

Guide to MCIBAS (Major Corridor Investment-Benefit Analysis System) and Its Economic Impact Analysis Component

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1.0 Introduction

■ 1.1 Objective

The Major Corridor Investment-Benefit Analysis System (MCIBAS) was developed for the Indiana Department of Transportation (INDOT) as a system for assessing the relative costs and benefits of proposed major highway corridor projects. It consists of a traffic impact simulation model, a user benefit-cost analysis processor and an integrated economic impact analysis system. This document provides an overview of all of the components of the MCIBAS, and their use. It also provides further explanation regarding the economic impact analysis component, which is designed to assist INDOT in evaluating effects on the economy of the state and sub-regions.

■ 1.1 Conceptual Approach

Definition of Economic Impacts. In general, it is useful to distinguish define three types of impact measures:

- *User benefits* refer to the travel time, cost and safety improvements which are realized by travelers. Effects on non-travelers are not counted in the analysis of user benefits. This is the measure of benefit traditionally used by transportation agencies for project evaluation.
- *Economic benefits* are defined as benefits to the economy --- i.e., the flow of dollars of income *into* the pockets of Indiana residents, including both travelers and non-travelers. These economic benefits can be compared to economic costs --i.e., the flow of dollars *out of* the pockets of Indiana residents. This measure of project impact is produced by economic models. It is important to recognize that economic impacts encompass only money flows and do not necessarily capture all aspects of benefits that can affect the quality of life for people.
- *Total Societal benefits* are measured, in theory, as the value of all benefits regardless of whether or not they affect flows of dollars. They encompass both income benefits to Indiana residents and the equivalent value of additional quality of life benefits that do not affect incomes. They can include both positive and negative factors. In theory, a public agency should seek to assess total benefits against total costs. In reality, this measure is seldom fully represented in benefit-cost analysis because of the lack of public agreement on the valuation of environmental and social factors.

Differences Between these measures are summarized in Table 1-1 below. Further explanation of the inter-relationship between user benefits and economic benefits is provided in Section 3.2. (For further explanation of these concepts, see the TRB Guide, "Assessing the Economic Impacts of Transportation Projects" Transportation Research Circular #477, 1977.)

Table 1-1 Differences In Transportation Impact Measures

Type of Benefit	User Benefit (value)	Economic Benefit (\$ income)	Societal Benefit (value)
<u>Work-Related Travel</u>			
Travel Expense	X	X ²	X
Traveler Time	X	X ²	X
Travel Safety	X	X ²	X
<u>Non-Work Travel</u>			
Travel Expense	X	X ³	X
Traveler Time	X	-	X
Travel Safety	X	-	X
<u>Businesses</u>			
Market Expansion ¹	-	X ¹	X ¹
Logistic & Scale Economies	-	X	X
Secondary Economic Effects ¹	-	X ¹	X ¹
<u>Area Residents</u>			
Air, Noise & Water Quality	-	-	X
Other Quality of Life factors			

Note: X indicates a factor that is typically included in the total benefit measure

¹ Market expansion and secondary economic effects are benefits at the state level, but insofar as they occur at the expense of other out-of-state areas, are not a benefit at the national/global level.

² Reductions in work travel time, travel expense and insurance expense represent an economic benefit to the extent that they reduce business operating cost.

³ Reduction in non-work trip expense is an economic benefit to the extent that it increases disposable income available for consumer spending.

Differences Between Economic Impacts and User Benefits. Economic benefits of highway improvements (as estimated by MCIBAS) differ from the travel efficiency value of user benefits. The differences are as follows:

- **Highway Usage** - User benefits accrue only to those individuals and businesses that actually use the affected highway corridor. Economic benefits are broader in that they may accrue to anyone deriving additional income from business growth attributable to the highway improvements (even if they themselves do not use the highway). These benefits can include income from business generated by both "indirect effects" (growth of suppliers to the directly-benefiting businesses) and "induced effects"

(growth of other activities from consumer spending associated with additional worker income) –collectively referred to as “secondary economic effects”. Thus, economic impacts include some non-user benefits.

- **Geographic Coverage** - User benefits cover all travelers on the affected highway segment, including pass-through travelers whose trips both originate and terminate outside of the state. Economic benefits, however, are counted only for people and businesses residing in Indiana, thus excluding benefits to out-of-state residents.
- **Class of Trips** - User benefits cover all safety, time savings, and cost savings benefits, regardless of the trip purpose. Economic benefits only count benefits that increase the flow of money, due to reduced costs (or increased sales) for businesses and/or increased spending income available for individuals. The time savings and safety benefits for many forms of personal travel, while they are clearly benefits to users, may not all translate into direct impact on dollars flowing in the economy.

The treatment of costs may also differ depending on the type of analysis; economic impact analysis can also account for the additional cost of acquiring the funding.

