TRANSPORTATION AND ECONOMIC DEVELOPMENT: CHARACTERIZING ECONOMIC DEVELOPMENT IMPACTS FOR CORRIDOR IMPROVEMENTS

101ST PURDUE ROAD SCHOOL
LYLES SCHOOL OF CIVIL ENGINEERING
Joint Transportation Research Research Program

By:
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Ruiman Yang
PROJECT BACKGROUND

SPR#3912 ECONOMIC DEVELOPMENT IMPACT OF CORRIDOR IMPROVEMENTS

Research Institution: Joint Transportation Research Program, Purdue University

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JTRP Program Director, INDOT R&D

Business Owner: Roy Nunnally
Director, Asset Planning & Management Division

Research Assistants: Davis Chacon Hurtado & Ruiman Yang
Lyles School of Civil Engineering, Purdue University
OUTLINE

- Research objectives
- Economic development
- Project planning stages
- Measuring economic impacts
- Project timeline
- SHRP2 overview
- Transportation Project Impact Case Studies (T-PICS)
- Tools for Assessing Wider Economic Benefits of Transportation (C11)
- Questions
RESEARCH OBJECTIVES

SPR#3912 Economic Development Impact of Corridor Improvements

1. Investigate the synergies among travel demand, traffic, and economic impact models in evaluating alternative corridor-level projects.

2. Investigate ways to adapt the ISTDM, and/or MCIBAS, or develop a post-processing method to meet the needs of INDOT’s Division of Asset Planning and Management.
TRANSPORTATION AND ECONOMIC DEVELOPMENT

- Economic Development Impacts
- Induced impacts
- Dynamic Impacts
- Direct impacts
- Indirect impacts
- Wider economic impacts

TRANSPORTATION DEVELOPMENT PROCESS

- **Early Stage Planning**
  - “Broad brush”
  - TPICS C03

- **Middle Stage Planning**
  - C11

- **Later Stage Planning**
  - EIA
  - BCA Transp Models

Source: Report SHRP2-S2-C11-RW-1

Decision making
### Wide range of tools

<table>
<thead>
<tr>
<th>Survey and interviews</th>
<th>Benefit/Cost analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corridor inventories</td>
<td>Expert interviews</td>
</tr>
<tr>
<td>Business surveys</td>
<td>TOPS - BC</td>
</tr>
</tbody>
</table>

**Economic multiplier / I-O tables**

| RIMS-II              | IMPLAN                | I-O model | PC Input-Output |

**Economic forecasting and simulation models**

| TREDIS               | REMI                   | Shopper surveys | Windshield surveys |

**Integrated traffic and economic simulations models**

| MCIBAS               | HEAT                   |

**Statistical analysis tools**

| linear regression / Logistic regression | Hedonic price modeling |

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*Source: Purdue University*
NEED?

Inputs

Expensive/ complex

MODEL

- Early Stage Planning
  - "Broad brush"
  - TPICS C03

- Middle Stage Planning
  - C11

- Later Stage Planning
  - EIA
  - BCA Transp Models
SHRP2 C03

TRANSPORTATION PROJECT IMPACT CASE STUDIES (T-PICS)
WHAT IS T-PICS?

SHRP 2 program to explore the interactions between Transportation Capacity, Economic Systems, and Landuse

T-PICS
A web tool of national database at sketch planning stage

100 before & after case studies on economic and land development highway / intermodal project

Source: SHRP2-Report S2-C03-RR-1
WHAT'S THE STRUCTURE OF T-PICS?

T-PICS

- Case studies database
- Case Search (Past Projects)
- My Project Tool (Predict Impact of future projects)

Source: SHRP2-Report S2-C03-RR-1
### Project Types and Settings

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Economic Market Setting</th>
<th>Economic Distress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Metro</td>
<td>Rural</td>
</tr>
<tr>
<td>Access Road</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Beltway</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Bridge</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Bypass</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Connector</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Interchange</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Major Highways</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Widening</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Intermodal</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>23</td>
</tr>
</tbody>
</table>

Source: SHRP2-Report S2-C03-RR-1
Economic Impact Measures

Number of jobs
- Direct
- Total job impacts

Income / wages
- Per capita or per worker
- Direct and total wages impacts

Output
- Business sales
- Direct and total output impacts

Source: SHRP2-Report S2-C03-RR-1
ILLUSTRATION OF CASE SEARCH

T-PICS Website: [http://www.tpics.us/](http://www.tpics.us/)

