Measuring Economic Development Benefits for Highway Decision Making in Wisconsin

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The Wisconsin Highway 29/45/10 study was a pioneering effort to conduct a comprehensive evaluation of potential economic development benefits associated with a proposed major regional highway project and apply those findings for cost-benefit analysis. A series of five alternative design levels, for each of two alternative highway routes, was evaluated. A set of interacting transportation and economic analysis models and techniques were used to evaluate the alternatives in terms of the potential for greater business expansion, new business attraction and tourism, and auto passenger-user benefits. A rigorous cost-benefit evaluation framework, designed to avoid double counting, was used to rank the alternatives for public policy decision making.

Issues involved in measuring and evaluating the economic development impacts of major highway investment and the application of those findings for investment decision making were examined. This paper focuses on a proposed highway construction project to create a 2,000 mile four-lane highway across north-central Wisconsin. This corridor would provide a major east-west link from Green Bay and Appleton on the east to Eau Claire and Chippewa Falls to the west. There the route intersects with I-94 and continues to Minnesota (see Figure 1).

A major motivation for considering the highway improvement was the belief, promoted by community and business leaders, that a high-quality four-lane highway connecting cities across the corridor would significantly enhance economic growth in the region. It was generally believed that unless highway improvements to the corridor were evaluated for long-range economic development potential, the benefits of the corridor improvement would be underestimated.

At the state level, there was also interest in using transportation investments to promote economic development objectives. The Wisconsin Department of Transportation was very interested in expanding its cost-benefit analysis to include not only benefits to the user, but also benefits to the economy. Accordingly, the department commissioned a study to assess the potential long-term economic development benefits of building a new major four-lane facility across the state (1).

The study evaluated five alternative levels of improvement for the Highway 29/45/10 Corridor, ranging from a two-lane arterial to a full freeway. The alternatives are described further in Figure 2.

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The most notable aspect of this study is its breadth. The analysis process included an integrated set of simulation and forecasting models of the economy and the transportation network to evaluate potential impacts of this major highway investment. In addition to projecting benefits to auto travellers, the study focused on estimating impacts on expansion of existing business, attraction of new business, and tourism growth. Specific attention focused on providing a rigorous framework for benefit assessment that avoids double-counting, a typical problem of economic impact assessment. In addition, attention was given to providing a methodology for estimating transportation and economic impacts that adequately recognizes implications of business efficiency benefits, a shortcoming of some prior economic assessment studies.

This article provides an overview of how economic impacts were measured, describes the analysis modeling techniques used, and shows how cost-benefit analysis was applied for highway investment decision making.

LITERATURE REVIEW

Before evaluating the economic impacts of proposed highway projects, it is important to understand the limitations of prior research on this topic. In fact, a major aspect of the economic impact literature is that the research has gone in several distinct directions, addressing different sets of issues. Overall, the studies provide only limited guidance for local economic development evaluations.

For instance, one set of studies has shown the relationship of national highway investments to reducing shipping costs and increasing business productivity (*2–5*). These studies generally find evidence, using national time series statistics, of increased business productivity over time associated with reduced shipping costs resulting from upgrading the national highway network. Such findings, however, are not transferable to the evaluation of individual highway improvements, where geographic differences in travel patterns and economic patterns become important considerations.

Another set of economic modeling studies has analyzed the relationship of highway locations to nearby business growth patterns (*6–10*). Other case studies have attempted to document the shifts in business growth patterns associated with specific new freeways (*11–13*). Most of these studies were conducted a decade ago and found mixed evidence concerning

FIGURE 1 Highway 29/45/10 Corridor.

whether there is statistical or causal relationship between regional economic growth and highway improvements. They generally conclude that many local factors other than highway improvements affect regional growth. Thus, one can only conclude from these studies that a new or substantially upgraded highway may or may not have economic impacts, depending on where it is located and the intercity connections it provides.

If, however, one moves beyond the numbers and talks to business executives who make location decisions, and economic development professionals involved in trying to attract businesses, the evidence shows that highway issues are prominent in the expansion and location decisions of many firms. Surveys of corporate executives by Dow Jones & Co. and by *Site Selection* magazine, for instance, have consistently found highway access to be among the top three locational considerations for corporate headquarters, regional offices, research and development facilities, manufacturing plants, and distribution centers. Overall, past research supports the assertion that major highway improvements can have significant economic development benefits, although the magnitude of those benefits will vary depending on the particular setting and types of highway improvements being considered.

MEASUREMENT OF ECONOMIC BENEFITS

Types of Economic Development Benefits

Whenever a section of highway is improved, individual auto and truck travellers benefit in terms of travel time, transportation cost, and accident reduction. These direct user benefits have been the traditional means of determining the benefits of a highway project. The direct user benefits for trucking can translate into real dollar savings for businesses that ship items by truck. However, highway improvements can significantly affect the corridor and state economies, over and above the direct user benefits. Specifically, by reducing truck shipping costs, a real efficiency benefit can accrue to the business shipping the product, and a potential cost savings can accrue to the business receiving the product. Cost savings can mean lower product costs, in turn making local area businesses more competitive compared with their outside competition, and better able to expand to new markets.

In addition to the business expansion benefit related to trucking cost savings, highway improvements can extend the market area that businesses can serve, as well as the areas

Two Route Alternatives

- "29/45 Upgrade Replacement" WIS 29 (Eau Clare to Green Bay) and U.S. 45 (E. of Wausau to Appleton) connecting to Highway 29.
- "29/10 Upgrade Replacement" WIS 29 (Eau Clare to Green Bay) and U.S. 10 (Stevens Point to Appleton) connecting to Highway 29 via U.S. 51 freeway.

