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Econ**Works** Case Study Design

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American Association of State Highway and Transportation Officials
AASHTO
SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

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PREFACE

P1. Project Products and Reports

This document is one of a series of technical products from SHRP2 Project C03, *Interactions between Transportation Capacity, Economic Systems, and Land Use.*

As of June 2015, the original web tool Transportation Project Impact Case Studies (TPICS) was rebranded into the web tool EconWorks. To provide guidance on the new web tool format, this document has been updated to reflect the new changes, although other resources documents may still refer to the original TPICS web tool.

EconWorks Web Tool. One of the products is a web-based database tool that contains 132 case studies: 100 original case studies, 5 added in 2014, 7 added in 2016, and 20 added in 2017. These cases include the economic and development impacts of highway and transit projects, along with analysis tools for screening, viewing and analyzing them. The web site can be accessed via the EconWorks web site sponsored by the:

- American Association of State Highway and Transportation Officials (AASHTO) found at: https://planningtools.transportation.org/13/econworks.html

Technical Documents. The project also produced a series of technical reports, which can all be viewed and downloaded from the EconWorks web page by selecting the Research Reports button under the Project Tools category within the green banner on top. These reports include:

Case Study Analysis

- EconWorks User Guide (Instructions for Use)
- Handbook for Practitioners: Description and Interpretation of Case Studies
- Case Study Design and Development (current document)
- Data Dictionary

Research Methods and Findings

- Economic Impact Data Analysis Findings
- Highway Economic Impact Case Study Database and Analysis Findings
- SHRP2 C03 Final Report (TRB format)

P2. Acknowledgements

Contract. This project was conducted under a contract from the National Academy of Sciences and Engineering, through the Strategic Highway Research Program II (Capacity Program, Project C03), to Economic Development Research Group, Inc.

Supervision. The project was undertaken with oversight from staff of the Strategic Highway Research Program, with direction from Stephen Andrle and David Plazak. The project benefitted from review provided by Oversight Panel of the SHRP2 Capacity Program.

Contractors. The case studies and technical reviews were conducted by a team comprised of Economic Development Research Group and subcontractors: Cambridge Systematics, Wilbur Smith Associates, Texas Transportation Institute and Susan Moses & Associates.

The TPICS (Transportation Project Impact Case Studies) database and web tool were designed and developed by Economic Development Research Group and implemented by ICF Consulting.

The EconWorks data base and web tool were designed and developed by CH2MHill.

1 INTRODUCTION

This chapter provides an overview of the research project elements and description of the handbook target – which focuses on use of the database of economic impact case studies and the ECONWORKS web tool.

1.1 Project Background and Overview

Project. The Strategic Highway Research Program II (SHRP2), Capacity Project C03 was entitled: *Interactions between Transportation Capacity, Economic Systems, and Land Use*. This project produced a series of reports on methods, models and case studies that examined the economic and development impacts of highway capacity investments projects.

Case Study Database. The most notable accomplishment of this project was the development of 100 original highway, freight, and transit-oriented case studies, with 32 additional cases added which (a) compared pre-project and post-project changes in economic and land development conditions, (b) contrasted them with corresponding conditions for a base of comparison, and (c) included both quantitative impact measures and qualitative assessments based on local interviews.

This collection of case studies, completed in 2010, 2014, 2016, and 2017 was compiled with the goal of including all known pre-post highway impact studies in the US, plus available English language studies from Canada and abroad. Members of the project team then conducted additional quantitative and qualitative data collection and analysis to bring all the cases up to a similar standard of comparability. (For further information on the case study development process, readers are referred to technical documents on “Case Study Design” and “Case Study Development,” as described in the Preface.)

EconWorks Web Tool. The case studies were put into a web-based viewing and analysis system called “EconWorks.” This system includes: (a) a case study search function that allows for user-defined screening and selection of relevant cases, (b) a case study viewer that provides user access to impact measures, discussion text, maps and related documents, and (c) an impact estimation calculator that shows the average and expected range of impact associated with any user-defined project profile. In addition, the web tool provides access to d) *Wider Economic Benefit (W.E.B.) Analysis tools (SHRP2 C11)* for evaluating Accessibility, Connectivity, and Reliability. For further information on this system, readers are referred to a separate document, EconWorks User Guide, which can be accessed as described in the Preface.

The EconWorks system was designed to assist transportation agencies in project planning and evaluation, by providing agency staff and interested stakeholders with a means for establishing the range of job, income and development impacts typically associated with various types of transportation projects in different settings.

1.2 Guide to this Document

This document describes the study design that underlies the data collection and analysis conducted as part of this project. That same study design also underlies the analytic framework embedded in the EconWorks web tool.

The material included in this report is an updated version of text originally contained in a series of technical memoranda covering Tasks 4 through 9 of the Amplified Work Plan. The remainder of this report is organized into six separate chapters:

- Chapter 2 presents the classification of transportation *project settings*.
- Chapter 3 presents the classification of transportation *project types,*
- Chapter 4 discusses our approach to coverage of *multi-project* studies.
- Chapter 5 discusses *combinations of project types and project settings* covered in the research and EconWorks system.
- Chapter 6 discusses criteria for *selection of case studies.*
- Chapter 7 presents the plan for conducting case studies and collecting needed data.

2 CLASSIFICATION OF PROJECT SETTING

This chapter defines and summarizes the types of transportation project settings covered in the case study database.

2.1 Importance of Project Setting

Development of the interactive database was driven by the ways that users access the information available in it. Of the two major dimensions used to characterize projects – settings and types – the information used to characterize settings provides the basic information about the geographic, social and economic context in which a project is to be developed. Project settings are important when choosing potential case studies because they represent the geographical, social and economic conditions in a region that ultimately have a major influence on the economic development outcomes of a project. Therefore, these settings provide a critical dimension by which all projects should be viewed.

