passenger origin/destination and attitude survey
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Ansett Transport Industries Inflight survey on consumer attitudes and behaviour Impact of sponsorship on purchaser behaviour Issues relating to business travel Issues in the distribution network Rail Strategic Western Australia Hamersley Iron In-house long term planning Robe River Railroad Investigate expansion proposals to new ore deposits, specifically the proposed transport options Commercial, financial and economic Australia BP Australia Costing study on specific rail routes to evaluate capital and operating costs Very Fast Train Joint Venture Pre-feasibility study of very fast train proposal Mayne Nickless Transport Services Group Development of new equipment to better handle movement of freight Conversion of 11.3m transiflats to 12.2m units Use of bulka bags and hopper systems for interstate cartage of pitch Western Australia Robe River Railroad Investigate feasibility of electrification of the railway Hamersley Iron In-house investment decisions Operational Australia BHP Slab and Plate Products Division Caster to slab yard transport Hot metal pre-treatment Slab yard shunting Plate subdivision

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Interworks transportation
     Design/development of steel sleepers and turnouts used for
      steelworks operations
   Melbourne Research Laboratories
      Operations model implementation
     Train performance calculator
 Western Australia
   Hamersley Iron
     Long train driving strategies
     Train simulator
     Traction related problems
   Mount Newman Railroad
      Wheel stresses and management
      Grinding efficiency
      Profile specifications
      Ballast characteristics
      Car bodies. materials
      Evaluation of car design
     Toe load requirements
      Rail replacement and sleeper tests
     Tamping efficiency
      Terminal model
      Train driving simulator support
      Locomotive cylinder condition monitor
      Locomotive logger support and solid state memory
      Fuel rack transmitter upgrade
      Remote brake control
      Rail stress
      Track video
      Feasibility study draft gear failure
    Robe River Railroad
      Locomotive fuel monitoring system
      Locomotive performance monitoring devices on train handling
      and maintenance procedures
Technical
 Australia
    Comena
      Ballast regulator
      Sleeper adzing machine
      Vandal resistant seats
      Fire resistant lining materials
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Double deck chopper cars Rack-drive passenger car New technology diesel locomotives High speed diesel train High speed TRIBO passenger locomotive High capacity people mover New lightweight ore car Bogieless suspension system Super high speed train Insulated tank wagon High speed diesel railcar Narrow gauge high speed bogies Articulated light rail vehicle Diesel-electric railcar Cooling group for diesel locomotive Heavy haul electric locomotive

BHP Railways, Long Products Division Materials testing for rails

Melbourne Research Laboratories Rail development Steel sleeper development Wheel stresser Automatic wheel inspection Track evaluation Subsurface wheel cracking New ore car design Vehicle requirements for high axle loads Wide gap thermit welds Ballast characteristics Rail profile degradation Axle load variability Retarder damage in wheels Rail grinding and lubrication Vehicle tolerances Wheel and rail profile assessment Wheel flange cracking Optimisation of wheel/rail profiles Wheel assessment

Queensland Comalco Railway Replacement rail sleeper type study

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Western Australia
     Hamersley Iron
       Train data loggers
       Wheel/rail interface
       Weld investigations
       Bogie-related problems
       Wheel-related problems
 Data collection and dissemination
    Western Australia
      Robe River Railroad
        Develop mainframe computer system for recording comprehensive
        database for all train operations
Road
  Strategic
    Australia
      Shell Co Australia
        Annual medium-term strategy
  Commercial, financial and economic
    Australia
      Mayne Nickless Transport Services Group
        Intermodal fuel savings
        Control of pallets
        Review of equipment requirements relative to increased mass
        limits
        Review of linehaul equipment utilisation
        Use of owner drivers versus company drivers
        Development of visa security system for the transport of
        cigarettes
  Behavioural
    Australia
      Shell Co Australia
        Vehicle accident database
      Mayne Nickless Transport Services Group
        Review of courses on offer
        Intermodal Morwell driver program
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Operational
Australia
Mayne Nickless Transport Services Group Feasibility study on computerised scheduling of pick-up and delivery vehicles Fleet management system
Shell Co Australia On-board vehicle information system PARAGON - packed scheduling ROVER - bulk scheduling Ongoing distribution studies by State Ongoing fleet evaluation by State
Technical
Australia
Shell Co Australia
On-board vehicle information system
Venicle maintenance information system Workshop study
Participation with Australian Institute of Petroleum.
Standards Association of Australia and Australian Liquefied
Petroleum Gas Association on standards and measurements
Ampol, Research and Development Department Optimising the deposit characteristics of leaded and unleaded petrol in automotives
BHP, Slab and Plate Products Division Study of blast furnace slag road pavements (University of NSW) Study of steel furnace slag in roadmaking (University of Newcastle)
Mayne Nickless Transport Services Group Program for improving fuel economy through changes to aerodynamics and equipment specifications Application of B Doubles
Comeng Suburban bus
Western Australia Hamersley Iron Specific local transport-related problems