Five Design Level Alternatives

- "Freeway" - A full four-lane, limited access divided highway, meeting interstate highway standards and therefore eligible for a 65 mph speed limit. Most of the freeway would be constructed on new alignment in order to bypass built-up areas around all communities.
- "Freeway/Expressway I" - About 35% of the finished highway would be constructed as 4-lane "freeway"; the rest would be constructed as "expressway." The major difference between expressway and freeway design is that an expressway allows some at-grade intersections rather than requiring that all access to the highway be through interchanges. (Later upgrading of the highway and intersections would be possible.) Under current law, the speed limit for a freeway/expressway combination would be 55 mph.
- "Freeway/Expressway II" - The primary design difference between this and the previous alternative is fewer interchanges and more at-grade intersections with other public highways. About 15% of the finished highway would be constructed as 4-lane freeway; the rest would be constructed as 4-lane "expressway". (Later upgrading of the highway and intersection would be possible.)
- "Base Case" - The base case parallels the Department's normal improvement schedule for the highways by proposing four-lane sections only warranted on strictly traffic capacity needs. Under this alternative, about 35% of the corridor highways would be four-lane by the year 2000.
- "No Build" - The No Build Alternative represents the point of reference against which to measure the additional costs and benefits of each of the four above alternatives. It represents maintenance of the highway segments at their current 2-lane design.

FIGURE 2 Design characteristics of highway alternatives.

from which they can access suppliers. They can extend the distance range accessible within a day's drive for truck deliveries or customer visits. They also can extend the distance range over which local businesses effectively compete with their out-of-state counterparts (and vice versa). The extent of such benefits depends critically on the relative locations of business buyers, suppliers, and competitors. These travel range impacts can provide opportunities for significant expansion and attraction of manufacturing and distribution industries. Consumer market areas for retail and service businesses are also affected by changes in effective trade areas, but those effects tend to be merely localized shifts in retail activity rather than true gains for the region and state as a whole.

There can be additional impacts on the attraction of new business. In the Wisconsin Highway Study, some types of businesses would find the corridor to be an attractive location if it were not for its lack of a four-lane, east-west highway. Some businesses not previously attracted to the area could also be attracted if they were to see the area upgraded to be fully served by four-lane freeway or expressway facilities, providing fast and reliable transportation links to the national highway network, regional population centers, and specific buyers or suppliers. Improvements to this corridor could also enhance the perception that north-central Wisconsin is an attractive place to live and locate a new business. These types of impacts of highway upgrading are over and above the incremental effects of travel time savings alone.

Some types of businesses could find the proposed highway improvements to be necessary, but not sufficient, to attract them to the area. Some businesses could be attracted to the area if the highway improvements were to be accompanied by other economic incentives and/or public improvements, as part of an effort to address what those businesses see as local or regional deficiencies in resources and services available. For this reason, the economic attraction benefits of each alternative must be viewed in the broader context of existing mar-

keting and business development efforts at the local, regional, and state levels.

Tourism-related business is a special type of opportunity, where passenger travel benefits can lead to additional visitation to the state. For instance, given the location of Highway 29, four-lane improvements to it can provide a particular opportunity to make vacation and recreation areas along the Lake Michigan shore more accessible and attractive to Minnesota residents. The easier and more relaxed quality of the travel experience along a four-lane freeway or expressway, in addition to safety and travel time benefits, can affect these tourism and recreational travel patterns.

The economic development effects of highway improvements do not end with the direct effects on business expansion and attraction. There are also very significant spillover effects on the rest of the area economy. The direct effect on business expansion and attraction leads to such "indirect effects" as additional orders for materials and equipment from other businesses. For instance, expansion of the food processing industry would lead to increased orders for plastic packaging and cardboard boxes. In addition, "induced effects" result when new and expanding businesses hire more workers, who then spend money on consumer products and services.

While businesses within the highway corridor study area are the principal beneficiaries of the direct benefits, the spillover that indirect and induced business growth can provide is a very real benefit for the rest of the state.

Appropriate Measures of Benefits

Economic growth can be viewed as bringing more business sales, jobs, personal income, and population growth to the state. Such economic growth is publicly perceived as desirable insofar as it leads to increased employment opportunities, greater variety of shopping merchandise and cultural activity, higher income levels, a more vibrant atmosphere for private business investment, and greater public resources for investment in local infrastructure.

The impacts can be measured in terms of jobs, business sales, or personal income. For cost-benefit analysis of Wisconsin highway projects, the "disposable personal income" measure is the appropriate measure of benefit for Wisconsin residents. The business sales measure includes benefits that go to out-of-state residents. For instance, fuel sales include the cost of Middle Eastern and South American petroleum. "Personal income" includes only the additional income to Wisconsin residents involved in the local sales, distribution, or manufacturing of the product. "Disposable income" further deletes the portion of personal income paid in taxes, the majority of which goes to the federal government.

There are other financial impacts of economic growth in addition to those associated with job creation, business sales, and personal income. Economic growth can also lead to impacts on *investment* in industrial, commercial, and residential land development, and hence increase *property values*. It would also be expected to bring about changes in local *government revenues and expenses*. These types of impacts tend to vary considerably by locality. Major new highway facilities and changes in economic growth can also bring localized changes in environmental conditions and quality of life resulting from shifts in traffic patterns, shifts in shopping patterns, and shifts in land use and development patterns.

While highway projects can provide potential benefits for many different groups, and those benefits can be seen in many different ways, it is *not* appropriate to consider all these different forms of benefits in a cost-benefit analysis, because it would be *double counting* to add what are really the same benefits showing up several different ways. For instance, property value increases can be the direct result of business growth and the increasing demand for property. Business growth changes, in turn, may be partly the result of changes in relative business cost, which, in turn, may reflect changes in travel time and operating cost.

