ASSESSMENT OF PUBLIC INVESTMENT IN TRANSPORT SECTOR

FINAL REPORT

Submitted to:

Department of National Planning, Ministry of Finance & Planning,
Sri Lanka,

December 1999

Kumarage A.S.
Storm U.E.
Gunaruwan T.L.
Mudannayake D.

Transportation Engineering Division,
Department of Civil Engineering,
University of Moratuwa.

PREFACE

When demand for public infrastructure is high but public resources are limited, it is important to ensure that scarce resources are used efficiently and effectively to maximise social benefits. If this is considered true even for developed countries, as illustrated by the quotation below, then it must be more true for countries that are still developing, such as Sri Lanka.

> *"A well-functioning infrastructure is vital to sustained economic growth, to the quality of life in our communities, and to the protection of our environment and natural resources. Our Nation will achieve the greatest benefits from its infrastructure facilities if it invests wisely and continually improves the quality and performance of its infrastructure programs."*[1]

The need to "invest wisely" in infrastructure facilities is recognised by the Ministry of Finance and Planning, which requires Departments and Agencies to submit feasibility studies for investment projects. As described in more detail in the following sections, Benefit Cost Analysis, although still not widely used in Sri Lanka, is an objective and valuable tool to evaluate the feasibility of transport sector projects.

Evaluation of Benefits

Except for mega scale projects, wherein cost-benefit analysis is expected, the 'Least Cost approach' appears to be the practice commonly adopted in the appraisal of most transport sector projects. While this requires the minimum of skills and effort, it has the major drawback that it makes the fundamental assumption that all benefits between alternatives are similar. Comparing between different investment opportunities is well neigh impossible, since benefits are usually qualitatively and quantitatively dissimilar in transport sector projects.

The intricacies in valuing benefits are seen as the reason for not applying benefit-cost analysis in project appraisal. Techniques are available for this purpose, and await further development and application through this study in Sri Lanka.

[1] W.J. Clinton, President of the USA, *Executive Order 12893 - Principles for Federal Infrastructure Investments*, (http://nodis.hq.nasa.gov/library/directives/nasa-wide/nasaeoas/eo12893.html), 26 January 1994.

Project Feasibility Analysis

The dictionary definition of *feasibility study* is "a study of the practicability of a proposed project"[2]. Indeed, this definition generally describes the types of feasibility studies that are presently undertaken by transport agencies, which focus mainly on the physical or technological practicability of undertaking a project – and which estimate only the corresponding input requirements and financial costs. Such a definition, however, is not complete, because it ignores a fundamental question: are the economic benefits of a project greater than its economic costs? The answer to this question must be "yes" before an investment can be said to be "wise".

For the purposes of this report, therefore, the above definition has been expanded to include the following - all of which must be true, before a project can be said to be feasible:

- Is the project *economically* justified – in other words, are its economic benefits greater than its economic costs?
- Is the proposed project alternative, location, strategy, or design the best - from economic, environmental, and/or social perspectives?
- Are the construction/procurement, operation, and maintenance of the project sustainable over its economic life?

Advantages of Benefit-Cost Analysis

Well-organised feasibility studies, including economic appraisal such as benefit cost analysis, can give the following advantages:

- Projects can be planned more thoroughly. The actions, especially, of defining who would be affected, of laying out the types of benefits that would be generated, and of *estimating their values*, will help confirm that benefits actually exist. Too many projects, at present, only consider procurement/construction and ignore what happens afterwards, or cover it under vague generalisations such as "improved service". Even if agencies benefit, it is sometimes unclear whether society as a whole receives a net benefit or not.
- Proposals can be more easily and completely evaluated if expected benefits and costs, and the assumptions on which they are based, are fully described.
- To estimate the values of benefits, project proponents must first quantify them. This facilitates post-evaluation, as targets are available against which actual performance can be measured. Knowledge that assumptions can be checked in his way might also discourage exaggeration of expected benefits.
- Decision-making becomes more well informed and transparent, and resource allocation more efficient, when the potential advantages and disadvantages and the economic consequences of a project are fully and clearly laid out.

[2] The Concise Oxford Dictionary, Oxford University Press, 1993.

Project Preparation & Appraisal

It should be understood that the purpose of a feasibility study is not simply to justify a project and thereafter automatically to begin implementation. More correctly, the purpose of a feasibility study is to determine whether a project is economically justifiable or not, to find the most efficient alternative, or to decide priority in project selection and implementation. Feasibility studies can equally show that certain projects or alternatives are not economically justifiable – that economic costs would be greater than economic benefits and that implementation, therefore, would result in a net reduction of the social wellbeing of the country instead of an improvement.

It should also be understood that projects with high economic feasibility, on paper, do not always generate high economic benefits in practice. This can be due to various factors – for example, benefits might be exaggerated, costs might be under-estimated, and assumptions might be incorrect (deliberately or innocently). One of the roles of the project appraiser would be to test the reasonableness of estimations and assumptions. Furthermore, projects might fail to achieve their expected benefits if they are poorly implemented or managed, if the socio-economic environment changes, if new technology makes the project obsolete before the end of its expected life, and so on. Risks and uncertainty associated with the completion of a project and in the realization of the anticipated benefits are also important. Project appraisers must also consider these factors when deciding which projects to recommend.

Evaluation and appraisal should not end with project implementation. Post-evaluation studies are an essential step to complete the planning process that starts with the feasibility study. The post-evaluation will determine if anticipated benefits and costs have actually been achieved, which is necessary to determine if existing projects and services need revision, to test if strategies and designs are appropriate, and to improve future estimates of benefits and costs.

It is recognized that feasibility studies and their constituent analyses are part of a larger decision-making process that includes non-economic and political factors, especially for public investments. Feasibility studies, however, can play a very important role by fairly showing the economic effects of decisions and by giving a transparent framework within which decisions can be taken.

Tools of Best Practice

This report contains a number of 'best practises' that can be developed to undertake the preparation and the appraisal of feasibility studies for transport sector projects in Sri Lanka. The study team has developed these tools after extensive research, discussion and debate on the most appropriate method or tool . These tools are not intended to be a prescriptive format for all project formulations and appraisals. It is intended as a guideline at most.

The tools include valuation techniques and values obtained from such techniques. It must be emphasised here that these should in all instances be used only where original data is either unavailable or cannot be collected within the available time frame. Even in such instances they

should be used as approximate values. It should be borne in mind that the duty of estimating and valuing benefits lies with the project proponent. These tools are developed for the purpose of assisting the appraiser in determining the validity of the methods applied and the estimates and values derived thereby. In this context, it should be pointed out, that both the methods as well as values need to be reviewed and updated from time to time.

Judgement of the Appraiser

The analytical tools of benefit-cost analysis do not intend to substitute for the judgements of the appraiser. They are intended to complement the technical skills of planners, and appraisers. These tools would most useful for appraisers with an understanding of transport economics, transport demand estimation and transport costing. Skills in engineering, environmental and operational aspects of transport projects would be a distinct advantage in transport sector project appraisal.

The use of these tools is intended to improve the process of benefit cost analysis by rationalising and providing a scientific approach to the assessment of benefits. The appraisers are encouraged to use these tools in this manner in order to avoid the pitfalls of potential generalisation and subjective evaluations. These tools can be a powerful instrument to provide a more objective and transparent application in Benefit Cost Analysis and overall project appraisal.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

1. INTRODUCTION

This report presents the findings of the study 'Formulation of Methods of Assessment for Capital Investment Projects in the Transport & Highways Sectors'. This study was commissioned by the Department of National Planning and undertaken by the Transportation Engineering Division of the Department of Civil Engineering, University of Moratuwa, Sri Lanka.

1.1. Terms of Reference

The revised terms of reference as decided at the meeting with National Planning Department (NPD) on 24th June 1999 and recorded in the minutes are as follows; Review of existing criterion for appraising capital investment projects in the transport & highways sector.

(a) Overall Review of the Six-Year Development Plan for transport & Highways sector projects and make recommendations accordingly.

(b) Formulate appropriate methods for the quantification of benefits from typical projects in the transport & highways sector;

(c) Document a selection of representative projects of the SYDP and Provincial Road projects as case studies using methodologies appropriate for the long & short methods of project evaluation

(d) Develop formulae and measures of assessing unit costs and progress of physical implementation of capital investment in the sector.

(e) Train the staff of NPD and others as may be selected by NPD to use the above methodologies and formulae in the assessment of transport and highways projects.

This was amended from the original TOR as per NPD letter dated 27th January 1999. According to the TOR, the Department of National Planning appointed a Consultative Committee (CC) for purpose of directing the study. At the first CC meeting held on 22nd July 1999, it was clarified that the study would be confined to public investment. Therefore, only economic appraisal was to be undertaken in the study. The only financial considerations to be investigated, would be confined to revenues earned from public investments. The second meeting of the CC held on 24th November

made the request for an implementation strategy, particularly for strengthening planning units in the Line Ministries and Line Agencies to be proposed.

1.2. Study Team

The study team comprised the following personnel:

- Dr. Amal S. Kumarage (Team Leader, Transport Planner & Engineer);
- Mr. U.E. Storm (Transport Costing Specialist);
- Dr. T.L. Gunaruwan & Mr. S. Ranawana (Transport Economists);
- Mrs. D. Mudannayake (Highway Engineer).

Professor Malik Ranasinghe and Mr. K.G.D.D.Dheerasinghe as Peer Reviewers assisted the study team in reviewing the documentation. Ms. MDRP Jayaratne provided the technical and administrative assistance to the study team. Their contributions are gratefully acknowledged.

1.3. Study Process

The Project was implemented over six months spread over three stages. In **Stage 1** (months 1-2) an initial meeting of the CC was held on 22nd July,1999 and an inception report was submitted prior to this meeting. The study team considered the comments received at the CC meeting for inclusion in the study. During the **Stage II** (months 3-4) the team developed quantification of benefits and methodology for investment appraisal. The first workshop was held on 19th August, 1999. The **Final Stage** (months 5-6) included the completion of the analytical tools for project implementation and the training of the staff of the NPD, line ministry and its agencies and provincial councils. Five training sessions have been held. A Draft Final Report was issued on 19th November ahead of the Consultative Committee Meeting held on the 24th of November 1999. This Final Report includes comments received from the participants of the training sessions, the Consultative Committee, the NPD and others forwarded by the NPD.

1.4. Brief Overview of Contents

A summary of the conclusions and recommendations, including the proposals for implementation have been incorporated into the Executive Summary given separately.

This report is divided into six chapters, including this Introduction. These describe:

(a) review of the existing criterion of project appraisal (Chapter 2), which is a concise review of the criterion developed for project appraisal in Sri Lanka and a discussion on the present and past practice;

(b) process of project appraisal for transport sector projects (Chapter 3), which describes the process of project formulation and appraisal that would be most appropriate for transport sector projects;

(c) applying methods of project preparation and appraisal (Chapter 4) is a full description of the issues in applying the methods of appraisal for transport sector projects, including the processes involved in formulating projects objectives and goals, identifying alternatives, estimating project life, assessing and quantifying life cycle costs and benefits, and selecting the appropriate discount rate;

(d) criterion of selection (Chapter 5) deals with the multi-criterion nature of decision making in transport sector projects and discusses issues to be reckoned with in making final decisions between projects;

(e) review of the Six-Year Development Plan (Chapter 6) is a critical review of the transport projects in this recently concluded plan.

The report has two appendices. These contain:

(a) case studies (Appendix A) where four selected projects from different sub sectors have been appraised and

(b) methods of quantifying & valuing sector benefits (Appendix B) is a description of the work of the study team in the review of available methodology; development of appropriate methods and valuation in the Sri Lankan context.

1.5. Acknowledgments

The study team gratefully acknowledges the initiative taken by Dr. (Mrs.) Pat Alailima, Director General- National Planning in deciding that the study be undertaken by a team of local consultants. The efforts of Mr. M. Vamadevan, Additional Director General, NPD, which ensured the smooth administration of the project and liaison with the Consultative Committee and other agencies, must be acknowledged with much gratitude. The study has been also enriched by the views expressed by members of the Consultative Committee, officers of the NPD and participants at the workshops and training sessions.

CHAPTER TWO

2. REVIEW OF EXISTING CRITERIA FOR PROJECT APPRAISAL

2.1. Introduction

In an environment of public resource constraints, it is imperative that proposals submitted by Line Ministries and Agencies are well prepared, thoroughly appraised to highlight the contributions of such projects towards the country's socio-economic development, and assigned with priorities. Financial allocations should then be made according to such priorities.

In general, the basis of appraisal should be the economic and financial viability of investment proposals[3]. The fundamental method to screen projects and to assess their comparative viability is benefit-cost analysis, which has been developed to cover financial, economic, and social issues, and, more recently, has been extended to incorporate environmental issues as well.

The Department of National Planning (NPD), as the apex appraisal body, is responsible for capital resource allocation. Its primary objective would therefore be to enhance the contribution to socio-economic development. Therefore, the appraisal process centers on the economic viability of projects it appraisers.

To do so, it has adopted a two-tier appraisal procedure comprising (a) a two-stage appraisal for investment proposals above Rs 100 million and (b) a single stage appraisal for projects below this limit.

While the NPD performs the central appraisal function for all projects, it has approval powers only for small-scale projects (below Rs 10 million). Proposals valued between Rs 10 million and Rs 100 million need to be approved by the Government Co-ordinating Bureau (GCB). The Cabinet of Ministers must approve mega-scale investments over Rs 100 million.

[3] When this report refers to economic viability, environmental aspects are also included.

2.2. Evolution of the Appraisal Mechanism

Public investment proposals are appraised using procedures that have evolved over the years, through experience and through various reviews that were carried out to rationalise and improve the appraisal mechanism. Two of the reviews are worth further mention. The first was the outcome of a consultancy provided in 1989 by a team from Bradford University led by Professor Mike Veitch, which is commonly referred to, as the "Mike Veitch Approach"[4]. The other major revision was an attempt to integrate environmental concerns into development planning[5]. This resulted in a mechanism called the "Integrative Approach".

2.2.1. Mike Veitch Approach: Salient Features

The underlying structure of the Mike Veitch Approach has been carried forward through all later revisions and reviews. The essential elements of this mechanism are:

- Differentiation between large scale and small scale projects;
- A two-stage appraisal mechanism for large-scale projects and a one-stage appraisal mechanism for small-scale projects;
- Emphasis on appraisal of large-scale projects;
- Project appraisal is considered the vital stage;
- Introduction of environmental appraisal.

Under this mechanism, all projects were expected to go through the NPD appraisal process at least once before approval. Large-scale projects would be subject to NPD appraisal at two stages – at a pre-feasibility stage and again at a detailed feasibility stage. At each of these stages, the NPD could provide feedback to the project developer to improve features of the proposal. The mechanism, if strictly followed, did not permit projects to be implemented without being screened. Furthermore, each institution was aware of its exact role at each stage of project development and appraisal, and hence proposals flowed smoothly through the various stages of the mechanism. This mechanism also, for the first time, highlighted the importance of environmental appraisal in evaluating development projects.

However, the mechanism had the following shortcomings also:

- Intervention was not early enough to allow NPD to be pro-active in project development;
- Environmental appraisal was subordinated and not integrative;
- Emphasis on small-scale projects was comparatively less.

[4] Veitch, M.D., *Project Planning Appraisal and Implementation in Sri Lanka*, Volume I (Main Report), Project Planning Centre for Developing Countries, University of Bradford, February 1986.

[5] Gunaruwan, T.L., *A Procedure to Integrate Environmental Concerns into Development and Appraisal of Public Investment Projects*, Department of National Planning, 1996.

2.2.2. Integrative Approach

The Department of National Planning, with the support of the Ministry of Environment, launched a project to revisit the public investment planning procedure, in order to improve appraisal, particularly to integrate environmental concerns. The two-year project, which ended in 1996, resulted in a revised project appraisal mechanism that, for the first time, explicitly integrated environmental appraisal with the economic appraisal.

The mechanism had the following distinctive characteristics:

- The focus was entirely on medium/large scale projects;
- The basic framework of economic appraisal laid down by the Mike Veitch Approach was retained;
- Environmental concerns were explicitly integrated into project appraisal;
- A three-stage appraisal was introduced, with the introduction of a concept paper at submission stage;
- Focus was shared between the project proponent and the appraiser.

The most distinctive advantage of this Integrative Approach was the earlier intervention by NPD, which was achieved through introduction of a "Project Submission Format" (PSF)[6]. This format made it compulsory for the proponent to submit the proposal at its concept development stage and to obtain preliminary clearance. This enabled early rectification of weaknesses and easy modification and improvement, avoiding wastage of resources at the end of the pipe. The integration of environmental concerns into project development was also facilitated.

The Integrative Approach called for a three-stage appraisal of large development projects. After the concept stage appraisal through the PSF, the procedure involved pre-feasibility and final feasibility appraisal stages. The Integrative Approach had retained the last two stages of the Mike Veitch Approach, but with considerable modifications.

The procedure emphasised the role of the project proponent and Line Ministries, as "ownership" of the project was considered important. Furthermore, since the Line Ministries were expected to become more involved in developing and reviewing projects, it was considered important to strengthen their planning capability by setting up Planning and Monitoring Divisions (PMDs) in their subject areas. The principle interaction during the project appraisal life, therefore, was expected to be between the NPD and the PMD of the Line Ministry.

The procedure proposed to establish institutional links among various external appraisal and/or regulatory institutions. It also recognised the necessity for the NPD to identify a pool of technical, engineering, and scientific experts whose services could be obtained on a case-by-case basis in order to supplement expertise within the NPD. The procedure, if implemented properly, was expected to reduce the end-pipe conflicts among institutions. However, in order to handle end-pipe

[6] Ibid.

conflicts among Agencies, should they occur, a Project Clearance Committee (containing multi-disciplinary skills) was proposed.

The mechanism had the following shortcomings:

- Little focus on small projects, but high emphasis on large projects;
- No reference to sector specific issues (e.g., the transport sector);
- Three stages were considered too long and inconvenient;
- It required strengthening of NPD and PMDs of Line Ministries;
- Partial implementation leading, sometimes, to lose the entire purpose.

2.3. Reviews of the Appraisal Mechanism

After official adoption of the integrative appraisal mechanism by the Department of National Planning in 1996, two important reviews were made. These are briefly discussed to understand important parameters that should be included in any project development and appraisal mechanism.

A first review was done in 1997 under the Natural Resources and Environment Policy Project (NAREPP)[7]. This noted certain strengths and weaknesses of the Integrative Approach, its implementation status and room for improvements.

A second review was done in 1998 under an ADB-funded project called Institutional Strengthening for Environmental Assessment (ISEA)[8]. This focused on the extent to which the integrative approach had been adopted by the respective government agencies, particularly with respect to integration of environmental considerations in project planning. The main points of the review were as follows:

- That institutional issues were interfering with effective implementation of the Integrative Approach;
- That the channels of information exchange among NPD, Line Agencies, and Environmental Authority, on which the Integrative Approach depends, were slow to be established.

This review also made a useful distinction between projects prepared with external donor assistance and projects originating within Line Agencies. Donor-funded projects require comprehensive review and appraisal to meet internal requirements of the donor organisations. The review suggested that the appraisal procedures of the donor agencies could be modified to meet the appraisal criteria of the Government whereas the Integrative Approach would continue to apply for project proposals prepared by Line Agencies.

[7] Sherine Jayawickreme, *Integration of Environmental Considerations in the Planning Process of Public Investment Projects for Sri Lanka: An Issue Paper (Draft)*, National Resources and Environmental Policy Project (NAREPP), Colombo, 1997.

[8] Cost-Benefit Analysis:Concepts and Practice (1996), Anthony & Boardman, et.al, Prentice Hall, NJ

2.4. Currently Adopted Procedure

The present practice of the NPD appears to be somewhat different from what was recommended by the studies. The NPD has issued a circular[9] to all Line Ministries to adopt a "Project Concept Paper"[10] (PCP) from July 1998. This format has origins in work done by a consultant to the Department of External Resources. It has been developed primarily as an attachment for obtaining additional information usually required by donor agencies in order to consider external funding of larger scale projects.

This seven page document requires details of objectives, locality, impacts to environmental by sensitive features, implementation proposal, cost and financing. It does not provide for assessing benefits. Neither does it indicate any form of benefit-cost analysis. The PCP like earlier formats is not sector specific. Other than the instruction in the PCP itself, as yet, no other official guidelines have been issued to Line Ministries and Agencies in this regard.

The project appraisal methodology currently adopted by the NPD has two stages. This involves appraising proposals submitted through the Project Concept Paper (PCP) at the first stage, for projects involving investment of Rs 100[11,12] million or less. A Feasibility Report is called for projects over Rs 100 mn. referred to as 'Mega' projects, at the second stage.

This procedure is different from the "Integrative Approach" adopted by the NPD in 1996, as that approach recommended a three-stage appraisal for large/medium scale projects. The current PCP is more detailed than the PSF of the Integrative Approach, raising a concern that the advantages of "early intervention" by NPD might be lost if detailed formats are to be submitted in the first round. Moreover, this PCP based process does not require an economic feasibility for any project up to a Rs 100 mn in value.

Furthermore, the two stages of pre-feasibility and detailed feasibility featured in both Mike Veitch & integrative approaches appear to have been reduced to one stage - a single feasibility study. This removes the distinction between medium and large projects. The following provisions made in the 'Integrative Approach' do not seem to be practiced at present:

- Intervention by the NPD at the earliest possible stage of project development
- "Pre-feasibility with Initial Environmental Examination (IEE)", which would be adequate to appraise medium scale projects,
- "Detailed feasibility report with an Environmental Impact Assessment (EIA)", which would be required for large scale and prescribed projects.
- Coordination between the environmental appraisal process (administered by the NPD) and the economic appraisal process (administered by the NPD) and

[9] By letter dated 5th June 1998, issued by Secretary, Ministry of Finance & Planning.

[10] National Planning Department in early part of 1999 has issued Project Concept Paper a seven page document to Line Ministries and Agencies.

[11] Development Planning Guidelines, Ministry of Finance & Planning.

[12] Financial Management Code, published by Ministry of Finance & Planning.

