*White Paper:*

# Use of Freight and Business Impact Criteria for Evaluating Transportation Investments

*Prepared for:*

**Port of Portland and**
**Portland Business Alliance**

*Prepared by:*

**Economic Development Research Group, Inc.**
2 Oliver Street, 9th Floor, Boston, MA 02109

**August 11, 2008**

# Table of Contents

# 1 INTRODUCTION

## 1.1 Motivation.

Local, regional and state transportation agencies have traditionally decided on transportation project priorities and investment on the basis of traffic flow needs, while also considering factors such as neighborhood quality of life concerns. There has been a growing recognition of the importance of considering economic development as a general factor motivating more transportation investment. However, the problem today is that even if the public and decision-makers recognize the importance of transportation infrastructure for their jobs, income and tax base, there is often no good way for them to differentiate projects that are particularly critical for business and economic growth.

This report seeks to address that need by laying out the case for: (a) why it makes sense to give weight to freight movement and critical business routes in the evaluation and prioritization of transportation investments, and (b) how a methodology and process can be implemented to appropriately take consideration of critical freight and business activities in the decision-making process.

## 1.2 Contents of this Report

This report is organized into three sections:

- Ch.2: The Importance of Freight and Business Impacts. This section shows how the region's traded industries are central to job and income generation in the region, and also particularly vulnerable to bottlenecks on key business supply routes– a factor to be recognized in transportation investment decision-making.

- Ch.3: Criteria for Project Evaluation. This section reviews practice in other states and lays out options for criteria that can be used to evaluate how proposed transportation projects will affect freight movement and critical business activity clusters.

- Ch.4: Methods for Estimating Business Impacts. This section describes of methods (that can be adopted by public agencies) for assessing the relative magnitude of freight and other business transportation benefits among alternative transportation projects.

# 2 THE IMPORTANCE OF FREIGHT AND BUSINESS IMPACTS

## 2.1 The Relationship of Traded Industries, Transportation and the Economy

Like most regions in the US, the stability and growth potential of the Portland Region's economy hinges on the health of its "core" or "traded" industries. Generally, traded industries are those selling products to national or international markets. (An example is a computer chip manufacturing plant, that ships most of its product to buyers elsewhere in the US and abroad.) These are the industries that bring a flow of incoming dollars to the regional economy. They then support additional "local-serving" industries, which primarily serve the needs of local residents. (An example is a dry-cleaning business, whose customers all live within the metropolitan area.)

Traded industries have been the subject of much study, including how they arise and evolve, whether or not they gravitate into "clusters", and how they interact with local labor markets and industries. Cortright (2004) also notes that some industries may begin as "local" and then expand into international markets, while others may be difficult to identify as exclusively traded or local. However, from the perspective of their place in a regional economy, the most important feature of a traded industry is that, because they produce for large non-local markets, they almost always produce (and sell) more goods or services than can be consumed locally. This additional production is the key: by selling locally produced goods to customers outside the region, core industries act as economic "pumps" that bring wealth into the region.

Local-serving industries do serve an important role in the local economy by circulating and distributing wealth within a region, but they do not generally add to its overall level. Rather, local industries are dependent on the existence of traded industries and their workers as an important source of demand for their goods and services. Because of this, traded industries serve as a foundation for the economic health of the entire region.[1].

By their very nature, traded industries rely heavily on transportation. However, while both local and traded industries depend on regional access to inputs –

---

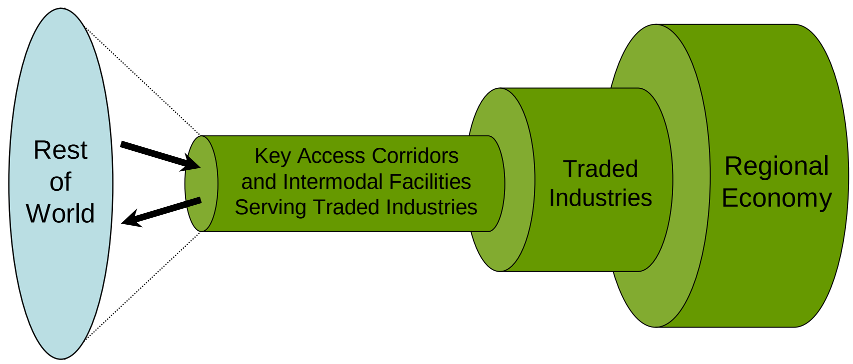
[1] In the academic literature, traded industries are sometimes referred to as a region's "export base," a term that reinforces their foundational role in an economy.

particularly labor – traded industries also depend on access to national and international destinations. In order for them to remain effective as economic pumps, they need to be able to ship goods and services to customers outside of the region, and they need reliable access to remote suppliers.

The nature of these dependencies can vary greatly depending on the specific industry. Historically, marine and rail were primary modes for moving commodities. Many resource-based traded industries arose in conjunction with improving transportation technology, and many still rely on these modes. Similarly, since the inception of the Interstate Highway System, manufacturing industries have come to be closely tied to the trucking industry. Highway and roadway networks enabled improvements in the production and supply chain process, utilizing access to increasingly specialized suppliers and multiple consumer markets. More recently, some service-based industries – once primarily "local" – have made the transition to being "traded". While this trend has been facilitated by (and continues to rely upon) improving communication technology, even service-based industries depend on the reliable movement of goods and people.

Most large urban areas display a variety of traded industries that collectively requires dependable long-distance transportation *across all modes*. In addition, fluid freight and passenger travel is only achieved with dependable connections *between modes*. This means that a region's travel corridors, intermodal facilities, and access gateways can act as life-lines to the region's traded industries, and therefore to the broader economy. These relationships are summarized in Figure 1. For these critical links, congestion, bottlenecks, and capacity limitations can have manifold consequences for the overall economic health of the region.

**Figure 1: The link between transportation, traded industries, and regional economy**




The purpose of this section is to more fully develop the link between traded industries, the quality of transportation networks, corridors, and facilities that serve those industries, and overall economic performance in the Portland region.

# 2.2 "Traded Industries" in the Region

The concept of traded industries has been firmly established in the Portland region. Studies by the Institute of Portland Metropolitan Studies (1999), Joseph Cortright (January 2004), and more recently by Economic Development Research Group (2005) have painted a consistent yet dynamic picture of the region's exporting industries.

Like many metropolitan areas, traded industries in the Portland region have historically centered on natural resource extraction. Forestry and logging (and mining, to a lesser extent) were critical to the early development of the region (Institute of Portland Metropolitan Studies, 1999). Over time, these natural resources seeded the creation of more advanced economic activity: manufacturing of wood-related products, printing, and primary metal manufacturing (Cortright, May 2004). Other manufacturing clusters emerged as well, sometimes without any initial local competitive advantage. The most important of these developed as the "Silicon Forest" cluster of high-tech electronic manufacturing firms, centering on industry leaders Hewlett-Packard, Intel, and Tektronix (Cortright and Mayer, 2000).

Among these previous works, different approaches have been used to identify traded industries in the Portland region. In Cortright's (January 2004) analysis, IMPLAN data was used to identify which of the region's industries focused production for consumption outside the region. Other recent work by Economic Development Research Group (2005) took a different approach by looking at industries with high location quotients[2].

An update of these analyses using more recent data confirms that the industries listed above remain important to the regional economy (see Table 1). However, it also reveals that (1), transportation and wholesale activity is increasingly important to the strength of the regional economy, and (2) certain service-based industries have become more export-oriented, and therefore are more important as generators of wealth in the regional economy.

Table 1 shows the total amount of production (supply) and consumption (demand) for traded industries in the Portland Region. The difference between these two provides a rough measure of the "excess production" for each industry, indicating its ability to generate wealth for the regional economy.[3] This difference is reflected in a high supply/demand ratio (and is also correlated with high location quotients). The important thing to note is that an industry's importance to the

[2] A location quotient (LQ) compares a region's share of employment in a particular sector with the U.S. share. LQs greater than 1 indicate relative concentrations for that industry.
[3] It is important to note, however, that the difference between local supply and demand (gross exports) does not necessarily equal total (net) exports. Even products in heavily exported industries may also be imported into a region, reflecting product variation within the industry sector.

regional economy depends not only on the extent to which it is "traded", but also on its overall scale of production.

