OBJECTIVE-BASED ASSESSMENT OF ENVIRONMENTAL EFFECTS OF MAJOR NEW ROAD PROJECTS IN VICTORIA

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ABSTRACT

VicRoads manages the arterial road system in the State of Victoria, Australia. One of VicRoads tasks in managing the State’s road system is to plan for the enhancement of the road network, including the construction of new road links or the enhancement of existing road links. The planning process seeks the required environmental and planning clearances to enable proposed road projects to proceed to the construction phase.

The State of Victoria has a planning and environmental assessment system that provides a tiered decision-making structure in relation to the approval of projects, whether they be roads or other developments. The most sensitive projects are assessed under the provisions of the State’s Environment Effects Act 1978. Where additional land is required for a new road that has not previously been reserved for that purpose in the planning scheme, approval for a Planning Scheme Amendment is also required under the provisions of the Planning and Environment Act 1987. Road projects may also need to be assessed, and approved under the provisions of the Commonwealth’s Environment Protection and Biodiversity Conservation Act 1999.

It is considered an important part of the functioning of our democratic society that people have a right to be consulted about decisions that affect them. Thus, the Environment Effects Statement (EES) process includes requirements for both informal and formal public consultation. The EES process enables consideration of a comprehensive range of economic, environmental and social factors.

A key part of the formal public consultation and assessment process under the provisions of the Environment Effects Act is for there to be a hearing by an independent Panel appointed by the Victorian Minister for Planning. This Panel considers the Environment Effects Statement prepared by the project proponent and any submissions made by members of the public. The Panel provides a report to the Minister for Planning who then prepares an assessment report for final decision by the responsible policy minister. In the case of road projects, the responsible Minister is the Minister for Transport. In some cases, the Minister for Planning’s report may also be considered by the Commonwealth Minister for Environment and Heritage.

Following criticisms by independent Panels of VicRoads use of a “Planning Balance Sheet” approach to evaluate options, VicRoads adopted a modified version of the Objective-based Evaluation Matrix (OBEM) used by Panels in their evaluation of road projects. The OBEM utilises a performance-based approach to the assessment of options rather than a comparative assessment between options. The paper will describe the use of the OBEM approach for the evaluation of alternative options as recently used by VicRoads, including differences with the approaches used by independent Panels. The paper will also discuss a range of issues that arose during the implementation of the OBEM, some of which are still being worked through. It was found for example, that the use of the OBEM approach required changes to the assessment approach of specialist consultants providing input into the process.
INTRODUCTION

VicRoads is the government agency responsible for managing the arterial road system in the State of Victoria, Australia. It is responsible for managing some 22,000 km of Freeways, State Highways, Main and other roads across the State.

VicRoads is the successor to a range of State government agencies that have been responsible for managing the State’s roads since the establishment of the first Victorian statewide road agency, the Country Roads Board, in 1913.

Originally, the rural road system was developed to connect rural areas with railway stations as much long distance passenger travel and freight transport was by train. Later, an arterial highway system was developed to connect Melbourne and major regional centres.

Since the early 1960s, VicRoads and its predecessor organisations have developed a significantly upgraded system of urban and rural freeways and highways. This has required an ongoing project development process to define the scope of individual projects. As with many other planning processes, the project development process involves the consideration of a range of potentially feasible options. This process, ultimately, needs to arrive at a single proposal for each individual project, which may comprise of a package of measures, to be implemented. This paper discusses recent developments in the assessment of project options.

BACKGROUND

Introduction

The State of Victoria has a planning and environmental assessment system that provides a tiered decision-making structure in relation to the approval of projects, whether they be roads or other developments. The most sensitive projects require an Environment Effects Statement and are assessed under the provisions of the State’s Environment Effects Act 1978. Where additional land is required for a new road that has not previously been reserved for that purpose in the planning scheme, approval for a Planning Scheme Amendment is also required under the provisions of the Planning and Environment Act 1987. Road projects may also need to be assessed, and approved under the provisions of the Commonwealth’s Environment Protection and Biodiversity Conservation Act 1999. This assessment may either be undertaken under an accredited state process, or be undertaken in a process that is independent of state processes.