- Provision of technical inputs to NPD's appraisal through obtaining expert advice on a short-term basis, selected out from a pre-established pool of experts

It is noteworthy that high value projects are more likely to involve larger-scale works of the type included on the list of environmentally prescribed projects that require EIA, although there are exceptions (e.g., purchase of rolling stock).

The current procedure also appears to be different from the "Mike Veitch Approach", although use of two stages of appraisal makes it appear similar. Mike Veitch Approach, for example, recommended pre-feasibility analysis and a subsequent detailed feasibility, coupled with a suitable environmental assessment. The current system appears to rely only on a "Project Concept Paper" stage and a single feasibility analysis stage, without an explicit mechanism to deal with environmental concerns.

The current approach, however, has the advantage of being simpler to use than the Integrative Approach. It has the additional advantage of giving sufficient focus for smaller-scale projects, in which the Integrative Approach appears to be weak.

Table 2.1 - Comparative Analysis of Appraisal Mechanisms

Characteristic	Mike Veitch Approach (1984)	Integrative Approach (1996)	Currently Adopted Approach[13]
Stages of Appraisal	Two (large projects) One (small projects)	Three (large projects) Two (small-medium)	Two
Development stage	Agency / ministry Less appraisal	Agency & PMD of Line Ministry More appraisal	Agency/Ministry
Initial submission	Pre-feasibility report	Concept paper (referred to as a PSF) at the very inception	Revised Concept paper (referred to as PCP at very inception)
Cross-sectoral Intervention	As a separate exercise (e.g., environmental)	Integrative (Advisory Group, Env. Group, etc)	Not Specified
Input from Appraisal apex	After some time	From the beginning	Not specified
Statutory obligations	Implicit	Explicit	Not specified
BCA requirement	Explicit	Explicit with extensions	Not specified
Decision	By the Cabinet assisted by CDS	By the Cabinet assisted by CS and	By the Cabinet assisted by GCB
Emphasis on Small Projects	Some emphasis	Almost no emphasis	Better emphasis
Implementation Record	Poor	Weak, only some elements implemented	Too early to Evaluate
Transport Sector Application	General, and no specific reference	General. No specific Reference	General. No specific Reference

[13] Based on the study team's interpretation, as written guidelines of implementation procedures for the current mechanism are under preparation and, therefore, not available.

2.5. Present Practice in the Transport Sector

The present practice in the transport sector is that Line Agencies formulate the Project Concept Papers as the initial submission for project appraisal. This practice has been in operation only for a few months. It is assumed that on receipt of the PCP, that small projects would be appraised and approved by the NPD. It is understood by the Line Agencies that if project cost is more than Rs 100 mn. that a feasibility study should be forwarded instead of the PCP.

However, there is no apparent dialogue as yet, that has developed, between the Line Agency, the Line Ministry and the NPD with respect to follow-up to a PCP when submitted to NPD. The process of appraisal and basis of rejection of projects does not appear to be understood very well by the Line Agencies. There is also the concern that projects are often initiated without submission of the PCP.

In case of foreign funded projects, a Terms of Reference is usually drawn up by the prospective donor agency and approved by the Line Agency before award of a feasibility study. There are no general guidelines available with agencies for preparing such studies. If an agency itself is to undertake such a feasibility study, the depth of the feasibility study is usually confined to the expertise available within the agencies.

In the case of large (i.e. mega) projects, including foreign funded projects, it is not clear when the Line Ministry, NPD and other agencies are required to get involved. The present understanding among Line Agencies is that the first submission of a large project is in the form of a Feasibility Study. It is possible that this could be interpreted a requirement not to submit a PCP.

Most agencies however, do not have personnel especially trained in project preparation. While many agencies have a 'Planning' branch or division, their duties are not understood very well. In most cases, their tasks related to project formulation & appraisal are confined to filling Project Concept Papers and other documents required for project approval, in the required format.

Most agencies rely mostly on cost information in project preparation. This arises from the lack of expertise available to value benefits. Consequently, most agencies have an outlook of "least costs" rather than maximising net returns on investment, as an objective in project formulation. The present PCP also has little emphasis on benefits or benefit-cost analysis. The present practice could therefore, lead to under emphasis in the consideration of benefits in project appraisal even further.

Furthermore, there is, in the Transport Sector, block votes that comprise a collection of small projects such as minor repairs or rehabilitation of small sections of road. At times, these add up to large monetary values, as there could be many such small items in a single block vote. There are problems in appraising such packaged projects due to the complexities in assessing total costs and benefits and it is found that most of such projects escape appraisal all together.

2.6. Present Practice in the Provincial Sector

The present practice in the provincial sector is yet different. There is no formal appraisal except what is done by the project proponent at the time of project formulation. There is no practice of following a Project Concept Paper or any other format. Projects are simply included in the budget on varying basis of consideration. Due to the small budgetary allocations in provincial road sectors, most new projects cannot be completed over a period of one or two years. Consequently, they are begun with a token vote and each subsequent year, some improvements are carried out with additional funds. Most projects evolve over several years, eventually ending up with a significant total investment that would have required a higher level of appraisal had it been considered as a single project.

2.7. Guidelines for a Revised Approach

The following appear to be the most important features to be incorporated in a project appraisal mechanism – to ensure that it can be practically implemented and can be instrumental in efficient allocation of scarce capital resources:

- Simplicity;
- Clear and short procedures to deal with small scale projects;
- Longer and more detailed procedures to appraise medium and large scale projects;
- Identification of appraisal and approval authorities;
- Preliminary intervention by the NPD at the earliest possible stage for medium/large scale projects;
- Explicit environmental integration, particularly for medium/large scale projects.

It appears appropriate, therefore, to use a "short and quick" method at the national level, to appraise smaller scale projects submitted by Line Ministries and Agencies. The same approach can be adopted at the provincial level, to appraise small-scale provincial and local government projects. Such a short cut is not appropriate, however, for medium- to mega-scale projects, and hence the NPD should adopt a more detailed (or long) methodology to appraise such projects.

CHAPTER THREE

3. PROCESS OF TRANSPORT SECTOR PROJECT APPRAISAL

The previous Chapter reviewed the process of project appraisal presently applied for all sectors. It was highlighted that existing methods are not sector specific.

This Chapter will propose and discuss thereafter, a framework within which an appropriate form of project appraisal can take place, for the transport sector. Some of the conceptual issues proposed may also be applied to other sectors if found appropriate.

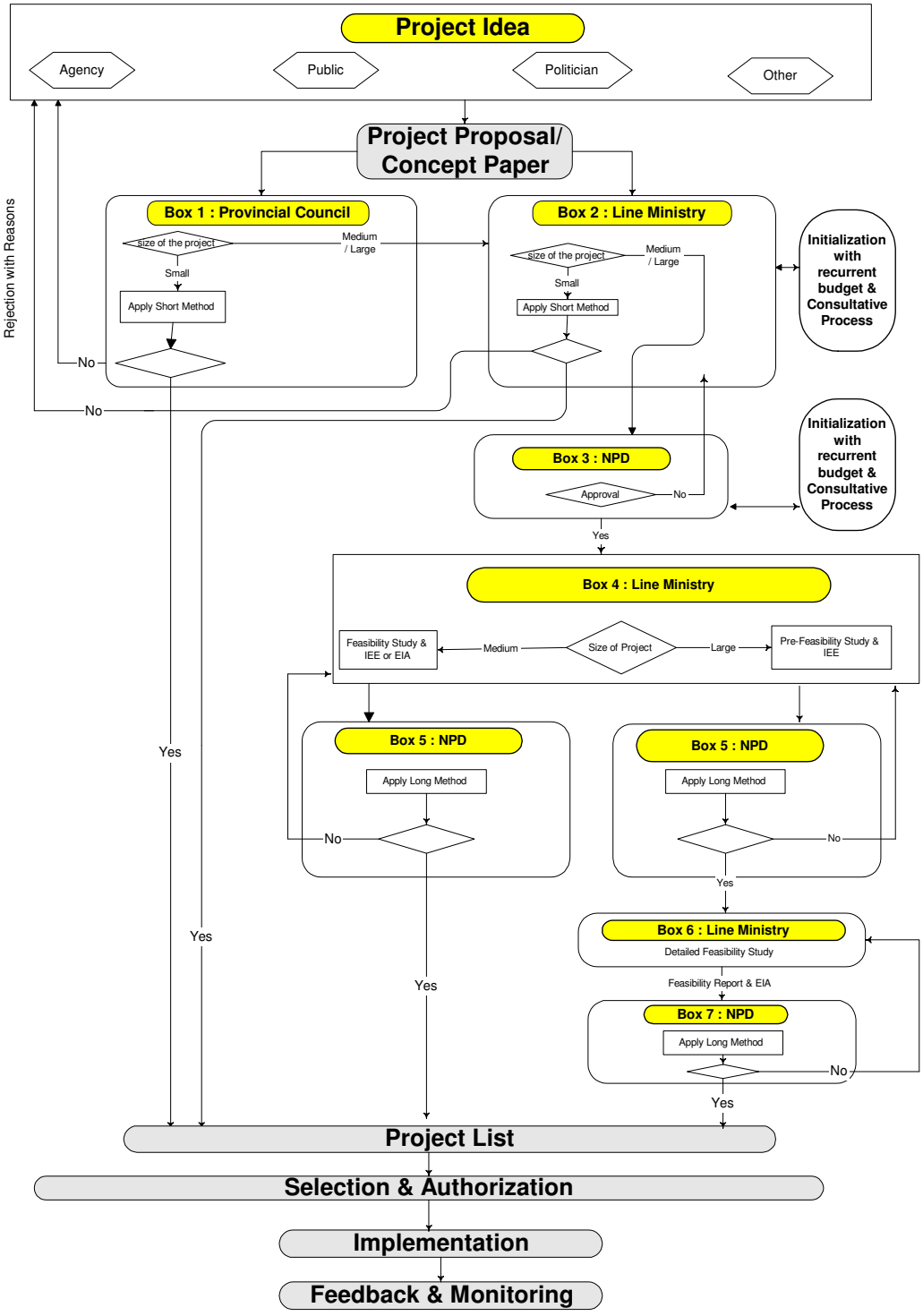
The proposed process of project appraisal is outlined in Figure 3.1. This process has several distinct steps and intermediaries, which are identified and described as follows:

- Project Idea
- Project Proponent
- Classification of Projects
- Concept Paper
- Project Appraiser
- Short Method of Appraisal
- Long Method of Appraisal
  - Initialisation of Pre-feasibility Study
  - Initialisation of Feasibility Study
- Project Authorisation
- Project Pipeline
- Monitoring Implementation
- Post Implementation Monitoring & Feedback

All projects should be appraised using a Concept Paper at the first stage. For small scale projects, this Concept Paper should be considered as being adequate submission for appraisal, provided costs and benefits are properly identified and even approximately valued. This would enable some benefit-cost analysis to be performed in the appraisal, which would otherwise be based only on qualitative information. For small scale projects, the appraisal process would then constitute a single stage only.

For medium scale process, it is recommended that once, the Concept Paper is appraised and approved, a pre-feasibility study be undertaken. This should be appraised as a second stage.

Figure 3.1: Flow Chart for Proposed Transport Sector Project Appraisal



In even larger projects, it is recommended that a feasibility study be carried out after the pre-feasibility is appraised. Thus, for large projects, the process of appraisal would comprise three stages.

3.1. Project Idea

A project idea can be defined as the first expression of need or requirement for a project. It can emanate from many different sources such as a discussion at a planning committee (or council) meeting, a request made by a political representative, a suggestion made by a member of the public, a recommendation made in a development study, and so on. These ideas by themselves do not constitute projects. An idea becomes a project only after a project proposal is made based on the idea. The project proposal should take into consideration the wider issues arising from implementing the idea and the associated benefits and costs.

3.2. Project Proponent

The Agency that is responsible for executing or implementing a project idea, should be the project proponent. The project proponent should ensure that appropriate technical skills and tools are available to convert project ideas to project proposals.

3.3. Classification of Projects

Project ideas in order to be converted into projects, need to be classified according to their critical attributes. This section will attempt to classify projects to assist the process of project formulation. Projects can be classified on the following basis:

- By Goals & Objectives
- By Type of Investment
- By Size of the Investment

3.3.1. Classification of Goals & Objectives

The results of any project or program could be assessed at two levels. On the one hand, projects can be evaluated on the basis of asset or service procurement and implementation; for example, number of buses procured, kilometres of road widened, kilometres of railway signals installed. This is a very superficial level of assessment.

Asset or service procurement and implementation, however, do not necessarily guarantee that benefits will be generated. A more meaningful and rational assessment would be based on the ultimate outcome of the project, of which there could be more than one attributed to a single project. Since transport is generally not a service desired for its own sake, its outcome is measured by the other benefits to which it can contribute. For example, higher speed on a road is not an

objective in itself, but is a means to achieve saving in travel time and thereby increase resource productivity. The following multiple goals are typical for transport sector projects:

- Economic
- Social
- Environmental

Transport projects should be evaluated on the basis of how much they contribute towards achieving these wider goals. A single project may have one or more of these goals.

> ***Example**: A new rail line may satisfy economic goals by reducing travel time, satisfy social goals by providing access to services such as schools and hospitals for hitherto inaccessible remote communities, and satisfy environmental goals by diverting road traffic to rail and thereby reducing air pollution.*

3.3.2. Classification by Investment Type

Investments can also be classified by (a) their functional nature and (b) their contribution to the national asset base, in a two-dimensional format as shown in Table 3.1. The classification is useful to determine the level of investment in each category. The amount for investment in each category should be consistent with the value of the asset base and its life period.

New Assets: These are investments that provide new and hither-to non-existing facilities to meet new demand, to keep up with increases in demand that cannot be satisfied with improvements, and to meet demand for increased quality of service. Generally, new assets generate new societal benefits—such as time saving, vehicle operating cost saving, development, comfort—but they increase recurrent costs because they add to the annual costs of operations and maintenance.

> ***Example**: If rail passenger demand is increasing by 5% per year, and if rolling stock is already being used efficiently, it can be argued that the rolling stock fleet should be also be increased by 5% per year. Operation of the additional fleet might encourage traffic to shift from road to rail and thereby reduce road congestion, but the Railway will incur additional expenditure to operate and maintain the trains over their economic life.*

Improvements: These are investments that develop or "make better" the condition of existing assets. They can involve any combination of the following (a) additions to existing assets, (b) replacement of existing assets with assets of increased capacity, and (c) replacement of existing assets with assets that have qualitative improvements. Generally, investments in improvements will generate only *incremental* societal benefits; analysts and appraisers should take care to ensure

that such benefits are not over-stated. Recurrent Agency costs may increase or decrease, depending on the nature of the improvement.

> ***Example**: Replacement of wooden sleepers and 88 pound rail with concrete sleepers and 90A rail would be an improvement, as the new rail can accommodate heavier trains and higher speeds. Benefits might be lower operating costs due to heavier trains and time saving due to high speeds. As concrete sleepers have slightly lower life-cycle costs than wooden sleepers, Railway recurrent expenditures would also reduce.*

> ***Example**: Widening a 2-lane road to a 4-lane road would be an improvement, as the extra capacity can accommodate greater numbers of vehicles. Benefits might be reduced congestion costs (until induced traffic fills the additional capacity). As 4-lane roads have higher maintenance requirements than 2-lane roads, other things being equal, Agency recurrent expenditures would increase.*

> ***Example**: Modifying a bus (or a railway carriage) to add air-conditioning would be an improvement, as a higher quality of service can be provided. This would increase operating costs, but its benefits would be the value of the higher comfort provided by air-conditioning.*

Under present highway terminology, certain types of projects that are called "rehabilitation" should more appropriately be called "improvement" if the new roads have a higher or improved standard than the old roads.

> ***Example**: Putting an asphalt concrete (AC) overlay on an existing double bituminous surface treatment (DBST) road would be an improvement, as the AC overlay would give longer life and smoother surface. Benefits might be time saving from higher speed, reduced vehicle operating cost (VOC) from lower roughness.*

It is the combined investment in "new assets" and in "improvements" that increases overall transport capacity.

> ***Example**: A network of 10,000 kilometres of national roads having 4-6% annual traffic growth, might require 4-6% capacity expansion per year to maintain the same level of service. Assuming a cost of Rs 10 million per kilometre to construct or improve roads, this suggests an annual investment of Rs 4-6*

billion. If the present level of service is inadequate, then road capacity should be expanded more than the increase in demand and investment should be higher.

Replacement/Rehabilitation: Replacement refers to investments that replace existing assets with *identical assets* in terms of capacity and/or quality at the end of their economic design life. Rehabilitation refers to investments that replace many or most major components of existing assets *to extend* their economic design life.

***Example**: Replacement is relaying an AC overlay on a road, putting up a new bridge with the same capacity and standards as the old bridge, buying a new shunting locomotive with the same operating and maintenance characteristics as the old locomotive. Rehabilitation is sand sealing an SBST road, replacing a decayed bridge deck but keeping the same foundations, replacing the engine, exhauster, and cooling system of a shunting locomotive but keeping the same body platform and bogies.*

Replaced or rehabilitated assets do not generate new societal benefits, but restore and maintain existing benefits. Analysts and appraisers, however, must still determine the quanta of benefits that would be maintained, which is done in a similar process to new benefits.

***Example**: Replacing an AC overlay will restore the original benefits—such as time and VOC saving—of higher speed and lower roughness. Net benefits, therefore, will be based on the difference in speed and roughness over the life of the new AC overlay, with and without replacement.*

Generally, replacement/rehabilitation reduce Agency recurrent costs because the replaced or rehabilitated assets have lower operating and maintenance costs than the old assets. Rehabilitation usually requires lower investment than replacement, but this is offset by shorter life, fewer benefits (as rehabilitated assets usually cannot maintain the same service standards as newly replaced assets) and by higher operating and maintenance costs.

***Example**: Rehabilitating a locomotive instead of replacing, it might reduce investment by 40-50%, but the rehabilitated locomotive will have a shorter life (e.g., 10-15 years instead of 25), lower reliability, and higher maintenance costs, as much of the locomotive is still old.*

Even without growth in traffic volume, assets need to be replaced or rehabilitated at the end of their economic life to maintain the asset base at its design level.

> ***Example**: A network of 10,000 kilometres of national roads with, say, an average 20-year life, require an average of 5% to be replaced/rehabilitated each year to maintain the asset base. Assuming an approximate cost of Rs 10 million per kilometre for replacement/rehabilitation, the annual investment requirement would be Rs 5 billion. If replacement/rehabilitation has been deferred in the past, a greater investment might be needed to "catch up".*

Maintenance: This refers to the normal recurrent expenditures—annual and periodic—required over the expected life of an asset, so it can perform with reasonable efficiency. Information on "normal" maintenance is not well developed for Sri Lanka, but most studies assume values between 1-2% of the replacement value of an asset for transport infrastructure maintenance and 4-6% for transport rolling stock.

> ***Example**: Annual maintenance includes routine work such as patching potholes, cleaning drains, and correcting edges on roads, tightening bolts, clips, and spikes, and replacing damaged sleepers on track, replacing brake shoes, hoses, filters, etc., on rolling stock, and so on. Periodic maintenance includes repairs to the entire asset, such as sand sealing of DBST and AC roads or performing scheduled repairs to rolling stock. Emergency or accident repairs—such as failure of a component such as a bus engine—also count as maintenance.*

Maintenance is not an investment, although Transport Sector Agencies presently include some components of maintenance under capital expenditures.

> ***Example**: Railway accounts earlier counted all unscheduled and scheduled repairs undertaken by the Mechanical Sub-department as capital. From 1998, labour expenditures were included under recurrent, but, inconsistently, spares were still included under capital, even for items such as brakes and filters. A more correct classification would be to include all maintenance labour and spares under recurrent, except those relating to rehabilitation of rolling stock.*

When investments are initially appraised, the analyses should include reasonable forecasts of annual and periodic operating and maintenance costs during the assets' economic life. Maintenance costs are thus appraised at the time of acquisition of the asset and need not be re-appraised annually. Annual expenditures need to be reviewed only if they are much lower or are much higher than forecast. Low amounts might indicate under-spending, which could reduce economic life, performance, and benefits. High amounts might indicate assets that have exceeded their economic life and should be replaced.

Technology and Human Resources Development: This refers to investments in research and development, in training (e.g., both in managerial and in technical skills), and in studies/surveys to develop transport-related information and databases, all of which are greatly under-represented in the Transport Sector. Technology research and development can yield lower cost designs, more efficient maintenance, increased economic life of assets, etc. Training can improve realisation of transport benefits (e.g., improved productivity and reduced Agency costs, more effective project implementation, etc.). Studies/surveys can collect information to improve economic analyses and to better match services with demand.

> ***Example**: It might be argued that investment in technology & in human resources development should not be less than 1% of total capital investment.*

Table 3.1: Two-Dimensional Project Classification by Investment Type

	New Asset	Improvement	Replacement Rehabilitation	Maintenance	Technology & Human Res. Development
Infrastructure Asset					
Rolling Stock					
Supporting Asset					

- **Infrastructure** refer to roads, bridges, rail tracks, signals & communication systems, etc.
- **Rolling Stock** refers to vehicles used for transport services, such as buses, locomotives, carriages, and wagons.
- **Supporting Assets** refer to facilities that support the core transport function, such as (a) technical (workshops, plant & machinery), (b) administration & management (offices), (c) operations, (d) marketing, (e) public relations, and (f) planning & monitoring.

3.3.3. Classification by Size of Investment

It is proposed that the size of the investment can be used to determine (a) if the "short method" or the "long method" of appraisal should be used and (b) the level of precision in analysis. This is more fully defined in the following sections.

However, given the large variation in investment —from under one million rupees to several billion rupees—and the requirements of environmental laws, which specify three types of evaluation, it is recommended that a three level classification be adopted as shown in Table 3.2. It should be noted, however, that requirements for environmental analysis are prescribed in the Environmental Act and may not necessary correspond only to the size of the investment.

