Project Summary Report 8164
Authors: Christopher Wornum, Daniel Hodge, Glen Weisbrod, Teresa Lynch, Julie Colby, Rod Payne, Mark Benson and Jeff Ang-Olson

Highway Reconfiguration Study

www.mdt.mt.gov/research/reconfigstdy

Introduction

In 2001, in response to interest in the potential economic benefits of highway expansion, the Montana Department of Transportation (MDT) initiated a study to examine the economic impact of reconfiguring Montana's major two-lane highways. The Study was directed by the Reconfiguration Study Steering Committee (RSSC), which was composed of private business owners, mayors, economic development officials, and senior MDT and Federal Highway Administration (FHWA) officials. The RSSC selected a team led by Cambridge Systematics, Inc. as its consultant in March of 2002 and asked the consultants to develop a software tool that would evaluate the economic benefits and costs of proposed highway projects, and develop and analyze several scenarios for highway reconfiguration options.

The original goal of this study was to evaluate the impact on Montana's economy if Montana's two-lane highway network was reconfigured to a four-lane network. The RSSC developed three objectives to achieve this goal:

1. Identify which transportation investments will benefit specific Montana industries;
2. Provide MDT with an analytical toolbox to evaluate economic development impacts of transportation improvements; and
3. Quantify the economic impacts of example system improvement scenarios.

The toolbox developed to accomplish these objectives became known as the Highway Economic Analysis Tool (HEAT). HEAT also provides a much more detailed understanding of the relationship between specific changes in highway capacity and economic development, provides data and models to quantify that relationship, and estimates the likely economic impacts of a range of highway improvements within both a constrained and unconstrained fiscal environment.

What we did

Fostering economic development with targeted transportation investments is not as simple as some might believe. As Montana's transportation system grows more mature, there are fewer opportunities to unleash significant economic development by widening roadways. Furthermore, transportation projects in and of themselves are almost never the sole impetus for economic development. Given this complexity, the Reconfiguration Study applied a comprehensive framework that was used to develop HEAT and ensure that it can provide a thorough assessment of the role of transportation in economic development. At the core of this approach, therefore, is a clear understanding of how much each industry (both those currently located in Montana and those targeted by economic development officials) depends on ground transportation. Of those that have such a dependence, which ones need help and which of those would likely benefit from the proposed transportation investment. In addition, we considered what other economic development efforts (i.e., collateral activities) must be included to assure that the proposed transportation investment achieves its intended benefit. This approach gives MDT a limited role in an industry-based program, but avoids using transportation investment to solve non-transportation

Montana Department of Transportation
MDT
serving you with pride

problems (see Figure 1).

This industry-based perspective bores into the mantra: *build it and they will come*. Our approach first determines: *who they are*. It then evaluates the performance of each industry likely to benefit from the investments, filtering out those that have little or no dependence on highways. The modeling framework is depicted in Figure 2 (below).

The analysis begins with the definition of a highway improvement project or group of projects. These improvements are coded into the **statewide roadway network model**, developed as part of this study within a GIS framework, to determine the affected traffic volumes, speeds, safety, and cost factors. Improvements can range from simply widening lanes and shoulders on a two-lane roadway, to adding passing lanes, or four-laning existing or new roadways.

Travel performance impacts include traditional metrics such as travel time savings and reductions in operating costs, as well as measures of accessibility to markets (e.g., change in access to labor within a one hour drive) and reliability (e.g., reduction in non-recurrent delay). HEAT also includes a detailed database of **commodity flows**, and trucks are grouped into seven commodity categories. This allows HEAT to measure which commodities are affected by highway improvements and apply different values of time by commodity to link travel performance impacts to industry effects.

The **industry analysis** module includes the estimation of three types of direct economic benefits: 1) reductions in the cost of doing business based on the size of each industry and its dependence on trucking; 2) net business attraction/retention based on market accessibility factors and industry profile assessments; and 3) visitor spending effects on the economy (an optional module depending on the nature of the highway improvement). These direct industry impacts are then used as inputs to a regional economic simulation model of the Montana economy to determine the total **transportation economic benefit**. HEAT incorporates a five region economic impact model developed by Regional Economic Models, Inc. (REMI) to estimate total economic impacts on gross state product (GSP), employment, and personal income. In addition, HEAT includes a **cost estimation** tool that provides a consistent method of estimating the capital and operating costs of highway improvements throughout the state.