■ 1.2 Coverage of Economic Impacts

Categories of Economic Impacts. Highway projects can have different types of impacts in the short-run (e.g., during the construction period) and in the long-run (e.g., after the improved highway is fully operational and in use). The MCIBAS is built upon the concept of distinguishing four types of economic impacts:

- **Construction Effects** are mainly the short-term economic effects of purchasing materials and hiring workers for highway construction. (There may be also be short-term impacts associated with traffic disruption and partial operation during construction, although those factors are not assumed for the basic analysis here.)
- **“Business Expansion”** is a term used here to refer to long-term economic effects of reducing travel-related costs for businesses and for individuals. Business cost savings can improve the relative cost competitiveness of area businesses and hence their ability to expand and grow. Any travel cost savings for individuals can also increase household purchasing power available for spending on other items.
- **“Business Attraction”** is a term used here to refer to long-term economic effects on industrial operations beyond those associated with travel costs savings. These effects on business may include more efficient inventory and logistics, implementation of just-in-time production processes, customer market expansion and associated scale economies, and access to a broader (and more competitively priced) set of suppliers.
- **Tourism Effects** are the long-term economic effects on tourism markets, beyond those associated with travel costs savings. These are primarily regional effects on tourism patterns due to expanded market access.

All of the preceding types of effects are measured in the MCIBAS, although the construction effects are not counted in the benefit-cost analysis insofar as they would occur regardless of whether or not the specific corridor is selected for highway spending.

Types of Economic Effects. The economic implications of highway improvements are tracked in MCIBAS at two levels:

- **Direct Impacts.** The immediately-realized benefits to travelers (i.e., user benefits) may be in terms of ease of access, comfort, safety, travel times and/or travel costs. They lead to various direct economic effects (i.e., income gains) to users and non-users in the form of cost savings to businesses and individuals, industry market effects and/or tourism effects (defined above).
- **Secondary Impacts.** Ultimately, the direct benefits to businesses and the residents of a region may also lead to broader impacts at the regional and statewide economies. The term “secondary impacts” is used here to refer to the sum of “indirect” and “induced” economic effects. *Indirect effects* refers to the growth of suppliers who gain additional orders to serve the growth of the directly-affected businesses. *Induced effects* refers to the further growth of businesses throughout the economy, which gain revenue as the additional workers –hired as a result of direct and indirect economic impacts -- spend their income on food, clothing, shelter and other goods and services. Other induced effects may occur over time as there are broader shifts in population and business location patterns, as well as prices. The Regional Economic Models, Inc. (REMI) simulation model is used with MCIBAS to estimate these effects over time.

Measurement Concerns. The design of MCIBAS is intended to address two common problems in the evaluation of project economic benefits:

- **Double Counting.** Money effects can occur in different forms as viewed from different perspectives. They may be seen as changes in business output, incomes or property values. Of course, these measures represent different perspectives for viewing the same basic effects of economic growth pressures resulting from the same basic causes. Because of that relationship, care must be taken to avoid “double-counting” benefits by adding together results of different levels of impact for the same class of travel. (For instance, a highway may save truck driver time, leading to greater business sales, higher incomes and increased property values along its corridor. Yet it would be wrong to add together those benefits, as they are all reflections of the same basic effect). MCIBAS avoids that problem by focusing the measurement of economic benefits on household income effects, and then separately tracking the value of other factors that are not represented in economic benefits (i.e., time and safety benefits for personal travel).
- **Geographic Incidence.** Care also must be taken to account for the geographic incidence of benefits, i.e., the fact that some local business gains may be partially offset by business losses elsewhere. MCIBAS addresses this issue by separately tracking economic effects for the highway corridor and the rest of the state. Thus, it allows us to see that regional economic benefits may be larger or smaller than statewide economic benefits, depending on the extent to which the area outside of the highway

corridor suffers from intra-state business shifts or actually gains from spillover economic benefits.

At the same time, the fact that transportation investments can cause intra-state location shifts in economic activity does not mean that the statewide economic impacts of transportation is just a "zero sum game". Relocation benefits to businesses may allow them to provide new products or services, or to provide existing products and services at lower cost. For these reasons, it is important to consider the potential business attraction impacts associated with improved market access and productivity. MCIBAS addresses this issue through an assessment of potential business attraction benefits for the State of Indiana.