Table 3.2: Proposed 3-level Classification by Size of Investment

Size of Investment	Value (Rs Million)[14]	Method of Appraisal	Extent of Appraisal
Small		Short method	-
Medium		Long Method	Pre-Feasibility
Large		Long Method	Feasibility

The short method of appraisal might be used for projects such as improvement or replacement of rural roads of less than 5 kilometres in length, construction of provincial bus terminals, or construction of train halts. Medium size projects requiring investment, say, up to Rs 100, might be appraised using the long method to a pre-feasibility level of detail. Larger projects (referred to as Mega Projects in the Development Planning Guidelines) might be appraised using the long method and a full feasibility level of detail. The environmental requirements of IEE and EIA reports may also correspond with size.

3.4. Project Proposal

A project idea should be developed as a potential project by considering first, the technical feasibility. If the project can be executed, then a proposal should be made by considering the facts surrounding the project. A proposal may be a pre-requisite for obtaining funds. Even otherwise, it acts as an instrument of appraising the viability and the returns on investment of such a project.

3.5. Project Concept Paper

It is the conclusion of this study that every project proposal, irrespective of the size of the investment, should be first submitted as a Concept Paper. It should form the first step in the process of project appraisal. Presently, the NPD requires submitting a seven-page Project Concept Paper (PCP). This appears to be too long as an instrument of first submission at the earliest possible stage. Furthermore, it lacks critical benefit considerations and identification of objectives and alternatives to effect a reasonable first stage appraisal. Some of these issues have been discussed in the previous Chapter.

A **Revised Concept Paper for Transport Sector Projects** (RCPTSP) that includes the relevant information considered essential for appraisal at the first stage, is given in Figure 3.2. This is a two page format, which is short enough to be a format for first submission, but is detailed enough to enable even an approximate benefit cost analysis. Its arrangement in a two-page format gives it more credibility as a 'paper' since it can be submitted on a single sheet of paper. As illustrated in Figure 3.2, the RCPTSP lays out the project objectives and alternatives, describes related issues,

[14] The National Planning Department, in accordance with Government Policy, should determine project values for the above classification. These values should be regularly updated in keeping with price escalation and project appraisal policy.

suggests some preliminary screening, and estimates the benefits and costs of each alternative considered.

It is intended as the only basis of appraisal for small projects. While for large projects, it will be provide the first set of information required for the first stage of appraisal.

Guidelines to filling the RCPTSP are given as Figure 3.3. The methods of estimating the costs and benefits in the proposed format are discussed in detail in Chapter 4.

Figure 3.2: Revised Concept Paper for Transport Sector Projects (page 1 of 2)

1. Project Proponent								
2. Project Name								
3. Classification	New Asset	Improvement	Replacement Rehabilitation	Maintenance	Technology & HR Develop.	Economic	Social	Environmental
(a) Infrastructure								
(b) Rolling Stock								
(c)Supporting Assets								
4. Objectives / Goals	•							
	•							
	•							
	•							
5. Project Impact Area								
6. Alternatives	•							
	•							
	•							
7. Conformity to Government Policy Directions	•							
	•							
8. Justification of Proposed Alternative	•							
	•							
9. Selection of Alternatives for Testing	Objectives							
	(a) Primary Alternatives		I	II	III	IV		
	(b) Secondary Alternatives		I	II	III	IV		
10. Geographic Locality	•							
11. Life of Project	•							
12. Project Commencement	•							
13.Conditions for undertaking project	•							
14. Environmental Issues & Clearance Required	• Is it a prescribed project as per Gazette No: 722/22 of 1993?							
	• Other requirements							

Figure 3.2: Revised Concept Paper for Transport Sector Projects (page 2 of 2)

15. Scenarios to be tested for BCA	•
	•
16. Arrangements for post-implementation activity	(a) Sustainability
	(b) Feedback
	(c) Post-evaluation
	(d) Monitoring

Alternatives	Base Case	Alt 1	Alt 2	Alt 3
17. Costs @ Pre-Discounted Rate				
(a)Land Acquisition & Resettlement				
(b) Civil Works				
(c) Consultancy & Supervision				
(d) Maintenance & Operations				
▪ Annual				
▪ Periodic				
(e) Training				
(f) Variations & Contingencies				
Sub Total				
(g) Cost of Externalities				
• Congestion				
• Environmental / Social				
• Others				
(i) Total				
18. Benefits @ Pre-Discounted Rate				
(a) Travel Time				
(b) Goods Travel Time				
(c) Vehicle Operating Cost				
(d) Accident Reduction				
(e) Vehicular Emissions				
(f) Regional Development				
(g) Other				
(i) Total				
19. BCA @ 0 % Discount Rate				
(a) BC Ratio (Benefits/Costs)				
(b) NPV (Benefits - Costs)				
(c) EIRR				
20. Investment Plan	**Years**			
(a) Capital Investment				
(b) Recurrent O & M (p.a.)				

Figure 3.3: Guidelines for Revised Concept Paper for Transport Sector Projects (page 1)

1. Project Proponent: name of agency making the proposal.
2. Project Name: name by which the project is identified (less than 40 characters including spaces). A project id number may also be useful.
3. Classification: the two-way dimensional classification of the type of project.
   - New Assets: Investments that provide new and hither-to non-existing facilities.
   - Improvements: Investments that develop or "make better" existing assets.
     - Replacement/Rehabilitation: Investments that replace existing assets with *identical assets* in terms of capacity and/or quality at the end of their economic design life.
     - Maintenance: Normal recurrent expenditures—annual and periodic—required over the expected life of an asset.
     - Technology and Human Resources Development: Investments in research and development, in training, and in studies/surveys to develop transport-related information and databases.
   - Infrastructure: refers to roads, bridges, rail tracks, signals & communication systems, etc.
     - Rolling Stock: refers to vehicles used for transport services, such as buses, locomotives, carriages, and wagons.
     - Supporting Assets: refers to facilities that support the core transport function, such as (a) technical (workshops, plant & machinery), (b) administration & management (offices), (c) operations, (d) marketing, (e) public relations, and (f) planning & monitoring.
4. Objectives/Goals: The economic, social and environmental goals that are pursued in the project as objectives should be listed here and ticked off against the appropriate column. These goals should be set after considering the existence of any anticipated problems that need to be solved through intervention by public investment.
5. Project Impact Area: A brief description of the geographical area that will be directly impacted by the project during construction and the distribution of the direct recipients of the benefits. In large projects, it is recommended that a map be attached.
6. Alternatives: All alternatives that are technically possible and are potentially capable of achieving one or more of the objectives stated in item 4 above.
7. Government Policy Directions: How the proposed project relates to documented Government Policy, strategic plans and investment plans.
8. Justification of Proposed Alternative: As the project proponent, the basis on which the project is being proposed over other alternatives.
9. Selection of Alternatives for Testing: From the alternatives tested in item 6. Above, what are selected for testing in the appraisal method. These are referred to as primary alternatives. Their degree of potential attainment of objectives maybe indicated by ticks/stars with a maximum of 5 for highest potential. In the case of secondary alternatives, these should be possible alternative variations of the proposed project itself.
10. Locality: the description of the Project Impact Area (PIA) in terms of administrative zoning.

Figure 3.3: Guidelines for Revised Concept Paper for Transport Sector Projects (page 2)

11. Life of Project: the lifetime of the project over which benefits are anticipated.
12. Commencement of Project: the year (and possibly the month) when the project is to commence.
13. Conditions: the conditions under which the project would be pursued.
14. Environmental Issues & Clearance: If the project is a prescribed project under Gazette Extraordinary 722/22 of 1993. Also other clearance such as coastal, flora & fauna, archeological etc as may be necessary.
15. Scenarios for BCA: The economic, transport policy and any other scenario under which the project alternatives should be tested in the appraisal process.
16. Post Implementation Activity: the activities that are proposed for (a) sustainability of the project, especially funds, resources and technical capacity required for ensuring the optimum level of maintenance and (b) monitoring of performance of the project and the capabilities of the agency in its actual achievement of the anticipated benefits (c) post-evaluation (d) feed-back.
17. Costs: the estimated costs before discounting. These may be computed from unit costs given in the Report '*Assessment of Public Investment in Transport Sector*', or from Agency SOR or estimates. In this, maintenance costs should be calculated for the project lifetime given in item 11 above. The total annual and periodic costs for the life time should be included. Consultancy and supervision costs include the cost of administering the project, which should be apportioned on some basis. Training refers to specialised training that needs to be a part of the project and required for its proper operation. A suitable percentage may be added for variations and contingencies based on project experience. Cost of externalities may also be estimated using unit values available for this purpose.
18. Benefits: These maybe estimated using approximate values and experience from previous detailed calculations. Unit values and methods of estimating these benefits are to be found in the Report '*Assessment of Public Investment in the Transport Sector*'.
19. Benefit Cost Analysis at pre-discounted rates computed as follows:
    (a) BC ratio (benefits (18 (i) divided by Costs 17 (i)) (b) NPV (benefits 18 (i) less Costs 17(i)) and (c) EIRR, the discount rate at which NPV is equal to zero.

Note : Item 17-19 should be completed for the proposed project and each of the selected alternatives.

3.6. Project Appraiser

Each project proposal should be submitted for appraisal in the Revised Project Concept Paper. It shoud be appraised by an institution other than the one proposing the project. In other words, no Agency should appraise its own projects. Typically, an Agency would submit its Concept Papers for appraisal to the Line Ministry, in which case the latter would become the appraiser. For larger projects, the NPD would become the final appraiser and the Line Ministry would assume co-ownership of the project along with the Agency that is the project proponent.

***Example**: The RDA might submit a proposal for a Rs 500 million bridge project. The Ministry of Transport & Highways would undertake the first appraisal. As this is a large project, which requires further appraisal, the Ministry would forward the proposal to the NPD for final appraisal.*

***Example**: A Provincial Agency might require approval for a rural road project of Rs 5 million. It would forward the*

proposal to the Provincial Ministry, which would appraise and, if viable, approve the project.

3.7. Short Method of Appraisal

The Short Method of appraisal is so called due to its intended shorter process. It is to be applied only in small scale projects. It requires only the Concept Paper for appraisal. In the appraisal of these relatively small projects, where the Short Method is to be used, it is not envisaged that detailed pre-feasibility or feasibility studies will be carried out. However, even for small projects, it is important to carry out some systematic BCA so that projects can be economically justified and ranked in order of priority.

It is proposed that the Short Method would be done as a single step, using information provided in the Revised Concept Paper (RCPTSP).

Costs can generally be calculated, without extensive effort, using engineers' estimates, and some unit costs are given in Chapter 4. Benefits, are more difficult to estimate. However, some unit values and methods of computing benefits are given in Chapter 4 as well as in Appendix B.

This study proposes to use a composite measurement for the Short Method, comprising direct transport user benefits and regional/other benefits. This is based on a review of methods used to evaluate rural road projects in various developing countries[15]. These methods calculate an index of benefits, which, although useful to compare the relative benefits of projects, do not reveal if they are economically beneficial, as benefits are not stated in monetary terms.

This study, therefore, proposes to estimate benefits in monetary terms by objectively valuing direct transport user benefits and by multiplying such monetary values by an index for regional development and other benefits. This method for "Valuation of Improved Accessibility" is introduced in Chapter 4 and described in detail in Appendix B5.

The Short Method should not ignore the features described in the Revised Concept Paper—such as definition of objectives, alternatives, life cycle, etc.—and a BCA should be carried out for all reasonable alternatives.

3.8. Long Method of Appraisal

The Long Method of Appraisal is required for any project that does not qualify for the short method of analysis. These projects are those large enough to require either pre-feasibility or a feasibility study to be carried out in the process of appraisal.

[15] Rural Roads and Poverty Alleviation, Edited by John Howe and Peter Richards, Intermediate Technology Publications, UK, 1984.

The Long Method should begin only on receipt of a pre-feasibility study. However, no pre-feasibility study should have commenced without the conclusion of the successful appraisal of the Concept Paper in the first stage of appraisal (common even to the Short Method). The appraisal of a pre-feasibility study becomes the second final stage of approval for a medium scale project, while the process should be repeated with a feasibility report as a third stage of appraisal for large-scale projects.

The Long Method begins by checking the submission of the pre-feasibility report for the proposed project for adherence to the originally stated goals and objectives in the Concept Paper. Benefits and costs should be more accurately quantified by accepted methods and valued appropriately for the proposed project as well as the alternatives identified in the Concept Paper. Tools summarised in Chapter 4 and described in more detail in Appendix B can be used for this purpose.

> ***Example**: A pre-feasibility study for the purchase of 500 buses would need to document information about the nature of the routes on which the buses would operate, loading patterns for passengers and freight, travel times, vehicle utilization, and potential revenue and operating costs.*

The environmental requirements may also be incorporated in to the pre-feasibility and feasibility stages. If the project is prescribed under Gazette No 722/22 of 1993, then it would be a sound practice to include at least an Initial Environmental Evaluation as part of the pre-feasibility study. A more comprehensive Environmental Impact Assessment could then be included as part of the feasibility study. However, since law requires environmental studies and approval, such procedures should be given due care and importance in the feasibility studies.

3.8.1. Initialisation of Pre-feasibility Study

Pre-feasibility studies should be undertaken for both medium and large projects. Such projects should have been approved at the first stage of appraisal after submission of the Concept Paper. Pre-feasibility will prepare a project proposal at a higher degree of accuracy than a Concept Paper. The proposal together with the pre-feasibility study, can then be re-submitted along the same lines as the original Revised Concept Paper, using the same (or similar) format given in Figure 3.2.

Pre-feasibility studies should be undertaken only after observations and recommendations relating to the Concept Paper have been received during a Consultative Process with relevant experts and Agencies, and should incorporate any proposed refinements. The appraisal agency, whether NPD or Line Ministry, should have access to expert views at short notice. If such expertise is not available in-house, it is advisable to have access to a pool of independent experts who can be called on as necessary.

> ***Example**: The pre-feasibility study for an expressway should also incorporate expert views on non-highway alternatives (e.g. railway or coastal shipping), urban and regional development,*

social and environmental issues, equity issues such as poverty and unemployment, and other matters such as industrial location and highway network planning.

Pre-feasibility studies, whether done by local Agencies or by consultants, should relate to the accepted goals and objectives and proposed project impact area. Such studies should also consider the alternatives proposed to achieve the given objectives, but may consider additional alternatives, too. All relevant benefits and costs should be quantified and valued. When models are used to estimate benefits – the inputs and outputs of the models should be dis-aggregated by type of benefit and justified. The level of accuracy or detail should also be clearly specified. The level of environmental study required should also be specified.

Studies, whether by local or foreign consultants, should be based on well-formulated Terms of Reference (TOR) that give detailed guidelines how to undertake the study. It is recommended that the Line Ministry, the NPD, and other Ministries that the NPD considers relevant should review and approve such TOR.

***Example**: The TOR to conduct a pre-feasibility study for a railway extension to a proposed industrial area should be approved by the Ministry of Transport, the NPD, and the Ministry of Industries.*

3.8.2. Initialisation of Feasibility Study

A feasibility study would be required only for very large projects, where detailed project preparation of an extremely technical nature would be necessary. Such a process should only be carried out when a pre-feasibility study has been appraised, the project has been judged viable, and it is intended to proceed towards project implementation. In this case, also, the project should be re-submitted in the same format as the Concept Paper and the pre-feasibility stage, except that the level of analysis and assessment of benefits and costs should be much more extensive and elaborate.

***Example**: If the pre-feasibility study of a project to improve access to Uva Province indicated that a new highway trace is the most feasible, a feasibility study could be commissioned to identify the most suitable trace through a detailed assessment of the benefits and costs of each alternative trace.*

Like for a pre-feasibility study, a consultative process with related agencies and experts would also be useful in a feasibility study. The TOR for the feasibility study should be approved in a manner similar to that recommended for the pre-feasibility. The status of environmental clearance required before approval of the feasibility should also be clearly specified.

3.9. Project Authorisation & Selection

The appraisal process should have recognized and accepted processes of project selection and authorisation. These should be clearly set out by the NPD through its circulars and guidelines. Decision-makers should also be made aware of what choices they have in selecting projects and authorising investment. The benefits, costs, and associated issues should be clearly outlined to ensure that rational and scientific evidence is available to guide the process of selection and authorisation.

3.10. Project Pipeline

A Project Pipeline can be defined as a list of proposed projects that have been appraised and are ready for implementation, showing order of priority for selection. A Project Pipeline should be formulated by each Agency well before the required date of implementation.

Such a portfolio of projects would be an important aide to decision making. Each Agency should be encouraged to have an on-going Pipeline that can be updated every year with new project ideas and approved Concept Papers. Projects can be selected for funding from the Pipeline. This would be an effective strategy to pre-empt political and other pressures that appear to be put on Agencies to implement projects that have not been appraised.

> ***Example**: A Provincial Council with a progressive Planning Unit might conduct a survey to determine which "C" class roads are in need of replacement and undertake an appraisal of each road identified. If a Provincial Minister wants to expedite implementation of road projects in his constituency, the Project Pipeline could be used to show which roads have the highest viability and how they compare with the rest of the road network for which he is also responsible.*

3.11. Monitoring the Implementation

Implementation is generally not considered a part of project appraisal. It is important, however, when deciding whether funding for a project should be continued. If a project is not being implemented properly or promptly, if expected benefits are not being achieved, or if the investment is not contributing to national development, continuity in funding may have to be re-considered. Monitoring project execution should also be considered a part of project implementation.

It is important to ensure that projects are not delayed beyond the planned time frames, as delays may substantially reduce benefits and increase costs, causing the economic viability of the project

to decrease or become negative. A process of monitoring the implementation should be set out in operation at the time of project selection.

3.12. Post Implementation Monitoring & Feedback

Post-evaluation of project implementation and operation is vital for the planning and appraisal process. It is a vital link to update appraisers' knowledge about Agency performance in project implementation, to verify appropriateness of assumptions for future studies, and to identify flaws in project design and implementation for correction in future planning.

> ***Example**: A feasibility study for purchase of diesel multiple units might assume that fuel consumption is 2.5 litres per kilometre. A survey conducted after trains have started operating, however, might reveal that this rate is achieved only when average speeds are 50-60 kph. On the other hand, in typical suburban operations fuel consumption might be 4 litres per kilometre. This information can be used in the appraisal of the next proposal to purchase DMUs or in a track rehabilitation project.*

4. METHODS OF PROJECT PREPARATION AND APPRAISAL

4.1. Define Project and Select Alternatives

The following sections describe some of the steps that are recommended for inclusion in feasibility studies and why they are important. As a start, however, care should be taken to divide investments into appropriate projects (or sections) for purpose of analysis; otherwise, large benefits from one section of a project might hide low or negative benefits from another section and result in a sub-optimal decision overall.

> ***Example**: A project to build a new highway between A - B - C might have an acceptable overall rate of return. Most of the benefits, however, might come from A - B, hiding that B - C is not viable as proposed. By appraising the investment in sections, which can reasonably stand alone, it might be possible to come up with better proposals, such as constructing B - C to a lower and less costly standard, or deferring construction of B - C for a few years until traffic volumes increase.*

4.1.1. Objectives

The starting point of a feasibility study is to define the project objectives. In very general terms, the over-riding objective should be to generate a net socio-economic improvement for the country by producing the greatest return of such benefits to costs. In the transport sector, this might be as follows:

- To improve the quality and performance of the transport system over what it would have been without the project - by reducing travel time (which also reflects reduced congestion), reducing operating and maintenance costs (a benefit for implementing agencies and for users), improving safety, reducing emissions, and so on.

- To efficiently implement (e.g., construct or procure), operate, and maintain the project infrastructure, rolling stock, and/or supporting assets - by incorporating cost-effective design features, using efficient techniques for construction, implementing efficient operating and maintenance practices, and so on.

As noted above, objectives do not relate only to project implementation or post-implementation operation and maintenance. Transport is a service that should, above all, be provided for the social and economic benefit of its users and of society as a whole, not only for the benefit of the implementing agencies. Service quality and performance—from the points of view of individual users and of society—are therefore very important factors that must be included in the objectives.

Objectives should, moreover, be defined in ways that can be directly related to benefits and costs, that can be quantified, and that can be monitored in post-evaluation. Individual user, societal, and agency benefits – all should be covered. Some examples are listed in Table 4.1 below, but there may be many others:

Table 4.1 – Examples of Objectives

User Objectives: - To have better personal access and mobility. - To have lower travel time. - To have lower vehicle operating costs (for vehicle owners). - To have greater personal safety. - To have more comfortable public transport.
Societal Objectives: - To provide a socially acceptable level of access and mobility. - To use resources efficiently. - To reduce social costs of accidents. - To reduce costs of emissions
Agency Objectives: - To have suitable design and construction standards. - To complete implementation within a certain time. - To develop knowledge and expertise. - To provide certain operational capacity (e.g., vehicles/trains per hour). - To achieve operational targets (e.g., speeds, safety). - To keep certain maintenance standards (e.g., roughness, speed, cautions). - To minimise lifecycle capital, operating, and maintenance costs.

Objectives should not be defined too narrowly, as this might exclude consideration of efficient alternatives. The first idea that comes to mind might be the best, but this will never be certain unless all reasonable alternatives are also studied. Some examples are as follows:

> ***Example**: An objective to "build a highway" would preclude consideration of a railway option. A more suitable objective might be to "develop an improved transport link" as it would allow both road and rail options to be considered.*

> ***Example**: An objective to "upgrade a road to 4-lanes" would preclude consideration of other widths. A more suitable objective might be to "upgrade as appropriate to meet projected traffic demand" as it would also allow consideration of, say, a 2-lane road with widening to 4-lanes only in busy sections. Similarly, an objective to "widen roads to reduce congestion"*

would preclude improvements to traffic management or introduction of Intelligent Transport Systems.

***Example**: An objective to "improve suburban rail service by electrifying" would preclude consideration of other non-electrification options. A more suitable objective might be "improve service parameters of suburban rail service" as it would allow improved diesel services also to be considered.*

***Example**: An objective to "increase rail speeds to 100 kph" would preclude consideration of other options to reduce travel time. A more suitable objective might be "reduce average journey time", as it would allow consideration of alternatives to reduce (i) access times to/from stations at origin/destination, (ii) waiting time at stations, or even (iii) distance between homes, shops, and work.*

Objectives should be quantified as much as possible. Thus, if an objective is to increase capacity, the present and target capacity (e.g., number of trains/vehicles per hour) should be specified. If an objective is to improve safety, the present and target number of accidents per billion vehicle kilometres (or passenger kilometres) should be specified. If an objective is to reduce costs, the present and target costs should be specified. This makes it easier both to estimate the economic benefits of the objectives and to monitor if they have been achieved.