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Corydon I-64 Interchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Corydon, IN</td>
</tr>
<tr>
<td>Project Type</td>
<td>Interchange</td>
</tr>
<tr>
<td>Region</td>
<td>Great Lakes / Plains</td>
</tr>
<tr>
<td>Motivation</td>
<td>Congestion Mitigation / Site Development</td>
</tr>
<tr>
<td>Urban / Class level</td>
<td>Rural</td>
</tr>
<tr>
<td>Economic Distress</td>
<td>All</td>
</tr>
<tr>
<td>Length of the Project</td>
<td>2.3 miles</td>
</tr>
<tr>
<td>Construction Cost</td>
<td>$5 Million</td>
</tr>
</tbody>
</table>
RESULTS FROM CASE SEARCH

Instructions

1. On right side, select characteristics of case study projects that you wish to view.
2. Press "View Results" button below to see case study names that fit those characteristics.
3. Click on individual case study names (titles) to see details.
4. Click on each tab to see further information. Apply that information as desired to help judge the possible range of impacts applicable for your situation.

Potential Matches: 1

View Results

Compare Projects

Results

<table>
<thead>
<tr>
<th>Compare</th>
<th>Title</th>
<th>Description</th>
<th>Project Type</th>
<th>State</th>
<th>BEA Region</th>
<th>Project Cost (current $)</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-94 / Opportunity Drive Interchange</td>
<td>The 1-94 Opportunity Drive (CASH 75) interchange in St. Cloud, MN added a new highway access ramp that connected I-94 to an industrial park off of the interchange in 2004.</td>
<td>Interchange</td>
<td>MN</td>
<td>Great Lakes/Plains</td>
<td>$9,813,580</td>
<td>2004</td>
</tr>
</tbody>
</table>

Source: T-PICS www.tpics.us
## I-94 / Opportunity Drive Interchange

The I-94 Opportunity Drive (CASH 75) interchange in St. Cloud, MN added a new highway access ramp that connected I-94 to an industrial park off of the interchange in 2004.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Direct</th>
<th>Indirect</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Jobs</td>
<td>1,103</td>
<td>543</td>
<td>1,646</td>
</tr>
<tr>
<td>Income/Wages ($M's)</td>
<td>$59.51</td>
<td>$28.55</td>
<td>$88.06</td>
</tr>
<tr>
<td>Output ($M's)</td>
<td>$309.85</td>
<td>$140.6</td>
<td>$450.45</td>
</tr>
</tbody>
</table>

Source: T-PICS www.tpics.us
ILLUSTRATION OF MY PROJECT TOOLS

T-PICS Website: [http://www.tpics.us/](http://www.tpics.us/)

<table>
<thead>
<tr>
<th>Project Name</th>
<th>East-West Corridor: From I-65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Boone or Johnson County, IN</td>
</tr>
<tr>
<td>Project Type</td>
<td>Connector</td>
</tr>
<tr>
<td>Region</td>
<td>Great Lakes / Plains</td>
</tr>
<tr>
<td>Motivation</td>
<td>Congestion Mitigation</td>
</tr>
<tr>
<td>Urban / Class Level</td>
<td>Rural</td>
</tr>
<tr>
<td>Economic Distress</td>
<td>Distressed Only / Non-distressed Only</td>
</tr>
<tr>
<td>Length of the Project</td>
<td>12 miles</td>
</tr>
<tr>
<td>Construction Cost</td>
<td>N/A</td>
</tr>
</tbody>
</table>
RESULTS FROM MY PROJECT TOOLS

- Distressed only – Johnson County

Source: T-PICS www.tpics.us
RESULTS FROM MY PROJECT TOOLS

- Non Distressed only – Boone County

Source: T-PICS www.tpics.us
WHAT ARE LIMITATIONS OF T-PICS?

Only for Highway Capacity Expansion Projects

Safety improvement or facility reconstruction, rehabilitation, and preservation cannot be evaluated through T-PICS

Transportation Conditions Were Not Included

The case study database cannot relate observed economic impacts to the magnitude of before and after changes in transportation conditions

It Isn’t a Economic Impact Prediction Model

Case study database and T-PICS tool cannot serve as a substitute for predictive economic impact models

Source: SHRP2-Report S2-C03-RR-1
C11-TOOLS

TOOLS FOR ASSESSING WIDER ECONOMIC BENEFITS OF TRANSPORTATION
1. Reduce congestion:
   • RELIABILITY
2. Enhance access to market and jobs
   • MARKET ACCESS
3. Enhance connectivity to intermodal terminals
   • INTERMODAL CONNECTIVITY

Complement each other
(3 main benefits)
C11 - TOOLS

WHAT IS IT?

HOW DO WE VALUE IT?