For this study, all user benefits associated with trucking travel time, cost, and safety improvements are incorporated in the measures of impacts on business expansion and attraction, and resulting disposable personal income benefits to state residents. The economic benefits are in fact larger when measured this way than when accounted for as simple user benefits. In the economic model, the additional income associated with business expansion is itself larger than the direct value a user benefits for existing truck travel. Similarly, the additional income associated with new business attraction is greater than the direct value of user benefits associated with the induced increment of truck travel.

To be complete in the cost-benefit analysis, all impacts related to value-of-time savings, out-of-pocket costs, and safety for auto travellers are also calculated, but no economic development benefits are calculated beyond the user benefits. All economic benefits in the cost-benefit analysis are presented in terms of the discounted present value of the stream of additional disposable income over the 1990–2020 period.

MODELS USED

Analysis Methods

The evaluation of economic development benefits involved the following analysis techniques:

- A computerized traffic simulation model of the entire state, sensitive to traffic distribution impacts and measurement of savings for area travelers;
- A detailed economic forecasting and simulation model of the study area and state economy, sensitive to business growth impacts of changes in transportation costs;
- An industry "screening" analysis process for identifying new business attraction impacts, sensitive to transportation impacts on interindustry sales and supply patterns;
- A tourism market forecasting process, sensitive to relative differences in travel time among competing areas.

The integrated design of the traffic and economic model systems used in this study is of particular note. A highway network model was used to estimate impacts on traffic, distribution, and travel times. These travel time changes were then input into the economic simulation model to estimate long-term impacts on population and employment growth. The forecast changes in population and employment were, in turn, used to estimate future changes in passenger and truck

traffic for the highway model. This ability to interplay the traffic and economic models ensured consistency and recognized interrelationships between traffic and business growth impacts. The transportation and economic models are discussed below. The methodology for applying these models, and the analytic processes used for business attraction and tourism forecasts, are discussed later.

Transportation Model

"User benefits" refers to the savings in travel time and out-of-pocket cost and safety associated with highway improvements. User benefits traditionally have been calculated for both autos and trucks and then combined to provide a total measure of direct benefits. For this study, however, truck benefits were separated from auto benefits and included as a basis for the analysis of some economic development benefits, in the form of business expansion and new business development. Although trucking cost savings were initially estimated using the traffic model analysis of benefits, they were used as an input to the economic impact model, rather than directly used in the cost-benefit evaluation.

Estimation of user benefits for each of the highway alternatives was based on the output of a trip-generation and route-assignment travel model. The basis of the traffic forecasting was a UTPS network representation of the current and expected future statewide highway system. Using origin-destination studies and traffic counts, these models simulated current traffic volume and travel patterns. Population and employment projections were used to forecast trip patterns and future traffic, separate from any improvements to the corridor. Once "no build" conditions were estimated, the models simulated new traffic and travel patterns expected under each of the improvement alternatives. In addition to the increase in normal traffic growth (expected from changes in population, employment, and auto use), the models were used to estimate how the alternative highway improvements would attract trips from nearby routes, thus further increasing traffic volume.

The assignment of traffic to the most efficient route linking origins and destinations on the system produced a different distribution of trips for each alternative. With each successive level of improvement, the corridor was forecast to attract more traffic from other routes previously used by travelers. As Figure 3 indicates, each higher improvement level extends the area of influence (i.e., the area of origins and destinations it would serve) of the improved highway.

