Indianapolis Takes on BRT
Tuesday March 10, 2015
Beginning in 2010, the Indy Connect team began an unprecedented, award-winning public engagement process that continues today.

- 60+ Public Meetings & Open Houses
- 100’s of Presentations for Groups & Organizations
- 30+ Fairs & Festivals
- 100+ Stakeholder Meetings
The plan was reviewed, vetted, adjusted, and revised by more than 10,000 public comments.
PHASE I:

HAMILTON, MARION, & JOHNSON COUNTIES

- Doubles local bus service
- Express bus between counties
- 5 rapid transit lines
Five Rapid Transit Lines

**RED Rapid Transit Line**
Carmel | Downtown | Greenwood

**BLUE Rapid Transit Line**
Plainfield/Airport | Downtown | Cumberland

**GREEN Rapid Transit Line**
Downtown | Fishers | Noblesville

**PURPLE Rapid Transit Line**
38th Street | Under Study in 2014

**ORANGE Rapid Transit Line**
Keystone Crosstown | Future Study
OBJECTIVE:
IDENTIFY A RECOMMENDED ALTERNATIVE

Vehicles → Termini
Alignment → Operating Plan
Stations → Running Way
Technology → Operating Plan
Running Way → Technology
Recommended Alternative

INDIANAPOLIS TAKES ON BRT
1. Westfield Connection study

2. Station additions or shifting during and to be compatible with the Purple Line study (38th & Central)

3. Tarkington Park

4. 38th & Meridian Street study

5. Meridian Street Transitway


7. Capitol Avenue contraflow

8. Washington Street contraflow

9. Virginia Ave. v. Eli Lilly campus

10. Potential termini study (highlighting all potential termini locations)
5. Meridian Street Transitway analysis

7. Capitol Avenue contraflow analysis
Impact of the PMT

- PMT – project management team
  - MPO, INDYGO, Cirta, IndyDPW, DMD

- Multiple agencies, stakeholders,
• Explain VISSIM, its capabilities, and why it was chosen for the analyses

• Discuss transit signal priority

• Describe the Meridian Transitway analysis

• Describe the capitol contraflow analysis
What is VISSIM?

"Verkehr In Städten -SIMulationsmodell"

- (German for "Traffic in cities - simulation model")

Microsimulation software

- models individual entities & their interactions

Ideal for analyzing multi-model corridors

- Not so ideal for signal timing optimization
• Better representation of traffic conditions
• Flexible geometry
• Easily communicate to stakeholders
• Detailed network MOEs
  • Delay analysis (LOS)
  • Queue lengths
  • Travel times (important for transit)
• Calibration & Validation are key!
• Not always the correct software for the study

Source: Oregon DOT
VISSIM capabilities
VISSIM capabilities
Goal of the study:

To determine the feasibility of utilizing Meridian instead of the one-way pair of Capitol & Illinois in both directions between 16\textsuperscript{th} & 38\textsuperscript{th} for Bus Rapid Transit.

why?:

The public and stakeholders indicated that Meridian should be studied further due to the potential economic and operational benefits.
Meridian Transitway analysis

Study area

- 2-way major arterial (main connector from downtown to suburbs directly north of indy)
- 11 signalized intersections
- 2 lanes in each direction
- parking
- 3 existing local bus routes (heavy ridership)
- Several busy destinations (ivy tech, children’s museum, apartments)
PMT agreed that two scenarios would be analyzed:
- Curbside Business Access & Transit (BAT) lanes (or Bus And Turns)
- Curbside BRT service in mixed traffic

Chosen due to minimal impact on:
- Existing conditions
- Right of way
- Existing parking
- Business access
Meridian Transitway analysis

Modeled Operational scenarios

Mixed traffic typ. (60’)

BAT lanes typ. (60’)

6’ Sidewalk
8’ Parking lane
11’ Drive lane
11’ Drive lane
11’ Drive lane
11’ Drive lane
8’ Parking lane
6’ Sidewalk

6’ Sidewalk
8’ Parking lane
11’ Bus lane
11’ Drive lane
11’ Drive lane
11’ Bus lane
8’ Parking lane
6’ Sidewalk
Meridian Transitway analysis

Station and bus assumptions

- 6 curbside stations in study area (shared BRT and local)
- 4 bus routes
  - 2 BRT (red and Purple) with 10 min headways
  - 2 local with 30 min headways
- Level boarding
- Pre-boarding fare collection
- 60’ articulated BRT buses (40’ local)
- No bus bays
- Dwell time of 25 seconds
Meridian Transitway analysis

sensitivity analysis

• Considered traffic diversion due to implementation of BAT lanes

• Justified diversion based on:
  — Availability of alternate corridors (Capitol/illinois, Central, college)
  — 40% reduction in capacity

