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16. Abstract
The major objectives of this report are to develop a benefit-cost methodology for the evaluation of intermodal projects in statewide transportation planning and to examine an institutional framework conducive to cost sharing by different modal-specific programs in the State Departments of Transportation. In order to find an appropriate institutional framework for intermodal planning, a compendium of current best practices adopted by various states is included. Evidently, better coordination and cooperation among model-specific programs seems to be the preferred institutional framework for implementation of intermodal transportation projects.

Although some states have novel programs for evaluating intermodal options, the evidence indicates that formal methodology that is unique to intermodal evaluation at the state level does not currently exist. Moreover, there was no formal cost sharing mechanism among state DOT modal-specific programs for funding statewide freight transportation projects.

The major tenet of the study is that in the development of an intermodal project evaluation methodology for the freight sector, public agencies must necessarily incorporate the significant differences in social costs among modes. While the private operators guided by market prices remain the driving force in the freight system, the public policies must be guided by accounting for social costs borne by the public as by products of transportation. Designing public policies quantifying largely intangible social costs of transportation and allocation on the basis of "users pay principle" remains as a key challenge to public policy makers at all levels. This study examines various theoretical and empirical issues involved in estimating social costs and benefits of intermodal projects combining various modal options.

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Access to Louisiana Freight Terminals:
An Intermodal Transportation Planning Framework for Needs Assessment and Funding

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The major objectives of this report are to develop a benefit-cost methodology for the evaluation of intermodal projects in statewide transportation planning and to examine an institutional framework conducive to cost sharing by different modal-specific programs in the State Departments of Transportation. In order to find an appropriate institutional framework for intermodal planning, a compendium of current best practices adopted by various states is included. Evidently, better coordination and cooperation among modal-specific programs seems to be the preferred institutional framework for implementation of intermodal transportation projects.

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This study examines various theoretical and empirical issues involved in estimating social costs and benefits of intermodal projects combining various modal options. Using two case studies, comparative costs are developed for truck, rail, and barge transportation under a total costs framework. Private costs are developed for truck, rail, and barge transportation based on relative costs indicated by market prices and social costs based on available state of the art estimation techniques. When private and public costs are added for different modal alternatives, total cost differences among alternatives reflect the desirability of public intermodal investments compared to the current system. The evaluation methodology accounting for both private and public costs outlined in this report provides for achieving public policy objectives of statewide freight transportation planning of sustainable economic development and improved quality of life.

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IMPLEMENTATION STATEMENT

The two main areas analyzed in this report are the trends in statewide transportation planning under an intermodal framework and the issue of accounting for social costs in planning and evaluation of intermodal transportation projects. A review of transportation planning practices indicates that planning environmentally sustainable and productive transportation systems will be a key challenge to transportation planning in the future. Therefore, the establishment of an Intermodal Planning and Enhancement Program with the following basic features is recommended.

Intermodal Planning and Enhancement Program

Implementing Agency

The empirical research included in this report is useful for strengthening the intermodal transportation planning initiatives already in progress at the Louisiana Department of Transportation and Development (LaDOTD). Both issues addressed in the report are important to achieve the mission and goals of the Department.

Program Design

A committee consisting of representatives from various modal programs at DOTD (i.e. Highway, Ports, Aviation, etc.) under the leadership of the intermodal division should be set up to determine the departmental procedures to implement an Intermodal Planning and Enhancement Program.

Program Scope and Purpose

The Program's purpose is to implement intermodal transportation projects on a cost-sharing basis by different modes based on project benefits to each mode. The Program should be considered as a pilot for the development of an intermodal project evaluation methodology accounting for total costs (including social costs) of transport, which will ultimately be adapted by the modal programs.

To develop this methodology, it is recommended that a team be assembled with both program administration experience and research experience in the economic analysis of social benefits. This approach should result in the development of a state specific evaluation methodology.

Program Management and Project Selection

The management of the Program will be by the intermodal division of the Department and the project selection will be by a committee consisting of representatives from each cost sharing modal program.

Eligible Projects

The proposed projects must show convincing evidence as to their intermodal character and must demonstrate that substantial benefits accrue to more than one mode.

Project Evaluation Criteria

The project prioritization must be based primarily on social benefit-cost analysis and any other relevant factors as determined by the committee. At a minimum, all projects must have a public benefit cost ratio of greater than one. However once projects meet the threshold test, other criteria should be used to prioritize projects based on funding objectives.

Program Funding

Funding from different modal programs is expected to be a contentious issue. Therefore, at the start a specified allocation ($5-$10 million) is recommended from the Transportation Trust Fund.

Freight and Passenger Mode Tradeoffs

Explicitly recognize that mutual benefits and alternative costs borne by different intermodal users may require development of non-traditional project planning and evaluation methodologies to augment traditional social benefit cost analysis, particularly for the freight sector.

Economic Development

Link intermodal projects, especially with regard to freight, to measures of economic development impacts within the State.

Environmental Impacts

Develop measures to quantify how intermodal projects promote environmentally friendly transportation alternatives.

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INTRODUCTION

The primary objective of this research is to develop an evaluation methodology for the selection of freight intermodal access projects, which includes a cost sharing formula by different modal-specific programs, based on relative benefits to each mode. This involves two major requirements: First to develop a compatible social benefit cost methodology across the transportation modes to evaluate relative benefits and, second, to set up an institutional framework at the state level for cost-sharing and implementation of such projects.

The access to intermodal terminals is broadly defined to include all facilities that help seamless transfer of freight between modes, project benefits, and costs. Costs are estimated from a public policy perspective. This includes private and social costs of each mode of transportation.

The Approach and Methodology

The Social Benefit-Cost Methodology - There is wide acceptance that statewide transportation planning decisions in the public sector must be guided by social costs of transportation, which include both private and public costs. As the public mission of statewide transportation planning is to improve the quality of life of communities on a sustainable basis, the policy makers are challenged to develop strategic choices, taking into account the non-market effects of transportation. Because of the significant differences in social costs among modes, comprehensive evaluations of freight intermodal options must be conducted under a social benefit-cost framework.

The identification and valuation of costs and benefits of intermodal projects in terms of private and social costs is the basic issue in developing an evaluation methodology. In this report, the private costs are estimated for different modes using a transportation cost model, assuming under competitive conditions that costs reflect the prevailing market rates. As social costs are intangible and estimation is more elusive, a significant part of the report is devoted to conceptions and the empirical issues involved in estimating them. Social cost estimates used in the study are based on various estimates in previously published reports by federal agencies, the Transportation Research Board, various agencies of the U.S. Department of Transportation, and other national professional and research organizations. All estimates are in terms of marginal costs and marginal benefits 'with and without project.'

Institutional Framework - An extensive survey of the best practice in State Departments of Transportation was made and results were analyzed to document various approaches adopted for intermodal project planning at the state level. In addition to the survey, published reports and information from individual web sites were also used in the analysis.

Case Studies - Two case studies involving freight movements from two different regions of the state are included in the report to illustrate the application of the proposed evaluation methodology. Based on infrastructure endowments in each region, Case Study I compares an all-truck option with a barge/truck intermodal option and in Case Study II an all-truck option is compared with a truck/rail option.

Review of Results and Research Significance

Although the concept of statewide transportation planning under an intermodal framework has been encouraged by federal mandates since the early 1990's, currently no cross modal project evaluation methodologies accounting for social benefits and costs are available. This report is an attempt to fill this void by developing such a methodology for application at the state level. Major input for the methodology is derived by synthesizing research efforts by the Transportation Research Board, U.S. Department Of Transportation, and many other national research agencies relating to public infrastructure costs and subsidies, environmental costs of air pollution, and other social costs of transportation. In addition, the experience gained by implementing a benefit-cost methodology to evaluate and implement more than 200 projects under the Louisiana Port Construction and Development Priority Program has been helpful.

The analysis of results indicates that social benefits and costs of freight transportation are highly specific to the region, time of travel, volumes and distances traveled, etc., requiring each transportation cost analysis to incorporate data specific to these variables. Therefore, the first part of the report explains the general methodological approach by distinguishing private and social costs, explaining specific factors affecting social costs, estimation techniques, user and non-user costs, etc. The second part of the report consists of two case studies to illustrate cross-modal applications of the methodology and provides guidelines to obtain project specific data. However, to evaluate intermodal projects at statewide levels on a routine basis, more databases have to be developed through specific regional studies, incorporating data from other social and economic databases. Finally, we recommend a data-linked approach where results of similar studies could be transferred, with appropriate adjustments, to be used in other locations.

The survey of best practices indicates that state departments of transportation essentially continue the system of modal specific programs with marginal changes in the institutional framework, creating intermodal divisions to coordinate such projects. In several states additional weight is given to intermodal projects in project selection, but cost-sharing practices between programs were not observed. However, there are clear indications that there is greater appreciation for the concept of intermodal planning among planners in charge of modal-specific programs.

During the last decade, the mission of statewide transportation planning agencies has evolved from mere construction and maintenance of state transportation infrastructure to a more ambitious one of providing infrastructure for economic development and improved quality of life. Intermodal transportation planning under a social benefit cost approach meets both objectives, namely, the objective of economic efficiency by combining the most efficient modes of transport and the objective of preserving quality of life by minimizing the negative effects of transportation development.

In terms of physical facilities and the institutional framework, Louisiana is positioned to achieve the above objectives. The state is uniquely endowed with a widely distributed intermodal network of highway, water, pipe and railroads. In terms of institutional strengths, the experience gained in evaluation of projects under the Louisiana Port Construction and Development Priority Program, databases developed under Statewide Intermodal Planning Studies, Statewide Intermodal Advisory Councils, and the strong commitment of the Department of Transportation and Development to the concept are positive points. Under these circumstances, the implementation of a pilot program for evaluating intermodal projects under a social benefit-cost framework and a cost sharing scheme for funding is not only feasible but will also be a pioneering effort in statewide transportation planning.

OBJECTIVE

The objective of this report is to develop an economic evaluation methodology for funding intermodal freight transportation projects through cost sharing mechanisms between highway, rail, and waterway programs and to examine alternative institutional frameworks for planning and coordination of such programs at the statewide transportation planning level. Specific objectives are to:

- Develop a compatible social benefit-cost methodology across transportation modes to evaluate and rank freight intermodal projects for joint funding by modal-specific programs, such as highway, rail, and ports and waterway programs

- Review existing evaluation methodologies and funding procedures at the statewide transportation planning level and devise cost sharing procedures proportional to the net benefits derived by each mode

- Develop as uniform as possible a set of criteria to assess economic and social benefits generated from freight intermodal projects, and

- Examine institutional alternatives available for planning and implementation of intermodal projects in a more coordinated manner at the statewide transportation planning level.

SCOPE

The main focus of this report is to examine the alternative approaches available for statewide intermodal transportation planning in an effective manner. Therefore, the study scope covers issues relating to the development of a social benefit cost evaluation methodology for freight transportation projects, and an institutional framework for the planning and implementation of such projects under a statewide program.

In order to keep the report at a manageable size, the study concentrates on a limited number of issues and makes short references to several others that are, perhaps, equally important. Out of the wide spectrum of issues covered in the scope of the study, areas for detailed analysis were chosen, primarily, with the statewide transportation planning practitioners in mind. Therefore, the study proceeds with an emphasis on the empirical issues involved in the measurement and application of social benefits and cost methodology as well as the selection of efficient intermodal alternatives in freight transportation.

Several important theoretical issues such as the macroeconomic effects of improved access and mobility on regional development, the differences that exist between modes in terms of industry structure, supply and demand elasticity for various services, etc., are not examined. Similarly, the report does not address controversial issues with regard to estimation of benefits, especially the non-market costs-noise damage, the effects of air pollution on human health, and the "green-house effects" on the environment, etc. However, the theoretical framework is vitally important in benefit-cost applications. The use of the methodology as a public policy instrument without considering these characteristics will often result in not achieving intended policy goals.

In developing an intermodal freight transportation model, the highly variable nature of social costs depending upon the distances, the routes traversed, travel time of the day, etc., make it necessary to develop area-specific, and commodity specific models. Therefore, the report includes two case studies involving different intermodal alternatives to demonstrate the application of social benefit cost methodology. In order to develop area specific freight models, it will be necessary to develop databases by under taking a series of empirical studies.

A survey of several state departments of transportation is included in the report to record various best practices adopted in statewide intermodal planning. The general observation from the survey indicates that the concept is widely accepted, but implementation is slow due to inherent coordination difficulties among various agencies. Therefore, the report recommends the implementation of a limited pilot program at the state-level to gain more planning experience. A program of this nature is expected to meet the twin objectives of developing regional databases on freight and the gradual evolution of a cohesive institutional framework for the implementation of intermodal projects.

METHODOLOGY

Evaluation of Transportation Projects – An Overview

The purpose of this chapter is to analyze the theoretical framework for the proposed intermodal project appraisal methodology. The most logical starting point for the analysis is to examine current practice in evaluating public sector transportation projects. This analysis will be in terms of methodological procedures and techniques used in developing the new framework as an extension of current practice. Several chapters in this report examine different methodological applications used at the state and local levels in planning various modes of transportation for passengers and freight. The focus of this chapter, however, is limited to analyzing major conceptual and analytical issues in the evaluation of transportation projects, and to assessing their implications for the development of an intermodal project appraisal methodology.

Choice of Evaluation Criteria

In general, the selection of an appropriate appraisal methodology is guided by the nature of project objectives. Based on economic objectives, transportation projects fall into two broad categories; growth-related projects with improved productivity, output, and living standards as measures of performance, and projects focusing on income distribution with employment growth, regional and sectoral transfers of benefits, etc. (table 1). Very often, economic objectives of transportation projects tend to be multi-faceted, requiring the use of several methodologies to evaluate different objectives. However, most transportation projects fall into the growth-related category where benefit-cost analysis (BCA) is used as the principal approach in project evaluation. Although wide variations are observed in the application of benefit-cost methodology, the conceptual framework of benefit-cost analysis is widely accepted as the appropriate methodological framework to evaluate transportation projects.

Benefit Cost Analysis (BCA) – Methodological Approach

The methodological approach followed in BCA is illustrated in five sequential steps in figure 1. Since BCA is based on a combination of economic concepts, evaluation techniques at each stage are rooted in various economic theories. An in-depth analysis of economic theories is beyond the scope of this report. Therefore, references to economic theory are made only in instances where theory helps to conceptualize the problem at hand.

Table 1

Choice of evaluation methodologies based on project and program objectives

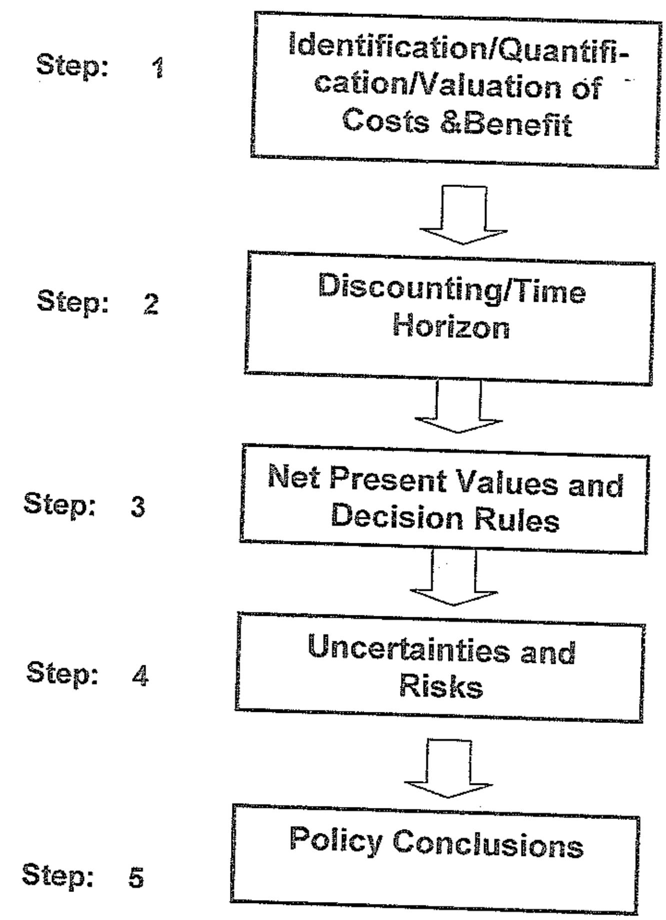
Focus of objectives		**Methodology**	
Growth	**Decision criterion**	**Principal approach**	**Supplementary approach**
Productivity	Rate of return above the average return on investment in the private sector	Benefit-cost analysis with scope restrictions	Incremental impact analysis
Output	Positive rate of return	Benefit-cost analysis with scope restrictions	Incremental impact analysis
Welfare and living standards	Rate of return greater than social opportunity cost of capital Alternatives ranked according to net present value	Benefit-cost analysis	Incremental impact analysis
Distribution Employment	Increased employment in the state or specified locality	Incremental economic impact analysis	Regional economic base analysis
Personal income	Increased wages and salaries in the state or specified locality	Incremental economic impact analysis	Regional economic base analysis
Regional output	Increased value of goods and services produced in the state or specified locality	Incremental economic impact analysis	Regional economic base analysis
Sectoral output	Increased value of output in a specified industry sector	Incremental economic impact analysis	Sectoral economic base analysis

Source: [1, page 39 with adaptations]

As indicated in table 1, in the transportation sector BCA is primarily used as an investment choice methodology for the evaluation of economic growth-related projects. The performance of these projects can be measured in terms of improved productivity, output, and living standards. By definition, productivity and output are market goods and services, making it is easier to develop empirical estimates. Productivity gains are defined as changes in the value of production of marketed goods and services per unit of time (hour). Output growth is defined as the increase in total production valued at market-determined prices. Since these projects deal with marketed goods, the decision criterion used in their evaluation is relatively simple and observable. The use of market prices to measure the value of output and productivity (i.e., value is equal to market price) points out that the foundations of BCA are based on perfectly competitive market conditions. The assumption of perfect competition in input/output markets may often be tested in transportation markets. Similarly, the criterion that the rate of return for public sector projects should exceed the rates achieved in the private sector is based on a perfectly competitive market framework. In addition, it is based on the value of an alternate-use concept, i.e., the rate of return for public investment should at least be equivalent to its value in alternative use in the private sector.