***Table 1: Traded Industries in the Portland Region***

| NAICS | Sector Description | Regional Supply ($mil) | Regional l Demand ($mil) | Regional Supply /Demand Ratio | Location Quotient* |
|---|---|---|---|---|---|
| 111 | Agriculture | 646 | 436 | 1.48 | 1.11 |
| 113 | Forestry & logging | 935 | 390 | 2.40 | 6.01 |
| 323 | Printing & related support activities | 503 | 270 | 1.86 | 1.30 |
| 331 | Primary metal mfg | 1,252 | 1,206 | 1.04 | 1.85 |
| 334 | Computer & electronic product mfg | 15,262 | 7,234 | 2.11 | 4.92 |
| 420 | Wholesale trade | 8,711 | 4,870 | 1.79 | 1.65 |
| 451 | Sports, hobby, book, & music stores | 218 | 153 | 1.43 | 1.25 |
| 484 | Truck transportation | 1,262 | 1,013 | 1.25 | 1.07 |
| 487 | Scenic & sightseeing transportation | 423 | 208 | 2.03 | 0.76 |
| 511 | Publishing industries | 1,864 | 1,603 | 1.16 | 1.45 |
| 522 | Credit intermediation & related services | 1,582 | 759 | 2.08 | 1.41 |
| 551 | Management of companies | 2,963 | 1,833 | 1.62 | 1.55 |

** Location Quotient measures an industry's share of local value-added relative to the same industry's share of US value-added.*
*Source: IMPLAN social accounting matrix for 3-County Portland Region, based on US BEA data*

By this analysis, the computer and electronic product manufacturing sector (334) is clearly the most critical to the regional economy, providing over $8 billion in "excess production" in 2003. While this result is probably not surprising to people familiar with Portland region, the fact that wholesale trade and truck transportation combine for over $4 billion in gross exports might be. Furthermore, whereas the historically important cluster of wood-related products and publishing (sectors 113, 323, 451, and 511) contributes a combined $1.1 billion, three service-based industries (522, 551, and 813) combine for over $2.6 billion in excess production. The importance of the industries shown in Table 1 is further summarized by the following 2003 statistics[4]:

- The Portland region's traded industries combined to account for 43% of all *gross* exports (by value).
- These industries generated $14.3 billion in *net* exports – $3.6 billion *more* than the region's total net exports across all industries (this means that the industries not shown in Table 1 were net *importers* of $3.6 billion).

[4] Source: IMPLAN social accounting matrix for 3-County core of the Portland Region

## 2.3 How Traded Industries use Transportation

The preceding section described how, from the perspective of the overall regional economy, the traded industries serve as a primary generator of wealth by producing more than can be consumed locally. However, from a transportation perspective, traded industries are important because their products are *traded* and hence depend on long-distance transportation connections to customers in national or international markets. As a result, any major reduction in access to customers outside the region can have serious implications for many traded industries (and therefore the broader economy). Thus, transportation's support for traded industries not only enables those industries to generate wealth for the region, but transportation becomes an important determinant of their future economic prospects.

However, transportation needs vary greatly among firms. At the simplest level, some traded industries produce goods that are heavy and bulky, while others are very light (indeed, the weight of many service-sector commodities can be measured at the quantum level). The value of commodities also tends to be inversely related to weight, although some of the highest value goods can be relatively bulky (for example, automobiles and clothes). These points were emphasized by Cortright (2001), who showed that while average output per worker (in $) was very close for electronic vs. wood-product manufacturing industries, a pound of goods produced by firms like Hewlett-Packard, Intel, and Tektronix was worth roughly 100 times that of firms in wood-product manufacturing. This translates into considerably different approaches to transport between the two sectors.

However, the importance of transportation to traded industries extends beyond how to handle heavy vs. light loads. This is because the weight (or value) of a good being shipped does not capture other important aspects of transportation demand such as timeliness, flexibility, containerization, the ability to make small shipments, and speed. As these features tend to be captured in shipping decisions made by firms, a more appropriate approach is to look at how they allocate their transportation budgets among alternative modes. Table 2 shows this data for Portland's traded industries.

***Table 2: How Portland's Traded Industries use Transportation***

| NAICS | Sector Description | Primary Mode(s)* | Secondary Mode(s)* |
|---|---|---|---|
| 111 | Agriculture | Truck (73%) | Rail (20%) |
| 113 | Forestry & logging | Truck (75%) | Rail (8%) |
| 323 | Printing & related support activities | Truck (75%) | Rail (12%) |
| 331 | Primary metal mfg | Truck (68%) | Rail (21%) |
| 334 | Computer & electronic product mfg | Truck (49%) | Air (16%)<br>LTL (13%) |
| 420 | Wholesale trade | LTL (58%) | Postal (20%) |
| 451 | Sport goods, hobby, book, & music stores | LTL (48%) | Postal (28%)<br>Truck (13%) |
| 484 | Truck transportation | Truck (74%) | - |
| 487 | Scenic & sightseeing transportation | Sightseeing (76%) | - |
| 511 | Publishing industries | Postal (36%)<br>Truck (35%) | LTL (11%) |
| 522 | Credit intermediation & related services | LTL (68%) | Postal (12%)<br>Air (11%) |
| 551 | Management of companies | Truck (45%)<br>Postal (43%) | - |

A first glance at Table 2 reveals several important aspects of how traded industries depend on transportation. First, trucks, less-than-truckload (LTL) couriers, and postal shipments are the most heavily utilized modes across the entire range of industries, and *all of these modes are highway-based*. Second, basic and heavy manufacturing sectors continue to rely on railroads for a significant portion of freight movement. Third, the two single most important industries to Portland (from an export-base perspective) are heavily reliant on LTL freight services. This is important because LTL carriers are highly decentralized with large fleets making frequent pickups/deliveries, and are therefore vulnerable to street and highway congestion. Fourth, the computer and electronic manufacturing sector spends a significant amount of its transport budget on air travel. While this budget combines air freight and business travel, it highlights the increasing importance of air travel to the region. (LTL and Postal services also rely on air shipments.) Finally, although trucks dominate, most traded industries depend on more than one mode to meet their transport needs.

Table 2 presents only a single year's snapshot of transport spending by Portland's traded industries. However, this picture is highly consistent with several trends facing firms with export-oriented activity, which are discussed next.

*Traded Industries, Transport, and the Internet*

While improving communication technology has enabled service-based sectors to engage in "export" activity, it has also had tremendous impacts on how manufacturing and resource-based industries use transportation. Clearly, the internet and cell phones have enabled sectors like "management of companies" and "grant-making & civic organizations" to ship their services (primarily information) to customers outside the region. However, ease of communication has also put enormous pressure on manufacturers to increase their level of responsiveness to customers. These trends were described by McCann and Schefer (2004), who noted that falling information costs increased the competitive environment among firms in large national or international markets.

With better information, firms were able to take advantage of changing demand patterns, and those who are able to respond quickly gained advantage over their competitors. This, in-turn, bred a wholesale change in industries' approach to inventory, supply chains, and access to markets, essentially substituting speed for large inventories (with just-in-time techniques being the most extreme example). Moreover, over time, firms' rapid response to consumers came to be *expected*. McCann and Shefer (2004) note that "modern household and industrial consumers now *require* a level of service customization and delivery speed which previously was not considered either so important or even possible." (p. 184, emphasis added). The end result of these trends is that *reliability*, *flexibility*, and (above all else) *speed* are more and more frequently cited as transportation needs among firms (Cortright, 2001). This demand for speed and flexibility is reflected in high demand for less-than-truckload (LTL), air freight, and postal modes shown in Table 2. Moreover, the industries most important to the Portland region's broader economy are largely dependent upon these very modes. The structural characteristics of these industries and their markets are expected to continue, even as higher fuel prices can cause some preference for closer suppliers.

*Traded Industries and the Dominance of Trucks*

Trucks (and the road networks that carry them), are the most commonly used mode of transport for nearly all of the Portland region's traded industries. With few exceptions, this is true for the Portland region's traded industries shown in Table 2. This may seem surprising when we recall that computer and electronic commodities are roughly 100 times more valuable per-pound than wood and paper products. But these two industries' shared reliance on trucking masks four important features of the trucking industry.

a) Trucks provide an inherent advantage over other modes in "spatial flexibility", which flows from the extensive and easily accessible network of roads and highways. Put simply, trucks are more and more frequently the easiest and cheapest way "to get there from here." The benefits of this flexibility have become evident for firms on all points of a supply chain.

b) The trucking industry itself is highly diverse, meeting demands across ranges of commodity value, weight, perishability, form (liquid vs. container), and origin/destination pattern (long-distance vs. short-haul).

c) The trucking industry has undergone significant change over the past few decades in response to the communication technology improvements discussed above. Trucks are increasingly becoming an integrated part of extensive supply chains and inventory management systems, and this is accomplished with own-account fleets, for-hire haulers, or less-than-truckload courier services such as UPS, FedEx, and DHL.

d) One of the increasing benefits of trucks is its ability to be integrated with other modes of transport. Containerization and improved trans-modal technology has greatly reduced “transfer penalties” associated with mode-switching along long-distance shipments. This integration means that although trucking can be seen as an alternative to other modes such as rail and air, it is also highly complementary to these modes. And as will be discussed below, this also means that roadway congestion affecting truck travel times can have high cost repercussions across all modes.