The database has been structured to allow users to search projects with comparable settings to their local area. This will enable them to control for project settings most like their own and will provide a basis for displaying generally comparable case studies and potential impacts. The most important settings that should be used to characterize highway projects at this level include:

- *Geographical Setting* – projects built in different regions of the country may be influenced by regional differences in climate, topography, highway network density and distances between cities.
- *Social Setting* – impacts may vary with the density and socio-economic composition of an area, regardless of geographic setting.
- *Economic Setting* – impacts of highway projects may also vary with difference in underlying patterns of unemployment and economic growth/decline that are in effect at the time of project construction.

2.2 Classification Factors and Data Available

Although the considerations mentioned above are simple examples of how the settings can affect results of a highway project, it is important to note that the above factors interact with each other – one factor can influence the impact of another. For that reason, when considering the usefulness of comparable cases, it is important that similarities or differences in both settings and project types be considered. Ideally, a user seeking to learn from the case studies would find a project that is comparable in setting with the proposed project or situation that they are facing. The database is designed to offer a range of setting attributes that can be used in this way to facilitate the screening of case study projects to be viewed or comparisons to be made among projects.

The following is a discussion of the availability of measurements for these factors and the relevance of each factor to the project. Setting factors were also assessed relative to their **primary** or **secondary** relevance with respect to their availability to the user at initial stages of project conceptualization, relative importance in influencing selection of similarly situated cases, and ability to provide a meaningful first-level screening for similar cases based on past studies and theories of the relationships between transportation facility development and economic impact. Primary factors were designated as the most influential for initial screening (for setting attributes) and secondary factors were considered important in terms of their ability to further refine the selection of cases and provide additional information that could amplify the factors associated with primary setting factors.

With these considerations in mind, a preliminary list of the spatial setting factors that could influence economic and land development impacts was identified, as shown in Table 1.

Table 1. Project Settings

Setting Factor	Primary	Secondary
Geographical Setting		
- Region	X	
- Topography		X
Social Setting		
- Urban/Rural class	X	
- Population density	X	
- Transportation access		X
Economic Setting		
- Economic distress	X	
- Economic growth		X
- Local Conditions		X

2.3 Primary and Secondary Factors

Primary Factors

Region. An important factor for determining the comparability of projects is the regional location. The region is a determinant of the impact of a project due to differences in climate, topography, land-use patterns, highway network density and travel distances in different parts of the US. This factor will allow the user to compare cases in similar areas or those with similar characteristics to their own. The regions are defined based on the US Dept of Commerce's Bureau of Economic Analysis (BEA) regions -- which classifies the US into eight regions. The number of regions used for this study was reduced to five, as three pairs of regions were combined (Far West & Rocky Mountain, Great Lakes & Plains, Mideast & New England). These regions are shown in Figure 1.

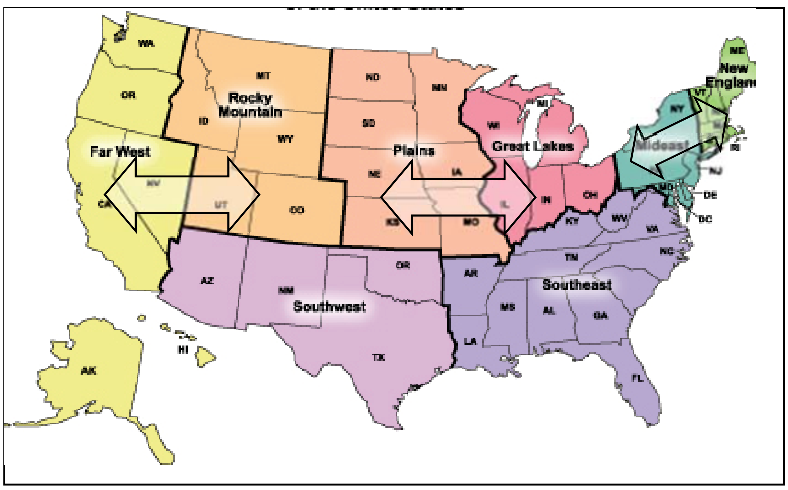

Figure 1. Geographic Regions

Urban/Rural Class. This measure is crucial since the magnitude of the market served by a given project would be expected to influence its impact (e.g. projects in metropolitan areas tend to produce more complex sets of interactions and potentially a broader array of economic impacts)[1]. Market size is measured using the metropolitan classifications of counties by the US Census. Every county is classified as part of a metropolitan area, micropolitan area or neither (i.e. rural) and these designations were used to develop three category types: Metro, Mixed, & Rural. This data is readily available for every county. With the addition of transit

[1] Weisbrod, G., T. Comings and T. Lynch (2007), "Spatial Geography: Effects of Population Base and Airport Access," Sources of Regional Growth in Non-Metro Appalachia, Vol. 3, Appalachian Regional Commission (with Massachusetts Institute of Technology).

cases, a fourth category was added; "Core" since most transit projects are in subarea of a county within a metropolitan area.

Population Density. This is an important indicator to use in conjunction with market size indicators (such as Urban/Rural classifications), since it is possible to have a relatively high-density county in an otherwise rural area, or a low-density county in a metropolitan or micropolitan area. Therefore, the two measures are not redundant but work in conjunction with one another.

Measures of density are also readily available at the county level. Population per square mile is the most straightforward measure. When taken together, market size and population density give an indication of the economic density of an area which influences the concentration and magnitude of economic impacts[2]. This data is readily available from the US Census.