Regardless of whether an Environment Effects Statement is required or not, for a major road project, there is a need to undertake a rigorous approach to the selection of the option to be implemented. The broad planning process followed is shown in Figure 1. The key steps are described below:

1. Establishment of consultative arrangements
2. Definition of scope of investigation
3. Conduct of investigation, including development of corridor and alignment options as appropriate
4. Internal review and assessment of options
5. Preparation of statutory documentation (e.g., Environment Effects Statement, Planning Assessment Report, Planning Scheme Explanatory Report)
6. Public exhibition of statutory documentation
7. Assessment of proponent’s proposal and public submissions by an independent Panel (normally applies for road projects)
8. Decision-making by Government Minister
This approach allows for extensive community consultation, firstly by the proponent in developing project proposals, and secondly, through the use of the independent Panel process, which facilitates formal community input into the project assessment process. Ultimate decision-making about project proposals rests with the elected Government. This is considered to be an important element in a democratic society, where people have the right to be consulted about proposals in which they have an interest or which could affect them.

**Previous approach to evaluation in Victoria**

Two examples of previous Victorian practice in the comparison of options for the selection of alignment or strategy options are described below.

The Austroads Ecologically Sustainable Development Tool Box (Austroads, 2000) included an example of project assessment as set out in the Environment Effects Statement for the Scoresby Transport Corridor. This example provided an assessment framework for considering the relative performance of four main strategy options. The example noted that this approach adopted three key principles or themes:

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* Prosperity focuses on economic development that enhances the capacity to meet the essential needs of the community and the welfare of future generations.
* Liveability focuses on the human environment and needs for well-being and quality of life. In particular, the transport related aspects include safety, accessibility, amenity (e.g., noise, visual amenity) and equity in terms of transport choice.
* Sustainability focuses on the natural environment. In particular, the key issues relate to energy use, greenhouse gas emissions, water quality, ecosystem processes and biodiversity.
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The sample table is shown in Figure 2.

VicRoads previous approach to the comparison of a range of project options is set out in its Project Evaluation Guidelines (VicRoads, 2000). The Guidelines set out an approach known as a “Planning Balance Sheet”. A sample layout of a Planning Balance Sheet analysis is detailed in Figure 3. The table as shown in Figure 3 was to be accompanied by a reasoned conclusion with a clear statement of any value judgements and their basis. The approach included the elimination of any option that was clearly inferior on all or most criteria, or otherwise unlikely or unrealistic.

**Revised evaluation approach by independent Panels**

**1st Advisory Committee – Hume Freeway, Craigieburn**

The Advisory Committee Report for the Relocation of the Hume Freeway between Craigieburn and the Metropolitan Ring Road (Gibson, Love and Sutherland, 1999) of October 1999 set out the first application of the use of what is termed an “Objective Based” approach to decision-making in relation to a Victorian Road project. The Committee’s considerations are summarised below. The Committee explained that its approach related to the planning reform program which had been implemented in Victoria. This program required all Councils to prepare a strategic plan for their municipality, known as a Municipal Strategic Statement (MSS). All MSS’s contain both a set of Statewide planning provisions, known as the State Planning Policy Framework (SPPF), and a set of Local Planning Provisions (Local Planning Policy Framework). The strategies contained in the MSS enable the objectives of the MSS to be met, while the planning controls set out in the planning scheme are the implementation measures. Thus, the Committee considered that the outcome of proposals put before it should always be assessed by reference to the planning scheme’s objectives.
The Committee considered that identifying relevant objectives should provide a transparent framework for decision-making. The Committee considered that the issue of transparency is important when all outcomes of a complex proposal cannot be measured according to the same criteria. Thus the Committee considered that it was not sufficient simply to identify the criteria by which a proposal must be assessed, but that the objectives to which those criteria relate must also be identified.

