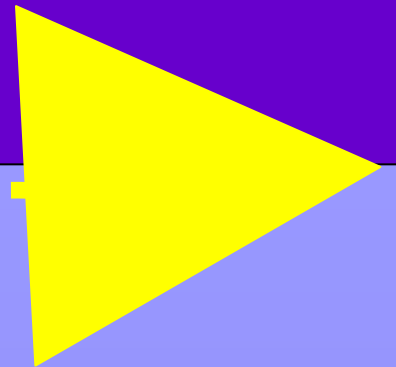


AP-R242

**ECONOMIC EVALUATION OF ROAD
INVESTMENT**

**Estimating Urban Inter-Modal Benefits
A Literature Review**



AUSTROADS

ECONOMIC EVALUATION OF ROAD INVESTMENT

Estimating Urban Inter-Modal Benefits – A Literature Review

***Economic Evaluation of Road Investment:
Estimating Urban Inter-Modal Benefits – A Literature Review***
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ECONOMIC EVALUATION OF ROAD INVESTMENT

Estimating Urban Inter-Modal Benefits – A Literature Review



AUSTROADS PROFILE

Austrroads is the association of Australian and New Zealand road transport and traffic authorities whose purpose is to contribute to the achievement of improved Australian and New Zealand transport related outcomes by:

- ◆ developing and promoting best practice for the safe and effective management and use of the road system
- ◆ providing professional support and advice to member organisations and national and international bodies
- ◆ acting as a common vehicle for national and international action
- ◆ fulfilling the role of the Australian Transport Council's Road Modal Group
- ◆ undertaking performance assessment and development of Australian and New Zealand standards
- ◆ developing and managing the National Strategic Research Program for roads and their use.

Within this ambit, Austrroads aims to provide strategic direction for the integrated development, management and operation of the Australian and New Zealand road system — through the promotion of national uniformity and harmony, elimination of unnecessary duplication, and the identification and application of world best practice.

AUSTROADS MEMBERSHIP

Austrroads membership comprises the six State and two Territory road transport and traffic authorities and the Commonwealth Department of Transport and Regional Services in Australia, the Australian Local Government Association and Transit New Zealand. It is governed by a council consisting of the chief executive officer (or an alternative senior executive officer) of each of its eleven member organisations:

- ◆ Roads and Traffic Authority New South Wales
- ◆ Roads Corporation Victoria (VicRoads)
- ◆ Department of Main Roads Queensland
- ◆ Main Roads Western Australia
- ◆ Department of Transport and Urban Planning South Australia
- ◆ Department of Infrastructure, Energy and Resources Tasmania
- ◆ Department of Infrastructure, Planning and Environment Northern Territory
- ◆ Department of Urban Services Australian Capital Territory
- ◆ Commonwealth Department of Transport and Regional Services
- ◆ Australian Local Government Association
- ◆ Transit New Zealand

The success of Austrroads is derived from the synergies of interest and participation of member organisations and others in the road industry.

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EXECUTIVE SUMMARY

The Austroads Strategic Plan 2001 – 2004 (Austroads 2001) identifies inter-modal effects as a priority (*inter-modal* defined as one type of a *multi-modal* journey). The eventual aim of Austroads work on inter-modal effects is to broaden harmonised urban transport investment evaluation, by including the effects on trips by bus, rail, cycle and on foot, with bus and rail as first priorities.

The work reported in this document involves a review of the literature to explore the availability of data, analysis and findings that could assist in estimating inter-modal benefits related to urban transport project evaluations. A review of both the Australasian (including a ‘targeted’ search of road authorities) and international literature was performed to establish the availability of this information.

Another purpose of this literature review is to provide input in scoping the development of a consistent approach that can be used in Australasia to evaluate urban transport road user effects (RUE), including the effects on trips by bus, rail, cycle and on foot. This report could also assist in scoping the development of appropriate software and supporting documentation that are suitable for use with the HDM-4 RUE module.

At present there are no accepted standards or guidelines for evaluation of benefits of travel using other modes in conjunction with car or truck travel.

Issues to be addressed include degrees of elasticity of demand among modes, estimating costs of changing modes (time and convenience and comfort), and quantifying parameters such as occupancy rates, travel times and trip purpose for public transport, and to a lesser extent, cycling and on foot movements.

At the heart of this study is the question of sustainability of transport systems in their current state. It is widely recognised that high dependence on the car for all trips, or for entire trips, may not be an efficient approach to meeting transport needs. However, attributes of car use such as convenience to the user may also have to be considered in seeking to achieve transport system efficiency and sustainability outcomes.

The eventual objective is to find a suitable methodology that can be used to assess inter-modal effects. As a first step, a search of literature and practice has been undertaken to establish whether or not a system or systems of this kind exist. It was found that there were trends towards developing such a methodology, emanating mainly from Europe, but with work moving roughly in the same direction, although not as comprehensive, also being done in the United States.

The findings of this literature review are examined against a framework or hierarchy of approaches to the problem, which is set out at the start of the report. A summary of these findings is presented below and the following conclusions can be drawn:

- ◆ Recent advances in assessing benefits of multi-modal projects are concerned with establishing a broader context within which traditional Benefit-Cost Analysis (BCA) ought to be carried out. The traditional methodologies applied to road-based projects are considered inadequate in this regard (see Section 3 for more detail).
- ◆ Factors other than standard BCA components that recent studies indicate should be considered are (see Guidance on the Methodology for Multi-Modal Studies (GOMMMS) by DETR 2000, Section 4.2):
 - environmental impacts;
 - equity, social inclusion and addressing social problems;
 - Local government objectives;
 - State or National government objectives; and
 - sustainability.

