MULTIMODAL FREIGHT INVESTMENT CRITERIA

Final Report

SPR 662

Oregon Department of Transportation

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by

B. Starr McMullen
Oregon State University
Department of Agriculture and Resource Economics
Corvallis, OR 97331

with contributions from

Ryan Siegel
Rachel Knudson
Nathan Eckstein

for

Oregon Department of Transportation
Research Section
200 Hawthorne Ave. SE, Suite B-240
Salem OR 97301-5192

and

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16. Abstract

Literature was reviewed on multi-modal investment criteria for freight projects, examining measures and techniques for quantifying project benefits and costs, as well as ways to describe the economic importance of freight transportation.

A limited assessment of how investment decisions are made in Oregon was conducted by examining projects selected for the *Connect*Oregon II program (other funding programs exist, which use different approaches in selecting projects – *Connect*Oregon was selected because it is a multimodal program). To compliment the investigation of investment decisions, stakeholder opinions on multimodal freight needs and issues were also solicited.

From the literature review and survey of stakeholders, new and supplemental multimodal freight investment criteria were highlighted.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	millimeters squared	mm^2
ft^2	square feet	0.093	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	kilometers squared	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	ml
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3
NOTE: Volumes greater than 1000 L shall be shown in m^3.				
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit	(F-32)/1.8	Celsius	°C

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
m^2	meters squared	1.196	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	kilometers squared	0.386	square miles	mi^2
		VOLUME		
ml	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celsius	1.8C+32	Fahrenheit	°F

*SI is the symbol for the International System of Measurement

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DISCLAIMER

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1.0 INTRODUCTION

Multimodal freight investment criteria refers to the set of evaluation standards that transportation authorities adopt to guide investment decisions in various freight modes including air, rail, trucking, and water/marine transportation. These investment criteria are often responsible for the prioritization and selection of specific freight improvement projects in long-range transportation plans (LRTP), transportation improvement programs (TIP), and freight-specific investment programs.

For freight projects to become an integral component in the transportation program of a state or a region, they must be recognized and acknowledged through multimodal investment criteria. The National Cooperative Highway Research Program (NCHRP) Report 570 (*NCHRP 2007a*) suggests that the development of freight investment criteria can be accomplished through a variety of activities, and identifies two alternative approaches: basic and advanced.

- The basic approach focuses on simple modifications to the existing project evaluation criteria to better reflect or accommodate freight projects. The objective of this approach is to ensure that freight projects are included in the evaluation process by inserting or changing language to the existing process.

- The advanced approach consists of similar steps to the basic approach, except that it calls for the development and integration of freight-specific evaluation criteria. Instead of modifying existing language to recognize freight, new language will be developed to specifically address freight projects, as well as ensure that transportation projects, in general, recognize the operational and design requirements of freight movements.

Several considerations are critical in the development of multimodal freight investment criteria:

- The investment criteria should reflect the underlying policy goals and objectives as identified in the long-range transportation plan or by decision-makers and freight stakeholders. Typical categories of policy considerations related to freight investment include: safety and security, mobility and system performance, cost effectiveness, economic development, land use and growth management, intermodal and multimodal connectivity, environmental impact, and quality of life. In certain areas, the freight investment criteria may need to be established to improve freight transportation for one or more freight shippers, carriers, and/or customers that are particularly important for the economy of the region.

- Tradeoff decisions need to be strategically made in the freight investment process. As revealed later in this report, many agencies have selected various subjective approaches to cope with multiple investment objectives.

- The successful implementation of freight investment criteria often demands a large amount of information about the current and future freight transportation system characteristics. Existing data sources may not support a very sophisticated set of investment criteria.

- Increasing the technical complexity of the freight investment criteria necessitates greater training (for implementation) and may become more or less practical.

- To ensure freight investment criteria are relevant to the real needs of the freight community, decision-makers and government agencies, outreach and partnership efforts are essential so that the investment criteria are verified and supported by freight stakeholders before implementation.

The purpose of this report is to provide Oregon policymakers with information that can be used to both develop and refine freight investment criteria that are relevant to the achievement of long-range planning goals. Accordingly, in Section 2 the state of the art and state of the practice regarding multimodal freight investment criteria are reviewed to identify universal conceptual, political, and practical issues experienced in the development and implementation of such measures as applied to the freight transportation system.

In Section 3 decision-making process are examined for selection of multimodal freight investment projects from the *Connect*Oregon II program. The purpose of the assessment was to see how well the process for decision-making resulted in alignment of project selection between the various stakeholder groups and decision-makers.

Finally, given the acknowledged importance of designing criteria that are relevant to the needs of the freight community, Oregon freight stakeholders were surveyed to assess the importance of various criteria and also views on where investment would have the greatest impact on the freight system. Results from the survey are presented in Section 4. Summary and conclusions of the study are presented in Section 5.

2.0 LITERATURE REVIEW

The purpose the literature review is to examine both the state-of-the-practice (Section 2.2) and the state-of-the-art (Section 2.3) in multimodal freight investment criteria, with a focus on previous research and practices in the United States.

Since Oregon has recently funded a number of freight transportation projects, through a dedicated non-highway transportation investment program, a note on this report's terminology is necessary. Unless otherwise clarified, "(multimodal) freight investment criteria" indicates all modes of freight transportation including truck movements on roadways; and "non-highway freight investment criteria" implies all freight modes except highways.

It should also be noted that success of the freight investment criteria depends upon the relationship between freight transportation and the economy as well as the various strategies for freight outreach efforts. Though these are important, they will only be briefly reviewed in Section 2.3 of this report.

2.1 BACKGROUND

The Oregon Transportation Commission (OTC) makes decisions about investments on the highways and, to a lesser extent, for other freight-moving modes (e.g., through special funding programs for specific purposes such as rail spur improvements). To guide investment decisions, the OTC has adopted project eligibility criteria and prioritization factors. For example, "projects that support freight mobility" is one of the prioritization factors established for the 2008-2011 Statewide Transportation Improvement Program (STIP). As used for the STIP, projects that support freight mobility are defined as modernization projects on freight routes of statewide or regional significance. These are projects that would remove identified barriers to the safe, reliable, and efficient movement of goods and/or would support multimodal freight transportation movements.

More recently, the OTC has been charged by the Oregon Legislature with making decisions on state-authorized funding for aviation, marine, public transit, and rail projects through the *Connect*Oregon program. *Connect*Oregon I (ORS 367.080), from the 2005 Oregon Legislative session, directed the OTC to consider factors such as transportation cost reduction, multi-modal connections, system efficiency, project costs, and economic benefits, in selecting projects to be funded via the *Connect*Oregon program (*ODOT 2009a*). However these criteria are broadly defined and are often challenging to relate to and assess consistently, highlighting the research need for a data-driven, yet practical procedure, for applying investment criteria and achieving policy objectives. Also of note is the challenge in developing and accessing data for freight performance measures that can be monitored to meet the various criteria of interest.

*Connect*Oregon II (Oregon House Bill 2278) has adopted a set of refined criteria for project prioritization, including:

- Whether a proposed transportation project reduces transportation costs for Oregon businesses or improves access to jobs and sources of labor;
- Whether a proposed transportation project results in an economic benefit to this state;
- Whether a proposed transportation project is a critical link connecting elements of Oregon's transportation system that will measurably improve utilization and efficiency of the system;
- How much of the cost of a proposed transportation project can be borne by the applicant for the grant or loan from any source other than the Multimodal Transportation Fund; and
- Whether a proposed transportation project is ready for construction (House Bill 2278, 2007).

Oregon House Bill 2278 also directs the Oregon Transportation Commission to allocate at least 10% of *Connect*Oregon II funds to each of the five ODOT regions. This is a change from the *Connect*Oregon I legislation, which allocated a minimum of 15% to each region.

*Connect*Oregon III further enhanced the selection process by creating an application scoring system based on quantifiable applicant responses. This method establishes a system of ranks, tiers, and priority levels for every application and provides a numerical score on which project funding requests are prioritized.

Apart from *Connect*Oregon legislation, several Oregon and national freight planning and research initiatives are currently underway. The 2006 Oregon Transportation Plan (OTP) provides guidance on addressing freight's economic importance through an economic vitality goal, as well as calling for ongoing public information and education about transportation needs and funding alternatives (*ODOT 2009b*). ODOT is currently developing the Freight Master Plan, "which will help shape freight policies and future investments in freight transportation systems. The master plan will include further development of criteria and procedures for prioritizing multimodal projects. The new National Cooperative Freight Research Program (NCFRP), sponsored by the US Department of Transportation and managed by the Transportation Research Board (TRB), also identifies freight investment criteria as a key research area" (*ODOT 2009c*).

The Oregon Highway, Aviation, and Rail plans each demonstrate the ways in which planning has been carried out in the state and are all based on previous versions of the Oregon Transportation Plan. The Oregon Highway Plan (*ODOT 1999*) emphasizes efficient management of the system for safety, increased partnerships with regional/local governments, as well as links with other transportation modes. The Plan incorporates a needs analysis, projects revenues, and prioritizes funding towards safety and infrastructure maintenance projects

The Oregon Aviation Plan (*ODA 2008*) reviews the state's current aviation system and guides future aviation development through several policy areas including the preservation of current system, protection of airports from incompatible land uses, airport safety, economic development / market access, intermodal accessibility, compliance with state and federal environmental requirements, modernization and capacity, seeking of funding for airport preservation, advocacy / technical assistance to airports and users, efficient management of state-owned airports. Each policy area then has several action items most of which have to do with educating the public, encouraging collaboration between sectors, inspecting/evaluating practices and investing resources. Airports around the state are evaluated according to their user accessibility (i.e. air and ground accessibility), development (serving existing and future needs of users at according to size of airport), economic support (considering runway length, all-weather accessibility, and other facilities such as a jet refueling station), and safety (particularly connected to nearby land use).

The Oregon Rail Plan (*ODOT 2001*) assesses freight and passenger rail systems as well as the state's planning system itself. The plan outlines the state's goals, measures performance, projects revenues, and determines investment needs for rail transportation of goods and people. The Rail Plan selects relevant goals as well as corresponding policies and actions from the 1997 Oregon Transportation Plan (note that the Rail Plan has not been amended since the adoption of the 2006 Oregon Transportation Plan). The Rail plan follows the suggestion of the Transportation Plan to invest first in maintenance of current transportation facilities, then on development to keep pace with growth, and lastly to address further goals of planning initiatives.

The Oregon Department of Transportation is well placed to conduct multimodal tradeoffs thanks to its culture and technical capacity to conduct multimodal tradeoff analysis. In terms of long-term planning, the Oregon Transportation Plan benefits from the integration of state transportation, land use, and economic models. Furthermore, the state has experience integrating the Highway Economic Requirement System (HERS) with its statewide travel model which permits for useful analyses of Oregon Highway Plan scenarios. ODOT also has facilitated the comparison of alternate travel models through the development of model-based measures including travel cost changes, regional/local economic vitality, and the distribution of benefits/costs (*Cambridge Systematics Inc. 2007*).

2.2 FREIGHT INVESTMENT CRITERIA: STATE OF THE PRACTICE

In view of existing freight transportation problems and/or in anticipation of future freight transportation needs, various government agencies at the federal, regional, state, and local levels have contributed to the advance in freight investment practices. However, it should be recognized that in the area of freight transportation planning, many public agencies are still struggling with freight data collection, archiving, and distribution, while limited attention has been paid to the refinement or the development of freight-specific investment criteria.

2.2.1 Studies on Freight Investment Criteria Funded by Federal Agencies

The following three sub-sections describe efforts at the federal level which have major bearing on considerations around freight investment criteria. The first two sections describe two very relevant documents to this analysis. Indeed, much of this section is based on these two documents. The third and last section discusses the Freight Analysis Framework (FAF) which was designed for various government agencies to obtain current and future freight demand information.

2.2.1.1 NCHRP Report 570: Guidebook for Freight Policy, Planning, and Programming in Small- and Medium-Sized Metropolitan Areas (2007)

NCHRP Report 570 (*2007a*), is a guidebook on freight policy, planning and programming in small- to medium-size metropolitan areas, and recommends practical approaches for metropolitan planning organizations (MPOs) to develop multimodal freight investment criteria. Overall, the study recognized that the development of freight investment criteria should not be an isolated activity within an MPO, but should be combined with a system for freight project identification, the freight element in the Long-Range Transportation Plan, and the development of the Transportation Improvement Program. The two practical approaches identified in the report were the basic approach and the advanced approach.

The identified basic approach centers on the integration of freight considerations into established general transportation evaluation criteria. A five-step strategy is recommended:

1. Review and evaluate existing transportation evaluation criteria.
2. Identify potential language modifications to better integrate or account for freight projects.
3. Identify new data requirements to evaluate proposed freight projects.
4. Refine evaluation process.
5. Implement process as part of next update.

The identified advanced approach separates freight-specific project evaluation criteria from the traditional transportation investment criteria, which focus on highway projects. This approach requires the development of a novel set of investment criteria for multimodal freight transportation only. It is recognized in NCHRP Report 570 (*2007*) that the advanced approach requires additional efforts towards the following: identification and collection of new data requirements; refinement to existing evaluation criteria; development of new criteria; outreach to private partners to verify evaluation criteria; and in the training of freight staff members. A six-step procedure is recommended for the advanced approach:

1. Review and evaluate existing transportation evaluation criteria.
2. Review available freight data, analyses, and projects provided by other activities.

3. Develop stand-alone freight-specific evaluation criteria.
4. Identify new data requirements to evaluate freight projects.
5. Integrate freight evaluation criteria in the transportation project evaluation process.
6. Implement process as part of next update.

The report also identifies three common issues in the development of freight investment criteria including the lack of candidate freight investment projects, the limitation of freight data, and the lack of political will for freight investment. In order to increase freight projects, the report recommends involving the private freight sector to submit projects for consideration. In order to overcome limitations of freight data the report recommends investigating freight data sources. The lack of political will may be overcome through advocates for freight and freight planning. Table 2.1 summarizes these issues and proposed solutions

Table 2.1: Common Issues and Potential Solutions in Developing Multimodal Freight Investment Criteria.

Common Issue	Potential Solution
Lack of freight projects. Many MPOs have not identified and developed freight-specific projects. Freight needs are typically addressed directly or indirectly as part of the overall transportation program. Without a process in place to identify and develop freight projects, it is not feasible to develop freight evaluation criteria.	**Allow the private sector freight community to submit needs and projects for consideration.** The private sector freight community can be an important source of information related to needs and deficiencies and potential freight improvement projects, because they are the primary users of the system and understand its strengths and limitations. In some MPOs, the private sector freight community is allowed to submit projects directly for consideration. The private sector also can be an important resource when developing freight-specific evaluation criteria.
Limitations of freight data. The availability of freight data continues to be a major factor for MPO planning staff when conducting freight planning activities. As a result, the creation of freight evaluation criteria is restricted to those criteria for which data are available.	**Investigate freight data sources.** There are a number of publicly available freight data sources and data techniques that can be useful in developing freight evaluation criteria. State DOTs, FHWA, and other agencies are potential sources of freight data. See the Data and Analytical Tools section of this module for more guidance. In addition, Module 5 includes a list of freight data resources.
Local political will. Many regions have a strong anti-freight political environment. This sentiment often restricts the ability of technical staff within MPOs to expand programs to include freight.	**Develop champions and advocates for freight and freight planning.** Few local decision-makers and general public members understand the link between efficient freight movements and quality of life. Articulating the positive benefits of freight can help create advocacy for freight planning.

Source: *NCHRP 2007a*

2.2.1.2 NCHRP Report 594: Guidebook for Integrating Freight into Transportation Planning and Project Selection Processes

The objective of NCHRP Report 594 (*2007b*) is to develop a framework for incorporating freight needs for all modes into transportation planning and priority programming by state, regional, metropolitan, local, and special transportation agencies. This framework is presented in a guidebook format and illustrated with examples of best practices for considering freight in transportation planning and priority programming decision-making. The report identifies seven elements that are critical to the successful integration of freight issues in the statewide and metropolitan transportation planning and project prioritization process, as well as the best practices:

- Freight point-of-contact/technical lead (i.e. liaison between transportation initiatives/department of transportation and agencies/stakeholders);
- Understanding the statewide or regional freight system;
- Link between freight planning activities and the transportation planning and programming process;
- Freight data needs assessment and collection;
- Effective outreach;
- Taking advantage of training and education opportunities; and
- Advocacy.

