Brent Spence Bridge History

- Opened in 1963
  - Double deck carrying both I-75 and I-71 over the Ohio River
  - Opened as 6 lanes
  - 2 lanes added in 1986 – Shoulders removed
- Carries double the volume designed for
- One of the busiest truck corridors in the country
- Rated as functionally obsolete in 1998
Environmental Assessment performed
- Joint effort between ODOT and KYTC
- 7.8 Mile corridor – Dixie Highway to Western Hills Viaduct

Purpose and Need
- Improve LOS and traffic flow
- Improve safety
- Correct geometric deficiencies
- Maintain connections

FONSI
- Signed August, 2012
- Preferred alternative $2.47 – 2.88B
  - Includes engineering, right of way, utilities, and construction
  - Split is about 40%/60% ODOT/KYTC
Brent Spence Bridge Funding

- Traditional funding options not feasible
- Alternative delivery and funding options researched
- Tolling identified as a potential alternative
- Requires re-visiting the EA including traffic modeling and projections
- No decisions yet made
Impact to Traffic Forecasting?

- Toll on BSB could impact various transportation decisions:
  - Continue to make the trip?
  - Continue to travel across Ohio River?
  - Continue to use personal auto?
  - Continue to travel on BSB?
Uses of Traffic Forecasting Tool

- Estimate traffic shifts based on changes in:
  - Housing & employment projections
  - Roadway design (lanes & speeds)
  - Access to/from BSB project
  - Toll rates on BSB
Uses of Traffic Forecasting Tool

- Forecast traffic volumes for:
  - Roadway operations & design
  - Indirect & cumulative impacts
  - Environmental Justice analysis
  - Revenue potential
  - Air & noise analysis
Building the Traffic Forecasting Tool

- Utilized the Ohio-Kentucky-Indiana (OKI) MPO’s travel demand model
- Incorporated impacts of tolling in 2 key areas
  - Trip distribution
  - Trip assignment
- Developed a Value of Time for region
  - Represents the perceived value in dollars for one hour of travel time
Initial Results

- Initial modeling completed in March 2014
- Results indicate:
  - Rebuilding BSB increased demand on bridge
  - Tolling rebuilt BSB reduced demand on bridge
- But… impacts across the range of BSB users not clearly defined.
Traffic Forecasting Update

- FHWA requested update of traffic forecasting in July 2014.
- Needed to explicitly look at various income groups
  - Value of Time to vary by income group
- Weekly team meetings initiated
  - ODOT and KYTC project staff
  - ODOT and KYTC traffic forecasting staff
  - OKI staff
  - FHWA Ohio, Kentucky and Resource Center staff
  - Peer Review Consultant (CDM Smith)
 Confirming Base Data

- Traffic counts used for model validation and traffic forecasting were revisited
  - Identified gaps in traffic data
  - OKI data on Ohio River crossings highly beneficial
Updating Future Condition Data

- Socio-economic projections from OKI updated from pre-recession values
  - Lowered housing projections for 2040 >10%
  - Reduced vehicle trips by >15%
Getting to Income Impacts

- ODOT provided team with Longitudinal Employer-Household Dynamics (LEHD) data
  - Publicly available data from US Census
  - Provided 2 key data points
    - # of Residents in 3 income groups by geography
    - # of Employees in 3 income groups by geography

<table>
<thead>
<tr>
<th>Income Group</th>
<th>% of Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (&lt;$15k/yr)</td>
<td>26%</td>
</tr>
<tr>
<td>Medium ($15-$40k/yr)</td>
<td>36%</td>
</tr>
<tr>
<td>High (&gt;=$40k/yr)</td>
<td>38%</td>
</tr>
</tbody>
</table>
Benefits of Modeling by Income

- Match low income workers to low income jobs
- Maintain non-work relationships that are less impacted by income
Incorporating Income into Model

- Maintain relationships through all steps of modeling process
  - Trip Generation
  - Trip Distribution
  - Mode Choice
  - Traffic Assignment
Revalidation of Model

- Compliance with ODOT’s Guidelines for Planning Level traffic and Use of Models for Project Travel Forecasting
- Validation of trip distribution post income segregation from JTW data
Income and Toll Interaction