*Traded Industries and Multimodalism*

Many of the Portland region’s traded sectors rely on more than one mode. For example, rail remains important to several low-value commodities, and air is increasingly important for rapid long-distance shipments of high-value goods. Moreover, the importance of *all modes* to the region’s traded industries is further summarized by the following statistics[5]:

- The Portland region’s traded industries accounted for 71% of domestic exports (by value) using modes other than truck and pipeline (as of 2006). The value is 50% for Imports.
- 82% of all domestic exports by air or truck/air are generated by the computer and electronic manufacturing sector (and 65% of imports).
- 55% of regional exports by rail are from logging, wood products, and crop farming industries, with primary metal manufacturing contributing another 20%.

Reliance upon multiple modes has important implications for intermodal and transfer facilities. As will be discussed below, the intermodal activities associated with the Port of Portland and area rail yards are critical for overall freight access and mobility in the region. Moreover, streamlined access to the airport is seen as one of the primary attractions for the “Silicon Forest” cluster.

*Traded Industries, Transportation, and Competitiveness*

Quality transportation is an important factor in attracting (and retaining) firms trading in national and global markets. If wholesale and truck transportation sectors are excluded, the industries shown in Table 2 spend roughly 1.2% of output on transportation and warehousing – this is *below* the regional average of 1.5%. This does not mean that transportation is less important to these industries; rather, it reflects the extremely competitive markets they serve. Because traded industries compete for market share against firms around the country or globe, low transport costs and reliable access are a critical source of market advantage.

[5] Source: 2006 Freight Analysis Framework, Federal Highway Administration

Moreover, because the markets for traded industries tend to be decentralized, firms have the ability to select among regions offering competitive advantages such as high-quality inputs (particularly labor), low production costs (for example, land costs, energy, and taxes), and fast, reliable transportation. Other things equal, congestion, bottlenecks, and capacity constraints all lower a region's competitive advantage.

# 2.4 Key Access Corridors and Intermodal Facilities

The analysis thus far has identified the Portland region's traded industries and how each generally uses transportation. This section brings that chain of economic dependencies to its terminus by considering how the transport sectors supporting traded industries use specific multimodal access points, intermodal facilities, and the broader street network in Portland.

Before proceeding, however, a few comments on Portland's geography will help illuminate how its transport system functions.

- First, Portland is a relatively isolated economy. Seattle lies 175 miles north, following Interstate 5. Vancouver, BC -- also part of the Pacific Northwest market -- is 300 miles north. However, the nearest large metropolitan area to the south, San Francisco/Oakland, is 635 miles away by road (also I-5). Interstate 84 and US Rt. 26 provide eastern access to the city, but economic activity is relatively sparse through the Cascades and Rocky Mountains – Denver, the nearest major metropolitan area to the east, is over 1200 miles away. The mountainous terrain to the east also limits rail movements to cities like Chicago.

- Second, Portland lies roughly 100 miles up the Columbia River from the Pacific Ocean. This river enables port activity in Portland, and also provides access to inland areas by way of the Snake River. However, the river also limits street and rail movements within the city, as there are relatively few street, highway, and railroad bridges across it.

- Third, significant transportation, warehousing, and distribution activity occurs in and around the Port of Portland marine/intermodal facility and the Portland International Airport. For those activities, the layout of the city requires many long-distance truck movements to transverse either business-district traffic to the south and east, or Columbia River crossings to the north. There are also clusters of warehousing and distribution activity south along I-205 in Tualatin, Wilsonville and Clackamas, and west along US-26 in Hillsboro. This geographic picture, combined with a closer look at Table 2, has important implications for the Portland region's transportation infrastructure as it relates to traded industries.

Maintaining an efficient network of highways, arterials, and streets is the most critical factor in the continued growth of the region's traded industries. This is because congestion can affect economic activity in so many ways. The most obvious impact of roadway congestion is increased travel times, which increases delivery costs despite poorer service[6]. Successive rounds of business interviews reinforced this fundamental point, but also revealed the complexity of this issue.

For example, relative lack of congestion and good access to freight facilities has historically been seen as one of the Portland region's *competitive advantages* – but one that is currently in jeopardy. Much of the region's transportation, warehousing, and distribution facilities are located just north of the central business district – including several marine terminals and Portland International Airport. Proximity to these terminals is seen as one of the attributes driving demand for new development. However, increasing traffic congestion threatens this competitive advantage.

But this congestion is not just seen as a highway problem. Businesses surveyed by the Port of Portland noted that in addition to the commonly cited problems on I-5, I-84, and I-205, several regional arterials, and even select surface streets, were limiting access to and from centrally located facilities. One of the most important of these is the Sunset Highway (US Rt. 26), which acts as a critical link between central transport facilities (including the airport) and the region's largest high-tech firms. Access to (and from) Swan Island is also a major concern. Businesses also recognize that highway, arterial, and street-level congestion are not independent problems – particularly for trucks, which can have limited alternatives for commonly used routes (for example, in St. Johns and Yeon).

Among these rounds of interviews, one of the most commonly cited consequences of increasing congestion is diminishing schedule flexibility. Distribution and trucking firms make ongoing scheduling adjustments to avoid peak-period travel times, which means that the businesses they support must also adjust scheduling, and possibly even increase inventories (Economic Development Research Group, 2005). The end result is that these adjustments force a trade-off between speed and reliability, flexibility, or convenience. These are the very attributes that will be most important to the region's traded industries in the future.

But roadway congestion's impact extends beyond the trucking industry. As discussed above, the overall transport network is increasingly integrated across all modes. Railroads depend on intermodal facilities to gather and distribute goods – this is particularly true for the region's wood and paper product industry, which is relatively decentralized. Furthermore, the use of air travel by the region's most

[6] These costs in great detail in the Portland Cost of Congestion study.

important high-tech firms is facilitated by the same highways, arterials, and surface streets discussed above. The Portland/Vancouver Trade Capacity Analysis (Global Insight et al., 2006) makes this point explicit: "good air cargo service is only as good as the local road access to the airport." This means that maintaining streamlined access from the "Silicon Forest" to Portland International Airport will be a critical factor in retaining these firms and expanding the high-tech cluster.

Altogether, this discussion makes a case that it can be both economically efficient and strategically logical to develop criteria for evaluating proposed new transportation projects that are sensitive to the particularly important economic stakes associated with serving core elements of the regional economy.

## 2.6 References Cited in Chapter 2


Baird, Brian A. "Public Infrastructure and Economic Productivity: A Transportation-Focused Review," *Transportation Research Record 1932*, National Academies, Washington, DC, pp. 54-60, 2005.

Cambridge Systematics. "Freight Rail and the Oregon Economy," *Report prepared for the Port of Portland*, March 2004.

Cortright, Joseph. "Transportation, Industrial Location and the New Economy: How will the knowledge economy affect industrial location and the demand for transportation?" *Prepared for presentation at the Transportation Research Board Conference on Transportation and Economic Development, Portland, Oregon,* September 2001.

Cortright, Joseph. "Urban Industry in Metro Portland," *White Paper prepared for presentation to the Symposium on Agriculture/Urban Land Needs,* January, 2004.

Cortright, Joseph. "Made in Oregon: The Future of Manufacturing," *White Paper prepared for the Oregon Business Council*, May 2004.

Cortright, J., and H. Mayer. "The Ecology of the Silicon Forest," *White Paper prepared for the Regional Connections Project*, Institute for Portland Metropolitan Studies, Portland State University, March 2000.

Cronon, William. "Nature's Metropolis: Chicago and the Great West," W. W. Norton & Company, New York, NY, 1992.

Economic Development Research Group. "The Costs of Congestion to the Economy of the Portland Region," *Report prepared for the Portland Business Alliance and other sponsors*, December 2005.

Economic Development Research Group. "The Cost of Highway Limitations and Traffic Delay to Oregon's Economy," *Report prepared for Oregon Business Council and Portland Business Alliance*, March 2007.

Global Insight et al. "Portland and Vancouver International and Domestic Trade Capacity Analysis," *Report commissioned by Portland METRO, Oregon Dept. of Transportation, Portland Development Commission, Port of Portland, and Port of Vancouver*, 2006.

Institute of Portland Metropolitan Studies. "Progress of a Region: The Metropolitan Portland Economy in the 1990s," Technical *report of the Regional Connections Project*, Portland State University, April 1999.