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Data collection and dissemination Australia Shell Co Australia Extensive ongoing use of existing and new systems for gathering and disseminating information in relation to transport operational performance Sea Strategic Australia ACTA Shipping Possible extensions to the shipping industry Commercial, financial and economic Australia Mayne Nickless Transport Services Group Hammond Palmer transport straitliners Sea Pak bulk cement transport and discharge BHP Transport General research on customers, competitors, target markets, associated industries and vessel characteristics Western Australia CRA (Dampier Salt) Study of shipping systems for salt in bulk to the USA: cost comparisons Operational Australia ACTA Shipping Efficiency of container movements within Australia Technical Australia ACTA Shipping Minimising damage to special cargoes Data collection and dissemination Australia BHP Transport Collection and presentation of tonnage data for a variety of ports

Pipeline

Operational Western Australia Hamersley Iron Specific local conveyor-related problems

Technical

Western Australia Hamersley Iron Ongoing efforts to improve port conveyor performance

CRA (Dampier Salt) Feasibility of moving coal by pipeline

ACADEMIC SECTOR

Air

Strategic New South Wales Macquarie University, Prof D A Hensher Development and application of a method to evaluate airport investments in remote communities Queensland University of Queensland, Dr R L Pretty An update of noise effects from air operations at the new Brisbane airport University of Queensland, Assoc Prof T Grigg Strategic management of commercial airlines (a study of strategic options under a variety of regulatory and operating environments) Australian Capital Territory Australian National University, Dr P J Forsyth Study of trade in international aviation services and tourism Study of regulation and the impact of competition on domestic airlines Commercial, financial and economic New South Wales Macquarie University, Prof D A Hensher Role of the air mode in the inter-urban passenger market

Victoria Royal Melbourne Institute of Technology Preparation of Northern Territory Government submission to domestic air transport policy review Australian Capital Territory Australian National University, Dr P J Forsyth Productivity measurement in international airlines Behavioural New South Wales University of Newcastle, Prof R Telfer Pilot judgement training: a safety oriented program on pilot decision making (funded by DofA) Data collection and dissemination New South Wales University of Wollongong, Dr H Bendall Building database of air freight exports by commodity and destination Australian Capital Territory Australian National University, Dr P J Forsyth Development of database on international airlines Rail Strategic New South Wales University of Wollongong, Dr P G Laird Australian freight railway (Australian Transport Research Forum paper) Commercial, financial and economic New South Wales Macquarie University, Prof D A Hensher Future demand for the Very Fast Train Behavioural Victoria Monash University, Dr M A P Taylor Dynamic modelling of patronage on regional passenger rail services Operational New South Wales University of Wollongong, Dr Ross Robinson Demand projections for Very Fast Train project