- **Value of Time by Income and Trip Purpose**
  - Low income trips have lower VOT
  - Non-work trips have lower VOT

Range of Values Used for BSB Modeling
Impacts of Tolls on Route Selection

- Travel Time Example
  - Future No Build
    - Equal times
  - Future Build Toll Free
    - BSB 1 minute faster
  - Future Build Tolled
    - BSB 8-13 minutes faster
Impacts of Tolls by Income Group

- Trips with lower Values of Time first to divert
- Travel Time on adjacent routes increase
- Local and Regional trips reroute independently
- Higher VOT trips less impacted
Developing Traffic Forecasts

- ODOT Screenline process adjusted for Tolled BSB
Draft forecasts show toll on BSB:
- Reduces volumes on BSB
- Diverts trips to other downtown Ohio River crossings
Additional Data from Model

- Income-Specific Data for EJ Analysis
- Intersections Potentially Impacted by Diversion
Summary of Forecasting Update

- Increased communication with all parties
- Major impact of updated land use projections
- Income-specific impacts obtainable
- Increased confidence in results by all parties
Independent Review

Why perform an independent review?

- Two clients – ODOT and KYTC
  - ODOT was the lead
  - different forecasting process
- Toll modeling a relatively new concept
  - Diversion impacts
  - Environmental justice – income levels
- CDM Smith
  - Agents of KYTC
  - Experience with similar project – Louisville Southern-Indiana Ohio River Bridges (LSIORB)
Project Overview

- I-65 bridge, Kennedy, is over 50 years old with over 120,000 ADT & 20,000 heavy trucks
- Confluence of I-65, I-64, I-71, I-264, US 31 and many downtown arterials
- Studied since late 1990s
- Solution – 2 new bridges
- Construction underway and will open in 2015 with tolling at 3 locations
CDM Smith Role on LSIORB

- Developed project model – based on KIPDA model with new data, new features
- Traffic forecasting – heavy review by FHWA
- Maintenance of traffic simulation analysis
- Toll analysis – planning level, investment grade performed in next step
- EJ analysis – example outcome in Louisville, Samuel Plato Academy - [https://nextcity.org/daily/entry/historic-preservation-louisville-historic-buildings](https://nextcity.org/daily/entry/historic-preservation-louisville-historic-buildings)
- Other - lighting
Review Process

- ODOT, as the lead agency, developed a comprehensive process involving all of the planning partners including:
  - ODOT – Central Office and District 8
  - OKI
  - KYTC – Central Office and District 6
  - FHWA
  - Consultants

- Process details
  - Started in October 2014, 4 months after modeling started
  - Weekly phone meetings
  - All day work session in Cincy in December
  - Shared deliverables and works-in-progress via email and ftp site
  - Consistently able to reach consensus!
BSB Review Areas

- Traffic counts – BSB, Ohio River Screenlines, KY Roads, growth rates
- Model results – VOT, diversion, TOD, select links, validation, assumptions
- Forecasts – big picture and details such as directional balance, truck %s, k-factors, capacity calculations
Traffic Data/Parameter Review

- River crossing/screenline
- Historic screenline distribution
- BSB volumes
- ATR/hourly counts
- Growth rates

<table>
<thead>
<tr>
<th>Route</th>
<th>River Crossing</th>
<th>2013 OKI Monthly Count Study</th>
<th>Min</th>
<th>Average</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-75/I-71</td>
<td>Brent Spence</td>
<td></td>
<td>149,000</td>
<td>161,000</td>
<td>178,000</td>
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<tr>
<td>US-42</td>
<td>Clay Wade</td>
<td></td>
<td>12,000</td>
<td>16,000</td>
<td>19,500</td>
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<tr>
<td>SR-17</td>
<td>Roebling</td>
<td></td>
<td>9,000</td>
<td>10,000</td>
<td>12,000</td>
</tr>
<tr>
<td>US-27</td>
<td>Taylor Southgate</td>
<td></td>
<td>8,500</td>
<td>10,000</td>
<td>13,000</td>
</tr>
<tr>
<td>I-471</td>
<td>Dan Beard</td>
<td></td>
<td>99,000</td>
<td>106,000</td>
<td>114,000</td>
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<tr>
<td>I-275 East</td>
<td>Combs Hehl</td>
<td></td>
<td>63,000</td>
<td>69,000</td>
<td>75,000</td>
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<tr>
<td>I-275 West</td>
<td>Carroll Cropper</td>
<td></td>
<td>26,000</td>
<td>30,000</td>
<td>39,000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>366,500</td>
<td>402,000</td>
<td>450,500</td>
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</table>
Daily Ohio River Crossing Volumes