Economic Distress. This measure can be critical in determining the timing and magnitude of economic impacts from a transportation facility[3]. Areas of distress are generally more affected in terms of growth than non-distressed areas. However, the impacts on distressed areas tend to be smaller and take longer to take effect. Basic measures of economic distress level include per capita income, unemployment, and percentage below poverty[4]. This study specifically focused on unemployment since it is very easy to obtain and (as with population density) is available at the community level from the US Census. The economic distress metric used for this project is based on adjusted local unemployment relative to the US level on an annual basis. This prevents comparison of an unemployment rate during an economic boom (e.g. the 1990's) to one during a downturn. A measure relative to the national level would allow for selection of cases completed in various years. This should also be considered as a primary factor.

Secondary Factors

Economic Growth Trend. An area's economic growth is an indicator of how its industries have been performing. In some cases, an area with a higher growth trend may tend to be better positioned to take advantage of new highway connections or capacity, or more in need of such improvements. Economic growth can be measured in terms of percentage change in any economic measure (output, value-added, income or employment) for any time interval. The percentage change in

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[2] Lynch, Teresa (2007), "The Impact of Highway Investments on Economic Growth in the Appalachian Region, 1969-2000: An Update and Extension of the Twin County Study," Sources of Regional Growth in Non-Metro Appalachia, Vol. 3, Appalachian Regional Commission (with Massachusetts Institute of Technology).

[3] Weisbrod, G., T. Comings (2008), "Economic Impact Study of Completing the Appalachian Development Highway System," Appendix B: Market Access and Economic Development Impacts Modeling, Appalachian Regional Commission (with Cambridge Systematics and HDR Decision Economics).

[4] The Appalachian Regional Commission (ARC) uses all three measures in classifying a member county's distress level.

employment was used in this study since it offers the cleanest measure for comparison – all other measures are in dollars and, therefore subject to inflationary adjustments for different data years. Employment data is available through several sources through the US Department of Commerce, including the US Census (County Business Patterns) and the Bureaus of Economic Analysis.). As with economic distress, this is also measured relative to a larger area like the state or country.

Transportation and Market Access. An area's access to transportation facilities and markets determine its ability to grow[5]. The influence of impacts associated with market access will depend on the mix of industries in the area and their dependence on certain modes of transportation. The proximity to marine ports is more important for certain industries (mostly heavy manufacturing) while the distance to airports is more important for others (light manufacturing and professional services)[6]. However, almost all industries are likely to benefit from highway access since it increases access to markets (for delivery, labor acquisition and as a consumer base). Several measures of access area available from the ESRI GIS system at the county level, including: population within 40 minutes (labor and consumer market base) and the travel time to nearest airport, interstate, and major market. However, this information is more difficult to collect for past years.

Topography. The extent of mountain terrain, wetlands and other land constraints can also have an impact on the outcome of a highway project[7]. The US Geological Survey (from the Department of Interior) has a rating of land surfaces by county from 1 (flat) to 21 (very mountainous). This will most likely be too specific of an indicator and, therefore, few cases would come up as matches to the user's area; though it may be possible to let the user come up with ranges of topography or to collapse the ratings into more general categories. Also, some indication of the general terrain may already be captured in the location factor (BEA regions).

Development Capacity. For business and population to expand there must be adequate land and utilities. This includes access to water/sewer lines, electricity, and zoning laws. However, these do not have standardized measures that allow for easy comparison; such information is best gathered through local research and interviews. Since this kind of data may not be readily available to users of the

[5] Targa, Felipe, K. Clifton, And H, Mahmassani (2005), "Economic Activity and Transportation Access: An Econometric Analysis of Business Spatial Patterns," Transportation Research Board #1932, Transportation Research Board.

[6] Weisbrod, G., T. Comings and T. Lynch (2007), "Spatial Geography: Effects of Population Base and Airport Access," Sources of Regional Growth in Non-Metro Appalachia, Vol. 3, Appalachian Regional Commission (with Massachusetts Institute of Technology).

[7] Ferreira, Joseph Jr., A. Ismail and Z. Tan (2007), "Spatial Influences in County Economic Performance," Sources of Regional Growth in Non-Metro Appalachia, Vol. 3, Appalachian Regional Commission (with EDR Group).

system, it should not be used for screening potential case studies. Nonetheless, it is reflected in the case study narratives, and can be used to complement quantifiable measures.

Summary of Project Setting Factors

The preceding factors are all significant influences on the impact of transportation projects. The relative importance of the factors will be left up to the user. However, the primary and secondary ratings are the principle means of initial screening of relevant cases and are the focus of our criteria selecting cases and for gathering additional data on the case studies.

Below is a summary of the project settings:

Project Setting Factor	**Measurement**
Primary Priority	
• Region	BEA Region
• Urban/Rural Class	Census Metropolitan Classification
• Population density	Population per square mile
Secondary Priority	
• Economic distress	Unemployment rate (ratio to national rate)
• Economic growth	% change in employment
• Topography	Land Surface rating
• Transportation access	Travel time to airport, interstate, and major market and population within 40 minutes

3 CLASSIFICATION OF PROJECT TYPES

This chapter defines and summarizes the transportation project types covered in the case study database.

3.1 Importance of Project Type

Project types are the single greatest differentiator among case studies, for different types of projects can have very different attributes in terms of (a) cost, (b) spatial footprint, (c) volume of activity and (d) performance characteristics. The most obvious differences are between small area projects such as interchanges and bridges, and large area projects such as major interstate highways. In between, there are various classes of beltways, town bypasses and connector routes.

For this study, project types are defined broadly by the functional definition of the project under consideration, and measures of the project size and scale of impact. This is done to provide a representative mix of cases necessary to enables the user to draw generalized conclusions about potential project impacts.