In addition, key freight issues are also identified for each of the following four steps in integrating freight into the transportation planning and project prioritization process: needs identification, plan development, project programming, and project development/implementation (see Figure 2.1). A variety of strategies are proposed to address these freight planning and prioritization issues:

Needs Identification Strategies

- Developing a Freight and Industry Profile
- Engaging the Private Sector in the Needs Identification Process
- Conducting a Hotspot or Bottleneck Analysis

Plan Development Strategies

- Identifying Corridors and Facilities of Statewide or Regional Significance
- Developing Freight Performance Measures

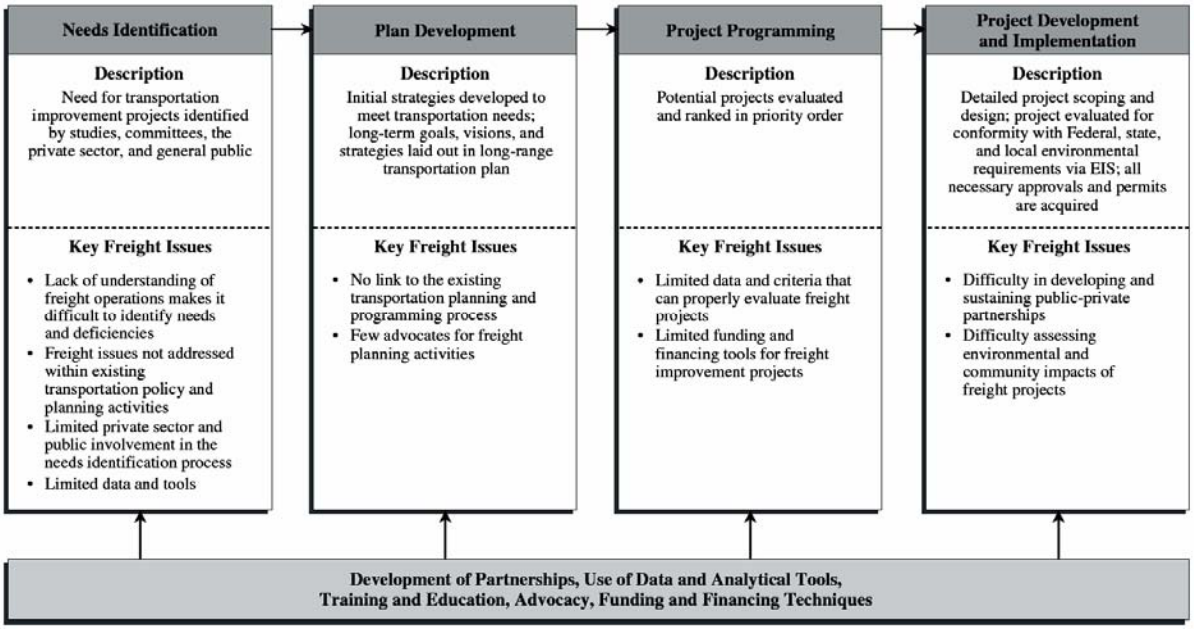
- Linking Freight and Land Use Planning

Project Programming Strategies

- Developing Freight-Specific Evaluation Criteria
- Evaluating Economic and Other Public Benefits of Freight Improvement Projects
- Using Alternative Funding and Financing Approaches

Project Development Strategies

- Addressing NEPA Requirements within Freight Projects
- Incorporating Context-Sensitive Solutions (CSS) into Freight Projects



Source: *NCHRP 2007b*

Figure 2.1: Key Issues with Incorporating Freight within the Transportation Planning Process.

For each of the proposed strategies, the report provides the summary of five elements essential to its success, including an overview of the strategy, key steps, data needs and other supporting resources, case study examples, and techniques to link to the "traditional" planning process. With regard to the development of freight-specific evaluation criteria, data and institutional support are considered the most important factors. The other factors include the support from the private sector and the availability of freight expertise within the agency. The report recommends the following five questions to guide self-evaluation of existing freight investment criteria:

- Are the evaluation criteria multimodal in nature?
- Are economic benefits (e.g., increased jobs, access, and improved market economics) included?
- Are specific measures for truck movements identified?
- How do the evaluation criteria relate to overall DOT or MPO goals and objectives?
- Do the criteria include scoring guidance?

The report suggests that state and local transportation agencies develop freight investment criteria that reflect potential freight, economic, and security benefits of freight projects. In addition, the report provides the following guidance:

- It may be necessary to modify existing criteria or develop new criteria that better reflects the potential freight, economic, and security benefits of freight improvement projects.
- The private sector freight community is an excellent resource that can help determine which measures to focus on.
- It is important to ensure that the final set of freight criteria can be supported by data and information that are relatively easy to collect, analyze, and update. Evaluation criteria that come with overwhelming data collection and analysis requirements will quickly be abandoned.
- Evaluators require scoring guidance to assist then in applying criteria to different types of projects. This is particularly useful for evaluators who may not fully understand the potential effects or benefits of a proposed freight improvement project as it helps them make more informed decisions about transportation investments and gives freight improvement projects a better chance of being selected for funding.
- In addition to traditional freight network supply and demand data, the report also includes freight stakeholder input as a major support resource for the development of freight investment criteria.

2.2.1.3 Other Federal Efforts

The Office of Freight Management and Operations at the U.S. Department of Transportation has developed the Freight Analysis Framework (FAF) for various government agencies to obtain current and future freight demand information. The Freight Analysis Framework integrates data from a variety of sources to estimate commodity flows and related freight transportation activity among states, regions, and major international gateways. The original version, FAF-1, provides estimates for 1998

and forecasts for 2010 and 2020 and using some proprietary data. The new version, FAF-2, provides estimates for 2002 plus forecasts through 2035 and is based on data from the Commodity Flow Survey.

FAF-2 represents a major improvement over the previous version though still has many limitations. While the second-generation framework can estimate flows among multi-county regions it cannot estimate county-to-county flows. On the other hand, it includes all modes (truck, rail, water, air, pipeline) plus two intermodal categories (truck-rail and other). The framework utilizes the Standard Classification of Transported Goods (SCTG) at the 2-digit level to specify trade statistics. This is consistent with what many agencies utilize though does not permit classification of hazardous vs. non-hazardous cargo. The framework's network database is based on the whole National Highway System, however, it does not identify freight (truck) movements within 50 miles. (Schmitt, 2008)

Although FAF was not developed as a freight investment tool, it has been used in federal, regional, and state freight studies to identify highway, rail, water, and air transportation bottlenecks, often in combination with parallel freight network capacity analysis (e.g. the Highway Performance Monitoring Systems, HPMS for highways). The severity of freight transportation congestion at the identified bottlenecks has become the justification for various freight investment projects.

A third generation FAF is currently under development and will likely include modest improvements over FAF-2 (compared to the more fundamental shift between FAF-1 and -2).

2.2.2 Multi-State and State DOT Freight Investment Processes

This section provides examples of approaches and methods used to implement investment criteria around the United States and Canada. All sections except for the first (i.e. Upper Midwest Freight Corridor Study) draw heavily from the NCHRP Report 594.

2.2.2.1 Upper Midwest Freight Corridor Study

The Upper Midwest Freight Corridor Coalition solicited input from transportation administrators in Ohio, Indiana, Michigan, Wisconsin, Illinois, Minnesota, and Iowa, as well as the provinces of Ontario and Manitoba, the Federal Highway Administration (FHWA) and several university researchers to draft an agenda designed to help meet the challenge of freight movement and economic vitality in the Upper Midwest (*Adams et al. 2007*). The agenda identifies six short-term and seven long-term priority initiatives to respond to growing freight demand. The multi-state study includes comprehensive analyses of the capacity of, demands for, and regulations on the multimodal freight transportation system in the region. Ranked number four in the short-term and number one in the long-term was an initiative to support multi-modal bottleneck solutions. This suggests a bottleneck-oriented approach that includes the systematic identification of freight bottlenecks, and providing funding from alternative investment resources to remove bottlenecks. Other investment criteria mentioned in this report include:

- Encouraging intermodal freight by reducing transfer costs (e.g. through containerization at ship yards);

- Considering not only direct revenue for government agencies, but also broader indirect and societal benefits, which implies subsidies to certain freight modes/facilities such as highway-rail crossings;

- Economic benefits of freight as captured by various indicators such as percent of freight-related employment, total freight trade by tonnage and value, contribution to the national economy, imports/exports totals, correlation between freight transportation productivity and GDP, rate of investment returns in freight transportation, freight inventory and transportation costs as a percent of GDP, and cost per ton of freight movement by commodity types.

These proposed investment criteria result from a through examination of the current and future freight supply and demand characteristics of the Upper Midwest region.

The study also makes an interesting comment on certain acts of legislation that may negatively affect the efficiency of freight movement, such as the Jones Act (i.e. Merchant Marine Act of 1920) which requires maritime shippers operating in American waters to use American-made ships. When it was passed, the Act was intended to protect and promote the American shipbuilding industry. The current effect of the act is to dramatically increase the cost of introducing new types of maritime service on inland and coastal waterways due to the requirement that these services be provided by U.S. flag vessels---which must employ U.S. built ships. Since there are no American-built vessels of the type that might be considered for inland waterway service in the pool of used vessels and new American built vessels are expensive, this effectively reduces the probability of using water transportation for freight even if investment is made in the infrastructure.

2.2.2.2 Rhode Island Department of Transportation

The Rhode Island Statewide Planning program (RISPP) staff along with a Technical Advisory Committee (TAC) and representatives from state and local governments, transportation user groups, environmental groups, and the general public, guide the state's transportation planning and programming process. This consortium includes freight representatives from trucking, construction, and economic development groups. Thus, there appears to be a real commitment to including all stakeholders in the decision-making process.

The process of planning starts when the state puts out a call for potential transportation improvement projects that must fit into the goals, objectives, and policies described in one of the state's transportation plans of which there is one for surface transportation, one for freight rail, and one for the airport system. Most proposals come from cities and towns which already are required to have a transportation plan consistent with the State Guide Plan. Of the proposals for the 2005 TIP, there were 137 proposals from 31 cities

and towns (out of a total 39 possible), 3 state agencies, 2 regional authorities, and three private sector transportation service providers (*NCHRP 2007b*).

The TAC then delegates responsibility for proposal review to four regional subcommittees and sometimes an ad hoc special committee such as the case in 2005 when a Rail Subcommittee was formed to review a rail passenger and freight projects. The reviewers evaluate each proposal using a specific set of criteria of the six major categories listed below and assigning scores for each:

- Mobility Benefits
- Cost-Effectiveness
- Economic Development
- Environmental Impact
- Degree of Support to Local and State Goals and Plans
- Safety/Security/Technology

The scoring system involves assessing specific qualitative and quantitative measures for each category using a scale from −5 to 5 (negative values being assigned to indicate negative effects) within each of these six areas. Following scoring by the TAC subcommittees, a prioritized list of recommendations is presented to the full TAC. The full TAC considers funding and develops a recommended draft TIP that is reviewed by the State Planning Council and made available for public comment before final approval (*NHCRP 2007b*).

It is hoped that having a quantitative scoring system with specific criteria will improve the chances that freight projects will be included in the state's TIP.

Scoring guidelines are provided for each criterion for each category as illustrated for the example of Economics Development in Table 2.2.

Table 2.2: Rhode Island DOT's Freight Investment Criteria: Economic Development.

Criterion	Measure(s)	Scoring Guidance
Support of state-designated enterprise zones	Location of project	Project located within an enterprise zone = 5 points All other projects = 0 points
Creation or retention of jobs	Jobs created or retained; or potential for jobs to be created Improved access to employment centers	Points may be deducted for projects that support the relocation of jobs to remote areas not accessible to public transit.
Facilitating movement of goods	Percent truck traffic on affected roadway	8% truck traffic = high 5-8% = medium < 5% = low A high score can be given to projects that have a special role for goods movement, such as any freight rail project or a project serving a freight terminal.
Encouraging tourism	Enhanced access to historical, recreational, cultural, or scenic assets	None.
Benefit to economically disadvantaged populations	Number of low-income residents or employees in project area, measured by percent of state median income	< 50% of state median income = 5 points 50-80% = 3 points 81-99% = 1 point Equal or greater to state median income = 0 points
Results in rehabilitation of brownfield sites, reuse of certified mill building, or is located in state-designated growth center	Project location	Located in state-designated growth center = 5 points

Source: *NCHRP 2007b*

Investment criteria used for all categories as listed in the report's tables are as follows:

- Mobility Benefits;
    - Number of travelers served/volume of freight transported.
    - Level of service improved, congestion reduced or freight service improved.
    - Number of modes provided for linkages between different transportation modes.
    - Regional scale and impact.
    - Mobility provided to transit users and others not using personal motor vehicles.
    - Improvement of user comfort, convenience, or information.

- Cost-Effectiveness
    - Capital cost in proportion to benefit/economic benefit.
    - Innovative or low cost designs.
    - Utilization and preservation of existing infrastructure; maintenance, operating, and capital costs.
    - Potential to leverage Federal funds with public or private investment.
    - Project scale back to achieve cost savings.
- Economic Development
    - Project supports state-designated enterprise zones.
    - Job creation/retention.
    - Facilitation of goods movement.
    - Encourages tourism.
    - Benefits economically disadvantaged populations.
    - Rehabilitates brown field sites; located in state-designated growth center.
- Environmental Impact
    - Improves air quality.
    - Promotes energy conservation.
    - Improves water quality.
    - Protection/enhancement of environmental resources.
    - Preserves/enhances historic district, views/visual appeal.
    - Contributes to greenways.
    - Promotes walkability, bikeability of neighborhoods, community quality of life.
    - Improves urban/village centers/or preserves open spaces.
- Degree of Support to Local and State Goals and Plans.
    - Project is a priority to local government.
    - Past commitment and local funding share.
    - Linkage with other local projects.
    - Cooperation between two or more municipalities.
    - Implements policies of local comprehensive plans regarding housing, land use.

- Implements goals and policies of state transportation plan and other State Guide Plan elements.
- Degree of public support.

- Safety/Security/Technology
  - Improves safety/corrects safety problem.
  - Improves walking/biking safety especially for children and the elderly.
  - Improves evacuation route.
  - Improves diversionary route for interstates and other major roads.
  - Serves hospital or other public safety facility.
  - Enhances ITS network (*NHCRP 2007b*).

2.2.2.3 Minnesota Department of Transportation

The Minnesota Department of Transportation (MnDOT) 2003 Statewide Transportation Plan uses a performance-based planning approach in making investment decisions. In this way, projects were selected which addressed specific performance issues. In order to conduct such evaluations the MnDOT Freight & Commercial Vehicle Operations (OFCVO) reviewed existing measures and their relevance to freight issues. Twenty such measures were identified several of which are included in Table 2.3, categorized by mode. The OFCVO then designed supplemental measures (*NHCRP 2007b*).

Table 2.3: Minnesota DOT's Performance-Based Freight Investment Strategy.

Mode	Measure
Trucking	Percent of miles of highway that meet "good" and "poor" ride quality targets
	Clearance time for incidents, crashes, or hazmats
	Ice and snow removal clearance time
	Percent of major generators with appropriate roadway access to key regional highway corridors
	Peak-period travel time reliability on high-use truck roadways
	Ratio of peak to off-peak travel time
	Heavy truck crash rate
	Number of heavy truck-related fatalities
Rail	Percent of major generators with appropriate rail access
	Total crashes at at-grade rail crossings
	Number of truck-related fatalities at at-grade rail crossings
Air Cargo	Percent of airport runways that meet "good" and "poor" pavement conditions targets
	Percent of air cargo facilities with appropriate roadway and rail access
Intermodal Facilities	Percent of intermodal facilities with appropriate roadway and rail access

Source: *NHCRP 2007b*

These measures were then connected to the policies and strategies contained in the 2005 Statewide Freight Plan, which was designed as a consequence of the 2003 Statewide Transportation Plan and its indication of the state's commitment to freight. Minnesota's Freight Plan guides decision-making by providing "recommended freight policies, strategies, and performance measures" (*MDOT 2005*). The Plan draws from the vision laid out in the statewide freight policy to outline six policy directions and several sub-strategies defined (as well as several measures/indicators). The following list outlines the policy directions and sub-strategies (*MDOT 2005*):

1. Improve the Condition, Connectivity, and Capacity of Statewide Freight Infrastructure
    - Support improvements needed on roadways with significant truck volumes, in particular, bridge and pavement deficiencies affecting trucks.
    - Structure Mn/DOT's freight assistance programs to achieve performance targets and assess benefits and costs.
    - Improve the efficiency, condition, and capacity of intermodal terminals (ports, truck-rail terminals).
    - Support efforts to develop a statewide interconnected 10-ton roadway system to serve major freight facilities.

- Pursue National Highway System Intermodal Connector designation for significant connectors.
- Evaluate railroad shuttle train trends to determine impacts on shippers and railroads; structure rail assistance and road system strategies to respond, as appropriate.

2. Improve the Condition, Connectivity, and Capacity of National and International Freight Infrastructure Serving Minnesota
    - Eliminate bottlenecks and improve national trade highways that serve Minnesota.
    - Eliminate bottlenecks on national rail corridors serving Minnesota
    - Improve intermodal container service to accommodate long haul movements
    - Establish an international air cargo regional distribution center to support direct
    - International service.
    - Support increased capacity at Upper Mississippi River locks and the Great Lakes' Sault Ste. Marie locks.
    - Support a study of the St. Lawrence Seaway and Welland Canal locks for accommodating large international ships.
3. Enhance the Operational Performance and Safety of Statewide Freight Systems
    - Address performance needs on roads with significant truck volumes
    - Continue to improve railroad crossings
    - Develop and implement a heavy truck safety program
    - Implement ITS and operational strategies to improve freight mobility
    - Assess and improve parking for commercial vehicles on major roads
4. Enhance Integration of Freight into Regional and State Transportation Planning and Investment Decisions
    - Develop and monitor performance measure and targets for freight system
    - Strengthen role of freight in investment and planning decisions
    - Provide technical and other assistant to other transportation organizations to improve freight planning
    - Continue coordination with FHA on strategies for improving freight transportation
    - Continue research programs on freight issues, trends and solutions

5. Strengthen Partnerships to Address Significant Freight Issues
    - Strengthen public sector partnerships to advance freight policies, strategies, and tools
    - Promote regional and local development to improve compatibility of freight facilities with adjacent land uses.
    - Continue to participate in shipper/carrier forums to address industry issues, needs, and public policies and regulations
    - Participate in multistate and U.S. border coalitions to improve border security and reduce delay
    - Participate in multistate coalitions to develop regional approaches to freight system improvements
    - Seek private-public partnerships for innovation finance solutions
6. Streamline and Improve the Effectiveness of Motor Carrier Regulatory Activities.
    - Develop and implement statewide Strategic Commercial Vehicle Weight Enforcement Program
    - Develop new technologies to improve compliance with commercial weight laws
    - Examine costs and benefits of changes in size and weight regulations
    - Examine size and weight regulations between Minnesota and adjacent jurisdictions and change accordingly
    - Develop technologies and initiatives to expedite transactions between motor carriers and regulatory agencies
    - Structure motor carrier safety programs to achieve performance targets, assess costs and benefits and coordinate across jurisdictions.