Finally, HEAT includes a **benefit-cost analysis** module to compare economic benefits and costs and help MDT prioritize projects. HEAT has more sophisticated methodology than used in existing benefit/cost tools. The existing software tools often do not quantify the effects of roadway improvements on business attraction. These benefits can be significant relative to the direct benefits to highway users in rural areas, where low existing and future traffic volumes produce modest aggregate benefits. HEAT includes a business attraction module and adds these benefits as inputs into the benefit-cost calculation.

HEAT provides MDT with an objective, consistent, efficient, and accurate way to quantify the potential economic benefits of roadway improvements.

What we found

The following list of factors provides broad guidance regarding the general conditions under which roadway investments may generate significant economic benefits: 1) high volumes of travel; 2) opportunity for diversion to a faster route; 3) connecting centers of trade; 4) improving access to labor; 5) enhancing access to manufacturing centers; 6) improving access of agricultural centers to markets; 7) providing access between raw materials and value-added manufacturing; and 8) enhancing access to tourist activity.

HEAT was tested on proposed improvements on four different highway corridors throughout the state. The results of these test scenarios are summarized below.

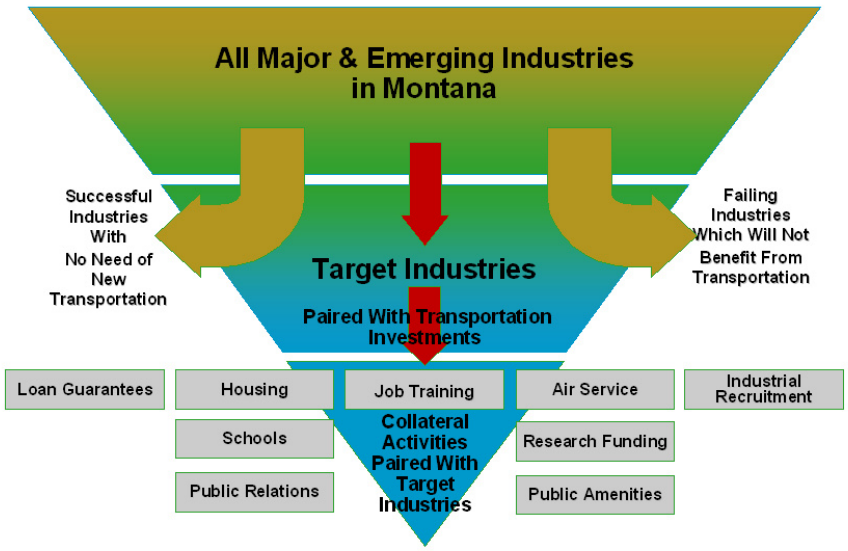

Figure 1. Screening for Industries that Will Benefit from Improved Ground Transportation