Evaluation of projects with welfare and living standards as the main objective involves analytical and conceptual issues that are more complex. Additionally, there are empirical problems associated with estimating project effects. The welfare and living standards objective is more encompassing and relates to all aspects of individual value. In this case, economic welfare includes non-marketed goods of transportation such as time savings, leisure, environmental effects, etc. Although the social opportunity cost of capital is conceptually different, it is often defined as the marginal rate of return that funds would yield if invested in private industry. This is based on the assumption of perfectly competitive markets.

Implications. For the proposed methodology to be effective, it must incorporate the welfare and living standards objectives discussed above in the evaluation process. The assumption of perfectly competitive market conditions will be further tested as the analysis extends to modal-specific differentiated market conditions. For example, market imperfections in the trucking industry may be quite different from rail or barge transportation.



Source: LSU National Ports and Waterways Institute

Figure 1

Benefit-cost methodology - sequential steps valuation of costs and benefits

The process of valuation of benefits and costs is the most significant stage in BCA and consists of three distinct stages:

- Identification of changes resulting from the project
- Measurement of change in terms of physical units and,
- Valuation of net changes in terms of costs and benefits

Identification. As transportation projects are intricately connected with various economic activities, the delineation of project effects in terms of affected region (spatial effects) and economic activities (sector effects) needs careful analysis.

'With' and 'Without' Project Conditions. In BCA, the project effects have to be calculated on the basis of changes "with" and "without" the project conditions and not "before" and "after" the project. Estimating the net effects of the project requires two distinct future forecasts, one with and one without the project. Obviously, within the multi-faceted framework of the intermodal analytical structure, identification of benefits and costs is more difficult and demands a higher degree of professional competence. This is necessary to avoid misapplication of technical fundamentals such as incorrect project definition, mis-specification of costs and benefits, counting transfer payments as real resource costs or benefits, etc.

Partial and General Equilibrium Framework. Another hypothesis relevant to identification of project costs and benefits is the view that using BCA for project-by-project appraisal (partial equilibrium analysis) fails to capture the induced effects (general equilibrium impacts) of transportation investments. For example, technological change such as just-in-time delivery, airport and seaport hub-and-spoke systems and economies of scale associated with private sector industry expansion are general equilibrium effects. However, as these effects will not be significant for local projects and for projects at the state level, no further elaboration of this area is attempted.

Valuation. Unlike private costs, inclusion of social costs and benefits in project appraisal leads to major methodological problems in quantification and valuation of these effects. From a valuation perspective, transportation costs fall into four categories, each category posing unique estimation issues (table 2).

- *Traded goods with private benefits/costs* – These are goods and services freely traded in the market, and under competitive conditions. The prices of goods and services traded in the market reflect private costs, e.g., truck hire rates or airfares. These costs and benefits, which are easier to identify and quantify are included in the scope of traditional project appraisals.

- *Traded goods with public benefits/costs* – These are costs and benefits resulting from the use of public infrastructures such as highways and urban transit systems. Private and public costs will depend on the extent of government subsidies.

- *Non-traded goods with private benefits/costs*– There are no significant examples in the transport sector.
- *Non-traded goods with public benefits/costs* – A major part of social costs associated with transportation such as air and noise pollution, accidents, and traffic congestion is included in this category. The identification and valuation of non-marketed goods with public value, especially environmental resources, leads to very complex conceptual and empirical issues.

Table 2

Classification of transportation service characteristics, market/non-market, and public/private goods and services

	Goods with private benefits	**Goods with public benefits**
Traded in markets	"Conventional" goods e.g., truck hire, airfares, etc. [cell: 1]	Marketed goods with significant public aspects, e.g., public infrastructure: highways, waterways, airports, etc. [cell: 2]
Not marketed	Non-market private goods –no significant examples [cell: 3]	Non-marketed goods with public value, e.g., clean air, water, amenities, etc. [cell: 4]

Source: [2, page 11 with adaptations]

Valuation Measures. It was noted earlier in this section that welfare and living standards are the decision criteria applicable to project evaluations. Economists have developed several measures to transform this measure into monetary units. One easily understood approach is the "Willingness To Pay" (WTP) concept, which is defined for a gain in an individual's well being as the maximum amount of money that the individual will be willing to give-up in order to obtain the change. Valuation of non-market social costs and benefits is based on this concept.

Social Costs as Externalities. Project appraisals under a social benefit-cost framework estimate both private and social costs of transport. Externalities occur under certain market conditions when the pricing mechanism fails to fully assign social costs and benefits of an economic activity to its producers and consumers. For example, increased air pollution, noise, congestion, and incidence of accidents are social costs imposed by transportation services on society. In economic theory, external costs (benefits) are defined as the difference between private and social costs. Transportation cost classification in table 3 indicates that social costs fall into several categories such as public infrastructure subsidies, costs to common users of infrastructure, and environmental costs. Accounting for social costs by mode (internalize externalities) will play an important role in an intermodal evaluation methodology. Comparative analysis of public infrastructure by modes and environmental externalities will become major areas of relevance.

Table 3
Cost classification for a typical freight shipment by truck

Type of cost	Initial bearer of cost	Cost classification
Vehicle/service	Carrier and shipper	Private cost [cell:1 in table 2]
Infrastructure	Carrier, government, and other users of common infrastructure	Private/social cost [cell:2 in table 2]
Air pollution	Public	Social cost [cell:4 in table 2]
Noise	Public and common users	Social cost [cell:4 in table 2]
Congestion	Carrier, shipper, and common users	Private/social cost [cell:1 and 2 in table 2]
Accidents	Carrier, shipper, common users, public, and government	Private/social cost [cell:1,2, and 4 in table 2]

Source: [3, page 33 with adaptations]

Macro-Economic Effects. The failure to include social costs of transportation has macro-economic implications as it leads to distortion of prices – with the ultimate effect being to influence efficient allocation of resources in the economy. For example, not accounting for environmental costs of transportation and under-pricing of transportation goods and services leads to the following market distortions.

- As transportation services are under-priced, the demand for and supply of services is too large resulting in more pollution.
- The prices of products responsible for pollution are too low.

- As pollution costs are low there are less incentives to research and develop "environmentally friendly" technology.
- Recycling and reuse of the polluting substances are discouraged.
- Market imperfections for transportation goods and services affect demands for raw materials and labor inputs for other goods and services.

Valuation Methods. Measurement and valuation of environmental costs of transportation are critical in developing a project appraisal methodology. The process of valuation involves estimating environmental effects in monetary values that people place on environmental costs and benefits. Several valuation approaches for non-marketed goods with public benefits are discussed below at a conceptual level. Various approaches used for valuation of non-market goods and their relative advantages and short comings are shown in table 23.

The Contingent Valuation Method (CVM) is a survey technique that attempts to elicit information about an individual's preferences for a good or service. This method is also called the "stated preferences method." The basic procedure is to provide a survey questionnaire to the respondents with sufficient information on the proposed good or service. The questionnaire asks how much they are willing to pay for the service, or how much they are willing to accept in compensation to forgo a loss. The data obtained in this manner are analyzed using various statistical methods. The CVM is a useful approach to measuring an individual's willingness to pay for goods and services that are difficult to value with other approaches.

Surrogate Market techniques are indirect methods of assigning monetary values to non-market goods and services packaged together with market goods. For example, air quality and neighborhood tranquility act as complementary qualities in the housing market. Therefore, it is feasible to relate property price differentials to these environmental attributes. This *hedonic pricing approach* examines systematic differences in property values between locations and attempts to separate the beneficial (or cost) effects of environmental quality. Similarly, the benefits of environmental improvements to human health are measured by using *wage-risk models* in the labor markets. This approach relates wage differentials to changes in risk of death, injury, and illness in various occupations. The *travel cost method* estimates value of improved environmental quality to recreational areas by estimating the increase in demand of recreational use of the facility. The surrogate market approach is also termed "Revealed Preferences Technique" because it looks at the relationship between the marketed (surrogate) good and the environmental goods to derive information about the unknown environmental demand.

The *Damage Functions Approach* attempts to determine the damages an individual will suffer, as a result of a change in environmental quality. It looks at a dose-response relationship between environmental damage (response) and some cause of this damage (for example air pollutants, dose). This method is used to examine the effects of pollution on the physical depreciation of material assets, aquatic ecosystems, etc.

Implications. In addition to valuation problems and more empirical data requirements, incorporating social costs of transportation into an intermodal evaluation methodology has several other implications. First, the methodological framework itself is more complex. Therefore it requires an interdisciplinary approach to develop empirical data estimates where variable relationships are controversial, e.g., environmental pollution and health effects, value of life, etc. Second, social costs such as congestion and the effects of air pollution on health are dependent on the time of travel, routes taken (urban/rural areas; interstate/local roads, etc). Consequently, it is more difficult to develop average values for the variables. From an implementation viewpoint, as the model tends to be more complex, it will be more difficult to convince policy makers to adopt the procedure.

Table 4
Valuation techniques for non-market costs/benefits

Valuation technique	Relevant application	Major advantages / limitations
Market approach	Value market goods and services	Wide applicability to goods and services transacted in the market; simple to estimate and understand; most widely used; cannot estimate value of public goods not traded in the open market;
Damage function approach	Value environmental damage (cost) in terms of market values	Estimates hypothetical damage functions based on observed relationship of relevant variables; widely used in environmental regulation areas;
Contingent valuation method	Value non-market goods	Survey technique tends to provide biased valuation; valuations often overestimated; an extensive body of research literature available with wide application;
Surrogate markets	Value non-market goods using market information	Attempts to value revealed preferences through market behavior;
Benefits transfer approach	Value market and non-market goods	Study results can be obtained quickly; inexpensive estimates may be more reliable, an important method for intermodal projects

Source: [2, pages 79-93 with adaptations]

Literature Review and Survey of Current Practice

The development of a methodological framework for intermodal project evaluation requires incorporating diverse socio-economic concerns inherent in transportation planning. The major factors that contribute to this complexity are twofold. First, purely from a logistics viewpoint, intermodal projects have to consider a larger matrix of multimodal planning options such as intermodal trade offs, connectivity, and capacity. Second, the methodology to be developed must be responsive to emerging concepts of statewide transportation planning that focus on productivity, efficiency, sustainability, etc. Therefore, the methodological framework to be developed should be responsive to meet statewide transportation policy objectives, as summarized below:

> "Key developments (in statewide transportation planning) include federal legislation and a shift in focus from facility planning to policy development, system management, customer needs, and financing. Emerging trends and issues include performance-based planning, customer-based planning, the formation of partnerships, the balancing of long-term and immediate needs, alternative financing approaches, elimination of modal biases in solving problems, understanding the economic effects of goods movement, adoption of new technologies, consideration of environment and environmental justice, travel forecasting, reengineering of the planning process, and the recruiting and training of qualified professional staff" *[4, page 4]*.

Under these conditions, a survey of current practice in statewide transportation planning as followed by the State Departments of Transportation and other agencies is considered to be a logical point to start a literature survey. In addition to the survey of current practice in state DOTs, this section will include a review of recent research literature published in this area.

Methodological Approach

Survey of current practice. An extensive database was created as part of the study combining primary and secondary data sources. The main focus of the survey of current practice was to collect information on programs and practices followed by state departments of transportation (DOTs) in intermodal transportation planning. Secondary data on DOTs were collected from published research reports, various national and regional conference proceedings, and from internet websites maintained by individual departments. In addition, a primary database was created through telephone interviews with officials of selected state DOTs to incorporate their views and augment data collected from secondary sources. These

Table 5
Analytical approach of the survey of current practice – a schematic presentation

Policy framework	Organizational framework	Model projects
Performance-based planning Efficiency and productivity Economic impacts Use of technology Quality of life Systems Approach Connectivity Multimodal and intermodal planning Sustainability Environmental impacts	Modal program coordination Management and operations Fund allocation Project selection and priority Freight/passenger Performance evaluation Private/public partnerships	Corridors and hubs Freight/passenger Public/private roles Public/public coordination Performance evaluation

Source: LSU National Ports and Waterways Institute

Ohio Department of Transportation. ODOT is responsible for the management of the state highway program, the public transit program, and the aviation program. State assistance and other matters pertaining to the rail program are coordinated through the Ohio Rail Development Commission. Ohio has no separate program for ports. However, for rail and highway access roads, ports can request funding from the ODOT.

Highway Program - Fund Allocation and Project Selection. The Ohio Motor Fuel Tax generates 22 cents per gallon of gasoline sold. This is the major source of funding for ODOT operations and capital investment. The ODOT policy is to follow two distinct procedures in funding highway maintenance projects and new capital investment projects. Funding for maintenance is guided by a policy of "preservation first", and is given a higher priority. Preservation and management of existing networks by providing funds for maintenance and then new construction is the stated policy. Therefore, after the departmental estimates for maintenance are met, the Director of Transportation will advise

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TRAC Project Evaluation and Selection Criteria. The TRAC's project selection criteria are guided by the policy goals of the state's long-range, multi-modal transportation plan. In order to accomplish these objectives capital investment projects are evaluated in five major areas. Points allocated for each of the criteria are weighted to reflect the significance of that factor (table 6).

1. *Network Efficiency* – The objective is to increase mobility and accessibility, increase capacity, and reduce congestion. The effects on network efficiency are measured using average daily traffic (ADT) and volume to capacity ratios (V/C). Points are allotted from 1-10. The roadway classification and macro corridor completion measures indicate the emphasis ODOT places on completion of the major highway network of the state
2. *Safety* – Safety is measured by accident rates and 0-15 points are allotted according to rates of incidents.
3. *Economic Development* - Job creation and retention, regional economic distress as indicated by chronic unemployment, cost effectiveness measured in terms of cost per job and flow of private capital are the variables used in this area. In evaluating economic development parameters ODOT is assisted by Ohio Department of Development.
4. *Leverage of State Funds* – Local participation in project funding by other public, private and local authorities is also taken into account. Allocation of 1-10 points is based on the percentage of project cost borne by these parties. Another 5 points are allocated based on size of the contribution, for example, $1-$3 million gets one point while more than $15 million gets five points.
5. *Intermodal Connectivity* - ODOT's Office of Planning will recommend up to five points for large-scale passenger transit projects or for a highway project that is intended to connect to another mode's intermodal center.

Rail Program. The Ohio Rail Development Commission (ORDC), sponsored by public and private authorities, provides direct loans and grants and may issue bonds for qualified rail projects in the state. The commission is composed of ten appointed the Governor and the public about the amount of money available for new construction. The selection of major new capacity projects for funding is the responsibility of the Transportation Review Advisory Council (TRAC), an advisory committee nominated by the Governor and the legislative leadership. The nine-member TRAC functions under the chairmanship of the Director of the ODOT, and has developed procedures for project election based on statewide transportation goals.

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ORDC Project Evaluation and Selection Criteria. As funding from the ORDC is in the form of loans and bonds, there is no need to rank projects. However, an evaluation procedure is in place to determine the public nature of benefits, a needs analysis, and the economic viability of the project. Although many intermodal aspects such as relief of highway congestion, wear and tear, improved safety, and access to intermodal terminals are taken into consideration, no quantitative evaluation procedure has been adopted. ORDC does not fund by project rankings.

Model Projects. An inland freight distribution hub organized under public/private partnerships and operating under performance-based intermodal transportation planning is described in figure 2.

Table 6
Ohio- TRAC new transportation project selection criteria

Goal	**Variable**	**Criterion**	**Quantitative measure**
Network efficiency	Average daily traffic	Volume of traffic on a daily average	1-10 points
	Volume to capacity ratio	A measure of congestion	1-20 points
	Roadway classification	A measure of highway's importance	1-5 points
	Macro corridor completion	Project contribution to macro corridor network	1-10 points
Safety	Accident rate	Accidents per 1 million miles of travel	0-15 points
Transportation points account for at least 70% of a project's base score			
Economic development	Job creation	The level of non-retail jobs created	1-10 points
	Job retention	Project capacity to retain existing jobs	1-10 points
	Economic distress	Based upon county unemployment rate	5 points
	Cost effectiveness of investment	A ratio of jobs created and investment attracted.	1-5 points
	Level of investment	The level of private capital inflow	1-5 points
Economic development points account for up to 30 percent of a project's base score			
Additional points			
Leverage of funds	Public/private/local participation	Does this project leverage additional funds	0-15 points
Intermodal connectivity	Project link to transit and freight intermodal centers	Does the project have some unique multi-modal impact?	0-5 points
Total possible points include transportation, economic development, and additional points.			

Source: TRAC Policies for Selecting Major New Capacity Projects, Ohio Dept. of Transportation

Lead agency

Greater Columbus Inland Port Commission, Ohio Department of Transportation

Description

The Ohio Inland Port is an exemplary public-private partnership where the Ohio Department of Transportation, the Columbus area Chamber of Commerce, and the shipper-carrier community jointly planned an inland distribution hub. It is a modal distribution center with state-of-the-art information systems to facilitate trade and logistics. Inland port directors are available from the contacts noted above.

The inland port is only one asset of Ohio's approach to intermodal management and planning. The Ohio Department of Transportation developed the "Access Ohio" approach to intermodal planning in the belief that state and local governments can reduce congestion through infrastructure improvements and better management of the highway/rail system.

To obtain the funding needed to do the job, decision makers need to have information on how well the existing system is performing, and they need to know the likely benefits to freight movements of an accomplished project.

The Ohio Department of Transportation is pursuing intermodal management approaches to improve Ohio's share of the global market. Access Ohio precepts are as follows:

1. Listen to the customers-ask the users what is important to them in freight/passenger movement.
2. Organize-involve private industry and public groups.
3. Adopt goals and objectives.
4. Establish standards of performance.
5. Decide what can be managed.
6. Collect only data that help make decisions.
7. Report what was found, the gaps and needs.
8. Develop a strategic plan-output of actions and processes.

Further information is available from the Ohio Department of Transportation.