The end product of the simulation process of all highway

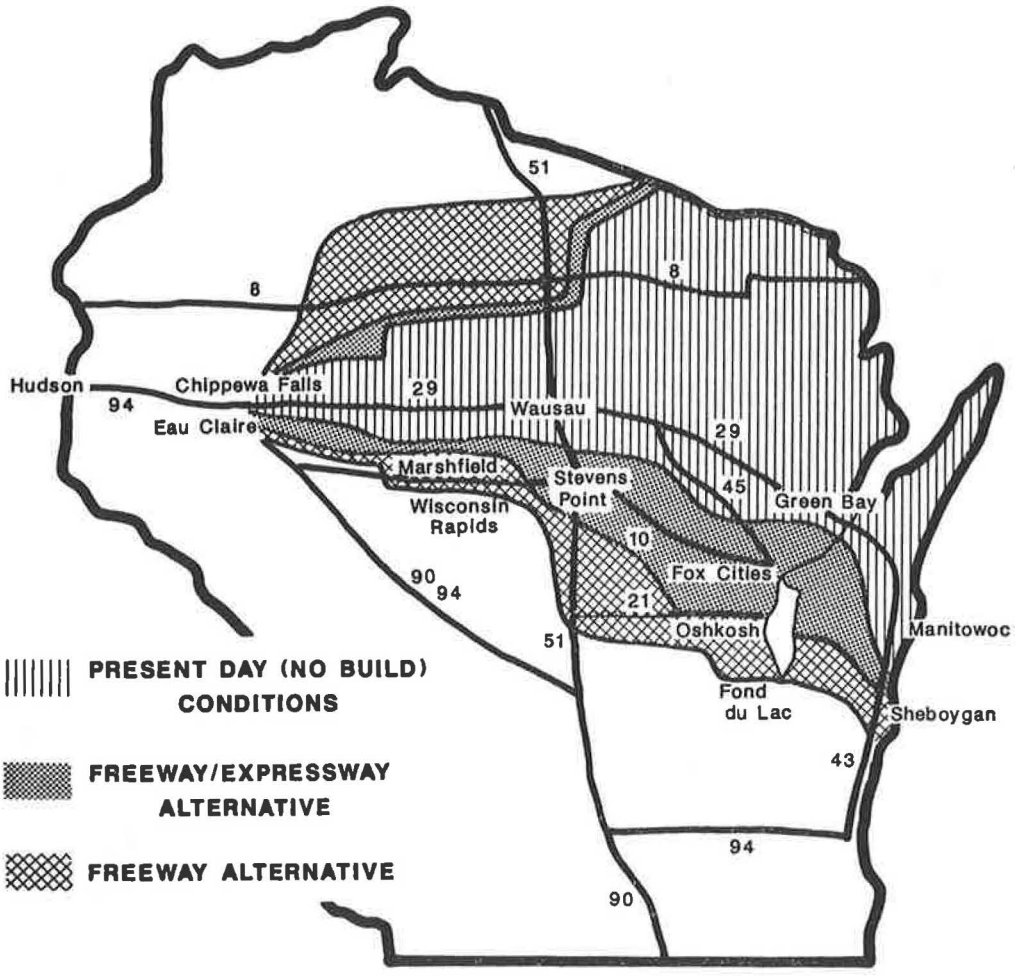

FIGURE 3 Highway 29/45 Corridor area of influence (travel to and from Twin Cities).

use was an accumulation of all highway use assigned to individual portions of the statewide highway network. Based on these assignments, miles traveled and hours spent were totaled for trips between all locations on the network. These miles and hours were related to safety, time, and operating costs and thus used to calculate auto and truck user benefits for each improvement alternative.

The automobile user benefits were calculated assuming a value of time of $7/hr, and a value of accident reduction based on "willingness to pay" studies sponsored by FHWA and conducted at the Urban Institute. Results of the auto user benefit analysis showed that a freeway produces the greatest absolute benefits, as time savings and accident reduction benefits more than offset the growing operating costs that result from higher freeway speeds.

Economic Model

The direct truck cost savings can lower such business costs as acquiring supplies and distributing products, thus making local businesses more cost competitive and better able to expand relative to out-of-state competition. This impact is estimated by examining the current relative cost of doing business in the study area compared to elsewhere (for each industry), and by considering how reductions in relative business costs lead to expansion in relative rates of business growth (for each industry).

Traditional economic analysis techniques fall short here. The traditional approach uses an input-output model to estimate the indirect and induced growth of the area economy, given a direct change in jobs and business sales that the highway creates. What it does not predict is how highway improvements will change the competitive position of different types of businesses, and how that competitive change will directly affect future business growth. To address such issues, the regional economic forecasting and simulation model (REMI) was created by Regional Economic Models, Inc.

The Wisconsin Forecasting and Simulation Model is a statewide REMI model used for the past several years by the Wisconsin Department of Development. A special multi-area version, specifically designed for counties within the study area, was applied for this study. Essentially, the model predicts, for each year in the future, the number and distribution of income, output, and employment in each substate area for each industry sector and each occupational category. The substate areas are defined as five subzones within the project study area, plus a sixth zone comprising the rest of the state. The REMI simulation model and conjoined input-output model provides information on business output and employment for 490 detailed industry sectors and 94 detailed occupational categories. The model process is shown in Figure 4. One basis for the REMI model was information on interindustry purchasing patterns for the specific industrial structure of the state. This is essentially the information that comes from input-output accounting tables tracing the extent to which each industry sector generates demand for inputs from other sectors. The REMI model, however, goes beyond simple input-output accounting by incorporating information on a large number of policy-sensitive economic factors and relationships—how they change the region's economic growth or

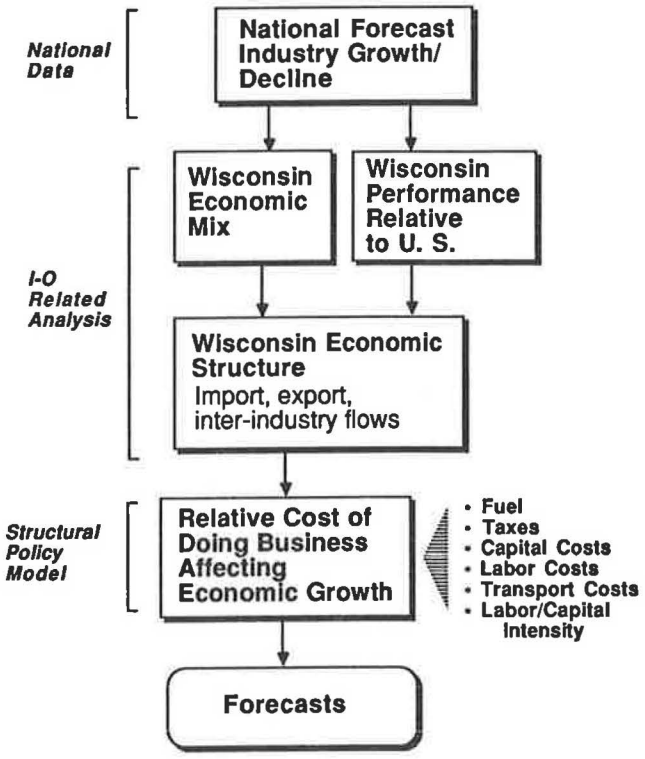

FIGURE 4 REMI Forecast.

decline by industry sector. They include the effects of transportation costs, as well as the costs of labor, equipment, materials, capital financing, and taxes.

In each case, the REMI model evaluates the cost of doing business for each industry sector, comparing costs for businesses within the study area with costs for similar businesses located elsewhere. The forecast of future business growth and decline in each area is then made based on the following: (a) national forecasts for change in each business sector and their technologies of production; (b) differences in relative costs of production in each business sector within the study area, compared with production costs elsewhere in the nation; (c) the expected change in transportation and production cost in each business sector resulting from the highway projects; and (d) the expected change in attracting business from out of state and tourists from out of state.

ANALYSIS METHODOLOGY AND FINDINGS

Future Economic Changes

It was recognized that the economic impacts of the highway improvements could be increased or lessened by future changes in the area's business mix, which will affect relative reliance on trucking. In addition, it was recognized that economic impacts could also be affected by future changes in technologies affecting interindustry shipping relationships.