- ◆ Few changes to economic analysis seem to have occurred. Most of the changes that have occurred are geared towards correctly tracking and understanding transport related revenues, costs and subsidies.
- ◆ In Europe major studies have been undertaken to develop an analytical framework in which economic BCA is paired with an assessment of tangible and intangible indicators to which monetary values cannot be ascribed (see EUROSIL 2000, Section 4.3).
- ◆ The United States is at the point of identifying the types of benefits and dis-benefits, which need to be considered alongside economic costs and benefits. However, they still see this extended list of evaluation aspects in the context of comparing road alternatives, rather than comparing multi-modal solutions with one another.
- ◆ Because of the sheer number of variables which can affect the success or otherwise of a project, there is as yet, no simple predictor of success. It appears that at least one current school of thought is advocating identifying common factors in success and failure stories as a first generation type of a prediction tool.
- ◆ Traditional single factor and localised studies are still needed in order to build the knowledge base for more systematic prediction tools, but they must be coordinated in order to deliver maximum value. Their role would be to limit reliance on assumptions made in compiling a global prediction tool.

Where to from here?

It is obvious and not surprising from the literature review that there is very little in terms of a comprehensive evaluation framework for multi-modal trips and investments. However, there is increasing research effort to better respond to an accelerating demand for appropriate evaluation approaches.

Given the number of variables which can affect the success or otherwise of a multi-modal project, and that the literature review did not identify a simple predictor of success, there may be merit in a wide ex-post survey of multi-modal projects, with the aim of determining the critical success factors of multi-modal transport projects.

In the short run, sets of demand elasticities (mostly for public transport) could be developed from those found in the literature for use in current evaluation frameworks of various jurisdictions.

The scope of the data and methodology requirements for estimating key evaluation parameters of the demand for multi-modal trip types could also be developed, for example, 'short' (or 'short' segments of) car trips, cycling and walking. It is anticipated that advanced survey techniques (eg Stated Preference surveys) would have to be considered for the collection of key data required to estimate these parameters (attributes) of the demand for non-motorised modes as well as some trip types of the motorised modes. For example, these types of data have been pursued in metropolitan centres such as Sydney and Adelaide (notably) and in pursuits of estimating the value of travel time for freight (Austroads 2003).

A prime objective is to be able to compare alternative options such as road investment, rail, bus only, transitways and cycling (for example, including the health benefits of cycling). The benefits of these alternative options need to be identified and valued along with the costs in a BCA type framework.

Finally, future work can extend the review of key studies identified in the literature search, which deal with methodologies of broader (than standard BCA methods) analytical processes. The aim here would be to better assess multi-modal (including non-motorised travel) objectives that may be addressed using more 'top-down' strategic transport evaluation/planning approaches.

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ABBREVIATIONS AND ACRONYMS

ARRB TR	ARRB Transport Research Ltd
BCA	Benefit-Cost Analysis
BTRE	Bureau of Transport and Regional Economics (Australia)
COBA	Cost Benefit Analysis (UK BCA methodology and system) (The COBA Manual is Volume 13 of the UK Design Manual for Roads and Bridges)
Db(A)	Decibel, a measurement unit for noise intensity
DETR	Department of the Environment, Transport and the Regions (UK)
DfT	Department for Transport (http://www.dft.gov.uk)
DoT	Department of Transportation
DTLR	Department of Transport, Local Government and the Regions (UK)
EUROSIL	European Strategic Inter-modal Links
FHWA	Federal Highways Administration (a Bureau of the US DoT)
GOMMS	Guidance on the Methodology for Multi-Modal Studies (a 2000 DETR publication)
HDM	Highway Development and Management (formerly Design and Maintenance Standards) – models, software and documentation initially developed by the World Bank and released in 1979, based on the Highway Cost Model produced by the Massachusetts Institute of Technology in 1971/72.
HDM-4	HDM-III was introduced in 1987. The International Study of Highway Development and Management (ISOHDM), managed by the World Road Association (PIARC), developed HDM-4. PIARC released HDM-4 in 2000. Only HDM-4 is supported since 2000. In 2000, PIARC released an improved model for estimating changes in road user costs, known as the RUE (Road User Effects) set of models in HDM-4.
HETA	Highways Economics and Traffic Appraisal (a Division of the former DETR (UK)). HETA is now IETA.
IETA	Integrated Transport Economics and Appraisal (a Division of DfT)
IMO	Inter-modal, Multi-modal, and Inter-operability
MCA	Multi-Criteria Analysis
NCHRP	National Co-operative Highway Research Program (US)
PEN	Pan European Network
PIARC	World Road Association (formerly ‘Permanent International Association of Road Congresses’)
RUE	Road User Effects
SP	Stated Preference
TEN	Trans European Network
TOD	Transit-Oriented-Development
TRPC	Thurston Regional Planning Council (UK)
TUBA	Transport User Benefits Appraisal
UK	United Kingdom
URECA	Urban Economic Appraisal
URL	Uniform Resource Locator
US	United States
VTPI	Victoria Transport Policy Institute (British Columbia, Canada)

SPECIAL USE OF TERMS

The terms “inter-modal” and “multi-modal” are used in this document with the following interpretations:

Inter-modal	Use of at least two different transportation modes for a single trip.
Multi-modal	Competing transport modes in a given corridor.

