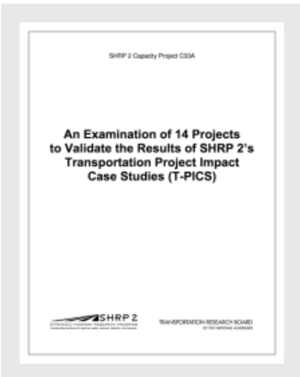

An Examination of 14 Projects to Validate the Results of SHRP 2's Transportation Project Impact Case Studies (T-PICS)

DETAILS

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SHRP 2 Capacity Project C33A

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SHRP 2
STRATEGIC HIGHWAY RESEARCH PROGRAM
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EXECUTIVE SUMMARY

Chapter 1: Introduction

This research report is intended to provide an evaluation of the SHRP 2 product known as Transportation Project Impact Case Studies (T-PICS). T-PICS was created to offer a preliminary planning tool for planners, policy makers, and others interested in gauging the economic impact prospects of typical highway capacity improvement projects conceived across a wide array of contexts, including project type, geography, project motivation and project length. The T-PICS tool, developed by the Economic Development Research Group (EDRG), consists of a simple user interface that accesses a database of 100 completed transportation projects, representing a variety of project types, sizes, and broad geographical distribution.

T-PICS has two primary uses. First, a Case Search function allows a user to access a comprehensive database on a project's observed economic impacts and other factors simply by inputting project characteristic selection criteria for a proposed project which generates the list of similar projects contained in the database. Second, a function called "My Project Tools" allows a user to provide similar project characteristic selection criteria—such as project type, geographical region, project cost, project motivation, and others—which generates an estimate of the potential economic impact—including metrics for employment, wages, and output. It is this second use—the My Project Tools function—that is the focus of this research effort.

The T-PICS tool is groundbreaking in that it strives to provide useful and practical information on potential economic outcomes associated with transportation investments to anyone with access to a personal computer. The tool is the product of an ambitious effort by its developers and its SHRP 2 sponsors to create a database and interactive model that provides answers to common questions that policy makers and stakeholders most frequently ask while considering their investment options, such as the following. "What are the potential economic impacts we might expect from this project?" "What were the economic outcomes of other, similarly situated projects?" "What lessons can be learned from others who confronted challenges similar to our own?"

Chapter 2: Methodology

As a means of evaluating the results of the T-PICS My Project Tools function, the research approach developed by SHRP 2 involved comparing the economic impact estimates generated by T-PICS with the observed economic impacts of real projects, representing a variety of project types, around the country. Each project has been completed and operational for a minimum of five years to ensure that the test case study projects have had time for resulting economic impacts to occur. The research approach involved conducting an independent analysis in which the project team applied a variety of analytical methods and tools to derive an estimate of the observed economic impact, as defined by the T-PICS results factors of jobs, wages, and output, for each individual test case study project. Those results were then compared to the results generated by feeding the same inputs into the T-PICS tool.

Project locations are depicted on the map, Figure E.1 below, and are identified by name and project type in Chapter 1, the introduction of this report.

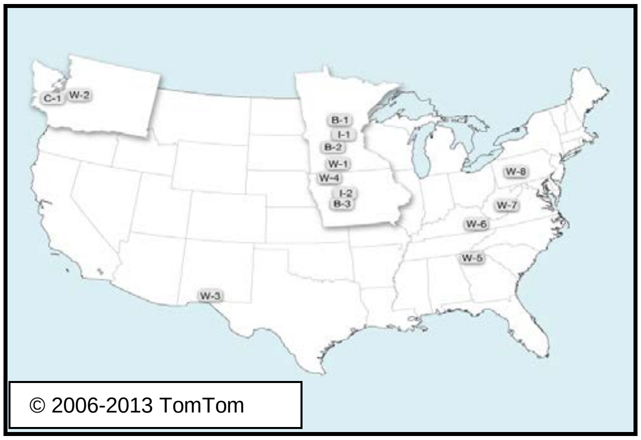


Figure E.1. Location of 14 test case study projects.

The research team acknowledges that each of the analytical methods that the research team applied to derive inputs for both the T-PICS test and our alternative method test are subject to estimation errors, the magnitude and direction of which will vary among the projects that we have tested. Working with this inescapable uncertainty, we have made every effort to "compare apples to apples" when conducting the analysis. We will consider this effort a success if we are able to offer new insights into what types of factors present in individual projects or project categories might explain the variances in results generated by T-PICS and other frequently consulted evaluation methods. Further, we seek to give the tool's developers greater awareness of opportunities in future versions of T-PICS to improve its applicability to the broadest possible spectrum of candidate projects during the preliminary planning phase.

Chapter 3: Findings/Conclusions

Interchange Projects

1. When the test case study interchange project is sufficiently similar to projects contained in the 100 T-PICS database projects, then the tool generates a reliable estimate of the proposed project's economic impacts. If the test case study project is dissimilar in key variables that are relevant in deriving the results through the regression analysis (i.e., annual average daily

traffic [AADT], urban/class level, population density), then the results generated by T-PICS are significantly less likely to align closely to the alternative methodology.

2. When certain test case study project variables (e.g. construction costs) are entered that are not in line with the T-PICS case study project variables, results can be skewed in the direction of one or the other sub-categories of “direct” or “supplier and wage” impacts. For example, if the construction costs of projects in the T-PICS database are significantly higher than the test case study project (e.g., Minnesota’s Opportunity Drive) T-PICS will overestimate direct impacts and underestimate supplier and wage impacts.

Highway Corridor Projects (Widening, Bypass, Connector)

1. A fundamental caveat mostly affecting the highway corridor (as opposed to the interchange) projects: Neither T-PICS nor the most sophisticated econometric models are wholly equipped to predict how local transportation conditions specific to a given highway corridor project will impact the potential economic outcomes with 100% certainty. Therefore, the total margin of the difference between the T-PICS estimate and the alternative method estimate should not be attributable entirely to T-PICS.

2. In the case of smaller highway corridor projects, T-PICS generally projected greater economic impacts than the comparative methodology. Preliminary estimates of economic impact generated by T-PICS are likely to be derived from a regression that incorporates projects of greater size, scale, and cost than many of the test case studies.

3. For longer widening projects, we found that T-PICS overstates the projected economic impact if the full length of the corridor is not readily developable (a rural greenfield).

4. In general, the projects that we tested whose market area was clearly classified as metro as opposed to rural or mixed tended to return the T-PICS economic impact results that were in best alignment with the results generated from our alternative method. This is attributable to the fact that metro projects are over represented in the T-PICS database, and also due to the homogeneity of metro projects relative to rural projects.

5. For projects located in a non-distressed area, we found that T-PICS tends to overstate the potential for economic growth relative to the comparison projects.

6. Certain other project characteristics (e.g. proximity to an airport, urban/class level near the project) might skew the estimates of the economic impacts when those characteristics have limited influence on economic development relative to the T-PICS comparison cases used to derive the estimate.

7. T-PICS tends to overestimate the economic impacts for rural bypass projects.

Chapter 4: General Evaluation: Suggestions for Consideration

This chapter contains recommendations that address the general functionality and usability of T-PICS and offers recommendations that might be considered for the future development of the tool.

1. Continue to emphasize the proper time to use T-PICS: early in the planning process as an initial policy or strategy development tool.
2. Don't oversell the predictive capabilities of T-PICS.
3. Incentivize state DOTs or regional MPOs to add additional case studies.
4. Reconsider the urban/class level designation of projects as rural, metro, or mixed, and develop clearer instructions on assigning a designation.
5. Reduce/restructure the number of project categories.

6. For the My Project Tools project type category selection criteria, provide clear definitions of the various project types (especially the highway corridor project types, e.g., bypass, beltway, widening, connector).
7. Provide definitions or source information on both Case Search and My Project Tools selection criteria data entry forms.
8. On My Project Tools, provide more flexibility of selection criteria inputs and include more basic case study information from the resulting regression analysis.
9. Reorganize the Further Information section of the home page.
10. Minor technical suggestions (detailed in body of report).

Chapter 1: Introduction

For many state Departments of Transportation (DOTs), metropolitan planning organizations (MPOs) and other public entities involved with transportation infrastructure planning, community and economic development has become an increasingly important undertaking. More and more often, a proposed project's economic impact is considered, both in the identification of potential projects and in the process used to select projects for programming.

Traditionally, states have relied on their departments of economic development, trade, or commerce to oversee and direct policy on anything related to economic development. Only within the last decade or so have many states begun to recognize the way transportation systems influence economic vitality and growth, and, as a result, virtually all state DOTs now designate staff resources to focusing on identifying and programming targeted improvements specifically for the purpose of promoting economic development. This trend will continue as resources become increasingly hard to come by and states compete for economic development at both a regional and global scale.

The most common method used by many state DOTs and MPOs to assess the economic impact of proposed transportation infrastructure improvements has involved acquiring sophisticated, commercially available econometric modeling tools. While these tools have proven very useful to some for project prioritization, programming, and development, they generally require the collection of complex input variables or include sophisticated travel demand models that are not universally available or easily accessible. They are also geared more towards deriving estimated impacts of projects that are relatively well defined.

Recognizing these limitations, the Strategic Highway Research Program 2 (SHRP 2) prepared a solicitation for the development of a more accessible, less data-driven planning tool that could have significant utility as a preliminary planning tool for transportation planners at state DOTs and MPOs all across the country. The result of this initiative is the Transportation Project Impact Case Studies (T-PICS) tool (http://www.tpics.us).

The T-PICS tool, developed by a team led by the Economic Development Research Group (EDRG), consists of a simple user interface that accesses a database of 100 transportation projects, representing a variety of project types, sizes, and broad geographical distribution. The tool has two fundamental objectives: (1) Using the Case Search function, it allows a user to apply selection criteria matching a project under consideration to identify and research the observed economic impacts and other factors of similar projects that have been completed. (2) Using the My Project Tools function, it allows a user to provide inputs describing a proposed project—such as project type, geographical region, project cost, project motivation, and others—which generates an estimate of potential economic impact. Metrics for employment, wages, and output are generated using a regression analysis of the information contained in the 100 T-PICS case studies. It is this second function that is the focus of this research effort.

The objective of this research, as articulated in the name of the project, is to validate the results of T-PICS. Our methodology involved comparing the economic impact estimates generated by T-PICS with the observed and modeled economic impacts of 14 independent projects representing a variety of project types around the country. Each project has been completed and operational for a minimum of five years to ensure that the test case study projects have had time for resulting economic impacts to occur. Project locations are depicted on the map in Figure 1.1 and identified by name in Table 1.1.

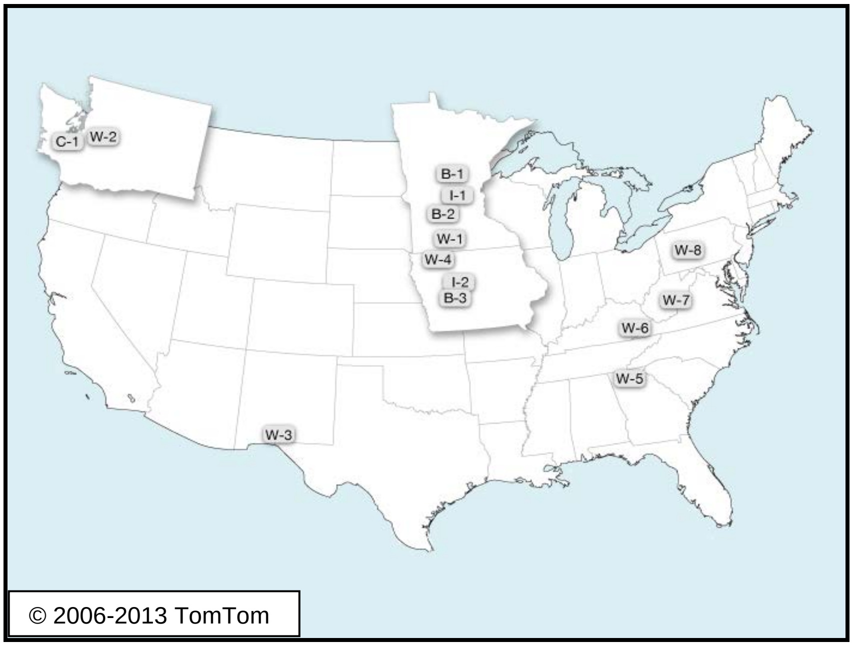


Figure 1.1. Location of 14 test case study projects.

Table 1.1. Test Case Study Project Names by Category.

Interchange Projects:

- I-1: Minnesota Opportunity Drive Interchange on I-94
- I-2: Iowa 86th Street Interchange

Highway Corridor Projects:

Widening Projects:

- W-1: Minnesota MN TH 60 Expansion from Windom to Heron Lake
- W-2: Washington State - Interstate 405
- W-3: New Mexico - U.S. 54
- W-4: Iowa 60/US 75 Le Mars Corridor
- W-5: Georgia - Appalachian Development Hwy System (ADHS) – Corridor A/A1
- W-6: Kentucky - Appalachian Development Hwy System (ADHS) – Corridor I
- W-7: West Virginia - Appalachian Development Hwy System (ADHS) – Corridor L
- W-8: Pennsylvania - Appalachian Development Hwy System (ADHS) – Corridor P

Bypass Projects:

- B-1: Minnesota 371 Little Falls to Brainerd
- B-2: Minnesota US 71/MN 23 Including Willmar Bypass
- B-3: Iowa 5/US 65 Beltway from W Jct 5/65 to I-80

Connector Projects:

- C-1: Washington State – State Route 509

One point of clarification: The terminology referring to the T-PICS case study projects (i.e., the 100 case studies currently populating the T-PICs database) and to the 14 case study projects that this research uses to test the validity of the T-PICS My Project Tools can be confusing. In an effort to avoid confusion we generally use the term “T-PICS case study project" to describe the 100 T-PICS case study projects and "test case study project" to describe the 14 projects that were used to test the results of T-PICS.

The report is organized as follows:

Following this Chapter 1 introduction, Chapter 2 of the report describes the four test case study methodologies that we utilize to evaluate and measure the economic impact of the 14 test case study projects that we examined. We applied a diverse range of analytical methods in order to test our own conclusions regarding the comparative results with T-PICS.

Chapter 3 of the report contains the analytical substance our research, consisting of an analysis for each of the 14 projects that we tested. Each test case study project is discussed individually, and includes a project map and narrative description, and a table showing the comparison of the T-PICS results to the alternative(s) methodology results. Each project section also includes a screenshot of the T-PICS tool's sliding scale that a user would adjust in order to get the best fit of the circumstances describing their particular proposed project. Each project section concludes with a concise summary of the Findings/Conclusions that identifies the differences observed in the comparison of the T-PICS results to the results generated from our alternative methodology, and a brief statement of our opinion on why the results are similar or disparate. Also included in Chapter 3 are two subsections that provide more detailed analysis of the treatment of T-PICS concerning the two broad project categories that are represented in this analysis: interchange projects and highway corridor projects.

Chapter 4 widens the earlier focus on the My Project Tools component of T-PICS and offers a more general discussion of the overall usability of the T-PICS tool, including specific recommendations that should be considered to enhance its utility. This chapter is intended to guide an action plan for those who will continue to develop and improve the tool in the future.

Our research team, which consists of transportation and economic development professionals from the state of Minnesota, the University of Minnesota, and economists with the firm Regional Economic Models, Inc. (REMI) agree: The T-PICS tool is groundbreaking in that it strives to provide useful and practical information on potential economic outcomes associated with transportation investments to anyone with access to a personal computer. The tool is the product of an effort by its developers and its SHRP 2 sponsors to create a database and interactive model that provides answers to common questions policy makers and stakeholders most frequently ask while considering their investment options, such as the following. “What are the potential economic impacts we might expect from this project?” “What were the economic outcomes of other, similarly situated and sized projects?” “What lessons can be learned from others who confronted challenges similar to our own?”

It is also important to acknowledge that each of the analytical methods that the research team applied to derive inputs for both the T-PICS test and our alternative method test are subject to estimation errors, the magnitude and direction of which will vary among the projects that we have tested. Working with this inescapable uncertainty, we have made every effort to “compare apples to apples” when conducting the analysis. We will consider this effort a success if we are able to offer new insights into which factors present in individual projects or project categories might explain the variances in results generated by T-PICS and other frequently consulted evaluation methods. Further, we seek to give the tool’s developers greater awareness of opportunities in future versions of T-PICS to improve its applicability to the broadest possible spectrum of candidate projects during the preliminary planning phase.

It is in this spirit that we will suggest a number of recommendations that we believe would help the tool become more effective, building on existing fundamentals—its quantitative project database, interactive capabilities, and wealth of actual project context.

Chapter 2: Description of Analytical Methodologies

The fundamental purpose of our research is focused on validating the results derived through use of the My Project Tools function of T-PICS. This research effort compares the results of the economic outcomes of 14 test case study projects in four of the T-PICS project categories (interchange, widening, bypass, and connector) that have been completed and in operation for a minimum of five years. Our research approach involved conducting an independent analysis (using a variety of analytical methods, as described below) to derive an estimate of the observed economic impact—as defined by the T-PICS results factors of jobs, wages, and output—for each individual test case study project. Those results were then compared to the results generated by feeding the same inputs into the T-PICS tool, to allow for a comparison of the estimated impacts.

So, for each of our test case study projects, we sought to answer the following question: "Do the results generated by the T-PICS My Project Tools align with the results derived from the alternative test methodology?"

The four general methods that our research employs are described below.

Method 1: Survey of Businesses Feeding Into REMI PI$^+$ (Survey/REMI)

[Source: Neal Young and Weston Merrick, Minnesota Department of Employment and Economic Development; Scott Nystrom and Ahmed Mustafa, Regional Economic Models, Inc.]

Method 1 utilized a statewide economic model developed by Regional Economic Models, Inc. (REMI) called REMI PI$^+$. The model is designed to generate economic impact estimates of a variety of economic events, including the economic value associated with improvements to transportation infrastructure. The model is a dynamic input-output model that automatically adjusts all model input variables as impacts are estimated. Once the data is input, the model simulates increased sales and purchases among affected businesses, suppliers of capital and labor, consumers, government, importers and exporters, and other entities interacting in the local economy. These interactions produce year-to-year estimates of total economic impacts composed of direct project impacts and indirect and induced impacts (or ripple effects) on the economy.

For the Minnesota test case study classified in the interchange category (Interstate 94 and Opportunity Drive near the city of Saint Cloud), the research team conducted a survey in the summer of 2013 (see Appendix 2) that was used to identify observed economic impacts attributable to the construction of the new interchange in 2004. Businesses within a 1-mile radius of Opportunity Drive were surveyed to obtain an assessment of the project's impact on their own operations and hiring/layoff decisions. Six relevant businesses were identified and responses were received from five of the six. Businesses surveyed in the industrial park noted that the interchange has generated cost savings, improved safety for residents and tractor-trailer drivers, and was a critical factor for firms that have since located there. Moreover, the park has a number of vacant plots that could support further expansion. New jobs and wages (results from the survey) were applied to REMI PI$^+$ model and were compared to the results generated by a T-PICS test.

Method 2: Travel Projections from EIS Feeding Into REMI PI$^+$ (EIS/REMI)

[Source: Neal Young, and Weston Merrick, Minnesota Department of Employment and Economic Development; Matt Shands and John Wilson, Minnesota Department of Transportation; Adam Fulton, Regional Economic Models, Inc.]

For the two Minnesota projects we classified as bypass (Minnesota Trunk Highway 371 Little Falls to Brainerd, and US-71/Minnesota Trunk Highway 23 Including Willmar Bypass) and for the one Minnesota project classified simply as widening (Minnesota Trunk Highway 60 expansion from Windom to Heron Lake) the research team examined project environmental impact statements (EIS) that were prepared in compliance with state and federal law prior to the construction of those three projects. The EIS documents were examined to gather pre-project data and post-project estimates of annual vehicle miles traveled, vehicle hours traveled, annual traffic growth rates, and the percentage of truck and heavy commercial vehicles to overall vehicle miles traveled. Input factors were applied to the REMI PI$^+$ econometric model to generate estimates for jobs, wages, and output. For vehicle traffic, time saved was considered a quality of life improvement valued at one-half the average hourly wage. For commercial traffic, vehicle hours saved increased the productivity of the trucking industry, which reduces employment in the short term but increases the competitiveness of the state's economy as a whole. The outputs from REMI were then compared to the results generated by a T-PICS test.

Note: The REMI model provides an estimate of total economic impact, but, because the EIS documents do not provide any estimates of direct employment, wages or output, it is not possible to separate out direct and supplier and wage impacts for the case studies. Therefore, the comparison tables only report only total impact.

Method 3: REMI TranSight Analysis (Travel Demand)

[Source: Scott Nystrom and Ahmed Mustafa, Regional Economic Models, Inc.]

In order to allow the research to include analyses of a greater number of completed projects, the research team added two economists from the firm Regional Economic Models, Inc. (REMI) to examine a number of case study test projects in states other than Minnesota. REMI was able to identify two projects in Washington State (a widening project—Interstate 405 south of Seattle, and a project classified as a connector—State Route 509 near the Seattle Tacoma International

Airport); three projects in Iowa (an interchange at 86th Street near Des Moines, a widening project called the Iowa 60/US-75 Le Mars Corridor, and a bypass project at Iowa 5/US-65 on the southeast side of Des Moines); one project in New Mexico (a widening of US-54 extending north from the border with Texas); and four widening projects along the Appalachia Development Highway System in Georgia, Kentucky, West Virginia, and Pennsylvania. These projects were all the subject of studies that REMI had conducted to consider the potential economic impacts associated with those improvements.

REMI utilized its own fully integrated transportation-modelling tool called TranSight, which quantifies the economic impacts of transportation projects based on changes in a region's transportation network. It utilizes travel time data and other project-specific data as inputs to derive estimates for economic benefits associated with savings in transportation costs, accessibility costs, and commuting costs. The simulation generates both an economic and demographic baseline forecast (the "no-build scenario"), and also multi-year post-project forecasts, which are compared to the baseline forecast. For the purpose of this study, REMI focused on the post construction phase, as opposed to the economic impacts of the construction phase of the project.

Method 4: Reduced-form econometric modeling of income and employment

[Source: Michael Iacono, University of Minnesota Center for Transportation Studies]

The fourth analytical method we employed to compare with the results from a T-PICS run was applied to three of the Minnesota projects to which we also applied Method 2. These projects include the two projects we classified as widening/bypass (Minnesota Trunk Highway 371 Little Falls to Brainerd; and US-71/Minnesota Trunk Highway 23 Including Willmar Bypass) and the one project classified as widening (Minnesota Trunk Highway 60 expansion from Windom to Heron Lake).

This methodological approach compares the estimated T-PICS results to the findings estimated from application of an econometric model predicting changes in economic output or employment by jurisdiction. Controlling for industry-level trends and macroeconomic influences, the resulting empirical models identify the economic impacts resulting from projects in a given jurisdiction (e.g. county) as residual changes in activity in each year following the project's completion, above and beyond those observed in other locations not impacted by the project.

Since the impacts are estimated from a series of time and location-specific dummy variables, the resulting estimates of employment, wage, and output changes take the form of an interval representing a 95% confidence band around the mean change attributable to the project. Thus, the intervals representing the impacts can encompass both positive and negative values in some cases. The findings table for the three projects utilizing this methodology identifies the median of the range (to be consistent with the point estimates derived by the other methodologies) as well as the entire range.

The first stage of analysis of the selected case studies involved before-and-after analysis of key economic indicators in the jurisdictions where the test case study projects are located. Data on income, employment, and wages from the Bureau of Economic Analysis, which are available down to the county level, formed the basis of the economic profile of each case study location.

Where possible, these data have been supplemented with other, smaller-scale data compiled by the Department of Employment and Economic Development (DEED) from the

Quarterly Census of Employment and Wages (QCEW). These data sets were analyzed to assess changes in employment and wages at the minor civil division (MCD) level, including most cities and townships. Beyond the initial examination of economic impacts resulting from the completion of the case study projects, the analysis estimated the contribution of the projects themselves to economic growth in the case study locations.

A further source of information on project impacts in the case study locations is land value data. Many projects that expand the capacity of existing roadways generate new economic activity near access points or other highly visible and accessible locations. These impacts tend to be localized and are often capitalized into the value of adjacent property. Evaluating changes in the price of property near an expanded roadway offers an additional metric for gauging project impacts.

Table 2.1 contains a list of each test case study project and the methodology that was applied to compare its estimate of economic impacts to the results generated by T-PICS.

Table 2.1. Test Case Studies and the Methodology Applied in Each

Project	Method 1—Survey/ REMI PI+	Method 2—EIS/ REMI PI+	Method 3 – REMI TranSight	Method 4 – Reduced Form Econometric Model
INTERCHANGES				
Minnesota Opportunity Drive Interchange	✓			
Iowa 86th St Interchange			✓	

HIGHWAY CORRIDORS				
Widening				
Minnesota TH 60		✓		✓
Washington I-405			✓	
New Mexico US-54			✓	
Iowa US-60/US-75 LeMars Corridor			✓	
Georgia—Appalachia Corridor A/A1			✓	
Kentucky—Appalachia Corridor I			✓	
West Virginia—Appalachia Corridor L			✓	
Pennsylvania—Appalachia Corridor P			✓	
Bypass				
Minnesota TH-371—Brainerd Bypass		✓		✓
Minnesota US 71—TH-23—Willmar Bypass		✓		✓
Iowa 5/US-65—Des Moines			✓	
Connector				
Washington SR 509			✓	

Chapter 3: Results/Estimates of Actual Economic Impact and Comparison to T-PICS Results

In order to compare the economic impact estimates generated by T-PICS with those observed by our alternative analytical methods, a first step for each project involved translating and entering the features of the 14 test case study projects into the T-PICS template. This step required the identification of quantitative or objective features for each project, such as project cost, traffic volume, economic distress, and urban class indicators and—after any necessary recalibration—entering that data as inputs to the T-PICS interface. That process generated results in the My Project Tools module of T-PICS, which were then compared to the values estimated through the alternative data analysis methodologies described in Chapter 2. Where a marginal correspondence was discovered between the two sources, settings for the qualitative variables, such as land use policy, business climate, and other infrastructure, was further considered and modified—within the constraint of preserving a credible representation of the project context—in an effort to achieve better agreement of T-PICS projections with the alternative methodology test case values.

We recognize that a typical user of the T-PICS tool does not adjust inputs to achieve a closer match to some other analytical method, as we do in our analysis. However, for purposes of validating the results of T-PICS, our analytical method is consistent with an approach that offers a broader range of interpretation that could conceivably be applied to a given project for subjective factors such as land use policies (restrictive vs. supportive), infrastructure (not available vs. state of the art) and business climate (negative vs. aggressive).

This chapter contains an analysis of each of the 14 test case study projects. Each project page includes the name of the project, a map of the project containing a photograph in the inset illustrating the economic development associated with the project, a table showing the results of the comparison, and a findings/conclusions chapter that will offer an analysis of the test results.

One of the more broad-based, general recommendations offered from this research addresses the classification of project types in T-PICS. As we detail in Chapter 4, which contains our conclusions and recommendations, we suggest that the organization of the project types be restructured to reduce the number of broad project types from the existing eight classes (bypass, limited access road, beltway, interchange, bridges, access road, widening and connector) to just three classes, containing inclusive subclasses as follows: (1) interchanges (no subclass); (2) highway corridors (bypass, widening, beltway, and connector); and (3) access roads (access and limited access).

We concluded that this is a more logical and intuitive way to classify projects, reasoning that each of those three categories has a distinct purpose and spatial characteristic. In terms of their economic impacts, all interchanges fundamentally achieve the same purpose: to provide high-mobility, high-speed access to an intersecting corridor. All highway corridor projects address mobility from one point to another, be they short distances or extended interregional corridors. And all access roads provide direct (and generally limited length) access to a specific economic center.

Consistent with that recommendation, this chapter is organized into the two categories in which we have conducted a test case, i.e., interchanges (two projects) and highway corridors (12 projects: eight widening, three bypass, and one connector). In addition to the analysis following each individual project, we also include a more general discussion of broad conclusions following each of the two main categories, i.e., interchanges and highway corridors, which include all of its subclasses.

Interchange Projects

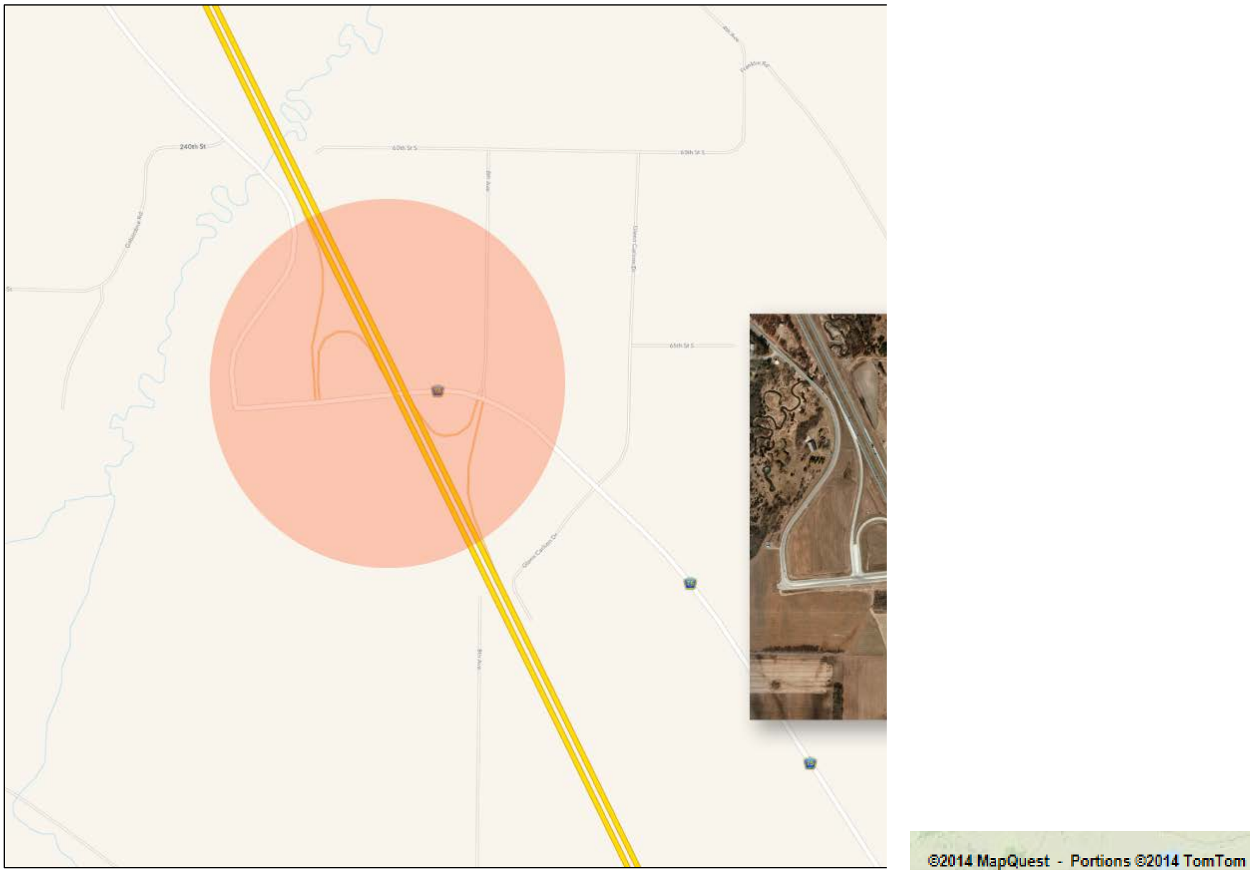


Figure 3.1. I-1: Minnesota Opportunity Drive Interchange on I-94.