For the study area, the REMI forecasts indicated that the output of three major industries—paper, food products, and health care—will grow in the future. Growth will proceed at a slower pace and employment will actually decline compared

with the past decade. These patterns, which hold for both the study area and the rest of the state, are due in part to the expected slowdown in the growth rates of the state population and economy. They are also due to forecasts of continued technology change, raising the output per employee over the long term (1986–2020). In fact, both the paper and food industries are also undergoing significant changes in product mix. In the paper industry, production of converted paper products is forecast to increase, while production of paperboard containers is not forecast to increase. In the food industry, production of frozen foods is forecast to increase, while production of dairy products is not. These changes in industrial mix were forecast to have a bearing on highway impacts because surveys showed that each type of industry had a different shipping pattern.

Trucking Cost Impacts

In order to estimate the magnitude of trucking-related benefits to business, a three-step process was used. The first step was to conduct a series of surveys to profile truck shipping patterns and current truck reliance on Highways 29, 45, and 10. The next step was to estimate the business cost savings of proposed highway improvements, based on the truck shipping patterns and the cost structure of different types of businesses. The final step was to estimate the impacts of these cost savings on business expansion rates. This process made use of the REMI economic forecasting model relating changes in the business costs of truck shipments to the competitive cost of doing business, comparing businesses in the study area, rest of the state, adjoining states, and rest of the country.

A mail-back survey of area firms provided information on the overall pattern of truck trips originating in or destined for locations within the study region. The survey showed differences in industry supplier-buyer locations among types of businesses. These were reflected in their truck shipping patterns. These patterns of interstate travel are shown for four major industries in the study area, in Figure 5. The survey also showed systematic differences in truck shipping patterns among subzones of the study corridor (Figure 6).

The cost savings for truck movements was then calculated on the basis of changes in travel time and operating costs for current users, forecast new users, and diverted trips under each highway improvement alternative.

It was recognized that the effect of a truck shipment cost savings on the competitive position of businesses depends on the importance of truck costs as a component of the total cost of doing business. Many components constitute the overall business cost, including labor, capital equipment, utilities, depreciation, financing costs, and so on. Truck shipping costs include the costs of businesses purchasing services from the trucking industry and the costs of businesses doing their own shipping (including truck driver labor costs). The types of businesses found to be most sensitive to truck shipping costs are trucking firms, petroleum product firms, and paper manufacturers.

The overall economic impacts reflect the expansion of businesses benefitting from trucking cost savings (direct effects), plus the expansion of their business suppliers (indirect effects) and the expansion of other businesses receiving the additional worker spending (induced effects). While the directly-benefitting businesses are largely manufacturing, distribution, and trucking firms, the indirect and induced benefits involve retail, wholesale, and service businesses.

The analysis of truck travel concluded that total benefits to existing business are larger for the freeway and freeway/expressway alternatives than for the base case. However, improvements beyond freeway/expressway II yielded no further increase in truck cost savings, because the time savings from further speed increases were cancelled by the lower fuel economy and higher vehicle operating costs that occur when trucks travel faster than 55 miles per hour.

Business Attraction Impacts

While trucking cost savings can lead to business growth, there are other ways in which highway improvements can affect the attractiveness of the corridor as a place to do business. The area might become more attractive to new businesses because of the geographic position of the highway relative to the locations of particular population centers, suppliers, or buyers (both in state and out of state). The area thus might provide special opportunities for combinations of industries to better support each other and take advantage of emerging technologies or provide new products. Highway improvements can improve the perceived quality of life of the region served. These are business attraction impacts over and above the truck cost saving impacts.

Estimation of the impact on business attraction of the proposed improvements to Highway 29 and 45 required a three-phased methodology. First, a list was compiled of industries compatible with the corridor economy and resources available. Second, characteristics of those industries—and the comparative cost of business operations in Wisconsin and the corridor—were evaluated to determine whether these types of businesses would find the area cost competitive to be attracted to the region. Third, business attraction and job creation potentials were distinguished in terms of whether they required (a) only highway improvements to be made, (b) other economic development or business attraction factors aside from highway improvements, or (c) both highway improvements and attention to other economic development or business attraction factors.

As a first step in identifying industries that might be attracted to the study area as a result of the highway improvements, economic development agencies and chambers of commerce within the study area were contacted. These organizations were asked to list current business attraction targets and reasons for these targeting efforts. To further identify industries that might be attracted as a result of the highway improvements, the existing economic base and regional characteristics were examined to identify potential linkages between the existing industries, natural resources, universities and technical schools, labor force, and so on, and the industries not currently located in the study area. In addition, interviews were conducted with representatives of individual businesses and trade associations. Interviewees were asked to identify the most important locational characteristics considered when making facility location decisions. These industry specialists were further asked to evaluate the importance of highway