• Completed using synchro (went from 0% to 25%)
Synchro results with 0% diversion

<table>
<thead>
<tr>
<th>Intersection</th>
<th>AM Peak</th>
<th>PM Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Delay</td>
<td>LOS</td>
</tr>
<tr>
<td>38th and Meridian</td>
<td>94.8</td>
<td>F</td>
</tr>
<tr>
<td>34th and Meridian</td>
<td>113.3</td>
<td>F</td>
</tr>
<tr>
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<td>87.3</td>
<td>F</td>
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<td>29th and Meridian</td>
<td>92.2</td>
<td>F</td>
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<td>28th and Meridian</td>
<td>34.3</td>
<td>C</td>
</tr>
<tr>
<td>Fall Creek and Meridian</td>
<td>142</td>
<td>F</td>
</tr>
<tr>
<td>22nd and Meridian</td>
<td>86.5</td>
<td>F</td>
</tr>
<tr>
<td>21st and Meridian</td>
<td>50.3</td>
<td>D</td>
</tr>
<tr>
<td>18th and Meridian</td>
<td>71.2</td>
<td>E</td>
</tr>
<tr>
<td>16th and Meridian</td>
<td>68.7</td>
<td>E</td>
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</table>

Synchro results with 25% diversion

<table>
<thead>
<tr>
<th>Intersection</th>
<th>AM Peak</th>
<th>PM Peak</th>
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<td>38th and Meridian</td>
<td>59.7</td>
<td>E</td>
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<td>34th and Meridian</td>
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<td>B</td>
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<td>32nd and Meridian</td>
<td>19.8</td>
<td>B</td>
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<td>16.2</td>
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<td>29th and Meridian</td>
<td>17.4</td>
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<td>5.6</td>
<td>A</td>
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<tr>
<td>Fall Creek and Meridian</td>
<td>81.8</td>
<td>F</td>
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<tr>
<td>22nd and Meridian</td>
<td>10.8</td>
<td>B</td>
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<td>21st and Meridian</td>
<td>13.7</td>
<td>B</td>
</tr>
<tr>
<td>18th and Meridian</td>
<td>9.4</td>
<td>A</td>
</tr>
<tr>
<td>16th and Meridian</td>
<td>35.8</td>
<td>D</td>
</tr>
</tbody>
</table>

- No diversion showed system failure
- Moved forward with 25% diversion, a conservative assumption
- Analyzed key intersections on alternative route
- Used these volumes in the VISSIM model
Meridian Transitway analysis

38th & Meridian BAT Lanes at intersection
Meridian Transitway analysis

38th & Meridian downstream BAT Lanes
Meridian Transitway analysis

VISSIM Model

- Transit inputs previously mentioned

- Two operational scenarios
  - BAT Lanes from 16th to 34th, mixed traffic from 34th to 38th
  - Mixed traffic from 16th to 38th

- 2020 traffic with 25% diversion

- Used optimized signal timings from synchro model
  - 90s cycle length at all intersections except Fall Creek & 38th (120s)

- PED push buttons (no PED recall)
  - Assumed 10 activations/hour

- Transit signal priority at each intersection
  - Early/extend
Meridian Transitway analysis

VISSIM Model

Check In Detectors

Check Out Detectors

**RED TRUNCATION**
- Bus approaches red signal

**GREEN EXTENSION**
- Bus approaches green signal
- Signal controller detects bus; terminates side street green phase early
- Signal controller detects bus; extends current green phase
- Bus proceeds on green signal
- Bus proceeds on extended green signal
# Meridian Transitway Analysis