2.2.2.4 Texas Department of Transportation and the Trans-Texas Corridor

The "Trans-Texas Corridors" is a multimodal project the idea for which came from a University of Texas professor who sought to find a better and more integrated solution for the State's increasing transportation congestion. The idea for the project made its way through the legislature and eventually won the support of the state Governor and Texas Transportation Commission. In 2003 and 2005 legislation passed which enabled the Texas Department of Transportation (TxDOT) to implement the project. (*TxDOT 2008*).

Several models help forecast transportation demand, estimate the economic benefits of various policy options, and find the optimal arrangement in the Trans-Texas Corridors. The Statewide Analysis Model (SAM) analyzes five modal networks, includes travel demand models for various regions, and is used to find which site would be optimal for the proposed Trans-Texas Corridors. The SAM results are then utilized as inputs for the Regional Economic Models Inc. (REMI) which estimates each alternative's economic

impacts. The Rail Traffic Controller Model is used to "compare a base case freight system with alternatives" according to various performance indicators such as "delay reduction, reduced shipment cost, accessibility, and utilization." These results can also be fed into the REMI in order to generate the economic impacts of each alternative.

While these models can be used to estimate very relevant information for decision-making, there exist some limitations. The SAM, for example, depends on proprietary data from freight shippers and cannot produce effective comparisons between modes (e.g. whether a rail or highway investment would be most effective). While the SAM works well in estimating highway improvement benefits, it does not work as well for rail. The REMI provides useful figures on economic impacts (e.g. jobs, gross regional product) resulting from segments of the Trans-Texas Corridors. However, it cannot distinguish changes made at a sub-county level (e.g. alignment options which vary by a few miles within a county).

2.2.2.5 Florida Department of Transportation

Florida's 2020 Transportation Plan sought to establish a transportation system that would work effectively for the economy as a whole. This system would be called the Strategic Intermodal System and would function effectively both in terms of the movements of goods and people. The development of this approach/perspective represented a fundamental shift in the way transportation investments were viewed in the past.

The SIS Strategic Plan outlined the process through which SIS investments would be decided upon and was divided into three stages. First, the Florida DOT determines investment needs based on the transportation system's performance relative the SIS goals. Second, the Florida DOT partners gather detailed information regarding each potential investment in order to be able to prioritize funding. Third, the Florida DOT selects projects for funding in its 5-year work program.

The first step creates the SIS Needs Plan which is a list of candidate multimodal investment projects proposed by FDOT, its local offices, and partners. These projects are then evaluated using the following broadly-defined SIS goals:

- Safety: A safer and more secure transportation system for residents, businesses and visitors
- Preservation: Effective preservation and management of Florida's transportation facilities and services
- Mobility: Increased mobility for people and for freight and efficient operations of Florida's transportation system
- Economic: Enhanced economic competitiveness and economic diversification
- Community and Environment: Enriched quality of life and responsible environmental stewardship

Florida's experience highlights how a decision-making process can include multiple objectives, successfully consider freight projects, and develop useful partnerships with the private sector as well as with district offices and local partners.

As is noted above, the FDOT uses essentially a bottom-up approach to ranking projects (i.e. districts identify needs, develop project ideas, rank projects, and present lists by mode to the Central Office). However, in the final step the Department must make funding decisions based on the best information available. According to the NHCRP report (*2007b*) FDOT is in the process of figuring out how to ensure comparisons can be made for projects of different modes. Although the Department has some data (e.g. vehicle counts and classification data) it does not yet have any performance measures for freight. It is interesting to note that the Department staff is not only struggling to find get the necessary data, they have also struggled in identifying what data is needed. In addition, the Department lacks the tools to compute benefits and costs for all types of transportation projects. It does not appear from the NHCRP document (*ibid.*) that any formal mechanism or model is used to rank projects.

2.2.2.6 Washington State Department of Transportation

Created in 2001 by the Washington Department of Transportation (WSDOT), the Freight Strategy and Policy Office develops freight investment plans and advocates freight investment in the State's transportation program. The office collects relevant data/information and connects with the firms in the private freight sector (*NHCRP 2007b*).

In 2007, 200 interviews had already been conducted with industry participants including high-volume shippers and carriers. These interviews have provided valuable information to WSDOT in the development of investment criteria, and the identification of the economic benefits of freight investment. For instance, during the interview process, it was found that a large semiconductor facility couldn't function without fast and reliable air cargo; if a certain tool was delayed overnight from across the Pacific, the plant would shut down and idle one thousand employees. Beyond increasing useful information and in-house expertise, the interviews have also helped foster better relationships with industry partners (*WSDOT 2008*).

Two key agencies the WSDOT works with include the Washington State Transportation Center (TRAC) and the Freight Mobility Strategic Investment Board (FMSIB). The TRAC provides the state with research capabilities. The FMSIB was established in 1998 and recommend freight improvement projects to the state. The Board includes representatives from WSDOT, local governments, Governor's office, and private industry (*NHCRP 2007b*).

The FMSIB has established a process to receive project recommendation and rank those that are available. In order for a project to be considered it must be included in an established regional or state transportation plan; fall under one of the state's Strategic Freight Corridors or emerging corridors; provide at least a 35% match in funds (*Ibid*).

Once projects have been accepted for consideration the FMSIB evaluates them using 10 categories. The criteria include both quantitative and qualitative measures. Tables 2.4 and 2.5 describe the criteria, measures, and scoring guidance for the criterion "General Mobility" and "Freight and Economic Value" as examples. The ten categories are as follows (*NHCRP 2007b*):

1. Freight mobility for the project area;
2. Freight mobility for the region, state, and nation;
3. General mobility;
4. Safety;
5. Freight and economic value;
6. Environment;
7. Partnerships;
8. Consistency with regional and state plans;
9. Cost [project implementation]; and
10. Special issues.

Table 2.4: Washington State FMSIB Freight Investment Criteria: General Mobility.

Criteria	Scoring
Reduce vehicular traffic delay	0-10 points
Reduce queuing and backups	0-7 points
Reduce delay from use of alternative railroad crossing	0-5 points
Address urban principal arterials	3 points for urban principal arterial 0 points for all other
TOTAL	**25 points possible**

Source: *NHCRP 2007b*

Table 2.5: Washington State FMSIB Freight Investment Criteria: Freight and Economic Value.

Criteria	Scoring
Benefit mainline rail operations	High: 5 points Moderate: 3 points Minimal: 1 point Negligible: 0 points
Access to key employment areas	0-5 points
Support faster train movements	0-5 points
TOTAL	**15 points possible**

Source: *NHCRP 2007b*

2.2.3 Freight Investment Criteria at the Regional and Local Levels

The following cases examine how freight investment criteria are being applied at regional and local levels. Both case summaries identify insights regarding the approach to decision-making.

2.2.3.1 Toledo, Ohio

The Toledo Metropolitan Area Council of Governments (TMACOG) is a voluntary organization established in 1968 which promotes a positive perspective of the region, enhances "awareness of its [the region's] assets and opportunities", provides "stakeholders a voice in regional decision-making," and supports "opportunities for Regional stakeholder networking" (*NHCRP 2007b*).

The TMACOG presents an example for how planning is modified when freight planning is viewed to be just as important as passenger/transit planning. Not only does the TMACOG ensure personal connections with the freight industry, but it also integrates the importance for freight in its decision-making criteria. For example, its 2006-2009 TIP makes use of a scoring guide which includes several "prioritization factors." One of these is the "multimodal factor" which accounts for 15 out of the 100 available points given to a project. Another factor is that for "System Use and Performance," which "includes points for truck impact routes". However, despite the use of such freight-specific points, "project ranking criteria still lean to heavier traffic facilities" and so issues of freight vs. people remain (*ibid*).

2.2.3.2 Delaware Valley Regional Planning Commission (DVRPC)

The Delaware Valley Regional Planning Commission (DVRPC) is the metropolitan planning organization for the Greater Philadelphia/Camden region which is actively concerned with freight transportation. The DVRPC demonstrates how freight needs can be formally integrated into a state's transportation planning process as well as how effective partnerships between private industry and government can be formed to generate useful information and trust.

Their planning process is, first of all, aimed at several goals, several of which are freight-specific. The process is also guided by the Goods Movement Task Force which engages the private sector in a needs-assessment. This field work feeds into the TIP which is developed every one to two years. Although potential projects are evaluated by the Regional Transportation Committee, the Goods Movement Task Force acts as a nonvoting member which justifies inclusion of freight projects in the TIP. Before implementation the TIP must be approved by FHWA and the Federal Transit Authority.

2.3 FREIGHT INVESTMENT CRITERIA: STATE OF THE ART

The review of the state-of-the-practice shows that the freight investment criteria developed and adopted by transportation funding agencies, at various levels, represent a conservative and incremental approach to integrated freight projects into the traditional transportation planning process. These practical investment criteria in general are less rigorous, less quantitative, and more heuristic than criteria seen in research articles in archived journals. However, the criteria representing the state-of-the-practice also have less data requirement and broader applicability.

In contrast, the state-of-the-art freight investment procedures, often developed by university researchers, tends to be very comprehensive, require good data availability, significant agency commitment, and additional training needs if adopted by state DOTs or other agencies. In addition, the freight investment procedures developed in various research projects often involve certain simplifying assumptions. It is interesting to note that the various reports on surface transportation investment published by the Government Accountability Office (*GAO 1996, 2001, 2004*) actually recommend more systematic analytical approaches to freight investment.

2.3.1 Multimodal Tradeoff Analysis Framework

The purpose of the NCHRP Project 8-36, Task 7, Phase I was to develop a structured approach for investment tradeoff analysis at the state level and apply it using hypothetical tradeoff situations. The results of this (sub) project should assist decision-makers outline consequences of various investment scenarios. The approach is applicable at the programmatic, corridor, and project levels (*Cambridge Systematics 2004*).

The purpose of the Phase II project, on the other hand, was to apply the approach to a real-world situation and document what was learned about the methodology. Two cases were utilized in this phase: one dealing with the Washington State ferry system and another with improvement alternatives in the suburbs east of Seattle.

Although these applications do not consider projects across freight modes, the framework could be extended for tradeoff analysis and into a set of investment criteria, measures, and scoring guidance for multimodal freight investment decision-making.

The following are the essential elements of a tradeoff analysis as identified in Phase I/II:

- Clearly defined “program areas” (i.e., defining what the tradeoff is between);

- For each area, clearly defined performance objectives, evaluation criteria, or impact categories that define the "consequences" of different levels of investment in the area;

- For each area, some method to relate the level of investment in that area to the resulting consequences in that area; and

- Some method for comparing or "equating" the consequences generated by each program area as a result of a specific allocation of resources between the areas.

Figure 2.2 shows the high-level conceptual framework for multimodal tradeoff analysis developed in Phase I. The figure shows that many program/resource areas can be compared and that objectives/criteria need be defined for each program/resource area. "Vertical alignment" indicates that objectives and criteria are suitable to the program/resource area whereas "horizontal alignment" is required to ensure that areas are comparable.

The following lists the five-step evaluation process which the analyst must complete in order to effectively create a successful tradeoff analysis procedure:

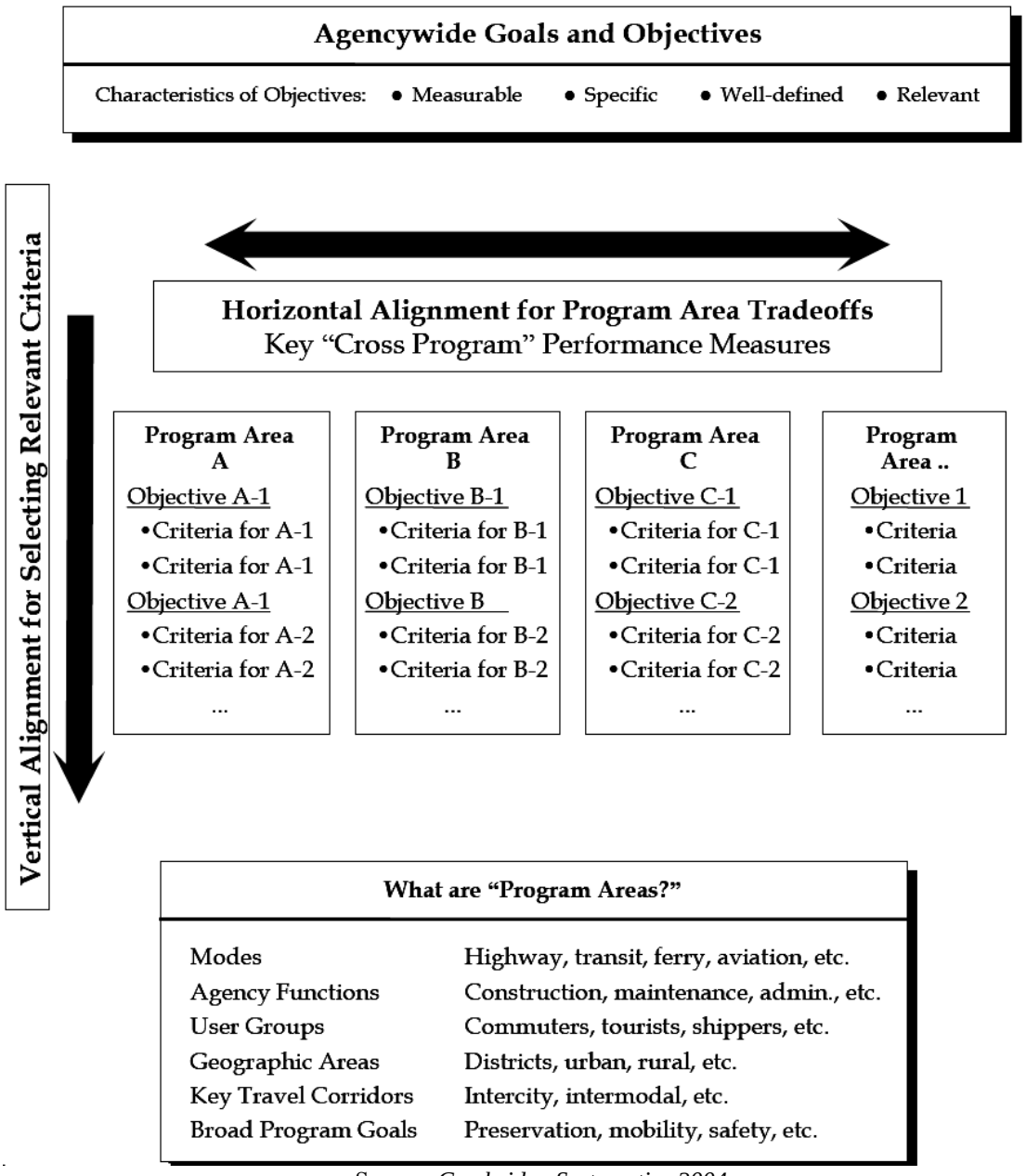
- Step A – Establish Structure for Inter-Program Analysis

- Step B – Establish Structure for Intra-Program Analysis

- Step C – Identify Program Areas of Interest

- Step D – Apply Analysis Procedures
    - D1 – Establish current levels of performance
    - D2 – Identify alternative future funding levels
    - D3 – Analyze individual programs for each alternative future funding level
    - D4 – Analyze inter-program effects for each alternative future funding level

- Step E – Present Tradeoff Information



Source: *Cambridge Systematics 2004*

Figure 2.2: A Generalized Framework for a Tradeoff Analysis.

The multimodal tradeoff analysis framework, when applied to real-world scenarios, often requires the identification and development of detailed investment objectives/goals, criteria, performance measures, and subjective scoring and weighting systems. However, the tradeoff analysis framework defines the key concepts and elements involved in the multi-objective decision-making process.

It should be noted that the multimodal tradeoff analysis framework has not been tested for program-level freight investment analysis (e.g. *Connect*Oregon is a program-level freight investment effort).

2.3.2 Multimodal Investment Choice Analysis

Washington State DOT (*Young, et al. 2002*) has developed the Multimodal Investment Choice Analysis (MICA) program for freight investment analysis. The purpose of the MICA is to "summarize the multimodal budgetary tradeoffs that will result from varying funding allocation and priority scenarios." This model could potentially serve as the needed program-level performance measures tool.

MICA is a multimodal decision-making tool able to handle a wide variety of projects (e.g., capacity enhancement, preservation, etc.). To use MICA, the analyst enters information at three levels: project level, scenario level, and scenario comparison.

To use MICA, the analyst first identifies the set of relevant multimodal projects. The analyst then enters information for each project on three categories: project benefits, project costs, and outcome objectives. It is important to note that while specific estimation methodologies vary between project types (e.g. highway and sea shipping projects necessitate different environmental impact methodologies), the program's output is comparable across projects. The project-level analysis produces both monetary and non-monetary measures. Monetary benefits include operating impacts (i.e. travel time/user costs), environmental impacts (i.e. changes in vehicle emissions and benefits from environmental retrofit projects), and safety impacts (i.e. social cost of accidents). The measures may be positive/negative, direct/indirect and negligible/significant. Monetary costs include capital, operation/maintenance, terminal value, and environmental retrofit costs. These monetary measures are combined using net present values into cost-efficiency measures such as a cost-benefit ratio. Non-monetary measures include the user operating, environmental, and safety impacts listed above, except in non-monetary terms (e.g. safety impacts would include the change in the number of fatal accidents). In addition "Outcome Objective" worksheets ask the analyst a series of questions which are translated into scores (0 to 100) for each of the seventeen outcome areas developed in the Washington Transportation Plan by the Washington State DOT Planning Office.