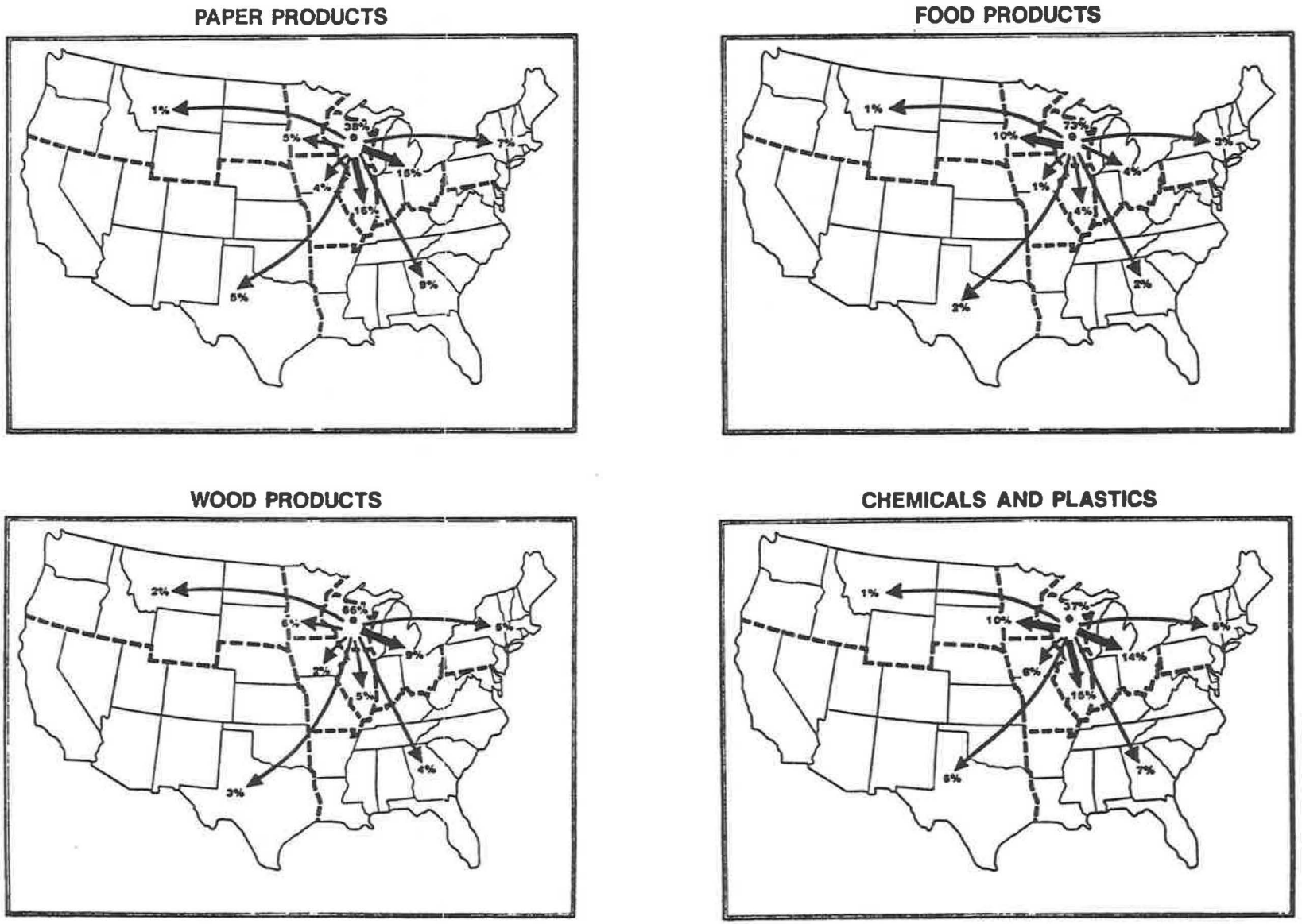

FIGURE 5 Interstate trucking patterns for selected industries (by zone of origin/destination).