Occasionally, projects might be implemented in response to public policy imperatives, such as legislative or regulatory requirements. If so, these policies should be clearly stated. The need for feasibility study (including benefit-cost analysis) would not change, as there would still be a need to identify the most efficient and effective way to meet the policy requirements.

4.1.2. Project Impact Area

This covers the areas that would be affected by implementation of the project, including for example, geographic area, potential users and beneficiaries, environmental aspects, and so on.

The purpose of explicitly defining the project impact area is to make project managers and appraisers more aware of what and who will be affected by the project. It defines, to some extent, the scope of the project, facilitates quantification and estimation of benefits and costs, and facilitates appraisal and comparison of projects and project alternatives.

***Example**: A project to upgrade rail infrastructure between Kosgama and Avissawella would affect the adjacent area, people who use or who are likely to use rail, and users of parallel roads if congestion is reduced. It is unlikely, however,*

that people travelling between Homagama and Colombo, or between Ratnapura and Avissawella, or by car, would benefit.

4.1.3. Definition of Base Case

Evaluation can be simplified by comparing each project to a "reference" or "base case". This allows alternatives to be evaluated by looking only at the changes—the incremental effects—relative to the base case instead of looking at the total costs and benefits of each option.

***Example**: A study into widening a road should consider the cost of acquiring new land for extra lanes, but should ignore the value of the land already used by the existing road, as this is a "sunk" cost.*

***Example**: A study into replacing 20-seat buses with 40-seat buses should consider, among other things, the extra fuel consumed by the larger bus and the higher costs of tyres and maintenance. If maintenance staff remain the same, then only parts costs would need to be considered. Crew costs can also be ignored if the same crews are used for both types of buses.*

The "base case" is sometimes represented in project appraisal as the "do nothing" scenario, which assumes that the status quo will continue unchanged into the future, or the "before project" scenario, which assumes that conditions prevailing before the project will continue even without the project. Such representations should be made only with great caution, however, because in most real-world situations some changes will occur. A "do nothing" scenario tends to overstate the benefits of improving transport facilities, as it ignores the small initiatives that would normally be taken to offset deterioration in service and increases in costs. The base case should, most appropriately, be a "without project" scenario that includes changes that might reasonably be expected to occur.

***Example**: A road study might take present traffic levels and growth rates and project them forward, unchanged, until traffic is assumed to come to a complete stop without road widening. In fact, as congestion increases, people would make fewer trips, or travel at different times, or find alternate routes, or take a train, or shop in different locations, or even look for different places to live and work. In such a case, use of the status quo would overstate traffic growth and congestion under the base case and thereby overstate the benefits of alternatives. A more correct approach might be to reduce growth rates as congestion increases and even set a maximum level of congestion.*

***Example**: A bus (or train) replacement study might assume that current fleet deterioration will continue, unchanged, until the fleet and the service benefits reduce to zero. In fact, it is more likely that reliability will reduce as the fleet deteriorates, but that part of the fleet will somehow be kept in operation and that some service benefits will continue, although at the cost of higher maintenance.*

***Example**: Data shows that accident rates are declining at about 4% per year. A study that claims accident reductions, but that fails to include this natural decline in the base case, will overstate the benefits of accident savings due to the project.*

The "second-best" alternative should not be used as a proxy for the base case. Appraisers should be aware that this is sometimes done, inappropriately, to make the favoured alternative look better. The previous paragraph defined the base case as the "without project" scenario. It is acceptable to include reasonable and minor changes in the base case, as mentioned. Major changes that involve high capital expenditure, however, are not the "base case"; they are separate projects or alternatives that should be evaluated separately.

***Example**: A new road project might use the existing old road as the base case. It would be correct to adjust old road data to account for reductions in traffic growth rates due to congestion, introduction of traffic management policies (e.g., restrictions on parking or on operation of heavy lorries during peak hours), implementation of government policies (e.g., bus use policy), and so on. Upgrading the old road, however, would be a separate project to be studied as an alternative to building a new road.*

4.1.4. Specification of Alternatives

Perhaps the most important single step in project appraisal is to ensure that alternatives are adequately specified and analysed. Feasibility Studies should consider, and clearly specify, a wide range of alternatives to provide the transport service, including new and innovative proposals. Some examples are given in Table 4.2. Each alternative should be well thought out and should be fully capable of meeting the objectives, so that the best one can be selected and the others rejected. Proposing and evaluating alternatives that cannot meet project objectives serves no purpose.

All alternatives should be reasonable and should be designed to maximise benefits and to minimise costs. Appraisers should be aware that it is possible, but incorrect, to make a favoured alternative look better by comparing it only with inefficient options. This could bias the decision and result in an unwise investment (i.e., one that does not maximise net economic benefits for society).

***Example**: A project to reduce congestion might consider only different options to widen the road, whereas reducing encroachment on pavements and restricting on-street parking at peak hours might achieve the same benefits at much lower cost.*

Table 4.2 – Examples of Alternatives

- Different routes.
- Different modes (e.g., road or rail, private or public transport).
- Different vehicles (low or high occupancy, locomotive or power set).
- Different designs (e.g., # of lanes/tracks, lane widths, geometry, axle loads, construction materials, # of seats, horsepower).
- Rehabilitation or replacement.
- Capacity increases.
- Traffic demand management (e.g., user charges, traffic signals, parking restrictions).

Unsolicited proposals, even if they include unbiased economic appraisals (very rare), generally do not consider efficient alternatives. Therefore, even if the unsolicited proposal shows a net economic benefit, there is no assurance that it is the wisest option, as economic appraisal of alternatives is generally not done.

Agencies generally will be able to specify and appraise alternatives only for their own areas. This makes it difficult, for example, to compare road and rail projects. Agencies can, however, be requested to submit independent studies based on common objectives. Terms of Reference for studies done by consultants can specify that all modal options should be considered. This would allow the Department of National Planning to find out which modal alternative is most beneficial for the country.

4.1.5. Data Requirements

Data is critical to undertake accurate feasibility studies. Construction and procurement cost data are most available, but operating and maintenance costs are less well understood. Traffic data is generally available only in very aggregated formats. Economic data is also difficult to obtain. In result, studies often need to collect data specially, at high cost, or make assumptions that might or might not be valid.

Agencies should implement procedures to capture data in more detail and in a systematic way, including by location and by time. This would then be available for studies as required. Some examples of data are shown below.

Table 4.3 - Examples of Data Requirements

- Infrastructure maintenance costs depending on type of road/track, volume of traffic, geographic/environmental condition. - Vehicle operation and maintenance costs depending on type of vehicle and operating condition. - Traffic data (e.g., numbers of vehicles/users, journey times, income levels, traffic growth) by mode, route, time of day, trip purpose, etc. - Economic data such as GDP growth.

4.1.6. Use of Assumptions

Assumptions used to estimate benefits and costs should be clearly explained and justified, including by referring to historic and current data. Analysts should also describe the strengths and weaknesses of the assumptions, particularly those that have the greatest effect on study results. Analysts and appraisers should be especially careful with traffic growth projections, with modal shift from road to rail or from low occupancy vehicles (such as cars) to high occupancy vehicles (such as buses), and with the economic values of external benefits, which frequently tend to be overstated.

> ***Example**: Rail improvement studies generally assume some shift of traffic from road to rail. However, people will not easily shift, especially from private vehicles, unless total costs are reduced (including cost of time). This is affected by factors such as distance between stations and trip origins/destination, ease of station access (road and bus connections), frequency and speed of trains relative to buses, and so on.*

Appraisers should carefully evaluate the reasonableness of the assumptions. The most basic evaluation criteria might be: "does it make sense?" Appraisers might also compare assumptions with those used in other similar analyses to see if they are consistent.

- Note: Benefits and costs are greatly affected by projected traffic volumes. One simple way of estimating traffic is by projecting past growth trends. Models may also be used, but appraisers should insist that they are calibrated for conditions in Sri Lanka, that results are not aggregated into hard-to-understand totals, and that results can be replicated outside the model. Even then, appraisers should be cautious in accepting model results and question if they make sense.

4.2. Assess and Quantify Benefits and Costs

The goals of transport projects are, or at least should be, to generate economic benefits that more than offset the projects' economic costs of implementation. The main categories of benefits are well enough recognised (e.g., service improvements and operating & maintenance cost reductions), as are the main categories of costs (e.g., construction and procurement costs). Valuing economic benefits, however, has been problematic. Local agencies often do not attempt to do so, perhaps due to lack of information. Feasibility studies done by "want to be" suppliers and by consultants, on the other hand, often do attempt to value economic benefits, but sometimes do so incorrectly due to use of inappropriate assumptions or methods. Valuing economic costs, although better understood for categories such as construction and procurement, also can have problems – for example, externalities such as congestion during road improvements are often excluded.

The following sections describe methods to assess and quantify economic benefits and costs. The first section defines relevant economic terms, the second section describes techniques to assess values, and the third section quantifies a number of important benefits and costs – relevant to the transport sector.

4.2.1. Economic Definitions

As a background to discussion of benefits and costs, this section presents, in summary, some relevant economic definitions. Interested readers may consult standard economic texts for more detailed definitions.

Benefits and Costs: *Benefits* are the economic gains arising from implementation of a project, which would not have been achieved without the project. Such gains can include net increases in economic activity (e.g., development and jobs), improvements in productivity of resource use (e.g., reduction in fuel used per passenger-kilometre of transport provided), and reductions in costs (e.g., reduction in emissions and corresponding damage to health). Benefits can also be negative if gains are negative (i.e., if benefits reduce or costs increase). *Costs* are the value of the resources used to implement the project.

Consumer and Producer Surplus: Economic benefits from transport projects should ideally be valued from the changes in the underlying consumers' and producers' surpluses. Some people generally would be willing to pay more than the market price for transport services they derive. The concept of *consumer surplus* describes the extra value that they enjoy from their use of transport services compared to the market price they pay. Similarly, some producers would be willing to provide a transport service at a lower price. The concept of *producers' surplus* describes the extra value that they obtain by providing transport services at the market price compared to the price they would have been willing to accept. See Figure 4.1. If all markets affected by a transport project could be modeled to determine demand and supply curves, the derived changes in consumers' and producers' surpluses would indicate the net benefits and costs.

Consumers' and producers' surpluses, however, can be measured only using econometric models, which are difficult to develop and calibrate. Moreover, surpluses are derived in conjunction with improvements in other sectors. An alternative approach, therefore, is to measure and value separately the components that would be included in such surpluses that is by suing willingness-to-pay as a measure of benefits and opportunity costs as a measure of costs.

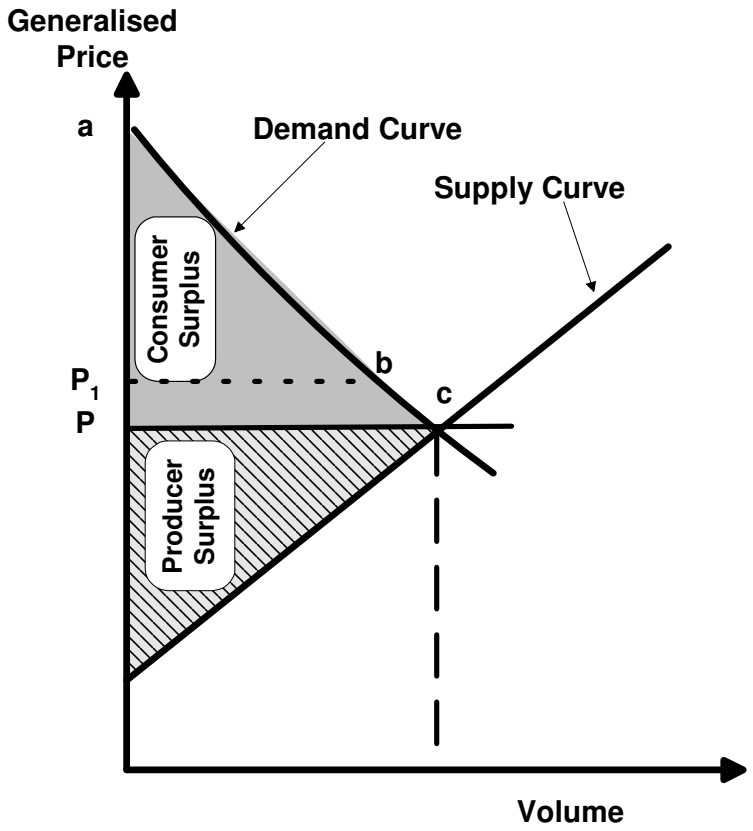


Figure 4.1 : Demand Curve, Price, Quantity, and Consumers' Surplus

***Example**: A village connected by a road in poor condition had a small weekly Pola (market) attended by a few wholesalers. With recent road improvements many more wholesalers have begun to arrive. This is attributed to the lowering transport costs, as well as the fact that the pola has now become more accessible. This has resulted in an increase in demand for vegetables at this village. As wholesalers are prepared to pay higher prices, more farmers are now motivated to grow vegetables. Therefore, the supply has increased, creating a producer surplus.*

***Example**: A university student was in the habit of visiting her village off Matara, once a month. She could not travel more*

often, since the trip from Moratuwa took seven hours each direction. The journey being so tiring that the benefit of going home was inadequate compared with the opportunity cost of time spent in study. Recently, an entrepreneur from her village has commenced a luxury bus service to Colombo. Seats could be reserved in advance and the travel time is only four hours. "But now she must pay a higher price. Therefore her consumer surplus has diminished from Pca to P_1ba.

Financial versus Economic: Both financial and economic analyses assess project viability - the difference is in the frame of reference. Financial analyses assess viability from the point-of-view of the investor, whereas economic analyses assess viability from the point-of-view of society as a whole. Note that societal benefits and costs are not the same as benefits and costs to government, as society includes public and private institutions and individuals (the national economy and all its members).

The differences between the financial and economic points of view translate into differences in the definitions of benefits and costs. In financial analyses, benefits are the revenues generated by the project and costs are the monetary out-of-pocket expenses incurred by the investor. In economic analyses, on the other hand, benefits and costs are based on decreases or increases in use of underlying resources (e.g., such as labour and materials used for construction, or travel time saved due to implementation of the project). The economic values of the resources are based on their opportunity costs.

Just as the value of resource inputs (measured in terms of their opportunity costs) are considered in the economic analysis, the true economic values of outputs are also taken into consideration. Typically outputs (i.e., goods or services provided by a project) are measured in terms of their monetary value based on market prices. Revenue thus generated by the project is considered a benefit in the financial analysis. However, such revenues must first be adjusted for distortions before consideration in the economic analysis. Distortions occur mainly from inclusion of taxes and subsidies in the revenue stream. These are simply transfer payments and therefore should not be included in the economic analysis. Only the remainder is considered as the true economic value of outputs.

Example: A private bus operator may charge Rs. 100/= to travel from Colombo to Matara. In the financial analysis of his project (i.e. operating a bus) his benefits from revenue would be estimated suing the fare of Rs. 1000/= per trip. However, the fare would include GST of 12.5%. Therefore, when estimates the economic benefits from revenue, the calculation should be based on the value less GST. That is Rs. 100 x (1 – 0.125) = 87.50.

Opportunity Cost: Resources used in transport projects are not available for other use. Their economic value, therefore, is defined as the value of the best alternative use. This is also called

opportunity cost. In liberalized economies such as Sri Lanka, it can be expected that prices of resource inputs such as labour, material and capital items reasonably reflect their true market values. What is left is to adjust prices for various government interventions in the form of duty taxes and subsidies. Such an assumption, however, may not be correct for goods and services purchased from the public sector (e.g., prices of diesel and petrol).

> ***Example**: The financial price of diesel is Rs 13.20 and that of petrol is Rs 50/= per litre (in Colombo). These prices, however, are set by government policy. Based on recent world oil prices of about $US 22 per barrel, the economic cost of diesel is estimated at about Rs 14/= per litre, and that of petrol at about Rs 15.50/= per litre.*

Market prices, if available, can be converted to economic costs by adjusting for the effects of government intervention and of imperfect markets. In theory, this can be done using shadow price factors. Such factors are available for Sri Lanka, but have not been updated in recent years and, therefore, may no longer be representative (the most recent shadow price factors are given in Table 4.4). However the adjustment of financial prices to reflect economic values can also be done more simply by dis-aggregating into foreign and local components. Shadow price factors for foreign exchange, and several categories of local costs (i.e., skilled and unskilled labour and 'other') are commonly used in project analyses and can be obtained from recent project analysis or appraisal reports of the World Bank, Asian Development Bank, or some bi-lateral donor agencies. An adaptation of these shadow price factors can be found in the Case Study in Annex A2.

- **Note**: In countries with high unemployment, the economic cost of labour may be less than the wage rate. On the other hand, if certain skilled labour is in short supply, and if suitable people cannot be trained in the required skills in a reasonable period, its shadow price might be higher than the market rate. This would affect determination of benefits as well as costs, but the economic conversion rates for benefits and costs might be different reflecting different types of labour involved.

Market versus Non-Market: Some economic benefits and costs of transport projects (e.g., labour, materials, capital assets) can be quantified based on the market costs of the resources used, adjusted as described above. These are sometimes also called *tangibles*. Other economic benefits and costs, however, are not typically measured through market transactions - for example, because they are not exchanged in the market for money (e.g., value of personal time saving). These are sometimes called *intangibles* or non-market benefits and costs.

Table 4.4 – Most Recent Shadow Price Factors[16]

Aggregate Conversion Factors		Sectoral Conversion Factors	
Average Conversion Factor	0.785	Tea	1.080
Investment Conversion Factor	0.906	Rubber products	1.294
Agriculture Conversion Factor	0.785	Coconut products	1.100
Infrastructure Conversion Factor	1.115	Paddy	0.697
Consumption CF - Surplus	0.906	Other food crops	0.870
Consumption CF - Scarce	0.732	Livestock	0.774
		Forestry	0.841
		Firewood	0.787
Primary Input Conversion Factors		Other Agriculture	0.723
		Gems	1.002
Foreign exchange	1.000	Cement	0.746
Transfers	-	Food processing	0.775
Surplus labour	0.722	Textiles	0.665
Scarce labor	0.785	Garments	1.004
Capital charges	0.906	Machinery & equipment	0.776
Surplus profit	-	Chemicals & petroleum products	0.650
		Metal products	0.717
		Other Manufacture	0.791
		Gas	0.598
		Non Residential construction	1.050
		Electricity	1.572
		Road transport	0.814
		Rail transport	4.534
		Communications	0.924
		Trade	0.579
		Water & sewage	2.517
		Financial Services	0.649
		Other Services	0.578

Externalities*;* An externality is the effect of a project that is felt outside the project, but is not included in the valuation of the project. More formally, an externality exists when the production or consumption of a good or service by one entity has a bearing on the welfare of other producers and consumers. There are two types of externalities: *technological* and *pecuniary*. In the transport sector, examples of *technological* externalities may include traffic congestion caused or reduced by a project or an increase or decrease of air pollution.

Such externalities are identified and valued to the extent possible using techniques for valuing non-market goods or services described below. They are included in the analysis of the project benefits and costs. *Pecuniary* externalities are the price effects of a project that are felt outside the project. An example would be, the effect on bus fares because of an improvement in the train service between two towns. Such *pecuniary* externalities are not taken into consideration in the analysis of a project.

[16] These shadow prices have been calculated by the National Planning Department in 1990. They need to be updated prior to use,

Since economic costs relate to the use of resources, factors for which the market does not set prices, but which nonetheless use resources and so reflect real gains or losses to society, should also be included in economic analyses. Examples are value of life, costs of externalities such as air pollution, etc.

4.2.2. Methods of Assessing Benefits and Costs

This section summarises techniques that are used to quantify, either directly or indirectly, the economic benefits and costs of transport projects and describes how they are used to value specific benefits and costs. Interested readers are directed to several useful references for further details[17,1819].

There are several techniques for valuation of benefits, which differ mainly in terms of the type of benefits that are measured. An explanation of these methods must be preceded by a brief description of the concept of economic value.

Economic value is best explained by disaggregating the different components. The following break-down is one that is commonly adopted in the literature. Total economic value is made up of two specific components: Use Value and Non-use Value. Use value in turn is made up of three components: Direct Use Value; Indirect Use Value and Option Value. The terms are somewhat self-explanatory. Direct Use Value refers to the value attached to a particular commodity because of its direct usage (e.g., water for consumption); Indirect Use Value is the value derived from an in-direct use (e.g., use of a wetland as a flood protection buffer). Option Value is the value attached for having the option of using a resource in the future (e.g., the value of a wildlife sanctuary, in anticipation of visiting it in the future)[20].

Non-use values are also broken down into two components: existence value and bequest value. Existence value refers to the value that one would attach to the knowledge of the existence of certain resources (i.e., the value of knowing of the presence of the Amazon rain forests). Bequest value is value attached to resources that may be used by others, perhaps even future generations.

Non-Use Values are particularly elusive and difficult to estimate. In any event, attempting to measure any of these components separately is not recommended since people would have difficulty isolating distinctively the different values they attach to a particular resource. The valuation techniques described below measure certain types of values. For instance the replacement cost method is primarily for valuing direct and indirect uses of a resource. However this is not to suggest that two techniques can always be combined to estimate the total economic value. When combining methods extreme care must be paid to preventing double counting of benefits.

---

17 P. Meier and M. Munasinghe, *Incorporating Environmental Concerns into Power Sector Decision Making*, World Bank Environment Paper, Series No. 6., Washington, D.C. (1994).

18 H. Kotagama and S. Thrikawala, *Environmental Valuation Studies and Estimated Unit Values in Sri Lanka*, Postgraduate Institute of Agriculture & APREETA, 1998.