1. INTRODUCTION

1.1 Context

The eventual aim of Austroads work on inter-modal benefits is to broaden harmonised urban transport investment evaluation by including the effects on trips by bus, rail, cycle and on foot, with bus and rail as first priorities. This inter-modal effects work is a direct response to ‘calls’ in the Austroads Strategic Plan 2001 – 2004 (Austroads 2001). Objective 1.2 is, in part, “to improve modal integration between road and other transport modes and between road-based transport modes”. Similar issues are raised in Strategy 2 (page 2 of the Strategic Plan), which calls for the “development of guidelines and techniques for consistent evaluation of modes, including transport investment for different modes”.

The work reported here involves a review of the literature to explore the availability of data, analysis and findings that could assist in estimating inter-modal benefits related to urban transport project evaluations. A review of both the Australasian (including a ‘targeted’ search of road authorities) and international literature was performed to establish the availability of this information.

Another purpose of this literature review is to provide input in scoping the development of a consistent approach that can be used in Australasia to evaluate urban transport road user effects (RUE), including the effects on trips by bus, rail, cycle and on foot. This report could also assist in scoping the development of appropriate software and supporting documentation that are suitable for use with the HDM-4 RUE module.

At present there are no accepted standards or guidelines for evaluation of benefits of travel using other modes in conjunction with car or truck travel.

Issues to be addressed include:

- ◆ degrees of elasticity of demand among modes;
- ◆ estimating costs of changing modes (time and convenience/comfort);
- ◆ quantifying parameters such as occupancy rates, travel times and trip purpose for trips by bus, rail, cycle, and on foot, and for trips using various combinations of these component modes; and
- ◆ varying degrees of subsidy for different modes may also be a relevant issue.

1.2 Description of the ‘Problem’

Effective use of multi-modal options of travel is essentially a means to make transport systems more efficient and more sustainable. It is widely recognised that high dependence on the car for all trips, or for entire trips, may not be an efficient approach to meeting transport needs. Generally, convenience to the user may outweigh matters of wider concern such as overall efficiency in allocating scarce resources, and sustainability of the transport system. Therefore, at the heart of a study on multi-modal benefits is the question of sustainability of transport systems in their current state. In broad terms, one of the major benefits of an effective multi-modal system is the extent to which it allows historical car and truck travel trends to be reversed. Effectiveness of a multi-modal system is therefore dependent on factors affecting modal choice, such as convenience, price differentials between options, travel time, and time to change modes.

In a broad sense therefore, assessment of developments in analysing the benefits and costs of multi-modal projects must also depend on developments in predicting and ensuring that a portion of users trade-off less efficient travel choices for more efficient ones.

Making other modes of passenger travel more attractive than private cars has technical and economic complications. Related to car ownership and use, there are issues of capital costs, vehicle operating costs and taxes that are met by the user, but also externality pricing issues related to environmental, congestion and safety costs that are often not directly *recognised* by the user. In addition, there are infrastructure costs and decisions that are required to create a different balance of multi-modal transport infrastructure to that currently available. However, sustainable transport system concerns, lifestyles and community expectations about the liveability of cities and suburbs may increase the pressure on decision making for a different modal balance. A much more integrated approach to transport (passenger and freight) would be required to find infrastructure investment solutions that are efficient and supported by the community. This is also likely to lead to pressures in overhauling the current taxation regimes applied by governments in raising revenues to pay for new transport and non-transport infrastructure. To begin to answer some of these issues, the need for more appropriate data and methodologies is heightened in order to provide a meaningful account of the benefits and costs of planned multi-modal transport outcomes.

The objective that gave rise to the work reported in this document is to find out what would be an appropriate methodology to use in assessing passenger travel mostly in urban environments. As a first step, a search of literature and practice has been undertaken to establish whether or not a system or systems of this kind exist. It was found that the current trend towards improving analytical capabilities is not directed at improving tools for comparing costs and benefits, but rather at improving the context and relevance of such comparisons. This trend applies to both Europe and North America.

This report describes the findings of the literature review and analyses their applicability. It does this by taking cognisance of essential differences between major types of studies. A summary of the findings is presented and directions for moving the study forward are proposed.

2. STUDIES/APPLICATIONS FOR ANALYSING THE ATTRACTIVENESS OF MULTI- (INTER-) MODAL PROJECTS

There are a number of approaches and study types for analysing the benefits of public transport and multi-modal transport solutions. The broad types include:

- ◆ Studies that are ‘local’ in nature and are often planned to tackle an existing transport challenge by trying to identify the problem and manage it. These studies either use the available data to quantify (and also predict) the costs and the benefits of introducing changes, or track (monitor) the implications of the presented challenge and apply incremental changes along the way. These studies mostly refer to the standard ‘project by project’ evaluation designs by assuming the wider network effects and accepting mostly given traffic conditions. The term ‘bottom-up’ is also used for this type of analyses, meaning a ‘project by project’ approach that can be aggregated up to produce wider network results. However, aggregating up to produce wider network results tends to be the exception rather than the rule in ‘project by project’ studies.
- ◆ Studies that are often characterised as ‘top-down’ analyses where analytical process and relevance are applied to plan and seek integrated solutions to emerging transport challenges. These processes are often proposed for achieving an improved integrated view of the transport (multi-modal) network, as a system closely linked with land use considerations and sustainable transport futures, in particular, of urban centres.