Source: Greater Columbus Inland Port Commission, Ohio Dept. of Transportation

Figure 2

Ohio inland port and access Ohio program

California. The statewide transportation planning system in California is highly decentralized, with its Metropolitan Planning Organizations (MPO) and Regional Transportation Agencies (RTA) making decisions on project selection and investment for new and expansion projects. In terms of transportation funds, 75 percent of the funds are allocated to the local agencies based on population and number of center miles in their jurisdiction. The remaining 25 percent is appropriated to the California Department of Transportation (Caltrans). The allocation of funds within local jurisdictions either to state highways, local roads or port access roads, etc. is left to the discretion of local authorities.

The California Transportation Commission (CTC). CTC is responsible for programming and allocating funds for the construction of highway, passenger rail, and transit improvements throughout the state. This is an independent body consisting of 11 members selected by the Governor. The Commission plays a key role in shaping transportation policies in the state by performing the following functions:

- Adopting the State Transportation Improvement Program (STIP), including an estimate of State and Federal funds available for transportation projects and a set of projects prioritized in keeping with regional and statewide interests;
- Adopting capital improvement programs for highway, rail, aeronautics, and enhancement projects;
- Offering policy guidance to the Legislature and the Administration;
- Developing statewide guidelines for local and private sector financial participation in State transportation programs; and
- Submitting to the Legislature an evaluation report on the proposed budget of the California Department of Transportation.

California Department of Transportation (Caltrans). California Department of Transportation is the leading transportation agency primarily responsible for statewide policy. While CTC is responsible for estimating and distributing transportation funds between Caltrans and local bodies, the responsibility of Caltrans is to provide guidelines to assist local bodies in project selection and priority setting, safety, operational improvements and productivity, and rehabilitation, etc. In addition, Caltrans is responsible for the maintenance of the Interregional Road System (IRRS), which includes 87 routes, part of the 249-route statewide highway network in the state.

Caltrans Policy Setting. Caltrans has developed priority setting processes for various state programs based on safety, rehabilitation, and operational improvements. This includes a wide range of subjects such as bridge restoration, roadway reconstruction, safety roadside rest area restoration, community noise attenuation, HOV operational improvements, etc.

The project selection and setting priorities for highway restoration and pavement reconstruction by Caltrans are based on highway classification and use conditions to prioritize projects (table 7). This means a heavily used class 1 highway with major structural problems and a bad ride will get preference over the others.

Table 7
Caltrans system of highway project priority setting

Ride score	**Problem type**	**Priority category**		
		Highway class		
		1	2	3
Ride score >= 45	Major structural problem and bad ride	1	2	11
	Minor structural problem and bad ride	3	4	12
	Bad ride only	5	6	
Ride score <45	Major structural problem and bad ride	7	8	13
	Minor structural problem and bad ride	9	10	14

Source: 1998 California Transportation Plan – Statewide Goods Movement Strategy, California Dept. of Transportation, Sacramento, CA, August, 1998

Intermodal Planning Characteristics. One major contribution to intermodal transportation planning in California is the California Intermodal Transportation Management Systems (ITMS) developed under Caltrans initiative. This system has provided a computer-based database for planning and analysis of intermodal transportation systems on a consistent and analytically supportive basis. It is structured to allow the planner to quickly assess the broad alternatives involved in making intermodal transportation decisions. Major capabilities of ITMS and the databases included are summarized in table 8.

The Interregional Transportation Strategic Plan (IRRS) plan prepared in 1998 by Caltrans is the statewide counterpart for 43 regional transportation plans developed by regional transportation planning agencies. The plan lays out a recommended course of action for the state highway system for a twenty-year planning period from 2000-2020. The Vision statements developed for various modes covered in the plan and the strategies recognize the need to plan transportation under an intermodal-planning framework. Specifically, the plan concentrates on four outcomes: accessibility, mobility, reliability, and cost effectiveness. The definition of these outcomes is compatible with the concept of performance-based planning and the systems approach required for intermodal planning. However, in practice, methodologies have not developed for intermodal projects because of statutory limitations on the types of projects for which funds can be used. In addition there are some unresolved policy issues on the role of private and public sector participation in intermodal planning and investment. This is mainly in the area of freight rail (private-owned), which will be discussed under freight transportation.

The statewide freight transportation policy framework is outlined by Caltrans in its 1998 planning document under statewide goods movement strategy. The strategy of the department is to improve existing system efficiency through new technology and other means, to maximize capacity and reliability, and to minimize long-term transportation costs. The vision of the department is to develop a statewide goods movement transportation system, which is multimodal, balanced, and integrated.

Caltrans Role in Freight Transportation Planning. The Deputy Director of Planning sets Caltrans policy framework for the goods movement-planning program and coordinates intermodal aspects of the planning process. The Transportation Planning Program (TPP) at Caltrans headquarters is responsible for system planning, such as current and projected goods movement, system deficiencies and advocates capital investments when necessary. The rail program at Caltrans mainly focuses on intercity rail passenger service.

The California State constitution limits the types of transportation projects that can be funded with the state motor vehicle fuel tax revenues to highways, roadways' and to public transit. These limitations essentially prohibit funding for private freight projects, improvement for freight railroad tracks, or harbor dredging. In addition, Caltrans is still in the process of evaluating the role of public and private sectors with respect to freight transportation planning. A summary of policy concerns as given in the 1998 California Transportation Plan – Statewide Goods Movement Strategy is listed below:

- Resolve state's overall role and responsibility for a multimodal transportation system and balancing private and public interests,
- Should priority be given to people movement or freight?

- How extensively should the state be involved in the planning and development of freight transportation? Should Caltrans, for example, simply focus on the state highway system as a part of its owner-operator responsibilities?
- What role should the state play in assuring that freight rail services continue to be available for California businesses?

The final conclusions of the report recommend that economic analysis of long-term costs and benefits of proposed transportation projects should determine project priorities and suggest more interaction between the public and private sectors to resolve the role and responsibility issues.

A description of the Alameda Corridor Project planned and implemented under the sponsorship of public and private partnerships is included in figure 3. The project is considered to be truly intermodal, connecting seaports, rail and truck terminals and improving environmental conditions and safety. In addition, its effect is complementary to passenger travel with congestion reduction and less delays.

The ports of Los Angeles and Long Beach, also known as the San Pedro Bay ports, handled nearly 100 million metric tons of cargo in 1991. Rapid growth in Pacific Rim trade will increase tonnage through the ports to nearly 200 million tons by 2020.

The challenge facing these ports and nearby communities is how to manage ever-increasing truck and train traffic to and from the ports. By 2020 the ports will generate nearly 50,000 truck trips and 100 train trips per day. Major improvements to the highway and the railroad system serving the ports will be required to accommodate this demand and to mitigate the impacts of traffic on communities north of the ports.

The major issue facing the ports and nearby communities is managing port growth in times of increasing urbanization, heightened environmental awareness, and limited financial resources. Problems of traffic congestion, noise, and air pollution must be addressed, but equally important is providing opportunities for economic growth. The Alameda Corridor project is a "win-win" solution for the economy and the environment.

Success will primarily depend on obtaining necessary financing, particularly $700 million in federal funds.

Lead Agency: Alameda Corridor Transportation Authority (ACTA)

Description: The Alameda Corridor Project will dramatically improve railroad and highway service to the ports of Los Angeles and Long Beach-the largest port complex in the United States. The project is designed to facilitate port access while mitigating potentially adverse impacts of port growth, such as traffic congestion, delays at rail and highway grade crossings, train noise in residential areas, and air pollution.

The corridor is approximately 20 miles long and runs between downtown Los Angeles and the ports. The project has a highway and a railroad component. The railroad component involves consolidating the port-related traffic of three former independent railroads: the Atchison, Topeka and Santa Fe Railway; the Union Pacific Railroad Company; and the Southern Pacific Transportation Company-onto a fully grade-separated right-of-way. Currently the railroads use four separate tracks that cross nearly 200 busy streets between downtown Los Angeles and the ports. This project would eliminate highway-railroad traffic conflicts.

North of State Route 91, the railroad corridor will be lowered into a trench about 33ft deep and 47ft wide. East –west streets will bridge this trench. South of Route 91 the tracks will be at grade, while east-west streets are raised above the tracks and Alameda Street. The project will be designed to accommodate future electrification of the rail line.

The highway component involves widening Alameda Street between Route 91 and Interstate 10.

Source: Alameda Corridor Project 'A National Priority', Alameda Corridor Transportation Authority

Figure 3
Alameda Corridor Project

Critical measures used in the environmental impact analyses include: (a) reduction in highway traffic delays (b) improved safety (c) improvements in train speed and other aspects of rail operation (d) reduction in air and noise pollution (e) economic growth, particularly in terms of the number of jobs to be created (f) construction impacts, and (g) project costs.

The Alameda Corridor will facilitate economic development through port growth, construction employment, and improved business and development opportunities along the corridor. The corridor traverses areas affected by the civil unrest of April 1992. These areas are in great need of economic rehabilitation.

By 2020, the growth of the ports and the Alameda corridor will generate an additional $31.9 billion in federal taxes per year, including $5.2 billion per year in additional customs receipts. Growth of the harbors will generate an additional 700,000 regional jobs and 2.2 million nationwide jobs. Construction of the actual project will employ 10,000 workers in the central Los Angeles area between 1995 and 2000. Economic development along the corridor will be enhanced because of improved traffic conditions, including reduced delays for customers, employees, and residents of the area.

The Alameda Corridor project involves all levels of government - local, regional, state, and federal - as well as the ports and the transportation industry. The private sector will contribute a significant amount of funding in the form of revenue bonds. Debt service for these bonds will be paid through fees (based on cargo volume and rail traffic) collected from the railroad and steamship companies.

Safety will be greatly improved by adding sophisticated train control systems and by eliminating traffic conflicts at nearly 200 grade crossings.

The Alameda Corridor project represents an innovative approach to problem solving. Consolidating the operations of multiple Class I railroads into one 20-mile corridor will significantly reduce traffic and air pollution as well as delay traffic noise.

Florida. The Florida Department of Transportation (FDOT) has defined intermodal transportation planning goals and objectives in the Florida Intermodal Development Plan, 1990. FDOT defines intermodal planning as "a process of addressing the linkages, interactions, and movements between modes of transportation." Intermodal planning focuses on providing a network of transportation facilities including airports, ports, bus terminals, transfer centers, railroad systems, and highways for the transfer of people and goods between modes. The ideal intermodal network contains all the facilities and technologies necessary to allow for the seamless transfer of people and goods to and from one mode of transportation to another. A schematic presentation of the FDOT statewide planning process is illustrated in figure 4.

However, these policies are implemented under modal-specific programs organized as Highway, Aviation, Rail, and Seaports programs. As a policy, FDOT has designated a network of links and nodes as Florida's Intermodal System of Statewide Significance and has assigned a higher priority to projects in this system. Another initiative undertaken by FDOT to encourage multimodal systems is its policy of setting limits to the maximum number of lanes on the state highway system that will be funded by department. The maximum lane policy limits the level of travel demand that can be satisfied by general use highway lanes encouraging alternate forms of transportation including High Occupancy Vehicle (HOV), transit, and rail for passenger and freight transportation satisfying additional demand.

Intermodal Transportation Planning. With a fast growing economy and associated demand for passenger and freight transport, FDOT has taken a systems approach to plan the statewide transportation network. In addition to the designation of the main intermodal network described above, other major programs such as the Florida Seaport Transportation and Economic Development Program, the Port Landside Access Program and the Florida Freight Stakeholders Task Force have been initiated. The emphasis in these programs extends beyond the direct consequences of transportation such as mobility and connectivity to a broader framework. These programs encompass public participation in decision-making and economic productivity. These basic policy changes are reflected in their programs of stakeholder participation, private/public partnerships and financing, emphasis on planning at the local level, and measurement of outcomes in terms of quality of life, etc.

The Designated Intermodal System of Statewide Significance. A description of the designated intermodal system is shown in detail because it is relevant to our study (figure 5). It provides a description of project priority order (the section on assumptions), elements of the system in terms of nodes and links, and definitions of criteria descriptors.

Florida Seaport Transportation and Economic Development Program (FSTED). Florida has developed two five-year construction plans to develop its intermodal connections to Florida seaports. Florida Seaport Transportation and Economic Development Program (FSTED) is projected to invest a total of about half a billion dollars during the 1998-2002 period. This includes $222 million of bond-financed state funds, including a 50-50 match by participating ports. In addition to fulfilling the land access needs of seaports, another state sponsored assistance program will be implemented in 2001. The Land-Side Access Study, sponsored by the FDOT and Florida Seaport Transportation and Economic Development Council, is of particular interest because it identified intermodal constraints to seaports, not

38 projects in this group have an unfunded cost of $ 222.3 million within the five-year period.

Table 9

Details of prioritization criteria (five-point scale)

	Criteria					
Rank	**Fulfillment**	**Readiness**	**System connection**	**Cost**	**Partner**	**Transportation impact**
5	Existing user or need	Ready	Direct FIHS/NHS/ Rail/ channel connection	Very low (under $1 million)	Funded or shortfall	Corridor or region
4	Planned imminent development	Design under way	On-port connection	Low ($4-9 million)	Non-FDOT partner	Local area
3	Prospective user or need	Under study	Yard/ gate/ queuing	Moderate ($10-$19 million)	FDOT pipeline	Port
2	Long-term plan	Concept	Equipment	High ($20-$29 million)	Prospect	
1	Germinating idea	Idea only	Other	Very high ($30 million and over)	None	

Source: Strategic Investment Plan to Implement Access Needs of Florida's Seaports, Florida DOT, 1998

- **Priority 3.** Projects the ports have included in the five-year intermodal program knowing their implementation is market-driven, and requires additional commitments before being taken to the next step - The 16 projects in this group have an unfunded cost of $71.7 million within the five-year period.

- **Priority 4.** Projects that are beyond the five-year planning period - The 18 projects in this group have an identified unfunded cost of $405.8 million, although as stated previously, this amount does not include the cost of all the projects. When combined with the $65.5 million carry-over for phased projects commencing within the five-year period, the identified total unfunded need beyond the five-year period is $471.3 million.

1999 Florida Freight Stakeholder Task Force (FFSTF). A task force of private and public transportation officials was organized in 1998 to examine two major aspects of Florida's freight transportation system. The two major assignments for the Task Force were:

1. Assess the current state of the freight transportation system and recommend projects for "fast track" funding.
2. Develop recommendations for the Year 2000 Florida Statewide Intermodal Systems Plan. The final recommendations made are shown in table 10.

FFSTF, in their final report, made seven recommendations on future directions for the long-term planning aspects of freight transportation (table 10). All recommendations are basically in line with the emerging concepts of intermodal transportation planning.

Table 10

FFSTF recommendations for statewide transportation planning

Recom. num.	Description
1.	Establish the Florida Strategic Freight network as a part of the Intermodal Systems Plan
2.	Adopt the Freight Task Force process for prioritization and selection of future freight projects
3.	Fund future research and planning studies
4.	Conduct a Florida International Trade and Port Strategy Study
5.	Establish a Florida Freight Advisory Council within FDOT
6.	Establish Freight Mobility Committees in the largest Metropolitan Planning Organizations
7.	Create a Florida Freight Project Investment Bank (FFPIB)

Source: Strategic Investment Plan to Implement Access Needs of Florida's Seaports, Florida DOT, 1998

Model Project. Miami Intermodal Center is a typical intermodal project implemented with the cooperation of public/private partnerships. The nature of the project, cost components, and the methods of financing of this project are noteworthy as innovative measures in statewide transportation planning (figure 6).

The early 1980's witnessed a dramatic increase in congestion at Miami International Airport (MIA). FDOT decided to pursue upgrading the airport facilities to a multimodal transportation system through the Miami Intermodal Center project. The project is estimated to take 20 years to complete. The first phase of the MIC project is scheduled for completion in 2000.

The long-term goal of MIC is to provide its users with a safe, efficient, economical, attractive, and totally integrated multimodal transportation system to ensure the mobility of people and goods in Metro-Dade County.

- Develops an integrated multimodal transportation system emphasizing the seamless movement of people by facilitating linkages between modes and establishing an efficient transportation network within and outside the Miami metropolitan area;
- Remains consistent with adopted federal, state, and local transportation plans and policies;
- Provides an efficient mass transit system for Dade County that offers alternative means of transportation to the automobile; and
- Ensures transportation improvements that preserve and enhance the quality of the environment.

MIC will represent a regional hub for Amtrak, featuring Tri-Rail, Metro rail, a future high-speed rail service between Miami, Orlando, and Tampa, and a proposed east-west rail line. In addition, this hub will provide a seamless network while also meeting the concerns of bicyclists and pedestrians. MIC is expected to complement and enhance MIA and will function as the landside terminal of the airport. The complex of MIC and MIA provides a robust synergy, creating opportunities for future private-sector development within and adjacent to the two facilities.

MIC receives financing from a variety of different sources. For FY 1997/98 through FY 2001/02, the Florida five-year TIP allocated $110 million to finance MIC and the East-West Multimodal Corridor project. The overall financing is spread over a 30-year period. During the initial stages of the project, planning authorities emphasized the need for sufficient land acquisition to ensure that land was available for additional construction in the future. To this end, TIP sets aside $86 million. In addition, the MIC capital plan identified and set aside initial funds for site preparation and further construction of infrastructure facilities. Individual mode tenants participating in site preparation and carrying out elements of the initial construction were reimbursed for their expenses related to the project. Table 11 details the funds used to finance MIC (including the reimbursements to mode tenants).

Source: USDOT, FHWA, and FDOT, Miami Intermodal Center:Final Environmental Impact Statement (Miami, FL., December 1997.)

Figure 6

Miami Intermodal Center (MIC)

Table 11
Source of MIC funds (in millions of dollars)

Source of funds	Funding allocation
FY 1997/98-2001-02 transportation improvement program	166.0
Dade County long-range transportation plan through 2015	220.0
Dade County long-range transportation plan through 2027	450.0
FTA (Section 5309-Bus)	25.0
Toll revenues	175.0
Commercial vehicle access fee	75.0
Joint development	70.0
Subtotal	**1181.0**
Tenant mode reimbursements	966.8
Total sources of funds	**2147.8**
Total uses of funds	**2146.9**

Source: USDOT, FHWA, and FDOT, *Miami Intermodal Center:Final Environmental Impact Statement* (Miami, FL., December 1997, p.6-6.)

