

Tools for Assessing Wider Economic Benefits of Transportation

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Transportation projects can lead directly to benefits beyond the traditional measures of traveler impact, which are based on average travel time and travel cost. These wider benefits are effects on business productivity—factors that enable businesses to gain efficiency by reorganizing their operations or by changing the mix of inputs used to generate products and services. There are at least three classes of transportation system impacts that can directly lead to wider benefits for business organization and operation—reliability, connectivity, and accessibility.

SHRP 2 Capacity project C11, Development of Tools for Assessing Wider Economic Benefits of Transportation, addressed these three classes of effects and developed spreadsheet tools for each that transportation agencies can use to assess specific changes in transportation conditions associated with transportation project proposals as well as their economic consequences. The tools shift the focus of analysis from traditional transportation impact measures to include broader factors that also matter to business operators, and thus drive economic development processes. The scope of this analysis provides planners the basis for more realistic and comprehensive assessments of the economic impacts of highway projects. Table 1 shows the effect on business operations of changes to improve transportation.

Three Classes of Transportation System Impacts

Reliability

Some transportation projects are designed to reduce congestion. Those projects may reduce not only average travel times, but also the likelihood of traffic incidents and length of traffic backups that result from each incident. That brings less variability and uncertainty in freight pickup and drop-off times, which results in more on-time deliveries. With more reliable delivery times, businesses can reduce inventories and centralize warehousing and delivery processes, effects known as supply chain benefits. More reliable travel times may also reduce employee lateness, leading to a labor productivity benefit.

Intermodal Connectivity

Some transportation projects have the effect of enhancing the frequency of service and reducing total time involved for bus/car/truck movements to and from business locations and intermodal terminals (including airports, marine ports, rail terminals or intermodal truck/rail facilities). Other transportation projects may enhance the frequency of air, marine, or rail services, or breadth of origins/destinations directly accessible from those terminals. Either way, the result

Table 1. Wider Transportation Benefits and Their Economic Effects: Relationship Between Transportation Changes and Business Reorganization

TRANSPORTATION CHANGE	EFFECT ON BUSINESS REORGANIZATION: BUSINESS OPERATION CHANGE
Improved Reliability: Freight Delivery	Tighter delivery schedule <ul style="list-style-type: none"> • More daily deliveries per vehicle • Fewer vehicles and trips required • Less fuel used • Less staff driver time required Less overtime required at loading dock Less warehouse “safety stock” required More centralized dispatch & distribution enabled
Improved Reliability: Workers	Fewer late worker arrivals and earlier start of full operation <ul style="list-style-type: none"> • More hours of full operation per day • Potential for less overtime or extra workers kept on hand
Expanded Access: Freight Delivery	Reconfigure delivery routes for broader scale service area <ul style="list-style-type: none"> • Larger scale warehouse & more centralized distribution enabled • Longer average trip distance
Expanded Access: Labor Market	Broader scale of labor market available to firms <ul style="list-style-type: none"> • Better matching of specialized business needs & worker skills • More innovation through interaction with complementary firms (and their employees) • Longer average trip distance
Enhanced Intermodal Connectivity: Freight Delivery	Same-day (or 2-day) delivery to more origins and destinations <ul style="list-style-type: none"> • Larger scale warehouse & more centralized distribution enabled • Scale economies
Enhanced Intermodal Connectivity: Business Travel	Same-day business interaction with firms in more markets <ul style="list-style-type: none"> • More innovation through worker interaction with complementary firms

is a faster movement for intermodal travel between some origins and destinations. That can be viewed as reducing travel cost for existing movements, as well as enabling new movements between origins and destinations that were previously not practical or economically feasible.

Market Access

Some transportation projects have the effect of expanding the breadth of destinations that can be served by same-day truck deliveries from a given business location, or the breadth of area from which a business can reasonably expect to draw customers and workers. These effects are often represented as changes in the effective size or the effective density of the customer market and labor market available to the firm. Expansion of the customer delivery market can enable scale economies in production and/or delivery processes. Similarly, expansion of the worker labor market can enable scale economies through better matching of specialized business needs and specialized worker skills, and can also enable more innovation

through greater interaction of complementary firms and their employees. Figure 1 shows how a transportation improvement project can expand the effective market area for car or truck access to an employment or activity center. In this case, it shows how a highway extension (I-90) and highway expansion (I-93) project broadened the area from which residents could access Boston’s airport within a given travel time.

Analysis Tools

Each of the spreadsheet tools is designed to require only data that are easily collected or assembled by those conducting a sketch planning study or that can be acquired from data sources that are widely available. The results produced by the tools can be used directly to generate project impact indicators that can be useful for project evaluation and prioritization processes such as multi-criteria rating systems. They can also be used as drivers for benefit-cost and economic impact models.

Reliability: The reliability assessment spreadsheet developed for this project uses information on the type of highway, projected traffic volume, speed, lanes, and capacity to generate measures of a travel time index, average delay, buffer time, and cost of delay. These last two factors provide a basis for further calculation of the direct economic value of improving reliability, in a separate accounting spreadsheet.