2.1 ‘Top-down’ integrated transport studies

The ideal of pro-active management approach is to prevent problems from occurring (‘prevention’ rather than ‘cure’). This is often not possible, so the second aim of pro-active management is identifying problems before they arise and then minimising their impact. Therefore the development of a systematic methodology or process for assessing costs and benefits of multi-modal transport systems fits at this level – the aim is to ensure that investments aimed at making transport more sustainable are not made if they do not deliver the required level of benefit. Implied in this is a full or better understanding of what the individual decision makers (customers, stakeholders, communities) perceive costs and benefits to be.

2.2 ‘Bottom-up’ project by project studies

‘Bottom-up’ or ‘project by project’ studies tend to rely on taking a ‘snapshot’ in time of the transport challenge as it exists in a local environment and trying to analyse its implications in isolation. In the situation related to this type of project, this would typically be a modal split survey at a given time in a given place (either town, metropolitan area, region or country). For example, a ‘partial’ (spatially or project by project) study attempting to analyse the multi-modal implications would, for instance, obtain (or assume) the nature of the demand for transport services offered by each available mode option and their interaction. Carefully ‘crafted’ and performed bottom-up benefit-cost analyses can generate useful information, but their ‘partial’ view of the problem and the series of rather crude assumptions made about the wider network/traffic implications, can render them limited. For example, some studies can provide useful insights about the ‘project’ public transport demand implications for car, bus, train, and possibly, taxi use. However, a ‘fuller’ view including cycling and walking options is often much more difficult to ascertain. A deeper analysis of the relationship between classes of trips for which these latter options interact with the car or bus, train and taxi options is required. These ‘finer’ demand studies are very scarce as they require detailed data normally not available.

‘Bottom-up’ or ‘project by project’ studies will continue to be performed and to provide useful information, but increasingly would be seen as a second more detailed analysis step, after a more strategic ‘top-down’ process has been completed to establish the wider integrated transport issues for the network being analysed.

In cases where it is not possible or difficult to understand the causes of a phenomenon or state (and hence model the future), an alternative may exist to try and understand whether the problem is getting worse or not. Essentially this involves taking a series of snapshots of the situation over time and comparing the sequential parameters measured, allowing the application of incremental changes. This could be a necessary but useful approach where investment horizons are long and mostly irreversible, as is the case with large transport infrastructure investments.

2.3 Next steps of this report

The remainder of this report assesses literature found according to the analytical approaches mentioned above.

Firstly, approaches and methodologies which appear to be pitched at the ‘top-down’ analytical process and at an approach seeking integrated transport solutions, are discussed. As part of this, the principles of traditional benefit-cost analysis techniques are also discussed and perceived shortcomings identified. It must be noted that there appears to be very little development in the field of economic models themselves; the only example found is that of TUBA (Transport User Benefits Appraisal) system (discussed in Section 3.2), which offers a new way of looking at funding flows, but is not ground-breaking in terms of economic and analytical processes.

Thereafter, some ‘local’ applications or bottom-up’ analyses found in the literature are discussed, in terms of characteristics and the contribution which each type makes in arriving at a systematic benefit-cost assessment methodology.

The findings are summarised and some concluding remarks are drawn at the end of the report.

3. LITERATURE ON ‘TOP-DOWN’ ANALYSIS PROCESSES

3.1 Broad trends

In all the major works consulted as part of the literature review, it was apparent that the modern trend in assessing the benefits of multi-modal projects was not towards refining economic models, but towards defining the context in which economic models could be applied. In defining the context there were aspects in which non-dollar costs and benefits of the project (environmental, social) were identified and recommended for inclusion in these analyses. Such methods focussed on comparing agency costs with user benefits both quantitative (i.e. dollars saved) and qualitative (assessed ‘value’ assigned by a user to subjective benefits such as convenience). More important however, is the understanding that analysis of directly quantifiable costs and benefits is but one process to be followed, when evaluating projects or searching for solutions to a particular set of problems. The most comprehensive such initiative seems to be that undertaken in the United Kingdom, with work also being done in the United States, and a more focussed study undertaken in the European Union.

3.2 UK ‘Guidance on the Methodology for Multi-Modal Studies’ (GOMMMS)

The UK Department of the Environment, Transport and the Regions (DETR 2000) made changes to facilitate appraising multi-modal projects alongside purely road-based projects. This was brought about by the publication of GOMMMS (Guidance on the Methodology for Multi-Modal Studies) by DETR, which in turn stemmed from the UK Government’s White Paper: “A New Deal for Transport”.¹

As the name implies, GOMMMS is intended as a guide to appraising multi-modal studies. It covers topics such as the identification and assessment of problems and the identification and assessment of options. Figure 1 illustrates the appraisal process in its general form (source: DETR 2000, Figure 2.1, http://www.dft.gov.uk/stellent/groups/dft_transstrat/documents/graphic/dft_transstrat_503873-1.gif).

It is clear from Figure 1 that a comprehensive framework of appraisal is called for, of which benefit-cost analysis is but one step (Item 7.3 lower right hand side).

It is also clear that the GOMMMS framework is based on the understanding that there is no recipe for solutions for a given problem, but rather that each situation is unique and must be treated as such. To apply GOMMMS to study a particular multi-modal initiative, it will therefore be necessary to do localised studies on how local users perceive and value costs and benefits, on local land use planning, current problems being experienced to mention but a few. These activities are listed in Box 2 within Figure 1.

In describing the benefit-cost analysis (BCA) procedure, the report on GOMMMS states explicitly that COBA (COst Benefit Analysis) and URECA (URban EConomic Appraisal) as applied to road projects are not appropriate for studies of multi-modal projects. It highlights the need to treat explicitly and consistently the following:

- ◆ Flows of taxes, so that the impacts on the Government can be identified;
- ◆ Flow of fares, tolls and charges paid by the customer (user); and
- ◆ Flow of revenues received by the operator (public or private authority).