McCann, P., and D. Shefer. "Location, Agglomeration, and Infrastructure," *Papers in Regional Science*, Vol. 83, pp. 177-196, 2004.

Port of Portland.. "Working Harbor Reinvestment Strategy Business Interview Results," *Report prepared for The River Plan, North Reach*. December 2006.

# 3 CRITERIA FOR PROJECT EVALUATION

## 3.1 Elements of Freight & Business Sensitivity

**Criteria for Recognizing Freight and Business Factors**

The preceding section makes the case that not all transportation bottlenecks and delays are equal; there can be wide variation in the extent of their implications for business retention and expansion. Specifically, the economic stakes (potential for addition or loss of jobs and income in the region) can be particularly large when they affect the viability and competitiveness of core "traded industries" that bring *income flowing into the region.* This finding points to the need for appropriate project evaluation criteria that can distinguish projects with particularly large or important economic consequences.

There is a three-step process that can be used to identify these types of situations. The three steps are:

| |
|---|
| Step 1: Identify those routes and facilities that have a disproportionately large potential for important economic impacts. |

↓

| |
|---|
| Step 2: Measure the extent to which sensitive economic activities are affected by those facilities; |

↓

| |
|---|
| Step 3: Estimate the potential economic benefit from improving those facilities, or the potential economic loss from failing to do so. |

Each of these three steps can be accomplished through use of a series of screening criteria and performance measures, as explained below.

**Step 1: Identify routes and facilities that have a disproportionately large potential for important economic impacts.** These are primarily facilities serving traded industries that are: (a) shipping freight products to outside areas, (b) serving tourists who bring in money from outside areas or (c) serving worker and customer travel affecting the productivity of industries that bring in revenue from outside customers.

It is possible to apply qualitative screening criteria to identify such facilities. This could be as simple as a set of questions used to “flag” those facilities that are known to serve particularly important functions. Five key questions are:

***Screening Criteria to Identify Facilities with Large Potential Impact***

(1) Does the facility serve the key industrial centers and (highway or rail) corridors that are locations for products made in Oregon?

(2) Does the facility serve the distribution/warehouse routes and centers that support the region or state economic base?

(3) Does the facility serve (or connect to) major airport, marine port or international land gateways that support a notable portion of jobs in the economy?

(4) Does the facility serve centers of convention, tourism and banking or commerce that brings money into the region or state economy?

**Step 2: Measure the extent to which sensitive economic activities are affected by those facilities**. The measurement can be done by relying on information from existing regional and statewide travel models, which provide information on origin-destination patterns, locations of intermodal nodes and patterns of vehicle mix and trip purposes. Such information can be used to assess differences among key corridors in terms of five quantitative measures:

***Measures of Sensitivity to Critical Economic Activities***

- *Vehicles* – the extent to which affected routes and facilities serve trucks freight (as opposed to cars or buses)
- *Purpose* – the extent to which vehicles on affected routes move freight (as opposed to commuters, visitors or general traffic);
- *Origin and destination* –the extent to affected routes carry shipments that are moving goods between the Portland region and outside areas (as opposed to purely local deliveries or pass-through traffic);
- *Intermodal Connectivity* – the extent to which the affected vehicles are serving ground transport needs enabling the region’s air, sea or rail gateway facilities to operate and remain competitive.
- *Location* – the extent to which affected routes serve industrial, warehouse or other business centers (where reliability is important).

**Step 3: Estimate the magnitude of potential economic benefit associated with making improvements to those facilities, or the potential economic loss from failure to make proposed improvements.**

The analysis of potential benefit typically involves consideration of the mechanisms by which proposed transportation projects can affect the regional (or state) economy. The most common ones are:

***Transportation Changes that Most Affect Traded Industries***

- Travel Time to intermodal terminals and global gateways
- Predictability of travel time
- Size of same-delivery markets
- Cost Competitiveness of shipping rates
- Access Restrictions on truck use

These transportation impacts can all affect the productivity and viability of traded industries, and thus lead to broader impacts on the economy. They can be assessed (a) through expert rating systems, or (b) through application of an economic development model that identifies how business loss vulnerability and business attraction opportunity can be affected by these transportation factors. Both approaches are described in sections that follow.

## 3.2 Criteria Used in Rating Systems

Many state DOTs define goal criteria for selecting projects. For instance, the Oregon Transportation Plan (OTP) prioritizes project based on eight criteria, one of which is "economic vitality."[7] That is described as "having a diversified and competitive regional economy with healthy and efficient markets and potential for long-term economic growth, *including efficient and competitive movement of people, goods and ideas*." The emphasis here is on movement of vehicles.

Some states have gone further. They have instituted point scoring systems that rate the different ways in which proposed projects will lead to economic development impacts and other impacts, and then use those scores for project investment decision-making. It is particularly useful at this juncture to consider

[7] The others are mobility and accessibility, effectiveness and efficiency, equity, public support and financial feasibility, reliable and responsive service, safety and sustainability.

how other states have developed criteria that give put explicit emphasis on *freight* factors – freight shipping costs, concentration of tractor-trailers, needs for reliability, connection to existing industrial areas, linkage to intermodal terminals, and access to global markets. Table 3 shows some of the different types of freight and economic rating criteria used in other states (and abroad). It is clear that there is tremendous variation among the various transportation departments in the definition of economic development factors and their components. However, an even more important general finding is that all of these transportation departments have, in one way or another, explicitly recognized freight movement, intermodal connections and delivery access as important elements of economic development.

It is also interesting to note that the rating criteria fall into two major classes: (1) *transportation changes* that are the drivers of economic impacts – similar to the factors previously discussed under Step 3, and (2) *economic growth outcomes* that result from those transportation changes.

**_Table 3. Comparison:_**
**_Economic Development Criteria Used in State Rating Systems_**

| Criteria | OH | WI | MN | MO | VA | Scot |
|---|---|---|---|---|---|---|
| ***Transportation Drivers of Economic Impact*** | | | | | | |
| Multi-modal & intermodal facilities | X | - | X | X | X | X |
| Connectivity to key statewide corridors | - | X | - | X | - | X |
| Supports desired land development clusters | - | X | - | X | - | X |
| Predictability of travel times | - | - | X | - | - | X |
| Connectivity or access to global markets | - | - | X | - | - | - |
| Concentration of trucks for goods movement | - | - | - | - | X | - |
| Enhances competitiveness of shipping rates | - | - | X | - | - | - |
| Reduces bottlenecks and size/wt. impediments | - | - | X | X | - | - |
| Supports economic development initiatives | - | - | - | X | - | - |
| Supports redevelopment of old industrial areas | X | - | - | - | - | - |
| Location in economically distressed area | X | - | - | X | X | - |
| ***Economic Growth Outcomes*** | | | | | | |
| Job Creation – supports industry attraction | X | X | - | - | - | X |
| Job Retention – supports existing industry | X | X | - | - | - | X |
| Public-private participation in funding | X | - | - | - | - | - |

OH = Ohio DOT's Rating System
WI = Wisconsin DOT's Rating System
MN = Minnesota DOT's Rating System
MO = Missouri DOT's Rating System
VA = Virginia DOT's Rating System
Scot = The Scottish Appraisal System

# 3.3 Examples of Rating Systems

In practice, the economic impact ratings in all of these states are used together with ratings of environmental, social and community impacts to present a "balanced scorecard" for assessing overall impacts of a proposed project. In that way, the value of economic development impacts receives explicit recognition, and can be compared on a "level playing field" with land use and environmental impacts. Among the six rating systems covered in Table 3 (above), the weight given to economic development ranged from 15% to 40% of the overall total. These rating systems are further described below.

## Ohio DOT's Rating System

Ohio DOT's TRAC (Transportation Review Advisory Council) oversees selection and funding of major transportation projects. All proposed projects costing over $5 million must be scored on transportation and economic development impacts. Transportation efficiency factors represents 70 percent of the total potential score. Economic development factors represent the other 30 percent. An additional 30 bonus points can be awarded for other impacts, among them support for urban revitalization at brownfield sites. Points are not given for effects on new retail development, and points for tourism jobs are pro-rated based on the length of the tourist season.