Technical South Australia South Australian Institute of Technology, Mr R J Taylor Energy optimisation via driver advisory unit Western Australia Curtin University of Technology, Mr B Generowicz Comparison of ballast settlement and breakdown under three different types of sleeper Comparison of resilient rails pads Road Strategic New South Wales University of Sydney, Prof G Mills Equilibria in spatially-differentiated trucking markets with price regulation and without entry control Macquarie University, Prof D A Hensher Privatisation of urban roads: tollway pricing Demand for automobiles University of Wollongong, Dr P G Laird Land freight transport subsidies in New South Wales Submissions to infrastructure sub-committee of the House of Representatives Expenditure Committee on rail infrastructure and road funding Victoria Monash University, K W Ogden Gateway Bridge road freight impacts Road freight cost recovery Traffic management and road freight Traffic management: futures study Teaching package for road design Oueensland University of Queensland, Assoc Prof T Grigg Land use impact of the Gateway Bridge: includes subprojects of a) spatial linkage change in response to major urban road network change b) organisation ownership and control, spatial linkage and location, and linkage and location adjustment

James Cook University, Assoc Prof L C Wadhwa A rational approach to the distribution of Commonwealth road funds Commercial, financial and economic New South Wales University of New South Wales, Dr J A Black Economic evaluation of Sydney Harbour tunnel Costing of local area traffic management schemes Macquarie University, Prof D A Hensher Economics and efficiency of private bus sector Privatisation of public operations of buses University of Wollongong, Dr P G Laird Applicable road user charges for heavier trucks and B Doubles Victoria Chisholm Institute of Technology, K T Solomon Dandenong traffic study Royal Melbourne Institute of Technology Revision of metropolitan fire brigade strategy Plan for the provision of fire stations and equipment (based on an analysis of travel time data and risk assessments) Behavioural New South Wales University of Newcastle, Prof R Sanson-Fisher Resource package for use by community groups in implementing road safety programs University of Newcastle, Prof R Telfer Driver judgement training: a parallel program in driver education Adaptation of a driver education manual for NSW Traffic Authority University of New South Wales, Prof H J Goldsmid Development of night driving simulator Research on drivers' sleep and drowsiness University of New South Wales, Dr J A Black Traffic flow under mixed vehicle composition of traffic stream Traffic flow and queuing theory

Effects of random breath testing in NSW Driver perspectives of road design University of New South Wales, Prof H L Westerman Traffic management in suburban shopping strings in Sydney Victoria Chisholm Institute of Technology, K T Solomon A critique of vehicle speeds and speed limits on Victorian arterial roads The effects of drugs on driving skills Delineation and its effect on drunk drivers Monash University, Dr M A P Taylor Equilibrium assignment models Traffic behaviour on local streets Monash University, Assoc Prof T Triggs Ergonomic performance of advisory speed sign formats Heavy vehicle driver reaction times Queensland University of Queensland, Dr R L Pretty Trip attraction of suburban shopping centres Factors affecting bus boarding rates University of Queensland, Dr M Sheehan A longitudinal intervention study of drink driving with components: planning research, development of education program, process evaluation, implementation and long term outcome evaluation South Australia University of Adelaide, Mr A J Fisher Seatbelt use Road accidents and the Adelaide Grand Prix University of Adelaide, Dr J A McLean Evaluation of random breath testing by the police Rural road accident study The safety of forward control passenger vehicles Truck accidents on the Mt Barker road

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Western Australia Curtin University of Technology, Dr Howat The Curtin University health promotion program (The research included evaluation of various strategies aimed at reducing the prevalence of drink/drug driving by tertiary students.) Operational New South Wales University of New South Wales, Dr J A Black Bus priority systems Public transport operations and demand in Jakarta Evaluation of low cost traffic engineering measures Road design using MOSS model of surface systems Comparison of SIDRA and SIMSET models of traffic delays at intersections Accidents on rural roads University of New South Wales, Prof H L Westerman Traffic management in suburban shopping strings in Sydney University of Wollongong, Prof L Schmidt Safety and operational characteristics of arterial and sub-arterial intersections Design and operational characteristics of 'off-side priority' roundabouts University of Wollongong, Dr R Robinson Vegetation/ecosystem and environmental impacts of roads Victoria Chisholm Institute of Technology, K T Solomon Road and rail transport system in the State of Kelantan A review of speed limits and speed control methods on arterial roads Skid resistance Traffic planning and management Black spot analysis Study of accident exposure at intersections Traffic generation and signalised intersections Roundabouts: general and in Shire of Mornington Monash University, K W Odgen Heavy vehicle braking performance Truck safety Signing of roadworks on local streets