Connectivity: The intermodal connectivity assessment spreadsheet developed for this project starts with information on the specific port or terminal affected by a transportation project, projected ground access volume and change in access time, and fraction of vehicles on the affected access route(s) with that terminal as their destination. It then looks up information on the modes and destinations served by that facility and generates a connectivity index. This index provides a basis for calculating the direct economic value of improving connectivity in the separate accounting spreadsheet.

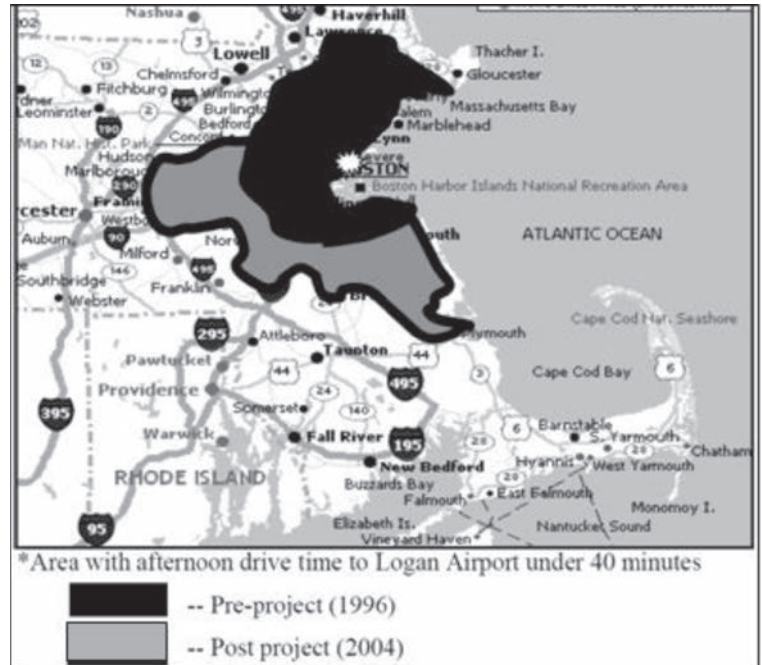
Accessibility: Two market access assessment spreadsheets were developed. One assesses truck access from a firm to buyers and suppliers; the other one assesses commuter access. Both work on the same general principal. They use information on zonal population or employment as well as distance or time decay factors to generate measures of effective market size or effective market density. This information can be used to calculate the direct economic value of improving accessibility, in the separate accounting spreadsheet.

Accounting: A generalized benefit-cost accounting framework is the fourth class of spreadsheet tool developed for the project. The accounting framework shows how results of the reliability, accessibility, and connectivity tools can be used, together with traditionally measured travel time and travel expense measures, to more fully assess the direct economic benefits that a given roadway improvement may have for travelers who use it and for businesses that depend on it (for workers, customers or deliveries). These results can also be used to drive more sophisticated economic impact forecasting and analysis systems to more fully estimate the long-term regional economic growth implications of proposed projects.

Product Availability

SHRP 2 Capacity project C03, Transportation Project Impact Case Studies, developed a national database of case studies documenting the actual, post-construction economic impact of highway and multimodal investment projects. The results of that effort are provided through

Figure 1. Market access measurement: Effect of the Central Artery/Tunnel project (I-90/93)



Source: Economic Development Research Group. *Economic Impact of the Massachusetts Turnpike Authority and Related Projects*. Massachusetts Turnpike Authority, February 2006.

a web tool, TPICS, which can be accessed on the web at <http://tpics.us>. That tool has two distinct uses:

1. It provides a searchable database of case studies covering most types of highway and intermodal facilities. For any type of highway-related project, it is likely that at least a few case studies of experiences elsewhere can be located. Used this way, the case studies provide a rich body of data that can be accessed to immediately inform the public and planners about past experience with similar projects and that information can be used to improve *Early Stage Planning*. It also provides a database that enables further research on the topic.
2. It provides an expert system that draws from the database to estimate the range of economic impacts likely to result from any specified type of project in any defined setting. This represents a form of 'analysis by analogy' and is a way to define a reasonable range of expected impacts of proposed projects based on prior experiences.

The spreadsheet tools developed in C11 are available in TPICS at www.tpics.us. The research report, which includes user guides for the spreadsheet tools, is online at <http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2prepubC11.pdf>.

**Project Briefs are also available for these SHRP 2 Capacity projects online at:
<http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/Pages/781.aspx>**

Collaborative Decision Making

Reaching Decisions that Deliver Capacity (C01)

Transportation for Communities: Advancing Projects through Partnerships (C01)

Performance Measurement Framework for Highway Capacity Decision Making (C02)

Operations Guide to Improving Highway Capacity (C05)

Incorporating Greenhouse Gas Emissions into Transportation Planning and Decision Making (C09)

Economic Impact Analysis

New Tool for Estimating Economic Impacts of Transportation Projects: Transportation Project Impact Case Studies (T-PICS) (C03)

Integrating Conservation, Highway Planning, and Environmental Review

Planning Transportation Projects for Better Environmental Outcomes (C06)

Freight Demand, and Dynamic Integrated Models and Networks

Improved Models for Better Decisions: Planning Models, Traffic Operations Models, and Activity-Based Models (C10A, C10B, C20)

Innovations in Freight Demand Modeling and Data (C20, C43)

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www.TRB.org/SHRP2/Capacity