At the scenario level, the analyst must first select those projects to be included in the analysis. These may be defined by mode and/or geography. The analyst then sets a budget level and decides whether and how to allot monies by region and/or program. The analyst must also set priorities for optimization as well as the relative weights of selected categories (e.g. "benefit cost ratio at 65% and tourism outcome objective scores at 35%", ibid.). MICA then takes data from the project level inputs/calculations and uses a linear programming model to rank all the projects using a linear programming model based on the project analysis as well as the user-defined weights for the various performance measures and budget level/allocation.

The analyst may finally create scenario comparisons once several scenarios have been developed. This is a simple operation that compiles calculated scenario measures into a comparison report. In this way decision-makers can see how changing parameters can affect the optimal project list in monetary and non- monetary terms.

While this approach provides a prioritized list of multimodal investment projects, it may be criticized on the significant reliance on expert knowledge and inputs, while the value of objective data and information is not fully explored. Since the MICA model contains a pre-

determined set of performance measures, the analyst can only choose to include a subset of these measures in a particular analysis. However, MICA cannot include any performances measures outside its pre-programmed set. This could be a shortcoming for generalized multimodal tradeoff analyses, because decision-makers may prefer to include measures not included in MICA, e.g. regional equity.

2.3.3 Technique for Order Preference by Similarity to an Ideal Solution

The University of California Davis created a tool for the Oregon Department of Transportation (ODOT) to rank multimodal mobility improvement projects among a predetermined set. First the user must evaluate projects using a set of criteria (e.g. cost efficiency and modal integration), and then the tool evaluates final scores using a modified TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) ranking algorithm (*Franklin and Niemeier 1998*).

Seven evaluation criteria are utilized in the model. Each criterion has certain data and methodological requirements. The tool computes a numerical score for each area and then a final weighted score for the project as a whole. The evaluation criteria are as follows (*Franklin and Niemeier 1998*):

- Ratio between Net Present Value and Cost (NPV/C ratio)
- Land Use
    - 1a. Compatibility with local land use plans
    - 1b. Growth management
- Environment and Resource
- Economic Development
    - 3a. Whether or not the surrounding region was considered distressed,
    - 3b. Whether or not the improvement project supported a regional transportation strategy
    - 3c. Direct use of the distress measure computed by the Oregon Development Department.
- Multimodalism
    - 4a. Multimodal and intermodal connectivity offered by the project
    - 4b. The expansion of mode choice
- Community Support
- Accessibility
    - 6a. Minimum level of service
    - 6b. Basic standards for minimum tolerable conditions.

After the weights for each performance measure and scores for each candidate project are determined, the TOPSIS ranking algorithm ranks all projects to produce a prioritized list. The TOPSIS-6 ranking procedure includes six steps (*Ibid*):

1. Project Scoring
2. Normalizing Scores
3. Weighting Scores
4. Determining Ideal Projects
5. Ranking Projects
6. Selecting Funded Projects.

The first three steps are fairly self-explanatory. An explanation of Step 4 is as follows: "to evaluate the projects on the basis of all of the criteria, TOPSIS defines two theoretical 'Ideal' projects that represent the best and worst projects possible, and act as benchmarks against which the submitted projects are compared. These best and worst projects are respectively known as the 'Ideal Positive' and 'Ideal Negative' projects. The Ideal Positive project's score in each criterion is established by finding the best score in that criterion from the submitted projects and giving that score to the Ideal Positive project; similarly, the worst score out of the submitted projects' scores is given to the Ideal Negative project. The actual scores of the Ideal Positive and Negative projects will depend on the group of projects being evaluated and are recalculated each time a new set of projects is evaluated" (*Franklin and Niemeier 1998*).

Steps 5 and 6 are relatively simple. In step 5 projects are distanced from the "Ideal Positive" and "Ideal Negative" using "separation measures" (which utilize a version of the Pythagorean theorem). Once these distances are calculated, projects are ranked using a priority index which is equal to the ratio of the distance to the Ideal Negative to the sum of the two distances (to Ideal Negative and Ideal Positive). In step 6 the algorithm selects projects to fund according to their priority index and whether or not a budget constraint has been exceeded (i.e. the algorithm selects each project according to its ranking, "funds" the project if funds are available, selects the next ranked project, "funds" the project if funds are available, etc. (*Ibid*)).

2.3.4 Simulation Tools for Multimodal Freight Investment Analysis

A major challenge facing transportation planners is the lack of rich, detailed data in order to make better decisions. A paper written by Zhang, et al. (*2003*) responds to this need by exploring and defining a methodology to do statewide freight transportation planning using public-domain data. The authors not only explore the relevant datasets, but also present a methodology to infer more detailed pieces of data as well as a way to utilize the data in a simulation model.

The authors of the study use several publically available databases to compile the necessary data to conduct freight investment simulations for the state of Mississippi. The Commodity Flow Survey (CFS) shines prominently as the most cost-effective and flexible database. Other

databases used include the Vehicle Inventory and Use Survey (VIUS) and the Cargo Density Database (CDD). All of these datasets could be combined to gather/infer pieces of data such as freight flows coming into, going out of, and going through Mississippi (*Zhang, et al. 2003*).

The Virtual Intermodal Transportation Simulation VITS was created by the authors in order to "demonstrate the feasibility of using [a] simulation to aid in the planning and design process" (ibid.). The VITS is not a decision-making tool, per se. That is to say, it does not rank projects according to certain criteria nor does model tradeoffs under a completely specified model. Instead, the VITS can be used to simulate the effects of changes on various parameters of the model, which may, in turn, assist in decision-making. The model is based on the CFS, VIUS, CDD data sets mentioned above as well as their derivatives (e.g. county level demand using CFS and Census data). The model simulates the movement of trucks, trains, barges, ships, and freight transference between modes. It also includes various parameters such as the transportation network itself, fuel efficiencies, speed limits, and road capacity. The model was used, for example, to forecast transportation demand in 2005, 2010, and 2020 (*Zhang et al. 2003*).

Reiff and Gregor (*2005*) conclude that many metropolitan areas lack performance measures to effectively examine their policy goals. Furthermore, they explore the use of various simulation models to produce such measures. Among the models they examine is Oregon's Statewide Model which could be used to examine the effects of projects on economic vitality.

Oregon's 2nd Generation Statewide Model which integrates economic, land use, and transportation elements. The purpose of the Statewide Model is to "adequately and practically support the analysis of a diversity of relevant issues, impacts and policies" (*Hunt et al. 2001*). The second generation Statewide Model made use of the lessons learned from the previous version as well as low-cost computing power to produce a more comprehensive model. The model spans all of Oregon (and portions of surrounding states), is sectionalized at the smallest level according to grid cells (30x30 meters in or near built-up areas and 300x300 meters in wide-open spaces), is dynamic, and models complex system behavior using seven separate but interconnected modules. The modules include one that estimates regional economics and demographics, another simulates production allocations and interactions, and yet another arranges household travel. Each module uses a different methodology but receives input from other modules. For example, some modules use agent-based modeling whereas others use linear programming to find an optimal solution (*Hunt et al. 2001*). The model has been utilized to simulate changes in model parameters such as increased highway capacity as well as increased driving costs and their effects on aspects such as travel time, travel distance, employment (by region), and even floor space (*Gregor et al. 2009*).

2.4 FREIGHT AND THE ECONOMY

In order to improve decision-making it is important to examine the connection between freight investments and the economy. On the one hand, understanding this connection enables decision-makers to see how investments in freight transportation systems can lead to overall improvements in economic wellbeing. On the other hand, economics may inform the way in which decision-making takes place by ensuring a clear understanding of benefits and costs of

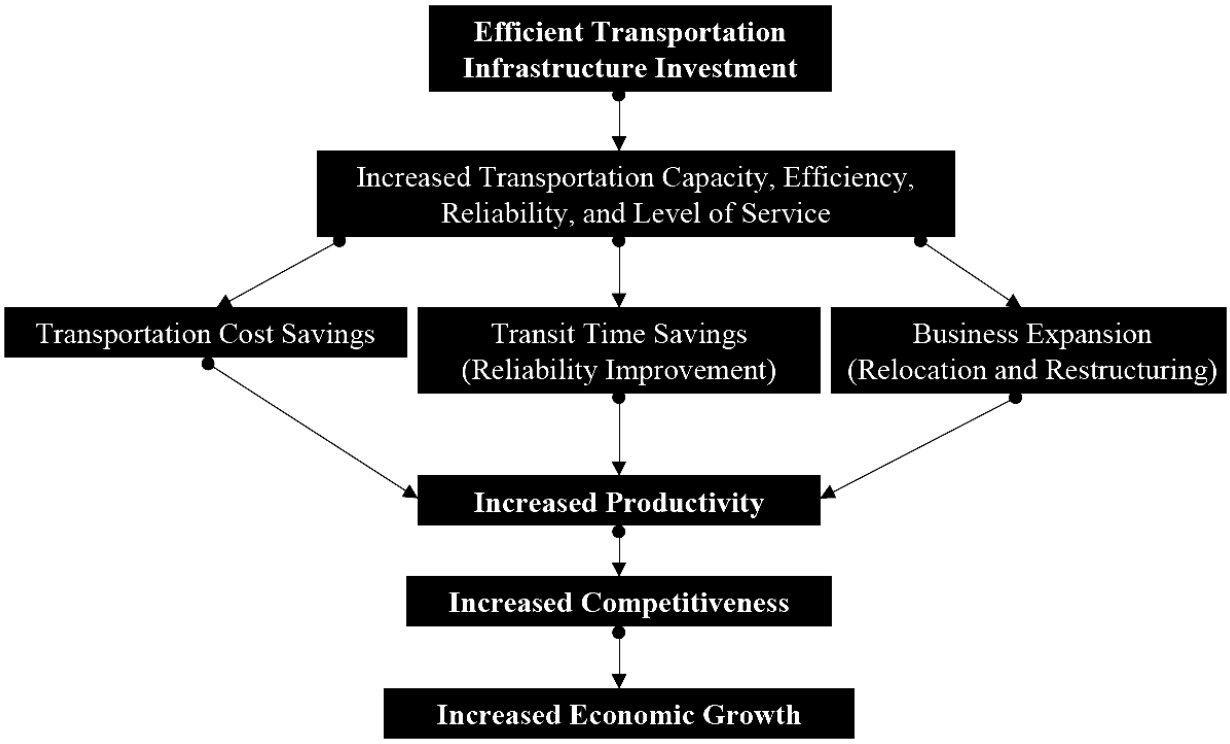
certain actions. The following sections sketch how investments can improve the economy as well as how public involvement should best proceed, particularly in the face of limited resources.

2.4.1 Economic Theory Linking Transportation Investments and the Economy

The benefits of freight transportation to the economy are enormous. Freight transportation increases the value of goods by moving them to locations where they are worth more and encourages competition and production by extending the spatial boundaries of commodity and labor markets. Freight transportation also stimulates demand for goods and services and employs millions of people. Freight transportation infrastructure is a significant component of our nation's wealth and productive capacity.

Figure 2.3 "illustrates how investments in transportation infrastructure can lead to generative effects and growth in the national economy. Although improvements in passenger transportation have important economic ramifications, freight transportation enhancements that reduce the costs of moving goods (and services) to and from markets are critical to economic expansion. This is because the movement of goods is what economists term a factor input in the production of goods. Much like labor and capital, transportation costs affect directly the price of goods and services and the profits of producers. Consequently, investments that reduce the cost of moving goods to and from markets (via improvements in reliability, transit times, service levels, etc.) can help to increase and sustain economic growth. In effect, the efficiency and reliability of the freight transportation system affects economic productivity, and many economists would argue that productivity is the most important determinant of economic performance" (*ICF and HLB 2002*).

ICF and HLB identify several economic effects of improved freight transportation. The first-order benefits of freight investment result from the "immediate cost reductions to carriers and shippers, including gains to shippers from reduced transit times and increased reliability" (*ICF and HLB 2002*). The second-order benefits involve reorganization-effect gains from "improvements in logistics" as well as changes in the quantity of firms' outputs. Third-order benefits include gains "from additional reorganization effects such as improved products, new products, or some other change." Other economic effects include "increases in regional employment or increases in [the] rate of growth of regional income" (*ibid*).



Source: *ICF and HLB, 2002*

Figure 2.3: Transportation Investment and Economic Growth.

Economists link transportation to economic growth in at least three ways. Using a macroeconomic view, economists find correlations linking economic indicators to transportation investment and efficiency. A more microeconomic view sheds light on how companies respond to better transportation systems. Yet another view is to utilize an equilibrium model which may demonstrate that better transportation leads to economic specialization, which leads to trade, which leads to greater material prosperity (*Adams et al. 2007*).

From a macroeconomic perspective, transportation accounts for a significant share of the U.S. Gross Domestic Products (GDP). In 2006, purchases of transportation-related goods and services accounted for approximately 10.6% of GDP. For-hire transportation services, which include warehousing, contributed about 2.9% (or $366 billion current dollars) to GDP during the same year (*BTS 2008*).

2.4.2 Public Involvement in Private Freight

Freight transportation also contributes to the economy by providing jobs to millions of people—an important indicator of economic growth. In 2006, 13.2 million people were employed in transportation-related industries, including for-hire services, vehicle manufacturing, and parts suppliers among others. Of that total, for-hire transportation (including warehousing) employed 4.5 million workers, 1.4 million of whom worked in truck transportation jobs (*BTS 2008).*

Improvements in freight productivity help the United States maintain its competitive position in the world economy. The Bureau of Labor Statistics reports that productivity (output per hour) for

the air transportation, line-haul railroads, general freight trucking (long distance), as well as warehousing/storage has improved between 1987 and 2006. Line-haul railroads have posted the most impressive gains (4.8%) followed by air transportation (3%) and then general long-distance freight trucking (1.4%) (*BLS 2008*). Improvements in railroad productivity resulted primarily from deregulation, divestiture of uneconomic lines, reductions in labor force, and changes in technology and logistics. Productivity improvements in trucking over time have resulted partially from public investments in a high quality national road network (*McMullen 2000b*) and changes in marketing strategies and motor carrier operations that took place following the Motor Carrier Act of 1980 (*Corsi et al 1991; McMullen and Okuyama 2000a; McMullen 2004*).

A study by Cambridge Systematics (*2004*) for the Port of Portland examines the potential public sector's involvement in Oregon's freight-rail system. While the report is specifically focused on freight rail and the Oregon economy, it provides some useful insights into the way that institutions can meet policy objectives while collaborating with market players. The report thoroughly explores the current situation, examines upcoming issues, and outlines economic consequences. Two themes run throughout the consequences: (1) increased rail/road congestion reduces competitiveness against alternative rail routes and (2) rail congestion or ineffectiveness implies greater use of freight on public roads. Also of note is the way in which the report uses data to identify bottlenecks and issues facing different sectors of the Oregon economy—this points to the value of information in appropriate decision-making.

An important justification for public-sector freight investment in private as well as non-revenue modes is the broader economic benefits not directly enjoyed by the investors. Therefore, the public sector should share in costs in proportion to the public and non-public benefit. This concept was recently affirmed by the Government Accountability Office in their review of the proposed expansion of the federal role in short sea shipping: "When public subsidization is being considered for freight infrastructure projects—which to a large degree would likely benefit the private sector—the appropriate scope of government involvement must be considered carefully. Apportioning the cost burden of freight projects among participants equitably is important not only to guard against the waste of limited public resources but also to enhance the efficiency of the transportation system by supporting only the most worthy projects" (*GAO 2005*).

Dahlgren (*1998*) shares many important insights regarding benefit/cost and performance measures as applied to transportation. For example, transportation jobs and investment costs, which are often considered benefits may actually be social costs if they are resources diverted from alternate uses (i.e. in many cases there is an opportunity cost to devoting resources to transportation). In addition, actual benefits and costs resulting from policies may be difficult to measure so indicators must often be used instead. Since management and collection of performance measures is expensive, the quantity and type of performance measures should be limited to those which support the goals of the planning agency. Dahlgren also points out that while a performance measure system is often needed to keep track of improvements and make decisions, ad-hoc studies may be appropriate at other times.

Several studies have been conducted to attempt measurement of the benefits of freight investments. A recent economic impact study of the St. Lawrence Seaway System estimated the revenue benefit to the US economy to be $3.4 billion, personal income and consumption benefit

of $4.3 billion and federal state and local tax revenue of $1.3 billion per year (*Martin Associates 2001*). The study examined growth patterns for the system from 1991 to 2000 and found constant expansion in jobs, revenue, tonnage, and economic indicators for the decade. A number of studies have been done on the environmental benefits of marine transportation (*USDOT 1994*). Specific studies on the Great Lakes marine transportation system provides clear evidence that the environmental benefits of marine transportation on the area are significant (*Minnesota DOT 1991*).