***Table 4. OHIO DOT- TRAC Program, Major Project Selection Criteria***

| **Goal** | **Factors** | **Max Score** |
|---|---|---|
| Transportation Efficiency | Avg.. Daily Traffic | 20 |
| | Volume to Capacity Ratio | 20 |
| | Roadway Classification | 5 |
| | Macro Corridor Completion | 10 |
| **Transportation Points -- at least 70% of a project's base score** | | **70** |
| Safety | Accident Rate | 15 |
| Economic Development | Job Creation (Non-retail only) | 10 |
| | Job Retention | 5 |
| | Economic Distress | 5 |
| | Cost Effectiveness of Investment (jobs/$ invested) | 5 |
| | Level of Investment | 5 |
| **Economic Development Points -- up to 30% of a project's base score** | | **30** |
| Funding | Public/Private Local Participation | 15 |
| Mulit-Modal Impacts | Unique multi-modal impact | 5 |
| Urban Revitalization | Access to brownfield site | 10 |
| **Total possible Bonus Points** | | **30** |
| **Total Possible Points** | | **130** |

# Wisconsin DOT's Rating System

Wisconsin DOT's Majors Program covers system capacity, interchange and enhancement projects that are over $2.5 million in cost or over 2.5 miles in length. Such projects are considered to be "Major Highway Projects," and are selected on the basis of a scoring system that considers economic benefits, land development, traffic flow, safety, environmental and community impacts. Economic development factors are given 40% of the total scoring weight.

***Table 5. Wisconsin WisDOT Scoring System of Major Highway Projects***

| Measure | Component | Percent | Weight |
|---|---|---|---|
| Economic Development | Existing business save travel cost | 10% | 40% |
| | Connections on Corridors 2020 or NHS Network | 10% | |
| | Increase productivity | 20% | |
| | Accommodate business growth sectors | | |
| | Facilitates exports that bring in outside dollars | | |
| Traffic Flow | Level of Service | | 20% |
| Safety | Crash rate; severity proportion; ped/bike impacts | | 20% |
| Environmental | Natural, physical resources | 5% | 10% |
| | Socio-economic, cultural resources | 5% | |
| Community Input | Public support or opposition | | 10% |

# Minnesota DOT's Rating System

Minnesota Department of Transportation implemented the *Minnesota Statewide Transportation Plan Cost-Effectiveness Policy* (MnDOT, 2004) providing a standardized project appraisal method for highway projects of 1.6 km or more, as well as airport projects of $1 million or more, transit projects seeking state or federal funds, and intermodal projects of $10 million or more.

Travel efficiency effects, defined by user travel benefits, is a first step. In subsequent steps, a project is considered based on whether it is concordant with other agency efforts, and whether it meets stated goals for social, environmental, community, or business development impacts. Projects that score well on these latter metrics may be selected for construction even if their user benefit/cost ratio is less than 1.0. In fact, Minnesota's performance measures for transportation investments include "economic benefit-cost" as only one of a series of considerations; others include predictability (reliability), safety and economic competitiveness impacts. Minnesota's State Freight Plan further requires that there be efficient connections between trade centers and between modes and that sufficient capacity is provided to meet current and future shipping demand.

***Table 6. Minnesota Freight Highway Investment Performance Measures***

***Part A - Performance Measures with Available Data***

| | |
|---|---|
| Predictable, Competitive Metro Area Travel Time | • Metro freeway travel time, by route and time of day<br>• Average speed on metro freeways, by route and time of day<br>• Congestion ranking of metro freeways, by route<br>• Congestion level compared to other major metro areas |
| Economic Benefit-Cost | • User benefit-cost ratio of major state transportation projects |
| Transportation Investment | • MN transport investment and spending as % of Gross State Product |

***Part B - Performance Measures Requiring Development***

| | |
|---|---|
| Intercity Travel Time | • Peak speeds on major routes between MN regional centers<br>• Shipper point-to-point travel time |
| Freight Travel Time to Global Markets | • Travel time to major regional, national and global markets—by rail, air, water, truck |
| Competitiveness of Shipping Rates | • Shipment cost per mile—by ton or value, by mode, for major commodities |
| Crash Rate and Cost Comparison | • Dollar cost of crashes and crash cost comparison by mode<br>• Crash rate per mile traveled (or other basis) by freight mode |
| Bottlenecks & Impediments | • # design impediments to freight traffic, by mode, by type (at-grade rail crossings, restricted roads, deficient bridges) |
| Timely Access to Intermodal Terminals | • Number of design impediments slowing access to truck, rail, air and waterway terminals |

## Missouri DOT's Rating System

Missouri DOT developed a prioritization process for evaluating proposals for "major projects" – i.e., those that involve system expansion via opening new roadways, bridges and/or roadway expansion. Economic development and freight movement are given 20 points out of the 100 total. The full scoring system is shown in the table below.

***Table 7. Missouri Roadway System Scoring Weights***

| | | | |
|---|---|---|---|
| **Economic Competitiveness – 15 points** | | **Safety – 30 points** | |
| Strategic Economic Corridor | 40% | Safety Index | 80% |
| Supports Regional Econ Devel Plans | 30% | Safety Concern | 20% |
| Level of Economic Distress | 30% | | |
| **Congestion Relief – 30 points** | | **Quality of Communities – 5 pts** | |
| Level of Service | 40% | Complies with Land Use Plans | 50% |
| Daily Usage | 30% | Connectivity between Cities | 50% |
| Functional Class | 30% | | |
| **Efficient Freight Movement– 5 points** | | **Environment Protection – 5 pts** | |
| Truck Volume | 60% | Environmental Impact | 100% |
| Freight Bottlenecks | 20% | | |
| Intermodal Freight Connectivity | 20% | | |
| **Access to Opportunity – 5 points** | | **System Function – 5 pts** | |
| Vehicle Ownership | 75% | Bridge Condition | 40% |
| Eliminate Ped/Bike Barriers | 25% | Pavement Condition | 40% |
| | | Substandard Roadway Features | 20% |

## Virginia DOT's Rating System

While VDOT has a twenty year state highway plan, each proposed project is separately rated by staff of VDOT's Transportation and Mobility Planning Division. Based on their internal technical analysis, each proposed is rated based on the criteria and weights listed below. Once each rating is complete, an overall score is determined. A second step then considers public feedback, funding availability and timing or phasing issues for proposed projects.

***Table 8. Virginia Scoring Weights for Project Prioritization***

| | |
|---|---|
| **Efficient movement of people and goods**<br>> Level of service<br>> Volume to capacity ratio<br>> Passenger car equivalents | 29% |
| **Safety and security**<br>> Crash rate | 23% |
| **Retain and increase business & employment**<br>> Avg. daily volume of tractor-trailer trucks for goods movement<br>> Local unemployment rate (economically disadvantaged area) | 18% |
| **Quality of life and environmental impact**<br>> Potential environmental or cultural impacts<br>> Utilization of existing right-of-way | 15% |
| **System preservation and efficient system mgmt**<br>> Interchange spacing/mainline adequacy<br>> Inclusion of HOV, bicycle, pedestrian facilities<br>> Bridge deficiencies<br>> Cost effectiveness of proposed recommendation | 15% |
| **Multimodalism**<br>> Highway component of multimodal investment network | bonus points |

## The Scottish Transport Appraisal Guidance (STAG)

In 2003, Transport Scotland introduced a new methodology for appraisal of the relative benefits of proposed transport projects and policies. This system laid out a framework for gauging the value of proposals to improve transport at a local or national level by supporting five key government objectives: Environment, Safety, Economic Development, Integration and Accessibility. A revised version was issued in 2006. Criteria used in the appraisal table are shown below:

***Table 9. Scottish Transport Appraisal Table***

| **Objective** | **Criteria (7-point rating system for each category)** |
|---|---|
| Environment: | How will the project contribute towards reducing emissions, and promote better air and water quality? |
| Safety: | How will the project enhance safety for different types of transport users? |
| Economy: | How will the project affect traffic volumes, journey times, and the reliability of travel times? How would the proposal help attract new jobs, help existing businesses, open up appropriate land for development? |
| Integration: | How will the project promote or enhance transport integration?<br>Will services be able to function in a more complementary manner? |
| Accessibility: | How will the project affect accessibility for transport users and for others, including access to jobs, communities, shops, services and other facilities? |

## 3.4 Criteria Used in Economic Model Systems

The very same criteria used in rating systems – including both transportation drivers and economic outcomes – are also represented in economic model systems. Whereas traditional forms of *regional economic models* (such as the REMI model) focus mostly on cost competitiveness, there is a separate class of *economic development models* that recognize the broader set of market access and system connectivity factors affecting freight movement, business attraction and retention. Examples include the following:

- LEAP (Local Economic Assessment Package) -- The Appalachian Regional Commission funded the LEAP tool to enable its regional agencies to identify opportunities for economic development and business attraction in areas served by newly-completed highways (ARC, 2004). The system calculates potential economic growth (by detailed industry sector) in terms of job creation, income generation and output. The inputs include a wide range of labor, utility, tax and transportation factors. The latter include transportation impacts on:

  - expanding labor markets and shopping markets
  - expanding truck delivery markets and tourism markets
  - highway connectivity (access time) to commercial airports
  - highway connectivity (access time) to public-use intermodal rail terminals
  - highway connectivity to (access time) commercial marine terminals

- CDSS (Congestion Decision Support System) -- The National Cooperative Highway Research Program funded a study of the business impacts of congestion, which developed the CDSS model to estimate effects of urban congestion on labor markets and truck delivery markets. Originally applied for the Baltimore and Chicago regions, the model forecast effects of alternative congestion scenarios on business costs resulting from:

  - changes in worker commuting access, by occupation
  - changes in local truck delivery access, by industry.