The Committee’s evaluation model contained a number of steps:

“1. Identify relevant objectives from legislative and policy context against which the proposal/options should be assessed.
2. Identify relevant issues raised by the proposal / options
3. In respect of each issue, identify the relevant objective and assess the proposal/options against that objective
4. Assign a score to the particular issue according to a scale of 5 to 1, where 5 means that the objective is best met (or very well met) and 1 means that the objective is least well met (or not met at all).
5. Develop a matrix incorporating all relevant objectives and issues, and enter scores for each proposal / option.
6. Apply a value judgement to the result in respect of any outstanding objectives, qualifications or issues which fall outside the matrix framework.”

The Committee considered that as its model was objectively based, there should be little dispute about whether, with respect to a particular issue, an objective is met very well or not at all. The Committee further noted that “at the conclusion of the process, the model allows explicitly for the application of value judgements to be made in respect of any objective that gives rise to the need for this value judgement or issue that has not been incorporated into the matrix framework.”

The Committee further commented that in relation to the legislative and policy context, there were two striking features:

“* the sheer volume of legislation and policy which impacts on the proposal, particularly the amount of Commonwealth legislation.
* the overwhelming prevalence of environmental objectives. Even in transport-related legislation and policy there is a clear intent that adverse environmental impacts should be minimised.”

The Committee considered that the sheer volume of legislation and policy could lead to a situation “where it may be possible to select an isolated objective to support virtually any proposition without regard to the overall context. The Committee considers it is always important to retain an overview of where the weight of legislative and policy direction lies. This avoids becoming trapped in detail or preferential bias creeping into the decision-making process.”

2nd Advisory Committee – Hume Freeway, Craigieburn

The Hume Freeway, Craigieburn Bypass was the subject of a second Advisory Committee Report (Gibson, Love and Sutherland, 2000), as the State Government was not satisfied with the recommended outcome. The Committee further elaborated on the use of the model in its report. The Committee noted that the matrix “is a useful comparative mechanism to be used in the first step in the assessment process.” The Committee noted that the second step “is then to look at the results of the matrix and consider whether in all circumstances, it represents a reasonable outcome. It is at this point that any particularly significant factor or individual objective can be considered and possibly given a different weighting from others.”
The second Committee examined criticism of the use of the model in the October 1999 report and concluded that “no substantive weakness in the model itself has been established. Rather, any disagreement with the outcomes produced is as a result of the value judgement applied as part of the final step in the model.” The Committee considered that the model did “not ignore the complex interrelatedness of issues, but rather seeks to separate them out and deal with each one fully before drawing them back together into the overall common framework represented by the matrix.”

**Minister’s Assessment – Craigieburn Bypass**

The then Victorian Minister for Planning in his Assessment of the Craigieburn Bypass set out reasons for not using the evaluation matrix used by the Advisory Committee. The Minister stated:

“* I agree with the Committee that it is necessary to consider what performance criteria emerge from relevant legislation and policies and that these must constitute the primary basis for evaluation. However, judgement also needs to be exercised regarding the particular relevance of this legislation and policies to the case in question. This depends in large measure on the particular circumstances of existing land use and settlement, development opportunities and environmental sensitivities involved. The particular values of Merri Creek and the adjoining grasslands and woodlands, as well as the strategic importance of the Hume Highway corridor, are central considerations here.

* Some criteria will represent basis requirements of acceptability while others will guide relative preferences. For example, the attainment of high standards of road performance is a basic requirement for this road link, while the protection of both ecological values of National significance and areas of high Aboriginal heritage value are basic environmental requirements. Economic impacts, including both the direct costs and benefits of the road and impacts on other land uses and activities, as well as impacts on environmental values of local significance, represent relative values. Any comparative assessment of project options should take account of these differences in the type of value involved. A stepwise approach to the application of performance criteria may therefore be appropriate, first applying “basic requirement” criteria and then “relative preference” criteria. The “basic requirements” can be applied to eliminate options that fail to meet these criteria – unless suitable mitigating or offsetting measures are available.

