Multi-Criteria Integrated Transport Assessment

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Multi-criteria Integrated Transport Planning is based around the idea that transport infrastructure not only has achievements within the transport industry itself but also beyond it, impacting on the economic, environmental and social elements of our society.

The Story of Multi-Criteria Integrated Transport in Western Australia working towards more sustainable transport systems

Introduction

The concept of Multi-Criteria Integrated Transport Assessment has been designed into a decision support tool known as the Transport Infrastructure Intelligent Relational Information System (TIIRIS).\(^1\) The tool will allow decision makers and planners to encompass this perspective in relation to transport infrastructure planning. This project is one of many strategy techniques that have been developed in recent years, but only one of the few, which have progressed to the stage of providing real support for improvements in the methods of assessment, and decision-making processes for policies and projects.

The Department for Planning and Infrastructure is currently assessing how it will progress the concepts and details of TIIRIS in the context of its integrated funding role.

Background

The current system of assessing a future transportation infrastructure project is largely based on the financial implications of implementing the project, and categorises any other areas of impact, such as environmental and social, into an externalities group. The problem with this process is that these externalities are only considered in the final stages of the assessment process and therefore the impacts of implementing a transport infrastructure project upon these areas are not fully accounted for within the design stages. Ultimately this often results in negative impacts upon important areas such as environmental and social well-being.

There are also many environmental, economic and social reasons for requiring an efficient and high quality transportation system. Environmental reasons include the level of greenhouse gases emitted from the transport industry, as well as smog-forming emissions from transport, noise and water pollution. Therefore our high levels of car dependence are of concern and alternative methods of transportation need to be exercised. Such alternatives include public transport, walking and cycling. For this reason TIIRIS is very beneficial, as it provides the basis for considering the development of infrastructure in a balanced way to make these alternative avenues of transportation more accessible and easier to use, thus increasing their use and reducing the use of cars.
Economic concerns for a high quality transportation system relate to the productivity and efficiency of our state's economy. For example in Western Australia alone, 50% of the nation's total volume of exports and 27% of the national value of exports are produced. To ensure that this industry is maintained and continues to grow, an efficient and high quality transport system is required. Social reasons for a good transport system relate to equity concerns such as accessibility. These issues would be addressed more widely and frequently to ensure the entire community has more equitable access to high quality public facilities.

The Story of the Transport Infrastructure Intelligent Relational Information System

TIIRIS had its genesis in 1998, when a team of four senior officers were selected by the Department of Transport's Corporate Executive to attend the Leadership Consortium Program. Their challenge was to develop a strategy that would benefit the decision-making and coordination processes in the development of transport infrastructure within Western Australia. It was here that the Transport Infrastructure Project (TIP) began. It was recognised that transport infrastructure plays a large role in the economic prosperity of our state and the social well being of our citizens. However the positive contributions are not only seen in an economic perspective but also in the social well-being of our communities. It was identified that safety and efficiency in relation to transport would be improved with a high quality system. Environmentally there will also be benefits, as alternative methods of travel such as public transport, walking and cycling will be more adequately catered for, reducing greenhouse gas levels. The Transport Infrastructure Project addressed many of the existing strategies involved in the development of our transport infrastructure. These considered a reduction in transport costs, removal of barriers to growth, extended transport access and improvements in transport safety. As well as maintaining these established objectives, the Transport Infrastructure Project produced a set of objectives it wished to achieve in the development of transport infrastructure systems. Factors that were considered in these objectives were:

To provide a focus for priority transport infrastructure, including the importance of alternative modal choices;

Attention given to areas that lacked efficiency within the current system; and

The identification of funding options for new transport infrastructure projects.

A variety of methods for achieving these objectives were also set out within the guidelines for the Transport Infrastructure Report. Finally the Transport Infrastructure Project also identified a number of gaps within the policies of existing and future developments relating to our transport infrastructure system. These gaps were identified as areas that may potentially limit the development of our state. To obtain benefits from the gaps identified,
they were converted into potential 'opportunities' for expanding the existing transport infrastructure to encourage and ensure the development of our state. These gaps were identified in a number of existing and future strategic plans.