3.2 Measures of Project Attributes

Project Size. Project size and data availability are related. Based on the case study research, we found that large scale projects tend to have more data available on costs of construction and economic impacts (if they occur) tend to be more observable than is the case for small scale projects. At the same time, projects that are very large also have unique characteristics which can makes it difficult to compare to smaller projects, even if they are of the same general type (e.g., large urban interstates or capacity enhancements.)

A review of relevant literature and past project experience suggests that projects costing at least $10 million in construction cost are likely to be large enough to create relevant and measurable economic impacts. However, costs vary by project type; the average local access road cost around $13 million while the average major interstate highway project cost well over $1 billion. In addition to the construction cost, other operational data such as length and lane-miles all were gathered and played a role in analyzing economic impacts.

Project Types. For the database to be effective, each project type has notable differences that matter to a user. There is enough variation in the measurement of impacts and capital costs within each type to allow for comparison between cases in the database. After reviewing several different case studies with potential for use in the database, ten categories of functional project types were developed for a total of 100 cases. Since the initial development of the 100 original cases, 32 cases have been added including three new project types to provide more detail regarding passenger intermodal projects, for a total of 12 project types.

Table 2. Number of Cases by Project Type

Project Type	Cases
Access Road	8
Beltway	9
Bridge	10
Bypass	13
Connector	12
Freight Intermodal	10
Interchange	15
Limited Access Road	17
Widening	13
Line Extension*	4
New Line*	9
Station*	12
Total	132

*Transit projects

Impact Scale. The geographic extent (scale) over which economic impacts are measured differs depending on the project's size and type. For instance, a highway corridor would affect areas around both ends and those along the corridor while an interchange would only affect the local area. Hence, the economic impact may also be provided on a micro scale (local) or meso/macro scale (regional or state) depending on the type of project. Different methodologies were used to capture economic impacts at the appropriate scale and geographies for each project. Having projects with a representative mix of impact scales and geographic extents was a key part of the case study selection process.

3.3 Matrix of Project Type by Region

The chart below shows the distribution of case studies completed, by combination of project type and region.

Table 3. Completed Cases by Type and Region

Project Type	Great Lakes & Plains	New England & Mid-Atlantic	Rocky Mtn. & Far West	South-east	South-west	Inter-national	Total by type
Access Road	2	2	1	2	1		8
Beltway	3	1	1	2	2		9
Bridge	1	2	3	2	1	1	10
Bypass	4	1	3	2	1	2	13
Connector	2	1	3	3	3		12
Freight Intermodal	2	2	1	3	2		10
Interchange	6	2	2	2	3		15
Limited Access Road	3	4	3	5	2		17
Widening	3	1	2	4	3		13
Line Extension		1	2	1			4
New Line	2	2	3		2		9
Station	2	3	4	2	1		12
Total by Region	30	22	28	28	21	3	132

4 SELECTION OF CASE STUDIES

This chapter discusses criteria by which case studies were selected.

4.1 Multi-Stage Selection Process

The case study selection process for the first 100 original cases was based on the application of criteria described in the preceding chapters of this report. In addition, project age (the period of construction and completion) was considered, with careful consideration to the likelihood that both pre- and post-construction impact data was available or obtainable. The result was a multi-stage process designed to ensure a representative mix of cases and meaningful range of project types for imputing economic impacts.

Round 1. The first step in the selection process was to classify type and region for each potential case. As mentioned above, some project types and regions had limited numbers of cases from which to select. By combining adjacent regions (e.g., New England and Mid-Atlantic, Plains and Great Lakes, and Far West and Rockies) the number and distribution of cases by type were increased to a number that met minimal threshold criteria for the total number of cases to be evaluated.

Although we could have similarly compressed project types, the project team judged that it was preferable to preserve greater detail on the range of project types and reduce the number of geographic regions. In the situation where there was an over-abundance of cases for a specific project type-region combination (e.g. Far West bypasses), cases were discarded based on over-representation of cases with many similar characteristics Projects that had detailed impact data were given preference when choosing those cases. Cases remaining after this round went into a second round of selection. Also, those that worked as case studies but, if included would result in too many of a project type-region combination, were placed in reserve.

Some highway projects were originally considered by the study team but ultimately were not included because of the time lag issues. Projects are generally planned 5 to 10 years in advance, take 1-10 years to complete, and subsequent economic development impacts can unfold over another 5 to 10 years after construction completion. Projects completed less than 5 years prior were dropped from consideration because they were deemed too soon to fully observe impacts. And projects completed more than 20 years prior were dropped from consideration because of the difficulty collecting data on pre-project conditions, finding interviewees who could report on pre/post land use and development changes, and disentangling observed changes from the many extraneous factors that have also changed over the long-time period.

Round 2. The second step was to rank all the remaining cases from the first round by their level of data completeness and expected level of effort required for completion of pre/post data. Each team member that designated a case evaluated the impact data that was available (with a simple "yes" or "no"). Rankings were done based on the number of impact measures. The selection was based on those with more impact measures and a more detailed look at the operational data and description of qualitative data (e.g. interviews). Of course, there are always exceptions in the process. For instance, if a consultant on the team indicated that a case was preferable to others that they had nominated, these cases were included. Some cases in this round were discarded, others were placed in reserve, and the remaining ones were deemed the best possible case studies.

Additional Considerations. As part of the overall case study selection effort, initial research conducted early in the project identified a number of prior research studies that had included case studies. Overall, members of the project team identified over 100 original cases covered in previous studies. Information about the kinds of data available from each case was compiled, along with an assessment of the quality and likely availability of the data.