VOT

VOR

VOR/VOT

0.5-1.18

Source: Report SHRP2-S2-C11-RW-1
## C11 - Tools

### Reliability

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Data</td>
<td>Congestion and Reliability Costs</td>
</tr>
<tr>
<td>- AADT</td>
<td></td>
</tr>
<tr>
<td>- Annual traffic growth</td>
<td></td>
</tr>
<tr>
<td>Truck Data</td>
<td></td>
</tr>
<tr>
<td>- Percentage of trucks%</td>
<td></td>
</tr>
<tr>
<td>Capacity Data</td>
<td></td>
</tr>
<tr>
<td>- Peak Capacity</td>
<td></td>
</tr>
<tr>
<td>- Traffic signal ratio/terrain type</td>
<td></td>
</tr>
<tr>
<td>Time Horizon</td>
<td></td>
</tr>
<tr>
<td>- Number of years into the future for which the analysis applies</td>
<td></td>
</tr>
<tr>
<td>Period of analysis</td>
<td></td>
</tr>
<tr>
<td>- Specify the hours of the day for which the analysis will be run</td>
<td></td>
</tr>
</tbody>
</table>

Source: Report SHRP2-S2-C11-RW-1
WHAT DOES IT DO?
Expansion the breadth of destinations for freight transportation (same day deliveries)
Expansion of the area which a business can attract customers and businesses

HOW DO WE MEASURE IT?
• Enhanced urban agglomeration

Access to Buyer – seller Markets
Access to Labor Markets

Source: Report SHRP2-S2-C11-RW-1
### C11 - Tools

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subdivision into ZONES</td>
<td>Effective density</td>
</tr>
<tr>
<td>Economic mass</td>
<td></td>
</tr>
<tr>
<td>Impedance</td>
<td></td>
</tr>
</tbody>
</table>

Source: Report SHRP2-S2-C11-RW-1
C11-TOLLS

WHAT DOES IT DO?

- Improvement in frequency
- Reduction of travel time

HOW DO WE VALUE IT?

- Location of the terminal
- Type of service
- Level of activity
- Number of other locations that can be reached

Business locations

Intermodal terminals

Faster mov. between existing O-D
Enabling new O-D

Source: Report SHRP2-S2-C11-RW-1
C11 - TOOLS

INPUTS
- Distance of the improvement from the facility
- Number of trucks or passenger vehicles on the segment improved
- Hours saved per truck or passenger vehicle
- Value per vehicle hour saved
- Fraction of vehicles on the segment associated with the intermodal terminal being evaluated

OUTPUTS
- Freight connectivity index
- Passenger connectivity index
- Weighted Connectivity
  \[ \text{Weighted Connectivity} = \text{connectivity index} \times \text{Savings associated with the highway} \]

Source: Report SHRP2-S2-C11-RW-1
<table>
<thead>
<tr>
<th>Project Objective</th>
<th>Mode</th>
<th>Threshold Factor</th>
<th>Analysis Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Time Reduction</td>
<td>Car</td>
<td>Annual reduction in VHT &gt; 80,000 hrs</td>
<td>STB Analysis</td>
</tr>
<tr>
<td></td>
<td>Bus</td>
<td>Annual reduction in PPT &gt; 80,000 hrs</td>
<td></td>
</tr>
<tr>
<td>Reduce Congestion</td>
<td>Car</td>
<td>Level of Service = D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bus</td>
<td>Average V/C &gt; 0.85</td>
<td></td>
</tr>
<tr>
<td>Travel Time Reliability</td>
<td>Car</td>
<td>TTI &gt; 1.3</td>
<td></td>
</tr>
<tr>
<td>Access between housing &amp; employment</td>
<td>Car</td>
<td>Pop &gt; 80,000 &amp; density &gt; 1800 /mi2</td>
<td></td>
</tr>
<tr>
<td>Business Delivery Access</td>
<td>Bus</td>
<td>Trucks &gt; 12% of veh.</td>
<td></td>
</tr>
<tr>
<td>Connectivity to Intermodal Terminal</td>
<td>Car</td>
<td>Trucks &gt; 12% of veh.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bus</td>
<td>none</td>
<td></td>
</tr>
</tbody>
</table>

Adapted from NCHRP 02-24 Assessing Productivity Impacts of Transportation Investments
Since Market access and reliability are wide concepts, their applicability is limited to urban ground transportation:

- The economic valuation is based on coefficients and elasticities derived for those types of modes.
- Not include:
  - Air, marine modes
  - Recreation trips
  - Long distance trips

Source: NCHRP 02-24 Assessing Productivity Impacts of Transportation Investments