Transport 2000\(^4\) is the document set up to address the opportunities, as identified above, that exist within current and future developments. Transport 2000 is supported by a database of projects that were later expanded into the comprehensive informational system known as TIIRIS. A future goal of the project is to have the prototype of this website implemented and fully functional (Figure 1). This system will have many functions. The first is to dispense information about current and future transport infrastructure projects, which are beneficial to many sectors of the community. This includes for example business owners who plan to set up a business but require specialty transport requirements. This system would allow such people to access information regarding current and future plans for transport infrastructure. The second of its functions is it allows various public or private sectors to contribute ideas and knowledge, possibly resulting in the modification of plans. Similarities between plans and actions from other groups can be identified, preventing unnecessary overlap of resources. Alternative funding options from public and private sources can be found and finally the system allows the general community to input ideas which will identify areas of transport infrastructure which require attention.\(^5\)

![Transport Infrastructure Diagram](image.png)

Figure 1: A Prototype Web-Based Entry into Transport Infrastructure Opportunities

The primary function of TIIRIS is to provide a better basis for decision making to take place. It provides a strong basis for comparisons between projects to be made and is easily understandable. It also identifies outcomes, which extend beyond solely transport related outcomes. Instead environmental, social and economic externalities, which are generally considered in the final stages of the decision making process, are addressed at the beginning. This
allows them to be more fully accounted for within the outcomes of the decision making process.

There were difficulties in incorporating such characteristics within a decision making model. As mentioned previously, currently there are few frameworks, which encompass the large variety of direct and indirect impacts associated with transport. Financial capital and direct economic impacts have largely been the focus of project assessment. This new framework however requires a broader, more contemporary method of assessment while still incorporating cost-benefit or socio-economic analysis.

A variety of frameworks, including Multi-Criteria Analysis and Goals Achievement Matrix, were considered, however the selected comparative framework was an Appraisal Summary Table (AST) (Figure 2). The Appraisal Summary Table has been trialled in the United Kingdom and been successful in demonstrating that information, regarding external impacts, did assist and influence the decision making process and ultimately the final outcome. The Appraisal Summary Table has a number of features which make it a good decision making tool. It allows for the identification and assessment of all alternatives and addresses the reasons for which the chosen project is better than other alternatives considered. It ensures that the chosen project not only addresses direct transport objectives but also the indirect impacts of transport infrastructure. It facilitates both qualitative and quantitative assessment. It is also a clear and easy system to understand.6

![Figure 2: Appraisal Summary Table for WA (under development)](Note: Criteria shown are for illustrative purposes only.)

Once a particular project is chosen and implemented, it can be monitored through a Strategic Outcome Profile (Figure 3). The profile is presented in a
graphical form, creating a profile of selected projects and objectives. It was produced to ensure that the desired objectives are being sufficiently met. Often many transport infrastructure projects are concerned in reaching the target of a particular objective. For example, the objective to increase bus use may obtained by implementing a variety of individual projects such as the construction of bus lanes down major highways, improve quality of buses by purchasing new fleet, allow cyclists to bring bikes onto buses and increase the level of access to under serviced suburbs. The Strategic Outcome Profile monitors each of these projects individually as well as monitoring how well the overall objective is being met, in this example, to increase bus use. By these means if an objective is not being sufficiently met, the Strategic Outcome Profile can identify specifically which project is not adequately contributing to the target, so that actions can be taken to solve this situation. The AST deliberately does not incorporate weights for the various criteria. Although it would be quite simple to add weights, its purpose is not to determine the priority of a project but to provide clear information for intelligent prioritisation and to make the basis of such prioritisation transparent and easily understandable.

![Strategic Outcome Profiles for Projects and Programs](image)

Figure 3: Strategic Outcome Profiles for Projects and Programs

As mentioned above, a future objective of the project is for the current and future transport infrastructure opportunities to be placed on the website for general access. For each of the transport infrastructure opportunities on the website there will be a relevant data sheet as well as the Appraisal Summary Table of those projects which have been implemented and assessed. The system will be flexible and easy to navigate to accommodate for a large variety of users.

**Implications for Sustainability**

The multi-criteria integrated transport project has many sustainability characteristics, which make it a very desirable framework to implement on a much broader basis. The most prominent characteristic is the recognition of impacts related to transport infrastructure, which are beyond the boundaries of the transport industry itself. This means that within the assessment process, environmental, social, economic and technological concerns are addressed.