Monash University, Dr M A P Taylor Expert system for intersection design Energy and emissions in urban road networks Local area traffic management models Traffic simulation methodology Network connectivity Traffic operations on two-way two-lane rural roads University of Melbourne, Prof P Joubert The role of roadside objects in safety on rural roads University of Melbourne, Dr H Watson Fuel consumption and emissions from cars and trucks Quantifying truck and van fuel conservation strategies Heavy vehicle fuel conservation Oueensland University of Queensland, Dr R L Pretty Optimum rural road cross-sectional design Operation of roundabouts Bus route planning James Cook University, Assoc Prof L C Wadhwa Engineering and policy analysis in highway analysis Western Australia Curtin University of Technology, Mr B Generowicz Trip generation rates of various urban land uses Technical New South Wales University of Newcastle, B S Heaton Steelworks slag asphaltic concrete test sections Steelworks slag roadbase test sections Rational road pavement design with marginal materials Skid resistance of concrete road surfaces University of New South Wales, Dr J A Black Road lighting performance and design Victoria University of Melbourne, Dr H Watson Seed oils as fuel for diesel engines Dual fuel CNG/diesel engines Monash University, Dr M A P Taylor Vehicle exhaust emission models

Appendix IV

Queensland University of Queensland, Prof C J Apelt Flood forces on bridges South Australia South Australian Institute of Technology, Mr R J Taylor Bus diesel engine conversion to LPG University of Adelaide, Dr J A McLean Vehicle inspections at change of ownerships Western Australia Murdoch University Traffic management and energy conservation Curtin University of Technology, Mr B Generowicz Deterioration of pavement marking materials under traffic Hazardous situations resulting from certain geometric features of road junctions Road friction factors involved in traffic accidents Data collection and dissemination New South Wales University of New South Wales, Dr J A Black Road pavement friction measurements Victoria Monash University, Dr M A P Taylor Traffic analysis methodology Origin/destination survey methods Sea Strategic New South Wales University of Wollongong, Dr R Robinson Australian bulk shipping projections University of Wollongong, Dr H Bendall Port investment strategies, Newcastle Tasmania Australian Maritime College, Mr B Lewarn Study to identify specific costs imposed on Australian flag operators due to legislative and institutional provisions peculiar to the Australian shipping environment

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Commercial, financial and economic
    New South Wales
      University of Wollongong, Dr H Bendall
        Shipping and foreign exchange earnings
      University of Wollongong, Dr Ross Robinson
        Australian and foreign flag manning costs
        Port pricing models for selected Australian ports
        Economic impact of a major Australian port
   Victoria
      Royal Melbourne Institute of Technology
        Productivity measurements for ports
    Tasmania
      Australian Maritime College, Mr B Lewarn
        International shipping subsidies in the area of capital
        costs and their effect upon the viability of Australian
        flag shipping
 Operational
    New South Wales
      University of Wollongong, Dr H Bendall
        Management and statistics reporting system - Maritime Services
        Board
      University of Wollongong, Dr Ross Robinson
        Port simulation modelling for an Australian port
 Technical
    Victoria
      University of Melbourne, Prof P Joubert
        Extra-strain rates in turbulent boundary layers
 Data collection and dissemination
    New South Wales
      University of Wollongong, Dr H Bendall
        Port Adelaide and Hobart: market research and trade
         forecasts
Pipeline
 Operational
    New South Wales
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University of Wollongong, Dr R Robinson Environmental impact of coal slurry pipelines