19 Economic Valuation of Economic Impacts, Environment Division, Asian Development Bank, March 1996.

20 Option value is sometimes categorized with Non-use values.

Valuation techniques are based on identifiable changes in behavior of consumers in response to changes in the resource to be valued. These changes are sometimes reflected in conventional markets, can be implied from related (or surrogate) markets or must be inferred from constructed markets. At the same time certain methods are based on actual behavior while others are based on potential (or hypothetical) behavior. The following table summarizes the techniques, the related markets and behavior type on which they are based.

Table 4.5 : Valuation Techniques

	Conventional Markets	**Implied Markets**	**Constructed Markets**
Based on actual behavior	change in productivity loss of earnings defensive or preventive cost	travel cost wage difference property values proxy market goods	artificial markets
Based on potential behavior	Replacement cost shadow project		contingent valuation

This method is based on presenting individuals with a hypothetical scenario. The scenario is constructed in a manner conducive to asking respondents a question regarding their willingness to pay for the good or service. (Alternatively a similar question could be asked about the willingness to accept compensation in lieu of being deprived of the good or service in question.) The hypothetical scenario must be realistic in order for this method to produce meaningful results. Research has shown that the approach is most effective when respondents are familiar with the good or service and have adequate information regarding the proposed payment mechanism. Contingent valuation is the only method capable of eliciting the non-use values (i.e., existence and bequest values) described earlier in this section. However it is difficult to separate these value components from the overall of value for a good or service. Hence use of this method simply to elicit the non-use value component is not recommended.

> ***Example**: People may be asked about their willingness-to-pay for a reduction in traffic congestion. The hypothetical scenario could be installation of a traffic light system, which would cost the Municipal Council, say, Rs. 70 million. The Municipal Council proposes to raise this money by increasing rates and taxes. The willingness to pay question would then be related to the amount by which rates and taxes could (or could not) be raised.*

Change in Productivity: Transport activities can affect the quantity, quality, or the production function of corresponding outputs. An improvement in transport facilities, for example, may result in an increase in productivity due to increased access to labour and to markets. The incremental change in productivity that can be attributed to the transport improvement could be valued at market prices to determine the corresponding benefit. This method may also be used to measure the economic development benefits of transport projects.

***Example**: Transport improvements may give workers a more comfortable journey to work in the morning and therefore make them more productive during the day. The increase in productive output would be a benefit of the project.*

Preventative/Defensive Cost: Individuals often incur expenses to prevent certain damages. The cost of adopting such preventive measures can be used as an indication of the value placed on the potential benefit from correcting the problem. This method is most effective when people are well aware, and have an accurate perception of the costs or risks involved.

***Example** : In the transport sector, this method may be used to measure the reliability of a bus or train service. People may choose to walk further or use an alternate means of transport in anticipation of delays or cancellations. The cost of such alternative actions can be used to estimate the value of improving reliability of the transport service. Alternatively, the incremental cost of air-bags and other such safety measures on vehicles can be used to estimate the value of preventing travel related injury or death.*

Human Capital (Loss of Earnings): The underlying rationale of this technique is that events that cause a person's future productivity to reduce, such as poor health caused by pollution, or injury/death caused by an accident, can be valued in terms of the loss of future earnings. This technique implies that the value of a rich person is worth more than that of a poor person, an educated person more than that of an uneducated person, a young person more than an old person, and so on.

Hedonic Valuation: This includes the property value and wage differential approaches, which try to determine values through indirect relationships, often using statistical techniques. For example, the value (or cost) of pollution might be determined by comparing prices of otherwise similar properties in polluted and in non-polluted areas. Lower property values in polluted areas, reflecting lower preference, would therefore indicate a cost of pollution. Similar analyses of wage differentials between jobs that are the same except in relative risk of injury or death can be used to estimate the value put on risk of injury or death. These methods are more effective in economies with efficient markets—for example, in property and labour—and therefore may not be appropriate for Sri Lanka at this time.

***Example**: If Job "A" has 1 in 500 chance of serious injury and Job "B" has 1 in 100 chance of serious injury, and if Job "A" pays Rs 5,000/= per month and Job "B" pays Rs 5,100/= per month (because of the higher risk), the implied value of a serious injury would be Rs 150,000/=. Such a value might then be used as a proxy for cost of serious injury in a transport accident.*

Travel Costs: This method is used mainly to value recreational facilities such as beaches and wildlife sanctuaries. The underlying concept is that the cost of travel by visitors to a site represents the value of that site. Travel costs include vehicle operating costs as well as the cost of time spent on travel. These costs are estimated for populations originating from concentric circles around the site. Obviously the cost of travel is in directly proportionate and the number of visitors and directly proportionate to the distance between the point of origin and the particular site. The method can be adopted for use in the transport sector to measure straightforward costs related with traveling between locations.

- **Note**: People who come from close by would have lower costs, and might visit more often, whereas people who come from far away would have higher costs, and might visit less often. The value would be the summation of the costs of all the visitors.

Benefits Transfer: This refers to using values determined from other sectors (or from other countries) to value benefits in current studies, with suitable modification for differences in income, land values, culture, and so on. An advantage is that data is sometimes more readily available from other sectors or countries. A disadvantage is that values so determined may not be applicable, even after adjustment.

4.2.3. Benefits of Transport Projects

Transport projects can yield benefits for users, for transport agencies, and for society as a whole; some examples are listed below.

- User benefits: improved access, reduced travel time, reduced vehicle operating costs, reduced personal costs of accidents, improved quality of transport, and value of additional travel, etc.
- Agency benefits: savings in operating and maintenance costs for transport infrastructure and assets; improved productivity of resources.
- Societal benefits: increased economic development, reduced congestion, reduced emissions, and reduced societal cost of accidents (including value of life), etc.

4.2.3.1 Quantifiable Benefits

Quantifiable benefits refer to those for which monetary values can be determined, directly or by using reliable empirical models or other forecasting tools. Important quantifiable benefits that are relevant to transport sector projects are described in more detail below. In developed countries, most emphasis of improving transport facilities is on saving time and, to a lesser extent, on reducing accidents, as infrastructure is largely developed. In developing countries such as Sri Lanka, on the other hand, savings in operating and maintenance cost, and provisions of basic access, are still important objectives. Methods of calculating these benefits are discussed in detail in Appendix B. A summary of the discussions, are given below.

Travel Time Savings:

Saving in travel time is a primary economic outcome sought in transport sector projects. These savings are enjoyed by passengers as well as freight consignees. Savings enjoyed by transport operators are usually included in the savings of vehicle operating costs discussed in the next section.

Passengers : The value of saving travel time of a passenger can vary with (a) hourly income; (b) the purpose of the trip and (c) the quantum of travel time saved. The average Value of Time (VOT) for passengers by mode of transport have been calculated in Appendix B1. Table 4.6 gives the summarised average VOTs for passenger travel in Sri Lanka.

Table 4.6: VOT for Transport User Groups (in 1999 Rs/Hour)

User Group	Urban	Rural	Intercity	All Sectors[21]
Car	100.06	78.62	135.81	106.50
Van	51.15	37.62	51.15	48.44
Motor Cycle	19.05	27.00	14.29	19.22
Public Transport	10.83	12.41	12.41	11.62
Non Motorised Modes	6.78	8.62	0.00	7.39
All Motorised Modes (AV)[22]	24.61	23.01[23]	28.81	25.55

Freight consignees: In this case, the time loss can lead to two different types of economic consequence; (a) having to carry higher inventory levels and (b) losses sustained by perishable commodities such as vegetables, milk, etc. The method of calculating these are shown in Appendix B1. Table 4.7 gives a summary of values and typical commodity shares in road freight transport in Sri Lanka

Table 4.7: Distribution and Value of Commodities in Road Transport

Type of Commodity	Urban[24]	Intercity[25]	Cost per Ton (Rs 000s)
Tea/Rubber/Coconut	0.1%	2.8%	10-150
Agricultural	0.2%	5.7%	10-100
Other perishable	0.2%	4.9%	20-150
Foodstuff	11.0%	9.5%	20-150
Forestry Products	1.3%	3.9%	5-20
Petroleum/Chemicals	0.7%	1.6%	10-15
Building Materials	10.8%	13.0%	5-100
Industrial Inputs/Outputs	11.7%	17.1%	n/a
Empty	50.2%	41.5%	-

[21] Assumed as been composed of 50% urban, 20% rural and 30% intercity travel.
[22] Assumed as being composed of 10% share for cars, vans and motorcycles respectively and 70% for public transport.
[23] If non-motorised travel is considered, for example in rural transport, this should change. If 50% of travel is assumed to be by non-motorised means, then the average VoTTS would be Rs. 15.31 per hour.
[24] Colombo Traffic Study (UoM, 1992)
[25] TransPlan: Traffic & Road Network Database (UoM, 1999)

Vehicle Operating Cost Savings:

Savings in vehicle operating costs (VOC) are the most direct and one of the most important benefits from transport improvements. These savings are mostly achieved by upgrading technology; increasing speed; reducing congestion; reducing road roughness and improving geometric design. The value of the savings is usually calculated as a derivative of the vehicle specifications, road features, cost of operational inputs and operating speed. VOC savings from a project are usually estimated by calculating the differences before and after completion of the project concerned. The process of calculating VOCs are discussed in detail in Appendix B2. A sample VOC is given in Table 4.8.

Accident Reductions:

Accident costs generally comprise direct tangible components, which can be readily determined, plus intangible components relating to injury, death, and pain and suffering.

These costs are based on a number of assumed values discussed in detail in Appendix B3. They should be treated as tentative and approximate. They do, however, correspond to international norms – for example, the cost of a fatal accident, at Rs 1.5 million is the equivalent of 24 years of human output based on a per capita income of Rs 62,000. Given that 20% was added for grief and suffering, this corresponds to the 20-year period adopted in most western countries. Cost summaries for different types of accidents is given in Table 4.9.

Table 4.8: Vehicle Operating Cost at Road Roughness IRR=6

Speed	Car	M/ Cycle	3W	Utility /Van	Medium Bus	Large Bus	Medium 2-Axle Lorry	Large 2-Axle Lorry	Large 3-Axle Lorry
10	12.98	3.68	9.64	16.00	28.81	31.35	22. 59	28.96	37.41
15	11.22	3.21	7.94	12.74	22.35	23.82	17.51	22.33	30.10
20	10.38	2.98	7.09	11.13	19.10	20.04	14.95	19.00	26.43
25	9.90	2.86	6.58	10.17	17.14	17.77	13.43	17.01	24.23
30	9.59	2.79	6.25	9.54	15.85	16.28	12.42	15.70	22.79
35	9.38	2.74	6.01	9.10	14.93	15.23	11.72	14.80	21.78
40	9.23	2.70	5.84	8.78	14.26	14.47	11. 20	14.14	21.05
45	9.13	2.67	5.70	8.55	13.75	13.91	10. 82	13.66	20.52
50	9.14	2.69	5.64	8.37	13.36	13.49	10. 54	13.32	20.14
55	9.16	2.70	5.59	8.24	13.06	13.18	10. 32	13.07	19.86
60	9.18	2.71	5.56	8.14	12.83	12.96	10. 17	12.91	19.67
65	9.20	2.73	5.53	8.07	12.66	12.81	10. 05	12.82	19.56
70	9.23	2.74	5.51	8.02	12.53	12.72	9. 98	12.79	19.52
75	9.26	2.76	5.50	8.00	12.45	12.68	9.93	12.82	19.54
80	9.30	2.77	5.49	7.99	12.39	12.70	9.92	12.90	19.62
85	9.34	2.79	5.49	8.00	12.38	12.77	9.93	13.05	19.76
90	9.38	2.80	5.49	8.02	12.39	12.88	9.96	13.25	19.96
95	9.42	2.82	5.49	8.06	12.43	13.03	10. 02	13.51	-
100	9.46	2.84	5.50	8.11	12.49	13.24	10. 09	13.84	-

Table 4.9: Accident Costs in 1999 Rupees

	Fatal	Grievous	Non-Grievous	Damage Only
Property Damage	51,846	51,846	51,846	51,846
Medical Costs	19,180	15,929	15,105	-
Police Costs	4,704	2,455	200	200
Insurance Costs	2,400	2,400	2,400	2,400
Congestion Costs	16,000	8,000	2,000	2,000
Output Loss	1,179,197	58,959	11,792	-
Pain & Grief	235,839	11,792	2,358	-
Total	1,509,166	151,381	85,701	56,446

The Appendix B3 also shows the calculation for the cost of accidents per vehicle kilometer operated or passenger km traveled. These are summarised in Table 4.10.

Table 4.10 - 1998 Accident Cost per Vehicle/Passenger Km (@ 1999 Values)

	Type of Accidents				
	Fatal	**Grievous**	**Non-Grievous**	**Damage Only**	**Total**
Annual Accident Cost (Rs. M)	2,899	431	995	1,913	6,238
Accident Cost (Rs/Vehicle Km)	0.184	0.027	0.063	0.122	0.396
Accident Cost (Rs/Psgr Km)	0.039	0.005	0.013	0.026	0.083

Reduction in Vehicular Emissions:

Transport activities generate environmental impacts such as air pollution, water pollution, and even noise pollution, all of which have economic costs – such as damage to health or agriculture and consequent lost productivity. Any savings in pollution costs that arise from implementation of transport projects are economic benefits. A valuation of air pollution by vehicle type and pollutant based on existing information has been carried out in Appendix B4. Other pollutants such as noise and effect on water have not been valued, as they still have not been studied in adequate detail.

Socio-Economic (Regional) Development:

Transport infrastructure is a prerequisite for socio-economic development. This is also referred to as regional development. This is illustrated by the new commercial, industrial, residential and agricultural activity that often springs up after a project is implemented. Transport projects, however, do not guarantee that such development will occur. Availability of other factors of development, supporting infrastructure (e.g., electricity), and government policies also play a role. If development is dependent on investment in non-transport infrastructure, net benefits should not

all be credited to the transport project, but must be apportioned in some way. Furthermore, transport projects generally would have less effect on economic development where adequate services are already available than where services are poor or non-available.

> ***Example**: A road opening up a new area may encourage farmers to bring idle land into cultivation, as it is now possible for them to bring their goods to market. Similarly, an improved road may reduce transport costs, thereby making farming more profitable and so encouraging farmers to increase production. As long as there is demand for the new crops (i.e., as long as farmers elsewhere do not reduce cultivation because they cannot now sell their produce) there would be net economic development.*

> ***Example**: A road such as Marine Drive is less likely to stimulate net economic development; its main benefits might be reduction in congestion related costs and improving access to sea frontage development.*

It is difficult to measure the contribution of transport projects on economic development. It usually demonstrated in a transport project through an increase in travel volumes. Either a consumer surplus or producer surplus or a combination of both causes this phenomenon (refer also section 4.2.1). This new (i.e. increase of) travel is referred to as generated or induced traffic. However, the increase in traffic itself has no economic value. It is nevertheless, an indication of increased economic activity in the region.

There are different approaches to estimating the contribution of a transport project to such a development, although, the methods of valuing regional benefits are less straight forward than in the case of other benefits. The general, approach is to estimate the value of the producer or consumer surpluses, as the case may be, that has caused the increased travel. Thereafter, to apportion a part of such surpluses as economic benefits due to transport. This proportion could be equated to the proportion of the contribution of transport sector (or road sector) to Gross Regional Development Product or any other valid basis.

Sometimes, however, the activities that spring up are not new, but have only shifted from somewhere else. Analysts and appraisers should be cautious not to include such transfers with benefits (refer also to section 4.2.5). Similarly, some activities might have occurred anyway, even without the project (analogous to accident reductions discussed in an earlier section, which occur anyway). Although these are new activities, they should not be credited to the project being appraised.

> ***Example**: Improvement of one road may shift traffic from a parallel and unimproved road. Shops catering to such traffic may then also shift to the improved road to keep their business.*

Looking only at the improved road would suggest that these shops are new economic activity; in fact, the activity is not new, it has only transferred from somewhere else. If a small factory shifts to take advantage of the better access and reduced VOC on the new road, the industrial activity would also be a transfer, not new activity.

***Example**: If a person, who was already looking for a site to open a new business, located on the improved road mentioned above, instead of somewhere else, the resulting activity, although new, would not be a benefit from the project because it would have occurred even without the project.*

Productivity improvements arising from transport projects are also economic benefits. For example, improved transport service may make it possible for industry to attract skilled workers from greater distances, allowing production to be increased. Alternatively, workers may be less tired and therefore more productive on the job and less likely to make mistakes. On the other hand, business may be able to achieve greater economies of scale because materials can be brought in at lower cost.

***Example**: If the small factory and the new business mentioned in the examples above can expand, because they can attract more skilled workers, or because they have better access to materials, or because lower transport costs make them more competitive, then the net increase in activity is a benefit.*

If prices of goods and services (buyer prices or seller prices) are monopolistic, or are set by a cartel, and if transport service improvements introduce price competition, then economic benefits also arise.

***Example**: If the farmers in the first example above can now get higher prices for their produce (e.g., because competing buyers come in) or lower prices for their farming supplies (e.g., because competing suppliers come in), then there is an economic benefit (increased producer surplus). A similar economic benefit (consumer surplus) arises if they can now buy their household supplies at lower prices (e.g., because competing retailers come in).*

Parking:

Parking results in direct and in indirect economic costs. Direct costs are the opportunity cost of land used for parking, capital invested in parking facilities, and cost of staff to operate parking facilities or to provide security. Indirect costs relate to congestion caused by on-street parking.

Projects that improve private transport access to urban centres—for example, new or improved roads—generally increase traffic levels and thereby increase the demand for parking, resulting in a cost. Projects that reduce the use of private low occupancy transport or encourage a shift to public high occupancy transport—for example, by improving bus or rail service—reduce the demand for parking, resulting in a benefit.

Although transport projects can affect the demand both for on street and for off street parking, only on street parking is relevant for benefit cost analysis, for the following reasons:

- Off street parking is generally not a publicly provided service. Financial costs are paid by the vehicle users through parking charges, higher prices of goods purchased at shops with "free" parking, and so on. Economic costs are offset by additional consumer surplus (gained by the person using the parking space) or by additional producer surplus (gained by the person supplying the parking place). More importantly, off-street parking does not inflict costs on other road users except, perhaps, at road access points.

- On street parking, on the other hand, is generally a publicly provided service. First, people who park their vehicles on the street are highly subsidised. Even where parking charges are levied—for example, in some commercial areas—the current charge of Rs 5/= per hour represents only a fraction of the underlying cost of providing the space. In most areas, even on busy arterial roads, no parking charges are levied at all. Because costs are subsidised, even people whose consumer surplus is lower than the marginal economic cost of providing the parking will use the facilities – resulting in an economic loss. Second, people who park on the street inflict a cost on other road users, including public transport users, in the form of congestion. On street parking, therefore, is an externality.

The effects of on street parking should be included in benefit cost analyses as follows:

- For road infrastructure projects, capital costs should include the cost of constructing extra lanes or lay-bys used for parking, which is generally done. Economic benefits, however, such as increased speed and reduced congestion, should be based only on the usable road capacity, excluding that part of the road used for on street parking. This will reduce the value of the benefits.

- Bus and rail projects that improve service induce some people to shift from private vehicles, which need parking, to public vehicles, which do not need parking or, at least, need less parking. Economic benefits, therefore, may include the additional congestion reduction that would result from less on street parking, in addition to the congestion reduction from modal shift. In developed countries, analysts sometimes also claim economic benefits for reducing the number of parking spaces provided (i.e., opportunity cost of land) on the grounds that the space will become available for other

purposes, such as expansion of pedestrian areas or development of small urban parks. This argument is not relevant for Sri Lanka, at this time, as there is still an acute shortage of on street parking, reflected by double parking and by parking on pavements.

Given the high externalities of on street parking, especially due to congestion, there is a strong economic argument to restrict parking on busy streets at all times of the day or to shift parking from on street to off street.

The above arguments also apply to pedestrian and other non-motorised traffic. When roads, especially in busy commercial areas, do not have pavements, pedestrian traffic is forced to use the edge of the roadway. Even where pavements exist, activities that reduce the pavement capacity (such as vehicle parking or encroachment by shops and hawkers) can force people onto the road. Like on street parking, this reduces effective road capacity and increases congestion and associated economic costs.

Accessibility:

This section describes a short method to evaluate benefits in relatively small transport sector projects. In such as situation, the different types of benefits discussed earlier, would be too small to be calculated separately. For such instances, a short method of assessing total benefits has been proposed. This is referred to as a composite index of measuring improvements in accessibility.

The index is based on population of the Project Impact Area and the total travel time savings that are possible from the project. Socio-economic (Regional) Development Benefits are computed as a percentage, based on the development potential of the project. This approach is discussed in Appendix B5. It should be noted that this should not be computed together with other benefits, as it would lead to double counting

.

The Baseline Road upgrading project will provide 6 lanes at a total construction cost of Rs 400 million per kilometre. The economic cost of using 1 lane in each direction for parking can be worked out as follows:

Annualised Construction Cost per Parking Space (25 Years, 10% Discount)

- Rs 400 m/km, 6 lanes, 160 spaces per km, 6 days/wk, 10 hrs/day
- Cost per Space per Hour = Rs 13.40

Annualised Land Cost per Parking Space (25 Years, 10% Discount)

- Rs 500,000/= per perch, 2 spaces per perch, 6 days/wk, 10 hrs/day
- Cost per Space per Hour = Rs 8.00

Congestion Cost per Parking Space (20,000 Vehicles/Direction/10 Hours)

- Speed Reduction 50 kph to 40 kph, 160 spaces per km, 6 days/wk
- Cost of Increased Congestion = 8,600 per km per 10 hours
- Cost per Space per Hour = Rs 5.40

Although only an illustration based on assumed data, the above calculations suggest a total economic cost of Rs 26.80 per parking space per hour. At peak hours, when congestion is greater and speeds are slower, congestion and therefore total costs would be much higher. This is presently allowed free of charge. Even if on-street parking was charged at the present approved rate of Rs 5.00 per hour, it remains a transport facility which receives the highest level of subsidy.

Other Benefits (Reliability and Comfort):

Because transport is essentially about access and mobility—arriving where you want to go at the expected time—*reliability* can be defined as the deviation of travel time from the mean. Reliability, thus, is not about shortness of journey times, but about the difference between the actual times and the expected times. People and goods want to travel quickly, but they also need to arrive at their destination on time – for example, at work to avoid losing wages, at a meeting to avoid upsetting a customer, at a factory to avoid shutting down production.