* Related legislative and policy criteria can be combined to a level of abstraction such that the derived evaluation criteria are of a similar level of importance. This situation may appear to invite both scoring of options against individual criteria and addition of scores across the various criteria for each option. However, this is not a valid procedure as a basis for decision-making if the criteria either differ in type or are strongly interdependent. This is not to say that such a tool may not be a useful heuristic tool, ie an aid to evaluation, or that similar conclusions might not be reached by alternative means – as is the case here.”
Calder Highway, Kyneton to Faraday Environment Effects Statement – Panel Report

The Panel appointed to assess the Calder Highway, Kyneton to Faraday Environment Effects Statement (Pitt, David and Thompson, 2001) commented that it had some reservations about the evaluation methodology set out in the Environment Effects Statement. In particular, the panel had three particular criticisms:

* there was no explicit assessment of route options against the Project Objectives
* the ‘criteria’ contained in the assessment were a list of relevant issues rather than actual criteria. The ‘criteria’ set out in the assessment did not have any standard or benchmark by which to judge whether the impact against that criteria was acceptable or not
* the summary of assessment was a comparative analysis rather than a performance based assessment, that is route options were rated in comparison to each other (eg “least impact” through to “most impact”) rather than rated in absolute terms as to the level of impact (eg low, moderate or high impact)

This Panel, after preparing the Objective-Based Evaluation Matrix, proceeded, in the first step of its analysis, to assess route alignment options on the basis of the frequency of score ratings. This Panel noted that it “believes it would be logical to expect that the recommended option would have scores concentrated at the upper end of the scale, and that an option with a very low score against one or more objectives would be unlikely to be recommended.” In this assessment of this project, the Panel’s conclusion from the evaluation matrix was consistent with the Panel’s value judgment.

Calder Highway, Kyneton to Faraday Environment Effects Statement – Minister’s Assessment

The Victorian Minister for Planning’s evaluation of options following receipt of the Panel’s report stated that “I have found the Panel’s summary of its ratings of the EES route options in a matrix to be a useful overview of its findings on various issues. At the same time, I have not found the matrix to be conclusive in determining the different options’ acceptability and relative performance (though I have ultimately come to similar conclusions).”

The process adopted by the Minister was to identify objectives, and key issues related to those objectives. The Minister then proceeded to “identify those route options which are unacceptable with respect to one or more of the above factors; and the relative performance of the remaining route options, after unacceptable route options are excluded and opportunities to mitigate various impacts have been taken into account.” This process provided a clearly argued case as to why certain options were rejected, and for the selection of the acceptable option.

DISCUSSION

Transparency of Process

Both the approaches adopted by Panels and by the Minister for Planning offer increased transparency of the decision-making process. This is achieved by having, in the case of Panel reports, clearly argued reasoning as to the ratings of each option against a particular objective and a clear framework and reasoning for overall assessment taking into account performance against all of the objectives.

The Minister’s Assessment approach of defining issues relating to each objective and rating each option as to its acceptability in relation to those issues is also a highly transparent assessment mechanism.
The assessment approaches previously adopted of utilising the planning balance sheet approach or showing ratings of each option against criteria from a “least satisfies objective” to a “most satisfies objective” could perhaps have been applied in a more transparent manner. The reasoning as to ratings applied against each criterion and as to the overall conclusions in relation to the most favoured option could also have been made more explicit. Furthermore, as the Kyneton to Faraday EES Panel observed, some of the criteria applied could have related more clearly to the project objectives and could have been more specifically related to assessing the acceptability or non-acceptability of options.