- University of Maryland – Maryland DOT funded the University of Maryland to develop an econometric model used to assess local economic development impacts of proposed highway investment (originally for the proposed Inter-County Connector). This model provided analysis of access impacts on a much finer "zip code" zonal level of spatial detail (Targa et al, 2005). The model's calculated outcome is growth of business activity per square mile for each zone. The inputs include changes in transportation factors including:

  - business accessibility to highway
  - peak period access times to airport
  - peak period access times to intermodal freight terminals
  - peak period access times to rail transit stations
  - access to labor, consumer and supplier markets.

- HEAT (Highway Economic Analysis Tool) -- Montana DOT funded Cambridge Systematics to develop an integrated system highway and economic analysis system so that the state could estimate economic development impacts and benefits of highway investments (Wornum et al, 2005). The system estimates how highway projects affect not only user travel time and cost, but also changes in various access measures, and then calculates economic development impact and benefit/cost impact. The calculated impact outcomes are job, income and business output growth. The transportation impact factors in this system include:

  - business cost of truck freight movement (by industry)
  - access to international trade gateways
  - access to intermodal (highway-rail) facilities
  - access to same-day delivery markets
  - labor market access

  .

- TREDIS (Transportation Economic Development Impact System) – EDR Group developed TREDIS as the first truly multi-modal economic analysis system for local, regional and state planning (Weisbrod, 2008). The system forecasts how transportation improvements affect business growth and attraction over time, in terms of jobs, wages, GDP and output by industry. The input factors include a wide range of transportation system changes, distinguishing changes affecting freight movement (by trucks, rail, air and marine modes), as well as passenger movement (by car, bus, rail transit, air and ferry). These changes are measured in terms of factors, including:

- cost of commuting (by industry and by mode)
- cost of freight movement (by industry and by mode)
- breadth of market for same-day delivery markets (2 hour time access ring)
- breadth of market for workforce (45 minute time access ring)
- level of passenger service at closest commercial airport (passengers)
- access drive time to closest airport with scheduled service
- access drive time to closest marine port with scheduled service
- access drive time to closest intermodal (highway-rail) terminal
- access time to international trade gateways
- constraints on particular classes of vehicles, trips or freight (such as weight or size restrictions)

**Common Features.**
What is most striking about all of the impact analysis models is that they incorporate many of the same freight and business impact factors as the qualitative rating systems that were previously discussed. The common factors (across both approaches) include coverage changes in:

*Drivers of Economic Impact*

- Access to global markets or gateways
- Access to (or connectivity with) airports and rail intermodal terminals
- Connectivity with larger national highway networks
- Connection to, or adjacency to, business activity clusters
- Freight shipping cost or cost-competitiveness.

*Ultimate Impacts on the Economy*

- Jobs
- Income
- Business Output or GDP

Altogether, this review of *quantitative* economic impact analysis systems and *qualitative* scoring systems makes a case that both approaches tend to recognize the same sorts of transportation input measures and economic outcome measures. That alone is reassuring, for it indicates that there is a general consensus about:

- the importance of considering freight and business impacts in project evaluation, and

- the theory of how freight and business are affected by accessibility and connectivity issues that are distinct from the user benefit measures underlying traditional approaches to project planning and prioritization.

On the other hand, this finding should not be construed to indicate that both qualitative and quantitative approaches are equivalent. There are significant differences that need to be recognized.

- *Quantitative estimates* have advantages that they yield numbers that are easier to apply for benefit/cost comparisons among competing alternatives. They also enable analysis of tradeoffs among various economic impact factors.

- On the other hand, *qualitative ratings* can represent a wider range of impacts that do not all get reflected in dollars of income generation, such as the additional value of supporting some types of industries and jobs that are most unique, or turning around distressed areas, redeveloping old industrial areas, or focusing on the most critical truck routes.

The next section examines opportunities for hybrid approaches that can incorporate both types of impact assessment.

# 3.5 References Cited in Chapter 3

Ohio Project Rating System
Ohio DOT, (2006), *TRAC – Transportation Review Advisory Council Policies & Procedures*.

Wisconsin Project Rating System
Wisconsin DOT (2007), "Economic Evaluation of Highway Major Investment Program"; also slide show: "Evaluating and Ranking Highway Major Projects from an Economic Development Perspective."

Minnesota Project Rating System
Minnesota DOT (1999), *Freight Performance Measures, A Yardstick for Minnesota's Transportation System.*

Missouri Project Rating System
Missouri DOT (2003), *Project Prioritization Process – System Expansion Major Projects,* Table 121.2.5.4

Virginia Project Rating System
Virginia DOT (2007), *State Highway Plan Prioritization Process*.

Scotland Rating System
*Scottish Transport Appraisal Guidance (2006),* Transport Scotland, Glasgow.

LEAP Economic Analysis System

Appalachian Regional Commission (2004). *Handbook: Assessing Local Economic Development Opportunities with ARC-LEAP, the Local Economic Assessment Package*, prepared by Economic Development Research Group.

CDSS Economic Analysis System

Weisbrod, G., D. Vary and G. Treyz (2003). “Measuring the Economic Costs of Urban Traffic Congestion to Business”, *Transportation Research Record* #1839.

Univ. of Maryland Economic Analysis System

Targa, Felipe, K. Clifton and H. Mahmassani (2005). “Economic Activity and Transportation Access: An Econometric Analysis of Business Spatial Patterns,” *Transportation Research Record* #1932.

HEAT Economic Analysis System

Wornum, Christopher et al (2005). *Montana Highway Reconfiguration Study*, Cambridge Systematics, Economic Development Research Group, ICF and SEH for the Montana Dept. of Transportation.

TREDIS Economic Analysis System

Weisbrod, G. (2008). “Models to Predict the Economic Development Impact of Transportation Projects: Historical Experience and New Applications” *Annals of Regional Science*, January.

General Background

NCHRP Project 8-36. (2007). *A Guide to State DOT Consideration of Economic Development Potential in Planning*, by ICF Consulting.

NCHRP Project 8-53 (2007). *Integrating Freight into Transportation Planning and Project Selection Processes*, by Cambridge Systematics, Prime Focus, K. Heanue

# 4 METHODS FOR INCORPORATING FREIGHT & BUSINESS IMPACTS

## 4.1 Recommended Hybrid Approach

The goal of this white paper is to discuss ways that freight and business impact factors should be represented in transportation investment decision-making in the Portland region. Towards that end, Section 2 established the nature of the need for consideration of these factors, by showing how the Portland region's key industries and supporting multimodal transportation infrastructure together play a significant role in supporting the area economy.

Section 3 further showed the range of approaches that can be used for assessing economic impacts in transportation project selection, including qualitative rating systems and quantitative analysis models. However, it also established that there are tradeoffs among these approaches, and that no single analysis system can fully capture all of the transportation and economic factors that are unique to the Portland region.

The considerations for assessing economic consequences of transportation decisions in the Portland region include unique spatial and functional transportation factors -- such as roles and locations of airport and seaport facilities, the Willamette River, interstate highway and rail corridors, and resulting concentration of truck movement. They also include unique economic factors – such as roles of the Portland region as an international air/sea gateway and the site of computer technology and distribution business clusters.

The rest of this section lays out a recommended methodology for assessing the regional economic consequences of transportation projects and policies that affect freight movement and associated business activity. It outlines the steps in an assessment approach that:

a) is based on a logic that is understandable and supportable by facts;
b) utilizes measurement techniques that are transparent and explainable by analysts; and
c) yields results that have practical application to aid decision-making.

The discussion follows the three-step process that was previously outlined in Subsection 3.1, and also covers how the results should be used.

# 4.2 Step 1: Identifying Critical Components of the Freight System

The first step is to identify those routes and facilities that have a particularly large potential for economic impacts. Given the existence of unique gateway and hub transportation facilities in the Portland region, it can be highly useful to develop a clearly delineated and updated *list of the most critical and vulnerable facilities that comprise the region's freight transportation system*. To be effective, the list should not be overly long, but should focus on the primary trucking routes and rail routes, and the intermodal terminals and intermodal crossings that are most critical to its success (starting with those previously noted in Section 2.4).

