

# **DISTINGUISHING THE BROAD AND LOCAL IMPACTS OF TRANSPORTATION INVESTMENTS**

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## **ABSTRACT**

### **DISTINGUISHING THE WIDE AND LOCAL AREA BUSINESS IMPACTS OF TRANSPORTATION INVESTMENTS**

by Glen Weisbrod

While transportation system investments are made for a wide variety of reasons (including improvements to capacity, traffic flow and safety, as well as economic development), they almost always involve some social, environmental or business impact tradeoffs -- whereby some class of travelers, businesses and/or area residents feel that they are made better off and some feel that they are made worse off by new facilities or new traffic activity patterns. The challenge for transportation planning is to properly recognize benefits and anticipate adverse local impacts, so that they such tradeoffs do not under-mine the capability to make larger system improvements. This paper focuses specifically on one class of impacts --business impacts. It then describes an analysis process for identifying and distinguishing the potential wide area and small area business impacts of highway improvements. A similar format can also be applied for other modes of travel.

**KEYWORDS:** Economic impact, local impact, highway planning

## **BACKGROUND AND OBJECTIVE**

### **The Complexity of Project Impacts**

Transportation system improvements can involve a variety of positive and negative impacts on travelers and non-travelers. These classes of impact include traffic movement, public safety, business, environmental and social/community impacts, as well as expenditures of funds. Depending on the project, any combination of those potential impacts may be positive or they may be negative, and they may be intended or unintended. Within any one class of impact, projects can also have distributional geographic impacts, which are simultaneously positive on some areas and negative on other areas.

Although the complexity of these impacts represents a challenge for transportation planning, for many projects it can nevertheless be important for planners to explicitly recognize and consider the balance of various types of impacts. This can be important, if for no other reason than the fact that failure to do so can provide project opponents with a potentially potent reason for undermining the credibility of project plans. Yet another challenge for transportation planning is to find ways to consider the full range of potential project impacts while being limited in information and resources available for the studying the problem.

## **The Focus on Business Impacts**

Business impacts can come in many forms, depending on the nature of the transportation project. For instance, local businesses tend to complain of adverse economic impacts when their access or pass-by traffic is reduced by the project construction process (as when traffic or local access is rerouted) or the project design (as when access is rerouted or made more circuitous by turn restrictions or limited curb cuts), or the project results (as when pass-by traffic is reduced by a new bypass route.) Local businesses and area economies tend to benefit when their accessibility, market (service) area and/or pass-by traffic is increased as a result of faster speeds, greater capacity and upgraded service and safety levels.

The above-cited types of business impacts comprise just one of many classes of impacts which may be relevant considerations for transportation project planning. In fact depending on the project, business impacts may be a major project benefit goal, or an unavoidable disbenefit to be mitigated, or just one of several complex factors to consider, or not even a significant factor at all.

Yet the analysis of business impacts can be particularly problematic for transportation planners, because planners tend to have less information and tools for estimating business impacts than they do for analyzing traffic patterns.

## **Objective for this Paper**

This paper focuses specifically on business impacts of transportation projects, and utilizes highway planning examples although the basic analysis framework should also apply for other transportation modes (and multi-modal plans). It describes a pair of analysis methods and tools which may help state and local planners build a basis for assessing the potential positive and negative business impacts associated with highway system changes. A series of information collection and analysis steps is described, which project planners can employ to help them understand the different types of questions to be asked, and identify for them the different types of data collection and calculation required to answer them. A set of companion spreadsheet templates have also been developed to aid in carrying out the required data entry and calculations.

## **Types Of Economic Impacts Covered**

The business impacts of transportation projects tend to fall into two general categories:

**(1) Localized Abutter impacts associated with shifts in traffic flow patterns and routes.** These are usually unintended business impacts of projects which were primarily intended to improve safety, capacity or traffic flow throughput. They apply primarily to retail stores and consumer service businesses (e.g., gas stations, restaurants, etc.) which depend on good customer access and/or pass-by traffic. More often than not, the localized impacts of concern to planners are the adverse impacts on already existing businesses.