Project Description

Interstate 94 at Opportunity Drive (Stearns County Road 75) is illustrated in Figure 3.1. It is an interchange providing access to the City of Saint Cloud and industrial development on the south and west end of the city. Saint Cloud is central Minnesota’s largest urban center, with a population of about 65,000. The Interstate 94 corridor is a key freight and multimodal corridor connecting Chicago and Seattle. The 75-mile segment between the Twin Cities and Saint Cloud represents one of the fastest growing segments of the entire I-94 corridor.

Construction of the Opportunity Drive interchange began in 2003 and was completed in 2004 at a cost of $7.85 million. Prior to the construction, vehicles used an interchange two miles north on I-94 and then traveled on county roads to reach an adjacent industrial park and other nearby destinations. The primary objective of the project was to reduce the costs and hazards associated with tractor-trailers traveling on existing secondary roads and to attract new businesses and employment opportunities to the area.

Prior to the interchange construction, only two manufacturing facilities had operations within the adjacent industrial park. Since the completion of the project in 2004, four new businesses have begun operations in the park and employment has increased dramatically.

Table 3.1 below shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.1. Comparison Table for Minnesota I-94 Opportunity Drive Interchange

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Direct Impacts	661 to 1,102	$34,100 to $56,800	$108,400 to $180,600
Supplier and Wage Impacts	484 to 807	$19,800 to $32,900	$61,500 to $102,500
Total Impacts	1,146 to 1,909	$53,900 to $89,800	$169,900 to $283,100
Alt. Method 1: Survey/REMI PI+			
Direct Impacts	500	$36,324	$158,125
Supplier and Wage Impacts	1,389	$44,653	$150,685
Total Impacts	1,889	$80,977	$308,810
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Direct Impacts	Over	Within	Within
Supplier and Wage Impacts	Under	Under	Under

Total Impacts	Within	Within	Under
T-PICS Basic Selection Factors	Interchange, Great Lakes/Plains, Metro, Non-Distressed		

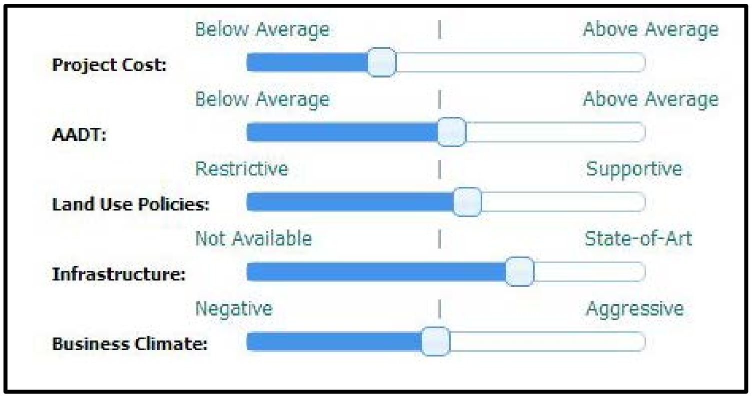


Figure 3.2. Sliding scale settings for I-94/Opportunity Drive.

Sliding Scale Settings

Settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect supportive zoning and development policies in place at the time of the project's construction. Project documents and observations of the corridor, along with our own understanding of the politics of the region influenced the position of the infrastructure slider and of the Business Climate slider. Figure 3.2 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

[Note on all the sliding scale settings: As expressed in the recommendations of Chapter 4 and elsewhere in this report, the authors suggest that future development of the T-PICS My Project Tools function include more explicit instructions on the use of the sliding scale settings. For each of the 14 projects examined in this analysis, the scales are generally set to represent our best estimate of the appropriate settings based on our knowledge of the project and related available data. However, we also were sensitive to the influence of the slider settings on the results generated, and the limited hard data available to potential users who are employing the tool. Therefore, we often set the sliders at positions that were true to the project circumstances but that also generated the closest estimate to the alternative analysis.]

Project Analysis: Minnesota I-94 Opportunity Drive Interchange

- In this case, T-PICS results fell relatively close to the REMI model results. REMI estimates of employment and wage impact fell within the ranges provided by T-PICS, though towards the higher end of the range. T-PICS output results for the Opportunity Drive interchange were below the REMI results, but not by a significant margin.
- The reliability of the T-PICS output is a function of the case studies from which the model generates its results. A fundamental finding of this research is that the T-PICS tool tends to be most reliable when the proposed project being tested is sufficiently similar to a number of the case studies that populate the T-PICS case study database. In the case of the Minnesota Opportunity Drive Interchange project, four T-PICS case study projects share the same set of basic criteria, i.e., region (Great Lakes/Plains) and project type (interchange) to the Opportunity Drive project. These four comparison projects had a mix of AADT, population density, levels of economic distress, and other criteria that were sufficiently similar to the Opportunity Drive test case study such that the resulting total impacts output generated by T-PICS was consistent with the alternative test methodology.
- Three of the T-PICS case study projects used to generate economic impact estimates for this project had significantly higher construction costs than Opportunity Drive and, as a

result, T-PICS generates an estimate of project costs that is significantly greater than the actual cost. (T-PICS estimated the project to cost more than $100 million when the true project cost was less than $8 million.)

- While the REMI total impact figures for employment and wages are within the range of the T-PICS impact, the source of these impacts is different. The REMI model predicted that the supplier and wage impacts would be larger than T-PICS estimates. For example, REMI estimated that indirect impacts would generate 1.7 to 2.8 times more jobs than the T-PICS estimate. This difference was somewhat offset by REMI direct impacts that were either lower (for employment) or on the lower end (wages) of T-PICS. These differences in attribution of impacts lead to a convergence in total impacts for employment and wages.
- Supplier and wage impact estimates generated by T-PICS might have been underestimated in this test case because the employment in the Opportunity Drive industrial park is mostly manufacturing, which tends to have a high economic multiplier relative to locations whose economies are more service or retail based.

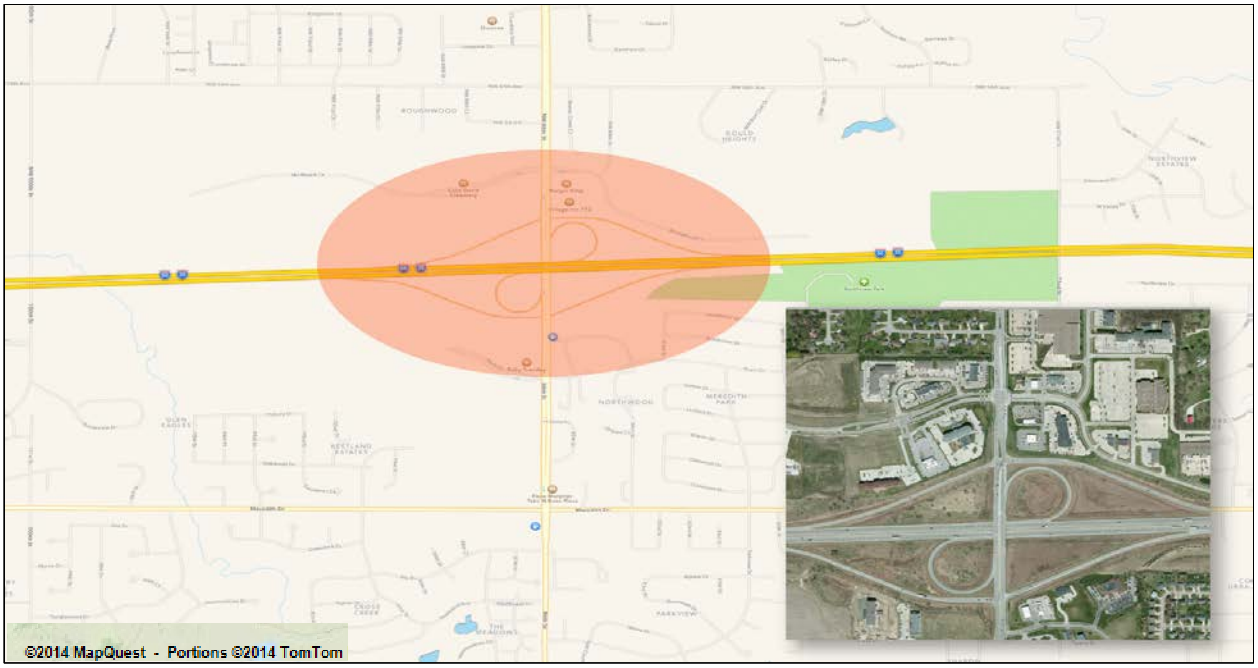


Figure 3.3. I-2: Iowa 86th Street Interchange.

Project Description

The Iowa 86th Street Interchange, illustrated in Figure 3.3, opened in 1994 and is located at I-80/I-35 in the northwest suburbs of Des Moines. The interchange added access into and out of two major, growing suburbs of Johnston to the north and Urbandale to the south. Prior to the interchange construction, the surrounding area was mostly undeveloped, but now it includes roadside retail developments and improved commuting access from these suburbs to other locations around the Des Moines metro area.

Table 3.2 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.2. Comparison Table for Iowa 86th Street Interchange

T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**

Direct Impacts	1,062 to 1,770	$58,600 to $97,700	$186,300 to $310,500
Supplier and Wage Impacts	908 to 1,513	$34,000 to $56,600	$105,800 to $176,300
Total Impacts	1,970 to 3,283	$92,600 to $154,300	$292,100 to $486,800
Alt. Method 3: REMI TranSight			
Total Impacts	82	$3,000	$10,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection Factors	Interchange, Great Lakes/Plains, Metro, Non-distressed		

Sliding Scale Settings

Settings were scaled to reflect the project cost and AADT levels. The Land Use Policies slider was scaled to reflect supportive zoning and development policies in place at the time of the project's construction. Project documents and observations of the corridor, along with our own understanding of the politics of the region, influenced the position of the Infrastructure slider and of the Business Climate slider. Figure 3.4 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

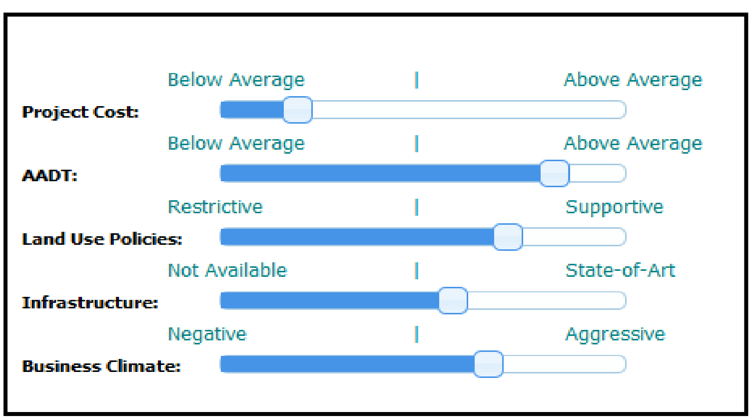


Figure 3.4. Sliding Scale Settings for I-94/Opportunity Drive.

Project Analysis: Iowa 86th Street Interchange

- Compared to the Alternative Method, T-PICS significantly overestimates the economic impacts for all three economic indicators: employment, wages, and output. One likely explanation is that the T-PICS interchange projects contained in the database tend to be mostly larger, urban projects. For example, of the four interchange projects identified in the Great Lakes/Plains criteria, three are large projects located close to major metropolitan areas, including two projects from Kansas City and one from Minneapolis (which is actually a combination of three interchange projects along the busiest retail corridor in the state, Interstate 494 in Bloomington). These three projects' costs are in excess of $60 million. Only one Midwest interchange project is included in the database, and its cost was less than $5 million. An examination of all of the interchange projects in the database shows that a typical project cost for an interchange starts at about $35 million and can range to well into the hundreds of millions. Smaller projects such as the Iowa 86th Street Interchange are underrepresented in the database.
- Another factor that might explain the lower economic impact results observed from the REMI test as compared to the T-PICS test is that this interchange improvement was constructed to address a less ambitious objective than many more typical interchanges included in the T-PICS database. In this case, the interchange wasn't built primarily for the purpose of attracting or stimulating significant new economic development. Instead, the project's more modest motivation was to address safety by adding an exit to aid commuting and access to existing retail amenities from the interstate. Moreover, since other options for exiting or entering the interstate a few miles in either direction were

already available, the economic impact attributable to this interchange is diluted. It is also likely, given the specific characteristics of this location, that a significant share of the economic activity occurring near this interchange gained access via local and secondary roads that also provide easy access for many living or working in the region.

Summary Graphic – Interchange Projects

Figure 3.5 shows the comparison for the two test case study interchange projects we examined for the Employment economic indicator. The purpose of this graphic is to provide a visual representation of the degree to which the alternative analysis that we conducted generates an estimate that is within or outside of the range of the estimates that the T-PICS test estimated.

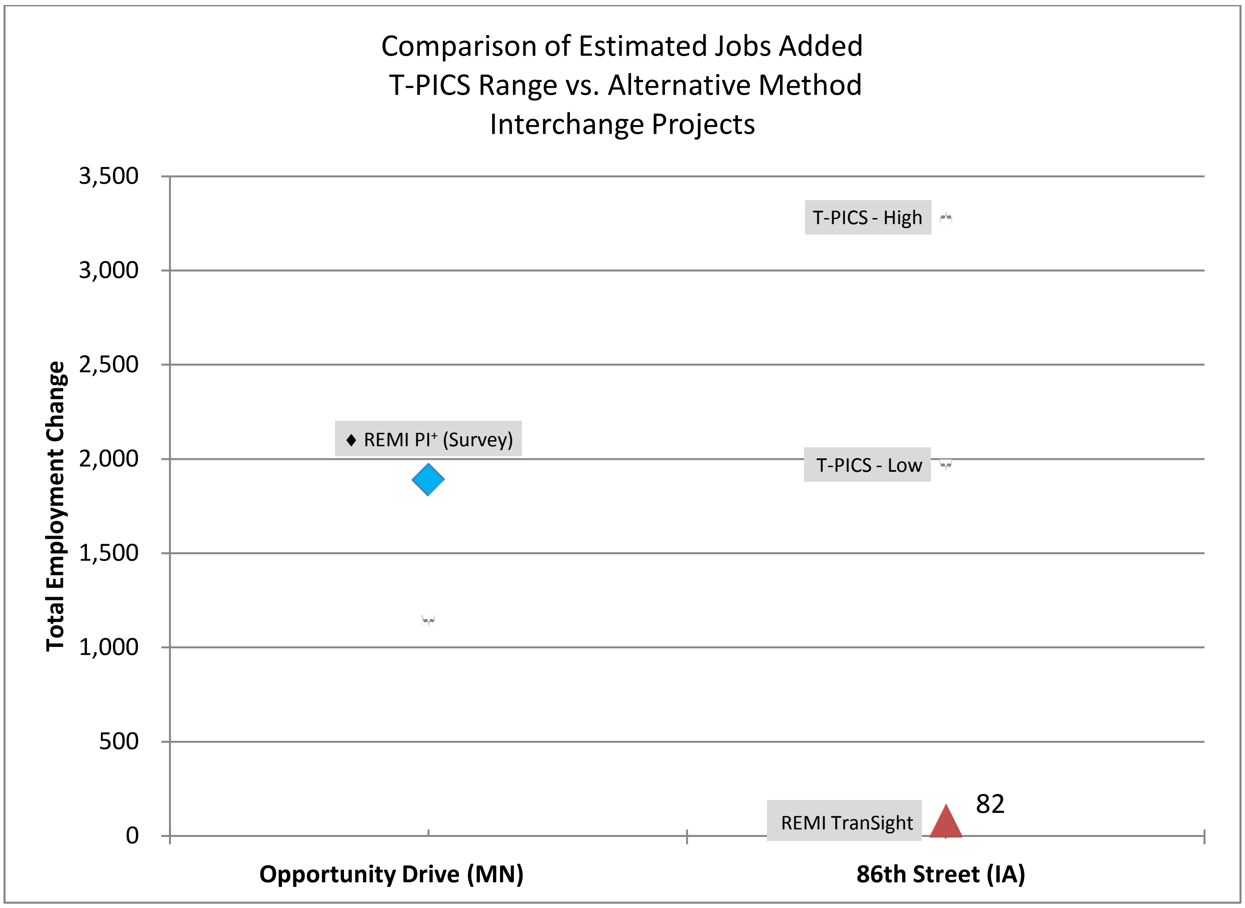


Figure 3.5. Comparison of estimated jobs added: T-PICS range versus alternative method interchange projects. (T-PICS = Transportation Project Impact Case Studies (T-PICS); REMI = Regional Economic Models, Inc.)

Findings/Conclusions on Interchange Project Comparisons

1. When the test case study project (e.g. Minnesota I-94 and Opportunity Drive) is sufficiently similar to projects contained in the 100 T-PICS database projects, then our analysis suggests that the tool generates a reliable estimate of the proposed project's economic impacts. If, on the other hand, the test case study project (e.g. Iowa 86th Street Interchange) is dissimilar in key variables that are relevant in deriving the results through the regression analysis (i.e. AADT, urban/class level, population density), then the results generated by T-PICS are significantly less likely to align closely to the alternative methodology. It is almost always the case that the T-PICS projection will overstate the potential economic impact because the vast majority of the T-PICS case study interchange projects are substantially greater in scope and cost than a more ordinary (i.e., $4-10 million in project cost) interchange improvement.

   Until there are sufficient numbers of cases and diversity in the database to address the project type and scale gaps in the existing database, it would be a useful improvement to compose a statement of caution to the user when a proposed project includes characteristics (limited scope or cost, for example) that is likely to generate overly optimistic economic impact estimates. (We also think that such a statement could be accompanied with a notice that T-PICS is always looking to add new case studies, and this example might be suitable to address a gap in the existing database.)

2. When certain test case study project variables are entered that are not in line with the T-PICS case study project variables, results can be skewed in the direction of one or the

other subcategories of direct or supplier and wage impacts. For example, in the Minnesota Opportunity Drive test case, three of the T-PICS case study projects used to generate its results had significantly higher construction costs than Opportunity Drive and, as a result, inflated the estimated project costs of Opportunity Drive. (T-PICS estimated this project to cost more than $100 million when the true project cost was less than $8 million.)

Highway Corridor Projects: Widening Projects

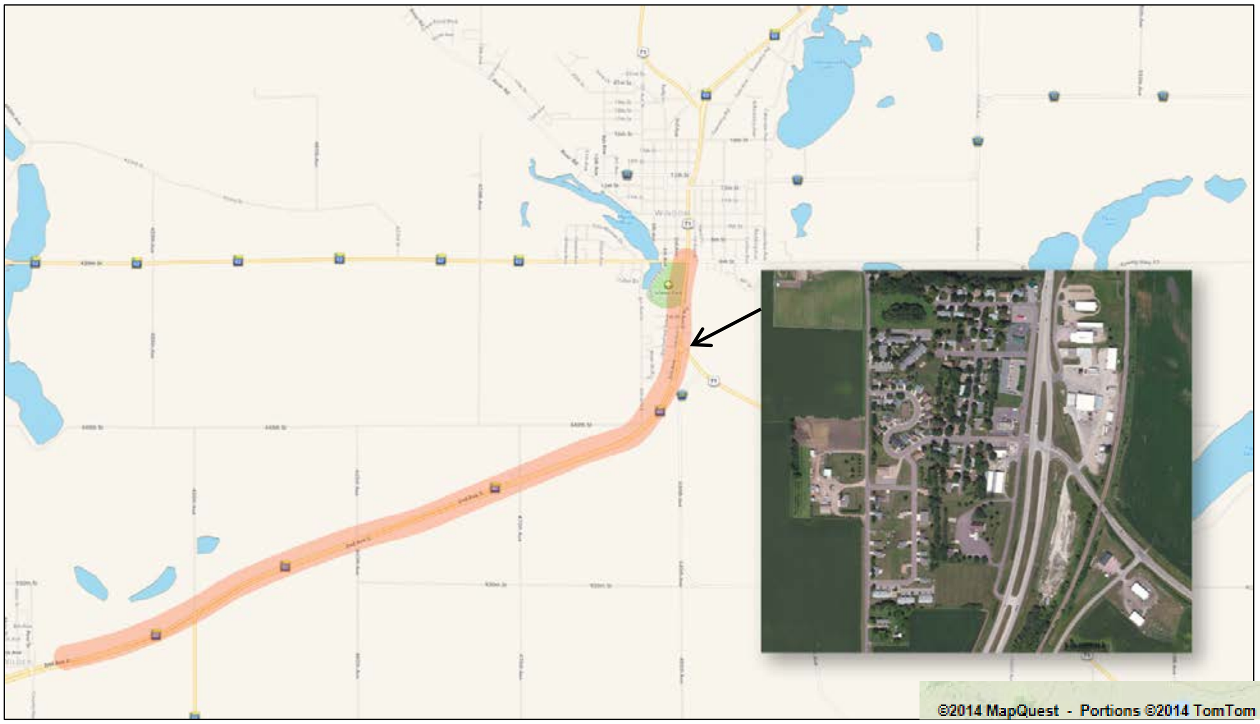


Figure 3.6. W-1: Minnesota MN TH 60 Expansion from Windom to Heron Lake.

Project Description

Minnesota Trunk Highway (TH) 60, illustrated in Figure 3.6, was reconstructed as a four-lane expressway with a reduced-width center median and located in part on a new alignment to bypass the city of Windom. TH-60 runs southwest to northeast, diagonally overlaying the basic north-south and east-west grid highway system in southeastern Minnesota. This project began in 1993 and widened a two-lane highway between Windom (a reasonably large economic center) and Heron Lake. The state completed the widening in 2005.

To the southwest, TH-60 extends approximately 90 miles to Sioux City, Iowa. It provides a connecting link, via interstates 90 and 29, to the markets of Sioux Falls, Omaha, and Kansas City. The TH-60 Corridor serves as a principal arterial link to local and regional markets from both ends of the corridor. In addition to its principal arterial function, TH-60 serves as a vital access link between the town centers located along the corridor, as well as providing access to the secondary county highway and local township road system serving the surrounding agricultural lands.

A major goal of the project, as articulated by the local planning authority (Southwest Regional Development Commission), was to develop a transportation corridor that would help attract additional employment opportunities, particularly in the industrial sector. Areas of particular interest for economic development identified in the planning stages of the project included southwest Windom, owing to the new bypass alignment.

Table 3.3 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.3. Comparison Table for MN TH-60 Expansion from Windom to Heron Lake

T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Direct Impacts	3,264 to 5,441	$155,900 to $259,800	$495,500 to $825,800
Supplier and Wage Impacts	1,974 to 3,290	$90,400 to $150,600	$281,300 to $468,800
Total Impacts	5,238 to 8,730	$246,300 to $410,400	$776,800 to $1,294,600
Alt. Method 2: EIS/ REMI PI+			
Total Impacts	2	-$140	$1,841
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
Alt. Method 4: Reduced Form Econometric Modeling of Income and Employment			
Total Impacts	3,201	$38,726	$70,664

	(range: 2,083 to 4,320)	(range: $9,802 to $67,651)	(range: $26,956 to $114,373)
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection Factors	Widening, Great Lakes/Plains, Rural, Non-Distressed, 14 miles		

Sliding Scale Settings

The slider settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect generally supportive policies given the zoning and development plans in place at the time of the project's construction. Project documents and observations of the corridor influenced the position of the Infrastructure slider. The Business Climate slider is scaled to reflect neutrality. Figure 3.7 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

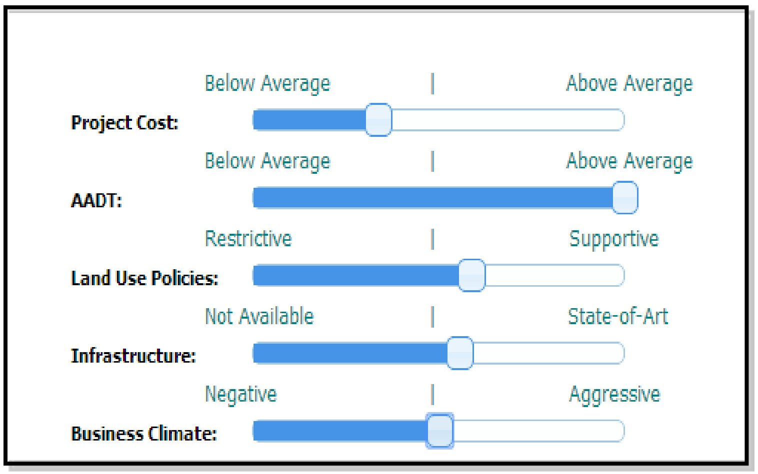


Figure 3.7. Sliding scale settings TH-60 Windom to Heron Lake.

Project Analysis: MN TH-60 Expansion from Windom to Heron Lake

- The comparison of the three methods of economic impact estimation for the TH-60 expansion project reveals that T-PICS produces the highest estimates of employment, wage, and output impacts. The single-equation, reduced-form models of employment and income generate impacts that are positive, yet smaller than T-PICS, under the assumption that only a portion of the growth in the counties directly impacted by the highway expansion can be attributed directly to the project itself. The higher estimates produced by T-PICS likely reflect the nature of the project as a rural highway widening project. Since the most similar projects of this type in the T-PICS database tend to be larger-scale projects with proportionately greater effects on employment and income, the TH-60 expansion impacts are predicted to be larger by virtue of this peer group effect. The results of the REMI PI^+ model are comparatively smaller, due to the inclusion of the project's relatively modest user benefits as inputs and the substitution of transportation for other production inputs in a way that limits its effects on wages and employment.
- Our analysis indicates that T-PICS tends to overestimate the potential for economic benefits resulting from projects in rural or semi-rural areas, relative to projects that are located in fully urbanized areas. A primary reason for this phenomenon is likely due to the fact that 77 of the 100 T-PICS Case Study projects are classified as metro or mixed, and just 23 are classified as rural. This natural bias in favor of projects located in or near metropolitan areas means that the tool will generate more reliable results when it is assessing the potential economic impact of metro-oriented projects. The flip side, however, it that the tool will tend to overestimate the potential economic benefits of projects that are more rural in nature. It appears, as well, that this bias is exacerbated for

the longer mileage rural projects. Recommendations that address this finding are articulated in Chapter 4.

- This wage decline projected by Alternative Method 2 (EIS analysis and REMI PI^{+}) reflects an anticipated change in employment mix. The REMI model predicts that efficiency gains would reduce the number of trucking and other transportation sector workers, but overall employment would increase very slightly as individuals move to the area for the higher quality of living associated with less congestion and quicker commutes. REMI PI^{+} expects the wages lost by transportation sector workers to exceed wages earned by individuals who migrate to the region.

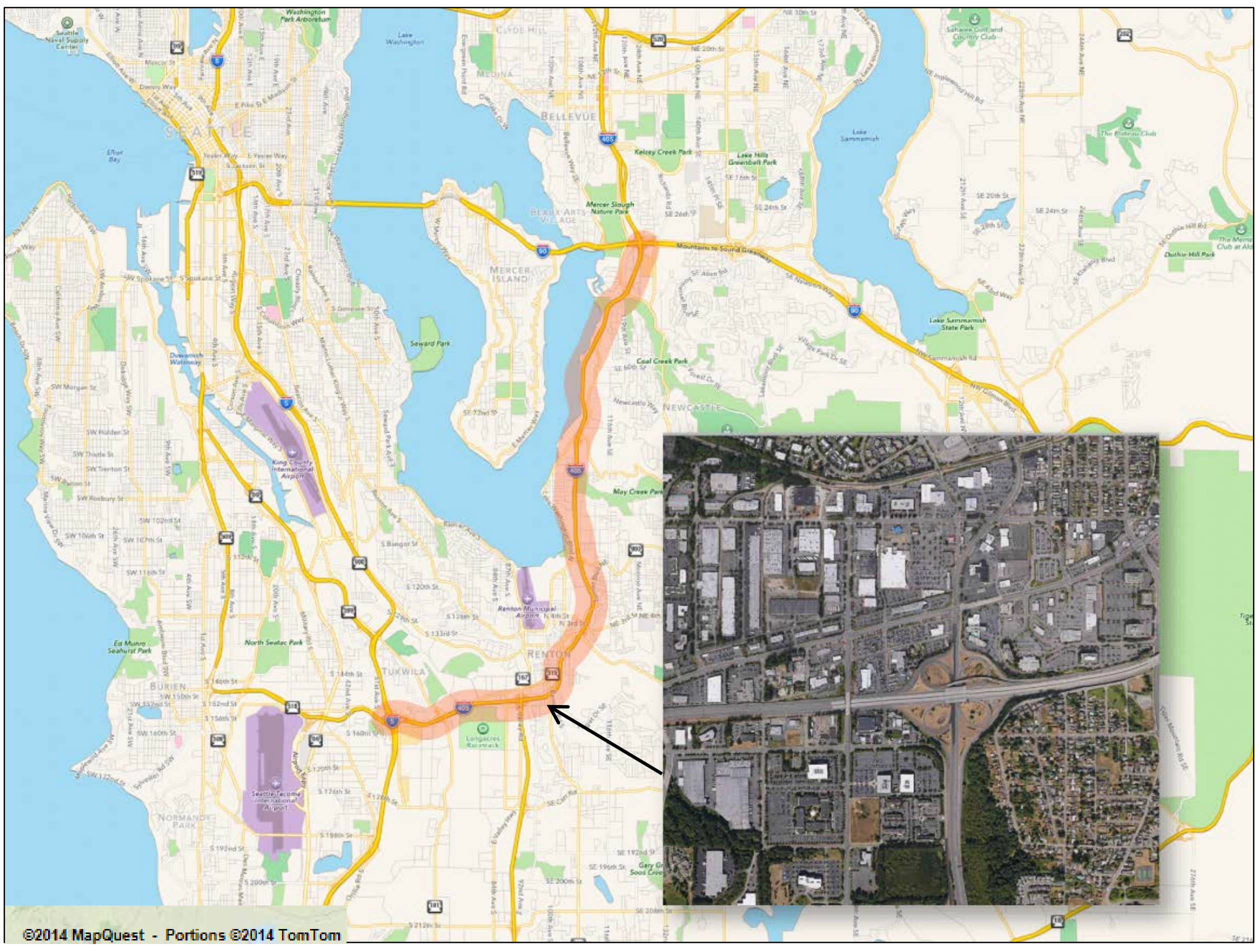


Figure 3.8. W-2: Interstate 405 in Washington State.

Project Description:

The Interstate 405 improvement project south of Seattle, Washington, illustrated in Figure 3.8, was intended to relieve congestion along the corridor by adding capacity, improving safety, supporting freight mobility, and investing in transit. The project improved 22 miles of Interstate 405 between Tukwila and Bothell. Roadway and interchange improvements include two lanes added in each direction from downtown Bellevue south to SR-167 in Renton. One lane was added in each direction from a new I-405/State Route (SR) 167 interchange, one south on SR-167 to South 180th Street and one connecting to I-5. One lane was also added in each direction north from SR-520 in Bellevue to SR-522 in Bothell. The project included high occupancy vehicle (HOV) direct access ramps, transit stations, park-and-ride lot expansions, purchase of transit vanpools and buses, bike trail and pedestrian connections, and environmental enhancements.