Equally important, the list should be accompanied by *specific reasons why each of these facilities is particularly critical* – such as connectors between key manufacturers and industrial/warehouse centers, the airport, seaport, intermodal rail and interstate highway corridors. These explanations can build upon the discussion in Section 1 of this document, as well as the earlier study of the Cost of Congestion study for the Portland region.

The list and its justification should also build upon updated measurement or estimation of the truck share of vehicles on affected routes. In general, freight highway needs and vulnerabilities should tend to be greatest on routes with the greatest truck flows, particularly truck flows that have a local trip end. From an economic impact perspective, pass-through traffic is of little benefit to the regional economy as neither the shipper nor the receiver is located in the region. However, pass-through traffic (on routes such as I-5) can still contribute to congestion that also degrades reliability and delivery markets for Portland-based industries.

This type of analysis, distinguishing critical connections and truck routes from other highways, is similar to the effort made by Chicago Metropolis 2020 and its Chicago Freight Plan, which identified key truck routes in the Chicago area and then made a case for the need to recognize them as routes with particular economic importance. In that case, the action was taken because the truck routes were poorly marked and not well known, and a series of policies and actions taken over the years had served to frustrate rather than support truck movements and industrial development along those corridors.

In this case, the list of *strategic freight facilities and corridors* provides a starting basis for consideration of freight issues in the transportation planning process. To be most effective, it should be developed jointly by private and public interests.

# 4.3 Step 2: Rating Economic Impact Sensitivity Factors

The second step is to assess the sensitivity of various economic activities in the Portland region to the functionality and performance of transportation routes and facilities that were identified in Step 1. After all, just listing the critical elements of the freight system is not enough to guide project selection and funding decisions. There must also a set of specific impact sensitivity factors that can be assessed and used to identify situations where proposed projects will particularly affect various industries in the economy.

These sensitivity factors should include both *needs factors* (relating to future demand for capacity enhancements) and *vulnerability factors* (relating to existing problems). They should relate the performance of various elements of the freight system to the needs of specific industry groups. For instance:

- air freight and just-in-time industries may be most sensitive to trip reliability,
- global export industries may also be most sensitivity to airport access,
- metal processing industries may be most sensitive to intermodal rail connections,
- distribution facilities and related industries may be most sensitive to market access (delivery area),
- warehousing growth may be most sensitive to highway system connectivity and flow.

The impact sensitivity factors cited above have a strong resemblance to the kinds of rating criteria used in some other states, as listed in Table 3 in Section 3, and they also encompass many of the same general concepts of reliability, access and connectivity. However, this second step involves additional work to assess how different *industries or elements of the regional economy* vary in their sensitivity to different aspects of transportation system performance. Of particular note is how the various "traded industries" (discussed in Section 1) are affected by *location-specific* sensitivities (e.g., focusing on airport and seaport access routes) and *time-specific* sensitivities (e.g., focusing on peak period issues).

While this discussion has focused on freight movement from local industries to outside areas, the list of business-oriented transportation facilities could also be broadened to include routes and terminals serving visitors and intermodal passenger connections (affecting visitors who bring in money from outside areas). Either way, this analysis of industry needs and vulnerability factors will provide a basis for distinguishing and giving weight to projects that most affect key industries supporting jobs in the region, and will also effectively implement the second step in the three-step process defined back in section 3.1.

# 4.4 Step 3: Estimating Economic Impact

The third step is to assess how investment and policy decisions affecting the performance of transportation facilities will also affect jobs and income job in the region. This step directly addresses the core goal of estimating the magnitude of economic gain from projects that address freight and business needs, and the economic loss from failing to do so.

The more specific and logically clear that these economic impact estimates can be, the more likely they are to be recognized in the decision-making process. There is thus an advantage to using predictive economic impact models when they support the logic developed in the preceding steps – i.e., making a connection between: (1) critical components of the freight or intermodal transportation system, as identified in Step 1, and (2) impact sensitivity factors, as identified in Step 2. This relationship is illustrated in Table 10.

***Table 10  Illustrative Matching of Impact Factors to Freight System Elements***

*("x" denotes relevant factors for each freight system element)*

| Freight System Element → <br> Impact Factor ↓ | Airport Access | Seaport Access | Intermodal Rail | Ind. Park Access | Truck Route | Just-in-time Mfg Site | Distribution Center | Employment Center |
|---|---|---|---|---|---|---|---|---|
| **Travel Benefit Factors from Enhanced Flow** | | | | | | | | |
| • Freight Cost Change from Time Savings | x | x | x | x | x | x | x | |
| • Freight Cost Change from Enhanced Reliability | x | | | x | x | | x | x |
| • Freight and Passenger Vehicle Oper. Cost | x | x | x | x | x | x | x | x |
| • Passenger Value of Time Savings | x | | | | | | | x |
| • Passenger Value of Enhanced Reliability | | | | | | | | x |
| • Truck Concentration – Serving Industrial Areas | x | x | x | x | x | x | x | |
| • Size/Weight Restriction –time & cost impact | x | x | x | x | x | x | x | |
| • Accident Cost Impact | x | x | x | x | x | x | x | x |
| **Connectivity Factors (Access routes flow)** | | | | | | | | |
| • Local Airport Connectivity | x | | | | | x | | x |
| • Local Marine Port Connectivity | | x | | x | x | | x | |
| • Rail Freight Connectivity | | x | x | x | x | | x | |
| • Interstate Highway Connectivity | x | x | x | x | x | x | x | x |
| • International Border Connectivity | | | x | | x | | x | |
| • Overseas Air Gateway Connectivity | x | | | | x | x | x | x |
| • Overseas Sea Gateway Connectivity | | x | x | x | x | | x | |

***Continued on next page***

***Table 10 (Continued)***

*("x" denotes relevant factors for each freight system element)*

| Freight System Element → / Impact Factor ↓ | Airport Access | Seaport Access | Intermodal Rail | Ind. Park Access | Truck Route | Just-in-time Mfg Site | Distribution Center | Employment Center |
|---|---|---|---|---|---|---|---|---|
| **Market Size (Accessible Market)** | | | | | | | | |
| • Local Labor Market (within Commuting Time) | | | | x | | x | | x |
| • Delivery Market (within Same-Day Schedule) | | | | x | x | x | x | |
| • Airport Service Mkt.-- destinations served | x | | | | | x | | x |
| • Marine Port Service Mkt. -- destinations served | | x | | x | x | | x | |
| • Freight Rail Service Mkt. -- destinations served | | x | x | | | | x | |
| **Market Level of Service/Activity** | | | | | | | | |
| • Airport Service -- Frequency of service | x | | | | | x | | x |
| • Marine Port Service -- Frequency of service | | x | | x | x | | x | |
| • Freight Rail Service -- Frequency of service | | x | x | | | | x | |

This approach represents a departure from more traditional forms of economic impact analysis. Traditional studies commonly focus on general concepts such as changes in region-wide traffic levels (represented by regional VMT), resulting impacts on region-wide travel costs and their consequences for change in regional economic growth and competitiveness. This approach, on the other hand, focuses on identifying key market segments – specific types of users dependent on specific types of transportation facilities – and then develops a logical process for understanding the implications of transportation system changes for those groups. The ultimate impacts on economic growth can then be shown by industry within the region. The most widely accepted measures of economic change are jobs and associated income, although alternative measures of impact on GDP, business output and private investment can also used.

It is possible to develop a new in-house system to conduct the evaluation process that is described here. However, there are two existing economic modeling systems that already support this logic, in terms of mode-specific access/connectivity factors and impacts. They are: TREDIS – a stand-along web-based tool, and HEAT –a geographic database system that encompasses many of the same components. To illustrate common concepts within these systems, we summarize the core TREDIS elements in the following text, graphic and table. This is the same analysis system that was used for the two prior studies: "Cost of Congestion to the Portland Region" and "Cost of Highway Limitations and Traffic Delay to Oregon's Economy."

**TREDIS** is comprised of four modules that work together to determine the full economic impact of transportation projects. Any single module or combination of modules may be used independently of the others.

1. **Travel Cost Module (TC).** The first module translates changes in traffic volumes, travel times and accidents into direct cost savings that accrue to various categories of households and businesses.

2. **Market Access Module (MA).** The second module translates changes in regional accessibility and intermodal connectivity into effects on productivity and business relocation (for various elements of the economy).

3. **Economic Adjustment Module (EA).** The third module incorporates a dynamic regional economic impact model to estimate total impacts on growth of the study area economy over time. (This can be the REMI model, the CRIO-IMPLAN model system or the Global Insight model.)