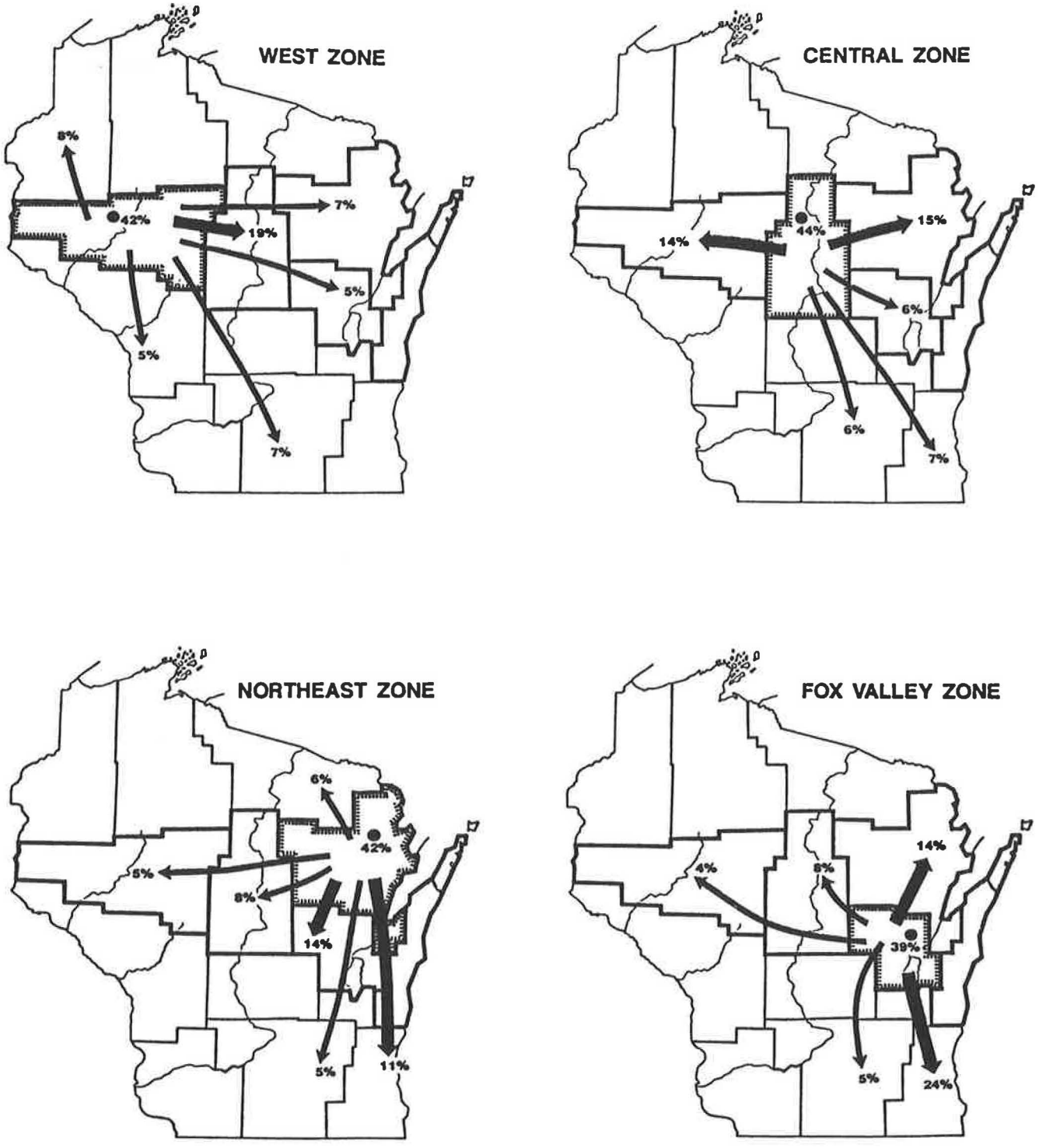

FIGURE 6 Intrastate trucking patterns—all industries (by zone of origin/destination).

access to their location decisions and the appeal of central Wisconsin locations.

The competitive position of the corridor study area for attracting the target industries was also evaluated in terms of relative costs for fuel, capital, and labor in the study area, compared with the same cost factors for the rest of Wisconsin, Minnesota, and the United States as a whole. The existing concentration of each industry in the study area was also compared with the concentrations in those comparison areas. This comparison was used to identify the types of businesses thriving nearby but currently underrepresented in the study area. Finally, because the highway improvements would improve accessibility through the region, the potential negative impacts of businesses attracted out of the region were also taken into account.

The analysis concluded that the greatest business attraction expected to occur as a direct result of the highway improvements was in the northeast area of the corridor, followed by the central and east (Fox Valley) areas. Essentially no further business attraction benefits were expected for the west or Lakeshore areas. The key beneficiary businesses were forecast to be specialized paper products, printing, food products, and wood products.

Compared to the full freeway, the two freeway/expressway alternatives and the base case were found to have a lesser benefit, because both have at-grade intersections, foregoing the "Interstate quality" freeway access that some businesses look for in their location decisions.

The business attraction analysis concluded that while highway improvements alone can enhance the region's ability to attract investment for business location and expansion, these positive impacts can be even larger if coupled with business marketing and economic development programs.

Tourism Benefits

The business impacts of the proposed highway improvements will extend beyond trucking firms and businesses that ship or receive goods by truck. In fact, one industry expected to be a major beneficiary of any of the proposed highway improvement alternatives is the tourism industry, which serves both business travel and recreational trips. Tourism benefits occur to the extent that highway improvements lessen travel time, reduce safety hazards, and make travel more enjoyable for trips to various tourist destinations and recreational attractions within Wisconsin. Tourism benefits occur principally because of increased visitation and spending by out-of-state visitors. Shifts among in-state visitor destinations are of no economic benefit to the state.

Deriving the impact of proposed highway improvements on tourism included two key steps. The initial part of the tourism impact analysis was to estimate baseline tourist and visitor activity in the area. The baseline data were then refined to estimate the number of visitors to each zone that used Highways 29, 45, and 10. Visitor spending for these highways was calculated based on prior surveys of typical spending levels by different types of visitors.

The second part of the analysis was to determine the potential impact on visitation patterns resulting from the proposed highway improvements. The findings drew heavily on responses to interviews with owners and managers of hospitality, tourism and recreation businesses, and promotional organizations within the study area. It drew upon their own evaluations of existing and potential market attraction characteristics, competitive position relative to competing attractions, travel distances, and spending patterns.

The assessment distinguished new tourist trips generated or attracted from out of state, and new tourist trips that are merely transfers of trip destinations from one part of Wisconsin to another. Overall, the study concluded that the Lakeshore and northeast areas would be expected to realize the greatest absolute increase in visitor days and dollars spent by tourists. The concentration of tourism impact on these two regions occurred because both have major regional and superregional tourist destinations with the potential to attract additional visitors from the Twin Cities and the rest of Minnesota.

OVERALL BENEFITS AND COSTS

Issues in Benefit-Cost Analysis

The cost-benefit evaluation is a comparison of benefits and costs associated with each of the four highway improvement alternatives, relative to the no build scenario. The comparison is made for net benefit (defined as benefits minus costs) and B/C ratio (defined as the ratio of benefits divided by costs).

The set of costs considered for each alternative includes estimates of all right-of-way acquisition and construction-related costs, plus all ongoing rehabilitation and maintenance costs. The set of benefits considered include user benefits to auto travellers plus estimates of long-run (after construction) economic development impacts, including those that result from the truck user benefits.

Construction period benefits are explicitly ignored for purposes of the cost-benefit analysis, due to the nature of the investment decision making. It is recognized that the highway construction expenditures associated with the project provide real benefits in terms of business sales, income, and jobs created. However, these dollars are assumed to be funds that would have been spent anyway by state government—if not on this project, then on other highway or public works investments with comparable capital expenditure benefits. For this reason, the short-term benefits associated with construction spending are not relevant as additional benefits for ranking the project alternatives.

The long-term transportation efficiency and economic development benefits associated with the project are measured by comparing statewide levels of income and jobs that would exist with and without each of the alternatives for proposed highway improvements. This is a clear, straightforward way of assessing project impacts on the state economy. The streams of benefits and costs over time are assessed by their present value, which discounts benefits and costs expected to occur in the future.