**(2) Regional Business Attraction impacts of access improvements.** These tend to be benefits of roads or other transportation improvements built with a specific intention of spurring economic development in the area where they are upgrading the level of transportation services and access. They tend to be most applicable for industrial, wholesale and office activities which can grow faster and attract new businesses to an area with greater accessibility to resources, labor and buyer markets. (Note: For purposes of this paper, “business attraction” encompasses any investment in additional business operations, whether it occurs at existing companies or at new companies.)

The approach and analysis procedures outlined below address each of these two classes of business impact, in parallel frameworks. They integrate analysis procedures for assessing potential localized impacts [1]. and analysis procedures for assessing potential regional impacts [2].

## **APPROACH FOR ANALYSIS**

### **Localized Abutter Commercial Business Impacts**

In order to assess the potential impacts of transportation access changes on abutting businesses, it is necessary to identify the types of existing retail and commercial service businesses that tend to be most dependent on pass-by traffic and customer convenience, evaluate the extent to which they are potentially vulnerable to impacts associated with localized changes in vehicular accessibility to stores. From such analysis, we can also identify the portion of their sales (and jobs) which are potentially at risk of loss. This information can be useful for planners to then adopt measures to mitigate such impacts. Depending on the access features of the new facilities, there may or may not be offsetting potentials for gains there.

Going beyond the identification of impact "potentials" is forecasting the actual change in sales (or jobs) which will occur at existing stores or anticipated new stores. That cannot be done unless we also have information on the availability of competing shopping (business) alternatives, the relative accessibility and attractiveness of those alternatives, and the impact of the transportation project on the relative accessibility and attractiveness of adjacent businesses compared to that of the competing alternatives. That can be done with information on the origins and destinations of all affected trips in the transportation system and a model for forecasting changes in trip distribution and traffic assignment for the affected classes of shopping trips. Alternatively, a simple gravity model (using a spreadsheet) can be used to estimate shifts in patterns of retail trip attraction.

In the long run, a significant impact on store accessibility, traffic volumes or travel speeds is likely to also bring about changes in the mix of business activities. This may occur as pre-existing stores fail or move away and are replaced (or supplemented) by new types of stores which can better take advantage of the new level and pattern of traffic flow. The net long-term impact on business

attraction and business sales activity can be either positive or negative, depending on the extent to which there are increases in traffic volumes and /or improvements in travel times which more than offset the negative impacts on accessibility to particular parcels. Of course, these overall net economic impacts cannot be forecast unless we also have some information (or estimates) of the pattern of highway trip distribution and projections of the project's expected effect on traffic volumes and speed changes, as well as some estimate of the support for new business in the corridor resulting from area population growth.

### **Regional Business Attraction Impacts**

In order to assess the potential impacts of transportation access improvements on business attraction, it is necessary to employ some type of policy analysis model which is sensitive to changes in transportation-related costs and access factors. It should build on research findings concerning how long-term business growth in a region is affected by: (1) the relative cost of doing business in the region (compared to competing regions of the country), (2) the size of the region's consumer markets and labor markets and (3) the region's natural and historic attraction for business, which is related in part to its proximity or access to raw materials or other product inputs. This set of factors is indeed consistent with economic development theory regarding business growth and attraction. Of course, the relative role and importance of each of these factors differs depending on the particular type of business.

In order to utilize a policy analysis model of this type, it is necessary to first collect information concerning how the project impact region currently compares to other regions in terms of business attractiveness. That requires information on the relative cost of labor, input materials, taxes and shipping costs, compared to elsewhere. It also requires information on the relative importance of each of these factors as a component of overall business cost. These cost factors are relevant because one of the significant impacts of a new highway (or other transportation improvement) can be an improvement in speed, expense, reliability and safety -- all of which can serve to reduce shipping costs for businesses in the region.

Yet it is also important to recognize that a great many businesses continue to thrive in and be attracted to areas which are not low cost in any sense. Thus, it is also important to utilize information on the extent to which growth and relocation rates of various types of businesses are actually affected by relative cost factors.