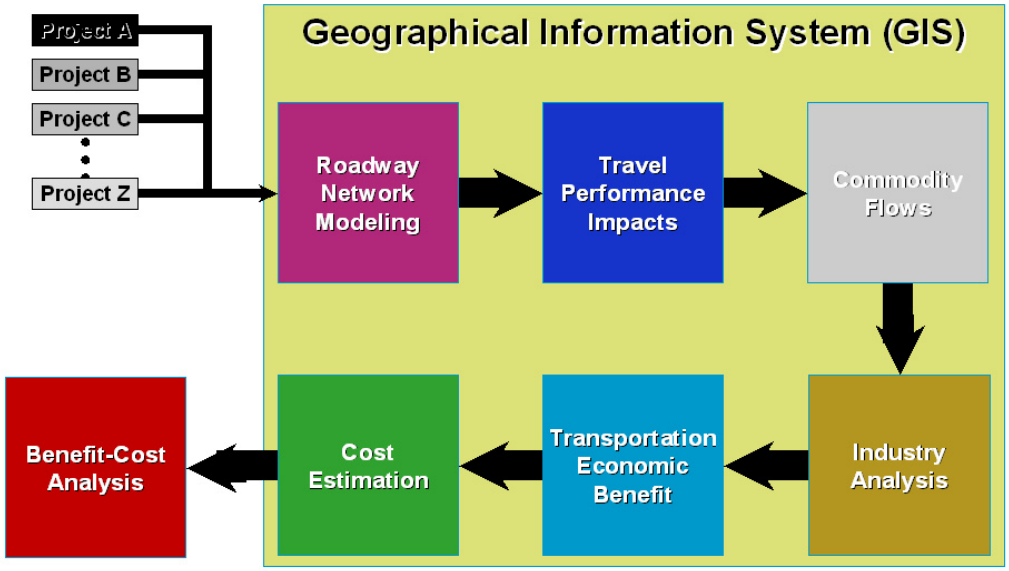

Figure 2. HEAT Analytical Modules

U.S. Highway 93 from Missoula to Polson. The U.S. 93 highway improvement scenario produces a benefit/cost ratio of 1.2 and a net present value (NPV) of $14.2 million. The primary reasons for the positive net benefits are the relatively high volume of truck and auto traffic affected (producing significant user benefits), and the relatively modest costs associated with a combination of improvements on this 48-mile highway segment.

U.S. Highway 2 Widening to a Continuous Super 2 and Four-Lane Highway from North Dakota to Idaho. Both of the highway investment scenarios produce benefit/cost ratios below 1.0 and a negative NPV. The estimated benefit/cost ratio for the Super 2 scenario is 0.3, while it is 0.2 for the four-lane scenario. Given the high costs of reconstructing over 600 miles of roadway, the relatively low-traffic levels, and the lack of connections to major markets, the benefits to Montana are unlikely to exceed costs. To obtain a benefit/cost ratio approaching 1.0, extremely aggressive assumptions would need to be made regarding economic development responses and/or funding.

MT 3 from Great Falls to Billings. The HEAT analysis of the improved two-lane scenario produced a net present value (NPV) of $110 million and a 1.4 benefit-cost ratio. For the four-lane scenario, the estimated benefit/cost ratio is 1.1 with a NPV of $73 million.

Secondary 323 from South of Ekalaka to Alzada. The estimated benefit/cost ratio for the paved scenario is 0.16 and a NPV of -$40.7 million.

What the researchers recommend

HJR 30-2001 required that economic development criteria be included in MDT's funding apportionment process, and that the TranPlan 21 update include consideration of economic development issues. Now that HEAT has become another evaluation tool for MDT, policies are needed to incorporate economic development criteria into the planning, funding apportionment, and project selection processes on an ongoing basis. The recommended new process would use HEAT within the following processes:

- **Long-Range Policy Plan Updates.** Use HEAT to do a series of corridor-level analyses, which rank corridors in importance from an economic development perspective, and identify which specific investments have benefits greater than their costs.
- **Investment Analysis.** Within MDT's Performance Programming Process (P^3), use HEAT to estimate economic benefits of various investment strategies.
- **District Nomination Process:** Use HEAT to screen and rank projects that are suggested for selection based on relative economic development benefits.
- **Five-Year TCP Development:** Use HEAT to examine the set of capacity projects not currently funded, and help prioritize which projects should be advanced in the program. Once the entire program is set, use HEAT to evaluate and then communicate the likely statewide economic benefits to be gained from the program.
- **Project Implementation:** Use HEAT as the standard tool for economic impact assessment for environmental evaluations.

For More Details . . .

The research is documented in Report FHWA/MT-05-003/8164, *Montana Highway Reconfiguration Study.*

MDT Project Managers:
Sue Sillick, ssillick@mt.gov, 406-444-7693
Dick Turner, dturner@mt.gov, 406-444-7289

Cambridge Systematics, Inc. Project Managers:
Christopher Wornum, cwornum@camsys.com, 510-873-8728
Daniel Hodge, dhodge@camsys.com, 617-234-0547

The research team also included the following subconsultants: Economic Development Research Group, ICF Consulting, and Short Eliot Hendrickson, Inc.

To obtain copies of this report, contact Sue Sillick, MDT Research Programs, 2701 Prospect Avenue, PO Box 201001, Helena MT 59620-1001, ssillick@mt.gov, 406-444-7693.

MDT Implementation Status
May 2005

With the completion of the Reconfiguration Study, MDT is in the process of implementing the researchers' recommendations and is hiring a staff person to serve as MDT's HEAT modeler and economic expert to insure that the results of the study are institutionalized.

For more information, contact Dick Turner, dturner@mt.gov, 406-444-7289.

250 copies of this public document were produced at an estimated cost of 0.33 each, for a total cost of $83.52.
This includes $0.00 for postage and $83.52 for printing