Table 3.4 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.4. Comparison Table for Washington State Route 405

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Total Impacts (Direct and Indirect)	4,902 to 8,170	$285,800 to $476,300	$773,500 to $1,289,200
Alt. Method 3: REMI TranSight			
Total Impacts	$4,954	$680,000	$862,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			

Total Impacts	Within	Under	Within
T-PICS Basic Selection Factors	Widening, Rocky Mountain/Far West, Metro, Non-Distressed, 22 miles		

Sliding Scale Settings

The slider settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect nearly neutral policies given the zoning and development plans in place at the time of the project's construction. Project documents and observations of the corridor influenced the position of the Infrastructure and Business Climate sliders. Figure 3.9 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

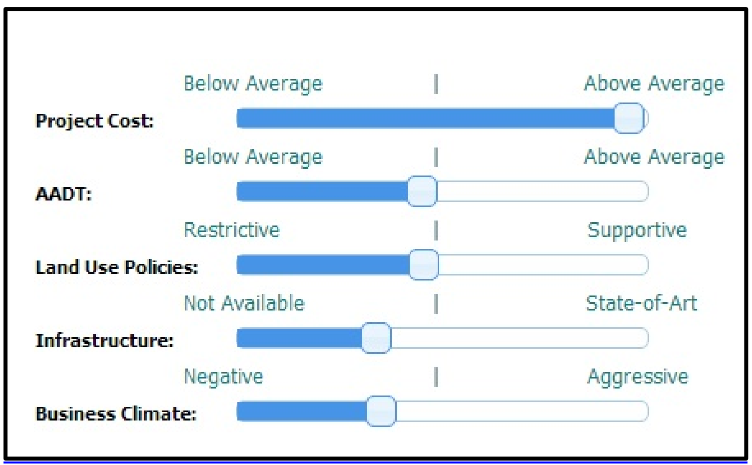


Figure 3.9. Sliding scale settings Washington SR 405.

Project Analysis: Washington State Route 405

- There is relatively close alignment between the T-PICS projection and the REMI TranSight projection of economic impacts for this project. T-PICS projection is consistent with the observed impacts as measured by the alternate methodology primarily because there is an ample number of case studies in the T-PICS database that are similar in nature to the Washington SR-405 test case study project. For example, the T-PICS Case Search function reveals that there are seven T-PICS case studies classified as widening projects (from many geographic areas, not just the Rocky Mountain/Far West) that are similar in nature to the test case.

- One reasonable explanation for the underestimation of wages of the T-PICs estimate relative to the alternative method is that the Seattle metropolitan area is a very high wage area with tech companies and major manufacturing companies well represented among the employment base of the region. The REMI model accounts for the industry mix in the region and so the greater estimate of wage increases is reflected in the model's results.
- The variable that appears to be the most important in terms of ability of T-PICS to reliably estimate the economic impact of a project is the project cost, and, secondly, the project motivation. (Our findings indicate that geographic region is not as critical.) In this case, of the seven widening projects, all seven are roughly comparable in terms of the per mile cost of construction, and all seven have a project motivation which was designated as site development or congestion mitigation. Our conclusion is that if a proposed test case study projects has a total cost estimate roughly in line with the T-PICS case study projects contained in the database, and if that project can be assigned to either the site development or the congestion mitigation project motivation criteria, then there is sufficient consistency within the T-PICS database projects that the regression analysis generates an output table that will be reasonably close to the observed impacts.

- Again, the wages estimate generated TranSight exceeds the estimate generated by T-PICS, although not by as large a margin as observed in some of the other examples. Another reason why T-PICS estimate of wages might not be as reliable as the alternative analysis is because T-PICS doesn’t adjust for the average wage rate as effectively, due to the limited size of the database. TranSight is a much more sophisticated tool, which derives wage data on the basis of existing distribution of regional impacted industries as identified by their North American Industrial Classification System (NAICS) codes. T-PICS does not hold itself up as a tool that generates an estimate of wages based on that level of sophistication.

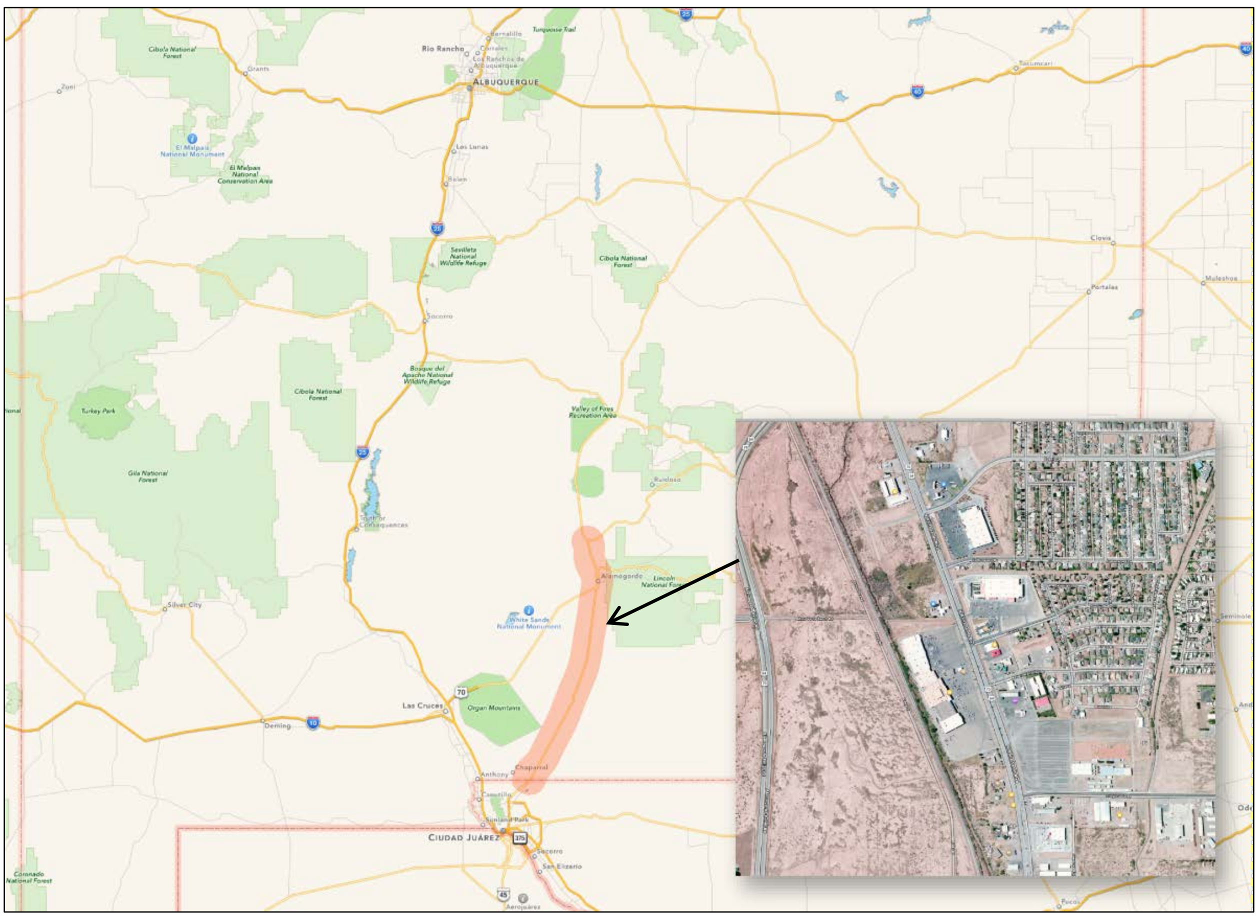


Figure 3.10. W-3: US-54 in New Mexico.

Project Description

The US-54 widening project, illustrated in Figure 3.10, addressed mobility concerns along a significant carrier of freight traffic in the central United States. The highway stretches in a northeasterly direction from El Paso, Texas toward Chicago, Illinois. This completed project covers the 80-mile segment in New Mexico, north from the state's southern border with Texas to the town of Tularosa, New Mexico, which was expanded to from two to four lanes in 2004.

While congestion was not pervasive along the length of the corridor in New Mexico prior to construction of this improvement, traffic was frequently backed up behind slower-moving vehicles because traffic volumes, coupled with the grades on the road, discouraged passing in the oncoming lane. Because of this potential for delays, drivers of commercial trucks often opted for alternative routes when hauling freight from Mexico and the Southwest United States to central and north-central population centers such as Kansas City and Chicago, even though those routes are less direct than US-54.

Table 3.5 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.5. Comparison Table for US-54 in New Mexico

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Total Impacts (Direct and Indirect)	2,071 to 3,451	$111,600 to $186,000	$341.0 to $568.4
Alt. Method 3: REMI TranSight			
Total Impacts	500	$8,630	$40,130
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			

Total Impacts	Over	Under	Under
T-PICS Basic Selection Factors	Widening, Southwest, Rural, Distressed, 80 miles		

Sliding Scale Settings

The sliding settings were scaled to reflect the appropriate cost and AADT levels. The remaining three sliders (Land Policies, Infrastructure, and Business Climate) were all scaled to the lowest level, reflecting the fact that the vast majority of this improvement was constructed in a desert, which is not conducive to favorable land use policies, infrastructure, or business climate. Figure 3.11 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

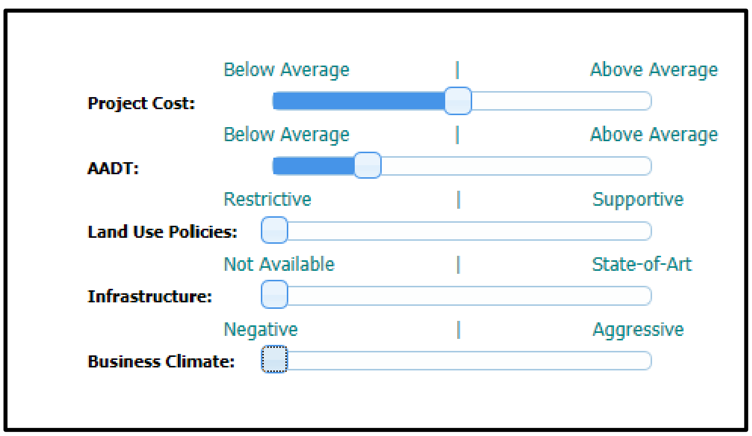


Figure 3.11. Sliding scale settings for New Mexico US-54.

Project Analysis: New Mexico US-54

- This project is a classic case of a highway corridor project whose location occupies a significant stretch of rural greenfield, which we define as a vast expanse of rural land that is undeveloped, but due to geographic or demographic factors (such as topography or population scarcity) is unlikely to experience much development in the short term. The economic impact results generated in T-PICS is largely dependent on the variable entered for Length of Project (i.e., there is a direct correlation between the estimated impacts and the Length of Project entered into the My Project Tools criteria selection page).

Our findings suggest that this project would have had relatively close alignment between the T-PICS estimate and the REMI TranSight estimate if the Length of Project had been entered at a distance much shorter than 80 miles, but rather a distance that might reasonably be expected to attract new development, perhaps five miles. A recommendation detailed in Chapter 4 suggests re-examining the influence that the Length of Project has on the economic impact results generated by the T-PICS tool.

- As the developers of T-PICS acknowledge, T-PICS' economic impact estimate does account for changes in traffic that would result from a particular improvement, so under certain circumstances, the alternative methodology will return a more reliable estimate. This particular improvement did not significantly change the traffic speeds or AADT along the corridor, and T-PICS' regression formula applies conditions in similar projects in its database and presumes that a widening along an 80-mile corridor would typically lead to greater traffic volumes and speeds.

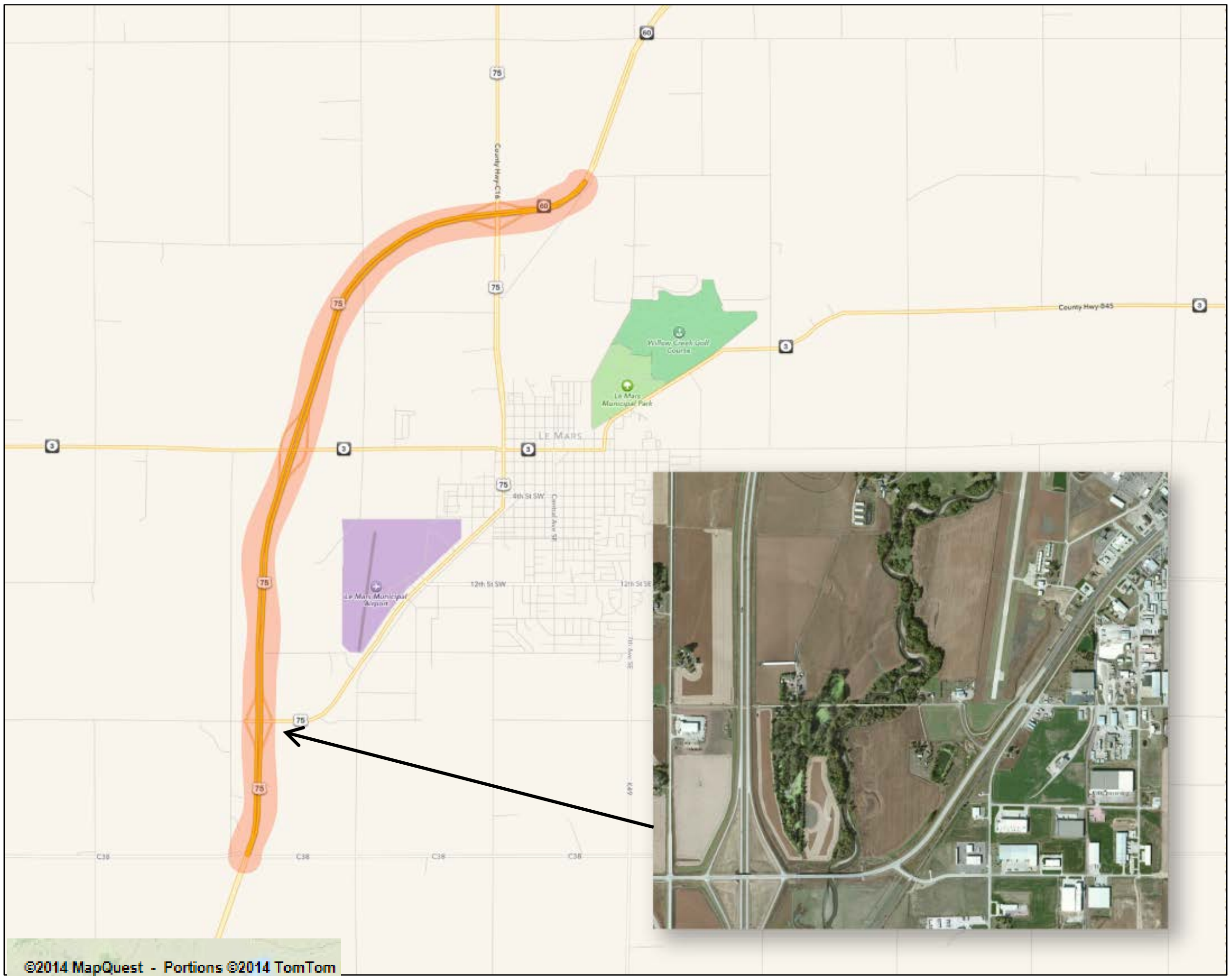


Figure 3.12. W-4: Iowa 60/US-75 Le Mars Corridor.

Project Description

The Iowa 60/US-75 Le Mars corridor, illustrated in Figure 3.12, is a diagonal northeast/southwest freeway, once two lanes and now four lanes, between Sioux City, Iowa and Worthington, Minnesota. The project was completed in 2004. It provides an easier route between Sioux City, Albert Lea in Minnesota, and on up to Minneapolis.

US-75 continues as a freeway to the Woodbury County/Plymouth County line in Iowa, where it becomes an expressway. This expressway becomes a freeway bypass of the city of Le

Mars. North of Le Mars, US-75 exits off the freeway bypass, which continues on as Iowa Highway 60, and turns north. US -75 continues as a two-lane, undivided highway passing through Sioux Center and Rock Rapids before leaving the state north of Iowa Highway 9.

The segment from the Missouri River to Le Mars is part of a larger expressway project, which will eventually provide a direct connection between Sioux City and the Twin Cities metropolitan area in Minnesota.

In Minnesota, US-75 stays very close to the state's western border passing primarily through small rural towns. US-75 enters Minnesota south of Luverne near Ash Creek, and passes though Pipestone, Canby, and Breckenridge.

Figure 3.18 below shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.6. Comparison Table for Iowa 60/US-75 Le Mars Corridor

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Total Impacts	14,457 to 24,094	$680,000 to $1,132,000	$2,144,000 to $3,573,000
Alt. Method 3: REMI TranSight			
Total Impacts	-27	-$4,000	$3,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection Factors	Widening, Great Lakes/Plains, Rural, Non-Distressed, 96 miles		

Sliding Scale Settings

The slider settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect supportive policies given the zoning and development plans in place at the time of the project's construction. Project documents and observations of the corridor influenced the position of the Infrastructure slider and the Business Climate slider. Figure 3.13 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

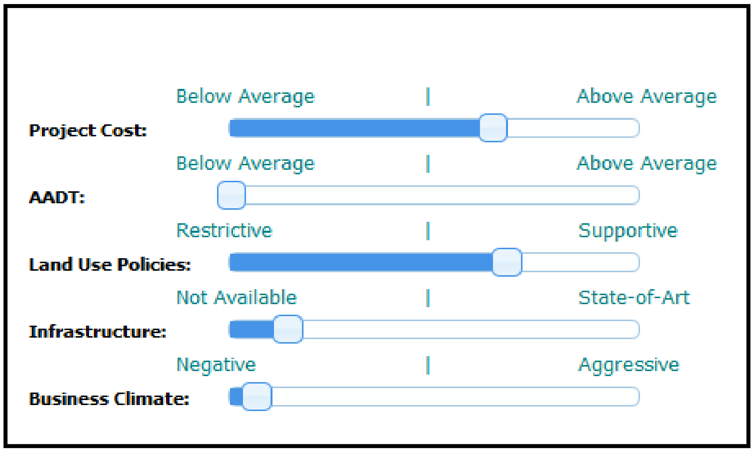


Figure 3.13. Sliding scale settings Iowa 60/US-75 Le Mars Corridor.

Project Analysis: Iowa 60/US-75 Le Mars Corridor

- This project shows the greatest difference in each of the three economic impact indicators. As shown in Figure 3.13, T-PICS estimates far exceed the estimates generated in the REMI TranSight alternative method. We believe that this discrepancy is attributable to the fact that the T-PICS model generates its output assuming a linear relationship between project size and impact, and so the characteristics of the project and its regional market may not have a direct influence on the magnitude of the estimates generated. (This project was entered into T-PICS as a 96-mile long improvement.) The

REMI model, on the other hand, does incorporate assumptions about urban/class level factors which may cause their estimates to deviate from those produced by T-PICS.

In the case of the Iowa 60/US-75 Le Mars Corridor project, REMI's model recognizes that the market area surrounding this project (northwest Iowa and environs) is generally smaller and more rural in nature. As a result, REMI's model generates relatively modest estimates of impacts on output and employment, even when the definition of the study area is broadened beyond Iowa's borders.

- The T-PICS slider to AADT seems not to be sensitive enough to handle a project like this one in a rural, uncongested part of northwestern Iowa. This project added a third and fourth lane to a highway that had no capacity issues even at two lanes, which means the project's limited impact on traffic volumes (and T-PICS inability to offer customizations to this level) lead to a large overestimation of the total impact of the project relative to the TranSight estimate. The lack of capacity improvement leading to significant increases in network performance from the travel-demand model also dampens the impact.

- The research team acknowledges that the REMI TranSight model may come with its own biases in projects located in rural or diminutive economies. The TranSight model makes certain assumptions based on certain economies of scale that are not difficult to imagine in New York, Chicago, or Los Angeles, but they are much harder to come by in rural Iowa or even in a small city like Sioux City.

Summary Graphic: Widening Projects (Excluding Appalachia Development Highway System projects)

Figure 3.14 shows the comparison for the four test case study widening projects we examined (excluding the four Appalachia Development Highway System projects, which are displayed in Figure 3.16) for the Employment economic indicator. The purpose of this graphic is to provide a visual representation of the degree to which the alternative analysis that we conducted generates an estimate that is within or outside of the range of the estimates that the T-PICS test estimated.

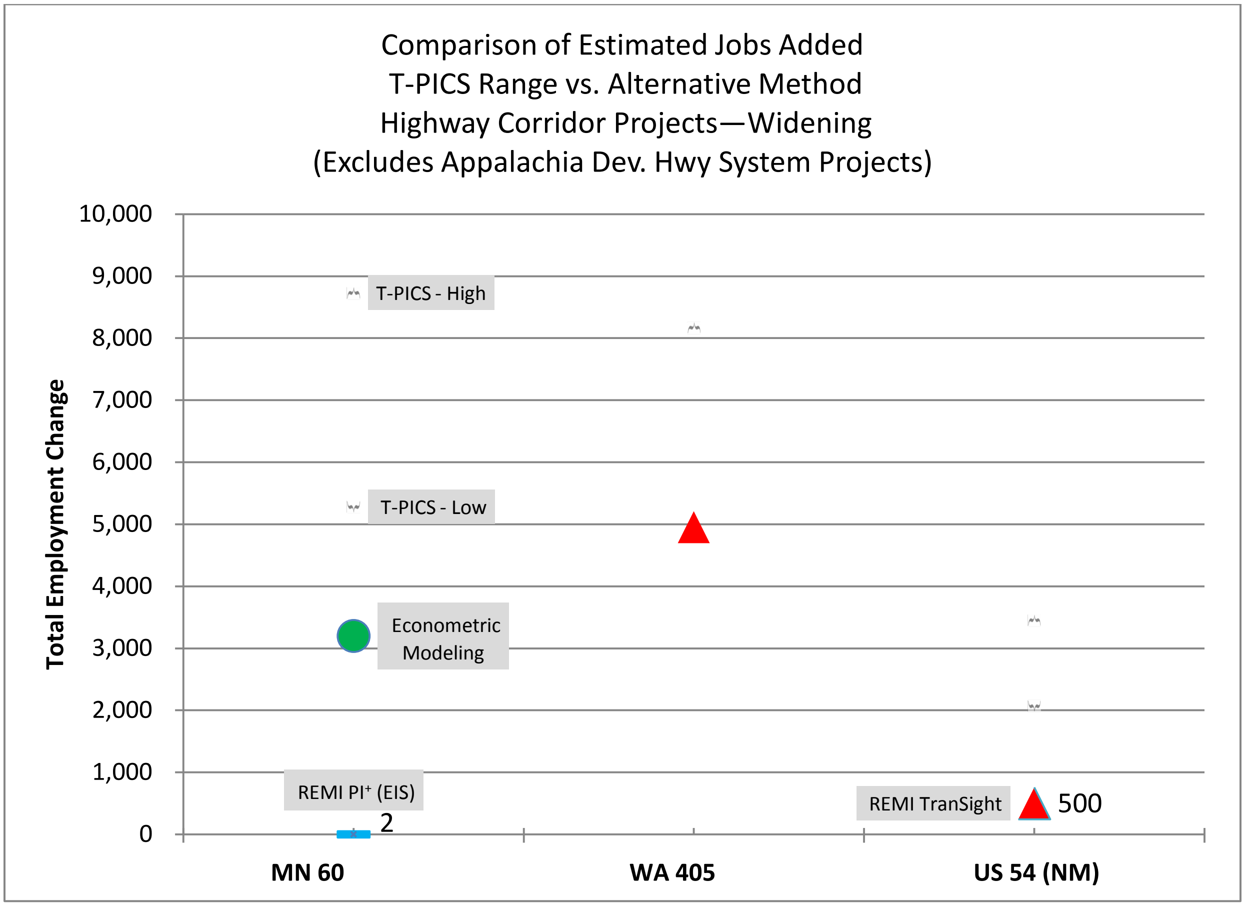


Figure 3.14. Comparison of estimated jobs added, T-PICS range versus alternative method, highway corridor projects: widening.

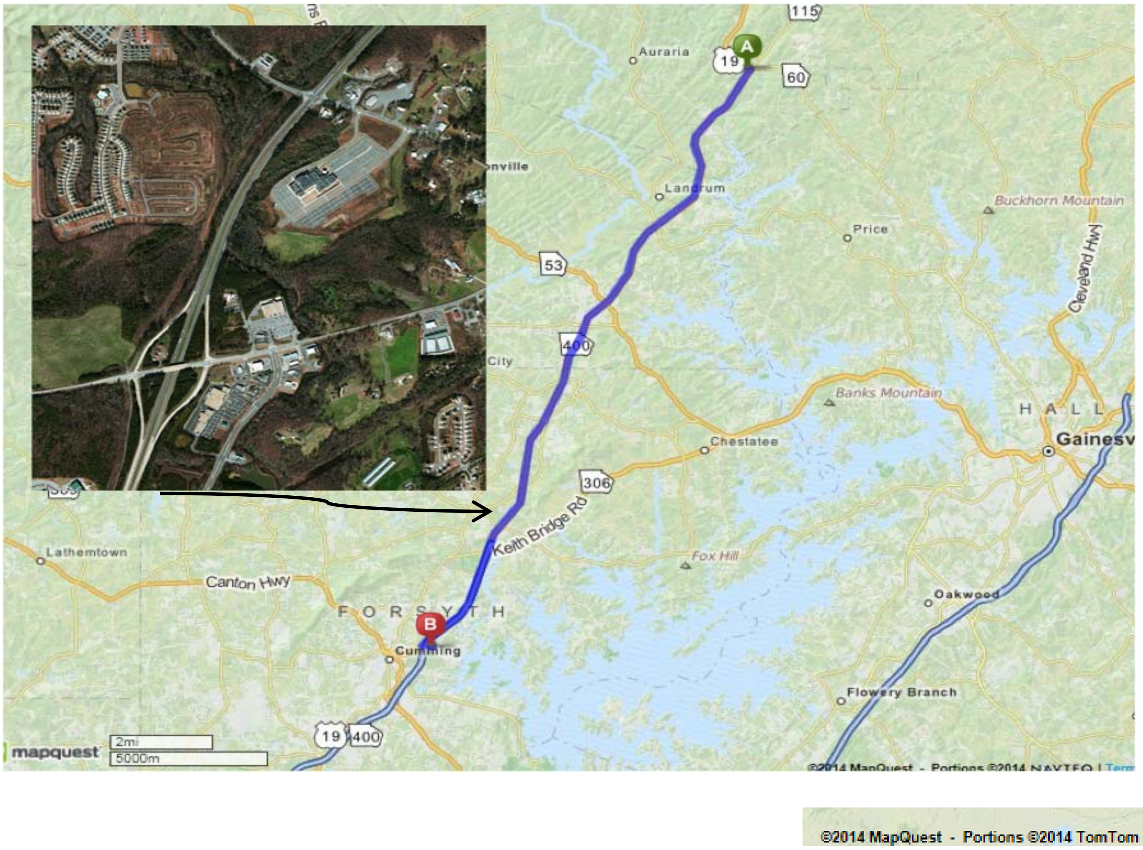


Figure 3.15. W-5: Appalachian Development Highway System (ADHS): Corridor A/A1.

Project Description

Corridor A-1, illustrated in Figure 3.15, uses Georgia State Route 400 from State Route 141 on its south end near Cumming, northeast to State Route 53. The corridor continues northeast along SR-400 as a four-lane highway from SR-53 to State Route 60 south of Dahlonega.

Table 3.7 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.7. Comparison Table for Appalachian Development Highway System (ADHS): Corridor A/A1, from Forsyth County Line, Georgia, to GA-60, South of Dahlonega, GA

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Total Impacts	3,029 to 5,048	137,400 to 229,000	425,600 to 709,400
Alt Method 3: REMI TranSight			
Total Impacts	3,578	276,000	532,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Within	Under	Within
T-PICS Basic Selection Factors	Widening, Southeast, Rural, Distressed, 30.4 miles		

Sliding Scale Settings

The sliding settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect neutral policies given the zoning and development plans in place at the time of the project's construction. Infrastructure is scaled toward Not Available to reflect the existing lack of utilities in place prior to development for much of the project area. The business climate is scaled to be at about the midpoint between negative and neutral, not due to any policy considerations, but because the region's topography and demographics do not favor strong economic viability. Figure 3.16 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

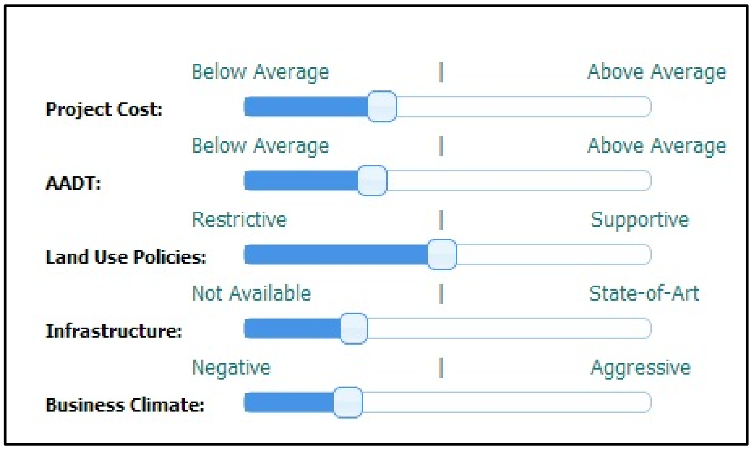


Figure 3.16. Sliding scale settings ADHS Corridor A/A1.

Project Analysis: Appalachian Development Highway System, Corridor A/A1

- The alternative method estimates for employment and output are within the range estimated by T-PICS, and the wages estimate is not off by a significant margin. The minor discrepancy on wages may be another example where the REMI TranSight model overestimates wage impacts due to its bias toward larger economies.
- Another factor that could explain T-PICS underestimation on increased wages for this specific project results from the model's linear relationship between project length and economic impact. This project's wage estimate is based on observed economic impacts of other Appalachian Development Highway System (ADHS) projects already contained in the database, and those projects are longer. As a result, T-PICS generates a lower economic impact estimate than the average ADHS project.

Figure 3.17. W-6: Appalachian Development Highway System: Corridor I.

Project Description

Corridor I, illustrated in Figure 3.17, is part of the Appalachian Development Highway System in the state of Kentucky. It runs from Interstate 64 southeasterly along the Mountain Parkway and Kentucky Route 15 to Corridor F (U.S. Highway 119) in Whitesburg. Corridor I meets Corridor R (Mountain Parkway) near Campton and future Interstate 66 (Hal Rogers Parkway and Kentucky Route 80) in the city of Hazard.