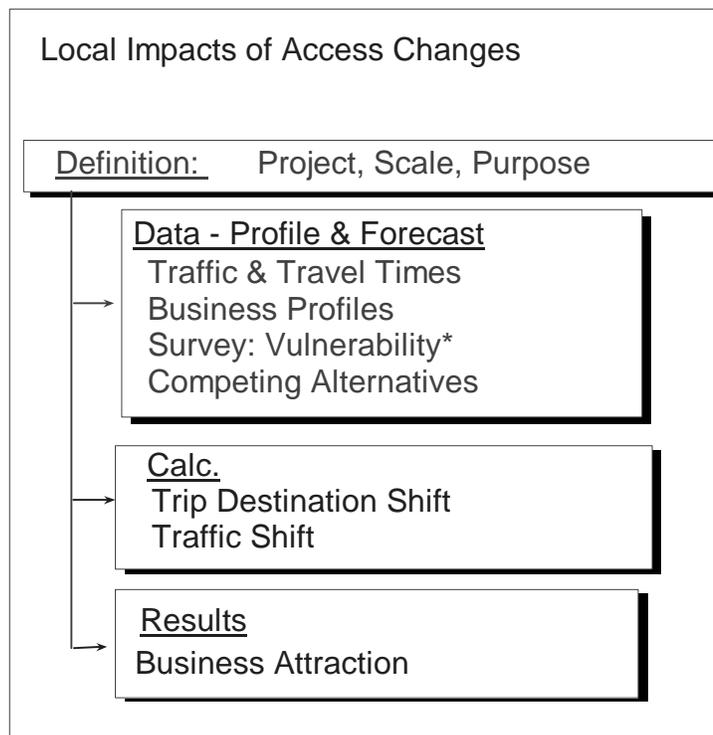
The other primary class of transportation project impacts is the expansion of markets or service areas. Highways, for instance, can have a variety of market expansion impacts including: (1) expansion of customer market areas for retail and personal service businesses, (2) expansion of labor market attraction areas for office activities as well as other types of businesses, (3) expansion of "just-in-time"(one day delivery) service areas, and (4) expansion of opportunities for multi-modal connections -- including road/rail/sea/air port connections for either passenger travel or freight shipments. All of these expansion factors can lead to additional attraction of various

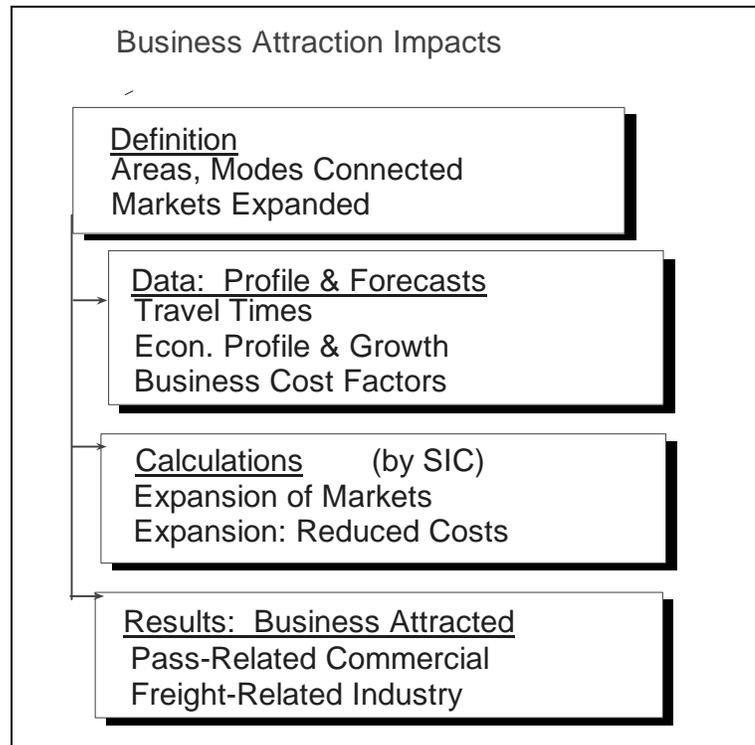
types of business. Of course, a new road (or other transportation service improvement) can help expand opportunities for areas served at origins and destination ends of trips. Thus, when studying highway impacts on any one region, it is necessary to consider not only the business attraction opportunities provided for the study region, but also the potential for offsetting business loss possibilities since businesses located elsewhere will also get improved access to serve customers within the study region.