Using information available from these cases and economic impact assessments developed using the projects upon which the cases were based, approximately 5 impact factors, 3 geographic scales and 2-time periods provided thirty data types. In addition, eight project descriptors were assessed. Project descriptors included geographic location (State and BEA region), urban/rural setting, measures of economic distress, availability of post-construction data, project type, sponsoring organization, available web-based information and a notation of the research/consulting firm that had undertaken any economic impact studies for the project. Data types were grouped into four classes including: project data, operational data, classification data, and impact measures. Availability, quality and access issues relative to securing data in each of these classes were assessed for each case.

Building on Prior Group Studies. Besides individual project cases, there were also opportunities to draw case studies and associated data from prior research reports that included pre/post measurement of economic impacts and changes associated with highway projects. Many prior studies were used as sources for the selection of additional case studies. They are listed below.

- Appalachian Regional Commission: evaluation of the Public Works Program, 1999 and 2007 -- pre/post evaluation of 199 access road projects in 13 states;
- Oregon Dept. of Economic Development, 2006: pre/post evaluation of 56 access road projects;
- California DOT Highway Bypass Case Studies, 2006: pre/post meta-analysis of 134 town bypass projects conducted by Virginia DOT, Indiana DOT, Wisconsin DOT, California DOT and Montana DOT (MDT);
- Federal Highway Administration, 2005: pre/post evaluation of seven rural interstate highway projects.
- Economic Development Research Group and Pennsylvania Economy League, 2000: pre/post assessment of 7 highway interchange projects.

4.2 Case Study Hierarchy

All potential case studies were placed in a hierarchy of categories based on their first and second round outcomes and the availability of impact measures. Tier 1 cases represent those that are were recommended for case studies (totaling 70 cases). Tier 2 cases were those serving as alternatives (i.e. back up). Tier 3 were not considered as suitable case studies. The subsets within each tier are as follows:

- *Tier 1 primary – 24 cases*: These cases had data from previously conducted "pre/post impact studies" (case studies that had already compiled both before and after data) or were deemed to be easily updated so that pre-post construction impacts could be quickly developed. These cases were given first preference as case studies. *These cases remained after the first and second round of selection.*
- *Tier 1 secondary – 36 cases*: These are cases where there was a reasonable amount of impact data available and that pre- and post-construction impacts were likely to be developed given the level of detail and documentation available from other sources. When combined with Tier 1 primary category, these cases provided the first phase of cases by region and type to populate the database. These cases remained after the first and second round of selection.
- *Tier 1 reserve – 10 cases:* These cases provided sufficient data and information for a case study. They were held in reserve as potential alternatives if any of the primary and secondary cases were unable to be

completed. These cases remained after the first and second round of selection.

- *Tier 2 primary – 12 cases:* These cases were considered viable case studies; usually with a significant amount of research for impact measures and qualitative information. They were also considered useful for inclusion in the meta-analysis for estimating project impacts. These remained after the first round and were placed in reserve during the second round.
- *Tier 2 secondary – 9 cases:* These cases were not classified as potential case studies due to limitations of existing data, but could were still considered useful for the meta-analysis (based on certain impact data) . These were placed in reserve in the first round of selection.
- *Tier 3 – 87 cases:* These cases lacked sufficient data for a case study, and given the current level of documentation, construction value or time of construction, were assessed as less suitable than cases in either tier 1 or tier 2. These were rejected in the first or second rounds of selection.

In sum, there were originally 70 cases in Tier 1 (of which 60 were used) that were evaluated to be used as full case studies. Tier 2 had a sufficient number of substitute cases for those in Tier 1. Also, those cases included in Tier 1 and Tier 2 had data suitable for inclusion in the meta-analysis to provide a larger sample with which to work with and therefore, provide more robust results for users.

With additional funding and interest in expanding the scope of the project, an additional 40 case were approved by the Technical Coordinating Committee (TCC) which enhanced the database with a broader scope of cases. Twenty-one cases were added from the Tier 1 reserve, Tier 2 primary and secondary categories. The other nineteen cases added represented two new project types: Passenger Intermodal and Freight Intermodal facilities. A comprehensive list of all the project types by region is listed in Appendix A.

The combined list of cases provides a case for almost each project type/geographic region and increases the information about the relationships between highway investments and economic impacts.

4.3 Addition of Intermodal Terminals

The TCC requested the addition of Passenger Intermodal and Freight Intermodal cases in the final stage of analysis. Both are defined as road/rail interchange facilities that involve some highway project element – most commonly in the form of a parking lot and highway access route.

The **Passenger Intermodal facilities** originally covered in this study are typically transit stations. They all involve the modal linkage between car and transit – which may be bus, light rail, or heavy rail. These projects are intended to change the patterns of typical urban sprawl by concentrating activity at transportation nodes. These changes can have significant impacts on economic development and implications for local transportation especially as a growing number of future projects along these lines are being actively planned. Passenger intermodal projects are intended to foster more intense, higher density metropolitan land uses and, through this mechanism, encourage a greater level of transit-dependency and pedestrian activity for those who live, work or shop in areas developed with this intent. Since the original 100 cases, additional transit cases were added to the database. To differentiate between the different types of transit projects, three projects types (line extension, new line, & station) were added to replace the generic passenger intermodal project type category. A transportation mode category was also added to classify the type of mode used which includes bus rapid transit (BRT), light rail transit (LRT), commuter rail (CR), and heavy rail transit (HRT).