Table 3.8 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.8. Comparison Table for Appalachian Development Highway System (ADHS) Corridor I From Corridor F (US-119) at Whitesburg, KY, to State Route 30 at Jackson, KY (60 Miles)

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Total Impacts	5,426 to 9,043	246,200 to 410,300	762,500 to 1,270,800
Alt. Method 3: REMI TranSight			
Total Impacts	1,688	70,000	192,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection Factors	Widening, Southeast, Rural, Distressed, 60 miles		

Sliding Scale Settings

The sliding settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect neutral policies, given the zoning and development plans in place at the time of the project's construction. Infrastructure is scaled toward Not Available to reflect the existing lack of utilities in place prior to development for much of the project area. The business climate is scaled to be at about the midpoint between negative and neutral, not due to any policy considerations, but because the region's topography and demographics do not favor strong economic viability. Figure 3.18 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

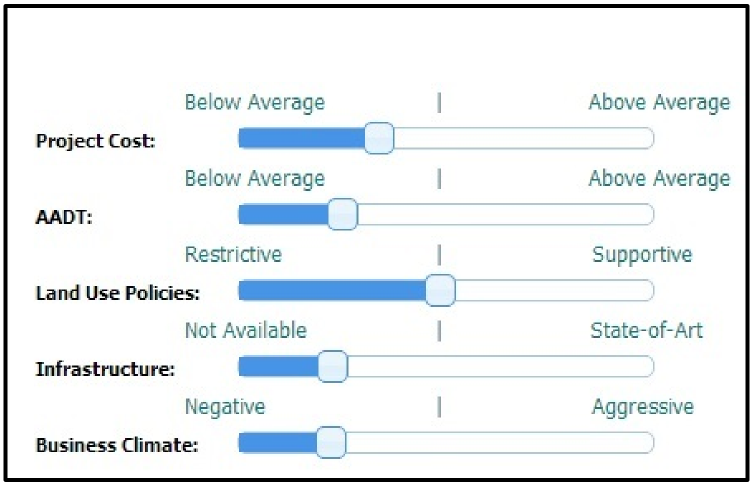


Figure 3.18. Sliding scale settings ADHS Corridor I.

Project Analysis: Appalachian Development Highway System, Corridor I

- Our analysis indicates that in the case of larger projects along the Appalachian Development Highway System, the T-PICS estimate of the economic impact tends to overestimate the economic benefit compared to our alternative analysis. Once again, we attribute this result to the rural greenfield phenomenon that we introduced in the analysis following project W-3, U.S. Route 54 in New Mexico. This project also occupies a significant stretch of undevelopable land. Since the economic impact results generated in T-PICS is largely dependent on the variable entered for Length of Project, this T-PICS estimate returns a much more substantial benefit than is likely to be observed.
- This project, along with some of the others that were examined, is representative of an issue that merits discussion as the T-PICS tool continues to be developed. This issue is more fully detailed in the recommendations contained in Chapter 4, but, briefly put, our findings indicate that the T-PICS tool's estimates of economic impact are compromised by the current classification requirement to classify a project as rural, metro, or mixed. These designations are unclear and overly broad, and, due to the distribution of the

existing T-PICS case studies, can generate results based on outcomes of other projects that are dissimilar in terms of their actual market size.

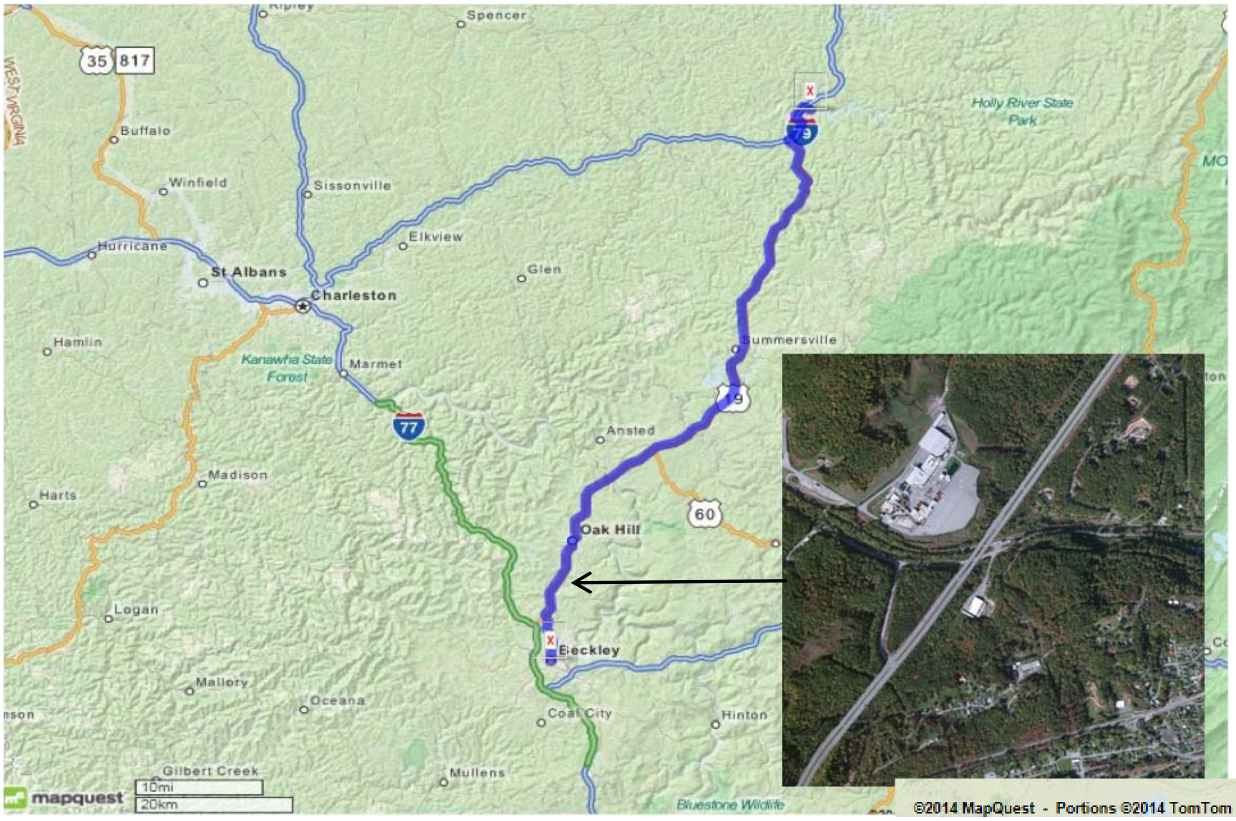


Figure 3.19. W-7: Appalachian Development Highway System (ADHL): Corridor L.

Project Description

Corridor L, illustrated in Figure 3.19, is part of the Appalachian Development Highway System in the state of West Virginia. It follows U.S. Route 19 between Beckley and Sutton. By exiting onto Corridor L from Interstate 79 at its north end, a southbound traveler can eliminate 40 miles re-entering the interstate system at the West Virginia Turnpike, at the junction of Interstate 64 and Interstate 77.

Originally this corridor was built as a four-lane divided highway for only the south half of U.S. Route 60; however, the large amount of freight and other traffic coming from the north (as part of the direct route from the cities of Toronto, Buffalo, and Pittsburgh to points south) required the state to reevaluate this plan and upgrade the northern half to four lanes as well.

Table 3.9 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.9. Comparison Table for Appalachian Development Highway System (ADHS): Corridor L, from I-77 at Beckley, WV, to I-79 at Sutton, WV

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Total Impacts	5,426 to 9,043	246,200 to 410,300	$762.5 to $1,270.8
Alt. Method 3: REMI TranSight			
Total Impacts	3,208	179,000	383.0
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection Factors	Widening, Southeast, Rural, Distressed, 60 miles		

Sliding Scale Settings

The sliding settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect neutral policies given the zoning and development plans in place at the time of the project's construction. Infrastructure is scaled toward Not Available to reflect the existing lack of utilities in place prior to development for much of the project area. The business climate is scaled to be at about the midpoint between negative and neutral, not due to any policy considerations, but because the region's topography and demographics do not favor strong economic viability. Figure 3.20 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

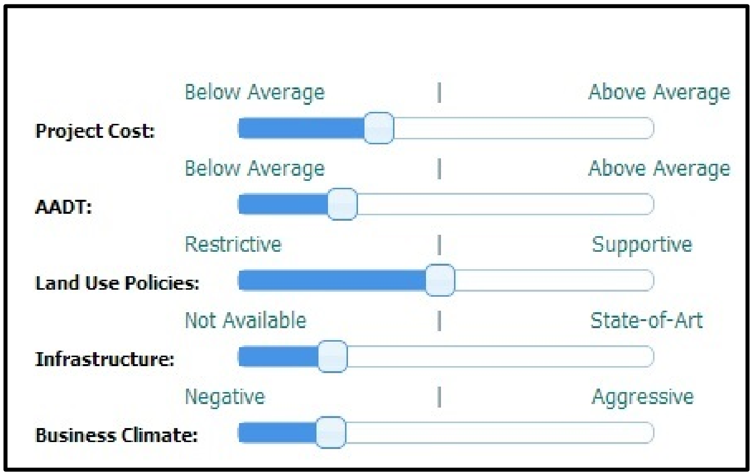


Figure 3.20. Sliding Scale Settings ADHS Corridor L.

Project Analysis: Appalachian Development Highway System, Corridor L

- Although the T-PICS estimate exceeds the alternate method for all three economic indicators, the comparison for employment and wages is relatively close. The T-PICS estimate for output, however, is significantly greater than the estimate generated by the REMI model. We attribute this discrepancy to the fact that the industries located along this corridor (which is located in close proximity to national park and forest lands) are low productive industries such as services, retail, and tourism. Therefore, one would not expect any economic growth resulting from the improvement to show the same level of impact in terms of total economic output as a region with high productive industries. (See the analysis on project W-2, Washington State Route 405.)

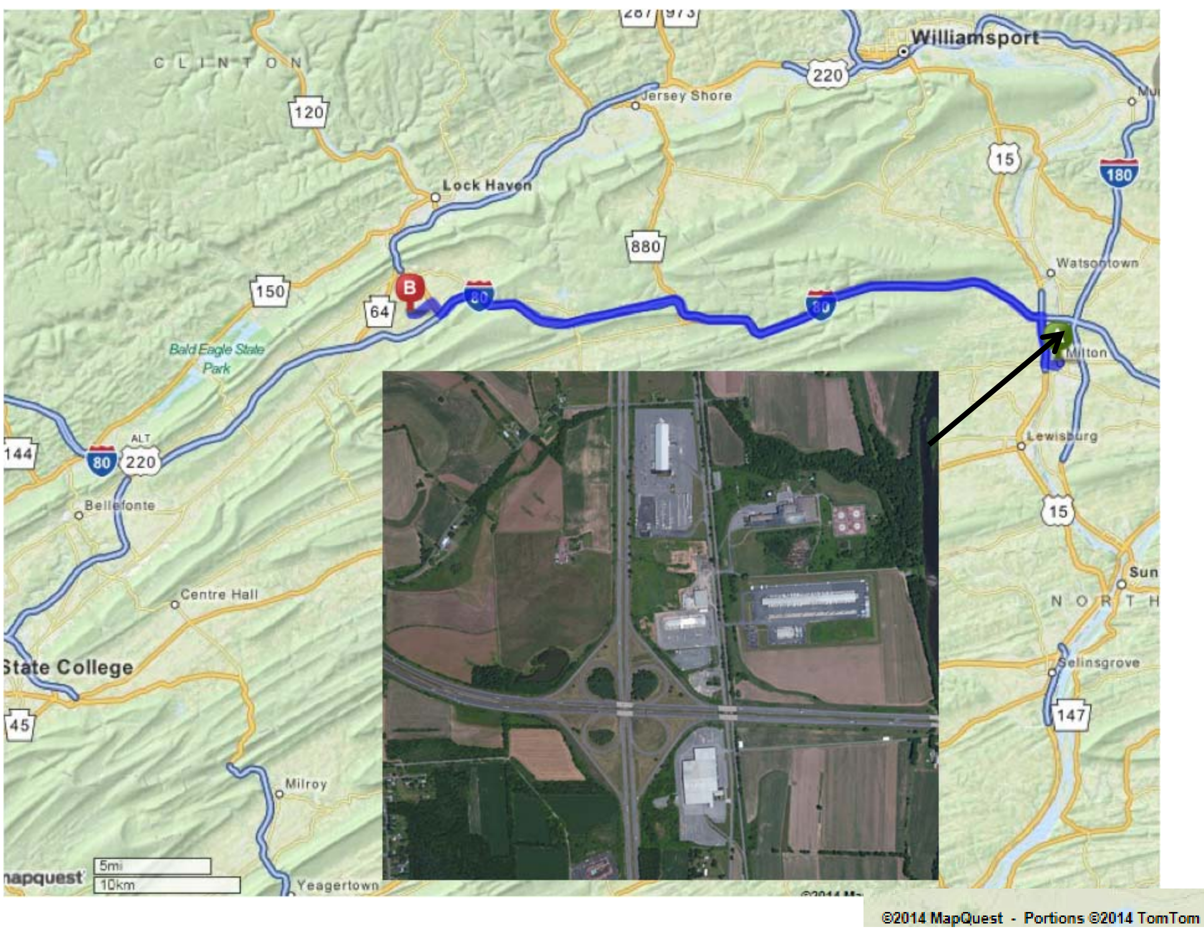


Figure 3.21. W-8: Appalachian Development Highway System (ADHS): Corridor P.

Project Description

Corridor P, illustrated in Figure 3.21, is a part of the Appalachian Development Highway System in Pennsylvania, running along Interstate 80 from near Mackeyville, eastward to Milton. Table 3.10 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.10. Comparison Table for Appalachian Development Highway System (ADHS), Corridor P, I-80, near Mackeyville, PA to I-80 near Milton, PA

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Total Impacts	4,775 to 7,958	236,400 to 394,000	685,300 to 1,142,200
Method 3: REMI TranSight			
Total Impacts	5,724	294,000	772,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Within	Within	Within
T-PICS Basic Selection Factors	Widening, New England/Mid Atlantic, Rural, Distressed, 55 miles		

Sliding Scale Settings

The slider settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect neutral policies given the zoning and development plans in place at the time of the project’s construction. Infrastructure is scaled toward “Not Available” to reflect the existing lack of utilities in place prior to development for much of the project area. The business climate is scaled to about the midpoint between negative and neutral, not due to any policy considerations, but because the region's topography and demographics do not favor strong economic viability. Figure 3.22 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

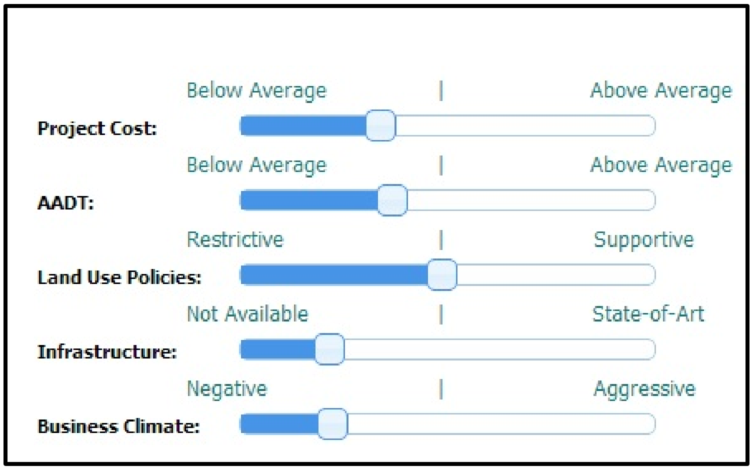


Figure 3.22. Sliding scale settings ADHS Corridor P.

Project Analysis: Appalachian Development Highway System – Corridor P

- Of the 14 projects analyzed in this research, this is the project that has the best fit comparing the TranSight's simulation results with the T-PICS estimate—all three indicators are aligned. We attribute this to the fact that Corridor P's characteristics are the most average of any of the Appalachian Development Highway System, in terms of project length and cost. Therefore, one would expect that the T-PICS existing slate of other ADHS projects would generate an economic impact estimate that reflects the actual economic activity along this corridor.

Summary Graphic: Widening Projects (Appalachia Development Highway System projects)

Figure 3.23 shows the comparison for the four Appalachia Development Highway System widening projects we examined for the Employment economic indicator. The purpose of this graphic is to provide a visual representation of the degree to which the alternative analysis generates an estimate that is within or outside of the range of the estimates that the T-PICS test estimated.

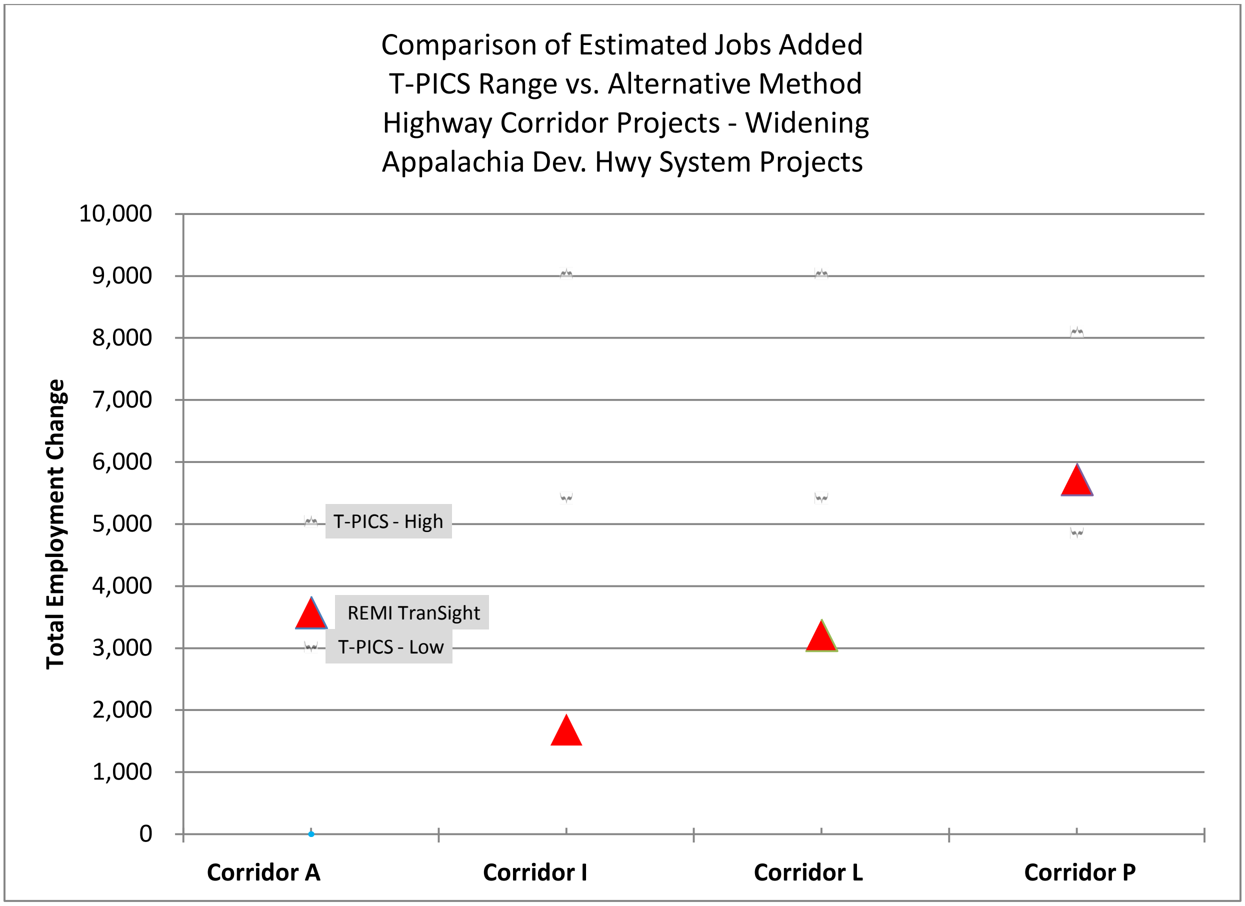


Figure 3.23. Comparison of estimated jobs added, T-PICS Range vs. Alternative Method, in ADHS widening projects.

Bypass Projects

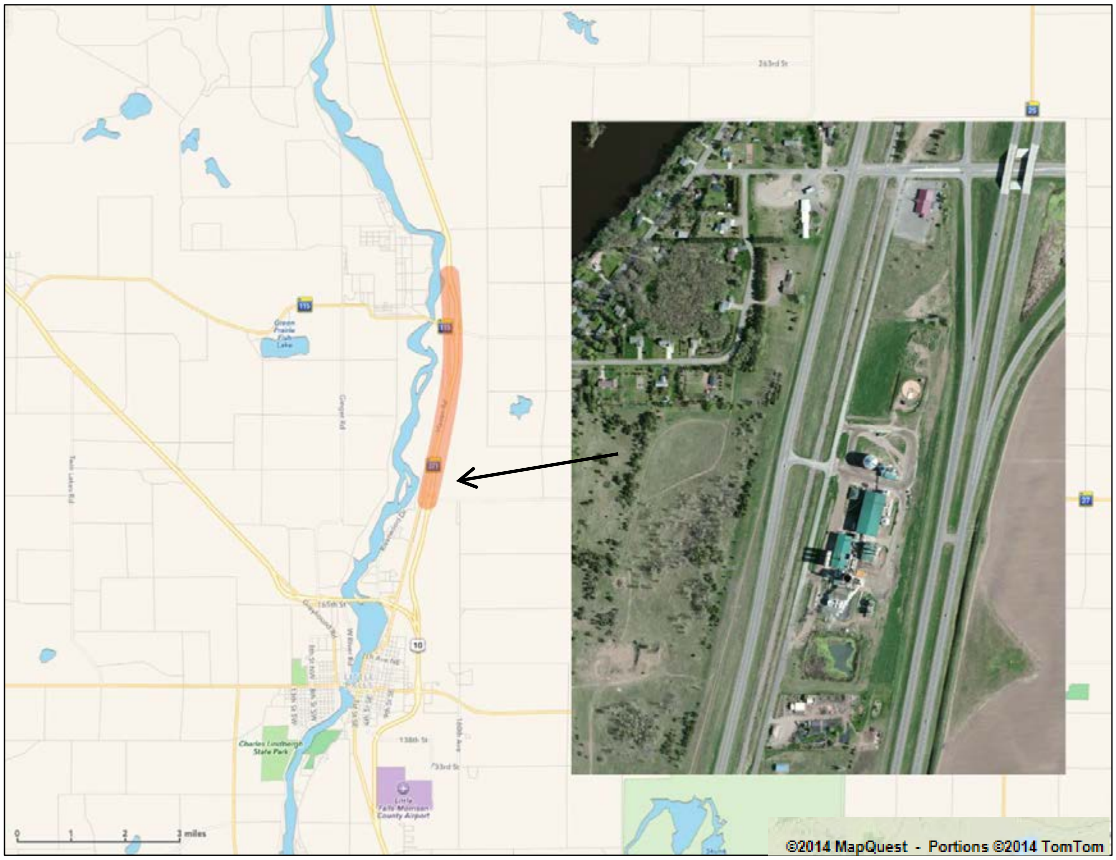


Figure 3.24. B-1: Minnesota 371 Little Falls to Brainerd.

Project Description

Minnesota Trunk Highway 371, illustrated in Figure 3.24, is located in central Minnesota, about 105 miles northwest of Minneapolis. The project extends from County State Aid Highway (CSAH) 46 north of the city of Little Falls to a half mile north of CSAH 48 for a length of 4 miles. The project is located entirely within Morrison County. The project consisted of an expansion from two lanes to four lanes, meeting applicable standards for a 75 mph design speed and controlled access. MN-371 has become a heavily-traveled arterial route that was once a two-lane roadway over almost all of its length, but has been widened to four lanes across most of its southern half. Much of the traffic utilizing the route is Twin Cities–based traffic heading to cabins on one of the many northern lakes. The project was completed in two phases. The first phase, from CSAH-48 to the south end of the proposed Brainerd Bypass, began construction in 2003. The second phase, from CSAH 48 to CSAH 2, began construction in 2004.

Table 3.11 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.11. Comparison Table for MN TH-371/Brainerd Pass

T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Direct Impacts	292 to 486	$9,300 to $15,500	$29,500 to $49,100
Supplier and Wage Impacts	20 to 33	$5,400 to $9,000	$16,700 to $27,900
Total Impacts	312 to 519	$14,600 to $24,400	$46,200 to $77,000
Alt. Method 2: EIS/ REMI PI+			
Total Impacts	11	-$109	$2,780
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
Alt. Method 4: Reduced Form Econometric Modeling of Income and Employment			
Total Impacts	1,169 range: (-2,080 to 4,419)	$6,139 range: (-$64,791 to $77,070)	$2,881 range: (-$112,572 to $118,344)
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Under	Over	Over

T-PICS Basic Selection Factors	Bypass, Great Lakes, Rural, Non Distressed, 4 miles

Sliding Scale Settings

The slider settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect neutral policies given the zoning and development plans in place at the time of the project's construction. Project documents and observations of the corridor influenced the position of the Infrastructure and the Business Climate sliders. Figure 3.25 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

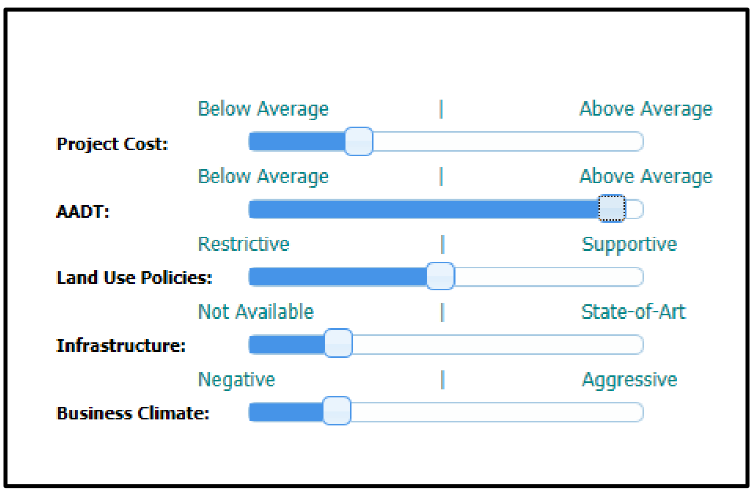


Figure 3.25. Sliding scale settings MN-371 Brainerd Bypass.

It is important to note that actual AADT levels observed after the project's completion (approximately 9,000) significantly exceed the estimate generated by T-PICS (3,924), even when the AADT slider is adjusted as far above average as allowable. While this restriction on the estimated AADT generated in T-PICS has only a very minimal influence on the ultimate economic impact estimate, our recommendations in Chapter 4 include the suggestion that an automatic notification be provided to the user that in those cases in which AADT projections require sliding the AADT slider all the way to the right (above average) the resulting estimate of AADT should clearly indicate that the actual AADT is likely be a greater number than the projection indicated.

Project Analysis: MN TH-371 / Brainerd Bypass

- The comparison of results from the three methods reveals that T-PICS produces estimates of impacts that are generally larger than those generated by the REMI PI$^+$ model and smaller than those generated by the individual, single-equation models for each of the impact measures (Method 4). (The Method 4 estimate generates a range with a 95% confidence interval, the midpoint of which is the median, and falls relatively close to the Method 2 estimate.) The smaller estimates generated by the REMI PI$^+$ model likely reflect assumptions about increased productivity and fewer labor inputs as a result of the highway improvement. The absence of a similar model structure and feedback mechanism among the other two methods leads them to generate higher estimates of both wages and output.
- Many academic studies have concluded that rural bypasses do not typically generate significant economic growth in the communities that are bypassed. One notable study conducted by Dan Otto and Connie Andersen of Iowa State University in 1993 examined the economic impact of rural highway bypasses in Iowa and Minnesota over a 6-year period. Its conclusion is consistent with the lower estimated impacts generated by the EIS REMI modeling method, finding minor redistributional effects—a gain in sales in the service sector and some decline in the highway-oriented businesses. Efficiency

gains would reduce the number of transportation workers, but overall employment would increase slightly as individuals move to the area for the higher quality of living associated with less congestion and quicker commutes. (See the references section for citation.)

- The REMI model expects the reduced labor costs due to the reduction in transportation workers will be greater than the additional wages earned by workers who migrate to the region.

Figure 3.26. B-2: Minnesota US-71/MN-23 Including Wilmar Bypass.

Project Description

The primary purpose of the Trunk Highway 23 reconstruction project, illustrated in Figure 3.26, was to address the safety, traffic operations, access, design infrastructure, roadway conditions and operational deficiencies identified by Minnesota Department of Transportation (MnDOT). Design deficiencies included factors such as limited passing opportunities, uncontrolled accesses, unsatisfactory intersection geometry, limited sight distances, and non-motorized versus motorized vehicle conflicts in developed areas.

The US-71/Minnesota TH Highway 23/Willmar Bypass was proposed as a four-lane freeway-grade bypass of the city of Willmar—a city with a 2010 population of around 20,000. Work on the project began in 1978, widening a 5-mile segment of US-71 and MN TH-23 just north the city. Funding constraints delayed the completion of the four-lane Willmar bypass until the fall of 2001. Shortly after the bypass was finished, MnDOT expanded additional section of TH-23 from New London to four-lanes.

Table 3.12 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.12. Comparison Table of US-71/MN TH-23 Willmar Bypass

T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Direct Impacts	302 to 503	$8,100 to $13,500	$25,600 to $42,700
Supplier and Wage Impacts	-31 to -51	$4,700 to $7,800	$14,600 to $24,300
Total Impacts	271 to 452	$12,700 to $21,200	$40,200 to $67,000
Alt. Method 2: EIS/ REMI PI^{+}			
Total Impacts	2	-$7	$376
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			

Total Impacts	Over	Over	Over
Alt. Method 4: Reduced Form Econometric Modeling of Income and Employment			
Total Impacts	229 range: (-780 to 1,239)	-2,172 range: ($-31,197 to $26,853)	$7,343 range: ($-27,904 to $42,591)
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection Factors	Bypass, Great Lakes, Rural, Non-distressed, 5 miles		

Sliding Scale Settings

The slider settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect somewhat restrictive policies given the zoning and development plans in place at the time of the project's construction. Project documents and observations of the corridor influenced the position of the Infrastructure and the Business Climate slider. Figure 3.27 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

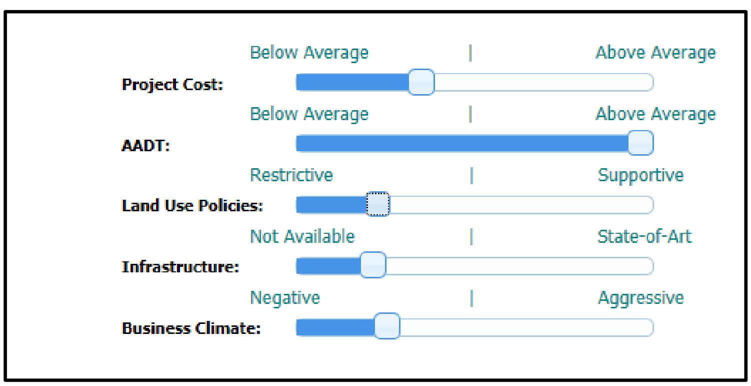


Figure 3.27. Sliding scale settings US-71/MN-23 Willmar Bypass.

It is important to note that actual AADT levels observed after the project's completion (approximately 6,000) significantly exceed the estimate generated by T-PICS (4,007), even when the AADT slider is adjusted as far above average as allowable. While this restriction on the estimated AADT generated in T-PICS has only a very minimal influence on the ultimate economic impact estimate, our recommendations in Chapter 4 include the suggestion that an automatic notification be provided to the user that in those cases in which AADT projections require sliding the AADT slider all the way to the right (above average) the resulting estimate of AADT should clearly indicate that the actual AADT is likely be a greater number than the projection indicated.