## MODEL STRUCTURE

The same basic analysis process applies for both the analysis of localized abutter business impacts and the analysis of regional business attraction and growth. The analysis process consists of a series of four parts -- Project Definition, Data Collection, Calculation and Results -- illustrated schematically in Figures 1 and 2. The same four parts apply for both problems although details of the data collection and analysis differ depending on whether the problem concerns localized abutter business impacts (as shown in Figure 1) or area business attraction and growth (as shown in Figure 2). These components are described below.

**Figure 1. Local Impacts of Access Change**



**Figure 2. Business Attraction Impacts****Part 1: Definition of the Project**

The first step is to define the project and the analysis to be done. Depending on the answers to these questions, the measurement of economic impacts, the area of analysis and the form of comparison done may be different. The key components are as follows:

**Type of Project.** The nature of the transportation project and its impacts on accessibility determine which portion of trips are affected, where the affected businesses are located, and whether the business impacts are restricted to locations along the affected right-of-way or also encompass a broader region.

**Purpose of the Project.** The purpose may be to: (1) improve safety, (2) improve speeds and travel times, (3) increase capacity and throughput, and/or (4) upgrade the road specifications as required for some major business to locate there. Determination of the project purpose has very important implications for the type of economic impacts to be studied. If, for example, the project is intended primarily to improve safety or

transportation system performance, then the analysis needs to focus primarily on assessing the potential for localized adverse impacts on abutters (as a consequence for which mitigation measures may need to be taken). If, on the other hand, the project is intended to bring major improvements in accessibility and business attraction for its service area, then the analysis needs to focus primarily on assessing the potential for regional business benefits (as a project objective to be assessed relative to project costs.)

**Project Impact and Study Areas.** For purposes of analyzing business impacts, the primary impact area is the area in which accessibility to businesses is affected. It is also necessary to clarify the area of jurisdiction of the funding and planning agencies involved in this analysis, since that is usually the appropriate area for the analysis of overall long-term business benefits. Smaller sub-areas will be relevant for analysis of impacts on abutting businesses.

**Purpose of the Analysis.** There are several different purposes for evaluating economic impacts of transportation projects, and they will affect the analysis methodology. The analysis purpose may be : (1) to identify the types of existing businesses which could potentially at risk of immediate economic hardship, (2) to forecast the actual magnitude of short-term shift in sales (or jobs) associated with project changes, or (3) to estimate the net long-term impact of the project on business attraction and business sales activity. The latter can then be used for cost-benefit calculations and project implementation decisions.

**Transportation Alternatives and Base of Reference.** The expected economic impacts of any project can only be measured in comparison to some base case. The base case can be either (1) the status quo (no physical change in the road system design or facilities) or (2) some other form of transportation system improvement project. Economic impacts can be increased or eliminated depending on which form of base case is used for calculating economic impacts.

## **Part II: Collect Data**

The determination of potentials for business impact depend critically on understanding the current and projected business and traffic patterns, and the sensitivity of businesses to the proposed transportation system changes. The required data components are as follows:

**Economic Data for analysis of localized abutter impacts.** For profiling abutting business, an inventory of businesses in the primary impact area is needed, classified by type of business. (This can be assembled based on a walk-through or drive-by survey) In addition, the evaluation of potential business loss risk requires information on the magnitude of business sales and employment associated with the inventory of adjacent businesses. (This can be collected through a local business survey, obtained from the state revenue department, or purchased from private data sources such as Dun & Bradstreet

files. Alternatively, it is possible to fall back on state or local averages for sales/store and employees/store from the Census of Retail Trade.)