Based on the report, the Florida Legislature has appropriated $10 million annually starting from 2001, to rectify these bottlenecks. This appropriation can also be bonded to meet the remaining needs of intermodal network connections to seaports. The total capital improvements identified under the Florida Strategic Seaport Intermodal Access Program for the period 1998-2002 are estimated at $1.2 billion. The type of intermodal projects identified in the Land Access Study and the relative cost shares are as follows:

The recommendations made for the Year 2020 Florida Statewide Intermodal Systems Plan are briefly described in table 10 as it illustrates the emerging priorities of transportation planning.

Development of a Methodology for Intermodal Project Evaluation

The literature review indicates that successful intermodal planning is based on identifying improvements to the linkages, interactions, and movements among all modes of transportation. The principal difficulty encountered is the absence of an intermodal project framework that can be used to identify and prioritize alternative intermodal combinations.

The literature review suggests that broadening the scope of transportation planning to intermodalism under the auspices of federal legislation and programs introduced earlier in the decade have not achieved a notable degree of success across modal programs and participants. For example, at the Federal level the requirement for statewide intermodal management systems was abandoned after states such as Florida found the concept to be too elusive to be implementable *[5, page 9]*.

The literature review of state of the art transportation planning from an intermodal perspective suggests that the concept is far from being perfected or uniform. The principal barriers affecting intermodal transportation planning and project evaluation have been summarized as follows:

(1) Imperfect information: Information on the use of intermodal transportation is often limited and sometimes proprietary.
(2) Unknown origins and destinations: Trip characteristics such as origin and destination are usually compiled by mode and are not customarily linked among modes.
(3) Lack of proper coordination: Planning and project evaluation are complex because of different participants.
(4) Modal structures: Transportation funding and programs are typically based on modal distinctions with limited opportunities and institutional frameworks for interaction.
(5) Conflicting interests: Intermodal projects typically mix public and private ownership, resulting in different priorities and objectives *[5, page 11]*.

It is not surprising that successful efforts to develop comprehensive intermodal planning and evaluation methodologies have not been widely publicized. The State of Florida, reputed to be a pioneer in intermodal planning and evaluation, organized the Florida Freight Stakeholders Task Force in 1998 to develop recommendations for the 2020 Statewide

Intermodal Systems Plan. Among the seven recommendations submitted by the Task Force was recommendation three: Fund future research and planning studies.

The Task Force recommends that FDOT enter into a contract with (CUTR), the Center of Urban Transportation Research, to conduct additional research studies related to freight transportation and goods movement in Florida. Among the study objectives would be a more accurate quantification of the benefits and costs of projects that improve freight mobility. Additional studies should research the economic impacts of improved freight transportation in terms of jobs creation, personal income, industrial productivity, and economic multiplier effects *[6, page 10]*.

Notwithstanding the absence of consistent quantitative intermodal project evaluation criteria among the different states, the concept of an intermodal project evaluation methodology is something that individual states have addressed in different forums and means. States such as Florida and Washington have developed extensive intermodal project evaluation methodologies because intermodal freight transportation is important to their economic growth and citizens *[6, page 10]*. Because of geography both states are heavily committed to marine transportation and international trade. Rapid growth in maritime commerce and urban development in both states has strained transport infrastructure adjacent to ports. This has placed emphases on intermodal access to marine terminals.

Florida is heavily committed to international trade, tourism, and the cruise industry. It has fourteen deepwater seaports primarily adjacent to rapidly growing urbanized areas that have substantial highway congestion and rail access constraints. Washington State is a major Pacific Rim gateway of far eastern trade. Large deep-water marine terminals in Seattle and Tacoma have encountered substantial rail access problems with attendant community impacts. Rail access is critical to the growth of these ports since about one-half of the containerized marine cargoes shipped through the state's ports move by rail to the US midwest in competition with southern California ports.

The efforts of individual states such as Florida and Washington to address particular freight intermodal access problems indicate the importance of improvements to critical linkages between different transportation modes. These linkages nurture and sustain economic growth tied to trade and maritime commerce. Both states became activists in intermodal freight planning and each recognized that failure to integrate the different pieces of the intermodal process would frustrate development of their resources and existing competitive advantages.

Louisiana, similar to Florida and Washington, is heavily dependent on international trade and intermodal marine terminals. Intermodal freight transportation is important to the state. Successful intermodal freight planning that addresses the efficiency of the intermodal freight sector in the state will minimize private costs to businesses and social costs to the public.

Intermodal transportation typically crosses both modal boundaries and private public sector boundaries. The private sector is well equipped to promote intermodal development to minimize private costs. However, the public sector costs will not be included unless there are major policy changes that further internalize social costs to private businesses. To a certain degree this has been done through public policies addressing highway safety, air emissions standards, etc. However, much of the transport planning for the highway and marine sectors remains in the public domain with substantial social cost implications for the future development and use of the infrastructure.

Rather than develop new programs or policies, the objective of this research is to define an intermodal freight project methodology that will allow the State to evaluate multi-modal transportation projects. An example of this may be a marine terminal access project that will reduce private and social costs for both users and non-users. The intermodal project evaluation methodology should recognize the State's interests in promoting transportation efficiencies. These efficiencies should minimize private and social costs, including capital investment for infrastructure, as part of an orientation to economic growth. Accordingly, the evaluation will incorporate all relevant private and social costs that relate to users and non-users from the State's perspective as the owner or equity provider of significant transport infrastructure.

Intermodal Project Evaluation Criteria Used by Florida and Washington State

The Florida Freight Stakeholders Task Force followed a four step process in assessing the current state of the freight transportation system and in recommending freight transportation projects for "fast-track" funding: (1) define and assess existing freight intermodal facilities; (2) define the Florida strategic freight network; (3) prioritize improvement projects, and; (4) evaluate projects for "Fast-Track" funding. A major objective of the Task Force was to create a methodology to evaluate and prioritize freight improvement projects for potential funding. With the assistance of CUTR the Task Force considered a number of existing transportation project priority systems, including: (1) methods used by Florida's Metropolitan Planning Organizations; (2) methods used in a

Table 12
Project prioritization criteria

Criterion	Weight	1	2	3	4	5
Benefit/cost ratio	2	1.0+	2.0+	3.0+	4.0+	5.0+
Stage of development/ environmental compliance	1	Planning	PD&E programmed	PD&E in progress	PD&E completed	Design completed
Time to complete project	1	< 5 yrs	< 4 yrs	< 3 yrs	< 2 yrs	< 1 yr
Current LOS or actual AADT/capacity at FDOT LOS standard*	1	B < 80%	C 80%+	D 100%+	E 120%+	F 140%+
Actual/critical safety rating	1	< 0.60	0.60+	0.80+	1.00+	1.10+
Neighborhood impacts of project	1	Project impacts residential land uses		Projectimp acts commercial land uses		Project impacts industrial land uses
Daily freight volume in truck trailer equiv. units	1	< 2000	2000+	000+	4000+	5000+
Total raw score		Sum of weighted criteria scores				
Total normalized score		Raw score divided by the sum of weights for applicable criteria				

- *Or equivalent standard for modes other than highway*

Source: Florida Freight Stakeholders Task Force, *1999 Florida Freight Stakeholders Task Force Report* (Tallahassee, Florida; November 23, 1999), p. 11.

Time to complete the project is an extension of the stage of development because it accounts for the actual time to complete construction and open the project.

Capacity is rated as level of service (LOS) and ratio of actual volume to maximum service volume allowable under level of service standards for the Florida Intrastate Highway System (FIHS) and other roadways used. The LOS is applicable to roads outside the FIHS because no statewide minimum standards have been established for these facilities.

The safety factor is measured as the ratio of the actual accident rate and the critical accident rate. The critical accident rate is the 95th percentile accident rate that would be theoretically possible on an "ordinary" piece of roadway, given traffic levels, roadway geometry, speed limits, and other factors.

Neighborhood impacts of a project reflect preferences for projects that increase freight movement through predominantly industrial areas and discourage increased freight movement through residential neighborhoods.

Table 14
Freight mobility project prioritization committee threshold eligibility criteria

Criterion #1
Eligible projects must be located on strategic freight corridors. Strategic freight corridors are corridors that: (1) serve international and domestic interstate and intrastate trade; (2) enhance the state's competitive position through regional and global gateways; and (3) carry freight tonnages of 4 million gross tons annually for state highways, city streets, and county roads; 5 million gross tons annually for railroads; and 2.5 million net tons for waterways.
Guidance: New alignments to, re-alignments of, and new links for strategic corridors that enhance freight movement may meet the threshold eligibility criteria, even though no tonnage data exists for yet-to-be built facilities.

Criterion #2:
Eligible projects must satisfy one of the following conditions;
(1) Primarily aimed at reducing identified barriers to freight movement with only incidental benefits to general or personal mobility; or
(2) Primarily aimed at increasing capacity for the movement of freight with only incidental benefits to general mobility or personal mobility; or
(3) Primarily aimed at mitigating the impact on communities of increasing freight movement, including roadway/railway conflicts.
Guidance: Projects meeting the reducing barriers or increasing capacity Requirements include: truck climbing lanes; re-alignment and re-routing projects to avoid excessive trucking climbing grades or general congestion; alternate truck routes; dedicated truck lanes; access into and/or out of ports, intermodal freight facilities and freight terminals; truck turning lanes; changes in roadway or intersection geometry or better accommodate trucks; and increasing weight limits on bridges; projects for HOV lanes and general purpose lanes do NOT meet the reducing barriers or increasing capacity requirements.

Criterion #3
Eligible projects must have a total public benefit/total public cost ratio equal to or greater than one based on WSDOT's benefit/cost approach. Total public benefits are benefits attributed to the public that result from a transportation improvement. Public benefits are calculated for the users of the transportation facility, and include time savings benefits (reduced delay) for both people and freight as well as accident reduction benefits. Total public costs are the sum of the costs incurred by all public entities for the construction of the project. Public entities include cities, counties, ports, the state, and the federal government.

Source: [*5, page 219]*

and tradeoffs in particular settings (projects). This is the *first* step in the evaluation process. For example, a rail barge intermodal service that substitutes for a rail service should be reviewed from an operational perspective to define the intermodal interface. The operational focus would define the nature and location of the rail and barge physical connections, scheduling, reliability, responsibility for transfer facility operations, and performance, etc.

The physical interrelationships between modes will be defined by differences in ownership and operation of assets along with the capacity and cost of the services provided. In the rail-barge example the "port" operator would be the fulcrum that distinguished the connectivity of the two modes with regard to cost and service.

Furthermore, the project scope for defining intermodal alternatives must allow for differences between users and non-users in order to identify external (public) third party costs or benefits. The typical transportation freight planning perspective that focuses only on private costs borne by users must be enlarged to include costs to the public for projects with and without intermodal components. Typically, intermodal projects will affect various public and private benefit categories that are only tangential to one mode but are defined by intermodal alternatives and combinations. For the rail barge example, the non-users might have less freight train noise or risk of delay and accidents at grade crossings.

The nucleus of intermodal project planning and evaluation is the project scope which defines the concept that the sum of the benefits to *individual* modes is less than the whole benefits of the project viewed from a least total cost systems (intermodal) perspective. For example, the barge function would not normally include benefits related to railroad crossing delays any more than the private rail operator would include these public costs in its evaluation.

The project scope, which reflects assessments of benefits among and between different substitutions and complements of modes of transport, must be sufficiently broad to capture the universe of possible tradeoffs. Again, the project scope reflects the nature of intermodal substitutes and complements, resulting in unique tradeoffs between benefits and costs, which would otherwise be overlooked or excluded from traditional modal based project planning and evaluation. For the rail barge example, the need to avoid capital investment in rail lines that could be downgraded or otherwise abandoned or a reduction in highway maintenance due to a shift to barge would constitute a substantial cost saving, particularly if there were publicly subsidized branch lines or highways that require major

Unfortunately, obtaining reliable current transportation rates from private sources is very difficult. Rates are usually regarded to be proprietary or are loosely quoted to protect privacy with regard to level. For example, a rate may be given as "about $3.00 per ton." Sometimes it is easier to obtain historical rates paid for transportation in previous years because shippers do not perceive this to be a relevant intrusion of privacy into their current affairs. Therefore, there are no potential competitive threats to existing and future business. However, the historical "rates" quoted may be based on memory rather than documentation and still have to be updated to reflect changes in cost and demand that may have occurred.

Moreover, rate quotations by themselves are often silent with regard to the particular attenuating circumstances that can more precisely define the rate and underlying scope of services as well as determine their applicability. For example rail and barge contract rates will change because of minimum and volume discounts; escalation clauses; performance penalties or incentives; as well as special circumstances altering shipper or carrier inputs. Such circumstances might include shipper owned equipment or carriers performing other equipment handling unique to the shipper, absorbing certain extra expenses otherwise paid by the shipper. For these reasons, transportation rates typically must be regarded with caution as an accurate representation of private resource costs. In the rail-barge example, most high volume bulk commodity movements by rail are done under proprietary contracts. These contacts usually restrict the ability of the parties to disclose contract terms without mutual consent.

There are a number of commercial software packages available that will allow "costing" rail, truck, and barge movements. The degree of detail and accuracy will vary depending on the sophistication of users and the resources available. Typical costing packages, if properly used with correct inputs, can estimate resource costs to accuracy levels of plus or minus ten to twenty percent of the carrier's *private* variable costs. Fixed and overhead costs present a special problem. Usually, these must be allocated and cannot be assigned under a causal basis as reflective of most statistical transport costing models. In the rail barge intermodal example, the level of actual rail rates paid could be as much as double the average total variable costs, while the actual barge rate may be fifty percent higher than average total variable costs. The extent of the markup of average variable costs will be determined by competitive conditions and may change as a function of demand for particular commodities, transport equipment, routes, directions, etc.

Transportation mode private cost models usually do not encompass any "intermodal" transfer resource costs for cargo transfer or shipper related logistic costs that are mode specific. For the rail barge, example it would be necessary to use a rail cost model and a barge cost model. A separate set of cost calculations would be needed for the intermodal connections with regard to port infrastructure and operations. These costs would reflect the transfer of cargo from rail to barge near origin and barge to destination mode or conveyance near destination. Additional costs of potentially larger stockpiles of cargo associated with the rail barge intermodal movement would also be estimated based on transit time, frequency, and any service disruptions such as low or high water or fog.

Modal cost models do not address public costs such as externalities. This is one of the principal difficulties of intermodal project evaluation from a public or social cost perspective. The relevant public costs have to be estimated outside of the transportation private cost models. Thus for the rail barge example, the rail frequency of grade crossing accidents and delay to motorists and pedestrians by route would have to be estimated. Other relevant public costs aside from accidents and delays would also be included such as noise, air pollution, injuries to other vehicles, and pedestrians (primarily trespassers), etc.

Public costs present three dilemmas with respect to identifying and measuring the type and quantity of impacts and assessing the value of the impacts to society. For example, a shift of rail traffic to barge could result in a reduction of trains that would reduce grade crossing delays and accidents with motor vehicles. Establishing the identity of the affected crossings, estimating the reduction of delay, depending on time or day and other circumstances, and valuation of time saved are all unknown public cost parameters that must be measured through field observations or estimated based on secondary data.

Determine Intermodal Movement Cost. The *sixth* step is the development of the intermodal movement cost of current alternatives under "without project conditions." The intermodal movement cost is the result of existing transportation alternatives that are substitutes or complements to the existing situation under without project conditions. For the state or the public entity responsible for the intermodal movement by providing infrastructures, such as marine terminals or multi-mode access corridors, the current intermodal movement cost is equal to the total private and public costs associated with the transportation substitution or complement under without project conditions. For example, if the intermodal alternative movement is a rail-barge transfer in lieu of a truck movement, the state's perspective is the total of private and public resources required by the two alternatives without any project or investment.

Clearly the intermodal movement costs are considerably more complicated because of multiple modes and transfer costs, each with its own set of attendant external (public) costs, service, and institutional considerations. Moreover, current intermodal costs may not be relevant to the "with project conditions" if intermodal alternatives do not practically exist under without project conditions. For example, a rail barge intermodal movement could not be expected to occur without a marine transfer facility.

The current cost of intermodal alternatives serves to quantify the impediments to intermodalism which the "with project condition" may address in the next step. The current costs should reflect a baseline condition that is expected to prevail for the future in the absence of an intermodal project. For example, if the current intermodal transfer of cargo from rail to barge is indirect from stockpiles at the port and the rail operator has plans to expand the trackage to achieve lower switching costs, the reduction in costs should be included in the (adjusted) "without project baseline conditions." The fact that the "with project condition" might include a direct transfer facility at another location has no bearing on "without project costs." Often, establishing the relevant current and future "without project baseline conditions" is the most difficult part of the framework. All future "with project conditions" have relevance only with respect to a set of "without project baseline conditions." Therefore, the uncertainties and assumptions made for the current and future baseline conditions are potentially the most important factors affecting project evaluation.

Determine Future Commodity Movement Cost. The *seventh* step is the derivation of future movement costs based on "with intermodal project conditions." Future costs under "with intermodal project conditions" incorporate changes in transportation demand induced because of new intermodal services compared to existing "without intermodal project conditions" (refer to figure 7). Future movement costs, disregarding inflation and economies of scale, would be expected to be the same as current movement costs in the absence of efficiencies induced by intermodal projects.

Future movement costs define the extent that "with project conditions" result in efficiencies. For the intermodal project the efficiencies can reflect a variety of tradeoffs between private and public costs from the perspective of users and non-users. For example, the private costs of the intermodal project may be greater than the "without project conditions" but there may be a sufficient reduction in public costs such as accidents and highway congestion that the project justifies from a benefit cost perspective.