Project Analysis: US-71/MN TH-23 Willmar Bypass

- Similar to the results from the TH-371/Brainerd Bypass case study, the impact estimates generated by T-PICS are more similar to those from the Method 4 single-equation models of employment, wages, and income than to the estimates resulting from the REMI PI^{+} model. (The Method 4 estimate generates a range with a 95% confidence interval, the midpoint of which is the median and falls relatively close to the Method 2 estimate.) These results most likely reflect the assumptions about factor substitution in the production processes of individual industries that limit wage and employment impacts in the REMI PI^{+} model. The other two methods either explicitly or implicitly assume that efficiency gains associated with the project's completion will scale with the size of the project without an accompanying reduction in labor inputs. The larger range of estimates produced by Method 4 capture the effects of the recent recession in the data set from which the impacts were estimated. The results of these effects were less accurate estimates and a larger confidence band, which includes the possibility of negative impacts on employment and output.

- The analysis following project B-1, the MN Trunk Highway 371 Brainerd Bypass, is all relevant for this project as well. T-PICS tends to overestimate the economic impacts for rural bypass projects. The 2003 Otto/Anderson study cited above concluded that rural bypasses do not typically generate significant economic growth in the communities that are bypassed. Its conclusion is consistent with the lower estimated impacts generated by the EIS REMI modeling method for rural bypass projects, finding minor re-distributional effects—a gain in sales in the service sector and some decline in the highway-oriented businesses. Efficiency gains would reduce the number of trucking and other highway-oriented transportation workers, but overall employment would increase only slightly as individuals move to the area for the higher quality of living associated with less congestion and quicker commutes. The REMI model expects the reduced labor costs due to the reduction in transportation workers will be greater than the additional wages earned by workers who migrate to the region.

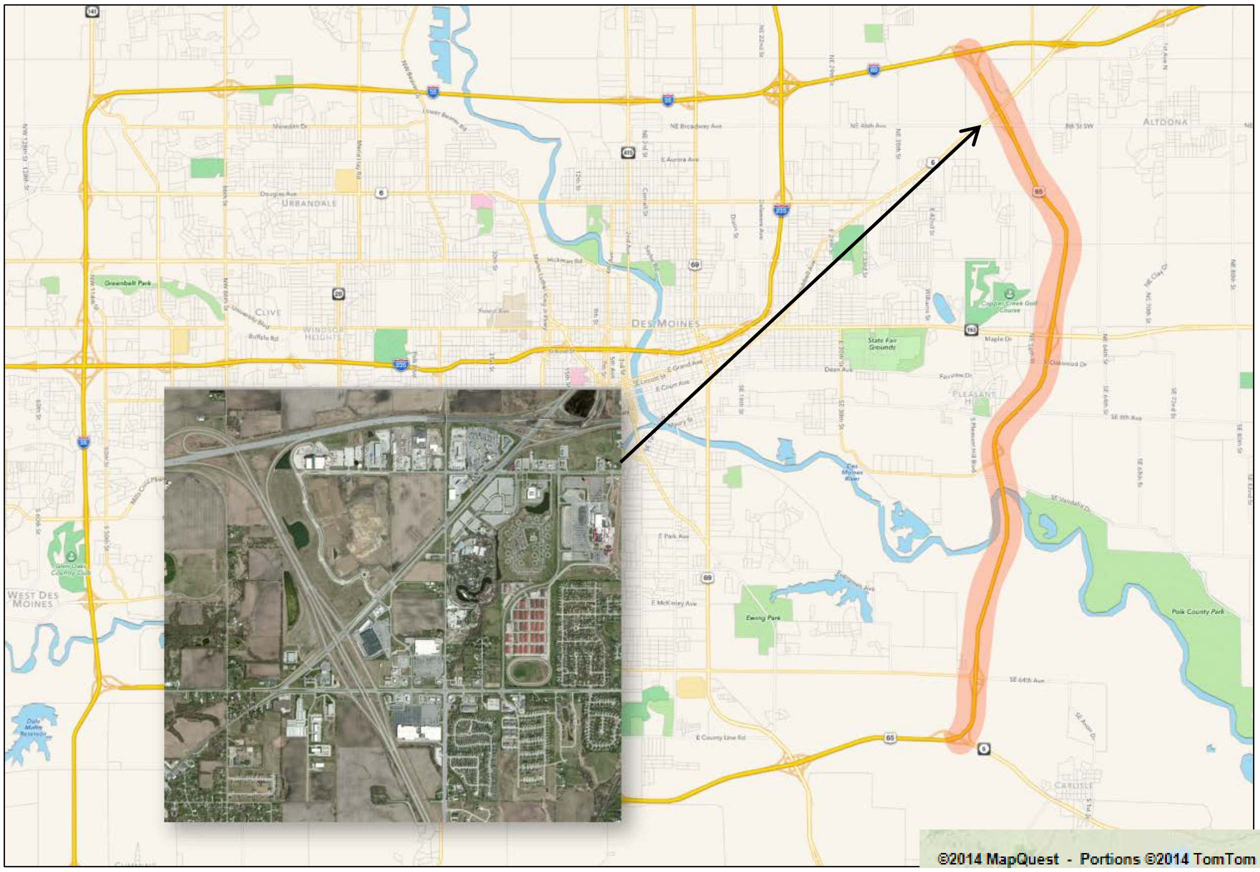


Figure 3.28. B-3: Iowa 5/US-65 Beltway (Bypass) from W Jct 5/65 to I-80.

Project Description

The Iowa 5/US-65 Beltway project, illustrated in Figure 3.28, opened in 1997 and, although the term “beltway” is used in its title, the project is essentially a “half-beltway” from I-35 in the south of Des Moines to the growth of I-80 on the eastern side. (This project is more accurately classified as a bypass in the T-PICS terminology.) This highway provides a foundation for a future three-quarters beltway, a reliever valve to freight traffic from going through I-80/I-35 through the center of Des Moines on the way between Chicago and Kansas City, and superb access into Des Moines International Airport. It also connects into freight centers on the eastern side of the city in Altoona, Iowa and Pleasant Hill, Iowa.

Table 3.13 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.13. Comparison Table for Iowa 5/US-65 Beltway (Bypass) from W Junction 5/65 to I-80

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Direct Impacts	1,174 to 1,957	$43,400 to $72,300	$137,900 to $229,800
Supplier and Wage Impacts	283 to 472	$25,200 to $41,900	$78,300 to $130,500
Total Impacts	1,458 to 2,430	$68,500 to $114,200	$216,200 to $350,300
Alt. Method 3: REMI TranSight			
Total Impacts	1,897	$77,000	$314,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Within	Within	Within
T-PICS Basic Selection Factors	Bypass, Great Lakes/Plains, Metro, Non-Distressed-only, 14 miles		

NOTE: This project is referred to in official planning documents as the Northeast Beltway. (See http://www.polkcountyiowa.gov/media/30898/appendixa-ne.pdf). Initially, the project type for this project was designated as a beltway, as opposed to a bypass. We ultimately modified its designation to bypass, which we concluded more accurately describes the motivation of this project. The designation of project types for highway corridor projects is addressed in recommendation F in Chapter 4 of this report.

Sliding Scale Settings

The slider settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was scaled to reflect slightly restrictive policies given the zoning and development plans in place at the time of the project's construction. Project documents and observations of the corridor influenced the position of the Infrastructure and the Business Climate slider. Figure 3.29 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

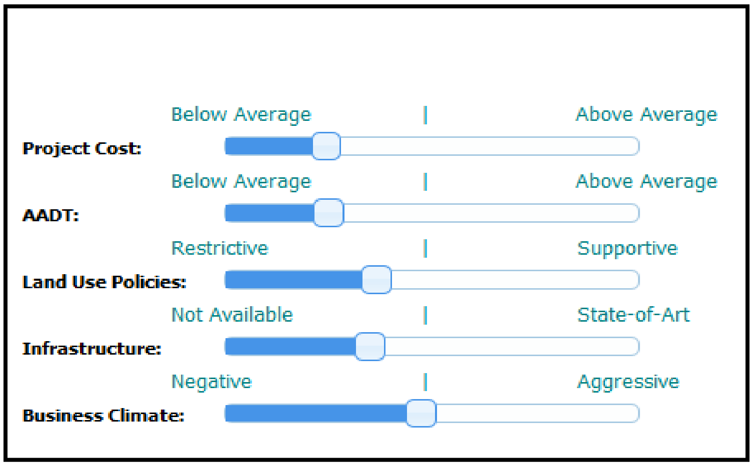


Figure 3.29. Sliding scale settings Iowa 5/US-65 Beltway.

Project Analysis: Iowa 5/US-65 Beltway (Bypass) from W Junction 5/65 to I-80

- The US-65/Iowa-5 beltway is not a true beltway, but rather a half beltway around only the south and east of Des Moines. A fuller beltway to encircle the whole of the city would logically have a larger impact, making this project a "tweener" relative to other projects in the T-PICS database, since it has some features of a beltway, some features of a bypass of downtown and suburban Des Moines, and some features of a connector between I-35 and I-80.

- The T-PICS results generated from this project run align very well with the economic impact estimates generated by the REMI TranSight model run. The consistency between the output of the two methodologies is likely due to the fact that this project is located in a metro area where development patterns are relatively well defined. The T-PICS database presently contains sufficient numbers of similar projects from which it derives its estimate of economic impacts to closely align with the alternative method that we modeled.
- This project was constructed with an economic development objective in mind, so the favorable economic impacts projected by T-PICS are consistent with the actual impacts observed and estimated by the alternative analysis. The project offers an advantage to freight by providing a route around the congested I-35/I-80 passages through downtown Des Moines when passing between Kansas City, Chicago, and even Omaha/Denver and Minneapolis. This route also greatly improves access into the growing Des Moines International Airport. The Iowa travel demand model does not include these long-range linkages, so it may be missing these freight effects on industry.

Summary Graphic: Bypass Projects

Figure 3.30 shows the comparison for the three bypass projects we examined for the "Employment" economic indicator. The purpose of this graphic is to provide a visual representation of the degree to which the alternative analysis that we conducted generates an estimate that is within or outside of the range of the estimates that the T-PICS test estimated.

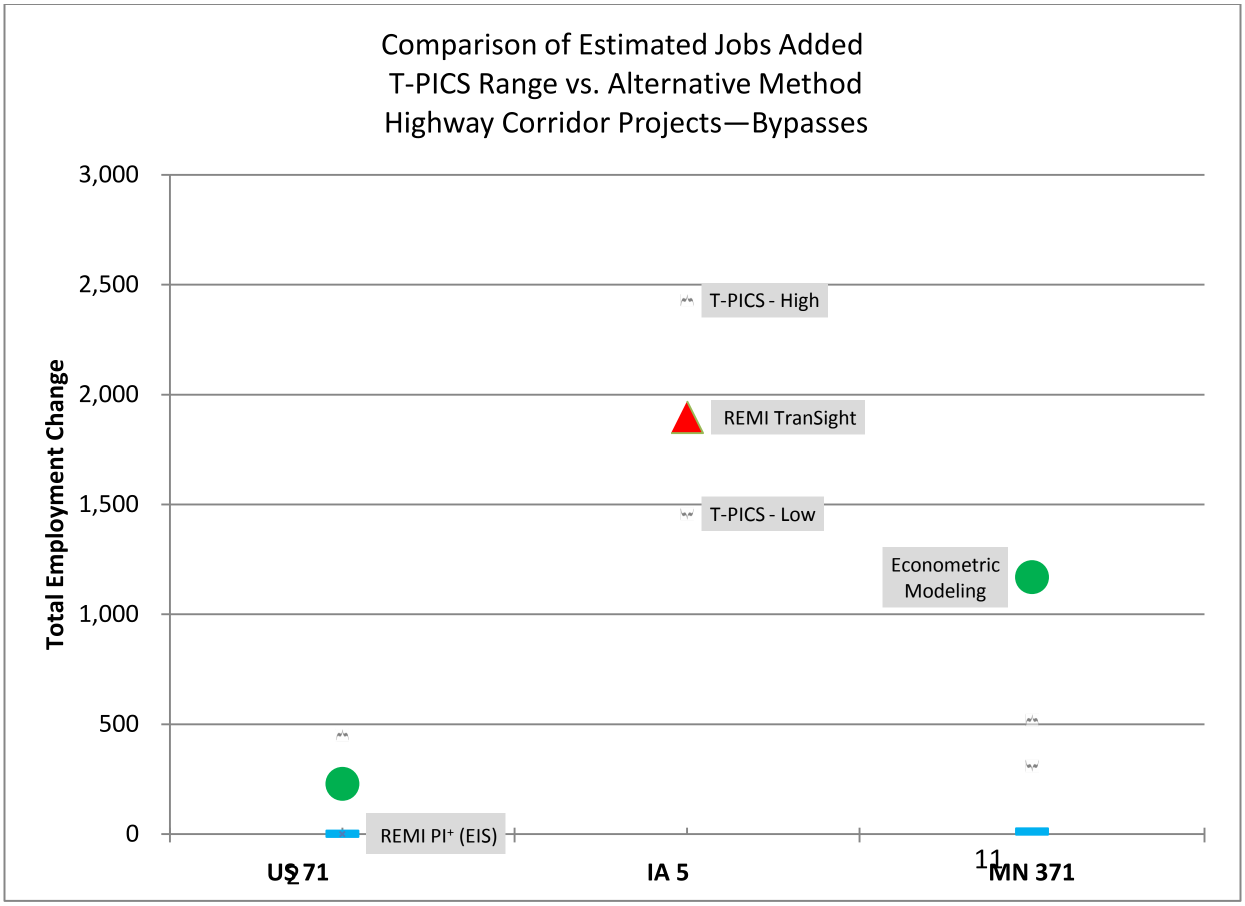


Figure 3.30. Comparison of estimated jobs added in highway corridor projects: bypasses

Connector Projects

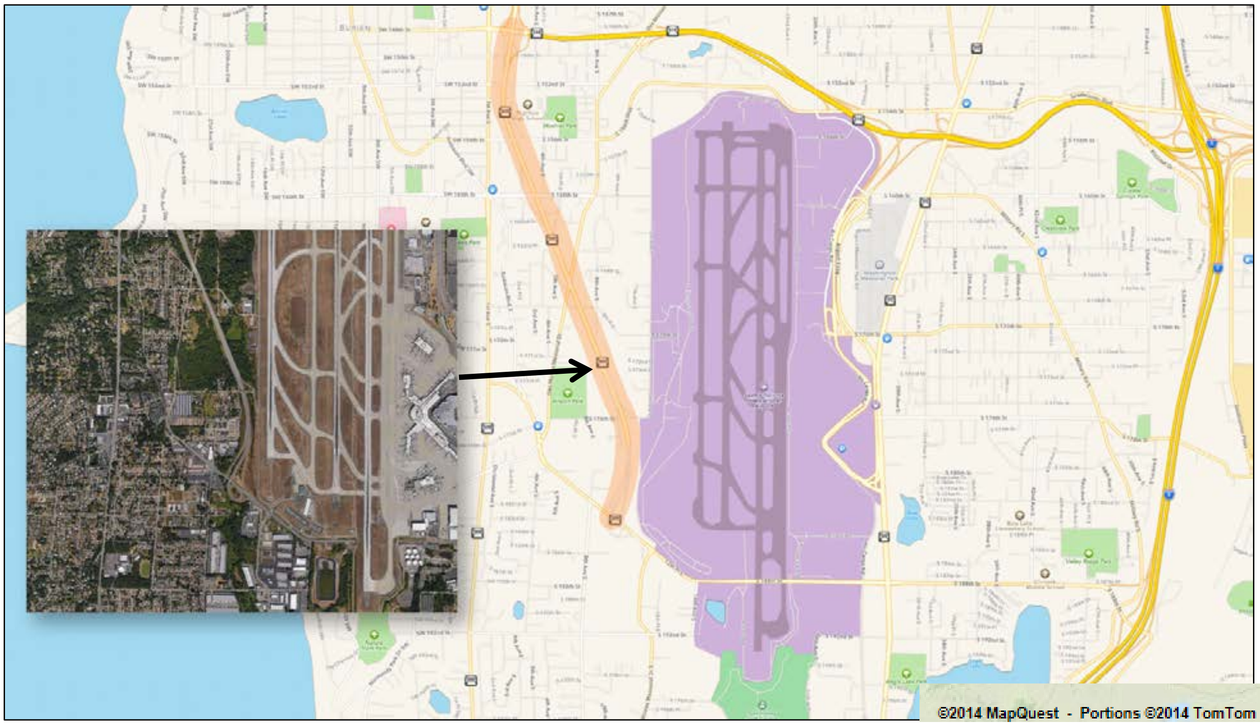


Figure 3.31. C-1: Washington State: State Route 509.

Project Description

The Washington State Route (SR) 509 project, illustrated in Figure 3.31, was completed in 2004 and helped to relieve congestion on Interstate 5 (the major north-south corridor through the Seattle-Tacoma metropolitan area) and to improve freight movement in south King County. The improvement consisted of completing SR-509 as a six-lane freeway with high occupancy vehicle (HOV) lanes between Interstate 5 and South 188th Street immediately adjacent to the SeaTac International Airport. SR-509 also provides substantial peak-hour travel time savings for commuters and other users.

Table 3.14 shows the results of the comparison of the economic impact estimates for the T-PICS model test to our alternative analysis test.

Table 3.14. Comparison Table for Washington State, State Route 509

T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Total Impacts	2,053 to 3,422	$119,700 to $199,500	$324,.000 to $540,100
Alt. Method 3: REMI TranSight			
Total Impacts	2,111	290,000	367,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Within	Under	Within
T-PICS Basic Selection Factors	Connector, Rocky Mountain / Far West, Metro, Non-Distressed-Only, 2 miles		

Sliding Scale Settings

The sliding settings were scaled to reflect the appropriate cost and AADT levels. The Land Use Policies slider was placed at neutral, given the proximity to the airport, which might attract some business but which would deter or prohibit others. Infrastructure is scaled toward state of the art to reflect the existing presence of utilities in place prior to development for much of the project area. The Business Climate slider is scaled to reflect neutrality. Figure 3.32 shows the placement of the settings used to derive the economic impact estimates in My Project Tools.

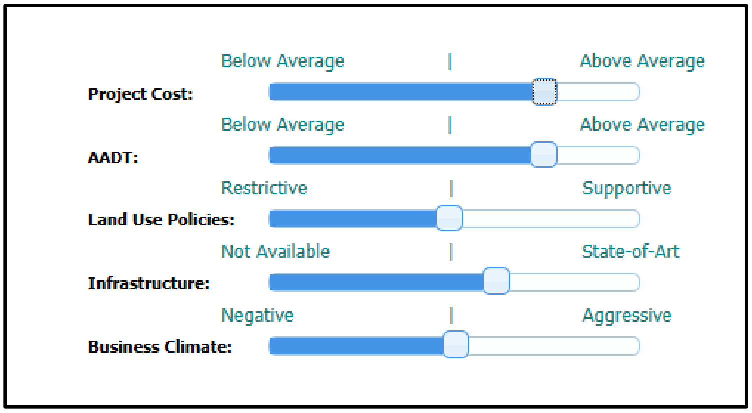


Figure 3.32. Sliding scale settings US-71/MN-23 Willmar Bypass

Project Analysis: Washington State Route 509

- The economic impact estimates on this project are relatively well aligned, matching on the jobs and output indicators. The wages indicator shows the alternative method estimate is about 30% above the T-PICS estimate. An examination of the eight existing connector project types presently included in the database reveals that the Washington SR-509 is similar in scope and scale to several of those projects.
- The research also suggests that T-PICS's estimate of economic impacts seems to be better aligned with the alternate method in cases classified as metro as opposed to mixed or rural. This finding is not unexpected, given that roughly 75% of the T-PICS case studies are classified as metro (which means that the project is located in a county that is part of an urban area with a population of 50,000) or mixed (which means that at least part of the project is located in a county that is part of an urban area with a population of 50,000). We further hypothesize that projects in metropolitan areas tend to be more homogenous in terms of their geographies, land availability, and population densities, which would suggest that their development potential is more uniform between projects relative to projects in rural areas.

Summary Graphic: Connector Project

Figure 3.33 shows the comparison for the connector project (Washington State SR-509) we examined for the Employment economic indicator. The purpose of this graphic is to provide a visual representation of the degree to which the alternative analysis that we conducted generates an estimate that is within or outside of the range of the estimates that the T-PICS test estimated.

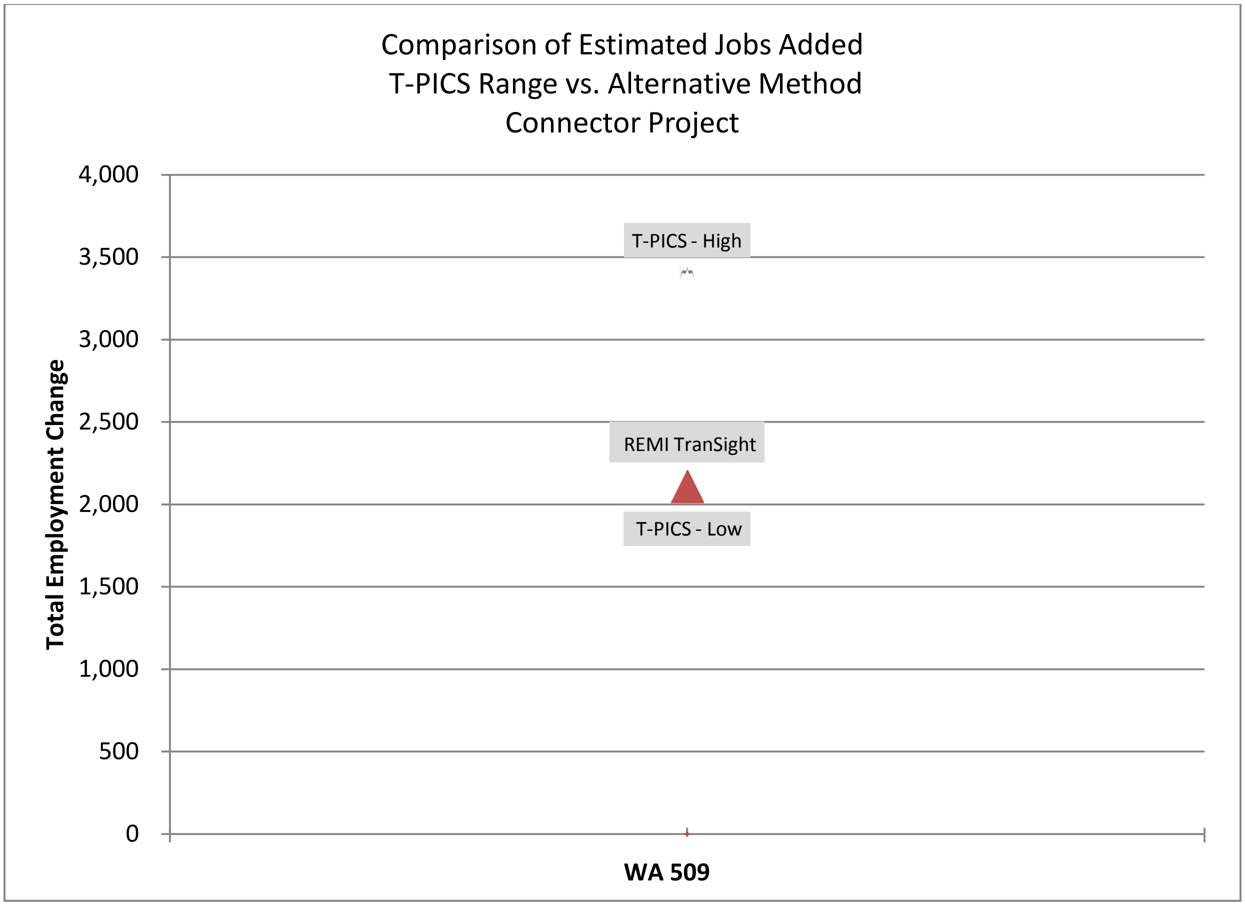


Figure 3.33. Comparison of estimated jobs added: Connector Project

Findings and Conclusions Highway Corridor Project Comparisons

The following list of findings and conclusions concern the 12 projects that we have classified under our recommended new broad heading of “Highway Corridor Projects.” These projects include the eight widening projects, the three bypass projects, and the one connector project.

1. The most fundamental issue related to our findings on the comparison between T-PICs economic impact estimates and those of our alternative methods is that neither T-PICS nor the most sophisticated econometric models are wholly equipped to predict how local transportation conditions specific to a given project will impact the potential economic outcomes with 100% certainty.

   Both tools are limited in their ability to predict economic impacts at a site-specific level. T-PICS uses its database of national projects to derive its estimates and makes no claims to be able to predict economic impacts based on local network traffic demand variables. More rigorous models that incorporate traffic demand factors can only analyze impacts at the county level or larger. Therefore, any tool that generates economic impact estimates will come with a level of statistical noise resulting from the specific circumstances of the project in question.

2. Overall, the analyses suggested that in the case of smaller highway corridor projects, T-PICS generally projected greater economic impacts than the comparative methodology. We attribute this to the fact that the preliminary estimates of economic impact generated by T-PICS are likely to be derived from a regression that incorporates projects of greater size, scale, and cost than many of the test case studies. In fact, when we attempted to make adjustments using the sliding scales on My Project Tools to the preliminary impact estimates based on project cost and traffic volume, the project costs for some of our projects were lower than any of the other projects in the database, meaning that the estimates could not be fully adjusted to reflect their smaller cost in the final estimates of total impact.

The test case study analysis performed on the Minnesota Trunk Highway 60 expansion project from Windom to Lake Heron is a case in point. A comparison of the Minnesota TH-60 test case study project with similar representative projects from the T-PICS database (e.g. I-70 Glenwood Canyon in Colorado and the Corridor J in Kentucky) revealed key differences that likely suggest why the economic impact results are so different. Most notably, the Minnesota TH-60 project was significantly smaller in terms of size and cost than the comparison projects from the T-PICS database. These differences appeared to be magnified in the estimates of total economic impacts generated by the My Project Tools application of T-PICS. These two projects both had significantly higher construction costs than the TH-60 expansion project in Minnesota. Corridor J is a much larger project, spanning over 200 miles and taking 14 years to complete. The Glenwood Canyon project was an extraordinarily expensive construction project owing to the need to negotiate some very difficult terrain and to tunnel directly through the canyon walls at certain points.

3. For longer widening projects, we found that T-PICS overstates the projected economic impact if the full length of the corridor is not readily developable (a rural greenfield). A case in point on this finding is the New Mexico US-54 test case study project, an 80-mile long corridor improvement, shown in Figure 3.32. Our alternative method analysis showed that economic impacts from the project's widening upgrade were relatively modest. This is primarily due to the small economic base and population in the New Mexico Five County region, which means that few economic agents are poised to take advantage of the improved transportation efficiency along the corridor. Most of the forecasted growth is experienced by the retail trade and service sectors, which have less

spillover effect on the local economy than expansion of the manufacturing base would produce.

Figure 3.34. New Mexico U.S. Route 54 north of the Texas Border (Public Domain).

4. Our findings also suggest that in general, the projects that we tested whose market area was clearly classified as metro as opposed to rural or mixed tended to return the T-PICS economic impact results that were in best alignment with the results generated from our alternative method. The most obvious reason that metro projects appear to return the most credible results is simply that they are overrepresented in the T-PICS database, so there is a richer variety of data on metro projects from which the proposed project draws. We also concluded that metro projects—more so than rural or mixed projects—tend to be more homogenous in terms of the development potential around the project area, cost per mile of the improvement, and various social and demographic features more commonly present in metropolitan areas.

5. For projects located in a non-distressed area, we found that T-PICS tends to overstate the potential for economic growth relative to the comparison projects. Once again, a good case in point for this project is the Minnesota Trunk Highway 60 test case study.

The improvement project was not built in an area that was in economic distress, measured by local unemployment levels relative to national unemployment levels, and designed to control for the influence of macroeconomic trends on local labor market conditions. The measure is a simple ratio of the local unemployment rate to the corresponding national rate. A ratio of less than one is taken as evidence of a lack of economic distress, while ratios greater than one imply varying degrees of distress. A number of the rural highway widening projects from the T-PICS database used in the regression analysis (e.g., I-70 Glenwood Canyon in Colorado and the Corridor J in Kentucky) appear to have been constructed in locations with (at the time of construction) relatively high levels of economic distress. By contrast, each of the Minnesota projects is located in a non-distressed area.

6. Certain other project characteristics (e.g. proximity to an airport, urban/class level near the project) might skew the estimates of the economic impacts when those characteristics have limited influence on economic development relative to the T-PICS comparison cases used to derive the estimate. These input variables are included as a proxy for existing economic activity that might be harnessed by the improvement. The implication is that projects constructed in locations near airports or with access to larger markets will have larger economic impacts, all else being equal. Market sizes are generally smaller for rural projects of all types, though there are notable differences between the smaller highway corridor projects we tested and the comparison projects in the T-PICS database.

7. As indicated in the project analysis following both of the Minnesota rural bypass projects (Minnesota 371 around Brainerd, and US-71/Minnesota 23 around Willmar) T-PICS tends to overestimate the economic impacts for rural bypass projects. The 2003 Otto/Anderson study cited above concluded that rural bypasses do not typically generate significant economic growth in the communities that are bypassed. Its conclusion is consistent with the lower estimated impacts generated by the EIS REMI modeling method for rural bypass projects, finding minor redistributional effects—a gain in sales in the service sector and some decline in the highway-oriented businesses. Efficiency gains would reduce the number of trucking and other highway-oriented transportation workers, but overall employment would increase only slightly, as individuals move to the area for the higher quality of living associated with less congestion and quicker commutes.

Chapter 4: General Evaluation: Suggestions for Consideration

Conducting this analysis has afforded us the opportunity to become familiar with the operation of the T-PICS tool. This chapter contains recommendations that address its general functionality and usability and offers recommendations that might be considered for the future development of the tool.

1) Continue to emphasize the proper time to use T-PICS: early in the planning process as an initial policy or strategy development tool.

What sets T-PICS apart from most commercially available econometric models is its ease of access and use. There are many potential users of T-PICS that include both public and private sector users who do not have the time, resources, or technical experience necessary to use commercially available software tools designed to assess the economic impacts of proposed transportation projects. T-PICS allows any user to learn from the experience of similarly situated project planners and to consider the potential economic impacts that could occur if a proposed project is similar in nature and scope to projects contained in the T-PICS database.

Marketing of the tool should continue to plainly emphasize that the tool is not intended for rigorous economic analysis. This point is made frequently in the tool’s supporting documentation, but we consider it important enough to reiterate as our first general recommendation. Both of its core functions—the Case Search function (to identify and learn from other completed projects that share similar conditions and circumstances) and the interactive My Project Tools function that derives a preliminary projection of the potential economic benefits of a project—are designed to be most valuable when conducted very early in the planning process.

The developers of the T-PICS tool, the Economic Development Research Group, Inc. (EDRG), aptly describe its intended function in their May 2002 SHRP 2 project brief, *New Tool for Estimating Economic Impacts of Transportation Projects: Transportation Project Impact Case Studies (T-PICS)*(http://onlinepubs.trb.org/onlinepubs/shrp2/T-PICS.pdf), as depicted in Figure 4.1.