¹ After the June 2001 elections in the UK, the Department of Environment, Transport and Regions (DETR) became known as the Department of Transport, Local Government and the Regions (DTLR). Following a cabinet reshuffle in June 2002, the DTLR was split, with a separate Department for Transport (DfT) being formed (<http://www.dft.gov.uk/>). The original GOMMMS web reference has been integrated into the new DfT website. The following URL is a general link to GOMMMS documentation:

http://www.dft.gov.uk/stellent/groups/dft_control/documents/contentservertemplate/dft_index.hcst?n=7923&l=3.

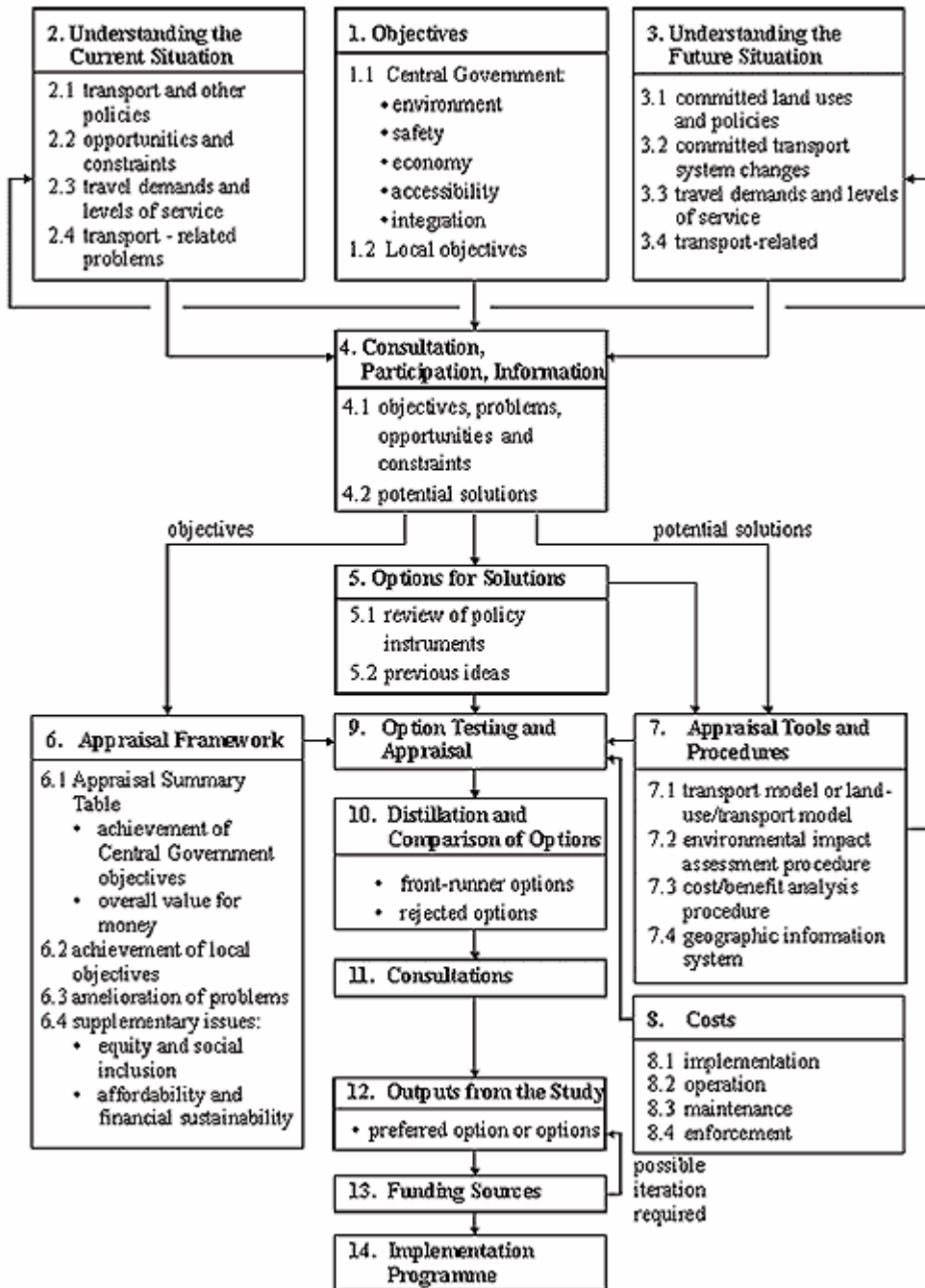


Figure 1 – GOMMMS framework for multi-modal studies

This gave rise to commissioning the development of the TUBA (Transport User Benefits Appraisal) system. TUBA can be seen as the analytical tool to assess variable trip matrices in line with GOMMMS. COBA is still needed to do accident analysis as TUBA does not cover this aspect (HETA 2001). In order to better understand how benefits are perceived, TUBA makes use of a ‘willingness-to-pay’ principle (as opposed to a method of social costs and benefits used in COBA), and uses market prices as the unit of account (as opposed to factor costs) [DTLR 2001]. However, it does not substantially differ in its analysis from traditional benefit-cost analysis processes.

The importance of this approach is that it formalises the need to put benefit-cost analysis (for multi-modal projects) in a fuller context than is often the case with purely road-based projects. It appears from reading the documentation, but this may not be the case, that it is aimed at comparison of motorised modes and not at comparing motorised with non-motorised modes. In GOMMMS defence, however, it is possible that the framework is general enough to include pedestrians and cyclists in the analysis, but some work would have to be done based on the initiatives of researchers such as Tolley (1999).