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Future movement costs under "with intermodal project conditions" serve as a framework to allow for tradeoffs between different intermodal alternatives. All costs, public and private, would be identified and quantified to the extent possible. Where market prices are not available or reliable some qualitative assessment or ranking may be required to introduce public (external) costs into the analytical framework or to add weights or other prioritization factors to the evaluation methodology.

An example of the "with project future costs" for the rail-barge illustration would be to identify how a new intermodal connection to an existing port would allow more efficient rail access to barge. Among the private cost savings could be improvements in train operations from reduced switching and access time, as well as improved rail car equipment utilization, reducing the size of the car fleet needed to support the service. The public costs could include reductions in crossing delays for motorists and pedestrians, accidents, as well as noise and emissions.

Determine Intermodal Use "With" and "Without" Project. The *eighth* step integrates the "without" and "with project conditions" by determining the current and future use of the intermodal project. Traditional transportation benefit cost analysis assumes a least a total cost criterion for intramodal competition based on the assumption that the same production processes result in perfect substitutes, other than cost. The presumption is that shippers will choose the rail or barge carrier with the lowest total cost compared to other rail or barge carriers, respectively.

The least total cost criterion is frequently applied to intermodal competition with less success because of dissimilar services and cost functions. For example, rail service is customarily measured by shipment sizes in the bulk sector, conforming to fifty 100-ton capacity car unit trains with a minimum of 5,000 tons of cargo, while barge service with standard Mississippi River hopper barges has 1,500 tons of cargo per barge. Rail unit train service speeds, on average, are about three times the speed of this barge. In some instances the intermodal service characteristics can be sufficiently different to materially affect costs. For example, the waterway might be subject to closure for several weeks due to cyclical occurrences of high or low water. In the case of the intermodal rail barge alternative, larger inventory stockpiles would be required to provide the same level of protection against stockouts that may result from rail service disruptions of only a few days, which might occur after a derailment.

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Project Evaluation Considerations Outside the Scope of Typical Benefit Cost Analysis

Nonquantifiable Variables. Impacts of intermodal transportation investments have been discussed in the preceding sections in terms of a quantitative approach to identifying public and private sector benefits and costs. The traditional process is to convert impact measures to monetary values to the feasible extent. This is accompanied by quantitative estimates of consumption of natural resources, which may not have accurate scarcity values (congestion, safety, energy, etc.) or environmental impacts such as noise, emissions, etc. Net monetary benefits and costs of alternatives are then used to evaluate the tradeoffs against non-monetizable benefits, assuming that proxy scarcity values for the non-monetizable benefits cannot be used.

This section deals with non-monetizable social and environmental impacts of intermodal transportation investments. The transport project evaluation literature reviewed suggests that a new paradigm is emerging for the evaluation of intermodal projects, particularly in the freight sector. This new evaluation is moving beyond exclusive reliance on a quantified cost benefit analysis that focuses primarily on changes in vehicle operating costs and other direct monetary impacts. Traditional cost benefit analysis is common to the highway sector, but is not without critics for its myopia to more dynamic occurrences *[8, pages 213-242]*. Moreover, its applications in the intermodal freight sector have been found to be insufficient to delineate projects perceived to have substantial intangible objectives as well as to command sufficient attention compared to other projects. A forthcoming example of port access will be used to suggest that intermodal freight mobility issues are often central to broad based community development goals, but outside of the scope of traditional transportation cost benefit analysis.

A category of particular localized intermodal projects that have special needs and circumstances relative to the measurement of social desirability from the perspective of "benefits and costs" appears to be evolving. Although localized, the intermodal issues are regional and national in scope. Examples of localized intermodal projects that have regional commonalties and potential impacts are: (1) sea ports with land side access, (2) inland ports/land access; (3) rail and highway interfaces; (4) airport cargo connections with highways and (5) freight corridors.

The intermodal freight sector under ISTEA has been contending with the issue of defining publicly visible projects that can command the attention of local Metropolitan Planning Organizations (MPO) for prioritization intermodal passenger projects. The common analogy "freight does not vote" has been used to characterize the fact that public

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The intermodal freight sector under ISTEA has been contending with the issue of defining publicly visible projects that can command the attention of local Metropolitan Planning Organizations (MPO) for prioritization intermodal passenger projects. The common analogy "freight does not vote" has been used to characterize the fact that public and political visibility of the intermodal freight sector has been weak compared to the passenger counterpart. It is our contention that traditional benefit cost analysis, even with rigorous applications, defines traditional benefits measured in resource savings that cannot overcome the lack of visibility of the freight sector to compete for public sector priorities.

The literature review suggested that the intermodal project evaluation process is searching for a new paradigm that will move beyond traditional benefit cost analysis and will incorporate different kinds of benefits customarily excluded from the transport sector's focus on direct changes in transport (vehicle) operating costs. The new paradigm reflects that transport investments, particularly in the intermodal sector, have important externalities peculiar to freight, which are beyond the direct effects on vehicles used. Examples are logistics costs affected by more reliable or faster delivery, greater scheduling flexibility, including shipment size fluctuations, and quick responses to external changes in demand to take advantage of fluctuating market opportunities. Traditional freight benefit cost measures of resource costs typically exclude the indirect costs of resources associated with the performance and productivity of the freight sector.

In the intermodal sector wherein modes are regarded as substitutes or complements for each other, improvements that affect total system performance may transcend issues of lower freight rates because of changes in direct costs. Instead, improvements in service levels or capabilities may become the driving factors within which the private sector defines associated changes in indirect costs such as logistics expenses. In certain commercial freight sectors, such as perishables and retail, changes in indirect costs based on service level improvements can become the driving factor for mode, route, and location decisions. Issues related to system cost such as "performance" are defined broadly outside of the scope of changes in vehicle operating costs, time savings, etc. Unfortunately, the conceptual linkages between direct impacts on vehicles versus intermodal freight system performance and productivity are considerably obtuse from the perspective of a formula driven statement of inputs and outputs relative to intermodal improvements. A similar set of conditions describes the linkages between direct impacts on vehicles versus economic development when the former is regarded as a means to the latter.

The search for a new project evaluation methodology for intermodal freight projects is proceeding along two parallel paths: (1) effects on economic development resulting from new or improved services which affect distribution quality and logistics costs other than direct freight cost; (2) effects on community welfare where intermodal transportation improvements lead to quality of life enhancements normally associated with reduction of and political visibility of the intermodal freight sector has been weak compared to the passenger counterpart. It is our contention that traditional benefit cost analysis, even with rigorous applications, defines traditional benefits measured in resource savings that cannot overcome the lack of visibility of the freight sector to compete for public sector priorities.

The literature review suggested that the intermodal project evaluation process is searching for a new paradigm that will move beyond traditional benefit cost analysis and will incorporate different kinds of benefits customarily excluded from the transport sector's focus on direct changes in transport (vehicle) operating costs. The new paradigm reflects that transport investments, particularly in the intermodal sector, have important externalities peculiar to freight, which are beyond the direct effects on vehicles used. Examples are logistics costs affected by more reliable or faster delivery, greater scheduling flexibility, including shipment size fluctuations, and quick responses to external changes in demand to take advantage of fluctuating market opportunities. Traditional freight benefit cost measures of resource costs typically exclude the indirect costs of resources associated with the performance and productivity of the freight sector.

In the intermodal sector wherein modes are regarded as substitutes or complements for each other, improvements that affect total system performance may transcend issues of lower freight rates because of changes in direct costs. Instead, improvements in service levels or capabilities may become the driving factors within which the private sector defines associated changes in indirect costs such as logistics expenses. In certain commercial freight sectors, such as perishables and retail, changes in indirect costs based on service level improvements can become the driving factor for mode, route, and location decisions. Issues related to system cost such as "performance" are defined broadly outside of the scope of changes in vehicle operating costs, time savings, etc. Unfortunately, the conceptual linkages between direct impacts on vehicles versus intermodal freight system performance and productivity are considerably obtuse from the perspective of a formula driven statement of inputs and outputs relative to intermodal improvements. A similar set of conditions describes the linkages between direct impacts on vehicles versus economic development when the former is regarded as a means to the latter.

The search for a new project evaluation methodology for intermodal freight projects is proceeding along two parallel paths: (1) effects on economic development resulting from new or improved services which affect distribution quality and logistics costs other than direct freight cost; (2) effects on community welfare where intermodal transportation improvements lead to quality of life enhancements normally associated with reduction of

	1. truck loading rate in weight or pieces per hour 2. truck loading cost (time or weight or piece) 3. truck route and distance to destination 4. truck unloading rate 5. truck unloading cost C. Barge 1. Dock a. Private or Public –length 1. location of unloading facility (facility name or river mile) 2. name of connecting railroad(s) 3. name of connecting public street or road 4. unloading b. Direct from barge to stockpile/plant 1. type – conveyor belt, pipe, etc. 2. operating cost to unload 3. unloading rate (tons or pieces per hour) 4. loading volume (tons or cube, which ever is constraining 5. number of barges loaded at one time for one shipment c. Truck or rail car 1. direct or indirect to truck or rail car a. truck/rail loading cost and rate at port b. truck/rail route and distance from dock c. truck/rail unloading rate in tons or pieces d. truck/rail unloading cost 2. port to truck or rail car

	1. truck loading rate in weight or pieces per hour 2. truck loading cost (time or weight or piece) 3. truck route and distance to destination 4. truck unloading rate 5. truck unloading cost C. Barge 1. Dock a. Private or Public –length 1. location of unloading facility (facility name or river mile) 2. name of connecting railroad(s) 3. name of connecting public street or road 4. unloading b. Direct from barge to stockpile/plant 1. type – conveyor belt, pipe, etc. 2. operating cost to unload 3. unloading rate (tons or pieces per hour) 4. loading volume (tons or cube, which ever is constraining 5. number of barges loaded at one time for one shipment c. Truck or rail car 1. direct or indirect to truck or rail car a. truck/rail loading cost and rate at port b. truck/rail route and distance from dock c. truck/rail unloading rate in tons or pieces d. truck/rail unloading cost 2. port to truck or rail car

	a. handling/ stockpiling cost b. loading rate c. loading cost

Source: LSU National Ports and Waterways Institute

	a. handling/ stockpiling cost b. loading rate c. loading cost

Source: LSU National Ports and Waterways Institute

Table 18

Railroad grade crossing corridor prioritization criteria

Rating Scale: Least Effective — Most Effective: 2 3 4 5

City	Crossing	2005 Trains	2010 traffic (thousands)	Percentage time crossing is closed	General mobility: Potential to reduce delay	General mobility: Queuing	General mobility: Cross-corridor arterial	Freight mobility: Truck use	Freight mobility: Mainline benefit	Safety: Intersection safety	Safety: Emergency services	Community environment: Community support	Community environment: Residential displacement	Community environment: Business displacement	Community environment: Strategic economic impact	Community environment: Emissions reduction	Cost effectiveness: Capital cost	Cost effectiveness: Cost-effectiveness	Composite rating	Recommended
Seattle	Broad	83	17.2	37%	4	3	1	1	3	2	5	4	5	5	5	4	$ 25	5	5	*
Seattle	Royal Brougham	133	22.8	43%	5	1	5	2	3	5	5	5	5	1	5	5	$ 102	2	5	*
Seattle	Holgate	92	13.6	27%	3	2	1	1	3	3	5	3	5	5	4	2	$ 30	2	4	One of two
Seattle	Lander	94	15.0	28%	4	2	1	1	3	1	5	3	5	5	5	3	$ 30	3	4	*
Seattle	East Marginal	15	15.2	11%	2	4	1	2	5	5	5	5	5	5	5	1	$ 19	2	5	
Seattle	Military Road	101	1.1	18%	1	1	1	1	3	1	1	1	5	5	3	1	$ 20	1	1	
Tukwila	Strander	75	15.0	9%	2	1	1	1	1	1	1	5	5	5	4	1	$ 10	3	2	*
Tukwila	S. 180th/SW 43rd	75	44.0	8%	3	2	5	5	1	2	1	5	5	3	5	2	$ 12	5	5	*
Kent	212th-BN	56	28.5	7%	2	2	5	2	1	1	1	5	5	5	5	1	$ 13	3	4	*
Kent	212th-UP	26	28.5	4%	2	2	5	2	1	1	1	5	5	5	5	1	$ 13	2	3	
Kent	228th-BN	56	13	6%	1	1	1	1	1	1	1	5	5	5	3	1	$ 10	2	2	
Kent	228th-UP	26	15.4	4%	1	2	1	1	1	1	1	5	5	5	3	1	$ 10	1	2	
Kent	James-BN	56	26.4	7%	2	3	1	2	1	1	1	5	5	5	5	1	$ 12	3	3	
Kent	James-UP	26	19	4%	1	2	1	2	1	1	1	5	5	5	5	1	$ 9	2	2	
Kent	Smith-BN	56	16.9	6%	1	2	1	1	1	1	1	4	5	5	4	1	$ 12	2	2	
Kent	Smith-UP	26	16.0	4%	1	2	1	1	1	1	1	5	5	5	4	1	$ 10	1	2	
Kent	Willis-BN	56	31.9	6%	2	3	5	3	1	1	1	5	5	5	5	1	$ 10	4	4	*
Kent	Willis-UP	26	31.9	4%	2	4	5	3	1	1	1	5	5	5	5	1	$ 10	2	4	*
Auburn	S. 277th BNSF	56	22.8	6%	2	2	5	1	1	1	5	5	5	5	4	1	$ 12	2	4	*
Auburn	S. 227th UP	26	22.8	6%	2	3	5	1	1	2	5	5	5	5	4	1	$ 12	2	4	*
Auburn	37th NW	56	14.3	5%	1	1	1	1	1	2	1	3	5	5	3	1	$ 32	1	1	
Auburn	W Main--UP	26	12.5	4%	1	1	5	1	1	1	5	3	5	5	3	1	$ 12	1	2	
Auburn	SW 3rd	54	30.0	7%	3	2	5	1	1	1	5	5	5	4	5	1	$ 22	2	4	*
Auburn	M Street	15	26.0	5%	2	4	1	1	1	1	5	5	5	5	4	1	$ 7	4	4	*
Algona	Ellingson Road Up	26	25.7	3%	1	2	1	3	1	1	1	5	5	5	5	1	$ 15	1	2	
Pacific	8th Street E BNSF	59	31.0	6%	2	3	5	2	1	5	5	5	5	5	5	1	$ 10	3	5	*
Pacific	8th St East/Stewart	26	31.0	3%	2	4	5	2	1	1	1	5	5	5	5	1	$ 10	2	3	*
Sumner	16th Street UP	26	0.3	4%	1	1	1	1	1	1	5	3	5	5	2	1	$ 16	1	1	
Sumner	24th Street BNSF	59	1.0	5%	1	1	5	1	1	1	5	5	5	5	5	1	$ 9	1	2	
Sumner	24th Street UP	26	18.0	4%	1	3	5	2	1	1	5	5	5	5	4	1	$ 12	1	3	
Sumner	Puyallup Street	59	27.0	5%	2	3	1	2	1	1	5	5	5	5	5	1	$ 12	2	3	*
Sumner	Zehnder Street	59	4.1	6%	1	1	1	1	1	1	5	2	1	4	3	1	$ 12	1	1	
Sumner	Maple Street	59	4.5	5%	1	1	1	1	1	1	5	1	4	5	4	1	$ 12	1	1	
Sumner	Main	59	9.6	6%	1	1	1	1	1	1	5	1	5	3	1	1	$ 12	1	1	
Puyallup	Shaw Rd. Ext.	59	15.6	7%	2	1	5	2	1	1	5	5	5	5	5	1	$ 15	2	4	*
Puyallup	4th/5th	59	17.5	7%	2	2	1	2	1	1	5	4	5	5	5	1	$ 62	1	2	
Puyallup	3rd Street SE	59	25.2	7%	2	2	1	2	1	1	5	3	5	5	5	1	$ 35	1	2	
Pierce	70th Ave-UP	26	17.5	3%	1	1	1	1	1	1	1	5	5	5	5	1	$ 6	2	2	
Puyallup	Fruitland Ave Ext	59	17.3	6%	1	2	5	1	1	1	5	4	5	5	5	1	$ 33	1	3	
Pierce	Stewart E/66th Ave	59	5.1	6%	1	1	1	1	1	1	1	3	4	5	3	1	$ 10	1	1	
Pierce	N Canyon Road	59	26.0	6%	2	2	5	2	1	1	1	5	5	5	5	1	$ 6	4	4	*
Tacoma	D Street	92	11.4	40%	4	3	1	1	3	1	5	5	5	5	5	3	$ 21	4	5	*
Tacoma	Lincoln St.	12	9.5	7%	1	3	1	2	5	1	1	3	5	5	5	1	$ 8	2	2	
Tacoma	Port of Tacoma Rd	12	8.1	58%	4	5	1	2	5	1	1	5	5	5	5	3	$ 22	4	5	*

Source: Washington State Department of Transportation

Table 18
Railroad grade crossing corridor prioritization criteria

Rating Scale
Least Effective — Most Effective
2 3 4 5

					General mobility			Freight mobility		Safety		Community environment					Cost effectiveness			
City	Crossing	2005 Trains	2010 traffic (thousands)	Percentage time crossing is closed	Potential to reduce delay	Queuing	Cross-corridor arterial	Truck use	Mainline benefit	Intersection safety	Emergency services	Community support	Residential displacement	Business displacement	Strategic economic impact	Emissions reduction	Capital cost	Cost-effectiveness	Composite rating	Recommended
Seattle	Broad	83	17.2	37%	4	3	1	1	3	2	5	4	5	5	5	4	$ 25	5	5	*
Seattle	Royal Brougham	133	22.8	43%	5	1	5	2	3	5	5	5	5	1	5	5	$ 102	2	5	*
Seattle	Holgate	92	13.6	27%	3	2	1	1	3	3	5	3	5	5	4	2	$ 30	2	4	One of two
Seattle	Lander	94	15.0	28%	4	2	1	1	3	1	5	3	5	5	5	3	$ 30	3	4	*
Seattle	East Marginal	15	15.2	11%	2	4	1	2	5	5	5	5	5	5	5	1	$ 19	2	5	
Seattle	Military Road	101	1.1	18%	1	1	1	1	3	1	1	1	5	5	3	1	$ 20	1	1	
Tukwila	Strander	75	15.0	9%	2	1	1	1	1	1	1	5	5	5	4	1	$ 10	3	2	*
Tukwila	S. 180th/SW 43rd	75	44.0	8%	3	2	5	5	1	2	1	5	5	3	5	2	$ 12	5	5	*
Kent	212th-BN	56	28.5	7%	2	2	5	2	1	1	1	5	5	5	5	1	$ 13	3	4	*
Kent	212th-UP	26	28.5	4%	2	2	5	2	1	1	1	5	5	5	5	1	$ 13	2	3	
Kent	228th-BN	56	13	6%	1	1	1	1	1	1	1	5	5	5	3	1	$ 10	2	2	
Kent	228th-UP	26	15.4	4%	1	2	1	1	1	1	1	5	5	5	3	1	$ 10	1	2	
Kent	James-BN	56	26.4	7%	2	3	1	2	1	1	1	5	5	5	5	1	$ 12	3	3	
Kent	James-UP	26	19	4%	1	2	1	2	1	1	1	5	5	5	5	1	$ 9	2	2	
Kent	Smith-BN	56	16.9	6%	1	2	1	1	1	1	1	4	5	5	4	1	$ 12	2	2	
Kent	Smith-UP	26	16.0	4%	1	2	1	1	1	1	1	5	5	5	4	1	$ 10	1	2	
Kent	Willis-BN	56	31.9	6%	2	3	5	3	1	1	1	5	5	5	5	1	$ 10	4	4	*
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Auburn	M Street	15	26.0	5%	2	4	1	1	1	1	5	5	5	5	4	1	$ 7	4	4	*
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Sumner	Maple Street	59	4.5	5%	1	1	1	1	1	1	5	1	4	5	4	1	$ 12	1	1	
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Pierce	N Canyon Road	59	26.0	6%	2	2	5	2	1	1	1	5	5	5	5	1	$ 6	4	4	*
Tacoma	D Street	92	11.4	40%	4	3	1	1	3	1	5	5	5	5	5	3	$ 21	4	5	*
Tacoma	Lincoln St.	12	9.5	7%	1	3	1	2	5	1	1	3	5	5	5	1	$ 8	2	2	
Tacoma	Port of Tacoma Rd	12	8.1	58%	4	5	1	2	5	1	1	5	5	5	5	3	$ 22	4	5	*

Source: Washington State Department of Transportation

Traffic Safety Projects Scoring Procedure for Candidate Locations*

1. Does the lane width fall below the threshold? (yes = 5 points, no = 0 points)
2. Does the shoulder width fall below the threshold? (yes = 5 points, no = 0 points)
3. Does the shoulder surface type fall below the threshold? (yes = 5 points, no = 0 points)
4. Does the alignment fall below the threshold? (yes = 5 points, no = 0 points)
5. Is the vertical clearance less than 14 feet? (yes = 5 points, no = 0 points)

Note: Maximum score for any candidate location = 25 points

Additional Capacity/New Infrastructure Projects Scoring Procedure*

1. Does the current level of service on the highway section fall at or below threshold? (yes = 50 points, no = 0)
2. Does the current level of service on the highway fall one level above threshold? (yes = 25 points, no = 0 points)
3. In which range does the current daily volume of commercial vehicles fall?

< 100	(0 points)
100 – 249	(1 point)
250 – 499	(3 points)
500 – 999	(5 points)
1000 – 1749	(6 points)
1750 – 2499	(7 points)
2500 - 3499	(8 points)
3500 – 4999	(9 points)
>= 5000	(10 points)

4. Is the highway section on the interstate system, other NHS system, or State Primary System? (yes = 7 points interstate, 5 points Other NHS, 3 points State Primary, no = 0 points)
5. Is the highway section a designated truck route? (yes = 5 points, no = 0 points)

Figure 8
LaDOTD scoring procedures for highway safety and capacity/new infrastructure projects

Traffic Safety Projects Scoring Procedure for Candidate Locations*

1. Does the lane width fall below the threshold? (yes = 5 points, no = 0 points)
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>= 5000	(10 points)

4. Is the highway section on the interstate system, other NHS system, or State Primary System? (yes = 7 points interstate, 5 points Other NHS, 3 points State Primary, no = 0 points)
5. Is the highway section a designated truck route? (yes = 5 points, no = 0 points)

Figure 8
LaDOTD scoring procedures for highway safety and capacity/new infrastructure projects

6. Does the highway section serve as an intercity bus route? (yes = 5 points, no = 0 points)
7. Does the highway section serve local transit trips (fixed-route bus service)? (yes = 5 points, no = 0 points)
8. Does the highway section serve as an international trade route? (yes = 5 points, no = 0 points).
9. Does the highway section serve as a national defense route? (yes = 5 points, no = 0 points)
10. Is the highway section a designated hurricane evacuation route? (yes = 5 points, no = 0 points)
11. Does the highway section provide direct access to one or more intermodal terminal (e.g. public port, public airport, truck/rail terminal, intercity bus, or intercity passenger rail terminal)? In other words, is the road an intermodal connector? (yes = 7 points, NHS intermodal connector, 5 other intermodal connector, no = 0 points)
12. Is the highway section part of a congressionally designated high priority corridor? (yes = 5 points, no = 0 points)
13. Does local jurisdiction in which the highway section is located have a growth management policy or plan in place that meets minimum state requirements? (yes = 15 points, no = 0 points)

* note maximum score for any section of state highway = 137 points for additional capacity new infrastructure

Source: Task Force on Highway Project Identification and Prioritization, Highway Selection Process (Baton Rouge, Louisiana, Department of Transportation and Development), January 2000, pages 21, 28 and 29.

Figure 8
LaDOTD scoring procedures for highway safety and capacity/new infrastructure projects (con't.)

6. Does the highway section serve as an intercity bus route? (yes = 5 points, no = 0 points)
7. Does the highway section serve local transit trips (fixed-route bus service)? (yes = 5 points, no = 0 points)
8. Does the highway section serve as an international trade route? (yes = 5 points, no = 0 points).
9. Does the highway section serve as a national defense route? (yes = 5 points, no = 0 points)
10. Is the highway section a designated hurricane evacuation route? (yes = 5 points, no = 0 points)
11. Does the highway section provide direct access to one or more intermodal terminal (e.g. public port, public airport, truck/rail terminal, intercity bus, or intercity passenger rail terminal)? In other words, is the road an intermodal connector? (yes = 7 points, NHS intermodal connector, 5 other intermodal connector, no = 0 points)
12. Is the highway section part of a congressionally designated high priority corridor? (yes = 5 points, no = 0 points)
13. Does local jurisdiction in which the highway section is located have a growth management policy or plan in place that meets minimum state requirements? (yes = 15 points, no = 0 points)

* note maximum score for any section of state highway = 137 points for additional capacity new infrastructure

Source: Task Force on Highway Project Identification and Prioritization, Highway Selection Process (Baton Rouge, Louisiana, Department of Transportation and Development), January 2000, pages 21, 28 and 29.

Figure 8
LaDOTD scoring procedures for highway safety and capacity/new infrastructure projects (con't.)

Total number of combination tractor-trailer unit trips to and from port per operating day. <indicator of disruptions associated with maneuvering combination tractor-trailer units to non-commercial traffic>

1. Long distance tractor trailer port trips (>250 miles) and local tractor-trailer trips per day (<100 miles) <indicator of local versus regional dependency on intermodal access, potential economic development, and port promotion>
2. Hourly distribution of tractor-trailer port trip arrivals and departures per operating day as well as access routes used to connect to major limited access arteries. <indicator of extent of interaction of slower moving vehicles with peak and off peak volumes of other users>
3. Port gate queues disrupting non-port traffic flows. <indicator of extent to which peak port flows directly disrupt other flows>
4. Number of maximum length unpermitted tractor-trailer unit trips per operating day. <longest combination units assumed to have the most restricted maneuvering capability and would be used as indicators of disruptions to non-commercial traffic>
5. Number of overweight permitted tractor-trailer unit trips per operating day. <indicator of possible road damage to non-commercial streets and roads and delays to other vehicles from heavily loaded, slower moving, legally permitted overweight vehicles>
6. Number of oversize cargo tractor-trailer unit trips per operating day. <indicator of possible movement impediments and delays to other vehicles from tight clearances of oversize vehicle maneuvering to accommodate close clearances>
7. Number of hazardous materials truck trips per operating day. <indicator of potential risk exposure, particularly relevant when no reliable reported accident time series exists>
8. Will improvements result in separating commercial port truck traffic from other traffic? <indicator of extent to which port traffic can be segregated from non-port traffic to maximize benefits to non-commercial vehicles>
9. Reduction of port traffic flows through local residential neighborhoods in terms of truck trips per day. <indicator of potential reductions in neighborhood noise and other negative amenities associated with heavy vehicles on non-commercial arteries>

Figure 9

Suggested criteria for prioritization of intermodal access for marine terminals and associated indirect impacts

Total number of combination tractor-trailer unit trips to and from port per operating day. <indicator of disruptions associated with maneuvering combination tractor-trailer units to non-commercial traffic>

1. Long distance tractor trailer port trips (>250 miles) and local tractor-trailer trips per day (<100 miles) <indicator of local versus regional dependency on intermodal access, potential economic development, and port promotion>
2. Hourly distribution of tractor-trailer port trip arrivals and departures per operating day as well as access routes used to connect to major limited access arteries. <indicator of extent of interaction of slower moving vehicles with peak and off peak volumes of other users>
3. Port gate queues disrupting non-port traffic flows. <indicator of extent to which peak port flows directly disrupt other flows>
4. Number of maximum length unpermitted tractor-trailer unit trips per operating day. <longest combination units assumed to have the most restricted maneuvering capability and would be used as indicators of disruptions to non-commercial traffic>
5. Number of overweight permitted tractor-trailer unit trips per operating day. <indicator of possible road damage to non-commercial streets and roads and delays to other vehicles from heavily loaded, slower moving, legally permitted overweight vehicles>
6. Number of oversize cargo tractor-trailer unit trips per operating day. <indicator of possible movement impediments and delays to other vehicles from tight clearances of oversize vehicle maneuvering to accommodate close clearances>
7. Number of hazardous materials truck trips per operating day. <indicator of potential risk exposure, particularly relevant when no reliable reported accident time series exists>
8. Will improvements result in separating commercial port truck traffic from other traffic? <indicator of extent to which port traffic can be segregated from non-port traffic to maximize benefits to non-commercial vehicles>
9. Reduction of port traffic flows through local residential neighborhoods in terms of truck trips per day. <indicator of potential reductions in neighborhood noise and other negative amenities associated with heavy vehicles on non-commercial arteries>

Figure 9

Suggested criteria for prioritization of intermodal access for marine terminals and associated indirect impacts

10. Reduction of commercial vehicle maneuvering requirements from nearest limited access artery to port gates in terms of intersection turns and required lane changes. <indicator of delays and potential accident reductions for non-commercial vehicles>
11. Decreased cargo and vehicle security concerns. <indicator of potential promotion of port concerning reduction of negative amenities>
12. Improved access to truck related services for drivers and vehicles. <indicator of potential promotion of port, and potential reductions in commercial vehicle shifting for local services with attendant improvements in delays and congestion for non-commercial vehicles>
13. Enhanced truck parking and waiting areas. <indicator of potential promotion of port and potential reduction of delays and accidents to other vehicles from otherwise blockage of arteries, parking along streets, etc. >
14. Decreased commercial truck conflicts with other port access users such as employees, railroads, service providers, etc. <indicator of safety improvements and port amenities>
15. Simplification of route for drivers not familiar with port access. <indicator of potential improvements to safety and port promotion>
16. Enhancement of overall appearance of port exterior for visitors. <indicator of port and community promotion>
17. New rail access directly to port facilities. <indicator of potential reduction in truck trips affecting congestion, safety, and enhanced port promotion>
18. New rail access directly to port facilities for multiple connecting carriers. <indicator of enhanced port promotion>
19. Other rail access improvements affecting intrarail rate and service competition. <indicator of enhanced port promotion>
20. Number of railroad grade crossings and average daily number of one way train passages (count switching passages individually). <indicator of potential reductions of vehicle conflicts, delays, and road crossing accident reductions>

Figure 9

Suggested criteria for prioritization of intermodal access for marine terminals and associated indirect impacts (con't.)

10. Reduction of commercial vehicle maneuvering requirements from nearest limited access artery to port gates in terms of intersection turns and required lane changes. <indicator of delays and potential accident reductions for non-commercial vehicles>
11. Decreased cargo and vehicle security concerns. <indicator of potential promotion of port concerning reduction of negative amenities>
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20. Number of railroad grade crossings and average daily number of one way train passages (count switching passages individually). <indicator of potential reductions of vehicle conflicts, delays, and road crossing accident reductions>

Figure 9

Suggested criteria for prioritization of intermodal access for marine terminals and associated indirect impacts (con't.)

21. Number of trains per day on main line or secondary route(s) with direct connections to the port. <indicator of intensity of use of local infrastructure by port and related delays to vehicles and pedestrians from blockage of arteries and crossing delays not directly associated with local port access>
22. Number of trains per day making deliveries and/or pickups to and from the port (count switching movements into or out of the port as one train unless multiple trips for different cars are made during the day). <indicator of intensity of use for possible blockage of local access road and crossing delays to vehicles and pedestrians>
23. Increased visibility of train crossings by vehicles and/or increased visibility of vehicles approaching crossings by trains. <indicator of potential road crossing accident reductions>
24. Reduction of train and pedestrian conflicts. <indicator of potential safety improvements>
25. Increased freight car maximum gross weight. <indicator of port promotion>
26. Increased freight car height/width clearances. <indicator of port promotion>
27. Increased freight car or train length to serve port. <indicator of port promotion>
28. Stimulation of commercial development outside of port gate that is compatible with maritime commerce based on port rail and truck access improvements. <indicator of potential for port related or other economic development>

Source: LSU National Ports and Waterways Institute

Figure 9

Suggested criteria for prioritization of intermodal access for marine terminals and associated indirect impacts (con't.)

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Source: LSU National Ports and Waterways Institute

Figure 9

Suggested criteria for prioritization of intermodal access for marine terminals and associated indirect impacts (con't.)

Total number of combination tractor-trailer unit trips to and from port per operating day. <one point each based on range of average daily truck trips> (1) <500; (2) 500 to 999; (3) 1000 to 1499; (4) 1500 to 1999; (5) 2000 to 2499; (6) 2500 to 2999; (7) 3000 to 3499; (8) 3500 to 3999; (9) 4000 to 4499; (10) >4499.

1. Hourly distribution of tractor-trailer port trip arrivals and departures per operating day and access routes used to connect to major limited access arteries. <*two points each based on level of interaction with non-port peak vehicle flow*> (1) very low interaction based on volume and/or direction; (2) low interaction with minor contribution to peak hour congestion; (3) moderate interaction and contribution to peak hour congestion; (4) high interaction and contribution to peak hour congestion; and (5) very high interaction and contribution to peak hour congestion.

2. Number of oversize cargo tractor-trailer unit trips per operating day. <two points each based on range of average oversize daily truck trips> (1) <5; (2) 5-9; (3) 10 –14; (4) 15 – 19; (5) >19

3. Will improvements result in separating commercial port truck traffic from other traffic? <two points each based on level of interaction with non-port traffic> (1) very low interaction based on volume and/or direction; (2) low interaction with minor contribution to peak hour congestion; (3) moderate interaction and contribution to peak hour congestion; (4) high interaction and contribution to peak hour congestion; and (5) very high interaction and contribution to peak hour congestion.

4. Reduction of port traffic flows through local residential neighborhoods in terms of truck trips per day. <one point each based on range of average daily truck trips> (1) <500; (2) 500 to 999; (3) 1000 to 1499; (4) 1500 to 1999; (5) 2000 to 2499; (6) 2500 to 2999; (7) 3000 to 3499; (8) 3500 to 3999; (9) 4000 to 4499; (10) >4499.

Source: LSU National Ports and Waterways Institute

Figure 10
Example of prioritization scaling of associated indirect impacts for intermodal access for marine terminals

Total number of combination tractor-trailer unit trips to and from port per operating day. <one point each based on range of average daily truck trips> (1) <500; (2) 500 to 999; (3) 1000 to 1499; (4) 1500 to 1999; (5) 2000 to 2499; (6) 2500 to 2999; (7) 3000 to 3499; (8) 3500 to 3999; (9) 4000 to 4499; (10) >4499.

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Source: LSU National Ports and Waterways Institute

Figure 10

Example of prioritization scaling of associated indirect impacts for intermodal access for marine terminals

Case 1: Access improvements that primarily benefit port

Program	Direct benefits (Vehicle impacts)	Indirect benefits (Port development)
Highway	10	
Port		90

Case 2: Access improvements that primarily benefit non-port highway users

Program	Direct benefits (Vehicle impacts)	Indirect benefits (Port development)
Highway	90	
Port		10

Source: LSU National Ports and Waterways Institute

Figure 11

Hypothetical highway and port benefits from road access improvements

Case 1: Access improvements that primarily benefit port

Program	Direct benefits (Vehicle impacts)	Indirect benefits (Port development)
Highway	10	
Port		90

Case 2: Access improvements that primarily benefit non-port highway users

Program	Direct benefits (Vehicle impacts)	Indirect benefits (Port development)
Highway	90	
Port		10

Source: LSU National Ports and Waterways Institute

Figure 11

Hypothetical highway and port benefits from road access improvements

The Basic Model

The purpose of this section is to describe the methodology used for estimating social costs of freight transportation. While the conceptual model and other theoretical issues of estimating the social costs of trucking will be the focus in this section, the results of two case studies using the methodology are discussed later. The description to follow should not be considered a procedural manual, but only a broad conceptual approach. Characteristically, benefit-cost analysis is an art, flexible and robust, accommodating a wide range of planning decisions. It is left to the decision makers who are using it as a planning technique, molding it to provide relevant and balanced information.

The flexibility of benefit-cost framework is illustrated, for example, by the alternative choices we have in developing this basic model. The primary objective of this study is to develop an intermodal project evaluation methodology for statewide applications. This calls for a simple, user-friendly, reasonably accurate, and widely applicable model, perhaps in that order. However, the accuracy of benefit cost estimates requires the inclusion of a large number of variables and detailed computations making the two requirements work at cross-purposes. A similar choice has to be made between model accuracy and wide applicability, particularly with highly specialized characteristics of freight movements. Therefore, the appropriate choice of model structure is left to the decision makers, and is guided by their planning information needs.

The key difference in passenger and freight transportation planning is that the factors influencing freight demand are more complex and interdependent. These complexities make freight demand forecasting and modeling a challenging task. In addition, highly distinct freight movements with respect to origin and destination, cargo type, the nature of service, etc., make it difficult to develop a widely applicable (e.g., statewide) and reasonably accurate methodology for the evaluation of intermodal projects. Major characteristics distinct to freight transport are:

- Freight transport offers a package service including specialized services such as warehousing, packaging, etc., making it difficult to identify the transport cost independent of other services.
- Commodities differ in physical form (liquid, solid-bulk, etc.) volume/value ratios, measurement units (container, carload, tons, etc.), all demanding a distinct need or characteristic to the freight flow.

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is given by the slope of the total cost curve of a typical firm at A (where, $\Delta Q \rightarrow 0$), and the incremental cost of increasing output from Q to Q1 is B-D. The slope of the line AB represents the average marginal cost for this range of output.

Although, the marginal concept is a key component in economic analysis with great theoretical appeal, it is of limited appeal in managerial decision making because it measures only the effect of unitary changes in output or some other variable. The incremental approach, on the other hand is broader in scope, and estimates wider incremental changes, resulting from a given managerial decision. Therefore, while marginal analysis may be appropriate for estimating total social cost of one truckload, incremental analysis is more suited to estimating the aggregate effects of larger freight shipments typically associated with intermodal projects.

The incremental cost analysis (and marginal analysis) used in the following case studies measures the increase in social costs under "with" and "without project conditions." The great appeal of this approach is that decisions can be made by considering the incremental effects of the project, treating all other costs as "sunk" or given costs. It is a measure of economic efficiency, and is not burdened with questions such as organizational costs or the system efficiencies of public transportation agencies. The method cannot be used as a cost recovery method for public agencies providing infrastructure services since it ignores fixed costs as sunk costs. However, by measuring the incremental change resulting from a given managerial decision, it measures productivity and efficiency, facilitating efficient resource allocation decisions.

Rate of Discount. Incremental infrastructure costs to the public agency occur by committing additional resources as well as by changing the schedule of costs in terms of timing. In other words, when additional traffic roads reach terminal serviceability levels faster than without the traffic it compels the public agency (PA) to incur resurfacing costs early. As all costs are measured in terms of present values, costs incurred early will be weighted more heavily than the costs incurred later. In this report the nominal interest rate is estimated to be 7.7 percent based on the 30-year bond financing by the state. Assuming an inflation factor of 4 percent, the real rate of discount is estimated to be 3.7 percent, implying constant prices.

Cost Classification. The total cost of a freight shipment can be classified into three categories: private, public, or external costs, on the basis of the party who bears the cost (table 19). For example, the cost of service provided by trucking companies is classified as a is given by the slope of the total cost curve of a typical firm at A (where, $\Delta Q \to 0$), and the incremental cost of increasing output from Q to Q1 is B-D. The slope of the line AB represents the average marginal cost for this range of output.

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Table 19

Classification of total social costs of a shipment by truck

Type of cost	Description	Cost classification*
Vehicle and operating cost	Shipping service	Private
Infrastructure	Net infrastructure cost - highway wear and bridge fatigue	Public
Air pollution	Air emissions	External
Noise pollution	Truck noise	External
Congestion	Time costs due to heavy traffic	Private/external
Safety	Increase in probability of accidents	Public/private/ external

*Note: All costs added together are termed social costs in this report.

Source: *[3, page 33 with adaptations]*

The three cost categories are defined in more detail below:

Private costs - current market rates charged for services by the operators, indicating market valuation of the service (market price). For our purposes we assume the price of trucking services is equal to the cost of the service, including normal profits. This implies the existence of perfectly competitive markets for trucking services.

Public costs – The incremental infrastructure cost incurred for the freight movement minus user fees paid by the operator, indicating the element of public subsidy; and,

Externalities - costs not internalized either by the public or private sector, indicating costs borne by society in general.

In this section we discuss several conceptual and analytical issues involved in estimating social costs. More detailed treatment of cost estimation methods will be provided in the next chapter on case studies. The following major cost components are included for analysis:

- Infrastructure
- Air pollution
- Noise
- Congestion

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- Infrastructure
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- Noise
- Congestion

- Accident costs
- Trucking rates

Infrastructure Costs. Assumptions on technical relationships-In estimating infrastructure costs, several simplifying assumptions are necessary. The major cost items in this case are accelerated wear and tear of pavements and early replacement of bridges associated with additional truck movements. As the bridge damage to concrete structures is negligible and the construction of steel bridges is rare, we will not estimate this component. The marginal damage done by additional traffic to ancillary infrastructure such as guardrails and medians, etc. is not estimated because they are relatively small.

Infrastructure costs are treated as public costs, on the assumption that the total network of roads is maintained by the PA. As truckers pay user-fees for the use of public infrastructures, the net additional cost to the PA is the difference between the marginal costs incurred by the additional traffic and the user-fees. The net infrastructure cost derived this way is neither a trucking subsidy, nor the additional cost borne by the public agency at the state level because federal user-fees paid by the truckers as well as federal grants to states are not considered here. Therefore, the cost to the state agency will depend on the relative share of user fees collected and the federal grants for maintenance. The calculation of subsidies requires more rigorous treatment of system efficiencies and several other considerations, which are beyond the purview of this study.

The infrastructure costs incurred by the movement of an additional freight shipment can be identified in terms of incremental resurfacing costs. Conversely, it could be considered as a cost saving by diverting it from one mode to another, such as a barge or rail. We assume constant unit costs for this range of highway use, as it consists of an infinitesimal part of the total cost curve of the public agency, maintaining state highways. The net change in infrastructure costs and who will bear this cost burden are related to the road maintenance policy adopted by the PA. The cost implications under three typical scenarios are illustrated in figure 14.

1. No action policy – The assumption here is with an incremental increase in traffic. No new action is taken by the PA. Such a situation is plausible under PA budget constraints or because of other higher priority investment needs. In this case, the routine pavement cycle will remain the same, forcing highway users to travel on deteriorated roads. The highway users will bear the cost in terms of sub-standard service, slower speeds, safety hazards, and damage to vehicles. Under this scenario, and assuming that the lowering of terminal

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2. Traffic response policy - In this case the PA will continue to maintain the same serviceability standards as in the past, and therefore, with increased traffic the cycle of resurfacing will be advanced. However, no change in pavement thickness will be made. The incremental costs are due to the advancing of the first cycle and the shorter time periods of subsequent paving cycles (figure 14b). The additional infrastructure cost, in this case, is derived as the difference of the future series of expenditures with and without the project converted to present values. Under the shorter time intervals the gap between the new cycle and the old becomes wider, eventually adding one more paving for a given time period (e.g., if the pavement cycle is reduced from seven years to five years, two additional resurfacings are necessary every 35 years). This situation is very likely when the PA revenue is constrained but decides to stretch its resources to maintain minimum standards of highways in the short run, although it is more expensive in the long run.

3. Variable pavement thickness policy - The assumption in this case is that the public agency will take new traffic into account and adjust the thickness of pavement so that terminal serviceability will remain the same. The model assumes that the adjustment of pavement thickness will not take place immediately after additional traffic for two reasons. First, there will be a lag in collecting new traffic information and decision-making. Second, the rigidities in PA budgeting and funding will not enable immediate action. Therefore in the initial cycle where additional cargo is added, perhaps midway, freight movements will be on roads with the same thickness and there will be a time period where the road will be below terminal serviceability. This period could be identified as the short-run response of the highway maintenance agency where all resources (inputs) are committed. However, in the long-run (defined in production theory as the time period where at least one input is variable), resurfacing thickness is increased to meet the additional wear and tear of additional traffic. Therefore, the paving cycles remain unchanged. The incremental costs in the first cycle are borne by the highway users and there is no cost to the PA. In subsequent paving cycles, PA costs will be higher because of the increase in pavement thickness. Therefore the additional infrastructure cost is the present value of the added series of expenditures.

The infrastructure costs in this study are estimated using the assumptions made under a variable pavement thickness policy. This is the more reasonable assumption because the other options are in the extremes. For example, the no action policy assumes that resurfacing is totally unresponsive to traffic or road conditions and the traffic response policy assumes serviceability has no significant effect on pavement costs, the added traffic does not result in additional infrastructure costs to the PA (figure 14a).

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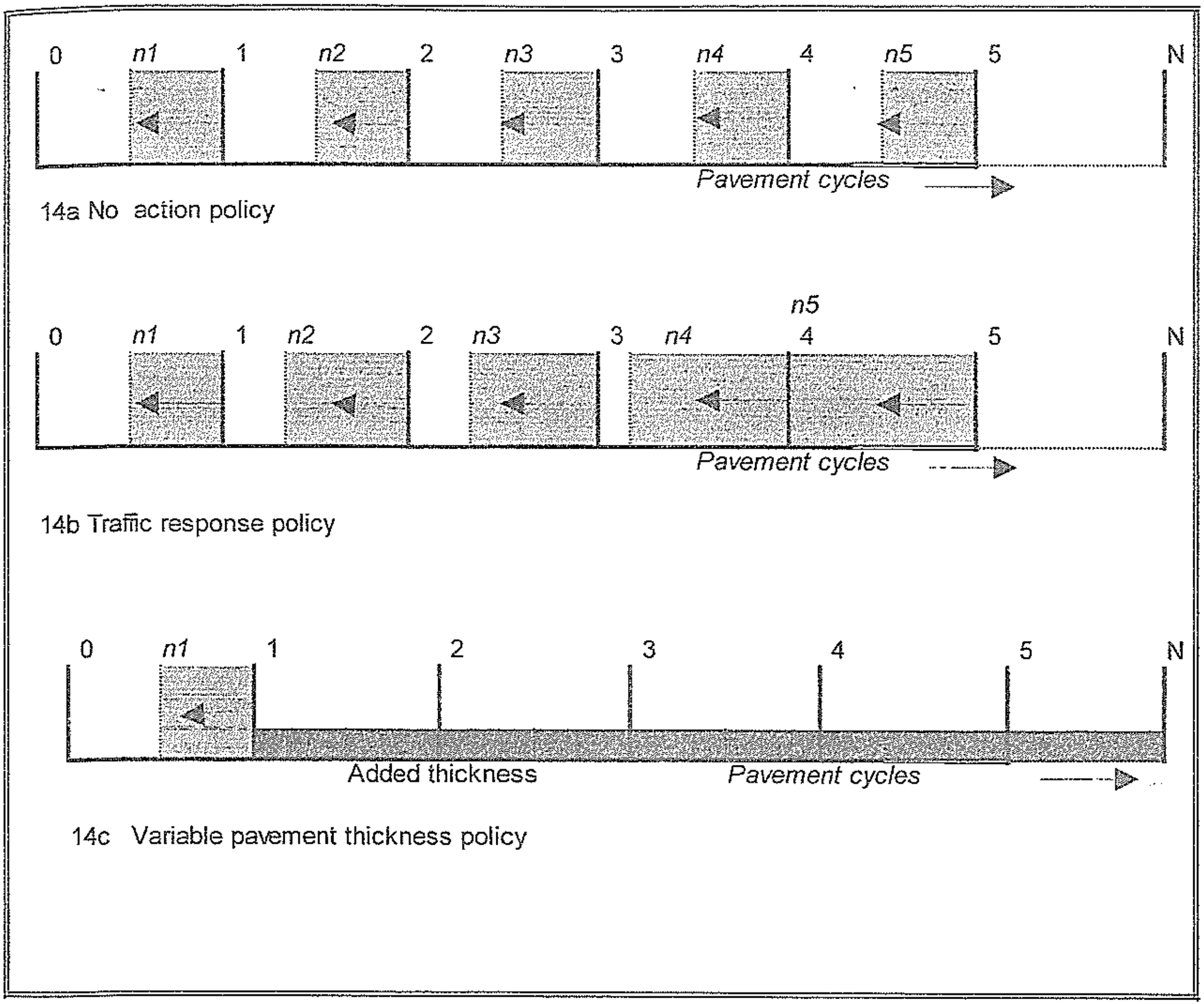

Source: LSU National Ports and Waterways Institute

Figure 14
Infrastructure costs under various highway maintenance policies

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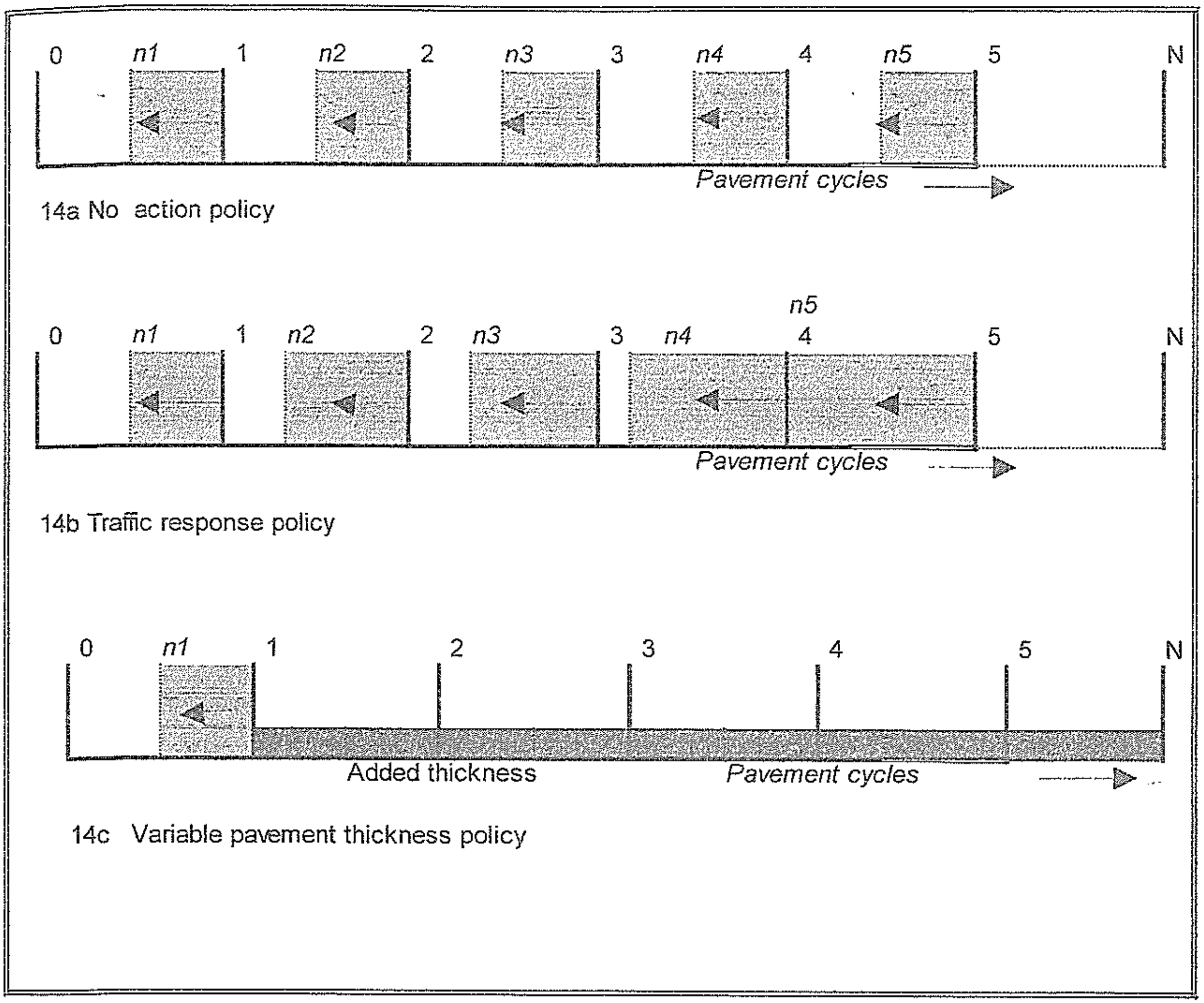
> An externality is present whenever some individual's (person A's) utility or production relationships include real (non-monetary) variables, whose values are chosen by others (persons, corporations, governments) without particular attention to the effect on A's welfare.



Source: LSU National Ports and Waterways Institute

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The non-inclusion of public good externalities is recognized as a source of market failure, resulting in several undesirable effects. In figure 15, the D line represents the demand for transportation services while MC_p represents the marginal cost of the service at market prices. MC_S is the marginal cost of the same service including social costs. The non-inclusion of air pollution and other environmental costs results in: (1) the output is larger under market prices (Q_m) than under social cost (Q^*), leading to more pollution, (2) the prices of services producing pollution are too low (social cost is P^* compared to market price P_m) and (3) as costs are external, there are less incentives to research ways to reduce pollution and recycling.

The sequential procedure for estimating air pollution costs and the variables influencing the estimates at each stage are illustrated in figure 16. The amounts of air pollutants emitted from truck movements depend on the size of the vehicle, mechanical condition, operating speeds and driving habits, and variety of other factors. The emissions from a typical truck operation are classified by major chemical compounds in table 20, along with a listing of harmful effects on human health, materials and atmospheric effects. The magnitude of air pollution damage from the emissions depends on meteorological conditions, for spatial dispersion. Numerous combinations of chemical reactions occur depending on the nature of existing atmospheric concentrations when new residuals are added. The exposure of flora, fauna, and human beings to air pollution depends on the locality of pollution, and the harmful effects are often joint and non-linear. This means the cost of a given dose of emissions is location specific; it depends on what pollutants are already in the air, and total costs are not necessarily proportional to the amount of emissions.

After estimating the magnitude of pollution using the above procedures, the next step is to convert the damage into a common denominator in monetary terms. Although a detailed description of various methods is beyond our scope, a few remarks on the general approach are appropriate. The general economic criterion followed is based on consumer economics, and the task of valuation to determine how much better off or worse off individuals would be as a result of the change in air quality. Based on this "willingness to pay" principle, some empirical studies use the direct method, which consists of interviewing people and estimating how much individuals are willing to pay to avoid air pollution. Another approach, termed "hedonic property value model" uses the differences in property values in polluted and non-polluted areas or job preferences and wages in polluted surroundings (road construction, etc.) Two other methods that do not directly depend on consumer preferences are the damage function approach and benefits transfer approach. In the former case, the analyst will directly attempt to estimate damages to property, human health, and other harmful effects in

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Noise Pollution Costs. The noise created by truck movements is a negative externality, the costs of which are borne by others. People would like to avoid noise because it affects property values, but this is not serious enough to be a significant hazard to human health. According to EPA estimates, trucks dominate road noise emissions and emit about two-thirds of all traffic noise energy. The incremental costs of noise pollution created by a freight movement could be estimated using similar methods as for air pollution costs. It involves the measurement of noise emitted, the activities and population exposed to noise, and assigning an imputed value to noise. However, in contrast with cumulative air pollution, the marginal cost of noise created by a truck in a quiet neighborhood may be greater than the added noise on a busy road.

An incremental increase in traffic may lead to congestion based on capacity use. Congestion costs tend to increase sharply after a certain threshold of traffic density. Interestingly, if the marginal revenue received from added traffic is more than the marginal cost of infrastructure use, high-density roads could be better for agency revenues. However, this depends on the point of the total cost curve of the agency. As truckers are aware of the typical route characteristics, they will include recurring delays as a part of trucking fees. However, additional traffic imposes time costs to other users, and system-wide economic inefficiencies in resource-use. Therefore, congestion costs are calculated on the basis of marginal delay in time based on traffic densities on the route (speed-volume curve) and value in PCE (passenger car equivalents). In the two case studies we will compute the congestion costs for the two shipments based on hourly operating cost of the truck and inventory cost of the cargo.

Accident Costs. The marginal increase in accidents imposed by the added traffic includes increased risk exposure for the added freight traffic as well as the increased risk to other users on the route. Accident damage includes loss of life, injuries, and damage to property. The sequence for estimating accident costs is: (1) based on the road design, traffic volume, and composition, observe the rates of change by types of incidents. From this data, calculate the expected increase in accidents, and the cost of accidents in terms of individuals' willingness to pay to avoid increased risk of injury and death. The data on the rate of accidents, traffic composition, and specifically, accidents caused by trucks are not available.

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The data-link method is essentially an indirect approach to incorporate the characteristics distinct to freight movements into the estimating process without processing primary data. As empirical estimates could be derived quickly, decisions also could be made without delay.

The main disadvantage of the approach is the considerable leeway given to the analyst. However, this element of subjectivity will be prevalent in any method including the studies using primary data.

Intermodal Project Evaluation Methodology. The second step is to develop intermodal project evaluation methodologies making cross-modal comparisons. As the stage is set by solving major issues by estimating social costs and benefits for all modes, it will be possible to concentrate on the main objective of intermodal project evaluation, namely, planning for the most productive mode of freight transportation.

Summary

Estimating social costs of transportation involves collection and interpretation of large amounts of data in several disciplines, mainly in engineering, economics, and environmental sciences. However, transportation activities impose major social costs in terms of air pollution and other social costs. As transportation is a major economic activity and will play even a more crucial role in the future, these costs have to be accounted in making rational policy decisions. In this section we presented a model to estimate freight costs of transportation and a methodological approach to estimate them. We conclude the section by observing that a well-established social benefit-cost methodology is a precursor to developing an intermodal project evaluation methodology.

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RECOMMENDATIONS

Intermodal projects should be evaluated by a benefit cost approach where the savings in monetary resource costs and non-monetary social costs would be assessed from the perspective of the auspices of the investment program that initiates the project. In the instance of port access, the Port Construction and Development Priority Program benefit cost methodology would be applied to develop benefits to the port from cargo and revenues as well as benefits to road users from savings in vehicle operating costs. The intermodal project perspective would also include non-user benefits such as changes in external costs associated with the project. In the case of the development or improvement of a port road access, the social costs included would include changes in noise, air pollution, accidents, and congestion.

Louisiana has been a pioneer in benefit cost applications as part of a state port investment program. Under the Louisiana Port Construction and Development Priority Program more than $300 million in public and private funds have been invested in port projects using an objective benefit-cost methodology during the past ten years. The most significant achievement of this Program is its wide acceptance by the public port authorities and other local constituents competing for state funds. Therefore, Louisiana is uniquely positioned to implement an intermodal project evaluation program incorporating social costs of transportation

The need to broaden the perspective of all modal investment and development programs to an intermodal perspective provides an opportunity for the state to continue its leadership in intermodal project evaluation by expanding the basis for benefit cost analysis to include social costs. The prescription of social benefits will allow multiple investment program beneficiaries to be identified and serve as an objective basis for cost sharing to allow full funding of beneficial projects that would not otherwise qualify under the investment programs of modal programs but under a full benefit cost application that can be objectively justified and apportioned among the beneficiaries.

LIST OF ACRONYMS

ACTA	Alameda Corridor Transportation Authority
AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
BCA	Benefit Cost Analysis
BTS	Bureau of Transportation Statistics
CALTRANS	California Department of Transportation
CTC	California Transportation Commission
CUTR	Center for Urban Transportation Research
CVM	Contingent Valuation Method
DOT	Department of Transportation
DOTD	LA Department of Transportation and Development
EPA	Environmental Protection Agency
ESAL	Equivalent Single Axle Loads
FDOT	Florida Department of Transportation
FFPIB	Florida Freight Project Investment Bank
FFSTF	Florida Freight Stakeholder Task Force
FHWA	Federal Highway Administration
FIHS	Florida Intrastate Highway System
FSTED	Florida Seaport Transportation and Economic Development Program
GIS	Geographic Information System
HOV	High Occupancy Vehicle
ICC	Interstate Commerce Commission
IMS	Intermodal Management System
IRRS	Interregional Road System
ISTEA	Intermodal Surface Transportation Efficiency Act
ITMS	Intermodal Transportation Management System (CA)
LOS	Level of Service
MIA	Miami international Airport
MIC	Miami Intermodal Center
MPG	Miles Per Gallon
MPH	Miles Per Hour
MPO	Metropolitan Planning Organizations
NEPA	National Environmental Protection Act
O&M	Operation and Maintenance
ODOT	Ohio Department of Transportation
OMB	Office of Management and Budget
ORDC	Ohio Rail Development Commission
PA	Public Agency
PCE	Passenger Car Equivalents
PD&E	Planning, Development and Engineering
RTA	Regional Transportation Agencies
STB	Surface Transportation Board

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Arkansas

Contacts: Cliff McKinney, Intermodal Transportation Planner, Arkansas DOT
Paul Revis, Director, Arkansas Waterways Commission

Within the Arkansas Department of Transportation there is an Office of Intermodal Transportation. This office deals with statewide railroad activity. For their purposes, an intermodal activity is defined as being: (1) a large rail terminal; (2) a regional transportation center (freight services with some containers on flat cars on short line railroads); and/or (3) a transloading center. This office conducts studies to evaluate transportation services within a region. Based on the results of the study, they will identify specifically needed improvements. Factors considered in the study include origins and destinations of freight, commodities being shipped, inbound tonnage by freight type, exports and export opportunities, and mode of transport. No scoring or value assignment is given to these factors.

For the recommended improvements to become projects, initiative must come from the local level. Arkansas legislation allows municipalities and counties to work together to build, operate, and maintain both passenger and freight rail facilities. These entities approach members of the legislature to request funding. Funding is administered through the DOT. If needed, the DOT will provide engineering assistance during project development.

The Arkansas Waterway Commission is a separate government agency that deals with maritime activities. It has no recurring funding source for construction. Funds can be made available to the ports for project development by legislative appropriation. Those funds are passed directly to individual ports without oversight by a state agency.

California

Contacts: California Department of Transportation
Ms. Pat Weston, Supervising Transportation Planner
Ms. Linda Turnquist, Senior Transportation Planner
Mr. Tremain Downey , Supervising Transportation Planner
Ms. Pam Korte, Senior Transportation Planner

California has large, heavily populated metropolitan areas. Many of them are the size of a small state. For this reason, their government is very decentralized with the majority of power being distributed to the state's 15 Metropolitan Planning Organizations. In addition to the MPO's, the state has 43 Regional Transportation Agencies. Seventy-five percent of all revenues available for project development goes to the 43 RTA's and the remaining twenty-five percent to CALDOT. The money is proportioned to the RTA's based on population and number of centerline miles within their jurisdiction. These regions have very flexible regulations regarding use of the money. It can be used on state highways, local roads, port roads, commuter rail lines, etc.

The state has greater limitations on how it can use its 25 percent share of the funding. It can use the money only on the state highway system or passenger/commuter rail improvements. CALDOT does not yet have detailed criteria on how it distributes its 25 percent. At the present time, they are considering an approach based on established criteria. This criteria has not yet been determined but will be consistent with the data that is available through their GIS system.

The state works with the regional agencies to develop and elevate the priority ranking for projects that improve the intermodal movement of goods. The regions select their projects from CA's Regional Transportation Plan. This plan is developed by the California Transportation Commission, which consists of 11 members selected by the governor. Every four years the RTA's develop and submit a new program. However, that program is based on the Regional Transportation Plan.

The state has developed a computer system with GIS capability to assist in evaluating intermodal movement. Called the California Intermodal Transportation Management System (ITMS), it is used in the early planning process to help assess where monye can be spent to derive the greatest benefits. It is designed to provide comparable multi-modal data across modal and facility types, including highway, transit bus and rail, inter-city bus and rail, commercial aviation, waterborne and pipeline systems. It addresses freight and passenger movement on all modes by analyzing performance measures. These include mobility measures, person throughput, lost time due to congestion, financial costs to users and providers, environmental measures, economic measures, and safety measures. Deficiencies are identified based on congestion, posted speed, weight limits, and geometrics.

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Florida

Contact: Mr. Rob Hebert, Administrator, Ports, Intermodal and Rail Office
Florida Department of Transportation

Florida develops a needs assessment for all of its programs. The revision period of this assessment is mandated by Florida State Legislation and varies from mode to mode. The assessment becomes the needs priority program or "work program" for Florida DOT. This modal plan is required to support the overall plan of the DOT. Emphasis is placed on access and connectability.

Intermodal projects are basically funded through one of two programs.

1) Fast Tract - This program was developed by Governor Jeb Bush in Sept. of 1999 to finance statewide or major transportation needs that have been unfunded or under funded in the past. The "Fast Tract" initiative is to accelerate existing or new transportation projects, which substantially impact Florida's economic competitiveness. Projects must be intermodal transportation projects with economic development impacts, again with emphasis on access and connectability. The application form explains that the project selection criteria and includes: (1) benefit to cost ratio; (2) stage of development/environmental compliance; (3) time to complete project; (4) current level of service; (5) safety rating; (6) neighborhood impact of project; and (7) current freight volume. Also, there is a selection committee that includes private sector representation.

Ohio Airport Grant Program, Fiscal Year 2000. Ohio Department of Transportation, Office of Aviation, Columbus, OH.

TRAC policies for selecting major new capacity projects. Ohio Department of Transportation, Transportation Review Advisory Council, Columbus, OH.

Pennsylvania

Pennsylvania has different programs for: Rail Freight-DOT, Passenger Rail-DOT, Aviation-DOT, and Ports-Dept. Of Commerce - Each program has its own fund source and appropriation amount. Within the DOT, funding between programs is decided at the legislative level.

Rail Freight

Contact:

Mr. Paul Wargo, Manager, Freight Rail Program, PENNDOT

Pennsylvania provides state funding to railroads through a program called the Rail Freight Assistance Program (RFAP). The program is divided into two parts with majority of available funding being allocated to rehabilitation of existing facilities. The remaining funding goes to new construction. Pennsylvania DOT made a policy decision that greater emphasis should be placed on maintaining existing rail facilities than to continuing to build new ones. Their annual appropriation is $18.5 million with the state general fund being the fund source.

Rehabilitation projects consist of maintaining existing rail track. This includes the replacing of ties, plates, turnouts and other track materials, structural materials and additional ballast that will have a useful life of at least five years. It does not include acquisition cost of land, right-of-way acquisition, buildings, or building materials to construct a new building. In effect, virtually all new construction is to provide siding for existing track.

There is an annual cycle for the application process, which consists of two phases. The first phase begins with submittal of an application on April 15th. Funding for applications approved during this cycle is distributed during mid July. A second phase begins in September. At this time applications not funded during the first phase compete with new projects for funding. The majority of funding is distributed during Phase 1. Phase 2 funds are held for distribution later in the year to address any dynamic situation that may have occurred since the initial application phase.

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Plans and specifications must be submitted with the application. The project must be completed within two years and all funds expended. The applicant for funding is the owner of the railroad track. He must provide a match, which is 50 percent for new construction and 25 percent for rehabilitation.

Project evaluation criteria are the same for both programs. Each program considers these five factors: 1) railroad transportation benefits; 2) user benefits; 3) transportation benefits; 4) economic benefits; and 5) financial considerations (having to do with past operational history and past program participation).

For rehabilitation projects the DOT engineering staff actually visits the site of the project. After the site inspection, a determination is made regarding which track is in the greatest need of repair.

For construction projects the following are considered: 1) How many railcars will use the track? 2) How many jobs will be created? 3) How many trucks will be taken off of the road? Each of these factors is given a score. The scores are combined and the projects are ranked by that score into a priority ordered list. Funds are then allocated from the highest-ranking project down the list until the funds are exhausted.

This program specifically excludes rail improvements associated with passengers and improvements that are solely grade crossings. Other fund sources are available for both of those activities.

Aviation

Contact:

Terry Complese, Pennsylvania Grant Program, PENNDOT

Pennsylvania provides funds for airport improvement projects through their Aviation Restricted Fund. These funds are generated by the tax collected on jet fuels and aviation gasoline. It generates approximately $7.5 million per year for construction.

Pennsylvania solicits applications to their aviation program. DOT planners go to the airports and help them plan for airport development and encourage them to make application for funding. A funding distribution formula assures that each of 3 types of

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Once the projects are sorted, they are scored based on five criteria:

Table 57
Pennsylvania - aviation project scoring factors

Criteria	Considerations	% Of total score
Airport activity	Service Classification Aircraft Factors Enplanements	20 percent
Project element	Runway = 100 pts. Taxiway = 75 pts. Terminal/Apron = 50 pts. Landside = 35 pts.	28 percent
Sponsor compliance	Outstanding Obligations (30%) Hazard Zoning (30%) Licensing Compliance (30%)	16 percent
Equity	Service Classification Total Funding Last 12 years	16 percent
Department goals	Department Goal Goal Points	20 percent

Source: Pennsylvania Aviation Project Priority Evaluation Worksheet

Spreadsheets are developed, projects are ranked, and funding is allocated.

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Passenger Rail

Contact:

Mr. Bob Shellenberger, Passenger Rail, PENNDOT

The State of Pennsylvania has over 700 route miles of Amtrak operations. There are approximately 100 daily trains, which carry 4.2 million passengers annually. The Philadelphia 30th St. Station is the second busiest Amtrak Station in the nation. Amtrak employs approximately 3000 Pennsylvania residents.

Because rail is so important in that state, Pennsylvania has a unique 5-year partnership with Amtrak where each one will provide $70 million. Essentially, this helps Amtrak to make improvements. A 104-mile long track connects the communities of Philadelphia, Lancaster and Harrisburg. The primary focus of this program is to develop that corridor which is known as the Keystone corridor. A new Amtrak station adjacent to the Harrisburg airport is scheduled to go to contract next year.

Amtrak drives the investments made in this program. Their engineers assess priorities and consultants are used as oversight for the DOT. Amtrak utilizes its own labor force. There is specific legislation that exempts Amtrak projects funded through this program from the public bid law process. This allows the Pennsylvania Department of Transportation to "sole source" the construction contracts. A study that assessed ridership, track condition, costs, and ownership led to the development of this program. Copies of the study are not available for distribution.

Pennports

Contact:

Mr. Hebert Packer, Director, Pennports

Pennsylvania has three ports: 1) Eerie which is a Great Lakes port and is closed three months per year; 2) Pittsburgh, a river port; and 3) Philadelphia an ocean port. In addition to those three, it cooperates with the state of New Jersey in the Delaware River Port Authority.

Pennports operates through the Department of Community and Economic Development. This office functions as an advocate for the ports through marketing and

Passenger Rail

Contact:

Mr. Bob Shellenberger, Passenger Rail, PENNDOT

The State of Pennsylvania has over 700 route miles of Amtrak operations. There are approximately 100 daily trains, which carry 4.2 million passengers annually. The Philadelphia 30th St. Station is the second busiest Amtrak Station in the nation. Amtrak employs approximately 3000 Pennsylvania residents.

Because rail is so important in that state, Pennsylvania has a unique 5-year partnership with Amtrak where each one will provide $70 million. Essentially, this helps Amtrak to make improvements. A 104-mile long track connects the communities of Philadelphia, Lancaster and Harrisburg. The primary focus of this program is to develop that corridor which is known as the Keystone corridor. A new Amtrak station adjacent to the Harrisburg airport is scheduled to go to contract next year.

Amtrak drives the investments made in this program. Their engineers assess priorities and consultants are used as oversight for the DOT. Amtrak utilizes its own labor force. There is specific legislation that exempts Amtrak projects funded through this program from the public bid law process. This allows the Pennsylvania Department of Transportation to "sole source" the construction contracts. A study that assessed ridership, track condition, costs, and ownership led to the development of this program. Copies of the study are not available for distribution.

Pennports

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