## VISSIM Model Results

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Weekday AM Peak Hour</th>
<th>Weekday PM Peak Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Delay</td>
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<tr>
<td>38th and Meridian</td>
<td>36.4</td>
<td>D</td>
</tr>
<tr>
<td>34th and Meridian</td>
<td>20.3</td>
<td>C</td>
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<td>B</td>
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<td>30th and Meridian</td>
<td>15.1</td>
<td>B</td>
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<tr>
<td>29th and Meridian</td>
<td>12.4</td>
<td>B</td>
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<td>28th and Meridian</td>
<td>6.4</td>
<td>A</td>
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<tr>
<td>Fall Creek and Meridian</td>
<td>40.7</td>
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<td>22nd and Meridian</td>
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<td>21st and Meridian</td>
<td>13.3</td>
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<td>16th and Meridian</td>
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<table>
<thead>
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<th>Intersection</th>
<th>Weekday AM Peak Hour</th>
<th>Weekday PM Peak Hour</th>
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<tr>
<td></td>
<td>Delay</td>
<td>LOS</td>
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<tr>
<td>38th and Meridian</td>
<td>54.2</td>
<td>D</td>
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<td>34th and Meridian</td>
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<td>32nd and Meridian</td>
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<td>30th and Meridian</td>
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<td>B</td>
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<td>28th and Meridian</td>
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<tr>
<td>Fall Creek and Meridian</td>
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<td>22nd and Meridian</td>
<td>12.1</td>
<td>B</td>
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<td>B</td>
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<td>18th and Meridian</td>
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<td>A</td>
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<td>16th and Meridian</td>
<td>23.6</td>
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<table>
<thead>
<tr>
<th>Direction</th>
<th>Weekday Peak Hour</th>
<th>Service Type</th>
<th>BAT Lanes from 16th to 34th, Mixed Traffic 34th-38th</th>
<th>BRT Service in Mixed Traffic Entire Corridor</th>
<th>Travel Time Savings</th>
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<tbody>
<tr>
<td>NB</td>
<td>AM Peak Hour</td>
<td>BRT</td>
<td>8:19</td>
<td>8:52</td>
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<tr>
<td></td>
<td>Local</td>
<td>15:03</td>
<td>15:53</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>PM Peak Hour</td>
<td>BRT</td>
<td>7:28</td>
<td>8:05</td>
<td>0:37</td>
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<td></td>
<td>Local</td>
<td>15:48</td>
<td>16:12</td>
<td></td>
<td></td>
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<tr>
<td>SB</td>
<td>AM Peak Hour</td>
<td>BRT</td>
<td>8:30</td>
<td>9:13</td>
<td>0:43</td>
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<tr>
<td></td>
<td>Local</td>
<td>13:38</td>
<td>14:54</td>
<td></td>
<td>1:16</td>
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<td></td>
<td>PM Peak Hour</td>
<td>BRT</td>
<td>8:14</td>
<td>8:18</td>
<td>0:04</td>
</tr>
<tr>
<td></td>
<td>Local</td>
<td>13:12</td>
<td>14:06</td>
<td></td>
<td>0:54</td>
</tr>
</tbody>
</table>
Both scenarios analyzed indicate that Meridian is capable of transit ops
  - Minimal differences in delay
  - Transit travel time benefits

Meridian allows for impacts to be made on one corridor

Planning studies indicated a higher transit oriented development (TOD) on Meridian

Less navigational challenges to the rider

Meridian has the potential to be a “Signature transit corridor”

38th & Meridian should be analyzed further
Goal of the study:

To determine the feasibility of utilizing Capitol (in both directions) instead of the one-way pair of Capitol & Illinois between 16th & 38th for Bus Rapid Transit.

why?:

• One-way pairs can be confusing to riders
• Impacts are isolated to a single corridor
• Closer to larger generators (iupui, statehouse, convention center)
- One-way SB major arterial (heavy morning peak)
- 3 travel lanes
- Parking on both sides (metered & unmetered)
- Bike lane on east side
- 3 existing local bus routes
- 13 signalized intersections
- Cultural trail
PMT agreed on prioritizing the following:
- Parking preservation
- Bike lane preservation
- Southbound curbside Business Access & Transit (BAT) lanes (or Bus And Turns)
- Northbound “transit only” contraflow lane

Synchro analysis indicated that the corridor needed a minimum of 3 travel lanes
- To preserve parking & bike lane, SB Bat lane was deemed infeasible
- SB buses would operate in mixed traffic

Chosen due to minimal impact on:
- Existing conditions
- Bike lane
- Right of way
- Existing parking
- Business access

Same station and operating assumptions as Meridian Analysis
Capitol Contraflow analysis

Modeled Operational scenarios

*Both segments would require road widening
1. Cultural Trail at Capitol & Walnut

2. Cultural Trail at Capitol & Washington

3. Parking Preservation

4. Pedestrian safety
Cultural Trail at Capitol & Walnut

Issue:

- Curb bump outs on both sides
- NB bus operates in existing curbside parking lane in this segment
Cultural Trail at Capitol & Walnut