Note: Roebling Bridge volumes in red italics are not that exact year but are within a year or two of the identified year.
I-71/I-75 Brent Spence Historic Daily Traffic Volumes

Model 2010 Daily Validation Target: 154,300

2013 OKI Monthly Count Study

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<td>161,000</td>
<td>178,000</td>
</tr>
</tbody>
</table>
- National VMT levels have not changed since 2007
- Is this trend consistent with greater Cincinnati region?

Source: http://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm
Model Review

- Reviewed OKI model documentation
- Reviewed 3VOT (project) model adjustments
- Reviewed tolling analysis results and process
  - Toll rates
  - Impact of VOT
  - Diversion/suppression
  - Time of Day
Model Results

- Expected range of volumes for No Build, Build Toll Free and Build with $2.00 Toll
Forecast Review

- K-factors
- Capacity concerns
- Trucks
- Forecast Examples
- Certified Traffic Plate Reviews
Forecast Review

- Plate by plate review
- Summary on spreadsheet – example is AM only

<table>
<thead>
<tr>
<th>Plate 1</th>
<th>NB Brent Spence Bridge</th>
<th>5,200</th>
<th>7,800</th>
<th>10,600</th>
<th>8.76%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>SB Brent Spence Bridge</td>
<td>4,300</td>
<td>6,500</td>
<td>8,300</td>
<td>6.82%</td>
</tr>
<tr>
<td></td>
<td>NB CW Bailey Bridge</td>
<td>600</td>
<td>1,400</td>
<td>1,300</td>
<td>9.35%</td>
</tr>
<tr>
<td></td>
<td>SB CW Bailey Bridge</td>
<td>400</td>
<td>1,200</td>
<td>1,100</td>
<td>8.94%</td>
</tr>
<tr>
<td></td>
<td>NB Roebling Bridge</td>
<td>300</td>
<td>500</td>
<td>400</td>
<td>8.33%</td>
</tr>
<tr>
<td></td>
<td>SB Roebling Bridge</td>
<td>300</td>
<td>400</td>
<td>400</td>
<td>6.35%</td>
</tr>
<tr>
<td></td>
<td>NB Taylor Southgate Bridge</td>
<td>500</td>
<td>700</td>
<td>700</td>
<td>12.96%</td>
</tr>
<tr>
<td></td>
<td>SB Taylor Southgate Bridge</td>
<td>300</td>
<td>500</td>
<td>600</td>
<td>8.33%</td>
</tr>
<tr>
<td></td>
<td>NB I-471 Bridge</td>
<td>5,600</td>
<td>5,800</td>
<td>5,600</td>
<td>11.74%</td>
</tr>
<tr>
<td></td>
<td>SB I-471 Bridge</td>
<td>2,300</td>
<td>3,500</td>
<td>3,500</td>
<td>7.31%</td>
</tr>
<tr>
<td></td>
<td>NB I-71 Downtown</td>
<td>4,300</td>
<td>5,600</td>
<td>6,200</td>
<td>8.82%</td>
</tr>
<tr>
<td></td>
<td>SB I-71 Downtown</td>
<td>3,100</td>
<td>4,300</td>
<td>4,200</td>
<td>7.05%</td>
</tr>
</tbody>
</table>
Independent Review Results

- A process that ODOT, KYTC and FHWA were comfortable with.
- An approved model and forecasts that were approved by all parties.
- An approach and results that are readily defensible.
- FHWA has presented the process and model to FHWA staff across the country as an example of best practice.
<table>
<thead>
<tr>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jerry Shadewald</td>
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<td>HNTB Corporation</td>
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<td>Rob Bostrom</td>
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<tr>
<td>CDM Smith</td>
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<tr>
<td><a href="mailto:bostromnr@cdmsmith.com">bostromnr@cdmsmith.com</a></td>
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