In the Sri Lanka environment, at present, reliability (or, more correctly, an allowance for unreliability) appears, in part, to be already factored into the average journey time. For example, people tend to leave home slightly earlier, so that even if they are delayed by unreliable transport service (e.g., sudden road congestion, bus breakdown, train delay or cancellation) they will not arrive too late. Similarly, factories might order materials earlier or keep extra stock on hand. When unreliability occurs, therefore, a buffer is available to reduce the possibility of negative consequences.

The cost of unreliability (and therefore, the benefit of improving reliability) would include the following:

- Value of time for the extra time that people and companies (for materials) build into their travel decisions and the value of extra inventory that companies maintain as safety stock against unreliability. This would require a study to determine if people really do include an allowance for unreliability in trip plans and, if so, how much.

- Incremental economic costs of other actions that people and companies take to protect against unreliability – for example, of using a different mode if it is perceived to be more reliable (such as a motorcycle instead of a bus or a private lorry instead of a train). In such situations, however, analysts must be careful to exclude other benefits that might also accrue, such as from speed or comfort.

- The economic costs of decreased economic activity (or productivity) due to risk of labour or materials arriving late. This would require a study to determine the probability distribution of delays and the consequences on productivity.

As transport services and facilities improve, however, the above three costs would reduce, as people and companies build less buffer time into their decisions, as they become less likely to select other alternatives, and as the probably of delays decrease.

Comfort refers to changes in physical and mental condition induced by the transport facility or service. The benefit of comfort, expressed in economic terms, would be "the additional consumer surplus enjoyed by the user". Expressed in non-economic terms, benefits of comfort might be:

- Being able to relax instead of becoming stressed while travelling.
- Sitting on a bus or train instead of having to stand.
- Travelling without getting tired and dirty.
- Avoiding having to breathe polluted air.
- Being able to read or listen to music while travelling.
- Being provided with extra services, such as toilets or meals, while travelling.

The value of comfort can be quantified, in part, using revealed preference methods. The value of "sitting comfort", for example, could be determined (a) by comparing prices and demand for ordinary and semi-luxury (i.e., seated but not air-conditioned) bus services, (b) by measuring the extra cost (value of time) of people who wait for the next bus at a terminal to get a seat, or (c) by comparing prices and demand for railway unreserved with reserved services. The value of "air-conditioning comfort" could be determined by comparing prices and demand for express but non-air-conditioned buses with express air-conditioned bus.

Although comfort has a high private value—hence air-conditioned buses and office vans—it is not clear that social values would be the same.

4.2.3.2 Non-Quantifiable Benefits

Non-quantifiable benefits refer to those that cannot be quantified in monetary terms easily. They include, but are not limited to, the following:

- Mitigating Ecological and Environmental Impacts
- Enhancing Visual and Aesthetic Considerations
- Use in Emergencies

These no-quantifiable benefits would be particularly helpful in deciding between alternatives when the results from the benefit-cost analysis using quantifiable benefits are similar and inconclusive.

4.2.4. Cost Components in Transport Projects

According to the principles of benefit cost analysis, "costs" are the economic values of resources used to implement a transport project and to operate and maintain the project over its economic life. Relevant cost components include the following:

- Surveys, Designs, and Other Pre-Construction/Procurement Costs
- Capital Costs for Construction/Procurement
- Costs of Externalities due to Construction
- Cost of Training & Human Resource Development
- Recurrent (Operating & Maintenance) Costs
- Costs of Externalities due to Operation.

4.2.4.1 Surveys, Designs, and Other Pre-Construction/Procurement Costs:

These refer to costs that will be incurred *after* a decision has been made to proceed with implementation, but *before* construction and/or procurement can begin. Example of related costs are land and traffic surveys to finalise the route, soil investigations, property valuations for compensation, preparation of detailed engineering designs and architectural plans, and so on. Note that costs incurred before a decision is made, such as surveys and investigations for feasibility studies, environmental impact assessments, benefit-cost analyses, etc., should not be included, as these costs will be spent and sunk before the decision is made.

Some pre-implementation costs would be incurred by the transport sector institutions in the normal course of business - for example, work done by permanent salaried staff who are paid the same with or without the project. On the other hand, without the project, some staff costs might be avoided by having smaller numbers of staff, or some staff might put to other productive activity (opportunity cost). It is, therefore, reasonable to include a portion of institutional overheads in pre-implementation costs, along with the other incremental costs of hiring outside surveyors, valuatuers, designers, and architects. To avoid calculating such costs separately for each project, most institutions estimate pre-implementation costs as a portion of total construction/procurement

costs, which is also reasonable. The relevant costs, however, should always reflect the difference between "with the project" and "without the project".

4.2.4.2 Capital Costs for Construction/Procurement:

These costs are generally based on engineering estimates using bills of quantity and schedules of rates (e.g., road/bridge/track/building construction, traffic signal systems), or on suppliers rates, such as quoted in tender bids (e.g., machinery, locomotives, buses, rail signalling systems).

Construction/procurement costs are generally better understood than other benefits and costs because of long practise in their estimation and because bills of quantities, materials unit costs, and suppliers' rates are readily available.

> Analysts and appraisers who are accustomed to working with financial costs should remember to convert such costs to economic costs when undertaking economic appraisals.

Economic analyses are generally done in constant prices, in which case general price contingencies should not be included, unlike for financial analyses. Material & labour variations may be included.

4.2.4.3 Costs of Externalities due to Construction:

Economic feasibility studies should include the costs of externalities such as delays and disruption due to construction. These would be relevant mainly for projects in which there are existing users who would get affected, such as infrastructure improvement projects (e.g., roads, bridges, railway tracks). Costs can be very high, especially for projects on routes with large numbers of vehicles and users and for projects that take a long time to complete.

Externalities are often overlooked in feasibility studies, although they are usually included in environmental impact assessments. Externalities can be measured and valued in a manner similar to benefits.

- **Cost of Increased Traffic Delays**: This would be calculated similar to calculating the benefits of increased speeds after construction – that is based on the numbers of people affected, their incremental time delay (instead of incremental time reduction), and their corresponding value of time.

- **Cost of Increased Vehicle Operating Costs**: During construction, congestion might be greater, speeds lower, and road roughness greater (although this also depends on road condition before improvement), resulting in higher vehicle operating costs, especially for fuel and maintenance.

- **Cost of Increased Accidents**: This would be based on the relative number of accidents before and during the project.

- **Cost of Environmental Impacts**: This relates to the incremental air pollution caused by congestion delays during construction, emissions of construction machinery, and other pollution that might occur, including due to dust. If actions are taken to mitigate noise and dust during construction, cost should also be included. When costs and/or benefits of environmental effects are valued and incorporated, such an analysis is called "Extended Benefit-Cost Analysis".

Relevant costs are not only the incremental costs of users who continue to use the section of infrastructure under construction, but also the incremental costs of users who detour to alternate routes (which may be longer), and the resulting congestion effects on the prior users of the alternate routes.

A great advantage of explicitly including externalities in project appraisal is that planners, in order to maximise project feasibility, will be encouraged to come up with engineering designs and construction plans that minimise such costs. This might be done, for example, by more efficient design or accelerated construction. Externalities are real costs to society, so actions to reduce them should definitely be encouraged.

> ***Example**: The economic costs of delays and congestion during implementation of the Baseline Road upgrading project are huge and might outweigh the eventual economic benefits. Accelerated construction—for example, by working day and night—although perhaps more costly in financial terms, would have increased economic viability through savings in externalities, savings in the opportunity cost of using construction equipment for an extended period with low utilisation, and for earlier realisation of benefits.*

4.2.4.4 Cost of Training and Human Resources Development:

Costs of training and human resource development may or may not be included with project costs. This would depend on which category such training falls, as below.

- The costs of developing specialised skills required for construction, operation, or maintenance of a particular project should be built into the project.

- The costs of developing general scientific, technical, or managerial skills should be considered under separate human resources development projects.

4.2.4.5 Costs of Operating & Maintenance:

Operating and maintenance costs (or recurrent capital costs) must be included in the benefit cost analysis for each year of the economic life of the project to avoid understating life-cycle costs and to avoid a mismatch with benefits[26].

> ***Example**: A bus (or train) generates economic benefits by providing a transport service. Without servicing and periodic maintenance the bus or train will stop operating and will, therefore, stop generating economic benefits. It is incorrect to include annual benefits in an economic benefit cost analysis without also including the annual operating and maintenance costs incurred to generate those benefits. The same rationale is true for roads or other infrastructure, which will deteriorate without maintenance and will, therefore, lose the ability to support services that generate benefits.*

Examples of recurrent costs that might be incurred during normal operation and maintenance of an asset after project implementation are below. Care should be taken to take their "economic value" by applying shadow price ratios to convert market costs to resource costs.

- Energy (fuel, power consumption)
- Labour (operating crews, maintenance crews)
- Materials (lubricants, replacement parts, maintenance materials)
- Machinery and tools (to support operations and maintenance)
- Overheads (administration, etc., if incremental)

Transport institutions in other countries increasingly use well formulated asset management techniques to determine efficient levels of maintenance based on the nature of the assets, their capital costs, their age and utilisation, their operating and maintenance costs, and their desired level of service. Such systems have not yet been developed in Sri Lanka. Transport organisations such as the Road Development Authority, Sri Lanka Railways, and the bus companies generally base maintenance schedules on "rule of thumb" norms or "past experience", which do not appear to be based on technical efficiency or financial cost effectiveness. Operating and maintenance costs are generally measured only in terms of present expenditures.

> It is highly recommended that Sri Lankan transport institutions should develop scientific asset management systems to support efficient use of assets. Such systems would, for example, indicate optimal maintenance levels to maximise asset utilisation and minimise life cycle capital and recurrent costs of the assets.

[26] The principle of life cycle cost evaluation is explicitly recognised in paragraph 125.3 of the *Guidelines on Government Tender Procedures, Part I*, General Treasury, Colombo (August 1997). Although this paragraph applies to tender evaluation, the same principle is also relevant for project evaluation.

Depreciation and amortisation are generally not included in economic analysis, which considers only the real flow of resources. Investment costs are usually included in full at time of investment, which can be at the beginning of the project or during the economic life of the project in case of recurring capital (e.g., replacing the A/C overlay on a road). Residual or disposal values of assets are considered at the end of the project life. An exception can occur in calculation of vehicle operating costs, which include depreciation and interest to annualise capital costs, as it is too difficult to consider the individual capital outlays for all vehicles using a road.

4.2.4.6 External Costs due to Operation:

External costs due to operation would be represented by environmental impacts such as the cost of air emissions, noise pollution, loss of productivity of land due to increased or unsustainable levels of transport activity. The cost of congestion may also be an external cost, if the project in question causes delays on the transport network elsewhere.

> ***Example**: The proposed Southern Highway, is intended to reduce overall travel time for those travelling between the Colombo and Matara. This will induce new traffic. This new traffic would have to use the present road network in suburban Colombo to access the Southern Highway at Kottawa. Although, their individual travel times would be decreased, the increased traffic levels, would increase the travel time of other traffic not using the Southern Highway. This should be reckoned as an external cost to be borne by persons who are non-users.*

4.2.4.7 Representative Costs:

Representative financial costs of typical transport sector projects are given below for bus, rail and highways. These are based on present experience in the sector and should only be considered as current industrial norms. It is recommended that some attention be paid at a future date to obtain construction and maintenance costs based on pre-defined levels of resource utilization and efficiency. All prices are in 1999 Rupees.

Buses:

Procurement Costs of Buses

Bus Type	Cost
D-Type (30 seater – one door)	Rs. 1.40 mn
B – Type (40 seater – two door)	Rs. 1.75 mn
A – Type (67 seater -two door	Rs 2.00 Mn

These costs vary with mode of payment and credit facilities, component of local assembly etc.

Operating Costs of Buses

	Up-Country	Flat land
Variable Costs Rs/km	9.50	11.00
Fixed Costs Rs/month/bus operated	30,000	30,000

These costs also vary with institutional factors, climate, size of bus operation etc.

Railways

Procurement Costs of Rolling Stock

New Locomotive (M8 Indian)	Rs 110 m excl duties/taxes
New Locomotive (M9 French)	Rs 165 m excl duties/taxes
New DMU Set (S9 Chinese)	Rs 180 m excl duties/taxes
New Wagon	Rs 5 million excl duties/taxes
New Carriage	Not available as none purchased recently
Signals (Local Tech)	Rs 3 m per km (based on Plk-Rbk)
Signals (Foreign Tech)	Rs 20 m per km (based on Wda-Hkd)

Track (million Rs/km) for single track with jointed rail excluding departmental overheads.

	Wooden Sleepers	Concrete Sleepers
▪ Rail	3.0	3.0
▪ Sleepers	4.2	3.4
▪ Ballast	0.9	1.8
▪ Joints/Fastenings	0.6	0.8
▪ Earthwork etc	0.2	0.2
▪ Labour for Laying	0.7	0.9
Total	**9.6**	**9.9**

Highways

Table 4.11 : Costs of Highway Construction

Item	Sub Item	Unit (per)	Civil Works (Rs. Mn)
New Infrastructure	Gravel Road (5 m)	Km	3.5
	Metalled Road (5 m)	Km	5.5
	SBST Road (6.7 m)	Km	14.5
	DBST Road (6.7 m)	Km	15.0
	AC Road (6.7 m)	km	17.0
	AC Road (std 2 lanes)	km	20.0
	AC Road (4 lane divided)	km	35.0-40.0
	AC Road (6 lane divided)	km	45.0-50.0
	Expressway (4 lane divided)	km	125.0 - 265.0
	Expressway (6 lane divided)	km	
	Bridges single span	sq.m	0.06-0.13
	Bridges multi-span	sq.m	0.08-0.15
Widening And Improvements	Gravel Road (2 lanes)	km	0.5-1.0
	Metalled Road (2 lanes)	km	1.0-1.5
	SBST Road (4½ - 6 m)	km	1.5-2.0
	DBST Road (4½ - 6 m)	km	2.5-3.5
	AC Road (sub std 2 lanes)	km	5.0-6.0
	AC Road (std 2 lanes)	km	6.0-8.0
	AC Road (4 lane divided)	km	25.0-35.0
	Bridges single span	sq.m	0.03-0.05
	Bridges multi-span	sq.m	0.04-0.05
Rehabilitation	SBST Road (std 2 lane)	km	8.0-10.0
	DBST Road (std 2 lane)	km	14.0-15.0
	AC Road (std 2 lanes)	km	15.0-22.0
	AC Road (4 lane divided)	km	25.0-35.0
	Bridges single span	sq.m	0.06-0.13
	Bridges multi-span	sq.m	0.08-0.15

It should be noted that these costs include the following mark ups from the Schedule of Rates:

- Price Escalation 10.0%
- Consultancy 12.0%
- Profit 28.0%
- Contingencies 10-12%

4.2.5. Transfers

Analysts and appraisers should take care to avoid confusing transfers with economic benefits and costs. Some factors that appear to be benefits from the point of view of the implementing agency, such as financial votes given by the national government, are actually transfers from the national point of view. Real economic benefits and costs relate only to net increases or decreases in economic activity and to net increases and decreases in use of resources.

Transfers are a special problem when trying to value economic development. Expansion of transport infrastructure clearly supports economic growth. However, if some of the economic activity that springs up at the project level would have occurred anyway or has relocated from elsewhere, the net national benefits are smaller.

***Example**: Providing small shops at bus stands or railway stations will stimulate commercial activity at those locations, but*

if this is merely a shift in activity away from other shops that consequently close, then there would be little net benefit.

Subsidies or duties/taxes are monetary transfers from one sector of the economy to another, which is not the same as a change in resource use. This is seen most clearly with respect to duties/taxes paid by government agencies, which are merely shifted from one pocket of the government to another.

4.2.6. Inflation and Price Escalation

Since inflation is a financial issue, it is not an important consideration in selecting of the best alternative. It is therefore, recommended that analysts avoid having to make assumptions about inflation by using constant (or real) values in analyses. Adjustments could however, be made for relatively significant differences in price escalation over the project life time.

***Example**: A railway electrification study compares diesel operation as an alternative over a 40-year project life time. It is assumed that since diesel is a limited and depleting resource, the world prices would increase in real terms. On the other hand, with greater technical innovations for converting different energy sources to electricity, it may be assumed that the price of electricity would remain constant or even decrease in real terms.*

***Example**: The planning unit of a bus company is evaluating the introduction of computers and related software for data entry and analysis that is presently handled manually. It could be assumed in this case, that costs for computing hardware would decrease in real terms, whereas human resources needs for both options would continue to increase with real growth in incomes.*

4.3. Undertake Benefit Cost Analysis

The following sections lay out the process of benefit costs analysis, discuss the appropriate discount rate to use, and point out some common problems against which to guard.

4.3.1. What is Benefit Cost Analysis?

Benefit cost analysis is a tool to identify and assess the economic feasibility of public infrastructure investments. It is widely used in other countries to evaluate transport projects because of its strengths in promoting economic efficiency and in supporting effective decision making. Its focus is mainly on efficiency – getting the most value for money.

In one way, the principle of benefit-cost analysis is quite simple - simply estimate the monetary

values of the relevant benefits and costs of a project, add them over time, and determine if the benefits exceed the costs. The important feature of benefit cost analysis is that it gives a logical framework to examine alternatives and to undertake the economic appraisal. This includes specifying what benefits and costs may be included, how to value them, how to distinguish real benefits and costs from transfers, how to recognise timing, how to account for risk, and how to compare benefits and costs.

Some other strengths of benefit cost analysis are listed below:

- The need to quantify and put monetary values to benefits and costs encourages more thorough study and planning.
- Quantifying external effects (externalities) such as congestion or pollution in monetary terms allows them to be evaluated in a common framework.
- Benefits and costs that occur at different times can be compared.
- Benefit cost analysis is more transparent than multicriteria evaluation, as the latter can exaggerate benefits by using inter-related or redundant criteria.

Analysts and appraisers must guard against potential pitfalls in using benefit cost analysis, as discussed below and in several of the following sections. Such potential problems, however, do not invalidate the advantages of using benefit cost analysis in economic appraisal.

- Results can be distorted if important benefits or costs are omitted from the evaluation or included when not relevant. This report attempts to avoid this problem by developing a list of potential benefits and costs and describing the circumstances in which they are relevant to use.
- Benefit-cost analysis is based on quantifiable costs. Intangible considerations that can be the main cause for success or failure could be ignored.
- Some potential benefits or costs cannot be accurately predicted. Their variations may be due to uncertainty of events occurring as anticipated.
- Some benefits or costs cannot easily be valued in monetary terms, such as pollution, ecological effects (wetlands, wildlife), visual aesthetics (landscape, waterfalls), and so on. However, methods such as described in Section 4.2.2 above are continually being refined to estimate monetary values for such factors. Even if some benefits and costs cannot be valued precisely, it is better to use the best available value than to ignore the benefit or cost completely.

All benefits should be included in benefit cost analysis, including those that do not have obvious market prices. Monetary values should be assigned where possible, but benefits for which monetary values cannot be developed also should be listed in the analysis. These can be used as an extra guide for decision making in addition to monetary benefits and costs. For example, such benefits might be important to decide between alternatives that have similar quantifiable benefits.

The savings of not implementing one alternative in a feasibility study are not benefits to other alternatives, as this violates the principles of benefit cost analysis that alternatives should be

evaluated independently of each other and that second-best alternatives should not be used as the base case.

> ***Example**: Two recent studies into railway electrification have assumed, inappropriately, that an economic benefit of electrification is a saving in the cost of building a highway. In fact, building a highway cannot reasonably assumed to be part of the base case – rather, it is an alternative to improve transport in the suburban corridors. Each alternative must be assessed on its own merits to determine which is more viable. It would be equally incorrect to assume that the benefit of building a new highway is a saving in electrification.*

Benefit cost analysis does not turn decision making into a mechanical process of approving the projects with the best numbers. Transport supports broad societal goals, some of which are not related to economic efficiency, are difficult to predict, or cannot be simply reduced to monetary equivalents. In public sector projects, especially, non-economic or political criteria, which cannot be incorporated in benefit cost analysis, must also be considered. The role of benefit-cost analysis, therefore, is to give policy makers better information on which to base their decisions and to make political decision making more transparent and informed.

> When this Report refers to "projects", the normal understanding might be "procurement projects", such as purchase of buses or railway rolling stock, or "construction projects", such as building or upgrading roads, bridges, and railway tracks. But "projects" can also mean "transport policy" or "regulation" and the principles of benefit cost analysis are equally valuable to determine whether the anticipated economic benefits (e.g., reduced congestion from traffic demand management) outweigh the economic costs (e.g., road user pricing or policing).

Incremental Benefits and Costs: When evaluating projects only the incremental benefits and costs should be considered. Sunk costs or benefits that have already been realised should be ignored.

Complementary Projects: Some transport projects can achieve benefits only if other complementary projects are also implemented.

> ***Example**: A project to build a highway might not attract expected traffic volumes unless feeder and access roads are also improved. In such a case, appraisal should consider the highway and the other roads as a single project for purpose of appraisal.*

Analysts and appraisers should take care that investments in such complementary projects are not forgotten. Options are as follows:

- Combine both projects in the economic appraisal. For example, a bridge might generate benefits only if an access road is also constructed. Therefore, develop a road/bridge project against which the joint benefits can be compared.
- Keep the projects separate, but divide the benefits between project components in a reasonable way. For example, railway double tracking might also require operation of new trains to achieve significant benefits. If the costs of buying new trains are kept separate, the benefits of the double tracking should relate only to those that can be generated by the existing trains.

Appraisers should carefully review benefits, as it is common to see the same benefits used to justify several projects (also refer to section 4.3.4 on double counting).

