

TRANSPORT RESEARCH - WHERE IS IT GOING?

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*Abstract:*

*This paper was prompted by the remarks made by several participants at the 5th ATRF and the author's concern about the direction, quality and relevance of transport research presently being undertaken.*

*The paper reviews the research activities and underlying philosophies of State and Federal Government agencies, consulting firms, tertiary institutions and other organisations and questions whether the results produced by those agencies advance the state-of-the-art.*

*In an effort to encourage as much discussion as possible on the topic the paper debates the relevance of transport research presently being undertaken and suggests how, through changes to the present institutional arrangements and philosophies, it may be possible to remedy the situation.*

*The paper should be of interest to those who are responsible for directing research in transport or sponsoring such research.*

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### INTRODUCTION

To properly reflect its content this paper should be subtitled "Who's Doing It and Why" since it addresses the more philosophical aspects of transport research and questions whether current research work is relevant and whether the present institutional framework within which it is undertaken is appropriate.

Those who attended the 5th ATRF will recall that a number of participants expressed concern that the programme contained few papers which could truly be described as reports on research in progress. Mention was made of the fact that each successive ATRF seemed to be drifting further and further away from being a meeting at which researchers could report upon their work and obtain useful feedback from practitioners and other researchers. In short it was stated that we were losing sight of the fact that ATRF stands for Australian Transport RESEARCH Forum.

For my own part I have, in the course of my work, come into contact with a number of researchers from various disciplines who all claim to be undertaking research into transport. Since much of their work can most charitably be described as superficial or a reworking of old theories and/or concepts it was considered that there was a pressing need to review the whole topic of transport research and try to establish what its goals should be in the future.

Before launching into the debate proper it is perhaps worthwhile to examine the institutional framework within which transport research is presently being undertaken.

### INSTITUTIONAL FRAMEWORK

Viewed in its broadest sense transport research is sponsored by State and Commonwealth Governments, (thanks in part to the Transport Planning and Research Act<sup>(1)</sup>) and is undertaken by State, Local and Commonwealth Government transport agencies, consultant firms, semi-government transport bodies (e.g. ARRDO<sup>(2)</sup>, ARRB<sup>(2)</sup>, etc.) and tertiary educational institutions.

Although one would therefore expect that transport research would be flourishing, if one examines the latest progress report of the Transport Planning and Research Program (Department of Transport 1979) one finds that such is not the case. One of the reasons for this lack of progress lies in the institutional framework within which it is undertaken.

#### Government Transport Agencies

Consider firstly the research work undertaken by Government transport agencies at the State, Local and Commonwealth levels.

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1. Transport Planning and Research (Financial Assistance) Act 1977.
  2. Australian Railway Research and Development Organisation (ARRDO) Australian Road Research Board (ARRB).

Although the increased financial assistance provided through legislation such as the Transport Planning and Research Act has encouraged Government transport agencies to undertake more research and planning work, emphasis has in general tended to be given to planning rather than research.

The reasons for this situation are that such agencies are, as a general rule, in the business of providing practical solutions to current and future transport problems and providing timely advice to Government on a variety of transport policies and strategies. Since this work is undertaken within a necessarily limited time frame it is neither feasible nor possible to carry out more than a limited amount of research. The techniques which can be used are generally restricted to those which are well proven and able to yield a useful result even though the result may have imperfections theoretically.

While some Government transport agencies seek to improve this situation by sponsoring research by semi-government transport bodies (e.g. ARRDO, ARRB, etc.) and tertiary educational institutions, it will be shown later that this is not altogether effective.

#### Consultants

Because a large proportion of the research and planning work undertaken by Government transport agencies is performed by consultant firms they also have tended to concentrate on planning rather than research work. Even when a client employs them to undertake a research project it is not possible for them to carry out such work in the same manner as a tertiary educational institution. Firstly they must not only operate under a time constraint but also under a more stringent cost constraint. They cannot therefore afford to "follow a lead" but must carefully plan their work to ensure that it produces a useful end product within a specified budget. Secondly, because they operate on a commercial basis in a shrinking and increasingly competitive market they cannot afford to commit staff resources full-time to one project. Finally, because they cannot afford to be altruistic and sponsor research from their own resources they are not able to significantly advance the state-of-the-art. They must rely on the research work carried out by others and be able to tailor that work to their client's requirements. Few clients will appreciate being provided with the most advanced analytical tools if the costs which they had to incur are considered to be too high. If a consultant is audacious enough to attempt pure research at his client's expense he is likely to find that his long term prospects become very uncertain indeed.