The **Freight Intermodal facilities** covered in this study are typically container loading facilities for loading containers from trucks to rail cars (or vice versa). While most are TOFC (truck-on-flatcar) and/or COFC (container-on-flatcar) terminals, this category can cover any project that supports the multi-modal interactions of freight movements. Logistics activities at intermodal terminals, in addition to their effects on truck demands on highway capacity, can add value to goods moving through the terminal (which require local jobs) and affect the efficiency of transporting goods (and therefore cost) once they reach their destination. These connections have become increasingly important for freight movement in recent years with a global economy increasingly reliant on trade and complex logistics support. Recent trends in fuel costs and concern about Greenhouse Gas (GHG) emissions have heightened interest in using non-highway alternatives (rail, short-sea shipping, etc.) for goods movement.

5 PROCESS FOR CONDUCTING CASE STUDIES

5.1 Collection of Empirical Data

After determining the case studies to be selected, the next process was to gather the necessary project information for the analysis. Empirical data was gathered from a variety of organizations and published sources. In addition, case study interviews were conducted with representatives of various organizations to gather both quantitative and qualitative data.

All the case studies required empirical data on impact measures relating to economic development and land development. They also required empirical data on attributes of the projects and their settings. Specific types of empirical impact measures that are appropriate for the case studies are shown in the lists below. These variables provide quantitative measures of the impact of each project. This list has been modified from its preliminary version based on work done in Tasks 1-8. However, the basis for including these variables remains in the FHWA Guide (2001), *Using Empirical Information to Measure the Economic Impact of Highway Investments*.[8]

Project Data. The first type of data that is typically collected is the set of key project descriptors. They are:

Project Indicators

1. Description of project (short paragraph)
2. Project type (access road, beltway, bridge, bypass, connector, freight intermodal, interchange, limited access road, widening, line extension, new line, & station).
3. Project motivation (e.g. access (air, rail, & int'l border, & marine port). site development, labor/delivery markets/, tourism, and congestion mitigation/air quality.
4. Project cost (planned if available)
5. Construction start and end years

[8] Available at www.edrgroup.com/library/highways/p-empirical.html

6. Project Sponsor (if applicable)
7. Case study author
8. Post-construction study date
9. Project magnitude (length, lane-miles)
10. GIS latitude/longitude coordinates
11. Related Links
12. Relevant Attachments

Location Classification. The next most critical set of project characteristics is the project setting indicators, as these factors (along with project type) provide the core options for an initial search by a user of the EconWorks system.

Location Indicators

1. Region (New England/Mid-Atlantic, Southeast, Great Lakes/Plains, Southwest, Far West/Rockies)
2. Urban/Rural/Mixed/Core class (census designation)
3. Population density (population per square mile)
4. Economic distress (unemployment level relative to national average)
5. Employment growth rate (+/- percent annually)
6. Population growth rate (+/- percent annually)
7. Economic market size (population within 40 minutes)
8. Airport travel distance (minutes)
9. Travel distance to interstate (minutes)
10. Travel distance to major market
11. Extent of mountain terrain (Land surface rating: 1 to 21)

Impact Measures. Each team member collected pre/ post economic impact data and interviewee reporting of project impacts for as many impact elements as was practical. The impact elements are listed on the next page. Through the local interview process, additional effort was made to estimate the portion of observed economic change that could be attributable to the highway project.

Impact Indicators

1. Per capita income
2. Economic Distress (unemployment level relative to national average)
3. Number of Jobs in the area (direct and total jobs impacts)
4. Population
5. Wages and other income (per capita or per worker; direct and total wage impact)
6. Business sales (output; direct and total output impacts)
7. Population density
8. $ Capital investment; direct and total investment)
9. Property values ($ aggregate total value change in study area)
10. State, local and federal tax revenues and costs (direct and total tax revenue)
11. Annual Average Daily Traffic count (AADT) or Average Weekday Passengers (transit)

Wherever applicable, the data was collected at the local (metropolitan or smaller), county, and state area level.

5.2 Case Study Interview Guide

While a significant part of the empirical impact data was collected via public sources (as listed above) there are some types of impacts that required local information. The case studies also include information about causal factors affecting project impacts (including both transportation programs and non-transportation considerations). To obtain this local information, we relied on interviews with key local private sector and public-sector participants and observers, as well as review of available local documents. The product of the interviews was to fill in as many impact measures as possible but also to develop a coherent narrative describing the planning, implementation, and results of the project.

Types of Interviewees. The interviews focused on filling in missing pieces of empirical information about highway impact outcomes, and additional explanatory insight into causal factors affecting those outcomes.

A minimum of three interviews (one from each type below) conducted for each case study.

1. *Staff of the transportation agency that built the project* -- to provide project characteristics, pre/post transportation data, and information on notable aspects of project planning and implementation;
2. *Staff of the local or regional planning agency* – to provide information (and refer us to other appropriate data sources) on changes in local land use and development, and relative roles of the highway project in affecting it; and
3. *Staff of a chamber of commerce or local economic development agency* – to provide information on how the highway project affected business growth and investment, and its role relative to other local initiatives and factors.

Some of the previously-conducted case studies already included some or all of these three types of interviews. In these cases, additional interviews were conducted with the original or new parties as necessary in order to update available information and fill in informational gaps.

Interview Questions. Additional Empirical Data – Many questions were asked to gather more empirical data. If the pre and post data was already available, then we asked the interviewee to validate or elaborate on it. When the data was not available we asked them to fill in the missing data. In both cases, it was useful to get qualitative information to either reinforce or substitute empirical measures.

- Describe the land use changes because of the project
- How has the project affected property values? (pre and post measures)
- How have property sales or building permits been affected by the project? (pre and post measures)
- Has there been any new construction activity because of the project? (pre and post measures)
- How much of the pre and post impacts are attributed to the project? (go through the list of available impacts data)
- Do you have other before and after measures available? (go through list of impact measures that you do not have)
- Do the direct impacts and total economic impacts accurately describe the influence the project has had on the area? (go through the list of economic impacts)

Special Aspects of the Project Setting and Planning. These questions focused on planning and development issues to provide more context for the project's existence and impact.