Intermodal Commercial, financial and economic New South Wales University of Wollongong, Dr R Robinson Port and port-related costs for mineral exports Shore-based shipping costs in one Australian port Tasmania Australian Maritime College, Mr B Lewarn Alternative usage of port resources: a preliminary study **Operational** New South Wales University of New South Wales, Dr J A Black Access to distant airport sites Multi-objective planning methods for ports University of Wollongong, Dr P G Laird Submission to Inter-State Commission on piggy back services University of Wollongong, Dr R Robinson Truck delays at container terminals Oueensland University of Queensland, Dr R L Pretty Parking policy at a university campus Multimodal Strategic New South Wales University of New South Wales, Dr J A Black Urban public transport in Australia University of Wollongong, Dr P G Laird Submission to Royal Commission into grain handling storage and transport Victoria La Trobe University, A S G Lubulwa Effects of road haulage deregulation on government owned railways Transport deregulation and the economy wide implications of the Wheeler-Gilmour hypothesis Road haulage deregulation: simulations with ORANI ORANI-Transport: an extension of the ORANI model to analyse the impact of macro-economic activity on the demand for transport

Monash University, Dr M A P Taylor Integrated demand-supply models for transit routes to provide information for multiobjective decision making on public transport operations
Western Australia Murdoch University Transport patterns, land use and energy conservation policies for Australian cities Redevelopment potential for underutilised road and rail reserves
Commercial, financial and economic South Australia University of Adelaide, Dr T Mules Economics of container traffic at Port Adelaide (to determine the amount of income generated in South Australia by redirection of container traffic from Melbourne to Adelaide as a gateway port)
Australian Capital Territory Australian National University, Dr P J Forsyth Economics of road/rail competition Pricing and taxing of roads
Behavioural New South Wales University of Sydney, Prof B Fisher An analysis of the interrelationships between transport, handling and storage services for grain: farm to ships' holds
Macquarie University, Prof D A Hensher Time valuation: route choice models Dynamic discrete/continuous choice modelling
University of New South Wales, Dr J A Black Temporal stability of trip distribution models
Victoria La Trobe University, A S G Lubulwa Travel patterns of university students in Melbourne New cars and outmoded cars a catastrophe theory analysis of consumer instability

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Appendix IV
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Oueensland
      University of Queensland, Dr R L Pretty
        Travel surveys
    Western Australia
      University of Western Australia, Dr P McLeod
        Choice of transport to Perth used by visitors for the
        America's Cup
  Operational
    Victoria
      Monash University, Dr M A P Taylor
        Tram system parameters
      Monash University, K W Ogden
        Tram system service parameters
        Pedestrians at public transport facilities
      La Trobe University, A S G Lubulwa
        Technical efficiency: an interstate comparison of railways
        in Australia
    Queensland
      University of Queensland, Dr R L Pretty
        Pedestrian mall design
  Technical
    Victoria
      Monash University, Prof N W Murray
        The behaviour of structures specifically desiged for impact
        loading (structural crashworthiness)
  Data collection and dissemination
    Queensland
      James Cook University, Assoc Prof L C Wadhwa
        Transportation developments in Australian cities
Any mode
  Strategic
    Victoria
      Monash University, Dr M A P Taylor
        Scenario forecasting for trends in land use/energy/transport
        interactions in urban areas
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Australian Capital Territory Australian National University, Dr P J Forsyth Privatisation: control of public enterprise and impact on transport enterprises, adequacy and efficiency of transport infrastructure in Australia Commercial. financial and economic Queensland Brisbane College of Advanced Education, Dr P A Cassidy The Australian wool supply pipeline Technology and marketing logistics: low cost alternatives Behavioural New South Wales University of New South Wales, Dr J A Black Accessibility and travel in Malaysia and China Dynamics of land use and transport Australian parameters for quick response system Optimisation techniques and transport analysis Operational New South Wales University of New South Wales, Prof H L Westerman Interaction between traffic and road frontage along arterial roads Macquarie University, Dr P Gilmour Logistics management/distribution management Oueensland James Cook University, Assoc Prof L C Wadhwa Freight systems modelling Technical New South Wales Macquarie University, Prof D A Hensher Demand for automobiles and their utilisation Data collection and dissemination Oueensland James Cook University, Assoc Prof L C Wadhwa . Transportation software in Australia

ASSOCIATIONS SECTOR

Air

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Strategic
Australia
Regional Airlines Association of Australia
Industry analysis, regulation and competition
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Road