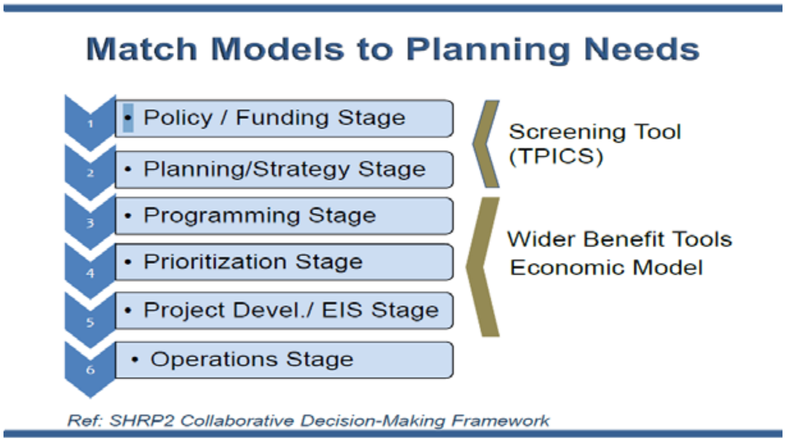


Figure 4.1. Matching stages of planning with tools and a model.

Source: Economic Development Research Group, Inc.

T-PICS is best suited as a screening tool (preliminary or sketch planning). According to the project brief, it can also be useful in these planning stages:

- Early-stage policy or strategy development—T-PICS can identify the magnitude and types of impact tradeoffs to be considered;
- Early-stage sketch planning processes—T-PICS can identify the types of local barrier and success factors that will need to be addressed in later, more detailed planning steps; and

- Public hearings—the case studies provide a way of responding to the hopes of proponents and fears of opponents, with information on the range of impacts that have actually occurred in the real world.

2) Don't oversell T-PICS' predictive capabilities.

As a corollary to recommendation 1, T-PICS' promotional and instruction materials should be cautious about characterizing the My Project Tools as capable of "estimating the range of economic impacts likely to result" from a proposed similar project. The narrative provided in the "Advice on T-PICS Use" link in the "Further Information" box under the "My Project Tools" guidance describes the functionality of the tool.

> The Project Tools feature is a form of expert system that draws from the case study database **to estimate the range of economic impacts likely to results from a specific type of project in a defined setting**. It provides a form of analysis by analogy, in that it identifies a reasonable range for expected impacts of proposed projects, based on prior experiences. You can thus use it as a screening tool for early stage project assessment. (Emphasis added.)
>
> Followed by the caveat:
>
> Users should note that neither the searchable database nor the project prediction tool provides information on the effects of changing traffic volumes, speeds, distances or safety, or effects of changing reliability, connectivity or accessibility. **In real world situations, these factors can play a substantial role in determining whether the actual economic impact of a project will be at the low end, high end or outside of the normally expected range.** To assess the impact of these additional factors, it is necessary to use economic

impact models and tools that do measure these added factors affecting the wider economic impacts of projects. (Emphasis added.)

These two statements are somewhat contradictory and, in our view, the second paragraph articulating the limitations of the My Project Tools results more accurately reflects the true capability of the tool. We recommend reworking the information contained in this and other supporting materials to better emphasize that point.

Another example of a possible overstatement of the tool's predictive capability is found in language from the Strategic Highway Research Program (SHRP 2) Report *S2-C03-RR-1: Interactions Between Transportation Capacity, Economic Systems, and Land Use.* We believe that this language effectively characterizes the utility of the tool, with one suggested caveat, underlined below. This language would be well suited as an element of the T-PICS home page:

> This report [for SHRP 2 C03] and the accompanying T-PICS website are intended to serve as a resource for transportation planners and others who are interested in better understanding the long-term economic impacts of highway capacity projects. … The T-PICS web-based tool provides transportation planners with a way to search for relevant case studies by type of project and setting. The case studies include details of the projects, their impacts, and factors affecting the impacts. The web tool also provides users with an option to specify the type of proposed project <u>and see the range of ~~likely impacts based on the studies~~ impacts that similar projects contained in the T-PICS database experienced.</u>

3) Incentivize state DOTs or regional MPOs to add additional case studies.

It is well understood that the reliability of the T-PICS tool—by its very nature—is a function of the composition/variety of case study projects and the total number of the projects. For the tool to achieve optimum reliability, its database of case studies should approximate the basic size and features of the universe of candidate projects whose economic potential is to be estimated. In addition, the economic impact estimates generated from the database must correspond to the impacts actually observed in the real world with a satisfactory level of precision.

The first factor—that the projects in the database must approximate the basic size and variety of the projects contained in the database—gets at the specific question of the adequacy of the size and scope of the T-PICS database. Recent discussions among the T-PICS developers and sponsors concerning the further development and promotion of the tool suggest that there is agreement that the tool's reliability and predictive accuracy would benefit from the addition of new and varied case studies that are similar in nature (size, scope, project type, project motivation) to potential projects most likely to be tested by T-PICS. In other words, the predictive power of the T-PICS regression analysis to estimate potential economic impact is most effective when there are a sufficient number of case studies similar to the one being tested.

After using the tool to compare the T-PICS results with results generated by other tools and methods, our conclusion is that larger, higher cost projects are overrepresented in the T-PICS database, so we suggest that an effort to add lower cost projects would have the greatest immediate value in terms of enhancing the predictive reliability of the tool. We believe that state DOTs and other users are more likely to use the T-PICS My Project Tools function to assess the potential economic impacts of lower cost projects (interchanges, limited-length widenings, and other limited highway segment improvements), as opposed to relying on it to estimate the economic impact of megaprojects, where a more sophisticated tool would likely be the preferred method.

Since any new projects added to the database will be added incrementally, an important consideration of the tool's developers will be to maximize efficiency by addressing as many common scenarios as possible (those most often using the tool to derive an economic impact estimate) with the lowest case count. As indicated above, we recommend developing a strategy that would add cases that are smaller (in cost and length) and projects in which the new development has occurred in relatively close proximity to the improvement. As an aside, one means of identifying the most common project types likely to generate demand for the tool would be to survey state transportation improvement plans and/or regional comprehensive plans to get a sense of the types of projects that are under consideration for their economic development benefits in the future.

New case studies could be added through a number of strategies. For starters, it might be possible to add some of the projects included in this study. Another option would be providing an incentive for a state DOT or an MPO to develop case studies that could be added. Potential case study proposers would be instructed as to the type of case study that would result in the greatest benefit to the operations of the tool. In either case, project proposals should be vetted so that the highest value cases are given priority.

NOTE: Even as new case studies are added to the database, it will remain true that some project categories (defined by project type, length, cost, motivation, etc.) are more likely to return a reliable projection of economic impacts than other project categories that are not sufficiently represented in the database. It would be useful information for the user to be notified in some manner of a confidence rating that would reflect the degree to which a particular project's estimate generated by the T-PICS tool is likely to be reliable. Initially, the confidence rating would probably be a function of the number of similar case studies contained in the database, but as the tool is further developed with the addition of new case studies and other enhancements, a more sophisticated metric could be devised.

Along with the notification, the instructions might use the opportunity to solicit proposals for additional case studies of the underrepresented project types, or simply recommend caution in interpreting the results until a sufficient number of case studies in the underrepresented category have been added.

NOTE: In an effort to encourage users to add to the T-PICS case study database, an existing tool that could serve as a model is the FHWA's Crash Modification Factors Clearinghouse. The Crash Modification Factors Clearinghouse is a web-based database of crash modification factors (CMFs), along with supporting documentation that is intended to provide engineers and planners with the means to identify effective safety countermeasures. The site allows users to utilize the tool or to submit a CMF for inclusion in the database**.** T-PICS could utilize a similar strategy to encourage state DOT and MPO officials to add cases to its database. http://www.cmfclearinghouse.org/

4) **Reconsider the urban/class level designation of projects as rural, metro, or mixed, and develop clearer instructions on assigning a designation.**

In identifying the proper geographical T-PICS designation (rural, metro, or mixed) to provide for a proposed test case study project, we found the instructions somewhat vague. There did not appear to be any explicit instructions on how to classify a proposed project.

Page 5 of the T-PICS Instructions for Use document says that the designation assigned to a project should be "based on the U.S. Census classifications by County," but offers no guidelines on how to go about locating that data. The SHRP 2 C03 report offers the following discussion of how projects contained in the database were designated:

Every county that is part of an urban area with 50,000 or more inhabitants is classified as part of a “metropolitan area.” For this study, each highway-related project setting was classified by the county or group of counties in which the project was located. (Many of the highways covered in the case studies run through multiple counties.) If the project counties were all classified as metropolitan then the project setting was classified as “Metro.” If the project counties included both metropolitan and non-metropolitan counties, then the project setting was classified as “Mixed.” And if all project counties were non-metropolitan, then the project setting was classified as “Rural.”

If it is determined that this system of delineating projects in larger urban markets (metro) from those in smaller urban markets (rural) is appropriate, then at a minimum, there should be instructions provided within the My Project Tools interface that provides the user with the definitions of rural, metro, and mixed; and perhaps even a link to the Census Bureau’s data so that a user can know for certain which is the appropriate designation.

However, our research suggests that it may be wise to consider expanding the range of urban/class level options to incorporate more than just three classifications. As we have indicated, T-PICS results of several of our test case study projects located in rural or mixed locations returned projections that far exceeded the estimate generated from the alternative analysis or that have actually occurred in the real world. We attribute this to two factors: (1) There are many more projects in the T-PICS database that are located in or near large metropolitan areas, so when a project from a more sparsely populated area is tested, there is a bias to project a greater economic impact than may be warranted. (2) Rural projects may be lengthy in terms of the mileage of the improvement, but often, there are limits to the developability of much of the corridor that is being improved. T-PICS requires as an input the length of the project as a proxy for the scale of the economic development that might occur, and yet it is often the case that the economic development generated by the improvement is limited to the segment of the corridor adjacent to an existing development, with infrastructure in place.

Recognizing the desire to keep input requirements simple wherever possible, consideration should be given to narrowing and redefining the urban/class level designations. This could be done by creating additional classifications (perhaps adding some sort of “ultra-rural” category, and on the other end of the spectrum a “fully developed metro” category) that better describe the region’s true market size and influence on the potential magnitude of a project’s economic impact.

5) Reduce/restructure the number of project categories.

One of the recommendations offered from this research is to restructure the classification of project types from the existing eight classes (bypass, limited access road, beltway, interchange, bridges, access road, widening and connector) to just three “level 1” classes containing inclusive “level 2” subclasses, as follows:

A. Interchanges

- (no subclass);

B. Highway Corridors

- Bypass
- Widening
- Beltway

- Connector

C. Access Roads

- Access
- Limited Access

We concluded that this is a more logical and intuitive way to classify projects, reasoning that each of those three level 1 classes has a distinct purpose and spatial characteristic. In terms of their economic impacts, all interchanges fundamentally achieve the same purpose—to provide high mobility, high speed, and safe access to an intersecting corridor. All highway corridor projects address mobility from one point to another, be they short distances or extended interregional corridors. And all access roads provide direct (and generally limited length) access to a specific economic center.

By restructuring the categories in this way, the tool might be able to access a greater number of analogous projects from its database and derive a better economic impact estimate from its regression analysis.

6) For the My Project Tools project type category selection criteria, provide clear definitions of the various project types (especially the highway corridor project types, e.g., bypass, beltway, widening, connector).

Our analysis demonstrated that selection of the project type has a substantial influence on the projected magnitude of the economic impact from a given transportation improvement. In many cases, however, there are no clear or easily accessible instructions on which category a given project would best fit within. A good example of this complexity from our analysis is the Iowa

5/US-65 Beltway from W Junction 5/65 to I-80. The common name of the project—recognized in official plans and other written documents—contains the word "beltway"; however, in the definition of project types included in the SHRP 2 C03 report, the definition of the various highway corridor project types indicates that this project would be better classified as a bypass as opposed to a beltway. The research team agreed that, typically, a beltway is a metro phenomenon, and a bypass is a rural phenomenon. Under those definitions, a beltway project would always have a substantially greater economic impact than a bypass project.

Table 4.1. Iowa 5/US-65 Beltway from W Junction 5/65 to I-80 T-PICS Comparison Designated as Beltway versus Bypass

This distinction might appear negligible, but the implications for the results generated

	Jobs	Wages(1,000)	Output(1,000)
As a Beltway			
Direct Impacts	15,876-26,460	$558,200-$930,300	$1,774,100-$2,956,800
Supplier and Wage Impacts	2,880-4,800	$323,600-$539,300	$1,007,200-$1,678,700
Total Impacts	18,765-31,260	$881,800-$1,496,000	$2,781,300-$4,635,500
As a Bypass			
Direct Impacts	1,983-3,305	$71,600-$119,300	$227,500-$379,200
Supplier and Wage Impacts	422-704	$41,500-$69,200	$129,200-$215,300
Total Impacts	2,405-4,009	$113,100-$188,500	$356,700-$594,500

for each of the two project type designations is significant. As indicated in Table 4.1, which compares the T-PICS results for the Iowa beltway project—classified first as a beltway and then as a bypass—the selection of the appropriate project type is critical.

When considering which project type category to classify a project—especially projects that are broadly described as highway corridor projects (e.g. widening, bypass, beltway, connector)—it is likely more often the exception than the rule that a project clearly fits within just one of those project types. Another case in point, for both the Minnesota 371 Little Falls to Brainerd project and the Minnesota US-71/MN-23 Including Willmar Bypass projects—it is not clear under which project type category these projects should be classified. They are both widening projects, but they are also both bypass projects.

There may be no completely foolproof way to always avoid this problem, but the simple step of including the definitions of the categories, as expressed in the report cited above (perhaps with a mouseover function built into the interface) would likely prevent many users from selecting the incorrect project type in their analysis. It might be advisable to even include a statement somewhere in the project type selection instructions to the effect of designating a project as a beltway (or other category) will return an estimated impact significantly greater than designating the same project as a bypass (or other category).

7) Provide definitions or source information on both Case Search and My Project Tools selection criteria data entry forms.

Another function that would enhance user friendliness would be to provide a brief description of all selection criteria categories, again, perhaps with a mouseover function. As an example, on the tool's Case Search feature under the Basic Criteria tab, the required selection of an Urban/Class Level offers no description of what constitutes a rural project versus a metro project. For the Economic Distress criteria, there is no definition provided that distinguishes between distressed and non-distressed. Under the Other Criteria tab, no definition is provided for the Urban/class level category, nor is there any source reference for determining the appropriate topography metric. This information is all available if the user is willing to spend the time searching in the tool's supporting documentation, but a better solution would be to simply design the tool's interface to include these basic definitions and information, since an understanding of these terms is essential to the effective operation of the tool.

8) On My Project Tools, provide more flexibility of selection criteria inputs and include more basic case study information from the resulting regression analysis.

As we have suggested above, one of the most effective means of enhancing the utility of the T-PICS tool is by increasing the number of case studies in the database. This issue is particularly apparent when working with the My Project Tools module, which only allows the user to select one choice from each of the Project Type, Region, and Urban/Class Level. If there were more case studies in the database, then the output generated from a My Project Tools run might arguably be more reliable using the current framework, which allows selection of just one criterion per category. In fact, due to the existing size limitations of the T-PICS case study database that generates the My Project Tools output for any particular project type or region, it is possible to select criteria for a project under consideration that returns no data after activating the View Results button.

My Project Tools does not always generate results due to database limitations.

As an example, testing one of our test case projects—the Opportunity Drive interchange—would require selecting the criteria as shown in Figure 4.2. The Project Type is an Interchange, its Region is Great Lakes/Plains, its Urban/Class level is Metro, and its Economic Distress is Distressed Only. As Figure 4.2 illustrates, the My Project Tools module is unable to generate any results because there simply are not sufficient numbers of similar case studies currently populating the database. Short of adding more case studies to the database (as we have recommended above) allowing the user to select more than one criterion for each selection category (i.e., Project Type, Region, Distress Level) would include more relevant case studies into the regression analysis and generate better results for the user. Another related design modification that might be considered is to designate a preferred sequence for selecting criteria to identify best T-PICS case study comparables. If it can be determined that a specific category (e.g. project type, region, urban/class level, or some new criteria?) is the most significant variable in accurately predicting the potential economic impact, then that criteria should take precedence over the others, in terms of how case study projects are selected for the regression analysis.

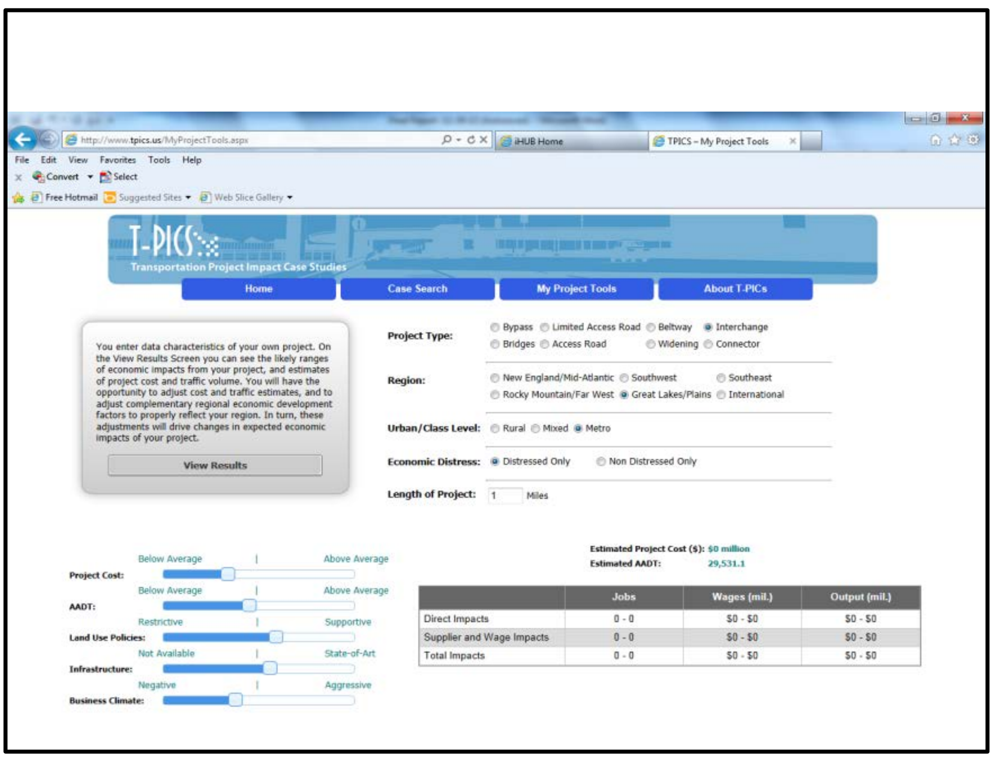


Figure 4.2. Screen shot of T-PICS My Project Tools.

9) Re-organize the Further Information section of the home page.

In order to encourage additional interest in learning more about what the tool has to offer, a new user to T-PICS would benefit from a concise description of the tool's purpose, design, and functionality. The tool's developers have gone to great lengths to ensure that any supporting instructions and documentation has been prepared and are accessible through the Further Information section of the home page. However, we suggest reorganizing the section to eliminate redundancies and to provide more basic instructions on how to navigate the tool as a newcomer to T-PICS.

One strategy that might be considered would be to reorganize the existing materials currently contained in "Summary of T-PICS," "Advice on T-PICS Use," and "Instructions for T-PICS." These documents each contains background information and instructions on using T-PICS and other technical information on the database, as well as the general SHRP 2 research program that produced the T-PICS tool. While this is useful and interesting information, it goes well beyond what the typical first time or beginning user needs to know to understand the tool and how to activate it.

We recommend creating links from the T-PICS home page to three new introductory sections: The first could be a "Read This First" section that offers guidance on how and when to use T-PICS. Much of that information is contained in the first couple of pages of the existing paper *A SHRP 2 Capacity Project Brief - New Tool for Estimating Economic Impacts of Transportation Projects: Transportation Project Impact Case Studies (T-PICS)* (http://onlinepubs.trb.org/onlinepubs/shrp2/T-PICS.pdf).

A second link could reference a new page called "Getting Started with T-PICS" or something similar that provides a more concise step-by-step guide to using the tool intended for the first time user. (The current site includes a link to a page called "T-PICS Quick Start: Advice on Use" which offers a very concise description of both the Case Search and My Project Tools modules, but little in the way of how to go about using the tool for the first time.) Once again, virtually all of this information is contained in an existing document, *Transportation Project Impact Case Studies (T-PICS): Instructions for Use* (http://www.T-PICS.us/documents/SHRPC03InstructionsForUse.pdf), and that version should certainly be retained along with other supporting documents; but a more concise version would lessen some barriers for first-time or beginning users.

A third link could be established that provides information that might be more useful for the intermediate and advanced user. This link would take the user to the more technical supporting information. This would include the information contained in the following documents: (1) *A SHRP 2 Capacity Project Brief—New Tool for Estimating Economic Impacts of Transportation Projects: Transportation Project Impact Case Studies (T-PICS)* (http://onlinepubs.trb.org/onlinepubs/shrp2/T-PICS.pdf); and (2) *SHRP 2 Report S2-C03-RR-1: Interactions between Transportation Capacity, Economic Systems, and Land Use* (http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_S2-C03-RR-1.pdf). This information would be useful for anyone seeking a more fundamental understanding of the tool's capabilities and limitations.

10) Minor Technical Suggestions

a) Provide additional feedback on the derivation of the AADT projection that appears above the results table in My Project Tools.

The AADT projection of a project being run on T-PICS is derived as a function of the regression that incorporates existing T-PICS database projects. Under some circumstances, however, the regression generates an estimate of AADT that will be lower than the actual observed AADT after the project's completion. Our analysis observed that for two of our projects—both rural Minnesota bypasses in relatively high volume tourism corridors—the projection for AADT did not nearly approach actual AADT levels, even after adjusting the AADT slider all the way to the right or to the above average setting.

While this restriction on the estimated AADT generated in T-PICS has only a very minimal influence on the ultimate economic impact estimate, we suggest that the user would appreciate some sort of affirmation that indicates that the AADT projection identified when the slider is placed as far as possible to the right (the AADT estimate generated by T-PICS and presented above the results table in My Project Tools) represents the lowest level of estimated AADT and that it is more likely to be greater.

b) Include a title to the My Project Tools output table that clarifies the fact that estimates represent net impacts, not gross impacts.

The table in Figure 4.3 shows an image of the results table, which displays the estimated economic impacts from a run of the My Project Tools function. It is not clear from the table that the figures for jobs, wages, and output represent estimates of the net impacts resulting from the improvement, as opposed to total new economic conditions after the improvement. It should also be noted that the estimates generated for wages and output are functions of the estimated change in employment (jobs) using applicable and local industry ratios, as indicated in the discussion of Table 4.3 in the SHRP 2 C03 report.

Estimated Project Cost ($): $14.2 million
Estimated AADT: 2,076.3

	Jobs	Wages (mil.)	Output (mil.)
Direct Impacts	189 - 315	$9.5 - $15.8	$27.4 - $45.6
Supplier and Wage Impacts	128 - 214	$6.2 - $10.4	$18.1 - $30.2
Total Impacts	317 - 529	$15.7 - $26.2	$45.5 - $75.8

Figure 4.3. The estimated economic impacts from a run of the My Project Tools function. (Note: An economic impact results table needs clarification that impacts are attributable to the improvement.)

We also suggest including a note similar to the narrative contained in the SHRP 2 C03 report to further clarify and define the key terms identified in the results table: **“***Employment, income, and output impacts.* Once buildings are occupied, there are commonly measurable increases in population (for residential use) or employment (for commercial and other uses). The employment increase reflects an added activity level that can also be viewed in terms of income (wages associated with the employment) or business activity (measured in terms of value added or total output growth). It is important to note that all of these measures reflect different ways to measure the same economic growth, so these measures cannot be added.”

c) In certain cases, selecting the “View Results” button on the My Project Tools module calls up a results table view that does not incorporate all cells of the table.

(See Figure 4.5.) Given the limited size of the results table (just four cells tall and four cells wide) it should not be necessary to have to include a scroll bar to view the whole table.

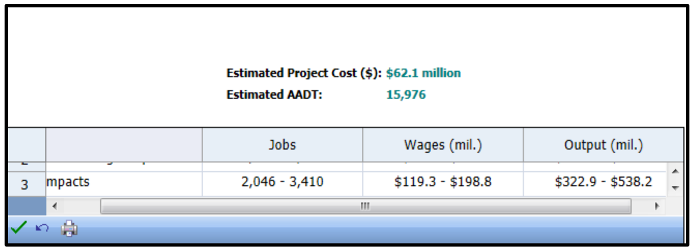


Figure 4.4. The results table generated in My Project Tools sometimes demands a scroll bar.

d) Instructions for the My Project Tools function assert that slider settings for the Land Use Policies, Business Climate, and Infrastructure input variables are set to average, and that "moving [the slider] to either side will increase or decrease economic impacts by the percentages shown." In fact, no percentages are shown as the slider is adjusted.

e) When you select the Compare Projects hyperlink from the Case Search function, the Completion Year, Length (mi), and AADT are all formatted as dollar amounts.

f) On the business climate slider on My Project Tools, we recommend changing the characterization of a positive business climate to "supportive" rather than "aggressive."

Reference

Otto, Daniel M. and Connie Anderson. The Economic Impact of Rural Bypasses: Iowa and Minnesota Case Studies. Midwest Transportation Center Project Paper, Iowa State University, January 1993.

Appendix A: How Variation Between the Test Case Projects and the T-PICS Case Study Projects Can Distort Estimated Impacts

As this research has demonstrated, the limited number of case studies in the T-PICS database for each project type can compromise the reliability of the economic impact projections for any proposed project. In other words, only when a number of the T-PICS case study projects are sufficiently similar to the test case project will the results generated by T-PICS be truly representative of the economic impacts that are likely to occur. Until such time that enough new projects are added to the database, a user will be able to draw more value from her analysis if she recognizes in what ways the project she is testing is similar—and how it is different—from the T-PICS case study projects that are used to derive the estimate of jobs, wages, and output.

This Appendix examines the details of the four test case projects located in Minnesota, which includes one interchange project—the Opportunity Drive/I-94 Interchange—and three highway corridor projects—the Minnesota 371 Brainerd Bypass, the Minnesota US-71/MN-23 Willmar Bypass, and the Minnesota Highway 60 widening project. We focus on these four projects to understand the similarities and the differences between those projects and the projects contained in the T-PICS database that are most similar, in order to draw conclusions on why certain biases in the results generated by the T-PICS regression analysis might be present. These similar projects were identified using the T-PICS Case Search function.

Minnesota Opportunity Drive I-94 Interchange

The Case Search function in T-PICS was used to identify the set of interchange projects most similar to the Opportunity Drive interchange project. Even though interchanges are one of the more common types of projects in the T-PICS database (there are 12 such projects), the application of two filtering criteria to identify urban interchange projects in the Great

Lakes/Plains region (which includes Minnesota) quickly reduces the number of matching projects to three. These projects are listed in Table A-1, below and include:

1) Overland Park, Kansas interchange—intersection of I-435 and Highway 69
2) Hays, Kansas-Commerce Park interchange—city access to I-70
3) Improvements to three I-494 interchanges in the city of Bloomington, Minnesota

As the table indicates, two of the matching projects are located in Kansas, with one in the Kansas City area (Overland Park) and one in the city of Hays in the western portion of the state. These two projects vary dramatically in terms of cost, with the Commerce Park Interchange project costing just under $5 million and Overland Park Interchange, which included widening of I-435 from six to eight lanes, costing over $68 million. The Commerce Park Interchange project is much closer in terms of cost to the Opportunity Drive project, which had a total cost of $7.85 million in 2008 dollars. The third urban interchange project listed is actually a series of three interchange projects located in the Minneapolis–Saint Paul, Minnesota metropolitan area on the Interstate 494 beltway through the city of Bloomington. These projects were all constructed between 1985 and 1991. These projects were very expensive, because they improved junctions with other major highways, served very high levels of traffic, and were constructed in locations with very limited available right-of-way.

Table A.1. Project Characteristics and Settings for Interchange Projects.

	Opportunity Drive & I-94 Interchange	**Overland Park Interchange, Kansas -**	**Hays, Kansas Commerce Parkway**	**Interchanges in a Major Urban Area: Bloomington,**

		435 & Hwy 69	Interchange access to I-70	MN
Project Characteristics				
State	Minnesota	Kansas	Kansas	Minnesota
City	Saint Cloud	Overland Park	Hays	Bloomington
AADT	33,000	80,278	1,701	147,000
Construction Start Date	2003	1995	1994	1985
Construction End Date	2004	1997	1995	1991
Project Cost (millions of 2008 dollars)	7.85	68.38	4.73	263.90
Project Setting				
Economic Distress	0.81	0.67	1.31	1.11
Population Density	1,960	1,083	30	2,028
Population Growth Rate (%)	1.2	2.2	2.2	0.1
Employment	0.3	1.6	1.6	0.3

Growth Rate (%)				
Urban/class level	335,695	797,618	203,159	1,428,278
Airport Travel Distance (miles)	12	35	35	5
Topography (1=flat, 21=mountainous)	3	4	4	2

Minnesota Highway Corridor Projects

[Minnesota 371 Brainerd Bypass, the Minnesota US-71/MN-23 Willmar Bypass, and the Minnesota Highway 60 widening project]

The three Minnesota Highway Corridor projects are all reasonably similar in terms of project characteristics and are located in places that would be considered rural according to the criteria in the T-PICS database, so they can be described together and compared with other rural widening projects in the database.

The two projects selected using T-PICS Case Search function as the best fit comparison projects to the three Minnesota highway corridor case study projects were the construction of a segment of Interstate 70 through Glenwood Canyon near the town of Glenwood Springs, Colorado, and Corridor J of the Appalachian Development Highway System through several counties in rural Kentucky. The project characteristics of all five projects are presented in Table A.2.

Table A.2 also contains a set of measures describing the economic and physical setting in which the project is located. Among these items is a measure of economic distress. Economic distress is measured by local unemployment levels relative to national unemployment levels. This is designed to control for the influence of macroeconomic trends on local labor market conditions. The measure is a simple ratio of the local unemployment rate to the corresponding national rate. A ratio of less than one is taken as evidence of a lack of economic distress, while ratios greater than one imply varying degrees of distress.

Table A.2. Project Characteristics and Settings for Minnesota Highway Corridor Projects.

	MN TH-371/ Brainerd Bypass	**US-71 / MN TH-23/ Willmar Bypass**	**MN TH-60, Heron Lake to Windom**	**I-70 Glenwood Canyon**	**Corridor J, Appalachia**
Project Characteristics					
Region	Great Lakes / Plains	Great Lakes / Plains	Great Lakes / Plains	Rocky Mountain / Far West	Southeast
State	Minnesota	Minnesota	Minnesota	Colorado	Kentucky
Nearest City	Brainerd	Willmar	Windom	Glenwood Springs	N/A
AADT	9,000	6,000	5,700	17,000	21,218
Project Length (miles)	30	20	14	12.5	243.5
Construction Start Date	1998	1978	1993	1987	1970
Construction	2006	2005	2005	1992	1984

End Date					
Project Cost (millions of 2008 dollars)	64.21	84.45	27.44	807.18	313.52
Project Setting					
Economic Distress	0.81	0.77	0.76	1.41	1.34
Population Density	1,443	1,327	994	17	74
Population Growth Rate (%)	0.5	0.7	0.2	2.5	0.8
Employment Growth Rate (%)	0.3	0.3	0.9	4.5	0.7
Urban/class level	97,112	74,213	53,347	14,621	29,384
Airport Travel Distance (miles)	22	61	83	56	110
Topography (1 = flat, 21 = mountainous)	4	3	2	17	17

Appendix B: Opportunity Drive Case Study Survey

The survey for the Opportunity Drive case study reached out to all businesses in a one-mile radius of the interchange that could reasonably expect an impact from the construction. (Several small service or farm sector businesses were in the 1-mile radius. These businesses were not included, because any benefits from the interchange were negligible.) In total, six businesses matched this criterion. Contact information was located for all respondents using local economic development professionals and information from ReferenceUSA. Researchers provided the interviewees with the survey in advance and asked them to consider the questions beforehand. In the emailed instructions for the survey, respondents were encouraged to imagine their companies' investment, employment and location decisions given the counterfactual of no interchange construction. Of the six businesses—all located in the industrial park adjacent to the interchange—four completed the survey and one had their exclusive contractor complete the survey (83% response rate). In all cases, the interviewees were top company executives or plant managers. Researchers checked employment responses against available employment figures in Dun & Bradstreet and ReferenceUSA to ensure their accuracy.