- What were the key motivations driving the need for this capacity improvement project?
- Describe the societal or environmental implications of the project? (emissions, safety, sprawl)
- How has the project affected the capacity for future development?
- Describe the local community involvement in the project.
- What were the roles of various stakeholders & public agencies in supporting or modifying the project?
- Describe the size of the project's area of influence?
- What were the economic and land considerations in project planning and implementation?
- How were economic and land development considerations analyzed? (try to get a copy of any study that was done)
- How were these considerations communicated to the public?
- Describe any other key analysis issues or performance measures used in project prioritization and planning processes.

Lessons Learned. A final set of questions was included to help in gathering ideas for future research on transportation projects.

- What impact measures or procedures do you think need to be addressed better or differently in the future?
- What types of impact data do you think are missing or unreliable?
- Do you agree with how the impact measures were estimated?

5.3 Organizing Data for Analysis

The information gathered for each case study was organized in a manner that could be entered into the electronic database and become accessible for users to view. For each project that a user selects, the following data can now be shown:

- Characteristics of the Project - description of the project, project type, length, AADT, year constructed, etc.
- Intermodal volume: for passenger and freight intermodal projects, a description of freight volume or passenger movement at the project location.
- Characteristics of the Project Setting – description of the project setting including the urban/rural, economic distress, etc.
- Pre/Post Conditions – shows the pre and post measures for the region's economy.
- Case Study Narrative – the full project narrative developed from the interviews.
- Project Impacts – a table of the specific economic impact findings for the project along with the relevant areas of impact.

A APPENDIX: LISTING OF CASE STUDIES (ORIGINAL 100 CASES)

Tier 1 Primary Cases

Project	**Type**	**State/Country**
Clermont County Industrial Park in Miami	Access Road	OH
Hammondsport Industrial Access Road, Steuben County	Access Road	NY
Cattaraugus Economic Development Zone Infrastructure	Access Road	NY
Carolina Factory Shops Infrastructure	Access Road	SC
Columbus - Lowndes County Riverside	Access Road	MS
Karuah Bypass	Bypass	Australia
Yass Bypass	Bypass	Australia
Eastern Washington - SR 195 Bypass	Bypass	WA
Spooner Bypass	Bypass	WI
Verona Bypass	Bypass	WI
Stonewall Bypass	Bypass	OK
Rush Springs and Snyder Bypass	Bypass	OK
SR 99	Limited Access Road	CA
Interstate 43	Limited Access Road	WS
SR 29	Limited Access Road	WS
Interstate 81 (PA)	Limited Access Road	PA
Interstate 68 – Corridor E	Limited Access Road	MD, WV
Interstate 29	Limited Access Road	IA
Interstate 81 (VA)	Limited Access Road	VA
Interstate 16	Limited Access Road	GA
Interstate 26	Limited Access Road	SC
Interstate 27	Limited Access Road	TX
Corridor B	Limited Access Road	NC, TN
I-86 NY Southern Tier	Widening	NY

Tier 1 Secondary Cases

Project	Type	State/Country
FM 2818 through Bryan/Industrial Park	Access Road	TX
Appleton, Wisconsin, Route 441 Bypass	Beltway	WS
Fort Wayne, Indiana, I-469 Bypass	Beltway	IN
MD Woodrow	Beltway	MD
Danville, Virginia, I-785 Bypass	Beltway	VA
Richmond, Virginia, I-295 Bypass	Beltway	VA
Beltway 8 Houston segments	Beltway	TX
SH 99 Grand Parkway	Beltway	TX
MI S-Curve (US 131)	Bridge	MI
Oresund Bridge	Bridge	Denmark, Sweden
Fred Hartman Bridge on SH 146 , TX	Bridge	TX
World Trade Bridge	Bridge	TX
Central Artery Tunnel	Bundled	MA
ID: Transportation Future*	Bundled	ID
Santan Freeway: part of Maricopa RTP, AZ	Bundled	AZ
Hollister SR156	Bypass	CA
Sonora & East Sonora SR49 & SR108	Bypass	CA
The Economic Impact of Rural Bypasses – Iowa	Bypass	IA
Georgetown Bypass	Bypass	KY
Mercer Co. KY, US-127 Bypass	Bypass	KY
Branson W (Ozark Mt. Highroad)	Connector	MO
Southern Connector	Connector	SC
US Highway 281, San Antonio (Extension)	Connector	TX
Bloomington, MN	Interchange	MN
Conshohocken, Pennsylvania	Interchange	PA
Peabody Route 1, Route 128, I-95 Interchange	Interchange	MA
I-95 Interchanges	Interchange	NC, SC
Dallas High Five Interchange	Interchange	TX
Houston, TX	Interchange	TX
Casey Highway in Pennsylvania (US Route 6)	Limited Access Road	PA
Shannon and Jackson Counties, South Dakota	Widening	SD
CO 285	Widening	CO
US 75 North Central Expressway, Dallas	Widening	TX
Corridor D	Widening	OH, WV
Corridor J	Widening	KY, TN
Corridor Q	Widening	VA, WV

Tier 1 Reserve Cases

Project	Type	State/Country
NY: Binghamton MTS*	Bundled	NY
Lebanon Bypass	Bypass	KY
Minnesota Bypasses	Bypass	MN
Capital Plaza-West Frankfort Connector	Connector	KY
Plymouth Meeting	Interchange	PA
Albany, NY	Interchange	NY
Springfield, MA	Interchange	MA
A2 Motorway (Poland)	Limited Access Road	Poland
US-59 Widening (SH6-SH99)	Limited Access Road	TX
Interstate 10- El Paso	Widening	TX