4. **Benefit-Cost Module (BC).** The fourth module calculates the net present value of project benefits and costs from the differing perspectives of federal, state and local agencies.

The relationship between these modules is illustrated in the Figure below. The types of input factors that can be used are shown in Table 11,which follows.

***Relationship of Economic Analysis Modules***

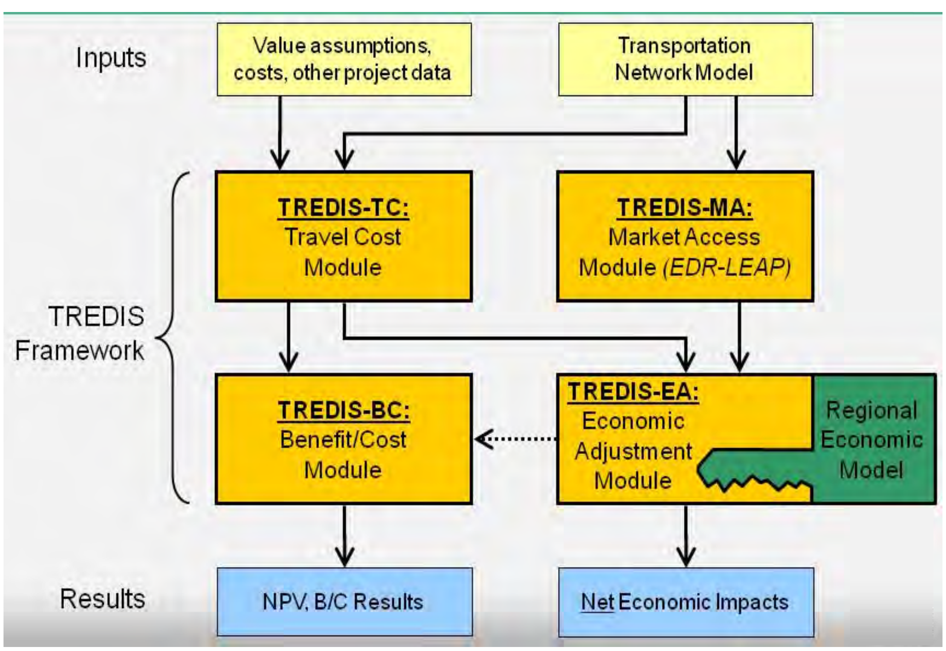


***Table 11 Definition of TREDIS Economic Analysis Input Factors***

**Travel Benefit Factors**
- *Freight Value of Time Savings and Reliability:* by mode & vehicle type (truck/rail concentration), industry/commodity type and time of day (reflecting peak and off-peak differences)
- *Passenger Value of Time Savings and Reliability:* by mode, trip purpose and time of day (reflecting peak and off-peak differences)
- *Vehicle Operating Cost:* by mode and vehicle type (truck, car, train, plane, ship), based on VMT (vehicle-miles of travel), VHT (vehicle-hours of travel), average speed and peak period delay
- *Accident Cost:* by mode and vehicle type

**Connectivity Factors**
- *Airport Connectivity:* average travel time from population center of the study area to closes available commercial airport
- *Marine Port Connectivity:* average travel time from population center of the study area to closes available commercial river or sea port
- *Rail Freight Connectivity:* average travel time from population center of the study area to closes available TOFC/COFC intermodal terminal
- *Highway Connectivity:* average travel time from population center of the study area to closes available interstate highway
- *International Border Connectivity:* average travel time from population center of the study area to closes available Mexico or US border station with truck or rail freight processing
- *Overseas Air Gateway Connectivity:* average travel time from population center to closest available international airport with scheduled overseas airline flights
- *Overseas Sea Gateway Connectivity:* average travel time from population center of the study area to closest available marine port with scheduled commercial ship calls to overseas destinations.

**Market Size (Access)**
- *Local Markets Size (shopper & labor markets)*: Population reachable within 40 minute drive time
- *Same-Day Delivery Market:* Employment reachable within 180 minute drive time
- *Airport Service* -- # of destinations served at closest commercial airport
- *Marine Port Service Market* -- # of destinations served at closest commercial river or sea port
- *Freight Rail Service Market* -- # of destinations served at closest TOFC/COFC terminal

**Market Level of Service/Activity**
- *Airport Market Service* -- Frequency of service (average daily scheduled trips) for closest commercial airport
- *Marine Port Market Service* -- Frequency of service (average daily scheduled trips) for closest commercial river or sea port
- *Freight Rail Market Service* -- Frequency of service (average daily scheduled trips) for closest TOFC/COFC intermodal terminal

As shown in the above table, this approach makes it possible to recognize how economic impacts vary by industry, depending on the mix of affected freight flows (commodities) and travel modes (truck, rail, air, water), and the extent to which they represent inward, outward or local freight movements.

# 4.5 Using Factor Ratings & Impact Estimates for Decision-making

The three preceding analysis steps are intended to provide both ratings of transportation factors and estimates of economic impact. However, there is a fourth issue which is how the information is used for decision-making. In general, experience among states that have adopted such systems is that the information is useful as guidance, but is not a replacement for personal judgment about local situations and needs. That general perspective also appears relevant for Portland, although it is outside the scope of this study to suggest specific ways in which decision-making occurs.

Below we summarize the experience of three states in which qualitative ratings and quantitative impact estimates are used in a flexible manner together with community (business and resident) input.

- In Minnesota, qualitative ratings and quantitative benefit/cost ratios are used together through a three-step process. (1) First, project alternatives are evaluated by calculating a dollar value of user (traveler) benefit and calculating that benefit/cost ratio. (2) A second step considers whether projects could be re-scoped to yield a higher benefit/cost ratio, or represent "an essential component of a larger project whose benefit/cost ratio exceeds 1.0" (3) A third step considers additional business impacts along with social, environmental and community impacts, and documents "how the proposed improvement addresses or affects these goals, either positively or adversely." As previously noted, projects that score well on these latter metrics may be selected for construction even if the user benefit/cost ratio is less than 1.0.

- In Ohio, the scoring of economic development factors is performed jointly by Ohio DOT and the Ohio Department of Development (ODOD). Strict guidelines are used to award economic development points; documentation is required indicating the intent of specific industries to locate, expand, invest, or create jobs contingent on the construction of the project. The TRAC process does not have any minimum numeric ranking rating needed in order to be selected. Nor does it require that projects be funded in order of their rating. The rating is meant as a general guide to project evaluation but projects can be selected regardless of their scores.

- In Wisconsin, ratings are again only an advisory input. The process there involves four steps. (1) First, staff of WisDOT's Economic Development Section develops the economic ratings, while other DOT staff complete preliminary environmental and engineering studies and develop those ratings. (2) On the basis of its ratings and its assessment of emerging needs, WisDOT recommends candidate major projects to the State Transportation Projects

Commission (TPC). (3) The TPC then holds hearings to get public comment on the candidate projects, which then generates the ratings of community interest. (4) "The TPC, with WisDOT's analysis and public comments, recommends to the Governor and Legislature a list of major highway projects and an appropriate annual funding level to support the ongoing major highway program. The Legislature may add or delete projects, and may change the recommended funding level from the TPC's recommendation."

In all of these states, ratings and impact forecasts are used to help clarify needs and impacts, but they never replace judgment about local factors in decision-making. Of course, the economic and financial challenges facing each state are different, as are environmental and community impact considerations in decision-making. Thus, each state makes its own decisions on exactly how to make tradeoffs among economic development and other considerations.

## 4.6 Closing

In the days before computers, the prioritization of public investments in transportation projects were often made by judgments considering economic development, safety, quality of life and traffic flow needs and opportunities. With the advent of computer models for transportation planning, there was an understandable focusing on available data -- which tended to elevate the importance of daily averages for traffic volumes and traffic speeds without distinguishing types of vehicles or intermodal movements. With increasing development of global markets, which provide both threats and opportunities for the region's economy, there is now a renewed interest in distinguishing the roles of freight flows and peak period bottlenecks in affecting jobs, income and economic competitiveness.

This white paper has shown how these issues of freight movement are of particular relevance and concern for the future of the region's economy. That is not to imply that freight movements and business impacts are more important than other community and social policy considerations. However, it does imply that they are a legitimate and important concern that needs to be recognized and appropriately considered in transportation project investment decisions.

Various forms of qualitative impact rating and quantitative impact estimation are described here to show how such techniques can be used together to provide information needed for informed decision-making, in a way that can be responsive to the unique aspects of the regional economic specializations and Oregon's transportation geography. The institutional framework for applying these methods, and the specific criteria that are deemed most important, are issues that must be worked out through consultation between public officials, business organizations and public input processes.