Also, in common with the observations of the Kyneton to Faraday EES Panel, an approach which rates options comparatively on a scale of ‘least satisfies’ to ‘most satisfies’ is not necessarily helpful in measuring ‘absolute’ levels of performance. “Most satisfies’ might not be acceptable; alternatively, ‘least satisfies’ might be acceptable. However, as will be discussed later, sometimes, acceptability of an option is a relative rather than an absolute matter, because under certain legislative or policy requirements, acceptability may depend on the performance of the other options in relation to a particular objective, or even in relation to performance against other objectives.

**Framing of objectives**

A key challenge is to ensure that the objectives that are established are appropriately framed to ensure that they are compatible with legislation. While the Craigieburn Panel referred to the great mass of legislation that exists, there is potentially likely to be a set of legislation that is particularly relevant to the proposal being considered and which should therefore be considered. It is considered that there is a relatively focused amount of “core” environmental legislation that should always be considered, with there also being an amount of legislation that is specifically more related to the proposal at hand, whether as the reason of the particular technology, proponent type and/or geographic location.

It is suggested that the objectives should relate in a hierarchical sense to Commonwealth legislation, followed by State legislation and then various policies, including planning policies of Local Government. In suggesting this, there is, at times, a tension between local desires on the one hand, and the wider societal directions as expressed in Commonwealth and State legislation and policy on the other, with the resolution of this tension not always being easy or straightforward.

Objectives established should be compatible in their framing with the intent of legislation without extending or diminishing the intent of legislation. The objectives also need to be sufficiently comprehensive and inclusive in relation to the requirements of legislation. Furthermore, not only the objectives, but also the assessment process against different objectives needs to be compatible with the requirements of legislation and/or policy.

For example, it is part of the Victorian Government’s Native Vegetation Management framework that avoidance of an impact is preferable to mitigation of an impact. The question then arises as to whether, if all options (other than “do nothing”) have an adverse impact, then is mitigation an acceptable strategy? However, if one option does not have that adverse impact, then avoidance is possible and mitigation is not preferred? On this basis, it would be potentially possible to rule out options in accordance with the strategy. This approach could thus lead to some otherwise potentially feasible options being not acceptable. It would however, on the other hand, indicate that there are potentially high hurdles to be overcome before an option could be considered as acceptable. This latter approach would seem to be compatible with the Victorian Minister for Planning’s establishment of “basic objectives”. The question perhaps then becomes as to when is an objective “basic” and fundamental compared with when a low performance against that objective may be traded off against a good performance against another objective.
The assessment process also needs to consider the requirements and needs of all decision-makers in the process. For example, the Commonwealth Minister for Environment and Heritage, when required, accredits State environment assessment processes, under the Environment Protection and Biodiversity Conservation Act 1999. Thus, such an assessment process would need to consider the requirements of the Commonwealth Minister in his decision-making role as well as the State Minister for Planning.

**Issues in assessment against objectives**

An issue to consider is the desirability of the need to avoid ruling out a road corridor option because that option as presented leads to a high level of adverse impact when an option in that corridor with some modification would not have that adverse impact. An example of this would be where an option as presented had an adverse social impact because of severance impacts on the local road system. Modification of that option to include additional local road crossings would lessen the severance impact. However, such a modification could cause performance against other objectives to change (for example, likely increase in cost and lowering of economic performance.) Similarly, the treatment of corridor suboptions needs to be appropriately evaluated. For example, a corridor should not be automatically ruled out as the result of particular localised impacts that could be avoided by relocating around a particular feature.

The criteria to assist in assessing performance against objectives need to be thought through by the relevant specialist consultants. In particular, as has been pointed out by Panels, the indicators need to assist in arriving at a conclusion of the performance of an option in terms of how acceptable it is. This can include the assessment of the impact of an option in relation to its regional effects, not just the impacts within the alignment. For example, if an option were to impact on flora and fauna, then this should be considered in its wider regional context, not just in isolation.