Tier 2 Primary Cases

Project	Type	State/Country
Alameda Corridor	Bundled	CA
Niagara to GTA Corridor	Bundled	Canada
Mexico Multimodal Corridor	Bundled	Mexico
Mojave SR-58	Bypass	CA
Barnevold Bypass	Bypass	WI
Rhinelander Bypass	Bypass	WI
Carolina Bays	Connector	SC
Worcester Route 140	Interchange	MA
King of Prussia, PA	Interchange	PA
Main Lessons of Ex Post Studies	Limited Access Road	multi
Case Study Candidates from Finland	Limited Access Road	Finland
Linking the Delta Region with the Nation and the World	Widening	LA, MS, AK, KY, MI, IL, TN

Tier 2 Secondary Cases

Project	Type	State/Country
Cloverdale US 101	Bypass	CA
Truckee, SR-267	Bypass	CA
Eastern Washington - I-82	Bypass	WA
Mittagong Bypass	Bypass	Australia
Berrima Bypass	Bypass	Australia
I-69 MS-SIU (MS)	?	MS
Franklin Co. KY, US-127	?	KY

Bella Vista (AR) Bypass – US71	Bypass	AR
US183, Austin	Widening	TX

Tier 3 Cases

Project	Type	State/Country
Tishomingo County Access Road	Access Road	MS
Marion Smith Access Road, Choctaw County	Access Road	MS
The Turner Industrial Park Access Road	Access Road	MS
Package Corporation of America's Utility	Access Road	MS
Eason Blvd.	Access Road	MS
Coley Road	Access Road	MS
Lee MS-Bryce-Toga Industrial Access Road	Access Road	PA
362nd Avenue Improvement	Access Road	OR
Industrial Park Infrastructure Improvements	Access Road	OR
Marietta Food-4-Less	Access Road	OH
Prescott Avenue	Access Road	NY
Fulton Industrial Road	Access Road	MS
Louisville/Winston County Access Road	Access Road	MS
Cambria County Industrial Park Infrastructure	Access Road	PA
Lee MS-Bryce-Toga Industrial Access Road	Access Road	PA
Trans Texas Corridor	Bundled	TX
Michigan BEST	Bundled	MI
Continental One Corridor	Bundled	multi
AZ: Maricopa*	Bundled	
Trans-Texas-Corridor (TTC)	Bundled	TX
Angel's Camp	Bypass	CA
Bishop	Bypass	CA
Brawley	Bypass	CA
Hopland, US101	Bypass	CA
Kramer Junction US395 & SR 58	Bypass	CA
Lockeford/Clements	Bypass	CA
Pine Grove	Bypass	CA
Sutter Creek, SR49	Bypass	CA
Willits US101	Bypass	CA
Anderson	Bypass	CA
Auburn	Bypass	CA
Buellton, US 101	Bypass	CA
Camarillo	Bypass	CA
Escondido	Bypass	CA

Fairfield	Bypass	CA
Folsom, Hwy 50	Bypass	CA
Fresno	Bypass	CA
Imperial, US 99	Bypass	CA
North Sacramento	Bypass	CA
Templeton	Bypass	CA
Tulare	Bypass	CA
SR 97	Bypass	WA
Blue Mounds	Bypass	WI
Dodgeville	Bypass	WI
Fort Atkinson	Bypass	WI
Mt. Horeb	Bypass	WI
Plymouth	Bypass	WI
Ridgeway	Bypass	WI
Tomahawk	Bypass	WI
West Bend	Bypass	WI
Northam Bypass	Bypass	WA
Georgetown Bypass	Bypass	KY
Impacts of Highway Bypasses on Community Businesses	Bypass	NC
Impacts of Highway Bypasses on Kansas Towns	Bypass	KA
Effects of Highway Bypasses on Rural Communities and Small Urban Areas	Bypass	TX
2035 Regional Plans	Connector	multi
Linking the Delta Region with the Nation and the World	Connector	LA, MS, AK, KY, MI, IL, TN
Mon-Fayette Highway	Limited Access Road	PA
Lackawanna Valley Industrial Highway	Limited Access Road	PA
Port-to-Plains highway	Limited Access Road	CO
I-73 in Southwestern Virginia	Limited Access Road	VA
J. Verne Smith Parkway	Limited Access Road	SC
I-73 South Carolina EIS	Limited Access Road	SC
LeEntrada al Pacifico – TX	Limited Access Road	TX
Houston Grand Parkway	Limited Access Road	TX
US 290- TX	Limited Access Road	TX
SH 249 Houston	Limited Access Road	TX
I-27	Limited Access Road	TX
SH 151 (Raymond Stotzer Parkway)	Limited Access Road	TX
Artcraft-El Paso	Limited Access Road	TX
US 287 Wichita Falls, TX	Limited Access Road	TX
I-27 (connect Lubbock to Interstate System) Segment in Lubbock (2)	Limited Access Road	TX
US Hwy 80 Marshall, Longview TX	Widening	TX

US59, Houston TX (Eastex Freeway)	Widening	TX
SH21, Caldwell TX	Widening	TX
SH183 Dallas	Widening	TX
Joe Battle Blvd.	Widening	TX
WSDOT I-405	Widening	WS
Rt. 12 - NY	Widening	NY
FHWA Econ Devel Hwy Initiative	Widening	multi
Economic and Land Development Case Studies from Long Range Plans	Widening	multi
TIPS	Widening	multi
Roosevelt County / Fort Peck Indian Reservation Corridor, Montana	Widening	MT
CO: Step Up		CO
Corridor K	Widening	TN
Corridor H	Widening	WV
Corridor V	Widening	MS, AL

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