While the survey instrument gathered data on a range of business factors, researchers only used five data pieces (location decision and full-time equivalent employment and wages) for REMI PI+ inputs. The location decision question was critical because it allowed researchers to consider what portion of employment would have occurred if the construction was not undertaken. Only employment that would not have otherwise occurred was included as input. (This approach has obvious subjectivity issues, but no other reliable method was available. Of the five businesses, two had no employment included, two had half their employment included and one had all reported employment included.)

Respondents' answers to questions on wages were used to do a wage bill adjustment in REMI PI+. After data collection, it was determined that construction and equipment investment should not be used as an input because the goal of the TPICS evaluation was to find economic impact five years after construction of the interchange. Construction and equipment purchases would only have a temporary impact on the state economy.

Analyzing the performance of this survey instrument after the completion of the project highlighted some lessons that might be applied for future research. While all of the respondents were prepared to answer the headline numbers, such as total employment, wages, location decision and total investment, the respondents predictably provided less reliable information on more detailed questions. For example, none of individuals interviewed could reliably quantify cost savings due to the interchange construction and merely relayed anecdotes of improved business performance or employee experience. Reliable estimates of permanent costs savings from decreased fuel consumption, shortened commutes, and increased safety would have reduced production costs and increased anticipated economic impact. Locating administrative datasets, more in-depth interviews, and questionnaires that provide ranges of values for detailed questions may improve data quality.

Note: *The economic analysis methodology (Method 1) used to generate the baseline estimate of observed economic impact that was compared against the T-PICS result is a direct survey of six area businesses and a run of the REMI PI^{+} model. Businesses surveyed in the industrial park noted that the interchange has generated cost savings, improved safety for residents and tractor-trailer drivers, and was a critical factor for firms that have since located there. Moreover, the park has a number of vacant plots that could support further expansion. The results of this survey indicate that the interchange accomplished its goals.*

Objective of Survey

This survey will gather qualitative and quantitative data from businesses on the impact of local infrastructure changes. In particular, this survey will seek to ascertain how transportation changes affected employment/wage levels, investment decisions, business operations, property values, and transportation system changes. The first such survey will be of businesses in a 1-mile radius of the Opportunity Drive Interchange.

Basic

In what year was your business established at this location? ____ (4-digit year)

Did the Opportunity Drive interchange meaningful impact your location decision? If so, in what ways and to what degree?

Economic

Employment, wages, sales, profits:

	Since 2005:	*By what amount?*	*Any other comments:*
Full-time Employment level	Up Same Down		
Part-time Employment level	Up Same Down		
Average wage ($/hr) – or wage range(?) for production employment	Up Same Down		

Average wage ($/hr) or wage range(?) for non-production employment	Up Same Down		
Sales	Up Same Down		
Profits	Up Same Down		

Employment questions

What share of these gains are permanent jobs (rather than temporary/seasonal/contract etc.)?

(all/most/half/some/none)

Had the opportunity drive project not occurred would these jobs been created at another location?

(Yes, No).

If YES, where?

How do you expect employment to change over the next five years as a result of the OD project?

(increase, no change/no impact, decrease, don't know)

Describe capital investments (i.e. equipment, facilities) over the last 10 years:

When did these investments occur? (4-digit year ____)

What were the investments (i.e. plant, property, equipment) and how much were they?

What investments resulted from OD?

	Year	Value ($)	As a result of OD?
Plant facilities			Yes No
Property			Yes No
Equipment			Yes No

Do you foresee any additional investments in the next five years as a result of the OD project (?)

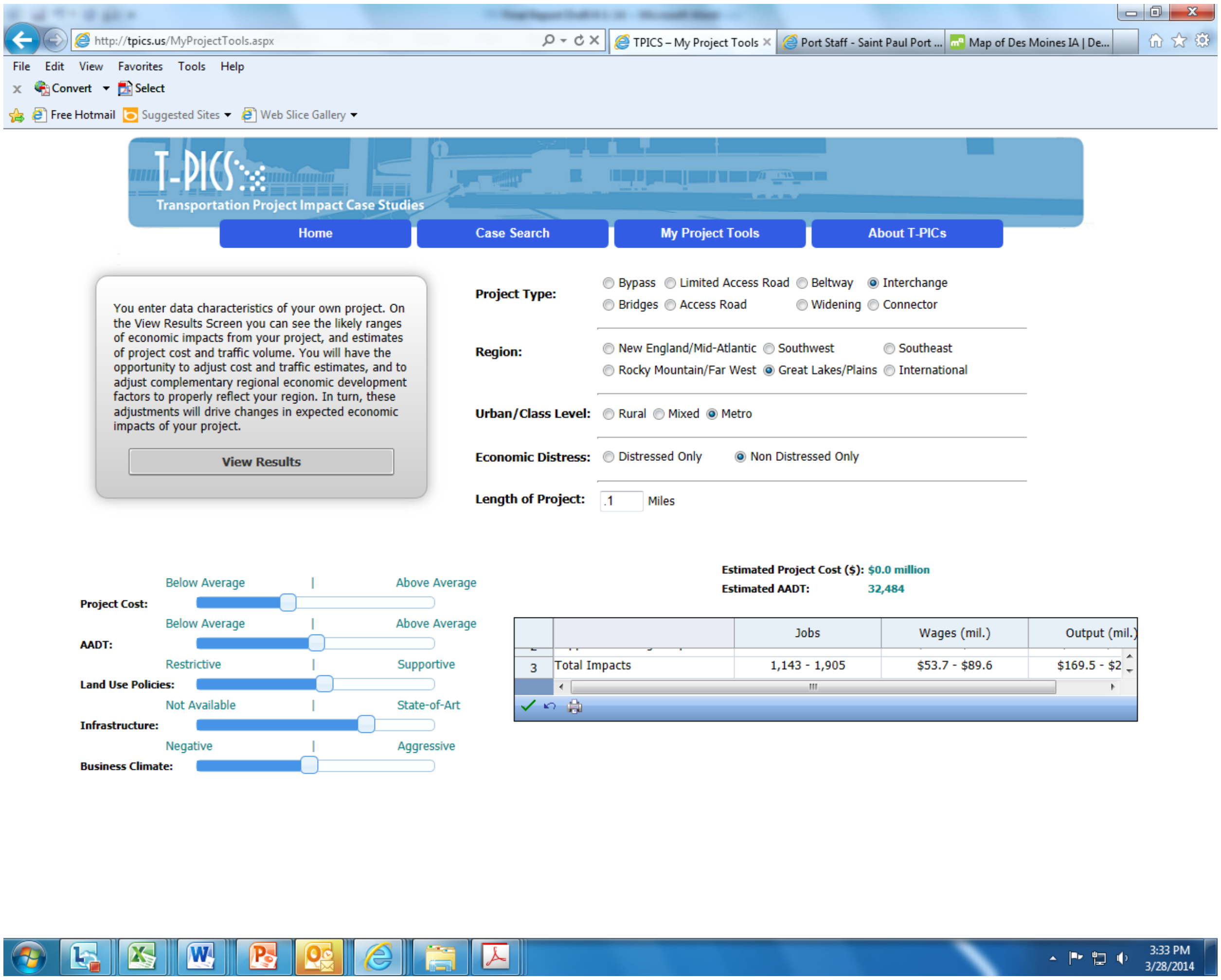
(Yes, No, Not sure)

Has this project lowered your supply, production or delivery costs (particularly through transportation)? If so, by what amount?

	Change since OD project?	Estimated value change (if avail.)
Supply costs	Up same down	
Production costs	Up	

	same down	
Delivery costs	Up same down	

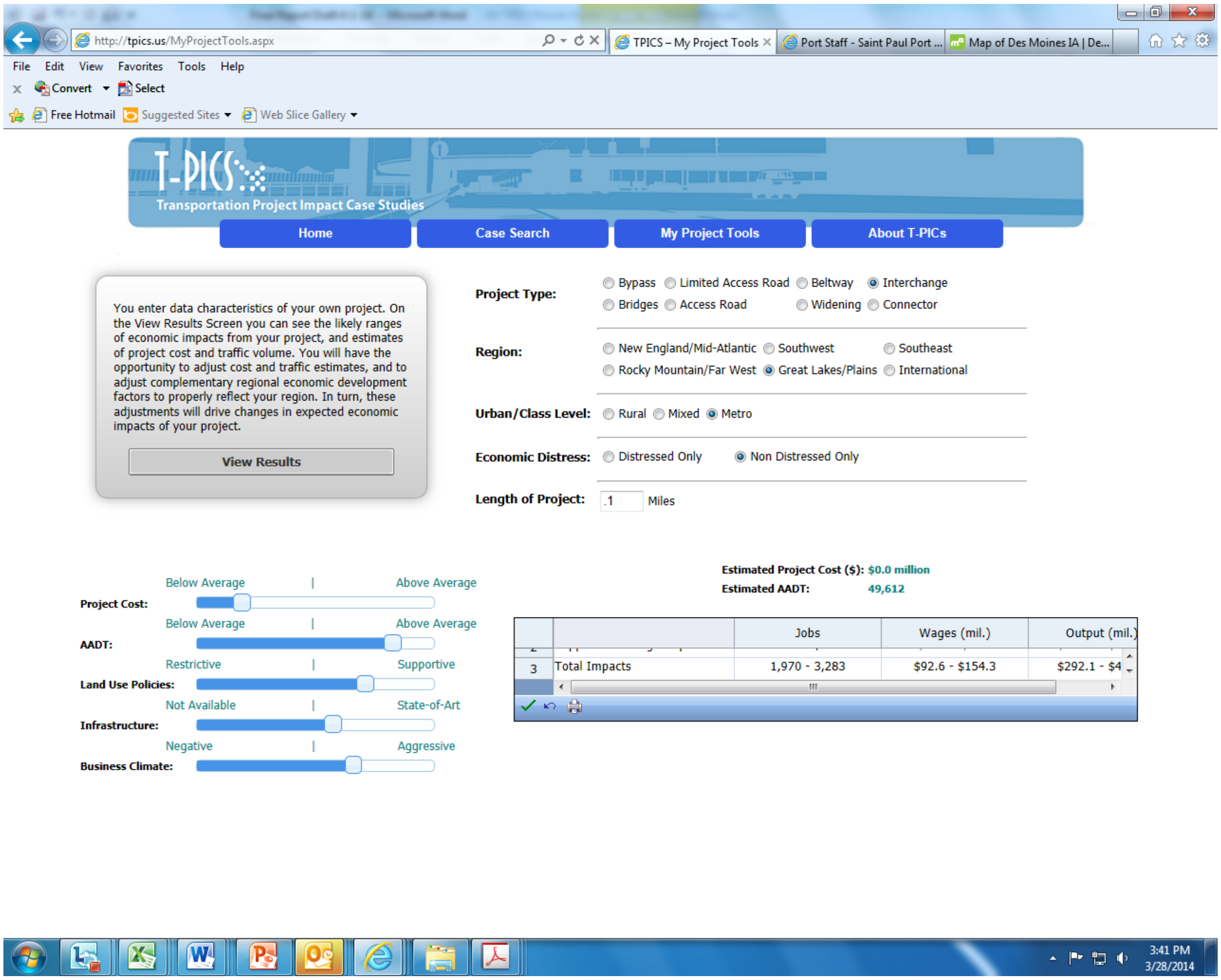
Appendix C: T-PICS Inputs, Sliding Scale Settings, and Results Tables For Each of the 14 Test Case Study Projects



Minnesota I-94 Opportunity Drive Interchange			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Direct Impacts	661 to 1,102	$34,100 to $56,800	$108,400 to $180,600
Supplier and Wage Impacts	484 to 807	$19,800 to $32,900	$61,500 to $102,500
Total Impacts	1,146 to 1,909	$53,900 to $89,800	$169,900 to $283,100
Alt. Method 1: Survey/REMI PI[+]			
Direct Impacts	500	$36,324	$158,125

Supplier and Wage Impacts	1,389	$44,653	$150,685
Total Impacts	1,889	$80,977	$308,810
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Direct Impacts	Over	Within	Within
Supplier and Wage Impacts	Under	Under	Under
Total Impacts	Within	Within	Under
T-PICS Basic Selection Factors	Interchange, Great Lakes/Plains, Metro, Non-Distressed		

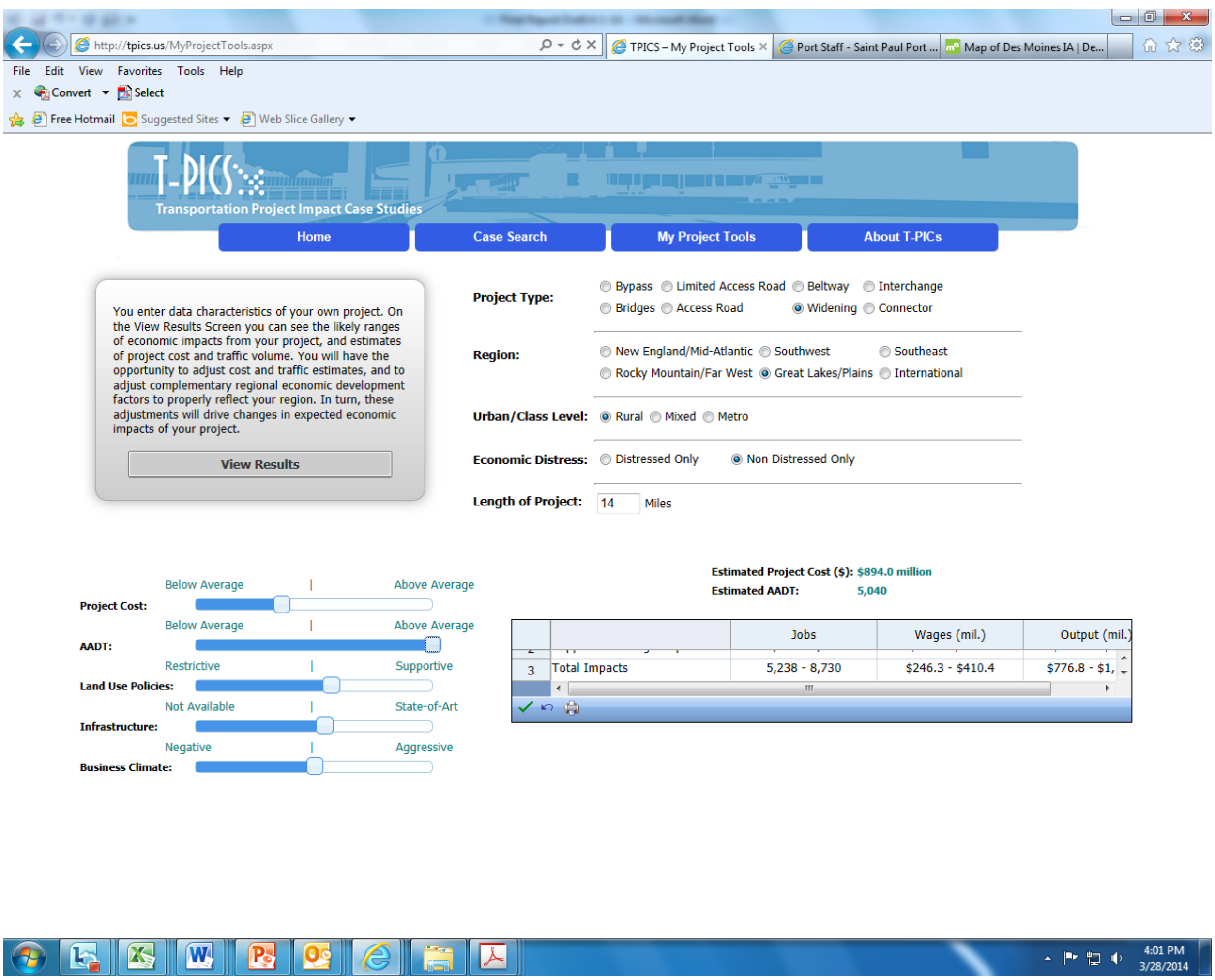
Figure C.1. I-1: Minnesota I-94 Opportunity Drive Interchange.



Iowa 86th Street Interchange			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Direct Impacts	1,062 to 1,770	$58,600 to $97,700	$186,300 to $310,500
Supplier and Wage Impacts	908 to 1,513	$34,000 to $56,600	$105,800 to $176,300
Total Impacts	1,970 to 3,283	$92,600 to $154,300	$292,100 to $486,800
Alt. Method 3: REMI TranSight			
Total Impacts	82	$3,000	$10,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			

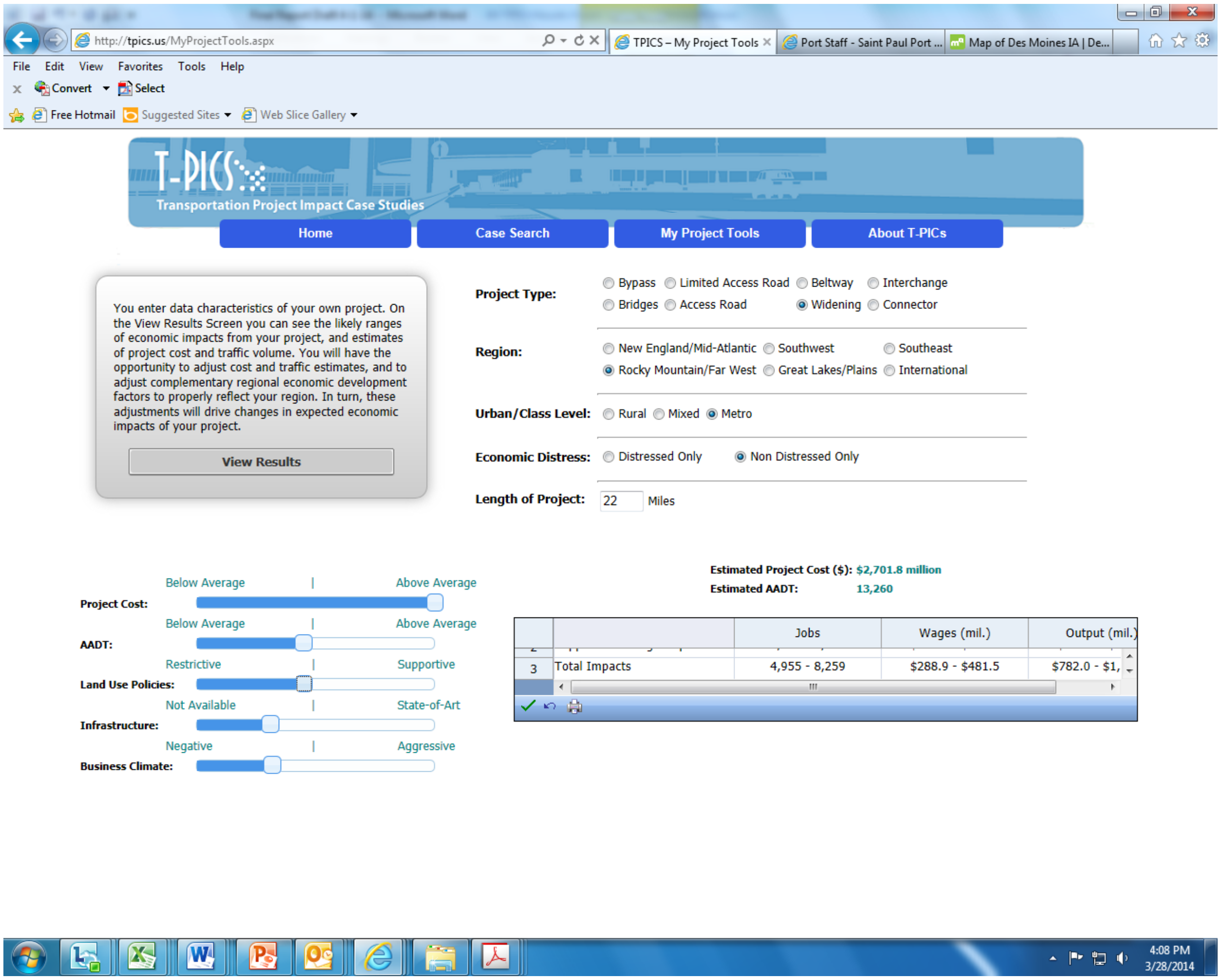
Total Impacts	Over	Over	Over
T-PICS Basic Selection Factors	Interchange, Great Lakes/Plains, Metro, Non-distressed		

Figure C.2. I-2: Iowa 86th Street Interchange.



MN TH-60 Expansion from Windom to Heron Lake			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Direct Impacts	3,264 to 5,441	$155,900 to $259,800	$495,500 to $825,800
Supplier and Wage Impacts	1,974 to 3,290	$90,400 to $150,600	$281,300 to $468,800
Total Impacts	5,238 to 8,730	$246,300 to $410,400	$776,800 to $1,294,600
Alt. Method 2: EIS/REMI PI+			
Total Impacts	2	-$140	$1,841
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
Alt. Method 4: Reduced Form Econometric Modeling of Income and Employment			
Total Impacts	3,201 (range: 2,083 to 4,320)	$38,726 (range: $9,802 to $67,651)	$70,664 (range: $26,956 to $114,373)
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection Factors	Widening, Great Lakes/Plains, Rural, Non-Distressed, 14 miles		

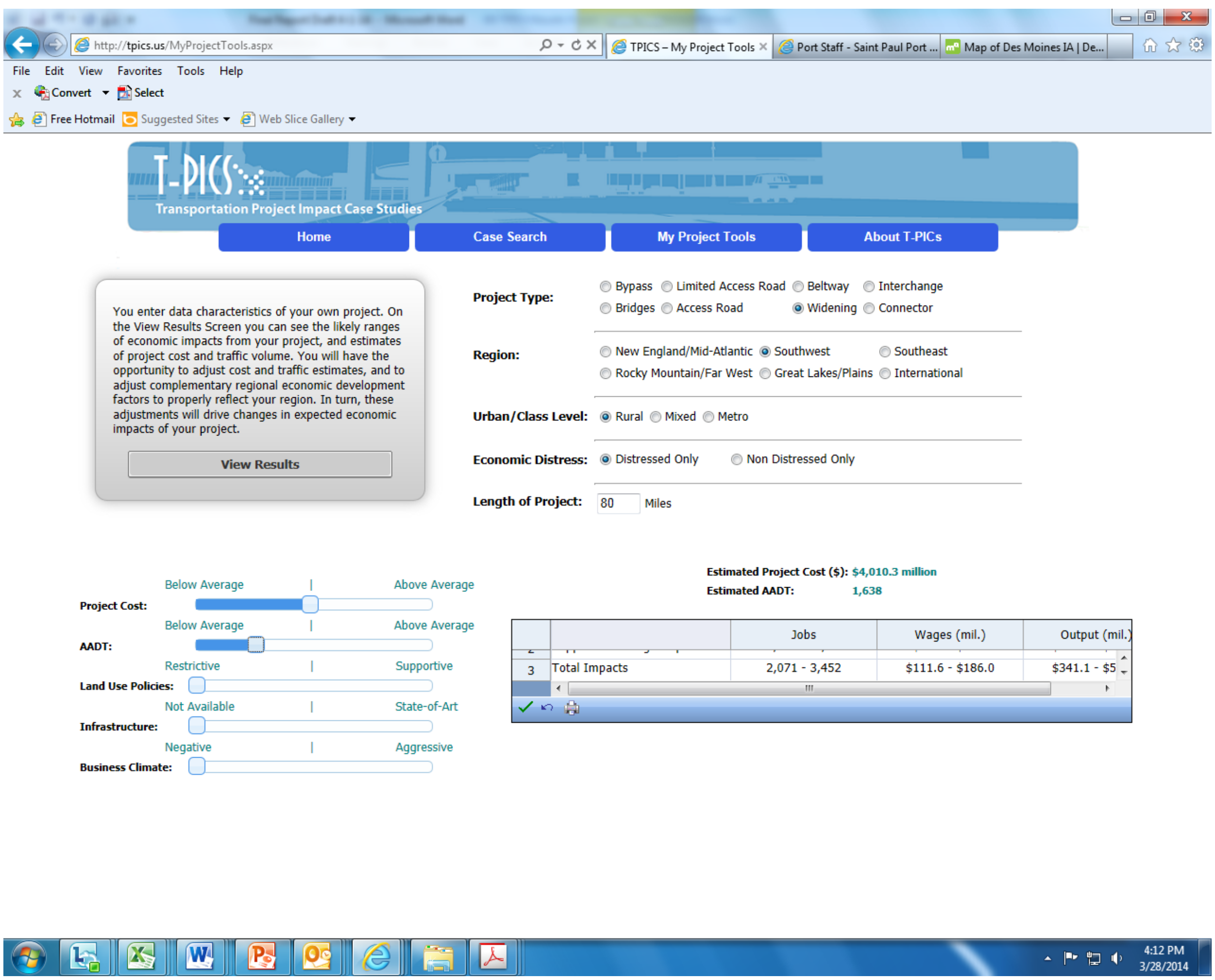
Figure C.3. W-1: MN TH-60 Expansion from Windom to Heron Lake.



Washington State Route 405			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Total Impacts (Direct and Indirect)	4,902 to 8,170	$285,800 to $476,300	$773,500 to $1,289,200
Alt. Method 3: REMI TranSight			
Total Impacts	$4,954	$680,000	$862,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Within	Under	Within

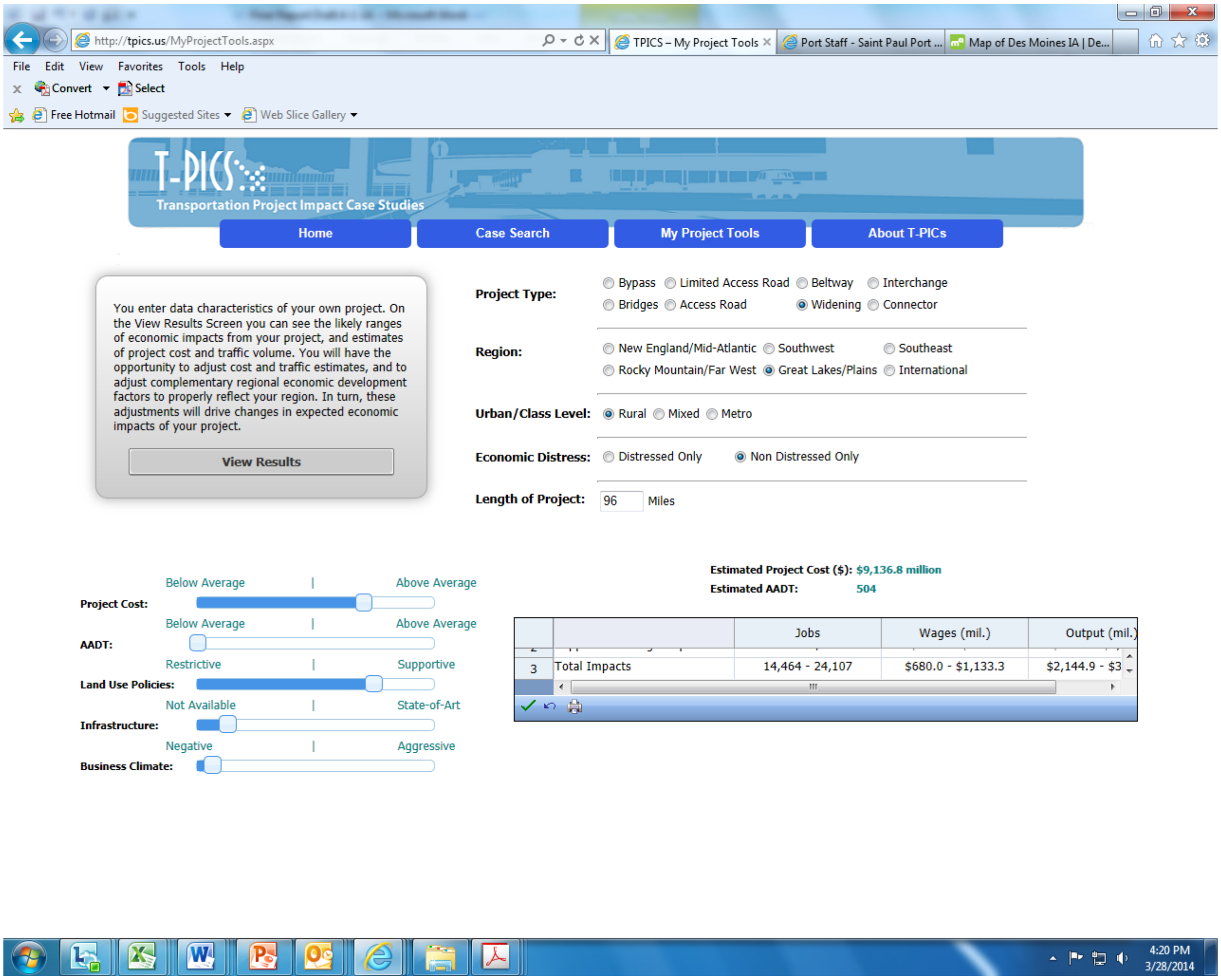
T-PICS Basic Selection Factors	Widening, Rocky Mountain/Far West, Metro, Non-Distressed, 22 miles

Figure C.4. W-2: Washington State Route 405.