> ***Example**: Three railway projects might count the economic benefits of passenger traffic (i.e., reduced road congestion due to shift of people from road to rail) to justify (a) new signalling, (b) double tracking, and (c) rolling stock. If the benefits of the program of projects are credited in full for each project component, economic viability will be greatly overstated. It would be more correct to divide the benefits between the three projects in a reasonable way. For example, signalling might reduce delays and thereby generate some value of time saving and some modal shift. Double tracking might further reduce travel times by avoiding crossing delays and thereby generate additional value of time saving and additional modal shift. It might also permit the existing fleet to make additional trips. New rolling stock might increase capacity and thereby support even greater modal shift. The benefits of each investment must be based only on the incremental effects on time and on numbers of passengers and must not be double-counted.*

4.3.2. Efficiency versus Equity

As mentioned in the first paragraph of section 4.3.1, benefit cost analysis is mainly concerned with efficiency. The analysis, however, can also be used to consider questions of equity (i.e., if benefits and costs are distributed fairly among users and different sectors of society).

> ***Example**: The benefit cost analysis for an express highway would assess if the total economic benefits are greater than the total economic costs. Assume, however, that mainly high-income people enjoy the benefits (perhaps because the highway is used mainly by cars, vans, and air-conditioned buses).*

Assume, also, that mainly low-income people incur the costs of constructing and maintaining the highway, say, through a tax on consumption. The project, therefore, would not be equitable. On the other hand, if tolls or user charges were levied to cover the highway's capital and operating costs, equity would be greater.

Equity is an issue that is more appropriately considered when deciding how funds for a project can be raised instead of in benefit-cost analyses. Appraisers, however, should be given enough information to understand the distributional effects of projects and to determine if they are equitable.

***Example**: If VOT savings are a significant component of project benefits, it would be useful to know what portion of such benefits related to private vehicles users who have high values of time and what portion related to public transport users who have low values of time.*

4.3.3. Economic Life

An early step in benefit cost analysis is to define the economic life of the project (or of the alternatives) being assessed. Each project should be based on a designated life, which reflects the anticipated period during which the asset can be used reliably and efficiently without needing replacement or rehabilitation, but with normal levels of servicing and maintenance (e.g., based on manufacturers' specifications). Note that without the proper level of maintenance the economic life cannot be reached.

***Example**: The economic life of a bus might be 8-10 years, that of a locomotive 20-25 years, and that of a road 20-30 years. The bus might need a new engine every 1-2 years, the locomotive a major overhaul after 10-15 years, and the road a new surface every 5-10 years, but these are expected periodic repairs to achieve the designed economic life, not rehabilitation.*

The concept of economic life is based on the rationale that the cost of maintaining assets increases as they age. At some stage—the end of the economic life—it becomes economically less costly to replace (or rehabilitate) the asset than to continue spending higher and higher amounts for maintenance. For assets that are subject to rapid technological change or obsolescence, the economic life would be less – even if the asset can still be maintained, the benefits of improved performance from new technology would make it economically beneficial to replace the asset early.

***Example**: Computers are subject to rapid technological change. Even if the old computers are still working, the higher capacity*

and enhanced features of new computers make replacement more efficient than continuing with the old.

***Example**: Advances in the technology of diesel engines, especially relating to fuel consumption and emissions, may make it more efficient to purchase new locomotives to gain from savings in fuel consumption and reduced emissions than to continue with old locomotives, even if they can still be maintained.*

Keeping an asset in service beyond its economic life may result in a net loss to society if the stream of higher maintenance and operating costs and reduced economic benefits is greater than the corresponding stream of new asset cost, reduced maintenance and operating costs, and greater economic benefits.

***Example**: It may be more efficient to re-surface a road before the surface gets completely worn and full of potholes, as the economic benefits of reduced vehicle operating costs and time saving from operating on a smooth surface may more than offset the cost of re-surfacing.*

Figure 4.2 : Costs and Project Life Span with and without Rehabilitation

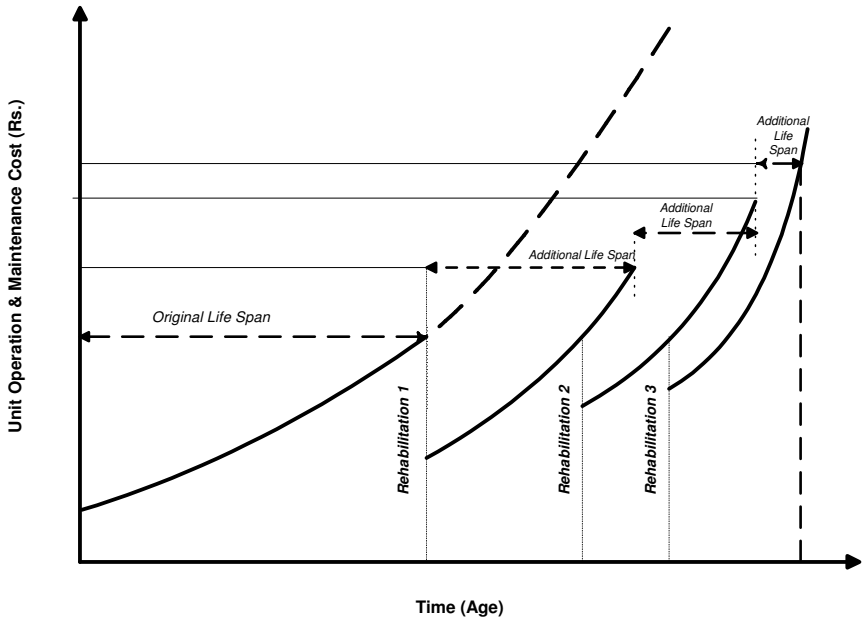


Figure 4.2 shows how operating and maintenance costs change with age of an asset and how rehabilitation might affect its costs and extend its economic life. However, each successive rehabilitation would add less life due to aging of non-rehabilitated components, which would also cause operating and maintenance costs to be higher than a new asset. At some point, replacement

becomes more cost effective than rehabilitation, depending on the cost of rehabilitation relative to replacement, the effect on operating and maintenance costs, and the effect on benefits. In some cases, replacement could be more cost-effective than any attempts at rehabilitation.

4.3.4. Double-Counting

Analysts and appraisers should take care to avoid double-counting benefits. One way is to list the expected benefits and describe how they would be generated (their cause). If several benefits appear to arise from the same causal activity, the risk of double counting is greater.

> ***Example**: Four expected benefits of a project might include (i) travel time saving, (ii) better access, (iii) greater reliability, and (iv) higher land values. Analysis might show that (i) travel time saving is based on reduced journey times, (ii) access is based on reduced time and greater convenience (therefore reduced journey time), (iii) reliability is based on fewer delays (therefore reduced journey time), and (iv) land values are based on greater demand from people who will commute to/from work (because of reduced travel time). In fact, all four benefits over-lap and are based on reduced journey time. The most appropriate benefit to value is the one with the most direct link to the causal activity – in other words, travel time saving. The other three are redundant as they double count the same benefit, in whole or in part.*

Analysts and appraisers should be very careful before counting increases in land values as economic benefits, as such increases often double-count other factors. For example, increases in land values generally double count value of time and travel cost savings for existing owners. Increases in land prices paid by new buyers, however, may reflect some consumer surplus in addition to value of time and travel cost savings.

Appraisers should also be cautious when trying to value indirect benefits, as they are often related to and therefore double count more direct benefits, or they can be transfers.

> ***Example**: Indirect benefits, such as reduced reliance on imported oil or motor spares, are double counts of fuel savings and spares costs already included in vehicle operating costs.*

4.3.5. Determining the Appropriate Discount Rate

After all the project benefits and costs have been identified, after they have been reviewed to ensure that no transfers and double-counts are included, and after economic (monetary) values have been estimated for those items that can be so quantified, the total benefits and costs must be compared to

assess feasibility. However, it is not correct simply to add up the benefits, add up the costs, and determine which is greater. Future benefits and costs must first be converted to their present values.

What is a Discount Rate: Receiving a benefit next year (or even next month) is less valuable than receiving the same benefit today. The opposite is true of costs – a cost incurred in the future has less value than a cost incurred now. Even without inflation, people prefer to receive benefits earlier and incur costs later. The same principle that applies to individuals also applies to society as a whole and is sometimes called the time value of money. The discount rate is the relative percentage by which future benefits and costs have lower values than benefits and costs today.

Why the Discount Rate is Important: A project is viable if its *net present value* is positive as there is contribution to an increase in wealth-i.e. economic development. To determine net present value, benefits and costs must be discounted to their present values depending on when they occur during the life of the project, using the discount rate. Net present value is positive if the sum of the present values of benefits is greater than the sum of the present values of costs (see also Section 4.5).

Benefits and costs are worth more if they occur sooner, as early years are not discounted as much as later years. Transport projects, however, generally have large initial capital outlays and generate benefits that are spread out for many years into the future. As the greatest costs occur in early years that are worth more and as benefits are spread throughout later years that are worth less, net present value depends critically on the discount rate used. The higher the discount rate, the more benefits are discounted relative to costs, the lower the relative present value of the stream of benefits, and the more difficult to achieve a positive net present value.

Determining the Discount Rate: According to economic theory, the discount rate should be equivalent to the *shadow price of capital*, but shadow prices have not been determined for Sri Lanka recently. Discount rates can also be approximated by removing inflation from the nominal opportunity cost of alternative uses of money. This can be based, for example, on the rate of return expected from investments in the private sector or on long-term cost of government debt.

According to the Central Bank, the average yield in 1998 on Treasury Bonds due in 2001 was about 12.5% [27]. With annual inflation of 6.2%, as measured by the Colombo Consumer Price Index[28], the real interest rate appears to be about 6.3%. In theory, when looking for reference discount rates, longer-term debt should be considered, with maturity periods similar to the economic lives of transport projects. Such debt, however, is not issued in Sri Lanka. Long-term debt usually has a higher yield than short-term debt to reflect greater uncertainty. Discount rates should also include an allowance for risk.

What Discount Rate to Use: The USA uses a real discount rate of 7%[29] for public transport projects. Australia also uses a real discount rate of 7%[30] for road projects, while Canada uses a real

[27] Central Bank of Sri Lanka, *Annual Report 1998*, Central Bank, Colombo, 30.04.99, Table 68.

[28] Ibid., Table 40.

[29] Office of Management and Budget, Circular No A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, (www.whitehouse.gov/omb/circulars/ao94.html), 29.10.92.

[30] Ausroads, *Benefit Cost Analysis Manual*, Ausroads, Sydney, 1996.

rate of 10%[31] for national transport projects. In Sri Lanka, as in other developing countries, capital is scarce and the required rate of return on investments is high. Individuals' time value of money is also high because of their urgent need to meet basic living requirements. Hence, interest rates and personal discount rates tend to be high.

In other countries, discount rates for public sector projects are set by the national bodies, such as the Office of Management and Budget in the USA and Transport Canada. It is recommended that the Department of National Planning should, in the same spirit, set appropriate discount rates for Sri Lanka and update them from time to time.

- **Note**: Some economists argue that different discount rates should be used depending on the type of project being analysed. For example, commercially oriented projects that compete with private sector investment should use high discount rates. Purely social projects (such as provision of schools) should use low social discount rates to give greater weight to long-term benefits. Environmentalists even argue for using zero real discount rates for longer term environmental benefits and costs.

Problems to Avoid: To avoid problems associated with trying to estimate inflation, benefits and costs should be measured in constant terms (i.e. excluding the effects of inflation) and the discount rate should also be the real rate.

4.3.6. Inefficient Pricing

The feasibility of transport projects is closely related to demand. High current demand and projected growth in demand encourages requests for extra transport capacity.Transport demand, however, is closely related to users internal transport costs (i.e., the costs transport users incur directly, such as travel time, variable vehicle operating costs for private vehicles, ticket prices for public transport users). According to economic theory, efficiency is maximised and resources provide maximum economic benefit when prices are set at marginal costs. Low prices (i.e., below marginal cost) encourage excess use and thus exaggerate demand.

Usually, economic analyses assume that transport demand is based on efficient prices. However, if it is known that prices are subsidised, the effect on transport demand of setting prices at efficient levels should also be considered when looking at alternatives. Otherwise, the economic benefits of increasing capacity might be exaggerated and inefficient alternatives selected. Similarly, investment in the transport sector, based on exaggerated demand, might displace investment in other sectors.

> ***Example**: If there is excess demand and congestion due to low prices, the analyst should first estimate the revised demand (and revised congestion) if prices at set at marginal cost (e.g., based*

[31] Transport Canada, *Guide to Benefit-Cost Analysis in Transport Canada*, Transport Canada, Ottawa, September 1994.

on the elasticity of demand). The economic benefits of increases in transport capacity should then be measured relative to the revised demand, not to the current demand. This is because one does not need capital investment to reduce congestion, to the extent that marginal cost pricing can reduce demand. Investment projects are required only for further reduction of congestion below that level.

4.4. Compare Benefits and Costs

There are five common methods to compare benefits and costs as listed below:

4.4.1. Net Present Value (NPV)

This is calculated by taking the difference between the discounted present value of the benefits and the costs. NPV is the most suitable method to compare benefits and costs for transport projects. If NPV is positive at the appropriate discount rate, the project will generate a net benefit for the country, which is generally preferred. NPV is also most appropriate for selecting projects, as it meets the objective of choosing projects that yield the highest net benefits. The main problem with using NPV is deciding what discount rate is appropriate, as results are very sensitive to the figure used.

4.4.2. Economic Internal Rate of Return (EIRR)

This is the rate at which discounted benefits and costs are the same. EIRR is less preferred than NPV for ranking projects or for choosing between them, as differences in project life and in the time stream of benefits can result in higher rates of return for projects with lower net benefits. It is useful, however, for preliminary screening of projects and for evaluating projects when the appropriate discount rate is uncertain.

4.4.3. Benefit/Cost Ratio

This is the ratio of the discounted benefits over discounted costs. This is often used because of its simplicity, but is a poor method of choosing between projects, especially if they are of much different size. The B/C ratio favours projects with small costs, and does not indicate which projects provide the largest net benefits. Another problem is that B/C ratios can be distorted by counting benefits as reductions to costs and therefore decreasing the denominator.

4.4.4. Payback Period

This is the number of years for annual net benefits to equal investment costs. Payback is a poor method for choosing between projects, as it favours projects with higher benefits in early years, but gives no indication of total benefits over the project life, which is more appropriate. It is more suitable for private investments, where quick payback might be an important factor in an uncertain environment.

4.4.5. Least Cost Method

This is a simplified application of the benefit-cost analysis that may only be used when the alternatives been compared have identical benefits. For example, if the objective is to purchase a bus, then evaluating the alternatives between import or local assembly, could be carried out using Least Costs, provided the entire life cycle costs are included. However, this method cannot be used to evaluate different technologies or alternative modes of transport, as benefits are never similar in typical transport applications. Moreover, this method does not provide for a means of prioritising between projects, and indeed does not provide the appraiser with the basic information on the project's economic viability either (i.e; if the NPV is positive).

4.5. Undertake Sensitivity Analysis

When the amounts and timing of important benefits and costs are uncertain, which is usually the case because of imprecision in data and assumptions, the effects should be recognised and reported. Benefit cost analyses should provide enough information to allow appraisers to understand what is being assumed, what is the degree of inaccuracy in the data and assumptions, and how changes in the data and assumptions would affect results.

4.5.1. Risk and Uncertainty

Risk refers to the probabilistic outcome of an event based on known or estimated data. Risk can be estimated by using probability distribution functions to reflect the risk elements. Alternatively, the expected value of the benefits, costs, or events can be calculated by weighting each potential outcome by its expected probability of occurring, and then adding across all potential outcomes.

> ***Example**: A road project might have the following probability distribution of traffic growth, based on experience from other similar road projects and based on economists forecasts of economic growth (these figures are only for illustration). Similar probability distributions might be developed for factors such as cost overruns, delays in completion, and so on, based on previous experience.*

Growth (%)	Probability (%)
0%	5%
2%	15%
4%	30%
6%	30%
8%	15%
10%	5%
Weighted Average Growth = 5%	

Uncertainty describers a situation where little is known about future conditions. Uncertainty therefore, refers to events that cannot be incorporated by estimating risk probability distributions. These events cannot be replicated because of a lack of data on frequency or because they are too complex to separate causes and effects. In the case of uncertainty, the approach to adopt in project appraisal is one of caution, supplemented by the judgement of the appraiser.

4.5.2. Sensitivity Analysis

Sensitivity analysis measures the degree of variation in the outcome of the analysis, if one of the variable assumptions were to change. It involves recalculating net present value and other outcomes after changing assumptions and variables for benefits and costs. The assumptions/variables that have the greatest effect on net present value, can then be given greater attention. A version of sensitivity analysis is to calculate the cross over point at which changes in assumptions/variables cause a project to become uneconomic.

> ***Example**: Cross-over analysis might show that a road project which is viable at 5% traffic growth, becomes non-viable if traffic growth falls below 3%.*

> ***Example**: Values of time are point estimates, as actual distributions of income (willingness-to-pay) and work/non-work trips are not available for all transport users by project. As value of time can have a significant effect on viability, it would be appropriate to test the sensitivity of the results to lower values of time.*

The following factors should generally be tested in sensitivity analysis:

- Changes in initial capital outlay (cost overruns).
- Traffic and traffic growth assumptions – with and without the project.
- Modal shift assumptions – from private to public vehicles or from road to rail.
- Values of major benefits – such as value of time, vehicle operating costs, accident savings, etc.

Feasibility studies should point out which assumptions have the greatest effect on net present value, so appraisers can focus their attention on them. Assumptions about economic and traffic growth are particularly important, as they are interrelated and as they also affect VOC, VOT, and other benefits that are related to traffic volumes and congestion.

5. CRITERIA FOR SELECTION

5.1. Fundamentals

The basic determinant in selecting projects for implementation is that they produce socio-economic benefits that are greater than their economic costs and so contribute to national development. Similarly, when choosing among projects, the ones that produce the greatest net benefits should be preferred, other things being equal. Net Present Value (NPV), which is defined in Section 4.4, most directly measures this net benefit and thus is the most suitable criterion for appraising competing projects and for ranking them by priority. Economic Internal Rate of Return (EIRR) is useful for general screening of projects, but is less appropriate for ranking projects.

Benefit-cost analysis, and its associated valuation techniques, is an objective and valuable procedure to determine NPV and is generally accepted as the best tool to evaluate transport sector projects. It allows decision making to be more informed, but does not turn decision making into a mechanical process of approving the projects with the highest numbers. The judgement of the appraiser is still critical – for example, in evaluating the "correctness" of feasibility studies, in appraising projects with similar net benefits, in appraising projects with significant non-quantifiable benefits and costs, in considering the institutional capabilities of Agencies to effectively implement the projects, and so on.

Transport supports broad societal goals, some of which are not related to economic efficiency, are difficult to predict, or cannot be simply reduced to monetary equivalents. In public sector projects, especially, non-economic or political criteria, which cannot be incorporated in benefit- cost analysis, must also be considered in project selection. In such cases, the role of benefit-cost analysis is to give policy makers better information on which to base their decisions and to make political decision making more transparent and informed.

Even when benefit-cost analysis can include all relevant factors and accurately determine net benefits, there may still be other practical considerations that require different decision criteria to be applied. This chapter examines the practical issues faced by decision-makers in deciding between project in the transport sector—diverse as they are—and introduces different decision criteria that may be used.

5.2. Other Bases of Selection

Benefit-cost analysis provides the decision-maker with information about the comparative viability of given projects or alternatives. In order to make the “optimum” decision, such information may be used in conjunction with other decision making criteria, such as:

- Matching investment ceilings
- Total NPV or Weighted Rate of Return
- Least capital cost
- Meeting Legislative imperatives
- Other

5.2.1. Matching Investment Ceilings

Investment proposals are usually not appraised with an "open-ended" investment envelope. To the contrary, the decision-maker often has to "manage" within a given resource allocation. In this situation, no matter how high the viability parameters of a project alternative, the decision-maker will be unable to select the project if the investment envelope is inadequate. Therefore, one of the important decision criteria would be the "investment ceiling".

> ***Example**: Let us say that three projects—A, B and C—have been categorised as "viable" according to BCA results. Assume that Project A, at the appropriate discount rate, offers the highest Net Present Value (NPV) of Rs 500 million, Project B the next (Rs 300 million), and Project C the lowest in this category (Rs 200 million). Project A requires Rs 100 million as investment, whereas B and C require Rs 50 million and Rs 20 million, respectively. If the available investment envelope is Rs 60 million only, the decision is constrained by this, and Project B will be selected, as A cannot be implemented even though it has the highest viability parameters as indicated by the BCA.*

The above situation frequently occurs when authorities responsible for resource allocation, such as the Department of National Planning, consider an investment portfolio. Consider the following situation:

> ***Example:** Let us consider a situation where the "investment envelope" for new roads in a Province is Rs. 100 million and three different road projects are competing for the funds. A study has considered three alternatives for each project, with the results shown in Table 5.1.*

Table 5.1: Economic Parameters of Projects & Alternatives in Portfolio

Project	Alternatives	Project Cost (Rs. Mn)	NPV @ r% DF	Rank
Road between A & B	1 : Thro C	10	100 Mn	1
	2 : Thro D	50	50 Mn	*
	3 : Thro E	20	- 10 Mn	No
Road between X and Y	1 : Thro U	50	75 Mn	1
	2 : Thro V	20	40 Mn	2
	3 : Thro W	10	-2 Mn	No
Road between P & Q	1 : Thro R	30	60 Mn	2
	2 : Thro S	60	150 Mn	1
	3 : Thro T	40	10 Mn	3

It is clear that Alternative 3 for the road between X and Y does not offer a positive NPV at the required economic rate of return (if the economic rate of return required from road sector projects is considered as r%, for example). Therefore, that Alternative can be rejected. Similar screening can be done for Alternative 3 of the road between A and B (although with less confidence, as the negative values are smaller).

An important inference in this example, would be the rejection of Alternative 2 of the project for a road between A & B (refer * in Table 5.1) based on the Principle of Incremental Analysis, even though this particular alternative offers a positive NPV. The logic is that an alternative with a higher capital investment will be considered only if it offers a positive incremental net present value. However, Alternative 2 requires Rs. 40 mn more incremental investment, whereas, the incremental NPV is negative (i.e Rs –50 mn.). Therefore, it can be inferred that Alternative 2 will never be considered for implementation where Alternative 1 is available. As such, we can eliminate Alternative 2 altogether from the analysis, although it has a positive NPV at the Minimum Accepted Rate of Return (MARR).