#### Semi-Government Organisations

Although semi-government transport organisations such as ARRB<sup>(1)</sup>, ARRDO<sup>(2)</sup>, NAASRA<sup>(3)</sup> and the ill fated Commonwealth Bureau of

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1. ARRB - Australian Road Research Board
  2. ARRDO - Australian Railway Research and Development Organisation
  3. NAASRA - National Association of Australian State Road Authorities

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Roads (CBR) were originally established as transport research centres the research which they now undertake is largely applied research based on the work of others tailored to Australian conditions. This is not really surprising when one examines the environment in which they operate. Firstly since they obtain most of their funds from Government transport agencies they are constrained to examine issues which are of concern to those agencies and they must produce a useful end product within a relatively short time frame. While it is possible to carry out applied research in such an environment, particularly when the proposed analytical techniques have already been developed, it is not possible to undertake pure research. Pure research work may not yield a useful end result even though it advances the state-of-the-art. Secondly, because they operate under the guidance of a number of committees, composed of members of Government transport agencies, who are responsible for reviewing their research programmes and setting priorities, the programmes developed tend to reflect the requirements of those Government transport agencies.

Although, to be fair, one must acknowledge that semi-government organisations do carry out pure transport research, it is largely restricted to experiments into civil engineering materials, structures and the like. The more complex and exotic issues of transport research (e.g. locational and travel demand issues, etc.) tend to be given lower priority in their programmes.

In a similar fashion to Government transport agencies, semi-government organisations seek to promote research by sponsoring work at tertiary education institutions.

### Tertiary Education Institutions

This group, which includes Universities, Institutes of Technology, Colleges of Advanced Education and the like, is possibly the most important of all since only they can provide an environment which is conducive to pure transport research. While it would be pleasing to be able to report that transport research is flourishing at tertiary institutions, my observations suggest that such is not the case. The reasons for this are threefold.

Firstly, since tertiary institutions derive a significant proportion (if not all) of their income for research from grants by Government and semi-government transport agencies, for which there is considerable competition, they are under pressure to assign high priority to applied rather than pure research because the former is more marketable. Pure research thus tends to be underfunded with the result that progress is slow and results are often inconclusive because work has had to be terminated prematurely.

Secondly, the level at which the bulk of research is undertaken (i.e. undergraduate and/or post graduate) is not appropriate. Consider for example the type of research which is carried out at the undergraduate level. Because it is usually undertaken in the final year of a course in conjunction with other studies the research topics selected must not require

students to spend too much time on investigation or analysis since they must have sufficient time to write (and print) a thesis or report describing their work. Research work undertaken by undergraduates thus tends to be relatively shallow and reflect its purpose, namely to demonstrate that they can investigate a topic, analyse results and write a report. While research undertaken at the postgraduate level tends to be more substantial it also suffers from the fact that it is being carried out to enable a student to obtain a higher degree. Because it is undertaken within a reasonably fixed time constraint, postgraduate students must select research topics that will yield results in the short term and not require many years of investigation. They therefore are not encouraged to attempt to break new ground and venture into areas which have not previously been explored by others. Consequently their work often involves using different (better?) techniques to solve problems which are currently being faced by practitioners in the "real world". There are of course exceptions which come to mind but they are unfortunately somewhat rare. Beyond the postgraduate level the picture becomes very gloomy indeed. Because tertiary institutions in Australia do not as a general rule employ large numbers of people solely for the purpose of carrying out research, responsibility for this usually falls on the shoulders of the teaching staff. Unfortunately, due to their teaching commitments and other responsibilities (e.g. supervising students research), they are not able to concentrate on research full time. Their progress thus tends to be extremely slow.

Finally, tertiary institutions are unable to retain suitably qualified and experienced researchers in the long term and thus establish specialist research groups. This is in part due to the fact that tertiary institutions do not appear to consider the establishment of such specialist groups to be important. It is also due to the fact that students, like everyone else, seek employment in organisations which offer adequate remuneration and career prospects.

Because Government and semi-government transport organisations and consulting firms compete aggressively between themselves for recruits and offer attractive career prospects they tend to acquire the more talented students soon after graduation. Tertiary institutions are thus unable to retain such students and establish a core of specialist researchers.

While the institutional framework described above contributes significantly to the current malaise it is by no means the only factor. In fact, the most important factor which has emerged over the last decade is that which results from what I have termed the "Bandwagon Syndrome".

#### BANDWAGON SYNDROME

To clarify what I mean consider the history of transport research in the past two decades. In the early 1960's transport research was largely carried out by engineers and civil engineers in particular. This occurred, it appears, in response to a need to gain an understanding of the factors influencing travel behaviour in urban areas to enable the transport system to be planned and designed as a complete entity rather than as a series of small isolated segments.