2.4.3 Benefit Cost Analysis

Investment decisions are often informed by an analysis of the benefits and costs of investment options. The comparison of benefits to costs can take many forms, however. For example, one can utilize the ratio of benefits to costs (benefits divided by cost) or the difference between benefits and costs (benefits minus costs). Alternatively, one may examine the benefits achieved given a certain cost or, conversely, the cost required to achieve a certain outcome/benefit. The appropriateness of each method depends on the situation and the goals of the planning agency. (*Dahlgren 1998*).

Benefit cost analyses are limited by the selection of options to be compared. At times agencies may compare a favored option to a "straw man" alternative, thereby biasing the decision. This highlights the importance of comprehensively selecting realistic options so that the decision is as inclusive and informed as possible. At times, however, it is best to compare policies to a "do nothing" baseline. Once again, the method depends on the context (*ibid*).

Since public institutions seek to maximize overall public wellbeing, and to do so equitably, many kinds of benefits and costs should be accounted for. In order for comparisons to be drawn it is necessary estimate the effects of policies and evaluate them; these include, for example, travel time, lives saved, and even aesthetics. It is also necessary to carefully define the geographical and temporal scope of analysis. Analyses must also discount future effects since benefits and costs exist over time and money has an investment return opportunity cost. Finally, benefit cost analyses should strive to account for uncertainty, an element rarely addressed (*Dahlgren 1998*).

Benefit cost analysis as applied to freight transportation investment decisions differs from traditional transportation investment decisions. Traditional decisions will consider factors such as time cost which affect all highway users. Freight investment decisions, on the other hand, need to consider effects through the complex chain of the private-sector: i.e. carriers, shippers, industries/markets, non-freight impacts (e.g. economic development), as well as other public impacts (*Cambridge Systematics, et al. 2006*). While a comprehensive benefit cost analysis should include some of these secondary effects it is important to avoid double counting benefits. (*ICF et al. 2001*).

A recent study identifies five steps an agency must go through to conduct a benefit cost analysis. First the agency frames the analysis by identifying the purpose of the transportation project. Second, it is necessary to identify expected economic impacts. Third, transportation impact evaluation tools must be utilized to explore the technical consequences of a project. Fourth, economic impact evaluation tools are utilized to explore the benefits and costs accruing to those directly and indirectly affected by the freight transportation project. Fifth, decision support

methods should be systematically applied to translate the information generated into action. It is important to note that the same study points out the importance of a tiered approach for screening and analysis. This implies that after about the third step, it may be possible to determine which projects merit more detailed (and therefore expensive) benefit cost analysis (*Cambridge Systematics et al. 2006*).

2.5 LITERATURE REVIEW SUMMARY AND CONCLUSIONS

A number of lessons have been learned from the development and research/implementation of multimodal investment criteria. An overview of these lessons, as identified from the literature review, is provided below.

2.5.1 Lessons from the Development of Multimodal Investment Criteria in Practice

Substantial documentation has been produced during the last several decades regarding multimodal freight investment criteria. Practices of multimodal investment in the United States have shown that traditional approaches are no longer enough to meet future transportation needs and that the following factors are critical to the success of freight investment programs:

- Encourage project submissions from many different agencies and entities.
- Use planning studies to drive projects.
- Develop prioritization process for potential projects and studies, even if it is rudimentary.
- Develop quantifiable criteria and guidance for project evaluation.
- Develop champions/advocates.
- Involve the private-sector freight industry.
- Include freight representation on the project evaluation committee.
- Legislative support is crucial to gain momentum and move programs forward.
- Build advocacy for major projects by linking them to economic development efforts.

Various federal, state, regional, and local government agencies have developed either comprehensive or ad-hoc multimodal investment criteria with the following methods:

1. Derive multimodal investment criteria directly from the long-range transportation planning goals and objectives (e.g. Minnesota DOT Statewide Freight Plan policies and strategies framing performance measures for planning);

2. Conduct detailed analysis of the multimodal transportation supply and demand characteristics in the study area in current and future years, and then propose investment criteria accordingly to address any identified supply-demand mismatches (e.g. Upper Midwest Freight Corridor Coalition identifying priorities due to growing freight demand);

3. Collect multimodal investment needs information from freight shippers and carriers through surveys and interviews, and develop multimodal investment criteria accordingly (e.g. WSDOT's high-volume shipper and carrier interview program).

Method 1 is a top-down and centralized approach that requires the least amount of effort for information and data collection. However, investment criteria developed via this approach tends to be relatively broad, and may provide limited guidance in the actual project prioritization and selection process. Compared to the other two methods, it also relies more on the subjective judgment of the project selection committee/panel. Method 2 reflects planners' and decision-makers' desire to make freight investment decisions in a way that is similar to the traditional highway investment decision-making process. This process relies on a reasonably accurate prediction of future transportation demand, and the performance of the existing transportation network, under the future-year demand, becomes the basis for future transportation investment decision-making. This comprehensive method has some theoretical appearance due to its consistency with rational planning theory. But it may suffer from significant data requirements, modeling needs, and practicality issues. Method 3 represents a bottom-up and democratic approach for developing multimodal investment criteria. It relies on actual freight agencies, shippers, and carriers to identify multimodal transportation issues, as well as the significance of these issues. Investment criteria can then be developed to target the most significant issues and investment needs. This approach has moderate data needs. The risk of the bottom-up approach is two-fold. First, the survey or interview may not reach a representative sample of all freight stakeholders (e.g. many small stakeholders may not be adequately considered), causing biases in the investment decision-making process toward the major stakeholders. Second, freight investment projects that have significant societal benefits but only moderate benefits to individual freight stakeholders may be undervalued.

Since the current data and model availability in Oregon is unlikely to support Method 2, it is recommended that a survey of the freight stakeholders in Oregon be conducted to support the development of a set of multimodal freight investment criteria. The development process should also be guided by the existing Oregon Transportation Plan goals and objectives, which suggests a combination of Methods 1 and 3.

2.5.2 Summary of Investment Criteria Developed Elsewhere

A highlight (i.e. not a comprehensive list) of investment criteria developed elsewhere is summarized below:

- Providing economic and other public benefits
- Promoting economic development and job creation
- Promoting commerce and economic diversification
- Using alternative funding and financing approaches
- Gaining support from higher- and lower-level government agencies
- Encouraging efficient land use patterns and urban logistics
- Incorporating context-sensitive solutions
- Addressing NEPA requirements and improving the environment
- Removing modal and intermodal bottlenecks
- Reducing freight transportation and transfer costs
- Improving freight transportation safety, security and technology
- Encouraging tourism
- Providing benefit to economically disadvantage populations
- Promoting regional equity
- Preserving existing freight infrastructure
- Improving freight transportation operations and traffic control
- Improving accessibility of major freight trip generators and attracts to key regional corridors and terminals
- Improving travel time reliability
- Improving quality of life
- Promoting partnerships among freight stakeholders
- Ensuring consistency with regional and state transportation plans

- Addressing special issues considered important by the agency
- Increasing the efficiency of existing facilities
- Serving critical port facilities

Compared to this comprehensive list, the exiting multimodal investment criteria employed in the funding program *Connect*Oregon, for example, could be expanded to include: considerations of land use patterns, environmental impacts, economically disadvantaged populations, infrastructure preservation, tourism, operational improvement, accessibility, and reliability. Section 4 of this report presents stakeholder views of these and other criteria, as well as provides insight into issues and contexts of Oregon's multimodal freight system. The conclusions to this report (Section 5), discuss the potential for investment criteria of interest to Oregon stakeholders and how these might compliment or add to those criteria/considerations already in use.

2.5.3 Lessons from Research in Multimodal Investment Criteria

Research on multimodal investment criteria has shown that criteria are often associated with significant data requirements, and significant agency commitment to the research product. This process produces a decision-support tool that ranks all candidate projects based on pre-defined goals and the relative weights of these goals. Past experience with the implementation of these research projects suggests that while agencies desire comprehensiveness and objectivity in the multimodal investment decision-making process, they also appreciate a decision support package that can be adjusted to their changing special needs.

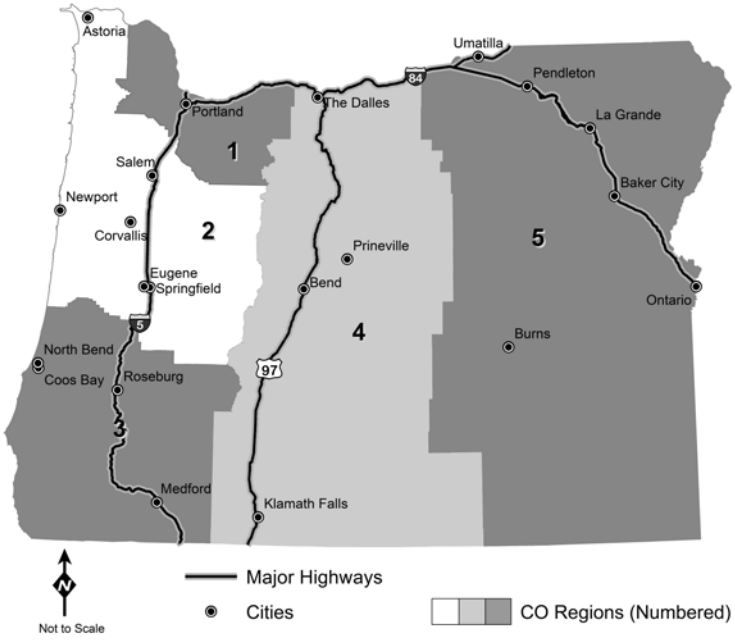
It should also be noted that the multimodal investment decision-making process involves substantial risks and uncertainty due to a variety of reasons, including: poor data availability, lack of reliable multimodal modeling tools, the inherent stochastic nature of the multimodal transportation system, and the difficulties in quantifying the values of certain investment goals. However, all practical and proposed multimodal investment criteria reviewed in this report ignore the uncertain and probabilistic nature of the problem. Although considering uncertainty in decision-making is not an easy task, ignoring it entirely may prove to be counterproductive.

3.0 EVALUATION OF AN OREGON MULTIMODAL FUNDING PROGRAM: *CONNECT*OREGON

A review of the literature relevant to the development of freight investment criteria found that the most successful freight investment programs used criteria developed through a combination of a top-down and bottom-up approach. The top-down approach relies on subjective judgment of the project selection committee, while the bottom-up approach consults with the freight community to identify needs and issues and discuss their significance.

In an effort to examine the approach Oregon takes in making multimodal investment decisions, the funding program *Connect*Oregon was evaluated. The Oregon Transportation Commission (OTC) was charged by the Oregon Legislature with making decisions on state-authorized funding for aviation, marine, public transit, and rail projects through this *Connect*Oregon program.

The *Connect*Oregon program evaluation uses a combination of the top-down and bottom-up approaches. The evaluation is top-down in the sense that there is a final evaluation by the Final Review Committee (FRC) and the OTC ultimately confirms the projects selected. Also, the application form and the specific questions are formulated by ODOT. However, there is the opportunity for bottom-up input provided by rankings done by stakeholders represented by the five modal committees (air, marine, rail, transit, the Oregon Freight Advisory Committee (OFAC)) and the five regional committees, which correspond to ODOT regions (Figure 3.1).



Source: *Baker et al. 2009, p.5*

Figure 3.1: *Connect*Oregon II Regions.

3.1 *CONNECT*OREGON II PROPOSED PROJECT RANKINGS BY DIFFERENT GROUPS

The concern with a "top-down" approach to project selection is that the ranking down by the "top" group may not be the same as that by the stakeholder (or "bottom") groups. If projects selected for funding are not valued and ranked highly by stakeholder groups, the result may be an inefficient allocation of scarce agency resources that does not lead to desired outcomes for the transportation system.

Accordingly, the first step in evaluating the *Connect*Oregon program was to compare the rankings. Evaluation focused on the *Connect*Oregon II program, for which project rankings and selections results were available at the time of analysis. Group rankings were reviewed for each of the *Connect*Oregon II applicants by the five regional groups, the five modal groups (the State Aviation Board, the Oregon Freight Advisory Committee (OFAC), the Marine Project and Planning Advisory Committee, the Public Transit Advisory Committee (PTAC) and the Rail Advisory Committee (RAC)), and the Final Review Committee (FRC). The Oregon Transportation Commission (OTC) officially approves projects. For *Connect*Oregon II, the 30 projects selected for funding by the OTC were also the top 30 projects as ranked by the FRC Since there appears to be a very close correlation between the FRC ranking and OTC decision-making for *Connect*Oregon II, the FRC ranking of projects is used as a proxy for the "top-down" approach.

The rankings for the 70 *Connect*Oregon II applications by each of the modal and regional groups as well as the FRC are presented in Table 3.1. Note that a separate ranking is provided for OFAC, which is considered to be a modal group although the committee does not represent any individual mode but rather contains members from a variety of freight constituencies. While the FRC ranked all 70 projects, OFAC only ranked 38 and other modal and regional groups only ranked those proposals relevant to their region or mode. In the table, the rank is shown over the total number of projects ranked by that group (e.g. 5/32).

Table 3.1: Ranking of *Connect*Oregon II projects by FRC, Modal, and Regional Groups.

Application	FRC Rank	OFAC Rank	Regional Rank	Modal Rank
Portland and Western RR-Col (R10026)	1	1/38	2/19	1/26
Port of Portland PDX North (A10040)	2	3/38	1/19	1/21
Port of Astoria- Pier 2 (M20042)	3	20/38	1/24	1/9
Port of Portland s. Rivergate (R10066)	4	4/38	3/19	1/13
BNSF- East St. Johns Siding (R10047)	5	2/38	4/19	2/13
Portland and Western RR (R20025)	6	8/38	1/6	3/26
City of Bend (T40010)	7	-	2/13	3/13
Gresham Redevelopment (T10076)	8	-	6/19	1/13
City of Salem-McNary Field (A20021)	9	-	1/4	2/7
Grant County (A50045)	10	-	1/6	4/21
UP RR co St. Johns (R10072)	11	5/38	7/19	5/26
Union Country Economic (R50007)	12	7/38	1/12	11/26
City of Prineville (R40005)	13	8/38	4/13	3/13
LTD and City of Veneta (T20024)	14	-	5/24	4/13
Modoc Northern RR co (R40043)	15	19/38	1/13	7/26

Application	FRC Rank	OFAC Rank	Regional Rank	Modal Rank
Port of Morrow (R50044)	16	6/38	5/12	4/13
City of Madras (A40075)	17	-	5/13	5/21
Albany and Eastern RR Bridge (R20051)	18	13/38	7/24	5/13
Coos County Airport (A30001)	19	15/38	1/2	2/21
Columbia County (T10038)	20	-	10/19	2/13
BNSF RR Astoria Wye (R10048)	21	9/38	8/19	9/26
City of Newport-Port of Astoria (A20030)	22	-	1/12	13/21
Salem-Keizer Transit District (T20035)	23	-	3/8	5/13
Port of St. Helens (R10016)	24	11/38	5/19	8/13
City of Salem-McNary Field (A20022)	25	33/38	1/8	1/7
P of P terminal 4 (M10029)	26	18/38	9/19	2/9
Redmond Airport (A40031)	27	23/38	3/13	1/3
City of Vale(A50020)	28	-	1/3	11/21
Rogue Valley International (A30061)	29	21/38	1	8/21
Mt. Hood Railroad (R10004)	30	26/38	12/19	1/2
Klamath N Railway (R40032)	31	22/38	6/13	6/13
City of Ontario (A50009)	32	-	7/12	3/7
Port of Portland-Terminal 2 (X10041)	33	16/38	11/19	4/9
Salem Keizer Transit District (T20036)	34	-	11/24	6/13
Albany and Eastern RR co (R20052)	35	14/38	7/12	15/26
Union Pacific Railroad Co (R50070)	36	10/38	11/12	7/13
City of Creswell Hobby Fd.	37	-	13/24	10/21
City of Klamath Falls Airport (A40003)	38	-	7/13	4/7
Northwest Container Services (R10058)	39	12/38	16/19	9/13
Vigor Industries LCC (R10039)	40	17/38	13/19	10/13
City of Baker City- Elkhorn (R50015)	41	32/38	1/4	19/26
Port of Siuslaw (M20065)?	42	-	7/8	1/3
Port of Umatilla (X50018)	43	25/38	2/3	11/13
District and Sundial	44	-	5/12	9/13
Union Pacific RR-Eugene (R20071)	45	28/38	1/3	17/26
City of Astoria (M20019)	46	-	1/2	7/9
City of Baker City (A50014)	47	-	1/2	16/21
City of Oregon City (T10056)	48	-	14/19	7/13
Whitney Family Properties, LP (A20046)	49	-	5/8	2/3
City of Wilsonville Transit (X10068)	50	-	15/19	8/13
Tidewater Barge Co. (M50050)	51	30/38	3/4	5/9
City of Eugene (X20064)	52	-	2/3	10/13
Albany and Eastern RR co (R20013)	53	27/38	3/4	21/26
Port of Tillamook Bay-Apron (A20055)	54	34/38	17/24	5/7
City of the Dalles (M40027)	55	-	9/13	8/9
City of Lebanon (R20062)	56	27/38	19/24	25/26
City of Bend (T40011)	57	-	11/13	11/13
Saddle Mountain Inc. (X20063)	58	35/38	11/12	2/3

Application	FRC Rank	OFAC Rank	Regional Rank	Modal Rank
VanArsdale Air Service, LCC (A50008)	59	-	5/6	19/21
City of Klamath Falls Airport (A40002)	60	36/38	8/13	1
Port of Portland (A10067)	61	-	18/19	17/21
Kah-Nee-Ta Resort/Mt. Hood (T40006)	62	-	10/13	1
Willamette Valley Railway Co. (R20057)	63	31/38	1	23/26
Klamath County (R40037)	64	-	12/13	12/13
Port of Tillamook Bay (R20078)	65	32/38	5/6	NA
TriMet and City of Milwaukie (T10074)	66	-	17/19	12/13
Wheeler County (A40023)	67	-	1	6/7
TTI Wireless (A20053)	68	-	23/24	20/21
Sumpter Valley RRd. Restore	69	-	1	1
Regional Maritime Security Co (X10073)	70	34/38	1	1

3.1.1 Spearman Person Rank Correlation Coefficients

Visual inspection of Table 3.1 suggests a certain amount of consensus between the rankings by the various groups, but to provide a more precise measure of correlations, Spearmen Pearson Rank Correlation Coefficients are calculated.