The process also requires the consideration of many alternatives to the chosen transport infrastructure project and the assessment of why the chosen
project is better than the identified alternatives. This element will allow many avenues of development to be considered and ensure that the best project is chosen to meet the desired objectives. As mentioned above, once the best project is chosen the system will then be able to monitor the progress of a range of projects, through the Strategic Outcome Profile, to identify how well the projects are meeting the desired objective. This ultimately prevents any unnecessary waste of resources, as a project that may be insufficient in its progress, can be immediately identified instead of attempting to guess which project may be causing the situation. For instance using the same example as above for the objective of increasing bus use, the project, which is designed to create better access to under serviced areas, may not be achieving very good progress and thus the objective is not being successfully met. The other projects are however achieving good progress and therefore it would be a waste to put more money towards these projects in an attempt to successfully complete the objective. The Strategic Outcome Profile can prevent this by identifying that it is in fact the project that is creating better access for under serviced areas that is lacking in progress and therefore direct additional funds to that project instead.

The system also encourages community support and interaction through the development of its website. The website will allow members of the community to provide input on issues of transport infrastructure which may require attention. Also individuals have access to new and future plans for transport infrastructure development. The website will provide the user with links to the information used throughout the assessment process, allowing the individual to become satisfied with the process conducted. Another feature which promotes community input and encourages more effective feedback systems, is that enquiries can be made in a free form language style, preventing the restrictions and predetermining nature of frequently used keyword systems.

One of the stated objectives of the system is to find alternative avenues of funding for the transport projects developed. These may be from either private or public sources and will assist the implementation of various worthy transportation projects, which may otherwise have not been implemented.

Another sustainable feature of the system relates to resource use by allowing inefficiencies to be identified and corrected within current infrastructure resources. This potentially saves the waste of considerable amounts of resources by ensuring infrastructure, which is reaching its maximum efficiency before more infrastructure is developed to cope with the demand that was not managed by the first project. These resources may either be physical or monetary, either way both are valuable.

**Conclusion**

Overall, the system reflects a high level of sustainability as it takes into consideration environmental, social, technological and economic concerns, while encouraging input from the community. It also identifies the need to consider alternative projects and includes the consideration of non-motorised and public transport methods of travel, as opposed to the private automobile
being the sole option for travel.

Global Significance

This system is quite significant on a global level with respect to transport planning. It is one of only a few to be developed around the world giving Western Australia a competitive edge in respect to transport infrastructure. Other existing systems of project evaluation include the New Approach to Appraisal (NATA) in the United Kingdom, Plans de Deplacement Urbains (PDU) from France and the Federal Transport Infrastructure Plan (BVWP) in Germany. Japan and the United States also have non-official evaluation packages. A comparison between all of these evaluation systems highlights one significant point. All of these systems are attempting to develop an element that is already working well within another system. This provides Western Australia with the potential to gain some significant global recognition in that, once this system becomes fully implemented, and is able to sufficiently satisfy all of the desired outcomes of other programs, we may have a marketable product. This may be in relation to financial profits or simply as a competitive edge on the global market for Western Australia. For example the United Kingdom is seeking a better system for the integration of economic and environmental impacts like that present within the French appraisal system. France however wishes to achieve a better economic theory base like the United Kingdom's while both countries are seeking the multi modal alternative assessment approach that is well established in Germany. This would be a significant achievement for Western Australia if we could successfully fulfill these and various other objectives within our own transportation assessment system and ultimately our infrastructure.7

Sustainability Characteristics

TIIRIS takes into account the impact of transport infrastructure projects on environmental and social sectors.
- Considers alternative methods of travel
- Considers alternative project proposals
- Ensures efficient use of resources
- Identifies alternatives for funding
- Encourages community input

Insight/ Innovation

Appraisal Summary Table
Strategic Outcome Profile
TIIRIS - website application

Key Words

- Multi-Criteria Integrated Transport
- Transport Infrastructure Intelligent Relational System (TIIRIS)
- Appraisal Summary Table
- Strategic Outcome Profile
- Transport infrastructure

Contacts
Figures

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Endnotes

1 Ker I., Hodge G., Bunbury J., Damen P., 2001, 'TIIRIS - Supporting New Directions in Transport', Department of Transport, Perth, Western Australia


4 Hayashi Y., Morisugi H., 2000, 'International comparison of background concept and methodology of transportation project appraisal' Journal of the World Conference on Transport Research Society, Special Issue: Transport Policy, 7:73-88