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Being applied scientists they used scientific techniques to analyse travel behaviour and they formulated mathematical models based on the theories of the physical and mathematical sciences (e.g. the gravity model) calibrated using data collected from household interview and other surveys. The reason why models were developed based on the theories of the physical rather than the social sciences was simply that the latter were more qualitative than quantitative at that time. While the models developed worked well using base year survey data (not unexpectedly) they did not provide reliable forecasts of demand. This latter shortcoming was due in part to the temporal instability of some of the model parameters and also to the fact that the forecasts of the variables used by the models were extremely inaccurate. The engineers also developed what has now become known as the "four step" transport planning process; trip generation, trip distribution, mode split and assignment. Although there was nothing drastically wrong with the process provided it was iterated through a number of times to achieve a degree of balance between the transport and land use variables (and systems), because the process was expensive in computer time, iteration seldom occurred. As a result, transport studies which adopted the single pass four step process, were characterised by their habit of recommending the building of extensive freeway networks which, had they been built, would have accelerated urban sprawl and necessitated the building of more and more freeways.

Because the freeway solutions recommended by these transport studies were considered to be unacceptable by both the public at large and politicians; by the beginning of the 1970's there was considerable disenchantment amongst transport planners with the techniques available and the processes then in use. They were unwieldy to use, data intensive, extremely costly and did not allow transport planners to address the important policy and planning issues which were emerging.

As a result of this and because transport was a topical subject for which there was a considerable amount of useful data and research money available, researchers from disciplines other than engineering (e.g. economists, social scientists, geographers and town (urban) planners) became increasingly interested in transport research. Although this should have resulted in considerable advances being made in a field which, by its very nature is multidisciplinary such has, unfortunately, not been the case. The reasons why advances have not been made appear to be twofold.

Firstly instead of concentrating on improving the state-of-the-art by building upon the work already done, researchers from each new discipline entering the field waste time attempting to prove that their theories are the only ones which make sense. Given the shaky foundations of most of these theories and the fact that none of them adequately explain travel behaviour it would seem futile to waste time trying to convince the world that their theories are superior to those of other disciplines.

Secondly while researchers from the new discipline have undeniably improved the analytical techniques (models) available to transport planners, in many respects they have done little more than reinvent the wheel. Consider for example the models developed by economists over the past decade. While the disaggregate travel demand models based on the multinomial logit model offer one the ability to address a number of policy issues, at the aggregate (i.e. Metropolitan area) level they suffer from many of the problems encountered when models such as the gravity model were used. They yield unreliable results at the aggregate level and do not perform well when used to forecast demand. Transport planners still do not have techniques which allow them to understand and analyse the complex inter-relationship between transport and urban development. They still lack a reasonably clear understanding of the factors which motivate people to live in specific locations, to travel by a specific mode of transport at a particular time of day. It is still difficult to accurately forecast the level of patronage which can be expected for a new transport route or new transport mode.

Although the discussion thus far has presented a fairly gloomy picture of transport research there is no compelling reason why it should continue to be so in the future.

#### WHAT OF THE FUTURE

While the future direction of transport research should really be established by the participants at this Forum in view of the foregoing comments it behoves me to make some suggestions. Based on my own past experience and observations there is considerable scope for improvement in a number of important areas.

Firstly, tertiary institutions need to recognise that transport research requires a coordinated multi-disciplinary approach and cannot be undertaken successfully within the narrow confines of any one discipline. There is clearly a need for tertiary institutions to establish specialist transport schools (faculties?) composed of academics from several different disciplines not just engineering, economics and the like.

Secondly, tertiary institutions need to place greater emphasis on pure as distinct from applied transport research since, without the former there is little likelihood that the state-of-the-art will advance over the coming decade. Tertiary institutions must therefore establish specialist research groups for this purpose who are able to compete on equal terms with other employers. They must also provide such groups with adequate financial resources to enable them to function effectively. Ideally funds should be apportioned between pure and applied research in an equitable manner.

Thirdly, semi-government transport organisations and those agencies responsible for overseeing their work, also need to recognise the multi-disciplinary nature of transport research and undertake their work using a coordinated, multi-disciplinary approach.

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Finally, since Government transport agencies benefit most from the research carried out at tertiary institutions and semi-government transport bodies, they must provide significantly more financial support. Whether this is done indirectly through legislation such as the Transport Planning and Research Act or by offering scholarships to postgraduate or postdoctoral students it does not matter, just so long as it is done.

To conclude on an optimistic note, if the deficiencies identified in the foregoing discussion are overcome then there is a reasonable hope that transport research will flourish in the eighties and yield considerable benefits as a result.

### REFERENCES

DEPARTMENT OF TRANSPORT (1979), The Transport Planning and Research Programme, Report on Progress to 30th June, 1979.