Of concern is the distinction made by GOMMMS between objectives and targets. In GOMMMS parlance, an objective is a generalised statement (eg. ‘reduce traffic noise in Greenwood Park’). A target for this objective would be to reduce noise levels below 65 dB(A). GOMMMS advocates against the setting of targets (DLTR 2000), because it is difficult to compare the value of achieving one target (or not achieving it) against others.

It is possible that this has arisen as a result of a perceived inability to set attainable targets. As project managers, it is hard to conceive any group embarking on a project with general aims in mind, but no real way of establishing whether the project has been successful or not.

3.3 ‘European Strategic Inter-Modal Links’ (EUROSIL) study

The ‘European Strategic Inter-Modal Links’ (EUROSIL) study was undertaken to provide guidelines to help those involved with assessing multi-modal projects. It focuses on methods of assessment which would take due cognisance of the implications of such projects on area development (EUROSIL 2000). It can therefore almost be seen as a framework for appraisal of projects in terms of achieving a single objective.

The general evaluation process is shown in Figure 2 below.

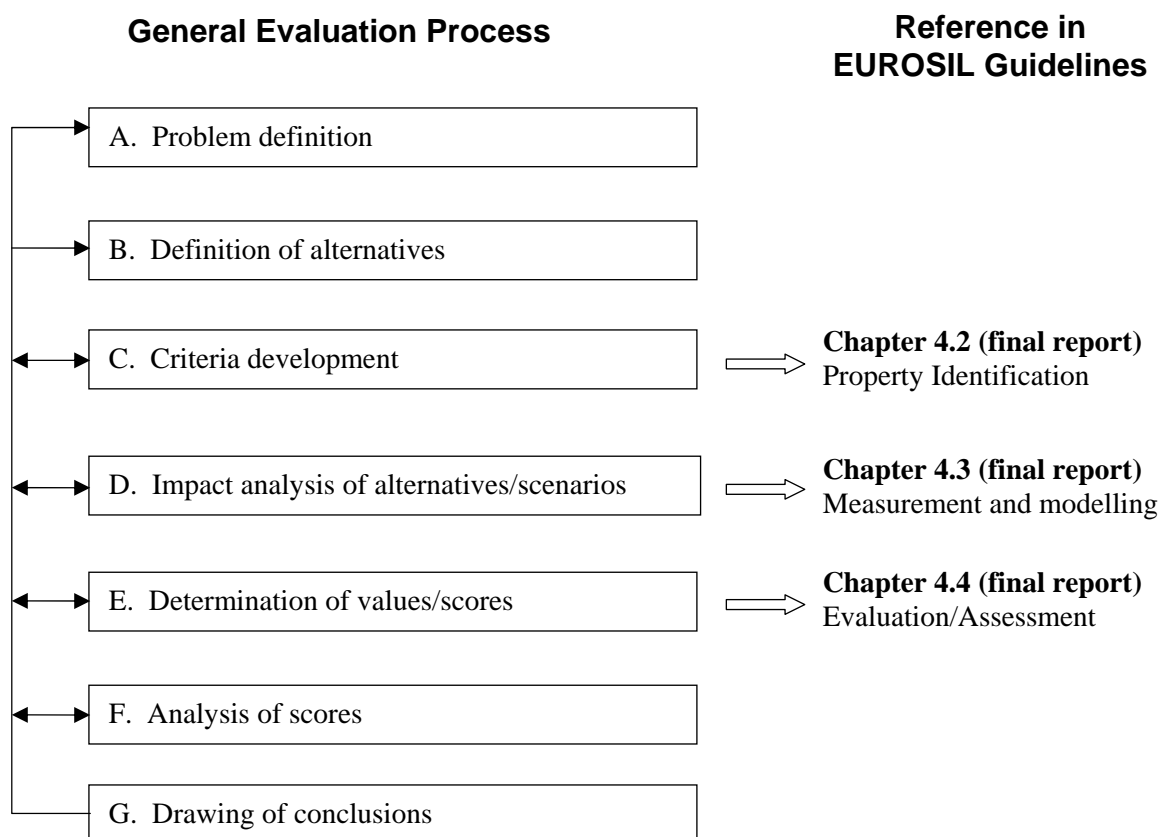


Figure 2 — Generalised evaluation process and scope of EUROSIL guidelines

The study's focus was very much freight based, and formulated its guidelines by scrutiny of a number of case studies on the Pan European Network (PEN) and Trans European Network (TEN), focussing on Inter-modality, Multi-modality and Inter-operability (IMO)². The output was similar to GOMMMS in nature, but of narrower scope and, it seems, in slightly less detail. It appears that there is no cross referencing between the EUROSIL project and the formulation of GOMMMS.

As far as benefit-cost analysis (BCA) is concerned, the guidelines appear to say that it is at the 'Evaluation/Assessment' stage that it needs to be carried out; the document does mention that Multi-Criteria Analysis (MCA) may also be performed. Chapter 4.4 of the final report (EUROSIL 2000) gives some background on these two methods and compares the two approaches. It must be remembered though that the recommendations made are in terms of assessing the impacts which Inter-modal, Multi-modal and Inter-operability (IMO) solutions have on land-use development.