■ 1.3 Model Components

Overall System Design. MCIBAS incorporates the previously-discussed categories of impact and types of effects through a series of modules:

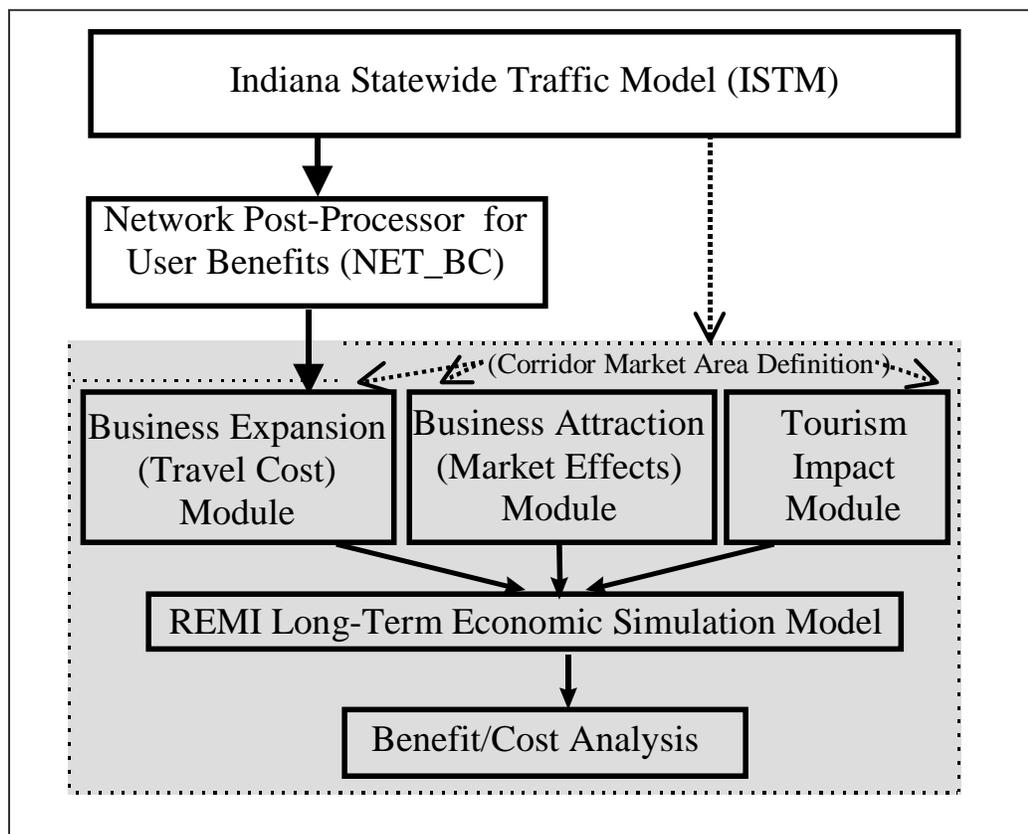
1. Indiana Statewide Travel Model (ISTM)
2. User Benefit Analysis (NET_BC)
3. Economic Impact Modules (Business Expansion, Business Attraction, Tourism)
4. REMI Simulation Model
5. Benefit/Cost Analysis

The relationship of these modules is illustrated in Exhibit and summarized below:

1. Indiana Statewide Traffic Model (ISTM), a statewide traffic network simulation model, predicts the direct effects of the highway system improvement on traffic levels, speeds and distances, and aggregate measures of system-wide VMT (vehicle-miles of travel) and VHT (vehicle-hours of travel).
2. NET_BC, a post-processor program to estimate user benefits, reads ISTM results and translates the predicted traffic changes into estimates of the dollar value of user travel time, travel cost and safety benefits. It also utilizes project cost data in order to produce a traditional user benefit/cost analysis at the statewide level.
3. Economic Impact Analysis System has three five modules. First, it is necessary to define the "Corridor Market Area," using predicted travel time changes from the ISTM to identify: (a) the potential area of impact on travel patterns, and (b) the extent to which the project would expand delivery, commuting, and tourism market areas for businesses along the highway. Once that is established, the five modules are run:
 - The *Business Expansion* module reads NET_BC results and translates them into direct impacts on business operating costs and household disposable income.
 - The *Business Attraction* module it takes economic information on the "Corridor Market Area" and translates it into factors directly affecting industrial business attraction (beyond what would be expected due to user benefits alone.)

- The *Tourism* module also it takes tourism market information and translates it into factors directly affecting tourism attraction.
- The *REMI Simulation Model* is run within MCIBAS to estimate the full economic impacts of the highway project. It takes the direct economic impacts as assessed by the preceding three modules, and then forecasts the total (direct and secondary) business output, income and population changes for the next 30 years. (It also separately forecasts short-term construction impacts.)
- *Benefit/Cost Analysis* is run within MCIBAS to estimate the net present value of all income benefits and project costs. It takes the total income changes forecast by the REMI model, together with total cost and non-business (personal time and safety) benefit data, and then calculates the resulting benefit/cost ratios.

Figure 1:
MCIBAS Components for Long-Term Benefit/Cost Analysis *
 (shaded elements are internal to the economic impact analysis system)



* The economic impact analysis system within MCIBAS also utilizes REMI to calculate economic impacts of highway construction, but that element is not shown here because it does not feed into the long-term benefit-cost calculation. See discussion of benefit/cost analysis (Section 5.2) for further discussion of that issue.

The specific inputs required by these modules, and the supporting data collection and analysis requirements, are discussed in the next chapter.