**Economic Data for analysis of regional business growth impacts.** For profiling business activity in the regional impact area, information is needed on current and projected changes in employment, personal income (or wages) and business sales, by type of business. (This can come from the US Commerce Dept.'s annual County Business Patterns data and zip code breakdowns of that data, or from monthly state Employment Service ES-202 records, or from other government sources.) In addition, projections of expected future growth are needed to provide a baseline against which to compare estimates of long-term project impacts. (This can come from US Bureau of Economic Analysis or from various economic forecasting models such as the REMI model.)

**Traffic Data.** For either analysis of localized abutter impacts or analysis of regional growth impacts, estimates are needed on the magnitude of project impacts on overall traffic volume and traffic speeds for the affected portion of highway in the primary impact area. (That can be predicted through use of a traffic network simulation model. Alternatively, for a localized road improvement project it can be predicted using the Highway Capacity Manual together with some assumptions about the nature of any demand for rerouting or turning movements). Also needed are estimates of the magnitude of project impacts on travel distance, travel cost and travel times to and from the affected businesses -- whether they be immediate abutters or businesses elsewhere in the primary impact area. (This requires some model, data or assumptions about trip origins and destinations).

**Additional Data on Business Vulnerability and Sensitivity to Traffic Changes.** For the analysis of localized abutter impacts, information is needed (or assumptions need to be made) regarding the portion of business sales which is "at risk" of loss from reduced accessibility, or for which there may be potential gains from greater pass-by traffic. That depends on the extent of business activity which is convenience-oriented and for which there are viable competing alternative destination locations nearby. Such information may be obtained via either a survey of business patrons or business managers, or by adoption of defaults based on store mix. Examples of default data, derived from surveys and statistical analyses for NCHRP Project 25-4, are shown in Figure 3. They show that business dependence on pass-by traffic levels ranges from 86% for gas stations, down to under 30% for durables retail, hotels and supermarkets in the particular areas studied.

For the analysis of regional business benefits, business sensitivity is based on the extent to which various types of business depend on just-in-time delivery, or are sensitive to shipping costs in their business operations and relocation decisions. (That can be estimated on the basis of business surveys or else by adoption of defaults representing the relative cost of doing business, the expected cost savings to businesses resulting from the highway improvements, and the expected rate of business attraction given a percentage change in shipping or delivery costs. Economic time-series models which provide historical and forecasting data, can be used to provide estimates of those numbers.) Examples of default data, derived from REMI model analyses for Iowa, are shown in Figure 4. They show that a fixed percentage reduction in operating costs for all types of businesses can lead to a different level of business attraction or growth, depending on the business type.

**Locational Alternatives.** Additional information needed for the estimation of localized abutter impacts is a profile of competing retail areas (destinations outside of the primary impact area) and the attractiveness of shopping there. For the estimation of regional growth prospects, the additional information is a profile of adjacent states or regions and their relative costs of doing business and relative accessibility costs compared to the study area. For either type of analysis, it is necessary to obtain information on the relative accessibility (travel time) to each alternative compared to the project corridor (or area).

### **Part III: Calculations**

The calculations involve estimating the extent to which traffic shifts will actually affect factors relevant to business impacts.

**Calculate Travel Pattern Shifts.** For the estimation of abutter impacts, the relevant calculations are the shift in trip destinations and traffic patterns as a result of the project. (The shift in traffic destinations among competing destinations may be calculated by considering the information on competing shopping alternatives and typical average travel times to them. That information is then placed into a "gravity model" calculation to assess how changes in travel time affect the distribution of those destination choices, and hence changes in the shares of trips stopping at destinations in the project impact area.) Indicators of traffic volume growth due to localized land development patterns can then also be estimated, to provide an overall estimate of "net traffic change".

For the assessment of regional economic growth impacts, the basic process is to combine information on traffic volumes and speeds with information on regional land development and population growth forecasts, in order to calculate the potential for future growth of local area traffic generation.