3.4 National Co-operative Highway Research Program (NCHRP)

The United States National Co-operative Highway Research Program (NCHRP) has also published guidelines for assessing social and economic effects of transportation projects (NCHRP 2001). These are based on reviews of literature and practice in various State and Metropolitan authorities across the United States. The guidelines cover eleven areas as follows:

- ◆ changes in travel time;
- ◆ safety impacts;
- ◆ changes in vehicle operating costs;
- ◆ transportation choice;
- ◆ accessibility;
- ◆ community cohesion;
- ◆ economic development;
- ◆ traffic noise;
- ◆ visual quality;
- ◆ property values; and
- ◆ distributive effects.

These aspects are covered in terms of an overview and guidance on:

- ◆ When to do an analysis of the topic.
- ◆ Steps in the analysis process.
- ◆ Methods for carrying out the analysis.
- ◆ Resources and references for further information on carrying out an analysis.

Looking at the recommendations for those aspects normally associated with benefit-cost analysis, they appear to be pretty much regulation processes by current standards. This is not surprising when considering that the guidelines are a distillation of current practice amongst various authorities. Furthermore, it appears to be geared for evaluation of different road-based alternatives and not multi-modal projects in the broader sense of the notion. Apart from that, the notion of a multi-faceted appraisal framework is similar to that discussed in Sections 4.1 and 4.2 (NCHRP 2001).

² The terms Inter-modal, Multi-modal and Inter-operability in EUROSIL, but also in the related literature and also accepted in this report, have the following general interpretations:

- a. inter-modality is a characteristic of a transport system which allows the use of at least two different transportation modes for a single trip;
- b. multi-modality is a characteristic of a transportation system which has competing transport modes in a given corridor; and
- c. inter-operability is the characteristic which describes the quality of the interfaces between different transport systems and/or different transport modes.

3.5 Other new issues and approaches

While investigating the above studies and related work, a number of tendencies or trends by researchers and research initiatives in the field of evaluations in general and multi-modal evaluation were identified. It is considered worthwhile mentioning the more common of these.

Success factors and ‘backcasting’

It is realised that the task of deterministically assessing the likely success of a multi-modal project is a near impossibility given the vast number of issues which contribute to success or failure. [See EUROSIL Final Report (EUROSIL 2000) and GOMMMS methodology (DETR 2000) for an indication of the complexity]. Researchers therefore seem to be gravitating towards identifying success factors in case studies, allowing them to indicate to industry factors, which if not present, minimise the likelihood of success. A typical methodology used in this approach is backcasting, defined by Dreborg (1996) as:

“Backcasting’s concern is not with what futures are likely to happen, but with how desirable futures can be attained. It involves working backward from a particular desirable future endpoint to determine the physical feasibility of that future and what policy measures would be required to reach it. Targets are continually revised as new knowledge is acquired.”

Researchers such as Nelson and Niles (2000) are looking at specific methodologies for applying backcasting to transport oriented problems. In their case, it is trying to predict success of Transit-Oriented-Development (TOD). Methods such as these require an understanding of the interaction between the planning issues and human issues involved with travel behaviour and the success thereof. This is being tackled by institutions such as the Massachusetts Institute of Technology (Srinivasan 1998).

Management for walking as a mode

One aspect that became abundantly clear as the search for information on ‘modal choice’ progressed was the emergence of walking as a mode of transport to be considered in transportation schemes. Table 1 gives some indication of how rapid this emergence has been. Although this has no direct bearing on the benefit-cost analysis of multi-modal projects, it does indicate how the problems of analysis are becoming rapidly more complex.

Table 1 - Rise in the awareness of walking as a viable mode

Period	Number of publications with “walking” as key word (#)	
	Total	Per annum
Pre 1980	17	-
1980 –1984	21	4
1985 – 1989	15	3
1990 – 1994	38	8
1995 – 1999	103	21
2000 & 2001	106	53

Note: # Recorded on database in the ARRB TR Library as at 4 June 2002.

The Federal Highways Administration (FHWA) has gone so far as to issue guidelines on estimating non-motorised travel (FHWA 1999), covering topics such as forecasting non-motorised travel, factors influencing cyclists and pedestrians, demand analysis and supply quality analysis.

4. 'BOTTOM-UP' PROJECT EVALUATION AND 'TRACKING' EVALUATION STUDIES

4.1 Quantification – modal share

One of the more common types of study in public transport related literature is a study in which the current passenger share of various modes, including walking and cycling is included. These are typically the 'problem quantification' type of studies, where the magnitude of required change is captured. These studies vary in scope from city-wide studies over time (Transport SA 2002a), city-wide studies at a particular point in time (TRPC 1999), to localised studies at particular school sites. These types of studies are also being used as a means of introducing school children to the value of transport research (Youngtransnet 2001). National level statistics are published regularly by some countries as well (eg. US DoT et al 2000).

For management of the problem, these studies on their own have very little value, unless accompanied by a survey of users. Such surveys allow attitudes towards various modes of transport to be linked to data such as income, prior investment in cars, and trip purposes.

4.2 Studies involving deriving information from observations

If a series of studies as described above are done in the same area over a period of time they have a certain value. This value is mainly through providing input to prioritising a remedial action, or to projects aimed at reducing the problem. Sometimes they would be used to indicate the success or otherwise of projects undertaken to solve the particular problem (Transport SA 2002b).

Studies such as Schaller's (Schaller Consulting 2001) also involve observing trends in mode use as well as trends in a number of socio-economic parameters over time in order to identify major factors influencing modal choice. Findings of these studies tend to apply to the area in which the observation was made; the conclusions should therefore be read in that light.