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Strategic
  Australia
    Australian Automobile Association
      Cost recovery in road transport
      Taxation of petroleum products
      Inter-State Commission investigation into cost recovery
      Analysis of automotive industry
    National Association of Australian State Road Authorities
      The Australian roads outlook report (TAROR)
      Accelerated loading facility
Commercial, financial and economic
  Australia
    Australian Automobile Association
      Road funding
      Changes in technology
      Review of road vehicle limits
Behavioural
  Victoria
    Royal Automobile Club of Victoria
      Drivers' speed perception
      Travel time surveys
      Travel lane behaviour
      Rural free speed management
      Urban free speed management
      Three-year-old traffic safety program
  Oueensland
    Royal Automobile Club of Queensland
      Surveys into seat belt wearing rates
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Operational Victoria Royal Automobile Club of Victoria Insurance accident database Highway facilities

Technical

Australia Australian Automobile Association Product testing Vehicle designs: safety

Data collection and dissemination Australia Australian Automobile Association Vehicle reliability survey Import parity pricing Fuel excise

New South Wales National Roads and Motorists' Association Survey of hydrogen sulphide smell from unleaded petrol cars Development of an automotive information database

UNIONS SECTOR

Rail

Strategic Australia Australian Railways Union House of Representatives infrastructure inquiry submission Submission to grain Royal Commission ARU submission to Inter-State Commission review of interstate registration charges

Commercial, financial and economic Australia Australian Railways Union ARU Victorian industry development initiative

Technical

Australia

Australian Railways Union ARU vehicle design committee

Appendix IV

Road

Strategic Australia Australian Railways Union House of Representatives infrastructure inquiry submission Submission to grain Royal Commision ARU submission to Inter-State Commission review of interstate registration charges Commercial, financial and economic Australia

Australian Railways Union ARU analysis of review of road vehicle limits (various States) Road cost recovery (national and various States)

Behavioural

Australia Australian Railways Union Submission to NSW Staysafe Committee

Sea

Strategic Australia Seamen's Union of Australia Industrial aspects and future needs of the shipping industry and the broader national political and industrial spheres

Intermodal

Strategic Australia Australian Railways Union Submission to Inter-State Commission intermodal inquiry

Multimodal

Commercial, financial and economic Australia Australian Railways Union Financing options (rail, road and multimodal) Specific urban public transport submissions and papers for various States

APPENDIX V ARRDO RESEARCH PROGRAM

This outline of the most recent research program of the former Australian Railway Research and Development Organisation has been derived from the provisional ARRDO Research Program to 30 June 1987.

MARKET INTELLIGENCE

Projects:

- . market intelligence reports
- . economic reviews.

Research in this area was intended to focus on those factors which impact on the demand for rail transport but which are not controllable by railways. The objective was to identify trends which are likely to have significant implications for rail transport activity.

MARKET SECTOR ANALYSIS

Projects:

- . freight
- . long distance passenger
- . urban.

The objective of this program area was to analyse in detail the characteristics of particular markets, with the aim of providing railway managements with information and analyses to assist them in developing marketing strategies.

Projects would include review, analysis and evaluation of rail market potential in particular markets (and especially competitive markets), market surveys, demand studies and evaluation of particular marketing strategies.

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RAIL TRANSPORT OUTLOOK

Projects:

- . corporate financial model
- . development of corporate financial performance indicators.

The corporate financial model was an aggregate 'what-if' model, for use in diagnosing and projecting the performance of a rail system in the light of managerial policies and changes in the rail environment.

The development of a set of corporate financial performance indicators aimed to provide a broader set of indicators than were currently published and used by the rail systems. These financial performance measures would be incorporated as output from the corporate financial model.

COSTS AND COST STRUCTURES

Projects:

- . cost models for financial analysis
- . contribution analysis.

Existing costs and cost structure models within each rail system were to be adapted to make them consistent with a common framework.