New Mexico US-54			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Total Impacts (Direct and Indirect)	2,071 to 3,451	$111,600 to $186,000	$341.0 to $568.4
Alt. Method 3: REMI TranSight			
Total Impacts	500	$8,630	$40,130
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Under	Under
T-PICS Basic Selection Factors	Widening, Southwest, Rural, Distressed, 80 miles		

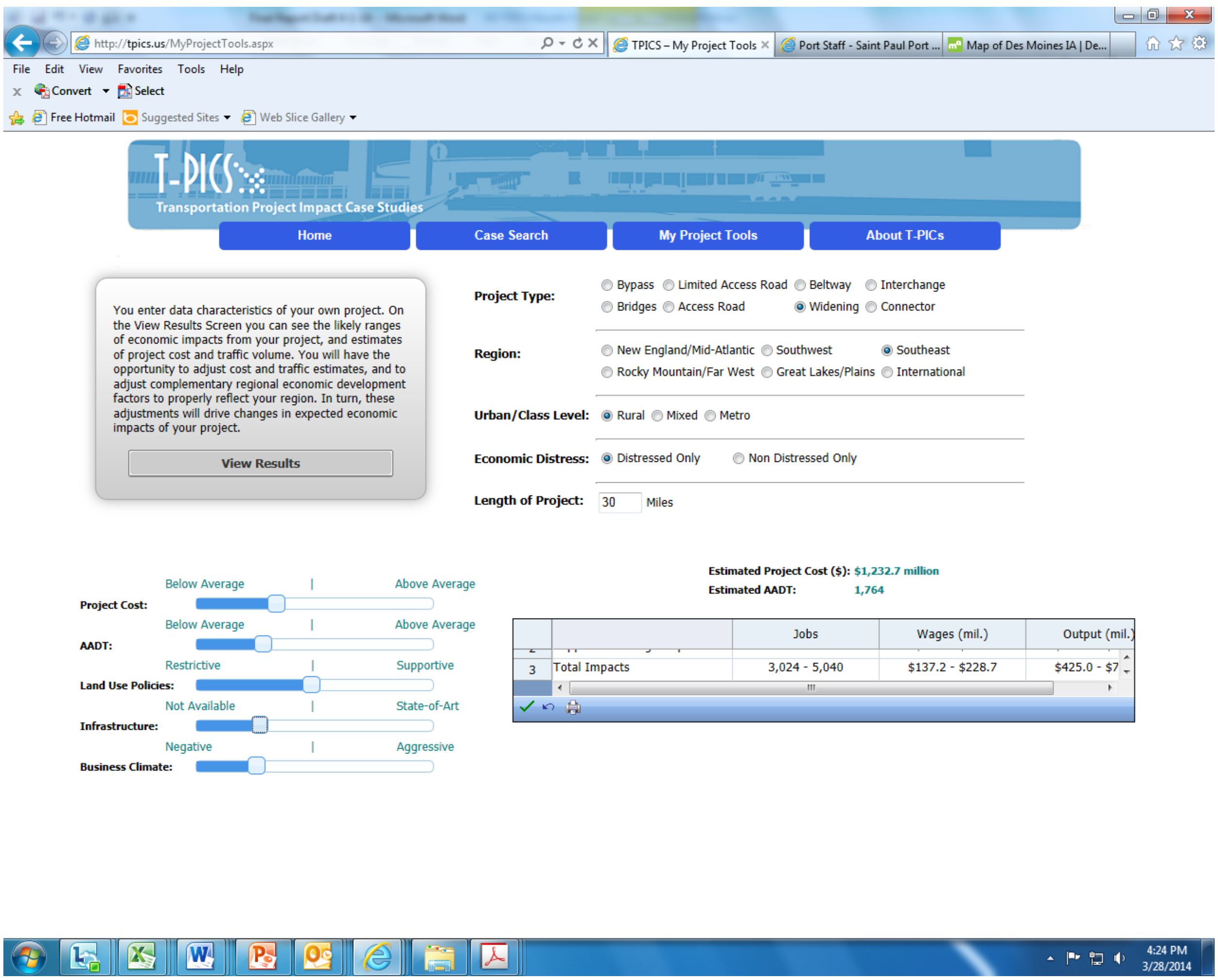
Figure C.5. W-3: New Mexico US-54.



Iowa 60/US-75 Le Mars Corridor			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Total Impacts	14,457 to 24,094	$680,000 to $1,132,000	$2,144,000 to $3,573,000
Alt. Method 3: REMI TranSight			
Total Impacts	-27	-$4,000	$3,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection	Widening, Great Lakes/Plains, Rural, Non-Distressed, 96 miles		

Factors	

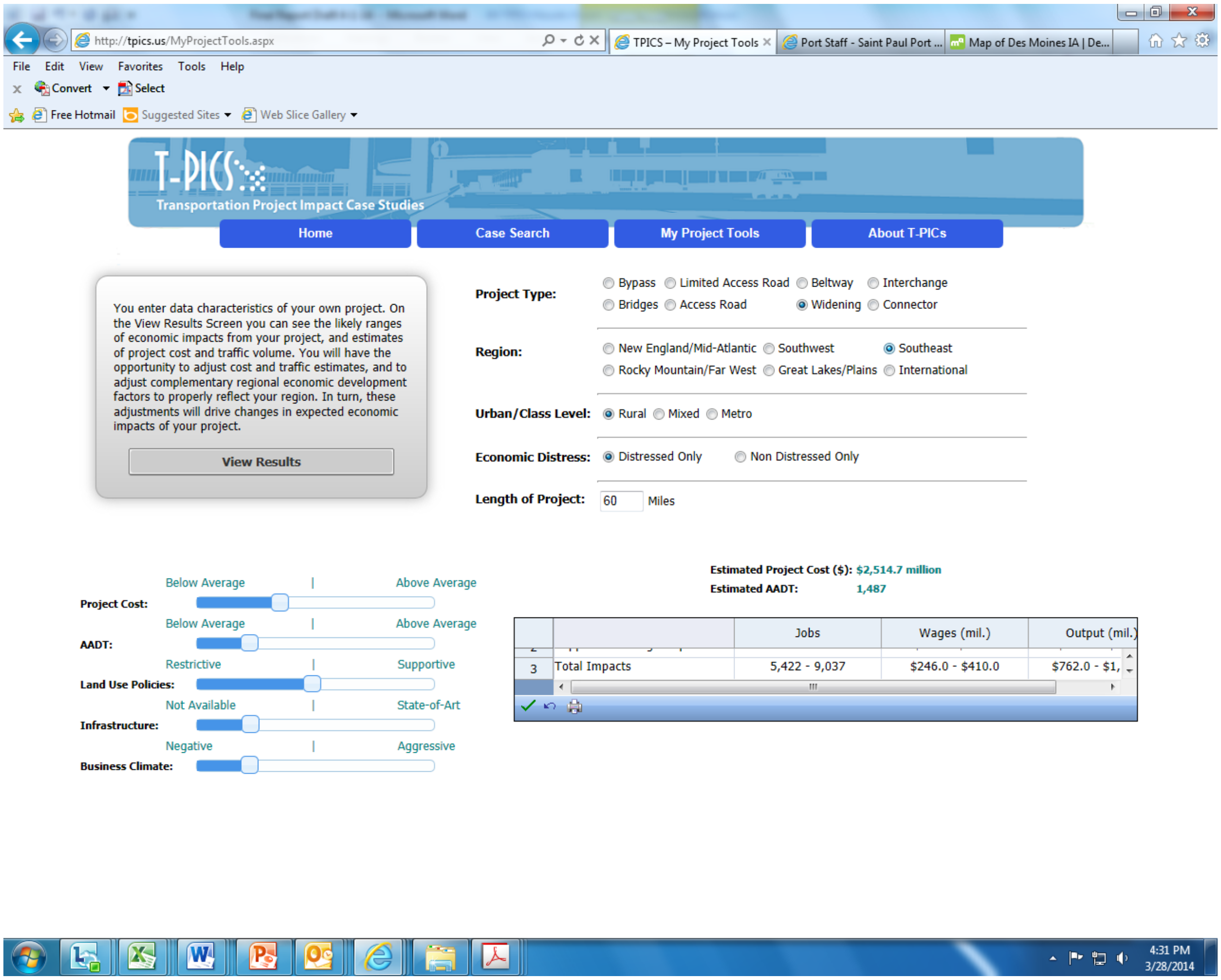
Figure C.6. W-4: Iowa 60/US-75 Le Mars Corridor.



Appalachian Development Highway System (ADHS)—Corridor A/A1 From Forsyth County Line, GA to GA-60, South of Dahlonega, GA

T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Total Impacts	3,029 to 5,048	137,400 to 229,000	425,600 to 709,400
Alt Method 3: REMI TranSight			
Total Impacts	3,578	276,000	532,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Within	Under	Within
T-PICS Basic Selection Factors	Widening, Southeast, Rural, Distressed, 30.4 miles		

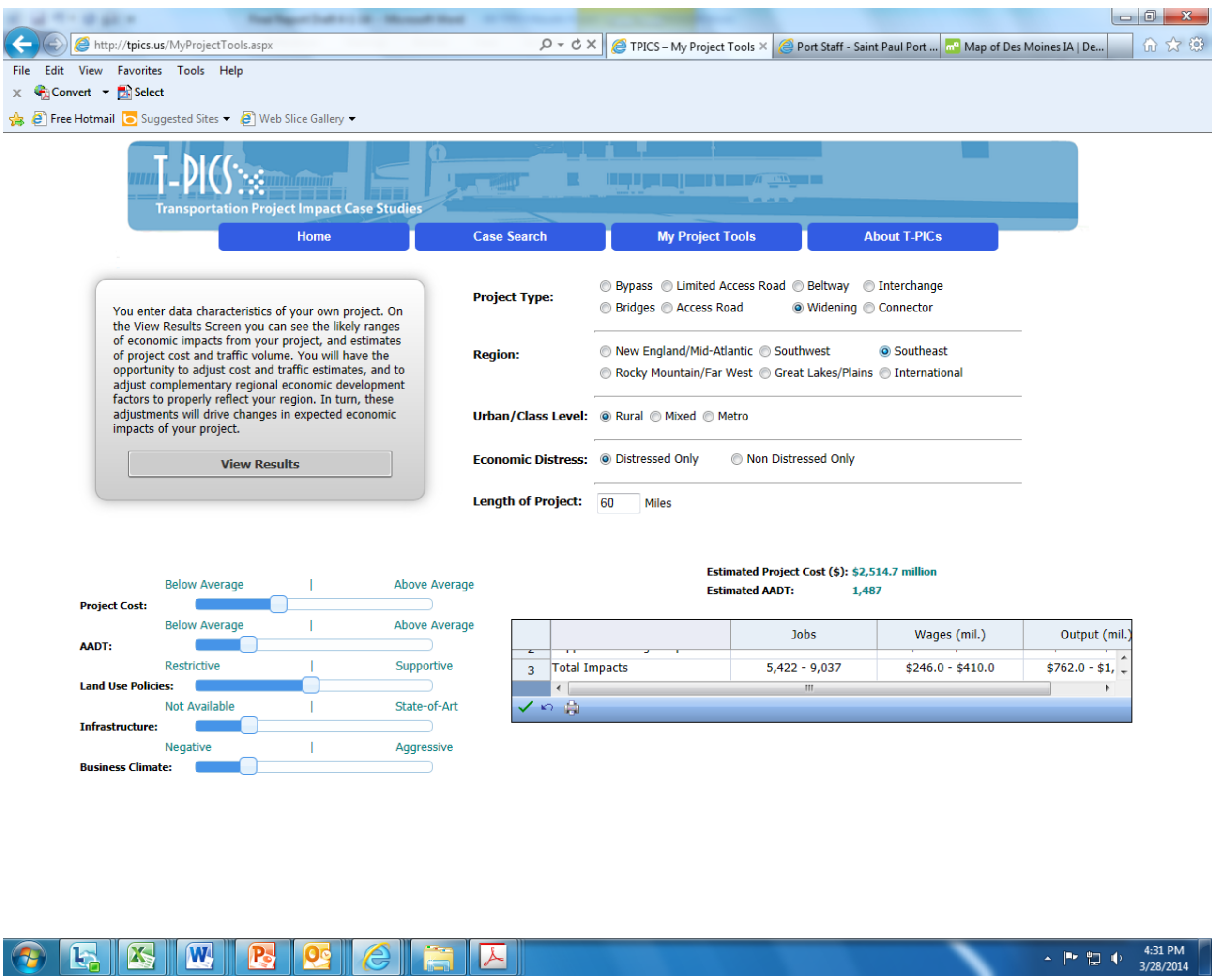
Figure C.7. W-5: Appalachian Development Highway System (ADHS)—Corridor A/A1, from Forsyth County Line, GA to GA-60, South of Dahlonega, GA.



Appalachian Development Highway System (ADHS)—Corridor I **From Corridor F (US-119) at Whitesburg, KY to State Route 30 at Jackson, KY (60 Miles)**			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Total Impacts	5,426 to 9,043	246,200 to 410,300	762,500 to 1,270,800
Alt. Method 3: REMI TranSight			
Total Impacts	1,688	70,000	192,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection	Widening, Southeast, Rural, Distressed, 60 miles		

Factors	

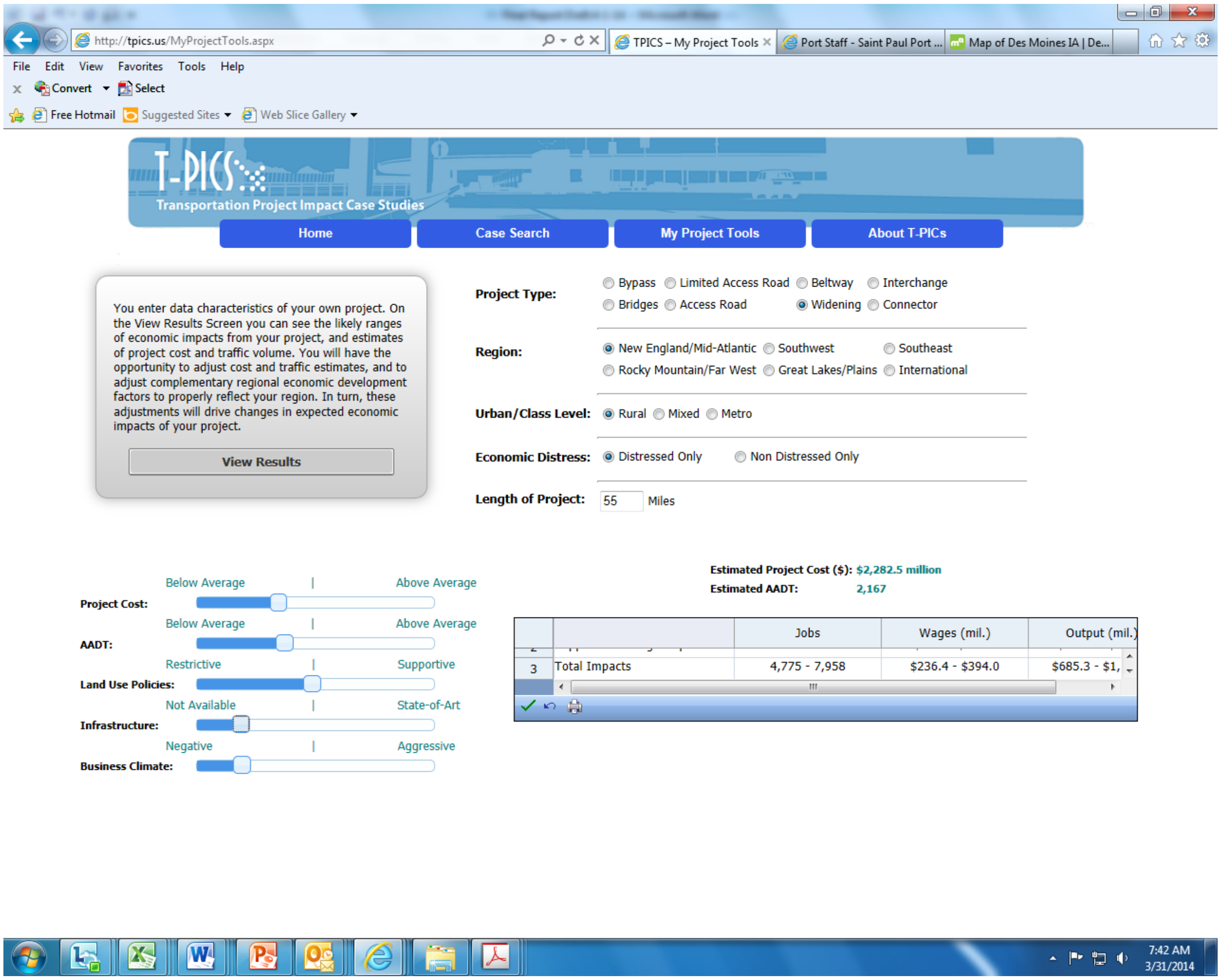
Figure C.8. W-6: Appalachian Development Highway System (ADHS)—Corridor I, from Corridor F (US-119 at Whitesburg, KY to State Route 30 at Jackson, KY).



Appalachian Development Highway System (ADHS)—Corridor L From I-77 at Beckley,

WV to I-79 at Sutton, WV			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Total Impacts	5,426 to 9,043	246,200 to 410,300	$762.5 to $1,270.8
Alt. Method 3: REMI TranSight			
Total Impacts	3,208	179,000	383.0
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection Factors	Widening, Southeast, Rural, Distressed, 60 miles		

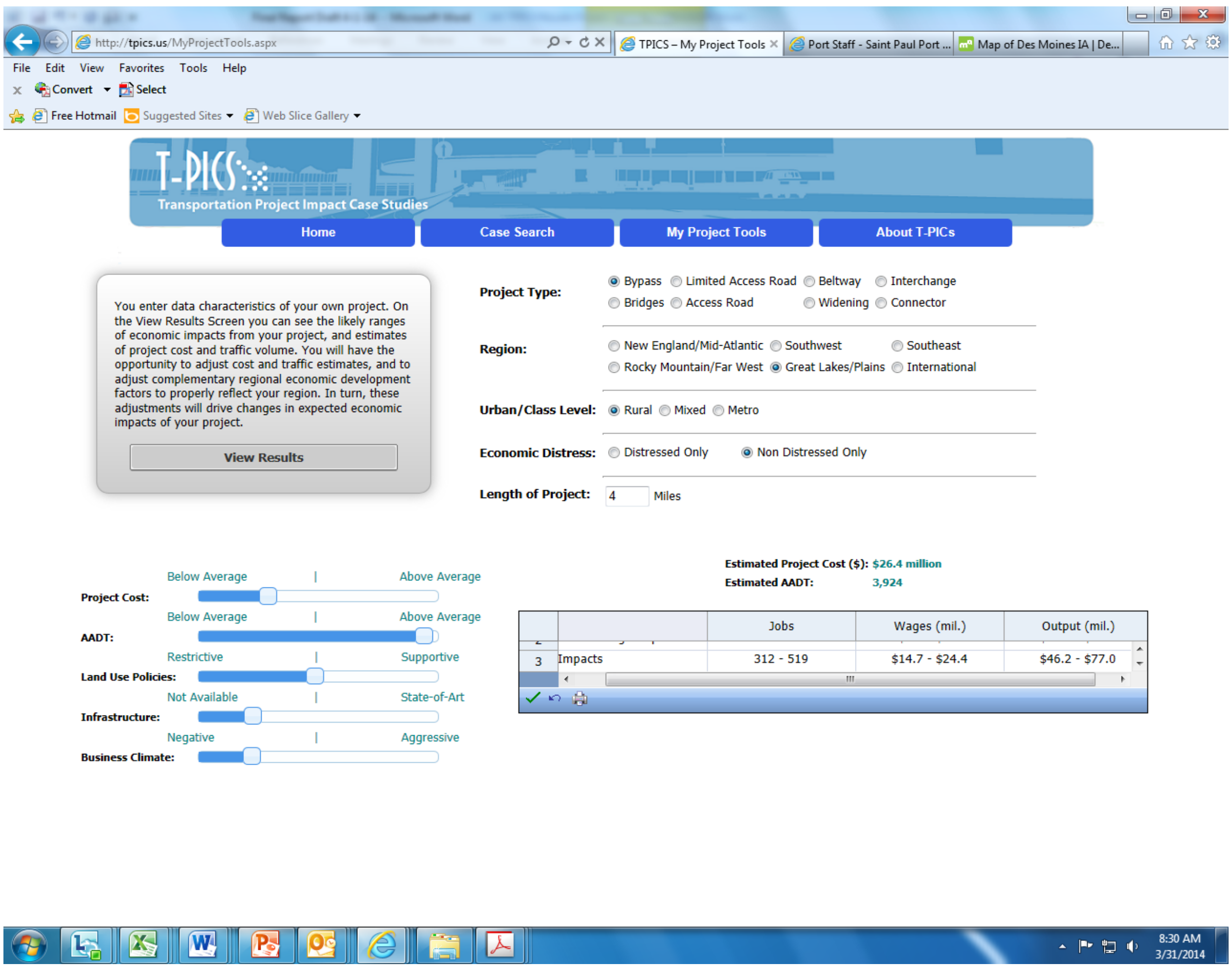
Figure C.9. W-7: Appalachian Development Highway System (ADHS)—Corridor L, from I-77 at Beckley, WV to I-79 at Sutton, WV.



Appalachian Development Highway System (ADHS)—Corridor P I-80, Near Mackeyville, PA to I-80 near Milton, PA			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Total Impacts	4,862 to 8,104	220,600 to 367,700	683,300 to 1,138,900
Method 3: REMI TranSight			
Total Impacts	5,724	294,000	772,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Within	Within	Within
T-PICS Basic Selection	Widening, New England/Mid Atlantic, Rural, Distressed, 55 miles		

Factors	

Figure C.10. W-8: Appalachian Development Highway System (ADHS)—Corridor P, from I-80 near Mackeyville, PA to I-80 near Milton, PA.



MN TH-371 / Brainerd Bypass

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Direct Impacts	292 to 486	$9,300 to $15,500	$29,500 to $49,100
Supplier and Wage Impacts	20 to 33	$5,400 to $9,000	$16,700 to $27,900
Total Impacts	312 to 519	$14,600 to $24,400	$46,200 to $77,000
Alt. Method 2: EIS/ REMI PI[+]			
Total Impacts	11	-$109	$2,780
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
Alt. Method 4: Reduced Form Econometric Modeling of Income and Employment			
Total Impacts	1,169 range: (-2,080 to 4,419)	$6,139 range: (-$64,791 to $77,070)	$2,881 range: (-$112,572 to $118,344)
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Under	Over	Over
T-PICS Basic Selection Factors	Bypass, Great Lakes, Rural, Non Distressed, 4 miles		

Figure C.11. B-1: MN TH-371/Brainerd Bypass.

US-71/MN TH-23 Willmar Bypass			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Direct Impacts	304 to 507	$8,100 to $13,500	$25,800 to $42,900
Supplier and Wage Impacts	-32 to -53	$4,700 to $7,800	$14,600 to $24,400
Total Impacts	272 to 454	$12,800 to $21,300	$40,400 to $67,300
Alt. Method 2: EIS/ REMI PI[+]			
Total Impacts	2	-$7	$376
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over

Alt. Method 4: Reduced Form Econometric Modeling of Income and Employment			
Total Impacts	229 range: (-780 to 1,239)	-2,172 range: ($-31,197 to $26,853)	$7,343 range: ($-27,904 to $42,591)
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Over	Over	Over
T-PICS Basic Selection Factors	Bypass, Great Lakes, Rural, Non-distressed, 5 miles		

Figure C.12. B-2: US-71/MN TH-23 Willmar Bypass.

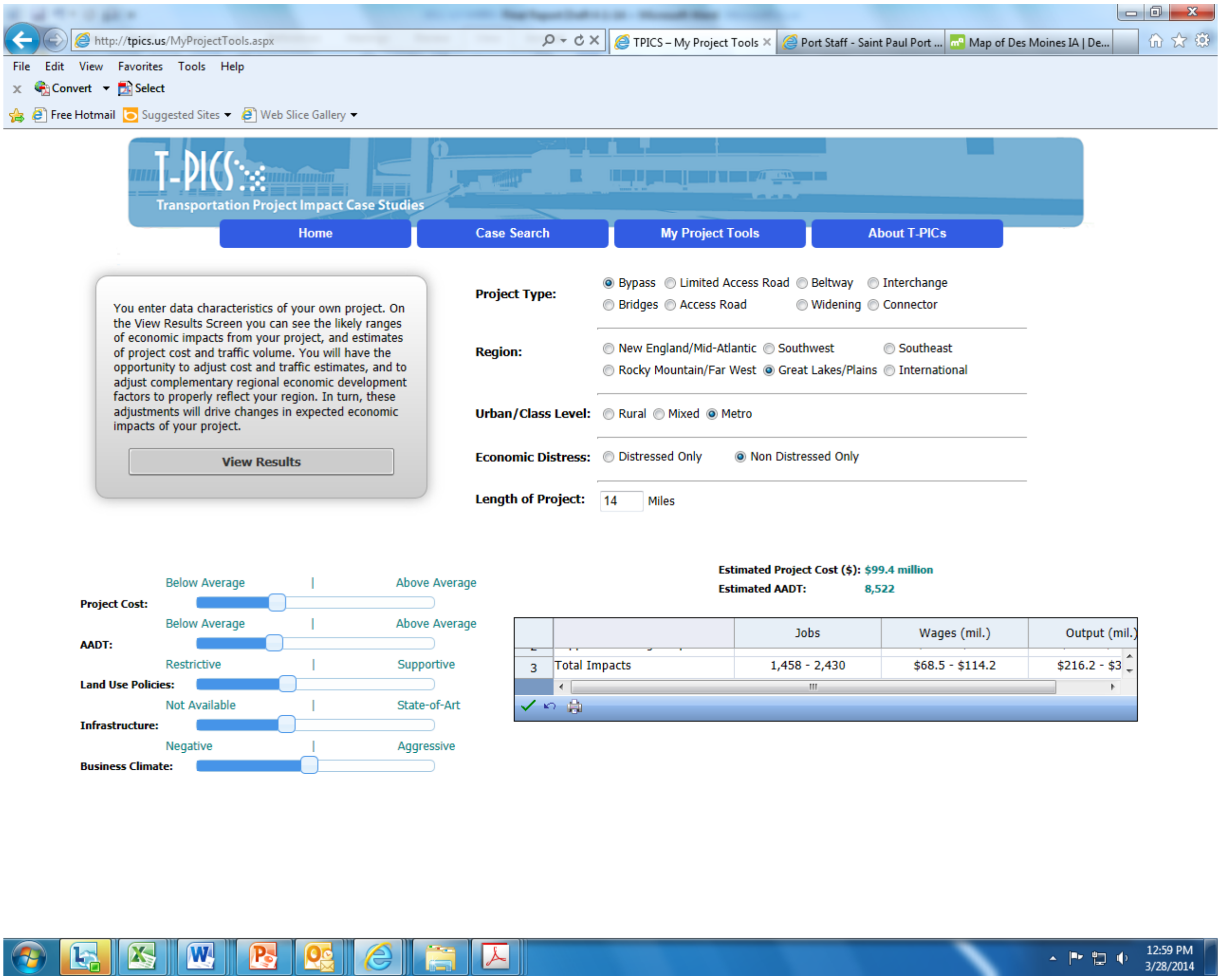
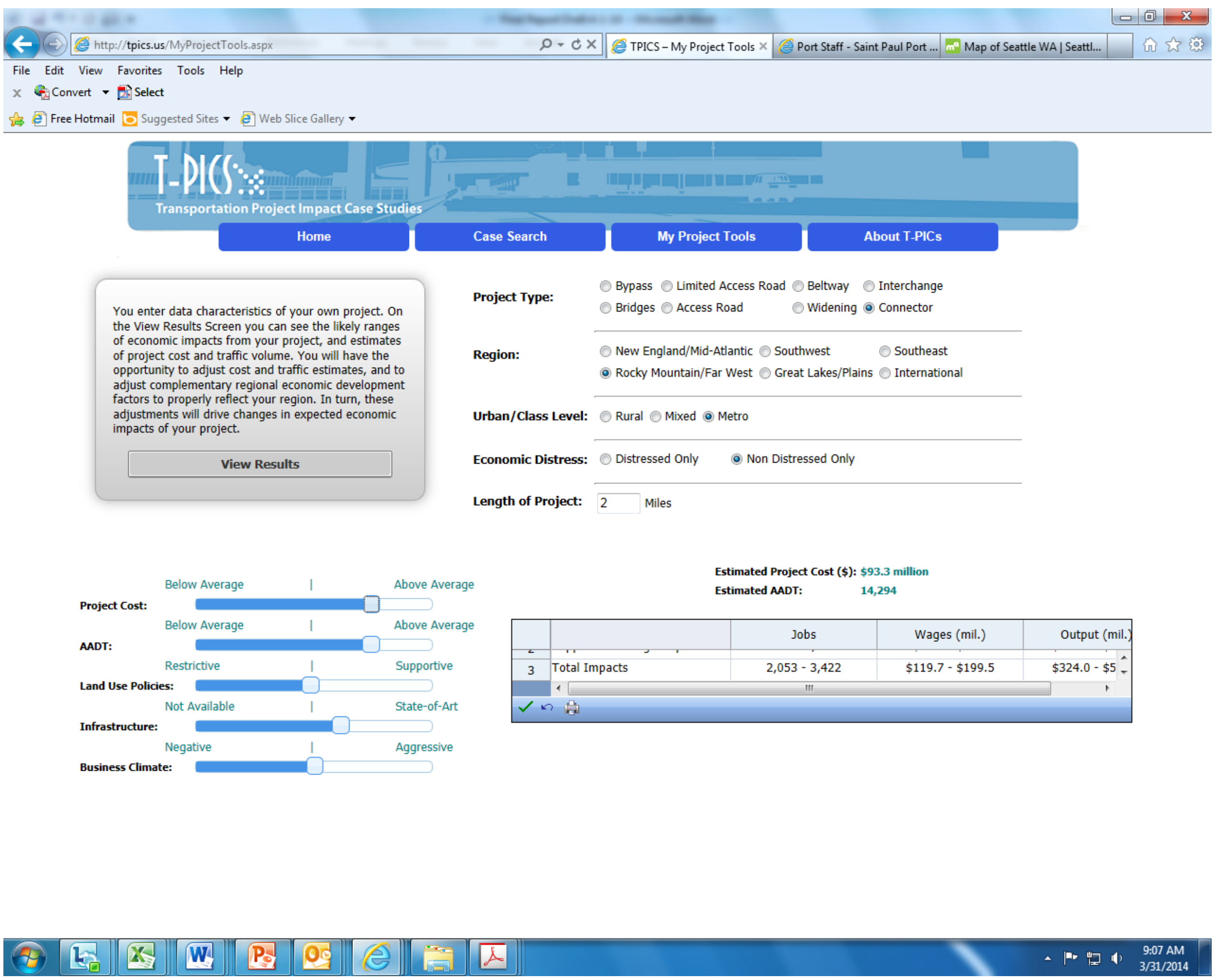


Figure 3.28: Iowa 5/US-65 Beltway (Bypass) from W Junction 5/65 to I-80			
T-PICS	**Employment**	**Wages ($1,000)**	**Output ($1,000)**
Direct Impacts	1,174 to 1,957	$43,400 to $72,300	$137,900 to $229,800
Supplier and Wage Impacts	283 to 472	$25,200 to $41,900	$78,300 to $130,500
Total Impacts	1,458 to 2,430	$68,500 to $114,200	$216,200 to $350,300
Alt. Method 3: REMI TranSight			
Total Impacts	1,897	$77,000	$314,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Within	Within	Within

T-PICS Basic Selection Factors	Bypass, Great Lakes/Plains, Metro, Non-Distressed-only, 14 miles

Figure C. 13. B-3: Iowa US-5/US-65 Beltway (Bypass) from West Junction 5/65 to I-80.



Washington State—State Route 509

T-PICS	Employment	Wages ($1,000)	Output ($1,000)
Total Impacts	2,053 to 3,422	$119,700 to $199,500	$324,.000 to $540,100
Alt. Method 3: REMI TranSight			
Total Impacts	2,111	290,000	367,000
Comparison (T-PICS to Alt. Method: Within Range, Under, or Over)			
Total Impacts	Within	Under	Within
T-PICS Basic Selection Factors	Connector, Rocky Mountain/Far West, Metro, Non-Distressed-Only, 2 miles		

Figure C.14. C-1: Washington State—State Route 509