Yet another academic issue is whether funding the Highway 29/45/10 project actually causes other socially beneficial, but competing projects (or other public expenditures), to be foregone. If so, it could be argued that the potential benefits of those foregone projects represent an additional opportunity cost associated with the Highway 29/45/10 project. In fact, it

is clearly premature and inappropriate to guess how the proposed project will be financed, whether it be federal grants, new taxes, or allocations from existing departmental budgets or other sources. Hypothetical competing alternatives need not be considered if the study objective is to evaluate highway improvement alternatives relative to each other, and not relative to all possible alternative expenditures.

Overall Project Benefits

Economic development benefits are classified in terms of business expansion induced by cost savings, additional business attraction, and increased tourism. User benefits for truck users are not counted in this benefit assessment because they are encompassed within the measure of business expansion benefits. Auto user benefits are estimated based on a valuation of travel time savings, operating cost changes, and accident rate reduction benefits.

The present value of all economic development and auto user benefits (compared with the do nothing alternative) is shown in Table 1. Among the several notable aspects of these data include the fact that economic development impacts account for roughly one-half the total benefits (varying from 42 percent to 52 percent with the highway improvement alternative.) This is particularly notable because trucks account for just 20 percent of the traffic on Highways 29, 45, and 10.

A second observation is that the spread in economic development benefits between the freeway and the base case alternatives is nearly twice as large as the corresponding spread in auto user benefits for the same alternatives. There are several reasons for this. One is that the computation of economic development benefits includes a large reduction in industry and tourism attraction for the base case alternative

TABLE 1 PRESENT VALUE OF COSTS AND BENEFITS OF HIGHWAY IMPROVEMENT ALTERNATIVES (PRESENT VALUE OF 1990–2020 DISPOSABLE INCOME BENEFITS IN MILLIONS OF 1987 DOLLARS, COMPARED TO THE NO BUILD ALTERNATIVE)

		Free-way	Free/ Exp I	Free/ Exp II	Base Case
Costs					
Present Value of Total Cost (Compared to No Build)	29/45	$550	$447	$334	$225
	29/10	564	415	337	250
Economic Development Benefits (disposable income)					
Expansion Due to Truck Cost Savings	29/45	164	164	164	131
	29/10	168	168	168	132
Additional Industry Attraction	29/45	218	164	153	55
	29/10	246	184	172	62
Increased Tourism	29/45	56	42	39	14
	29/10	55	41	39	14
Subtotal: Economic Development Benefits	29/45	$438	$370	$356	$200
	29/10	469	393	379	208
Auto User Benefits					
Value of Auto Travel Time Savings	29/45	$385	$305	$296	$218
	29/10	356	288	287	200
Change in Auto Operating Costs	29/45	-115	-46	-13	7
	29/10	-116	-39	-12	4
Value of Auto Accident Reduction Benefits	29/45	138	103	98	56
	29/10	146	123	107	67
Subtotal: Auto User Benefits	29/45	$408	$362	$281	$281
	29/10	386	372	382	271
Present Value of Total Benefits	29/45	$846	$447	$334	$225
	29/10	855	765	761	479

TABLE 2 COMPARISON OF BENEFITS AND COSTS (PRESENT VALUE OF 1990–2020 BENEFITS AND COSTS IN MILLIONS OF 1987 DOLLARS, COMPARED TO THE NO BUILD ALTERNATIVE)

		Free-way	Free/ Exp I	Free/ Exp II	Base Case
Present Value of Total Benefits	29/45	$846	$732	$737	$481
	29/10	$855	$765	$761	$479
Present Value of Total Costs	29/45	$550	$447	$334	$225
	29/10	$564	$415	$337	$250
Benefit/Cost Ratio	29/45	1.5	1.6	2.2	2.1
	29/10	1.5	1.8	2.3	1.9
Net Benefit (Benefit - Cost)	29/45	$296	$285	$403	$256
	29/10	$291	$350	$424	$229

where less than a fully four-lane expressway is provided. The other is that auto user benefits do not increase proportionally to speed increases and travel time savings for the higher level improvement alternatives, because of the offsetting impacts of increased fuel consumption and auto operating costs at higher speeds. In fact, the penalty of higher operating costs at higher speeds causes the freeway/expressway I alternative to have slightly lower auto user benefits than the lower speed freeway/expressway II alternative.

Project Costs

Costs associated with each highway improvement alternative include construction costs from 1989–1999, plus rehabilitation and general maintenance costs from 1989–2020. All costs are shown in excess of those for the no build alternative that includes pavement maintenance costs.

Benefit-Cost Comparison

Table 2 compares the benefits and costs of each of the four highway improvement alternatives for both the 29/10 route and the 29/45 route. The benefit-cost ratio measures the efficiency of spending in terms of return on investment. Highway 29/10 freeway/expressway II alternative provides the greatest benefit-cost ratio. It returns $2.30 of benefit for every dollar spent on the highway. Of course, not all these benefits represent dollars added to the economy. In fact, half the benefits from the Highway 29/10 freeway/expressway II alternative are in the form of auto user travel time and safety benefits.

Another measure is the net benefit, calculated as benefits minus costs. The Highway 29/10 freeway/expressway II alternative also provides the greatest net benefit, which has a present value benefit of $424 million over costs. Thus, the freeway/expressway II alternative for the Highway 29/10 route clearly emerges as the most beneficial, providing more benefits than that same alternative using the Highway 29/45 route.

CONCLUSIONS

The Wisconsin study demonstrates how the economic development benefits of highway projects can be estimated, and those estimates used for benefit-cost analysis to support policy decisionmaking. The State of Wisconsin has adopted and started to implement the highway alternative recommended by this study. However, this study also shows that a full evaluation of economic development benefits can be complicated, requiring separate analytic techniques for estimating the impacts on relative business costs, business attraction, and tourism, as well as modeling of travel patterns and regional economics.

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