The remaining alternatives can then be ranked according to their NPV as indicated in Table 5.2, where their investment requirements are tabulated:

Table 5.2: Capital Requirements for Alternatives in Project Portfolio

Capital Requirement (Rs Mn)			
Alternatives/ Project	**Road between A – B (Project I)**	**Road between X – Y (Project II)**	**Road between P – Q (Project III)**
Alt Ranked 1	10	50	60
Alt Ranked 2	-	20	30
Alt Ranked 3			40

If the total available investment envelope is Rs 100 million, there is no way to choose the best alternatives in all three projects. If for example, the best alternative for the road between P and Q (Project III), is picked up, only Rs 40 million will be left for the other two projects. Therefore, the decision will have to be made to pick up the best alternative for the road between A and B (Project I) with the second best alternative for the road between X and Y (Project II).

This shows how investment ceilings could impose constraints on making decisions purely based on the viability parameters revealed by the benefit-cost analysis.

5.2.2. Total NPV or Weighted Rate of Return

In the above example, we have indicated the possibility of selecting the best alternatives for Projects I and III, and the second best alternative for Project II. However, other combinations may also be possible to meet the objective of implementing all three projects. For example, one can decide to select the best alternatives for Projects I and II, and the second best alternative for Project III. It is important, in such a situation, to identify the most beneficial combination.

One way in which this may be done is simply by adding the NVP of the different combinations of alternatives and choosing the combination with the highest total NPV.

***Example**: In our earlier case, the order of alternatives for each project could be tabulated as shown below:*

Table 5.3: NPV of Alternatives

Alternative/ Project	**Project I (Invest)**	**(NPV)**	**Project II (Invest)**	**(NPV)**	**Project III (Invest)**	**(NPV)**
Best Alt.	10 Mn	100 Mn	50 Mn	75 Mn	60 Mn	150 Mn
2nd Best Alt			20 Mn	40 Mn	30 Mn	60 Mn
3rd Best Alt					40 Mn	10 Mn

Combination A—the best alternatives of Projects I and II and the second best of Project III—has an investment envelope of Rs 90 million. Combination B—the best alternatives of Projects I and III and the second best of Project II—also has an investment envelope of Rs 90 million. Combination A, however, has a total NPV of Rs 235 million for the three projects, whereas Combination B has a total NPV of Rs 290 million.

As the total NPV of Combination B is greater than that of Combination A, the Combination of B —i.e. the best alternatives of Projects I and III and the second best alternative of Project II , should be selected.

Another way to identify the most viable combination of projects is to use the weighted Economic Internal Rate of Return (hence the name "weighted rate of return" approach), particularly if the investor is looking for faster returns. The logic in this case is that resources should be used in ventures that give the highest overall rate of return.

***Example**: In our earlier case, let us say that the EIRRs of the "viable" alternatives are as shown in Table 5.4 below:*

Weighted average rate of return is calculated by weighting the return on each alternative according to its investment. Accordingly, Combination A—with Rs 10 million at 15%, and Rs 50 million at 12%, and Rs 30 million at 12%—would have an average weighted return of 12.33%. Similarly, the weighted average rate of return for Combination B would be 13.22%. This means that Combination B of alternatives would maximise the rate of return on investment.

Table 5.4: EIRR of Alternatives

Alternative/ Project	Project I (Invest)	(EIRR)	Project II (Invest)	(EIRR)	Project III (Invest)	(EIRR)
Best Alt.	10 Mn	15%	50 Mn	12%	60 Mn	14%
2nd Best Alt	50 Mn	10%	20 Mn	10%	30 Mn	12%
3rd Best Alt					40 Mn	10%

In the above example, the decisions implied by bot NPVC and EIRR based criteria are the same, i.e. combination B of alternatives should be selected for implementation. However, there can be a possibility that the two bases of analysis give rise to divergent decisions.

If in our earlier example, we assume a different set of EIRRs as given in Table 5.5, then, the Combination A with projects of Rs 10 mn at 15%, Rs 50 mn at 12% and Rs 30 mn at 14%- would have an average weighted EIRR of 13%. Combination B – with projects of Rs 10 mn at 15%, Rs 20 mn at 10% and Rs 60 mn at 12% respectively, would have an average weighted EIRR. of only 11.89%. This means that based on the 'faster return' criteria, Combination A should be accepted as it offers greater weighted EIRR compared to Combination B.

Table 5.5: Example of NPV & EIRR

Alternative /Project	Project 1			Project II			Project III		
	Invest	**NPV**	**EIRR**	**Invest**	**NPV**	**EIRR**	**Invest**	**NPV**	**EIRR**
Best	10 mn	100 mn	15%	50 mn	75 mn	12%	60 mn	150 mn	12%
2nd Best				20 mn	40 mn	10%	30 mn	60 mn	14%
3rd Best							40 mn	10 mn	10%

The above is an example, where two different decisions are implied by two different analytical bases. Analysts should therefore, be mindful that total NPV indicates the net benefits offered by a given combination, whereas the EIRR indicates how quickly the benefits can be reaped. In theory, if higher returns are expected, then such an investor should use a higher discount factor, which would automatically correct the divergence between the decisions, implied in two methods. Therefore, once the MARR is determined, the indicators given by the NPV analysis should be preferred.

However, when the difference of the NPV between the two alternatives is close enough and the investor preference is for early recovery of costs, then the alternative that offers the greater EIRR maybe selected- even though it may have a lower NPV compared to the alternative at the MARR.

5.2.3. Least Capital Cost

When investors are faced with a capital shortage, an obvious constraint is the investment ceiling. The above sections show how to make the best selections in such circumstances. However, there are instances where investors become so pressed by capital shortages that they are compelled to sacrifice benefit-cost criteria to save capital. This is not a favourable position, but the possibility of such realities occurring cannot be ruled out.

Assume that the investor in the above case is concerned to save capital, in order to make additional investment with the saved funds (this is always true as demand for resources in developing economies always exceeds availability). The investor might then choose to assign greater priority to less capital-intensive alternatives, even if they are not the optimum combinations.

> ***Example**: if the best alternative of Project I and the second best alternatives of Projects II and III are selected, the total capital cost would be Rs 60 million for all three projects, enabling the investor to save Rs 30 million vis-à-vis Combination B as described above. The weighted average rate of return, for this choice, would only be 11.8%, much lower than that of Combinations A and B. However, the investor, in this case, could implement a fourth project, while going with viable*

alternatives (EIRR above benchmark) for Projects I, II, and III. An example would be constructing a wooden bridge instead of an iron bridge. The net benefits might be lower, perhaps due to speed and load restrictions, but the access road is provided (with acceptable viability parameters), achieving the main objective of connecting two localities.

The deviation from benefit-cost logic is more significant in this case, but having performed a BCA enables one to pick from "above the bench-mark" alternatives and, hence, to be confident that the selected combination will not result in an economic loss, even if it is not the best combination.

However, the analyst must ensure that in such circumstances, that the capital that is saved is invested in ventures with as high returns as possible. This is because more the deviation from the combination of best projects, more would be the deviation from the maximum achievable NPV as clearly depicted in the Principle of Incremental Analysis.

5.2.4. Least Cost Approach

There is a possibility in certain situations, that the benefits of a set of alternatives to a project are the same. Though such is not commonly found in the transport sector, one cannot exclude the possibility. In such cases, it is possible to ignore the benefits streams and evaluate the alternatives based on costs alone. Naturally the 'least cost' (life cycle costs in this case should include the operating and maintenance costs) alternatives can be selected in such a case, as the benefits would be common to all alternatives considered.

Example: In generation of electricity, one kwh supplied to the national grid will be valued similarly, irrespective of the source of generation. Therefore, this could be evaluated on the basis of determining the source of supply with the least costs.

However, one has to be careful in adopting this method. It leads to ignore the project activity based benefits (such as those concerned during the construction phase, employment etc) and externalities.

Example: There are two alternatives to obtain buses of a certain technical specification. In the one case, these buses may be imported and in the other, they could be assembled locally. The latter could have a number of benefits where although the economic costs are similar, there are additional benefits that need to be included in the selection criterion.

5.2.5. Meeting Legislative Imperatives

Selection criteria are influenced by legislation. A project and/or an alternative with a very high rate of return may nonetheless have to be rejected because of statutory requirements. For example, the shortest and lowest cost alternative for a road project might be across a nature reserve, resulting in the highest NPV and EIRR among the alternatives, particularly if the costs of environmental impacts are not valued and incorporated. However, if environmental legislation prohibits such activity in the reserve, the alternate route may have to go around the reserve at greater cost and with lower returns. Note also that the legislative requirements do not necessarily conform to economic logic. If they do, then the extended benefit-cost analysis will coincide with the legal requirements. Otherwise, even the 'best economic alternative' would not be legally possible as the legislative imperatives would outweigh economic criteria and a decision-maker would have to forego the best alternative in favour of next best alternatives.

When project proponents choose alternatives for evaluation, those that contradict laws or regulations should not be considered, as it is a waste of resources to study options that are prohibited.

5.2.6. Other criteria

Decision makers may sometimes have to select less viable alternatives due to urgency – for example, when a bridge has been washed away and must be replaced as soon as possible. Care should be taken, however, not to confuse real urgency caused by external forces (e.g., *"force majeure"*) with artificial urgency caused by earlier delays in taking action.

Public pressure and political interests also interfere with decision makers' freedom to select the most optimal alternative. As interference that results in sub-optimal decisions may result in heavy socio-economic costs, it is advisable to keep such interventions to a minimum. This might be done, in part, by educating pressure groups about the economic benefits and costs of different alternatives.

5.3. Summary

Projects must be appraised properly, and the diversity of selection criteria is no excuse to do a less extensive appraisal. The results of benefit-cost analysis will always be informative and should, in any case, form the base for decision making.

Deviations from the choices implied by benefit-cost analysis may sometimes be necessary – for example, due to investment ceilings and legislative imperatives. When there are investment ceilings, a scientific approach should be used in selecting the most optimal alternative or combination of alternatives. Simple ranking by total NPV or weighted ranking by average EIRR can be adopted in doing so. Though sometimes unavoidable, it is advisable to minimise the intervention of other parameters that constrain selections based on benefit-cost analysis.

6. REVIEW OF SIX YEAR DEVELOPMENT PLAN

6.1. Background

When we think about transport, we usually think first about vehicle movements - by car, bus, motorcycle, lorry, or even by train. If prompted, we might consider that transport relates to mobility; therefore, it also includes non-motorised transport—walking, cycling, and even carts—which are still common forms of transport, even in urban areas.

When asked how to improve transport, we usually talk first about purchasing additional motor vehicles or trains and upgrading or expanding roads and railway tracks. If prompted, we might consider including facilities for pedestrians and cyclists, although perhaps with the underlying objective of keeping them off the roads and tracks, so they do not interfere with motorised traffic. We are less likely to talk about traffic management or transportation demand management, as these subjects are still not well understood, even though they might sometimes provide the most cost effective solutions to transport problems.

But even so, our definition would not be complete. The ultimate objective of transport is to provide access – for goods, for services, for information, for employment, and for personal activities. Transport, therefore, encompasses more than vehicle movements and more than mobility - it also includes factors that affect access, including communications and even land use planning. These aspects must also be considered when assessing transport projects. For example, at one time, sending a message required sending a messenger, or going our self, and generating at least one trip in each direction. With modern technology—telephone, facsimile, and even electronic mail—we can send messages without generating trips, and can bank without visiting branches. In future, we may be able to educate our self without going to school and work without going to office; in fact, in developed countries, this is already starting to happen. And efficient land use planning can ensure, in future, that when we do want to go somewhere in person—to the bank, shop, school or office—it will be reasonably close at hand, thereby reducing the length of our trips in distance and in time.

6.2. Policy Framework

- An effective development programme requires a framework or a policy within which it can be prepared, or reviewed.
    - The policy should be from the national point of view.
    - It should describe the national goals, the general objectives for the Transport Sector to contribute to these national goals, and priorities.

- The objectives should not be narrow or specific, as the Line Ministry should have flexibility to consider different strategies to meet the national objectives in the most efficient way.

- Currently, there appears to be no overall National Transport Policy in place, although it is said that a draft policy is being prepared. Various policies and reports, however, have been prepared on the subject of transportation in recent years. Some examples are as follows:
  - National Transport Policy, M/T&H, 1992
  - Policy Statement, M/TEWA, 1996
  - NDC and Related Reports, 1997-1999

- The above are generally not Transport Policies – they are more concerned with strategies to implement assumed national goals and objectives for specific sub-sectors such as the Railway, Buses, Roads, etc. Assumed national objectives are as follows:
  - To support socio-economic development.
  - To sustain and enhance national and regional economic growth.
  - To be effective and efficient in use of resources.
  - To improve access and mobility – to jobs, markets, health, education.
  - To provide good quality of service.
  - To be affordable to the majority of users.

- Strategies that have been proposed to meet the above objects are:

  - To maintain and preserve existing assets. Transport assets have high investment costs. Existing assets must meet acceptable service standards (to achieve expected economic benefits). Life cycle capital, operating, and maintenance costs must be minimised (for which assets should be maintained efficiently)

  - To increase utilisation of road and rail assets, in order to maximise benefits and improve efficiency. Utilisation can be improved by:
    - Improved scheduling of rolling stock such as buses and trains.
    - Shifting from low occupancy vehicles to high occupancy vehicles. This applies to road vehicles (e.g., 20-seat bus to 40-seat bus) and to rail (e.g., single power sets to double sets, 7-carriage trains to 15-carriage trains).
    - Improving traffic management by putting signals at junctions, reducing encroachments onto roads (including parking), improving train control.

  - To encourage traffic shift from road to rail, because improving roads induces new traffic and congestion, whereas rail has high potential capacity.

- To improve co-ordination within modes and between modes (including airport and port) to develop synergies.

- To compensate transport providers for their costs, through user fees (such as tickets) or subsidies (which might include duty rebates or even free buses).

- To develop and enforce traffic & safety rules as a way of saving accident costs and increasing infrastructure capacity.

- To improve co-ordination among and between agencies under M/T&H and UDA, Ports, Airports, Provinces, Urban Councils, etc.

- To strengthen transport institutions so they can provide facilities and services more effectively and to improve planning, decision taking, and implementation.

6.3. Overview of the Six-Year Development Program (SYDP)

- The SYDP appears to be a collection of 5 independent packages, not a programme, drawn up with little co-ordination.

- Projects are defined in physical units—kilometres of infrastructure, numbers of rolling stock, etc.—not by expected outcomes, such as what services will be provided or what economic benefits will be achieved. Even when they are identified, benefits are not quantified in units (such as numbers of passengers served, number of accidents reduced, minutes reduction in trip times) nor in monetary values.

- Road and rail projects seem to compete for economic objectives rather than co-operate.

- Foreign-funded projects undergo economic feasibility studies, but locally funded projects often do not, so it is not clear if they bring about economic benefits. Post-evaluations are rarely done. The purposes of doing post-evaluations is not to assign blame if projects do not meet objectives, but to identify the strengths and weaknesses of the project implementation, so the weaknesses can be corrected in the next project and the strengths can be incorporated.

6.3.1. Ministry of Transport & Highways

- This package comprises projects to improve transport infrastructure in the Colombo Metropolitan Region. The main objective appears to be savings in vehicle operating costs and in time. It includes rehabilitation of roads, extension of Duplication Road & Marine Drive, pilot traffic management systems, city centre transport terminal development, rail-based Inland Container Depot, and technical assistance.

- The central theme to the projects is to reduce traffic congestion in the Colombo Municipal Region by expanding corridor capacity, improving traffic management and inter-modal connections, and by shifting container traffic from road to rail.

- As these projects overlap with projects proposed by other agencies such as the RDA (Duplication Road, Marine Drive) and SLR (Inland Container Depot) good communication and co-ordination is essential to ensure smooth integration.

- Unlike projects proposed by other agencies, it appears that these will receive post-evaluation.

6.3.2. Sri Lanka Railways

- SLR proposes to improve capacity and quality of rail service by upgrading infrastructure, adding rolling stock, and improving reliability. The main benefits are described as higher revenues from an increase in passenger-kilometres and an increase in passenger market share.

- Improving service and capacity should reduce road congestion, especially in CMR, thereby generating economic benefits of savings in vehicle operating costs and value of time.

- The projects address objectives to maintain/preserve assets, to increase utilisation (as more trains will be using the same track), to encourage shift from road to rail by improving rail service, and to improve inter-modal co-ordination through station development and construction of an Inland Container Depot.

- The plan gives only investment amounts. There are no descriptions of what work will be done and where, such as physical targets, making it difficult to monitor progress.

- It is unclear how the target of doubling passenger volumes can be achieved. Passenger trains are already congested during the peak, the new locomotive and power sets are not enough to double peak capacity, and there seem to be few actions proposed to increase off-peak traffic when trains are running much below capacity.

- Track investment appears too low to both maintain the track and to achieve the target of upgrading speeds to 100 kph. Furthermore, it is not clear that increasing speeds to this level will give benefits. With frequent stops and a mix of express and stopping trains on the same lines, trains will rarely reach the maximum speed.

- Some projects appear to be duplicated; for example, three projects include investments to upgrade communications in the Colombo area (Coast Line Signalling, All-Island Digital Radio, and Signal Post Telephone System). If the communications components of the Coast Line Signalling project or Signal Post Telephone project are implemented, the potential

benefits of the Digital Radio network will be reduced with little or no potential reduction in cost, making this project less viable or making the other projects redundant.

- Institutional strengthening is shown as a priority, but no related investments are proposed.

6.3.3. Department of Motor Traffic (DMT)

- DMT proposes to improve the registration of motor vehicles, to improve vehicle testing, and to introduce a Motor Traffic Act.

- Benefits include reducing backlog of registrations to reduce unroadworthy vehicles on the roads.

- Institutional strengthening is included.

6.3.4. National Transport Commission

- This package includes purchase of buses, subsidies for loss-making services, and setting up of route planning and costing functions.

- Benefits include improvements to bus service and reduced load factors, and social benefits from operation of buses in rural areas. Improving bus service will yield economic benefits from reduction in vehicle operating costs (e.g., if traffic shifts to bus from other road-based modes), from saving in time (e.g., if new services are introduced on rural routes and if service frequencies are increased on existing routes), and from improved comfort (e.g., if load factors are reduced).

- An institutional strengthening component is included.

- Provision of buses appears to be compensation for past and present low fares. Ongoing provision of new buses, however, should be related to fare policy. If fares are increased to cover long-run replacement costs, then the need to continue providing subsidised buses should be reviewed. A review of fares should include rail fares and road user charges.

6.3.5. Road Development Authority

- This package includes new road and links, increase in capacity and strengthening of existing roads and bridges, maintenance, and institutional development.

- Claimed benefits include reductions in road roughness and congestion, increases in speed, reductions in accidents, and regional development. Economic benefits are not quantified, but would be sensitive to traffic volumes on the roads being upgraded. Experience on recently modernised roads suggests that accidents do not decrease unless active safety measures are

introduced as part of the highway design – such as medians and barriers to prevent pedestrians from freely crossing the roads.

- The projects address objectives to maintain/preserve existing road assets, increase capacity, and reduce vehicle operating costs and time.

- Focus appears to be on developing a radial transport network centred on Colombo. It is not clear if the need for links between regional growth centres, such as proposed in the UDA's Colombo Metropolitan Region Structure Plan, have been considered.

- Several projects relate to improvement of radial roads in Colombo. As on street parking and diversion of pedestrians to the roadway greatly reduces road capacity, these projects should consider the provision of adequate pavements and either off street parking or restrictions on parking. As traffic increases to fill new road capacity, the improved roads will eventually become congested. Other congested cities have found that the provision of "bus-only" lanes significantly improves speeds for these vehicles and therefore encourages people to shift from private low occupancy vehicles. The new roads should include a provision for bus-only lanes to be introduced in future.
- To allow the Railway to achieve its targets of doubling passenger traffic and increasing market share, some stations will need improved access roads. RDA has not included such projects in its plan. These should be co-ordinated with railway station development plans.

- There seems to be some duplication between road projects (e.g., between Peradeniya-Gampola) and between road and rail projects (e.g., new/upgraded rail lines and new/upgraded roads on the same routes, such as Colombo-Anuradhapura, or Batticaloa-Pottuvil). To be economically viable, such projects must generate economic benefits, which are very sensitive to traffic volumes. If two new roads serve the same market, benefits will get divided, thereby reducing economic viability. Similarly, if new highways parallel rail corridors, traffic will be diverted from rail, or from the new highway as and when rail service is improved. Again, net economic viability will reduce. It is recommended, instead, that road and rail should complement each other, by feeding traffic back and forth depending on the comparative advantage of each mode. This might suggest that in some areas, new highways are more efficient, but that in others areas, railway is more efficient and that roads should support rail by feeding and collecting traffic to/from rail.

- Annual and period maintenance expenditures seem too low to sustain the RDA road network in good repair.

- Institutional strengthening seems heavily weighted towards new buildings, with no spending indicated for human resource development.

6.4. Conclusions

- A development programme should start with direction from the top.
    - A "National Structure Plan", similar to the plans prepared by the UDA for Western Province and by the Southern Development Authority for Southern Province would be useful, as it could be used to develop a national transport network that will meet long-term requirements.
    - NPD could supplement such a plan with information on other national development priorities.
- Based on national priorities, the Ministry of Transport & Highways should provide guidelines for its Sector Agencies. Such guidelines would specify priorities for the transport sector, also taking into consideration requirements of the Ports and Airports Sectors and the Provincial Councils.
- A National Transport Policy would provide a useful framework for the above.
- Line Agencies should prepare plans and undertake necessary technical, economic, and environmental feasibility studies according to the national and sector policies and priorities communicated by the Ministry.
- The Ministry should review plans and studies prepared by the Agencies to ensure they are technically acceptable and conform to policies and priorities. It should also co-ordinate multi-Agency studies and projects as necessary.
- A completed programme could then be submitted to the Department of National Planning, which would review them to ensure they are correct and are acceptable from the national perspective.