The Spearman Pearson's Rank Correlation (ρ) is a number between 1 and -1 which shows the statistical dependence of two ranked variables. This is done by ranking all observations from lowest to highest within each category. For the FRC this means that projects were ranked 1 to 70 and for Region 1, for example, projects were ranked 1 to 19. The formula given below was used:

$$\rho = \frac{\sum_i (Xi - \bar{X}) * (Yi - \bar{Y})}{\sqrt{(\sum_i (Xi - \bar{X})^2 * \sum_i (Y - \bar{Y})^2)}}$$

Where the means ($\bar{X}$ or $\bar{Y}$) always equal (1+70)/2 = 35.5 for the 70 observations. Missing data was corrected by setting the missing observations equal to the mean ($X_I = \bar{X}$), thereby canceling them out of the equation when we take ($X_I - \bar{X}$), which will now equal 0, leaving the correlation unaffected.

The sign of the correlation shows whether the two ranks move together positively or negatively. ρ = 0 shows no tendency for one variable to change as the other changes. While ρ = -1 shows that the two are perfectly monotonically negatively related, in that the highest rank of one variable is associated with the lowest ranked of the other and the second highest would be associated with the second lowest and so forth . A ρ = 1 shows that the two variables are perfectly monotonically positively related, in that the highest rank of one variable is associated with the highest rank of the other.

Table 3.2 shows the Spearman Pearson Rank Correlation Coefficients calculated for ranking of projects between the FRC and the various regional and modal groups.

Table 3.2: Spearman Pearson Rank Correlation Coefficients Between FRC Modal and Regional Group Rankings.

Group	Spearman Pearson Coefficient	Number of Projects Ranked
OFAC	0.84826827	38
Region1	0.95363869	19
Region2	0.84869852	24
Region 3	1	2
Region 4	0.9331156	13
Region 5	0.79664795	12
Rail	0.96523359	26
Transit	0.95252368	13
Marine	0.79740475	10
Aviation	0.92059211	21

The positive coefficients indicate that rankings are positively correlated for all groups. The correlation between the FRC ranking and the ranking from the regions and the modals groups are very high, in most cases over 90%. Interestingly, the OFAC group correlation with the FRC ranking is .848 which indicates a high correlation but less that the correlation between the FRC and most of the other modal groups (rail, aviation, and transit). The exception is with the marine group where the Spearman Pearson Coefficient is only .797.

These results suggest a high degree of agreement with regard to the ranking of these projects between the regional and modal groups (the "bottom") and the FRC (the "top"). The exception is for Region 5, which represents much of the eastern part of the state. In the interest of obtaining greater statewide consensus for funding decisions, more in-depth examination is needed to determine the reasons for this apparent difference in the way in which Region 5 interpreted and implemented the criteria for ranking *Connect*OregonII projects.

3.2 C*ONNECT*OREGON II QUESTIONS AND RELATIONSHIP TO PROJECT RANKINGS

The *Connect*Oregon I (ORS 367.080) program resulted from the 2005 Oregon Legislative session and directed the OTC to consider factors such as transportation cost reduction, multi-modal connections, system efficiency, project costs, and economic benefits, in selecting projects to be funded via the *Connect*Oregon program (*ODOT 2009*).

The selection criteria for *Connect*Oregon II were revised by ODOT to include consideration of access to jobs and sources of labor and remove consideration of multimodal connections. The *Connect*Oregon II application materials included details on job creation and associated wages, documented support of businesses that benefit from the funding request, and whether or not the affected region of the state could be categorized as economically distressed. Projects were ranked by the various stakeholder groups and assigned to tiers based on how many of the basic *Connect*Oregon criteria were met, according to the opinion of the reviewer.

The tier system was an attempt to classify projects based on how well they fit the five strategic considerations as listed in HB 2278 where the first three were considered to be strategic considerations as indicated in HB 566. These are:

1. Whether a proposed transportation project reduces transportation costs for Oregon businesses or improves access to jobs and sources of labor;

2. Whether a proposed transportation project results in an economic benefit to this state;

3. Whether a proposed transportation project is a critical link connecting elements of Oregon's transportation system that will measurably improve utilization and efficiency of the system;

4. How much of the cost of a proposed transportation project can be borne by the applicant for the grant or loan from any source other than the Multimodal Transportation Fund; and

5. Whether a proposed transportation project is ready for construction.

The tiers were then assigned in the following fashion (*ODOT 2008*):

- Tier 1 (Meets all considerations **thoroughly**)
- Tier 2 (Meets all 3 of the **Strategic** considerations **thoroughly**)
- Tier 3 (Meets 1 or 2 of the **Strategic** considerations **thoroughly**)
- Tier 4 (Does not meet any of the of the **Strategic** considerations **thoroughly**

In a 2008 ODOT report on the results of the *Connect*Oregon II selection process, participants in the freight stakeholder groups were asked to provide comments on the process (*ODOT 2008*). One participant remarked that of the 70 projects considered, only 35 were assigned to the same tier by both the region and the modal committees. This comment suggests that there may be a difference of opinion between the way the different groups apply and evaluate the considerations listed above.

Further, several remarked that there seemed to be a lack of consensus in the ranking of projects between the regional and modal groups. Of particular concern was the possibility that different groups might be applying the criteria in inconsistent manners. However, there was little concern expressed regarding the possible difference between the FRC ranking and the modal and regional group rankings. As shown above in section 2.1.1, we find consistency in rankings between these groups.

The questions addressed here is whether the specific questions and measures of the considerations included in the *Connect*OregonII application forms are being used consistently to form the rankings made by the modal, regional and final review committees.

3.2.1 Application Questions (Section D)

The questions in section "D" of the *Connect*Oregon II applications were designed to evaluate aspects of the application that relate to the five considerations mentioned above. Some of the considerations, such as "whether a proposed transportation project reduces transportation costs for Oregon businesses," were not directly asked on the application form although several questions (notably D1-D7) related to the economic benefits (including possible reductions in transportation costs).

Given the technical nature and difficulties involved in assessing economic benefits from a project, economists from the Oregon Department of Transportation (ODOT) and Oregon Economic and Community Development Department (OECCD) were utilized to provide a professional evaluation of potential project benefits based upon the applicant responses to these questions. This supplemental evaluation was used by the FRC in ranking projects discussed below in section 3.2.3.

*Connect*Oregon II questions evaluated in this section were:

- D1: Does the project improve an existing connection or add a new connection to an industrial or employment center?
- D2: Does this project link workers to jobs?
- D3: Identify if the project serves one or more of Oregon's Statewide Trade Clusters or the tourism industry (Yes/No ---and which sector as listed below).
    1. Agricultural products
    2. Apparel/sporting goods design
    3. Business services
    4. Communications equipment
    5. Electronic/advanced materials
    6. Information technology
    7. Logistics and distribution
    8. Medical products
    9. Metals
    10. Processed food/beverage product
    11. Transportation equipment/parts
    12. Wood and other forest products
    13. Tourism
- D4: Does this provide an economic benefit by attracting new businesses or industry to Oregon?

- D5: Is this project located in an economically distressed or severely distressed community, as defined by the OECDD (Oregon Economic and Community Development Department)?

- D6: Does this project benefit the Oregon economy by providing improvements that ensure specific non-speculative job creation or retention (beyond short-run construction jobs)? (Yes/No ---Number of jobs, average annual wage of jobs created, *Connect*Oregon II funding request per job created).

- D7: Does this project improve the use or efficiency of Oregon's transportation system? (Yes/No) If so, how:
    1. Improves Safety
    2. Increases system Capacity
    3. Improves a bottleneck or congestion point
    4. Completes gaps in transportation system
    5. Removes an existing barrier

- D8: Does the project provide links between, or include improvements in, multiple modes of transportation (air, marine, pipeline, passenger rail, freight rail, transit, truck, bus, bicycle, pedestrian, personal automobile)?

- D9: Does the project improve or create linkages to transportation networks outside Oregon?

<u>D1: Does the project improve an existing connection or add a new connection to an industrial or employment center?</u>

Table 3.3 reports counts of applicants' responses to question D1. The "Yes" and "No" rows sum to 69, as one of the 70 applications answered N/A for all questions in section D.

Table 3.3: Summary of Question D1. (Does the project improve an existing connection or add a new connection to an industrial or employment center?)

Number that Reported **Yes**:	54
Number that Reported **No**:	15
Number that Reported **Industrial Centers**:	30
Number that Reported **Employment Centers:**	9
Number that Reported **Both**(Ind/Emp):	15
Number that Reported **None**(Ind/Emp):	15

To assess how the answers to this question impacted FRC ranking of projects, four dummy variables were created for all the possible outcomes (Both, Industrial Center, Employment Center, and None), and an OLS regression was run using the FRC rank as the dependent variable with the dummies as independent variables. Results are shown in Table 3.4.

Table 3.4: OLS Results for FRC Ranking and Question D1.

Source	SS	df	MS		# of obs =	69
Model	3046.23768	3	1015.41256		F(3, 65) =	2.59
Residual	25488.4	65	392.129231		Prob > F =	0.0604
Total	28534.6377	68	419.627025		R-squared	0.1068

Frc	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Industrial	-13.86667	6.262022	-2.21	0.030	-26.37279	-1.360545
employment	-1.266667	8.349363	-0.15	0.880	-17.9415	15.40816
both	-15.33333	7.230761	-2.12	0.038	-29.77416	-.8925074
_cons	44.93333	5.11292	8.79	0.000	34.72213	55.14454

The dependent variable in this question was rank, from 1 to 70 where 1 is the highest and 70 is the lowest, meaning that a negative coefficient indicates a positive relationship between rank and whether the connection is provided by the project. These results and the associated levels of significance for the estimated coefficients indicate that a connection to an industrial center had a large and statistically significant impact on FRC ranking. The connection to an employment center did not have a significant impact on FRC ranking. Projects that provided both employment and industrial center links also had significant impacts on FRC ranking.

D2: Does this project link workers to jobs?

The responses for D2, whether the project linked workers to jobs, were "Yes" or "No". For the 69 projects, 35 answered "Yes", and 34 answered "No". Of the 30 projects ultimately funded (which were the top 30 in the FRC ranking), 27 answered "Yes." This indicated that linking workers to jobs was a consideration that played an important role in the selection of projects for *Connect*Oregon II funding. This clearly reflects the importance of the economic development as a criterion for project selection.

D3: Identify if the project serves one or more of Oregon's Statewide Trade Clusters or the tourism industry

Table 3.5 summarizes the answers to question D3. Note that many applications indicated that the projects would serve multiple trade clusters. Tourism, wood products, and logistics and distribution were the clusters most frequently cited in applications (38, 37, and 36), closely followed by agricultural products (34). This suggests the continued dependence of Oregon's natural resource-based industries on the transportation system.

Table 3.5: Summary of Question D3. (Identify if the project serves one or more of Oregon's Statewide Trade Clusters or the tourism industry.)

Reported "Yes"	63
Reported "No"	6
1. Agricultural products	34
2. Apparel/sporting goods design	14
3. Business services	27
4. Communications equipment	13
5. Electronic/advanced materials	13
6. Information technology	13
7. Logistics and distribution	36
6. Medical products	10
7. Metals	23
8. Processed food/beverage product	21
9. Transportation equipment/parts	28
10. Wood and other forest products	37
11. Tourism	38
Serve all clusters (1-11)	6
Serve no clusters	6
Average number of clusters per application	4.4637

Economic Benefit

- D4: Does this provide an economic benefit by attracting new businesses or industry to Oregon?
- D5: Is this project located in an economically distressed or severely distressed community, as defined by the OECDD?
- D6: Does this project benefit the Oregon economy by providing improvements that ensure specific non-speculative job creation or retention (beyond short-run construction jobs)?

For D4 (Does this provide an economic benefit by attracting new businesses or industry to Oregon?) 51 applications indicated "Yes," and 27 of those were funded. For D5 (Is this project located in an economically distressed or severely distressed community, as defined by the OECDD?), 37 indicated "Yes," but only 17 were funded. For Question D6 (Does this project benefit the Oregon economy by providing improvements that ensure specific non-speculative job creation or retention (beyond short-run construction jobs)?) 33 responded "Yes," but only 17 were funded. The apparent lack of correlation between the applicant responses to these questions and the funding decisions reflect the fact that it is difficult to fully evaluate the economic impact of these projects with a "Yes/No" answer. This is why input from professional economists was deemed necessary to provide a more in-depth and case-by-case evaluation of the economic benefit effect (see section 3.2.3 below.)

D7: Does this project improve the use or efficiency of Oregon's transportation system?

Table 3.6 shows the applicant responses to the seven options in the check list for question D7. Applicants could report multiple efficiencies so an additional category was created in Table 2.6 to measure the number of efficiencies each applicant reported.

Table 3.6: Summary of Question D7. (Does this project improve the use or efficiency of Oregon's transportation system?)

1. Improves Safety	**54**
2. Increases system Capacity	**56**
3. Improves a bottleneck or congestion point	**38**
4. Completes gaps in transportation system	**25**
5. Removes an existing barrier	**39**
6. Reduces traffic or use conflicts	**52**
7. Provides another measurable improvement	**37**
All (1-7)	**7**
None (no efficiencies provided)	**2**
Average number of efficiencies per applicant	**4.3**

To see how well the identified "efficiency" corresponded to the ranking given by the FRC, OLS regression was run with the FRC as the dependent variable and nine dummy variables (representing one of the seven "efficiencies" from Table 3.6) as the independent. In addition, two more dummies were included; one if no efficiencies were reported and the other corresponding to the case where a project claimed to results in all of the efficiencies. Results are presented in Table 3.7.

Table 3.7: OLS Results for FRC Ranking and D7.

Source	SS	df	MS		# of obs =	69
Model	8347.01212	8	1043.37651		F(3, 65) =	3.10
Residual	20187.6256	60	336.460426		Prob > F =	0.0054
Total	28534.6377	68	419.627025		R-squared	0.2925

Frc	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
safety	8.994673	6.191342	1.45	0.151	-3.389856	21.3792
Capacity	-6.544161	6.453585	-1.01	0.315	-19.45325	6.364932
bottleneck	-14.88349	5.061416	-2.94	0.005	-25.00783	-4.75915
gaps	1.750726	4.748321	0.37	0.714	-7.74733	11.24878
Barrier	-7.926106	4.649799	-1.70	0.093	-17.22709	1.374878
Conflicts	4.934749	5.669772	0.87	0.388	-6.406484	16.27598
Other	-5.319089	4.905337	-1.08	0.283	-15.13122	4.493045
efficiency~e	20.2331	15.29057	1.32	0.191	-10.35261	50.8188
_cons	44.2669	8.097621	5.47	0.000	28.06925	60.46456

Elimination of bottlenecks and chokepoints was the only efficiency enhancing category that appears to be significantly (using a 5% confidence interval) related to the FRC ranking. Removal

of barriers was statistically significant at the 10% level of significance. Again because rankings go from 1 to 70, the negative coefficient demotes a positive relationship between the efficiency and the FRC ranking. Therefore, all else constant, both the improvement of a bottleneck or congestion point, or removal of an existing barrier were positively correlated with the rank given by FRC. Interestingly the "efficiency" listed most often (safety) did not seem to be a statistically significant determinant of the FRC ranking.

3.2.2 Funds Requested

Table 3.8 provides information on the relationship between funding requested and the success of the applications. On average, successful applications requested more (an average of about $3.3 million) as opposed to unsuccessful applications (average was less than $2 million).

Table 3.8: Summary of Funds Requested Statistics.

	Count	Sum Funds Requested	Average Funds Requested
All Applications:	70	$179,998,832	$2,571,412
Successful Applications:	30	$100,265,613	$3,342,187
Unsuccessful Applications:	40	$79,733,220	$1,993,330

3.2.3 Economic Benefit Assessment

For assessment of the economic benefit from the project, independent evaluations of the information presented in section "D" (primarily the response to three questions: D4, D5 and D6) were evaluated by two externally appointed groups: the Oregon Department of Transportation (ODOT) and the Oregon Economic and Community Development Department (OECCD). In addition to information provided by applicants in section "D", the potential economic benefit for each projected was evaluated and a rating was given based on whether the project would: (5) clearly; (4) be likely to; (3) have the potential to; (2) be unlikely to; or (1) would not provide an economic benefit. Economists from both ODOT and OECDD provided ratings independently of the review committees. Note that this question directly reflects the third consideration listed above in the HB 2322 legislation.

The ODOT and OECDD economic benefit scores for the top 70 ranked projects are shown in Table 3.9. To provide a way to evaluate this, ODOT and OECDD scores were combined (possible high score of 10). None of the top 36 FRC ranked projects received a score of less than three from either evaluator or a combined score of these than six. Most had combined scores of 8-10, indicating that the top ranked projects would "clearly" or "be likely" to have a potential economic benefit as assessed by the economists at ODOT and OECCD.