The issue of benchmarking does, however, need to handled appropriately in the decision-making process. By their very nature, road projects are one-off projects. Therefore, benchmarking across different projects against a measure such as cost per kilometre is not overly helpful. In such cases, it is considered that factors such as net present value or benefit-cost ratio are more helpful in deciding both project priorities between projects, and option performance in relation to an economic objective for an individual project.

It is noted that there have been changes in the assessment against objectives as used by Panels. The stage 1 assessment used by the Craigieburn Panel involved the adding up of scores against objectives. While it is recognised that the Panel subsequently applied a value judgement, the adding of scores is not considered to be an appropriate approach when different objectives may have very different weightings. The approach used by the Calder Highway - Kyneton to Faraday Panel considered the frequency of scores and implied that an option could be ruled out if it scored low against one or more objectives. However, it is considered that this approach should be further tempered by the approach adopted by the Planning Minister, that is that an option should satisfy ‘basic objectives’. Therefore an option that would not perform well against an objective that is not ‘basic’ would not automatically be ruled out.

It is considered that the use of qualitative descriptors of option performance would avoid the problem of adding up numbers of the scored ratings against objectives. As indicated previously, the different weightings that should be applied imply that scores should not be added. Furthermore, qualitative descriptors are more readily understood than numerical scores.

The assessment by objectives on a 1 – 5 scale may lead to there being an identical performance assessment for options that are discernably different. A rating scale that allows nine points of difference would provides a more finegrained approach in comparing options.
**Implications for project proponent**

Several recent VicRoads Environment and planning submissions have been prepared utilising an objective based evaluation matrix framework. This has been done in an endeavour to increase the likelihood of being successful in having project proposals accepted in one round of Panel hearings. Experience has shown that more than one round of Panel Hearing has been commonly required to finally reach an acceptable project solution.

VicRoads has modified the approach used by Panels and the Minister for Planning to suit its role as project proponent. In particular, it has adopted qualitative descriptors of performance with a nine-point base scale. It has also endeavoured to develop measures of performance to enable a better assessment of the acceptability of an option against the project objectives. It has also further considered alternative mechanisms in reaching a conclusion following the assessment against individual project objectives. This has included ‘sensitivity testing’ by using alternative reasoning approaches to determine if the alternative approaches yield a similar (and therefore hopefully a robust) result.

Project proponent use of a somewhat similar assessment approach as Panels and the Minister for Planning is not considered to be a ‘magic bullet’ that will, on its own, instantaneously lead to a higher success rate for project proposals in one round of Panel Hearings. There are several reasons for this. These include, firstly, that the formal panel process focuses considerations and discussions on the project in a way that the earlier less formal consultation process does not. Opponents may hire expert witnesses. People with detailed local knowledge have the opportunity to cross-examine the proponent’s expert witnesses in the Panel hearing. This may result in reconsideration of conclusions previously drawn. Secondly, there is a value-based consideration of the weighting of different objectives that may be different between the project proponent, the Panel and the Minister for Planning. This value-based difference may even extend to the consideration of what are the important objectives. As an example, one Panel considered landscape considerations to be of high importance, whereas the Planning Minister (and the proponent) considered these to be of lesser importance.

Even if the different approach is not a ‘magic bullet’, in the author’s opinion, it is considered that from a project proponent’s viewpoint, the use of the objective-based assessment approach (which is also used for internal decision making) has led to a more critical internal assessment of the project options. This has resulted in a willingness to search further for project options that are more likely to be acceptable to the decision-maker before the preparation of assessment documentation for formal public display. The use of the objective-based assessment approach has also required a change of thinking to more closely and explicitly embrace the requirements of legislation and of planning and other policy in the environment assessment process.