**Calculate Linkage of Business Shifts to Travel Shifts.** For the estimation of localized abutter impacts, the basic process is as follows: The business survey provides information on: (a) the extent to which visits are regular or irregular in frequency, (b) the typical size of purchases made and (c) the extent to which visits at these businesses are made as stops along the way to/from a primary destination. These data are combined with data on competing alternatives in a calculation worksheet. The worksheet is then used to derive “vulnerability ratings” -- calculated estimates of the percentages of sales which are both dependent on pass-by traffic and subject to diversion to competing alternatives.

For the estimation of business attraction impacts, the basic process follows: The previously-described analysis of business sensitivity provides estimates (by business type) of the relative extent to which businesses depend on schedule reliability, minimizing travel times, and/or minimizing shipping costs to lower operating costs and the extent to which those cost reductions affect business growth and attraction rates. That data is then combined with five indicators of the project-induced shifts in business costs and business service areas. They are:

- (1) “service area expansion factor” -- which represents expansion of the customer market area for retail and personal service businesses, and expansion of the labor market area for offices and other business activities;
- (2) “cost reduction factor” -- relative reduction in freight shipping and delivery costs for the impact area, with a further adjustment for the improvement in just-in-time (one-day delivery) service area for applicable types of businesses;
- (3) “adjustment for connection losses” -- offsetting losses of business activity to outside areas which are also beneficiaries of the improved transportation connections;
- (4) “growth limitation factor” -- which is an estimate of the extent of growth necessary to bring the transportation project impact area up to the economic activity levels of the areas to which it is being connected; and
- (5) “non-transportation attractiveness factor” -- an estimate of the relative labor, tax and energy costs of doing business in the impact area compared to connecting areas.

The worksheet is then used to derive a calculated estimate of the percentage of business growth which is both dependent on transportation level of service and subject to diversion to competing business locations.

#### **Phase 4: Results**

The impact estimates and forecasts which result from these calculations are in the form of estimates of the shifts in business sales volumes and employment by type of business (SIC code).

For the estimation of project impacts on abutters, the basic results are estimates of potential short-term impacts on adjacent business sales (usually losses), by type of business. These are calculated by multiplying the previously-derived “vulnerability ratings” by the sales volumes of existing businesses. Forecast of the overall long-term impacts on business activity levels in the primary project impact area are made by adjusting (multiplying) the estimates of short term impact by the previously-derived “net traffic change” factor (that is a forecast of the potential for business growth impacts which may counter or offset the business risks).

For the estimation of regional business expansion/attraction impacts, there are two types of basic results, both of which are represented as estimates of business sales and associated employment and personal income (or wages) . One type is the estimates of passenger-related commercial business growth. In the current spreadsheet template, these are calculated (for each type of business) by adjusting the baseline employment levels by four factors which were previously derived: (1) “service area expansion factor”, (2) “growth limitation factor”, (3) “non-transportation attractiveness factor” and (4) “adjustment for connection losses”. Given the calculation of employment impacts, the corresponding business sales and personal income impacts are then estimated based on average sales/employee and income/employee values for each business type.

The other regional result is the estimates of freight-related industry growth. These are calculated by adjusting the baseline employment levels by the “cost reduction factor” and three other factors that are the same as above –“growth limitation factor”, “non-transportation attractiveness factor” and “adjustment for connection losses.” Business sales and personal income values are then estimated from employment impact estimates as previously described.

#### **MODEL FORMS AND SPREADSHEET CALCULATIONS**

Model forms for inputting the required information and a computer spreadsheet model for making the calculations were developed to operationalize the analysis steps described here. That analysis tool may be used by transportation planners as a basis for the evaluation of their own projects.

## CONCLUSIONS

The methodology described here illustrates the breadth and complexity of issues which must be acknowledged, if not fully addressed, by planners confronting the topic of transportation project impacts on businesses. While the analysis framework provided here is extremely data hungry, planners always have the option of either collecting relevant information or else adopting reasonable assumptions regarding business and traffic flow patterns. The latter option may be the expedient route or the only practical route, but even that can be preferable for planners than to appearing ignorant of economic factors.

## ACKNOWLEDGMENTS

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