4.3 Role of small scale studies

One study on its own therefore has a limited impact on management of multi-modal analyses. If however, a number of such studies are undertaken, it will be possible to identify elements or socio-economic trends and patterns which are present in all successful (or unsuccessful) projects. In this way these smaller studies can contribute to an overall understanding of what makes multi-modal projects work and what influences users in their choice of mode.

This concept is demonstrated by the single study done by Schaller (Schaller Consulting 1998) which was restricted to investigating the elasticities of a single mode (taxis) in a single place (New York City), and the activities of the Victoria Transport Policy Institute (VTPI 2001), which publish elasticities for many modes, drawn from a large number of studies across the world. Another source of elasticity estimates for many modes is BTRE's "Transport Elasticity Database", which provides over 300 estimates of transport elasticities from a large number of sources (see <http://www.dynamic.dotars.gov.au/btre/tedb/index.cfm>).

In order to have a wider impact on modelling multi-modal usage, Schaller's study (and others like it) needs the resources of a VTPI (or a similar organisation) to build up a bigger picture than that covered by Schaller's study. On the other hand, VTPI could not develop a database of the type they have without studies similar to Schaller's to provide hard, measured data.

5. CONCLUDING REMARKS

Based on the discussion in this report, the following observations can be made:

- ◆ Recent advances in assessing benefits of multi-modal projects revolve around the understanding of the enormous complexity of any particular project in terms of factors which can affect the success or failure of the considered project. Changes to existing economic analysis procedures are not widespread in the literature.
- ◆ In Europe major studies have been undertaken to develop an analytical framework in which economic benefit-cost analysis is paired with assessment of non-monetary indicators (qualitative assessments).
- ◆ The United States is at the point of identifying the types of benefits and dis-benefits which need to be considered alongside economic costs and benefits and procedures for analysing different types of aspects individually, as opposed to a multi-criteria decision making approach. At present, their approach seems to be looking at comparing road-oriented alternatives in a more comprehensive fashion rather than comparing various multi-modal alternatives, but it is probable that the fundamentals would apply to multi-modal analyses as well.
- ◆ Because of the sheer number of variables which can affect the success or otherwise of a project, there is as yet, no simple predictor of success. It appears that at least one current school of thought is advocating identifying common factors in success and failure stories as a first generation type of a prediction tool.
- ◆ Traditional single factor and localised studies are still needed in order to build the knowledge base for more systematic prediction tools, but they must be coordinated in order to deliver maximum value. Their role would be to limit reliance on assumptions made in compiling a global prediction tool.

5.1 Where to from here?

Taking the process of developing benefit-cost analysis tools for multi-modal projects forward will be a complex issue, as shown by international experience. A suitable future step would be to scope and plan the development of a comprehensive methodology, in which the objectives, strategies, responsibilities and actions (or tasks) are clearly mapped out.

It is obvious and not surprising from the literature review that there is very little in terms of a comprehensive evaluation framework for multi-modal trips and investments. However, there is increasing research effort to better respond to an accelerating demand for appropriate evaluation approaches.

Given the number of variables which can affect the success or otherwise of a multi-modal project, and that the literature review did not identify a simple predictor of success, there may be merit in a wide ex-post survey of multi-modal projects, with the aim of determining the critical success factors of multi-modal transport projects.

In the short run, sets of demand elasticities (mostly for public transport) could be developed from those found in the literature for use in current evaluation frameworks of various jurisdictions.

The scope of the data and methodology requirements for estimating key evaluation parameters of the demand for multi-modal trip types could also be developed, for example, 'short' (or 'short' segments of) car trips, cycling and walking. It is anticipated that advanced survey techniques (eg Stated Preference surveys) would have to be considered for the collection of key data required to estimate these parameters (attributes) of the demand for non-motorised modes as well as some trip types of the motorised modes. For example, these types of data have been pursued in metropolitan centres such as Sydney and Adelaide (notably) and in pursuits of estimating the value of travel time for freight (Austroads 2003).

A prime objective is to be able to compare alternative options such as road investment, rail, bus only, transitways and cycling (for example, including the health benefits of cycling). The benefits of these alternative options need to be identified and valued along with the costs in a BCA type framework.

Finally, future work can extend the review of key studies identified in the literature search, which deal with methodologies of broader (than standard BCA methods) analytical processes. The aim here would be to better assess multi-modal (including non-motorised travel) objectives that may be addressed using more 'top-down' strategic transport evaluation/planning approaches.

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INFORMATION RETRIEVAL

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ABSTRACT:

This document is a report on a review of Australasian and international literature in 2002 exploring the availability of data, analysis and findings that could assist in estimating inter-modal benefits related to urban transport project evaluations.

The main purpose of this document is to provide a basis for scoping the future development of a consistent Australasian approach to the inclusion of trips by bus, rail, cycle, and on foot, in the evaluation of multi-modal urban road transport infrastructure.

Applications of 'bottom-up' (local, project by project) and 'top-down' integrated strategic approaches are discussed.

Top-down strategic approaches discussed include the UK Guidance on the Methodology for Multi-Modal Studies (GOMMMS), the European Inter-Modal Links Study (EUROSIL), and the 2001 NCHRP Guidebook. The rapid growth of literature on walking is noted, as is the 1999 FHWA overview of methods of estimating non-motorised travel.

The document suggests that the results of a number of smaller local studies, taken together, can contribute to an overall understanding of what makes multi-modal transport work. Studies on elasticity are cited from New York, Victoria (BC, Canada), and Australia.

Broad conclusions are drawn, and suggestions are put forward for further work to develop a consistent Australasian capability in evaluating benefits of multi-modal road transport.



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