A further implication from the project proponent’s viewpoint is that the use of the objective-based approach to assessment has required a change of approach to the environmental assessment process from almost its beginning. The establishment of assessment objectives (at least on a preliminary basis) at the start of the process allows a more consistent approach to decision-making throughout the planning process. However, it should be noted that there is a need to consider revising the objectives if new information arises that confounds the earlier assumptions.

Specialist expert consultants have needed to be educated in the use of the new system. Further, consultant shell briefs have needed to be revised to establish upfront that VicRoads is requiring performance-based assessment in relation to project objectives from its consultants, and in some cases this requires assessment of option performance in relation to wider regional or other performance.
CONCLUSION

Major reforms to Victoria’s planning system have resulted in a change to the manner in which project proposals are assessed by independent Panels and the Minister for Planning. This change has now been embraced by VicRoads as a project proponent seeking to harmonise its assessment approach with the assessment approach of the other participants in the environment assessment process.

The change is not considered to be a “magic bullet” that will lead to instantaneous greater success for VicRoads as a project proponent in having its proposals accepted in one round of Panel hearings. It is considered, however, that the change of assessment approach has led to a more critical internal appraisal of the acceptability of project options and a greater search for options that are likely to be acceptable. This changed assessment approach has required and will continue to require further modification as there is further learning from the application of the approach.

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AUTHOR BIOGRAPHIES

In his current position, Clive Mottram is Manager, Planning Investigations, at VicRoads where he has responsibility for project development including seeking environmental and planning clearances for a range of projects. Clive has a strong interest in planning and in improving business performance. Clive has previously held a range of positions in corporate planning, traffic management, road planning and construction and vehicle registration and driver licensing policy. Clive received a Bachelor degree in Civil Engineering from the University of Melbourne in 1976. He subsequently gained a Master of Engineering Science degree from Monash University, majoring in Transport and Traffic Engineering.
Figure 1. Environmental Impact Assessment Process

Decision has been made that an Environmental Impact Assessment is required for the proposal.

- The Consultative Committee can include representatives from relevant government agencies, local government, community and environmental groups.

- VicRoads, in consultation with the Consultative Committee, develop the Scoping Document. (This document includes the Terms of Reference)

Stakeholder involvement

Public comment/suggestions are invited

Informal public engagement process

Statutory public engagement process

M.P. - Victorian Minister for Planning

M.T. - Victorian Minister for Transport

C.M.E. - Commonwealth Minister for Environment

EIA - Environmental Impact Assessment (State)

EES - Environmental Effects Statement (State)

PSA - Planning Scheme Amendment (State)

PER - Public Environment Report (C'wealth)
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<td>- Improve safety of transport system</td>
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<td>- Maintain air quality in compliance with EPA objectives</td>
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<td>- Minimize risk from exposure to contaminated soil or groundwater</td>
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<td><strong>Environmental Ancestry</strong></td>
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<td>- Enhance regional accessibility and maintain or enhance local accessibility</td>
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<td>- Maintain landscape character and minimize visual impacts</td>
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<td>- Preserve social fabric and community values</td>
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<td>- Minimize fuel consumption and greenhouse emissions</td>
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<td>- Maintain existing drainage patterns and maintain or improve water quality</td>
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<td>- Conserve the quantity and quality of groundwater</td>
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<td>- Protect the functioning of natural ecosystems and biological diversity</td>
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**Legend**

Least satisfies objective

Best satisfies objective


Notes. This representation is useful for comparative purposes, however, in terms of decision making, the legend would need to have a stronger action focus. For example, does the 'least satisfies objective' translate into a 'no-build decision'?

In addition, the representation provides an assessment of the project suitability in isolation. ESD requires 'cumulative thinking' in which the needs of one project can be compared with other community needs. Cumulative Impact Assessment (CIA) is one tool that assists this approach and is described elsewhere in this Guidance Package.

*Figure 2. Qualitative ESD Assessment Framework*
Figure 3. Sample Layout for Planning Balance Sheet