Solution:
- Lane shift
- Remove bump out on the west side

Justification:
- Maintains min. 3 travel lanes, bike lane, and NB contraflow lane
- Minimizes impact to recently constructed cultural trail
Cultural Trail at Capitol & Washington

Issue:

- Existing curb bump out on NE corner creates radius that the buses cannot traverse
Cultural Trail at Capitol & Washington

Solution:

- Modify curb radius to 25 feet
- Construct a 10 foot ped safety island

Justification:

- Modified curb radius allows articulated buses to make the turn
- Safety island provides refuge location to offset increased crossing distance
Parking Preservation between Vermont & Washington

Issue:

- Parking spaces have high utilization
- parking removal would cost $50k per meter
- 96 metered spaces on the east side
- Proposed alignment shows removal of 20 metered spaces
- Removal of ALL metered parking on the east side would cost $4.8 million
- Limited removal of metered parking with proposed alignment would cost $1 million
Capitol Contraflow analysis

Project Constraint #3

[Bar chart showing average utilization by hour for different blocks]
Parking Preservation between Vermont & Washington

Solution:
- Relocate parking between NB contraflow lane & SB general traffic lane
- Construct a 10 foot ped safety island

Justification:
- Saves $4 million
- Preserves 76 parking spaces
- Does not limit driveway access
Pedestrian Safety

Issue:

• Parking on the east side next to contraflow lane presents an issue to pedestrian safety
Pedestrian Safety

Solution:
- Construct raised ped safety island
- Construct mid-block ped accommodations

Justification:
- Safety island provides refuge location
- Mid-block crossing provides locations for peds to cross bus lane
Capitol Contraflow analysis
Modeled Operational scenarios

*Both segments would require road widening
Capitol Contraflow analysis

VISSIM Model

- Only analyzed AM Peak, build scenario
  - One model with local routes
  - One model without local routes

- NB contraflow bus only lane

- SB transit operates in mixed traffic

- Operational scenarios previously mentioned

- 2020 traffic plus 25% diversion from meridian transitway

- Used optimized signal timings from synchro model
  - 70s cycle length at all intersections

- PED recall

- Transit signal priority at each intersection
  - Early/extend
### Table 8-1. LOS and Delay

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Delay (seconds per vehicle)</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>16th &amp; Capitol</td>
<td>19.0</td>
<td>B</td>
</tr>
<tr>
<td>12th &amp; Capitol</td>
<td>18.9</td>
<td>B</td>
</tr>
<tr>
<td>11th &amp; Capitol</td>
<td>13.4</td>
<td>B</td>
</tr>
<tr>
<td>10th &amp; Capitol</td>
<td>6.2</td>
<td>A</td>
</tr>
<tr>
<td>St. Clair &amp; Capitol</td>
<td>6.6</td>
<td>A</td>
</tr>
<tr>
<td>Cultural Trail &amp; Capitol</td>
<td>11.9</td>
<td>B</td>
</tr>
<tr>
<td>North &amp; Capitol</td>
<td>10.6</td>
<td>B</td>
</tr>
<tr>
<td>Michigan &amp; Capitol</td>
<td>13.7</td>
<td>B</td>
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<tr>
<td>Vermont &amp; Capitol</td>
<td>13.4</td>
<td>B</td>
</tr>
<tr>
<td>New York &amp; Capitol</td>
<td>30.3</td>
<td>C</td>
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<td>Ohio &amp; Capitol</td>
<td>14.5</td>
<td>B</td>
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<tr>
<td>Market &amp; Capitol</td>
<td>5.5</td>
<td>A</td>
</tr>
<tr>
<td>Washington &amp; Capitol</td>
<td>14.5</td>
<td>B</td>
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### Table 8-2. Travel Time Comparison

<table>
<thead>
<tr>
<th></th>
<th>Capitol Avenue With Local Routes</th>
<th>Capitol Avenue Without Local Routes</th>
<th>Illinois Street</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>8 minute 56 second</td>
<td>7 minute 27 second</td>
<td>5 minute 43 second</td>
</tr>
</tbody>
</table>
Capitol Contraflow analysis

Conclusions & Findings

- Two-way transit on Capitol Ave between Washington & 16th is feasible
- Conceptual designs that preserve metered parking should be further analyzed
- Three SB travel lanes for general purpose traffic are required to maintain LOS standards
- Travel time comparison indicates longer travel times for BRT vehicles on Capitol vs one-way pair of Capitol & Illinois
  - Local buses on Capitol increases travel time
- Inclusion of the contraflow lane as an alternative during the environmental analysis is recommended
Questions??

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