The relationship between the OECDD and ODOT combined score and the FRC rank was used to calculate a final correlation coefficient of -.4344 (the higher the combined score, the higher the FRC ranking (ie. the smaller number)).

Table 3.9: Score for Economic Benefit to the State Relative to FRC Ranking.

Application	FRC Rank	ODOT	OECDD	Total
Portland and Western RR-Col(R10026)*	1	3	4	7
Port of Portland PDX North(A10040)*	2	4	4	8
Port of Astoria- Pier 2(M20042)*	3	4	4	8
Port of Portland s. Rivergate(R10066)*	4	4	4	8
BNSF- East St. Johns Siding(R10047)*	5	4	4	8
Portland and Western RR(R20025)*	6	4	5	9
City of Bend(T40010)*	7	3	3	6
Gresham Redevelopment(T10076)*	8	3	3	6
City of Salem-McNary Field(A20021)*	9	4	5	9
Grant County(A50045)*	10	4	4	8
UP RR co St. Johns(R10072)*	11	3	4	7
Union Country Economic(R50007)*	12	4	4	8
City of Prineville(R40005)*	13	4	4	8
LTD and City of Veneta(T20024)*	14	3	5	8
Modoc Northern RR co(R40043)*	15	3	5	8
Port of Morrow(R50044)*	16	4	5	9
City of Madras(A40075)*	17	4	4	8
Albany and Eastern RR Bridge(R20051)*	18	3	5	8
Coos County Airport(A30001)*	19	5	5	10
Columbia County(T10038)*	20	4	4	8
BNSF RR Astoria Wye(R10048)*	21	3	4	7
City of Newport-Port Astoria(A20030)*	22	5	5	10
Salem-Keizer Transit District(T20035)*	23	2	3	5
Port of St. Helens(R10016)*	24	4	4	8
City of Salem-McNary Field(A20022)*	25	3	3	6
P of P terminal 4 (M10029)*	26	4	5	9
Redmond Airport(A40031)*	27	3	5	8
City of Vale(A50020)*	28	4	4	8
Rogue Valley International(A30061)*	29	4	5	9
Mt. Hood Railroad(R10004)*	30	4	4	8

Application	FRC Rank	ODOT	OECDD	Total
Klamath N Railway(R40032)	31	3	5	8
City of Ontario(A50009)	32	3	3	6
Port of Portland-Terminal 2(X10041)	33	4	4	8
Salem Keizer Transit District(T20036)	34	3	3	6
Albany and Eastern RR co(R20052)	35	3	5	8
Union Pacific Railroad Co(R50070)	36	3	3	6
City of Creswell Hobby Arpt.(A20054)	37	3	3	6
City of Klamath Falls Airport(A40003)	38	3	3	6
Northwest Container Services(R10058)	39	3	3	6
Vigor Industries LCC(R10039)	40	3	5	8
City of Baker City-Elkhorn(R50015)	41	3	4	7
Port of Umatilla(X50018)	43	4	5	9
District and Sundial Travel (X20060)	44	3	3	6
Union Pacific RR-Eugene(R20071)	45	4	2	6
City of Astoria(M20019)	46	3	3	6
City of Baker City(A50014)	47	4	4	8
City of Oregon City(T10056)	48	3	3	6
Whitney Family Properties, LP(A20046)	49	3	4	7
City of Wilsonville SMART Trnt (X10068)	50	2	3	5
Tidewater Barge Co.(M50050)	51	4	4	8
City of Eugene(X20064)	52	3	2	5
Albany and Eastern RR co(R20013)	53	3	3	6
Port of Tillamook Bay-Apron(A20055)	54	4	4	8
City of the Dalles(M40027)	55	3	3	6
City of Lebanon(R20062)	56	3	5	8
City of Bend(T40011)	57	3	3	6
Saddle Mountain Inc.(X20063)	58	4	3	7
VanArsdale Air Service, LCC(A50008)	59	4	4	8
City of Klamath Falls Airport(A40002)	60	3	3	6
Port of Portland(A10067)	61	3	4	7

Application	FRC Rank	ODOT	OECDD	Total
Kah-Nee-Ta Resort/Mt. Hood(T40006)	62	4	4	8
Willamette Valley Railway Co.(R20057)	63	3	3	6
Klamath County(R40037)	64	3	3	6
Port of Tillamook Bay(R20078)	65	4	4	8
TriMet and City of Milwaukie(T10074)	66	2	2	4
Wheeler County(A40023)	67	4	4	8
TTI Wireless(A40023)	68	1	1	2
Sumpter Valley RRd. Restore(R50012)	69	3	3	6
Regional Maritime Security Co(X10073)	70	3	3	6

3.3 *CONNECT*OREGON II EVALUATION CONCLUSIONS

The review of the *Connect*Oregon II evaluation process shows that there does not appear to be a large difference between the ranking of projects by the modal and regional groups and the FRC. This suggests that the process is already employing the combined top-down/bottom-up approach found in the literature review to result in the most successful freight investment programs.

There was a very strong relationship between whether the proposal improved an existing connection or added a new connection to an industrial or employment center (question D1) and the ranking of projects (27 of the top 30 funded projects). The determination of economic benefit (as rated by ODDOT and OECDD) was also found to be an important factor in ranking projects.

It is noted here, however that the questions included in the application process did not directly assess whether costs for transportation system users were reduced by the project or whether a proposed transportation project is a critical link connecting elements of Oregon's transportation system. Indeed, the "efficiency" listed in the application that was most often cited by applicants, safety improvement, was not found to be a significant factor in the assignment of project rank.

Accordingly, the following section provides a survey of stakeholders in the freight transportation system to see what the strategic considerations mean to them and which ones they consider most important for fulfillment of the three strategic considerations.

4.0 OREGON FREIGHT STAKEHOLDER COMMUNITY VIEWS

A review of literature relevant to the development of freight investment criteria found that the most successful freight investment programs used criteria developed through a combination of a top-down and bottom-up approach. The top-down approach relies on subjective judgment of the project selection committee, while the bottom-up approach consults with the freight community to identify needs and issues and discuss their significance. In accordance with the bottom-up approach, the research team sought input from stakeholders in the Oregon freight community.

Initial efforts to seek input centered on the formation of focus groups; one representative of freight modes (water/marine, truck, rail, and air), and the other of the various regions in Oregon. However, this methodology proved infeasible due to commitments and availability of the freight community. Instead, it was determined that stakeholder input could be solicited through key informant interviews and through a survey. Information gathered from the limited number of key informant interviews helped to provide insight on the broad needs and issues of the stakeholder community, as well as to inform the development of the survey instrument. The survey focused on the use of the freight system and the benefits of potential improvements. The results from the key informant interviews and the survey are described in the subsections below.

4.1 KEY INFORMANT INTERVIEWS

Using recommendations provided by one or more Technical Advisory Committee members, select individuals from the Oregon Freight Advisory Committee (OFAC) were contacted to participate in the key informant interviews. The individuals interviewed represented high-level freight community members from the modes of marine/water, truck, and rail.

Discussions focused on general criteria identified for multimodal investment in various state funding programs such as *Connect*Oregon and the Statewide Transportation Improvement Program (STIP). Because the criteria is fairly broad, there is not a methodology established to make direct comparisons between different projects that may be necessary for making decisions regarding tradeoffs between alternate projects.

As evident in the literature as well as Oregon's existing investment criteria, the impacts of investment to the entire state's economy is an important consideration. Specific to freight is the impact of investments on reducing transportation costs for Oregon's businesses. All of the informants interviewed mentioned that improving overall system efficiency was a significant factor in lowering transportation costs. Also mentioned was:

- improved use of the system (volume of freight transported)
- improved level of service (mobility)

- increased reliability
- reduced freight transfer costs
- increased efficiency of existing facilities
- improved connectivity and access (goods-to-market)

Based on comments provided by the key informants, the relative importance of each of the factors listed above varied by mode. Since the factors were only discussed in abstract, the degree of variance could not be measured.

Overall, discussions revealed that factors affecting transportation costs (such as those listed above), along with freight bottlenecks and chokepoints influenced mode choice. Both the size and type of shipment were mentioned as being sensitive to these factors. One of the key informants used electronics as a good example of the influence of shipment size and type on mode choice. Because electronics often represent small and light shipments, transporting the goods by rail is typically impractical, as rail contracts often involve multi-carload shipments. More practical to such shipment types is air, which usually charges by weight and typically has a guaranteed service schedule—which is important due to the higher value of the cargo.

In a general discussion of freight investment, multiple key informants mentioned that it was important to not only understand the factors impacting freight costs and the movement of goods but to also understand institutional, regulatory, and business barriers. These barriers may affect the ability for the investment in a transportation facility to result in the expected cost reduction. For instance, a capacity expansion may be beneficial, but regulations such as expansion fees may negate some of the benefits from the improvement or may be too costly to consider the project. As another example, trucks may be affected by size and weight limitations that are due to government regulation and have little to do with investment. Additionally, each business has its own business plan that may place obstacles in the way of a seamless transportation system and cannot be dealt with by infrastructure investment alone.

Several interviewees emphasized the challenges in making multimodal freight investment decisions, but highlighted the need to develop a good understanding of the system and its users in order to optimize investments. The interviewees discussed the importance of the mode choice decisions made by shippers. This relies on the availability of service (regular schedules) and the ability of transfer to occur seamlessly between modes—both for the intermodal connection, but also for the last minute decision-making that may be necessary to lower costs.

4.2 STAKEHOLDER SURVEY

Information gathered from the key informant interviews was used to help develop a survey instrument (Appendix A). The goal of the survey was to identify needs and issues of the freight stakeholder community. Questions were developed which focused on the respondent's use of the system, as well as the importance and impact of system performance factors.

For the distribution of the survey instrument, findings from the *Connect*Oregon II analysis of proposal rankings (see Chapter 2 of this report) were considered. The findings showed that while there was a high correlation (over 92%) between the Final Review Committee (FRC) rankings and those of the truck, rail, and air modal groups, there was a lower correlation (84%) between the rankings of projects by the Oregon Freight Advisory Committee (OFAC) and the FRC. The marine modal group also showed a lower correlation (of about 80%) with the ranking of the FRC. Because of these differences, the survey was distributed so that results could be distinguished between OFAC respondents and the general modal groups.

Accordingly, the survey was distributed first to the Oregon Freight Advisory Committee (OFAC) and then to freight organizations and industry groups including: the Oregon Trucking Association (OTA), the Oregon Business Association (OBA), Oregon Rail Users' League (ORULE), the Westside Economic Alliance Transportation Committee and port stakeholders. Note, that this was not a random survey but depended on the willingness of the various stakeholder organizations to send the survey to their membership.

Response rates among both groups was low, with nine responses from OFAC members (for a response rate of 33%; 9 of 27 members) and 12 responses from the members of the general modal group. Since the modal group surveys were distributed by a variety of organizations, there is no way to tell the response rate other than it seems to be quite low.

Of the OFAC group respondents, 55.6 % represented private companies with the rest identified as public. About 44% were from government agencies and another 22% were shippers, none represented carriers. Although carriers are members on OFAC, none of the respondents represented carriers. The rest of the OFAC respondents included consultants and trade association representatives.

Respondents from the general modal group overwhelmingly represented private companies, with no one responding who worked for a government agency. Half of this group identified themselves as shippers, 42% reported they were carriers and the rest responded "other," such as a public affairs group.

The variance in representation between responses from OFAC (44% from government agencies) and the modal group (50% were shippers and 42% were carriers) is an important distinction. The modal group can be interpreted as representative of practitioners, whereas OFAC respondents may or may not be involved in operations and are likely more involved in policy and program implementation. Members of OFAC are also probably more used to dealing with issues related to the statewide freight system, whereas members of the modal group may have more familiarity with their own specific operation and less with the overall state freight system. Accordingly, survey results are presented in the subsection below in a way that the responses from the two groups can be compared and contrasted. Due to the overall low response rate for both groups, the data should be considered with caution. For this reason, calculations of statistical differences were not performed.

4.2.1 Survey Findings

In addition to identifier questions for representation (e.g. public vs. private, and shipper vs. carrier), respondents were asked to identify the modes that were used by their company/organization. All respondents indicated the use of truck transportation, followed by rail (66%), maritime/water (55%) and then air (33%). These figures combined with the response that almost 78% use intermodal transfers, attests to the importance of the intermodal transportation system.

In addition to the use of various modes, respondents were asked to identify the proportion of their business that relies on each mode. Table 4.1 shows the percent of operations that relied on each mode from each respondent group. Truck represented the largest share of operations for both groups. Secondary to truck, the OFAC sample included users that relied more heavily on water whereas the general modal respondents relied more on rail.

Table 4.1: Percent of Operations by Each Transport Mode.

Mode	OFAC	General Modal
Truck	77.5 %	64.3 %
Rail	11.8 %	35.4 %
Air	8.3 %	14.3 %
Marine/Water	21.0 %	8.7 %

A secondary purpose of the question on percent of mode reliance was to prompt respondents to think about how system investments and changes in performance factors might impact their operations. In line with that idea, questions were included on the survey to evaluate the perceived importance of select performance factors and how an improvement to a performance factor might impact mode reliance. Results from these questions, as well as one focusing on system efficiency gains through improved performance are presented in the following subsections.

4.2.1.1 Perceived Importance of Performance Factors by Mode and Survey Group

In an effort to gauge the importance of various performance factors, investment criteria that emerged from both the literature and from the informant interviews were included on the survey. For each of the freight transportation modes (truck, rail, air, and water/marine) and intermodal transfers, respondents were asked whether the following performance factors were “very important”, “somewhat important”, “not very important”, or “not at all important” to the performance of their organization.

- Mobility (congestion, delay)
- Efficiency (transportation costs, throughput)
- Safety (loss and damage from accidents)
- Infrastructure (design, condition, and maintenance)
- Reliability (scheduling or weather, incidents, and other uncertainties)

- Accessibility (ease to reach markets and transportation facilities)
- Rules, Restrictions, and Institutional Issues

Responses to this question are presented in Tables 3.2 through Table 3.7. The percentages reported in each of these tables is the percent of respondents that said that the relevant performance factor was "very important" to the specified mode.

Mobility

Table 4.2 shows that mobility, which is defined to include congestion and delay, was very important for trucking for 90.9% of the general modal respondents versus only 50% of OFAC. OFAC seemed to think that mobility was most important to the air mode whereas the General stakeholder group deemed it most important for truck. The general modal group seemed to consider mobility (congestion and delay) more important for intermodal transfers than did the OFAC respondents.

Table 4.2: Percent of Respondents that Considered Mobility "Very Important."

Mode	OFAC	General Modal
Truck	50.0 %	90.9 %
Rail	50.0 %	37.5 %
Air	75.0 %	50.0 %
Marine/Water	25.0 %	20.0 %
Intermodal Transfers	25.0 %	50.0 %

Efficiency

Efficiency, defined as transportation costs and traffic throughput, was considered "very important" by the majority of all survey respondents across all modes (Table 4.3).

Of all of the performance factors evaluated, there was the greatest agreement on the importance of this factor.

Table 4.3: Percent of Respondents that Considered Efficiency "Very Important."

Mode	OFAC	General Modal
Truck	88.9 %	100.0 %
Rail	66.7 %	75.0 %
Air	75.0 %	50.0 %
Marine/Water	60.0 %	60.0 %
Intermodal Transfers	60.0 %	100.0 %

Safety

As noted in McMullen et al. (*2010*) safety is often mentioned as an important consideration for investment decisions, but the way in which it is measured for freight is somewhat different than for passenger transportation. Accordingly, safety is defined here

as the loss and damage from accidents, resulting in economic impact on the freight shippers or carriers.

Conventional wisdom is that there is a greater probability of loss and damage in rail transport than for truck—suggesting that improvements in safety for rail might lead to mode shift. However, results from the survey show that loss and damage is considered a more important factor for truck than for the other modes; rail had the second highest proportion (Table 4.4). This may be because trucks usually carry higher valued commodities where the economic impact of loss and damage may be greater.. It is interesting to note that air safety (loss and damage to air freight) is not considered to be an important factor to any of the general modal respondents and few (33.3%) of the OFAC group. This again may simply be due to the small percent of operations going by air and the perception that the probability of loss and damage from accidents is very small.

Table 4.4: Percent of Respondents that Considered Safety "Very Important."

Mode	OFAC	General Modal
Truck	62.5 %	75.0 %
Rail	40.0 %	55.6 %
Air	33.3 %	0 %
Marine/Water	25.0 %	40.0 %
Intermodal Transfers	25.0 %	60.0 %

Infrastructure

Infrastructure design , condition, and maintenance, is considered to be a very important performance factor for truck and rail, especially by the general modal group as seen in Table 4.5. This factor seems to be more important to the modal group for the truck and rail modes. Interestingly, OFAC seems to place more importance on this factor for the marine/water and intermodal transfer modes.

Table 4.5: Percent of Respondents that Considered Infrastructure Design "Very Important."

Mode	OFAC	General Modal
Truck	62.5 %	90.9 %
Rail	40.0 %	62.5 %
Air	33.3 %	25.0 %
Marine/Water	50.0 %	40.0 %
Intermodal Transfers	40.0 %	25.0 %

Reliability

Table 4.6 shows the percent of respondents that considered reliability (defined to be due to scheduling or weather, incidents or other uncertainties) as being a very important factor for each of the transportation mode types. While the two groups seemed to be in agreement that this was a very important factor for truck and rail transportation, there appeared to be a difference of opinion for air and water. All of the OFAC respondents

considered this a very important factor to air, compared to only 25% of the general modal group. This is particularly interesting given that the general modal group reported that a larger share of their operations move by air (14.3%) (OFAC reported only 8.3%). Finally, none of the respondents of the general modal group considered reliability to be a very important performance factor for water, whereas 40% of the OFAC group did. This may reflect the fact that OFAC respondents reported that more operations move by water than those in the general modal group (21% versus 8.3%) and thus may have experienced more service delays.