The second project aimed to provide an up-to-date contribution analysis by standard traffic groups (including urban and non-urban passengers) for Australian railways as a whole, together with cost models applicable to individual traffics and activities.

RAIL TRANSPORT ECONOMICS

Project:

. economic impact and economic performance of railways.

The acquisition and use by railways of physical resources imposes costs and provides benefits, the values of which are not necessarily captured by financial measures. The objective of this program was to examine railways from an economic point of view.

The work would have examined the economic costs of railway resources and activities and related these to cost recovery in rail and other modes. It would have sought to identify approximate ways in which economic costs and benefits could be established.

RAIL TRANSPORT NETWORK PERFORMANCE

Projects:

- . technical relationships in line, terminal and network operations
- . performance characteristics of network elements.

This work aimed to extend ARRDO's network model (which was essentially a line-haul model), and would have made use of other network models where appropriate. Network structures and any cost inputs were to be consistent with those of rail systems.

The objective was to develop technical relationships applicable to particular line and terminal operations and to network operations as a whole. This would have entailed analysis of capacity, speed, delay and other performance characteristics of network elements.

The model was mainly intended for assessment of the physical performance of railways under varying conditions, and for development of performance indicators.

CAPITAL/MAINTENANCE TRADE-OFFS

Projects:

- . further development of existing locomotive model
- . development of a general replacement evaluation model for track.

The aim of the first project was to further develop the existing model, to facilitate and simplify its use and extend its capabilities to include additional cost types and to cover application to replacement evaluation for diesel rail cars and electrical multiple units.

The second project was intended to develop the existing model into a more general replacement evaluation model which could be used to assess track investment proposals (such as upgradings and rehabilitations).

RAIL TRANSPORT ASSET INVENTORY

Projects:

- . track and related infrastructure
- locomotives
- other rolling-stock.

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The objective of this program was to develop nationwide assets inventories for these three types of assets, in the form of a number of related data bases. The approach to be used was progressive expansion from initially-restricted data bases in response to actual rather than perceived use and deficiencies.

RAIL TRANSPORT MOVEMENTS DATA BASES

Projects:

- . intersystem freight
- . intrasystem freight.

The objective of this program was to develop and maintain movements data bases (initially for intersystem and intrasystem freight) in consistent, up-to-date, accurate and readily-usable form.

RAIL TRANSPORT PERFORMANCE DATA BASE

Projects:

- . systematic performance measures
- . performance data base development.

This program was designed to review and assess systematic performance measures.

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AGPS	Australian Government Publishing Service
AN	Australian National
ANL	Australian National Line
ARRB	Australian Road Research Board
ARRD	Australian Road Research Documentation
ARRDO	Australian Railway Research and Development Organisation
ARRIP	Australian Road Research in Progress
ARTAC	Australian Road Freight Transport Advisory Committee
ASTEC	Australian Science and Technology Council
ATAC	Australian Transport Advisory Council
ATID	Australian Transport Information Directory
ATLIS	Australian Transport Literature Information System
ATRIP	Australian Transport Research in Progress
AVIAC	Aviation Industry Advisory Council
BTE	Federal Bureau of Transport Economics
CSIRO	Commonwealth Scientific and Industrial Research
	Organisation
DofA	Department of Aviation
DoT	Department of Transport
FORS	Federal Office of Road Safety
GIRD	Grants for Industry Research and Development (Scheme)
IRRD	International Road Research Documentation
ISC	Inter-State Commission
LASORS	Literature Analysis System on Road Safety
MSAC	Maritime Services Advisory Council
NAASRA	National Association of Australian State Road Authorities
NERDDC	National Energy Research, Development and Demonstration
	Council
NMHB	National Materials Handling Bureau
OECD	Organisation for Economic Co-operation and Development

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QR	Queensland Railways
R&D	research and experimental development
RIC	Railway Industry Council
ROA	Railways of Australia
SRA	State Rail Authority (of New South Wales)
TIAC	Transport Industries Advisory Council
TP&R	Transport Planning and Research (Program)
V/Line	State Transport Authority (of Victoria) (trading name)
Westrail	Western Australian Government Railways (trading name)