Table 4.6: Percent of Respondents that Considered Reliability "Very Important."

Mode	OFAC	General Modal
Truck	62.5 %	66.7 %
Rail	50.0 %	55.6 %
Air	100.0 %	25.0 %
Marine/Water	40.0 %	0 %
Intermodal Transfers	25.0 %	40.0 %

Accessibility

The results for accessibility, the ability to reach transportation markets and facilities, are reported in Table 4.7. The general modal group ranked this as a particularly important factor for truck whereas the OFAC group ranked it most important for air freight.

Table 4.7 Percent of Respondents that Considered Accessibility "Very Important."

Mode	OFAC	General Modal
Truck	55.6 %	81.8 %
Rail	33.0 %	37.5 %
Air	66.7 %	25.0 %
Marine/Water	40.0 %	40.0 %
Intermodal Transfers	25.0 %	25.0 %

Rules, Restrictions, and Institutional Issues

Finally, the role played by rules and regulations in affecting the performance of the freight transportation system, a factor mentioned several times in the telephone interviews, was considered to be a very important factor for the majority of OFAC respondents for all modes, with percentages between 50% and 66.7% (see Table 4.8). However, the importance of this factor to the general modal respondents varied widely by mode, with 80% considering it a very important factor for truck but none considering it very important for air freight. Indeed, only about 25% of the general modal group considered this as a very important factor for rail, water, or intermodal transfers.

Table 4.8 Percent of Respondents that Considered Rules and Regulations "Very Important."

Mode	OFAC	General Modal
Truck	55.6 %	80.0 %
Rail	50.0 %	28.6 %
Air	66.7 %	0 %
Marine/Water	60.0 %	25.0 %
Intermodal Transfers	50.0 %	25.0 %

4.2.1.2 Perceived Impact of a Modest Improvement in a Performance Factor by Mode and Survey Group

Next the respondents were asked to consider a "moderate" improvement in a performance factor and whether this would result in change (increase, stay the same, or decrease) in the percentage that their organization relied on each mode. In a few cases respondents indicated that an improvement would reduce use of a mode, a response that does not lend itself easily to interpretation. One possible explanation is that the respondent viewed a performance improvement as increasing the use of one mode and proportionally decreasing the use of another (i.e. mode shift).

Mobility

Table 4.9 shows the percent of respondents that indicated a moderate improvement to mobility, defined as a reduction in congestion and delay, would increase their use of a mode. For the OFAC respondents, improvements in mobility were seen as having the largest impact on use of air and intermodal transfers. The general modal group agreed with OFAC on the the increased use of intermodal transfers (with 75% of both groups saying use would increase), but overwhelmingly disagreed about increased rail use (57.1% of the modal group reported their use would increase, while 0% of OFAC reported the same). A decrease in mode use was reported by the general modal group for improvements to truck mobility.

Table 4.9: Percentage of Increased Mode Use Resulting from a Moderate Improvement in Mobility.

Mode	OFAC	General Modal
Truck	25.0 %	36.4 %
Rail	0 %	57.1 %
Air	66.7 %	33.3 %
Marine/Water	25.0 %	20.0 %
Intermodal Transfers	75.0 %	75.0 %

Efficiency

For a moderate improvement in efficiency (defined as a reduction in transportation costs or increase in throughput) both groups had similar views as to how much use of rail, air, marine, and intermodal would be affected (Table 4.10). Both groups viewed an increase in efficiency as having a major impact on rail and intermodal transfers with over 70% of respondents indicating that a moderate increase in efficiency would increase use of those modes. Only 25% of the OFAC respondents thought that an increase in efficiency (a reduction in transportation cost and throughput) would increase the use of truck, whereas 45.5% of the General stakeholder group thought an increase in truck use would result. A decrease in mode use was reported by the general modal group for improvements to truck efficiency.

Table 4.10: Percent of Increased Mode Use Resulting from a Moderate Improvement in Efficiency.

Mode	OFAC	General Modal
Truck	25.0 %	45.5 %
Rail	80 %	71.4 %
Air	66.7 %	66.7 %
Marine/Water	25.0 %	20.0 %
Intermodal Transfers	75.0 %	75.0 %

Safety

For the most part, moderate increase in safety as represented by a decrease in loss and damage due to accidents, was seen as having little or no impact on mode use by both groups (Table 4.11). The exceptions included 42.9% of the general modal group respondents who indicated that increasing rail safety (reducing loss and damage due to accidents) would increase rail use, and 75% of OFAC respondents who thought safety improvements in intermodal transfers would increase use of these facilities.

Table 4.11: Moderate Improvement in Safety (The percent of respondents that would not change use of the mode and the percent that would increase use of mode).

Mode	OFAC	General Modal
Truck	12.5 %	18.2 %
Rail	0 %	42.9 %
Air	0 %	0 %
Marine/Water	0 %	20.0 %
Intermodal Transfers	75.0 %	25.0 %

Infrastructure

OFAC respondents seemed to think that improvements in infrastructure would increase use of the various modes more than the general modal group (Table 4.12). The exception was truck, where slightly more modal respondents saw such improvements as increasing truck use (36.4%) than the OFAC group (25%). A decrease in mode use was reported by the general modal group for improvements to truck infrastructure.

Table 4.12: Percent of Increased Mode Use Resulting from a Moderate Improvement in Infrastructure.

Mode	OFAC	General Modal
Truck	25.0 %	36.4 %
Rail	60.0 %	28.6 %
Air	33.3 %	33.3 %
Marine/Water	50.0 %	20.0 %
Intermodal Transfers	75.0 %	25.0 %

Reliability

As seen in Table 4.13, for a moderate increase in reliability, defined to be due to scheduling or weather, incidents or other uncertainties, half of the general modal group thought there would be an increase in use of rail and truck only, while all other mode use would stay the same. OFAC respondents seemed to think that reliability improvements would increase use of all modes, especially for rail, with 80% of respondents reporting a resulting increase in use.

Table 4.13: Percent of Increased Mode Use resulting from a Moderate Improvement in Reliability.

Mode	OFAC	General Modal
Truck	25.0 %	50.0 %
Rail	80.0 %	50.0 %
Air	33.3 %	0 %
Marine/Water	25.0 %	0 %
Intermodal Transfers	50.0 %	0 %

Accessibility

The impact of improvements in accessibility were viewed as increasing use of all modes with OFAC reporting the greatest impact on rail, and the general modal group reporting the greatest impact on intermodal transfers. Eighty percent of OFAC respondents saw accessibility improvement as increasing use of rail while 42.9% of the general modal group held this view (Table 4.14)

Table 4.14: Percent of Increased Mode Use Resulting from a Moderate Improvement in Accessibility.

Mode	OFAC	General Modal
Truck	37.5 %	36.4 %
Rail	80.0 %	42.9 %
Air	33.3 %	33.3 %
Marine/Water	25.0 %	20.0 %
Intermodal Transfers	25.0 %	75.0 %

Rules, Restrictions, and Institutional Issues

Finally, for the general modal group a moderate improvement in restrictions and rules was only seen to increase use of truck and rail with other modes unaffected (Table 4.15). This suggests that the rules and regulations are viewed as a constraint on performance for those modes but not the others. Interestingly, OFAC respondents seemed to see the largest impact of improvements in this factor as affecting rail, air, and marine. A decrease in mode use was reported by the general modal group for improvements to rail and marine rules, restrictions, and institutional issues.

Table 4.15: Percent of Increased Mode Use Resulting from a Moderate Improvement in Rules and Restrictions.

Mode	OFAC	General Modal
Truck	12.5 %	18.2 %
Rail	20.0 %	14.2 %
Air	33.3 %	0 %
Marine/Water	25.0 %	0 %
Intermodal Transfers	0 %	0 %

4.2.1.3 Ranking of Performance Factors Relative to Improving System Efficiency

Finally survey respondents were asked to rank 10 select performance factors from 1 to 10, with "1" being the being the performance factor that would influence efficiency the most for their organization. Given the fact that the two groups ranked these performance factors in a very similar manner (the Spearmen Correlation coefficient was 0.9879 for the rankings between the two groups) the overall rankings are combined for OFAC and the general modal group responses. In ranked order, the results were as follows:

1. A decrease in congestion.
2. An increase in travel time reliability.
3. A reduction in travel time.
4. An increase in system capacity.
5. An improvement in connectivity and access.
6. Preservation of existing infrastructure.
7. An improvement in existing facilities.
8. An improvement in safety.
9. Service to a critical link.
10. A reduction in freight transfer costs.

Thus, despite some observed differences regarding the importance of these factors when applied specifically to different modes, there appears to be general consensus regarding the relative importance of the general performance factors in determining the efficiency of the freight transportation system.

4.3 CONSIDERATION OF FREIGHT STAKEHOLDER COMMUNITY VIEWS

Views expressed by the freight stakeholder community can be used in the consideration of weights for existing investment criteria and in the consideration of supplemental or new criteria. Additionally, information gleaned from the stakeholder survey provides practitioner perspectives on needs for performance improvements and how performance-based factors might impact operations. More specifically, the results provide indications of how investment decisions might impact system use and mode choice.

From a policy perspective, some of the "performance factors" identified through the literature review and stakeholder interviews (and evaluated in the survey) are easier for decision-makers in Oregon to affect through investment policy and project selection, than others. For instance, projects often focus on clear-cut issues such as infrastructure maintenance or improvement. Increasing mobility by reducing congestion and delay may be affected by infrastructure improvement, but also can be affected greatly by pricing and incidence response programs, which represent a departure from traditional Oregon transportation investment policy.

5.0 SUMMARY AND CONCLUSIONS

The establishment and implementation of multimodal investment criteria for freight is a complex endeavor. Previous research has indicated the importance of making sure that the selected freight investment criteria are relevant to the needs of the freight community, decision-makers and government agencies. Accordingly, this report has focused on the freight system stakeholders and the way in which their opinions on multimodal investment criteria are included in the decision-making process. Such efforts are essential so that the investment criteria are identified and supported by freight stakeholders prior to implementation. An evaluation of the *Connect*Oregon II review and selection process indicates that there is a high degree of consensus between the various stakeholder groups and the decision-making authority. This supports the conclusion that the *Connect*Oregon program has successfully implemented the sort of combined top-down and a bottom-up process that is generally thought to be most successful in meeting long-range transportation planning goals.

That said, differences were noted in the ranking of *Connect*Oregon II projects between the Freight Review Committee (FRC) and one or more of the modes or regions. As an example, one of the greatest differences was observed for the eastern portion of the state, which may reflect the rural/urban or east/west split that is often perceived in discussions of transportation issues in Oregon. This also may reflect the fact that regional groups may give more weight to projects in their area above considering the needs of the overall statewide system.

Overall, most of the regional and modal groups had rank correlation coefficients well over 90%. A lower correlation was seen between OFAC and the FRC (~85%). Examination of data from the survey portion of the research revealed a difference between the perceived importance of criteria by mode, especially for marine/water transport. This difference may be due to the variance in roles that marine/water transportation plays in the freight transportation system in Oregon.

5.1 CONCLUSIONS

Below is a list of general conclusions and suggestions for further research from this study:

1. The *Connect*Oregon program, evaluated as part of this research, seems to have incorporated input from the stakeholder groups into the review process in a way consistent with the preferred combined bottom-up/top-down approach to decision-making.

2. There seems to be some difference of opinion between the various stakeholder groups as to the importance of the various criteria as applied to marine/water investment decisions as well as some regional differences in rankings. To achieve greater

consensus in project selection decisions, more in-depth inquiry into the reasons for these differences is suggested for future research.

3. Efficiency, defined as transportation costs and traffic throughput, was considered "very important" by the majority of all survey respondents across all modes. It may be useful for future research to explore what aspects of efficiency are relevant to the stakeholders and which can be affected by public investment as opposed to decision-making by private firms.

4. The results from this study should provide decision-makers with a better idea of where moderate improvements in the various considerations (such as mobility or efficiency) might yield the largest benefit to the modal groups.

5. Reduction of congestion, increased reliability and reduction in travel time remain the most important considerations for most stakeholders. This seems to be in line with the general considerations for non-freight system operations. Research is needed to determine whether general improvements to the system will be as effective for both freight and passenger transportation or whether there are different types of policies required for freight alone.

6. Although rules and regulations have often been cited as a constraint on the freight transportation system, only the truck mode indicted strongly that these impeded modal performance.

7. Including professional input to support the bottom-up process may help improve the overall program especially when there are complex technical issues involved such as the evaluation of economic benefits that require more specialized expertise.

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APPENDIX A:
FREIGHT STAKEHOLDER SURVEY INSTRUMENT

Investing in Multimodal Freight Transportation

1. Stakeholder Needs

This survey is part of a research project investigating "Multimodal Investment Criteria." It is sponsored by the Oregon Department of Transportation Research Section and conducted by Oregon State University.

The goal of the survey is to assess stakeholder needs and issues related to freight transportation. The information gathered from this survey is confidential, and will be used to help analyze multimodal freight investment criteria. Changes to freight investments are outside the purview of this research project, however the knowledge you give us will help inform decision-makers.

1. Do you work for a public or private company or organization?

- ◯ Public
- ◯ Private

2. Which best describes your company or organization?

- ◯ Government agency
- ◯ Shipper
- ◯ Carrier
- ◯ Other (please specify)

3. In which ODOT Regions (see map below) does your company or organization primarily operate (click on all that apply)?

- ☐ Region 1
- ☐ Region 2
- ☐ Region 3
- ☐ Region 4
- ☐ Region 5

Investing in Multimodal Freight Transportation

ODOT Regions

4. Please click on all the freight transportation modes that are used by your company or organization (click all that apply):

- ☐ Trucking
- ☐ Rail
- ☐ Air
- ☐ Marine/Water

5. Does your company or organization rely on intermodal transfers (e.g. Air-Truck, Truck-Rail, Truck-Water)?

- ◯ No
- ◯ Yes (please specify types of intermodal transfers below)

6. Please estimate the percentage of your operations that rely on each mode.

Trucking	
Rail	
Air	
Marine/Rail	

Investing in Multimodal Freight Transportation

7. Please indicate how important each of the following freight transportation performance factors are for each mode your company or organization relies on.

(Please only rate the performance categories in the columns that correspond to the modes that influence your company or organization. For instance, if your company or organization only deals with trucking and rail, please rate each performance category only in the "Trucking" and "Rail" columns.)

	Trucking	Rail	Air	Marine/Water	Intermodal Transfers
Mobility/Efficiency (congestion, speed, delay)					
Safety (accidents, fatalities)					
Infrastructure (design, condition, and maintenance)					
Reliability (due to weather, incidents, and other uncertainties)					
Accessibility (ease to reach markets and transportation facilities)					
Rules, Restrictions, and Institutional Issues					

Comments

Investing in Multimodal Freight Transportation

8. Hypothetically, if a project were completed that resulted in a moderate improvement to a performance factor (e.g. safety, or reliability), would the percentage that you rely on each mode increase, stay the same, or decrease?

(Please consider each performance factor independently. Only rate the performance categories in the columns that correspond to the modes that influence your company or organization.)

	Trucking	Rail	Air	Marine/Water	Intermodal Transfers
Mobility/Efficiency (congestion, speed, delay)					
Safety (accidents, fatalities)					
Infrastructure (design, condition, and maintenance)					
Reliability (due to weather, incidents, and other uncertainties)					
Accessibility (ease to reach markets and transportation facilities)					
Rules, Restrictions, and Institutional Issues					

For any changes (increase or decrease) indicated above, please explain:

Investing in Multimodal Freight Transportation

9. How important are multimodal linkages (e.g location, access, and ease in transferability) in increasing overall system volume?

- ◯ very important
- ◯ somewhat important
- ◯ not very important
- ◯ not at all important
- ◯ don't know

Please explain:

10. How important are multimodal linkages (e.g location, access, and ease in transferability) in increasing overall system efficiency (e.g. improving delay, and reducing costs)?

- ◯ very important
- ◯ somewhat important
- ◯ not very important
- ◯ not at all important
- ◯ don't know

Please explain:

Investing in Multimodal Freight Transportation

11. Please read the following list and click on the three improvements that are most critical for the primary geographic region in which you operate (please select only three).

- [ ] removing modal bottlenecks
- [ ] removing inter-modal bottlenecks
- [ ] preserving existing infrastructure
- [ ] upgrading facilities (e.g. increased maneuverability)
- [ ] improving accessibility of major freight trip generators
- [ ] serving critical port facilities

Comments:

12. Please rank the following performance factors with regard to the amount each would influence an improvement in system efficiency for your company/organization.

(Type a 1 next to the performance factor that would influence efficiency the most, a 2 next to the second most influential, and so on until you have ranked all 10 performance factors.)

improves safety	
reduces travel time	
increases travel time reliability	
decreases congestion	
improves connectivity and access	
preserves existing infrastructure	
improves existing facilities	
increases system capacity	
services a critical link	
reduces freight transfer costs	

Investing in Multimodal Freight Transportation

13. To help us understand more about your company's or organization's needs relative to multimodal freight transportation please provide additional thoughts below:

14. (Optional) If you would like to receive an electronic copy of the final report for this research project (expected to be completed in late summer), please include your email below.

Email Address: