THINKING OUTSIDE THE BOX - A STRATEGIC APPROACH FOR RIGHT-SIZING SOLUTIONS FOR THE SUM-76 AKRON BELTWAY PROJECT

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1. Project History/Overview
2. Principles of Practical Design
3. Beltway Strategic Planning Process – Study Approach
4. Project Status
   • In progress
5. Next Steps
PROJECT HISTORY/OVERVIEW

STUDY AREA
PROJECT OVERVIEW

HISTORICAL SAFETY LOCATIONS
Study goal:
Identify potential Buildable Units through Strategic Planning of Solutions.

Purpose & Need:
- Congestion
- Safety
- Infrastructure Conditions
Existing Geometric Conditions
Bridge Conditions
Pavement Conditions

- Reviewed Record Construction Plans, Available GIS, Inspection and Inventory Reports, Previous Studies
- Evaluated by Current Design Standards
PROJECT OVERVIEW
AKRON BELTWAY GEOMETRIC/ASSET CONDITIONS

<table>
<thead>
<tr>
<th>RAMP ID</th>
<th>EXIST. HORIZONTAL ALIGNMENT</th>
<th>SPIRAL LENGTH</th>
<th>DEGREE OF CURVE</th>
<th>ACTUAL SPEED FOR DEGREE OF CURVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-1a</td>
<td></td>
<td>250' &amp; 200'</td>
<td>14'00''</td>
<td>36</td>
</tr>
<tr>
<td>R-1b</td>
<td></td>
<td>400'</td>
<td>20'58'44''</td>
<td>31</td>
</tr>
<tr>
<td>R-2a</td>
<td></td>
<td>400'</td>
<td>20'58'44''</td>
<td>31</td>
</tr>
<tr>
<td>R-2b</td>
<td></td>
<td>350'</td>
<td>23'00''</td>
<td>29</td>
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<tr>
<td>R-3a</td>
<td></td>
<td></td>
<td>9'34''</td>
<td>75</td>
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<tr>
<td>R-3b</td>
<td></td>
<td>200'</td>
<td>4'00''</td>
<td>62</td>
</tr>
<tr>
<td>R-3c</td>
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<td>200'</td>
<td>10'00''</td>
<td>41</td>
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<tr>
<td>R-3d</td>
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<td>1'30''</td>
<td>75</td>
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<td>4'00''</td>
<td>62</td>
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<tr>
<td>R-4b</td>
<td></td>
<td>200'</td>
<td>13'00''</td>
<td>37</td>
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</tbody>
</table>

LEGEND
- Entrance Ramp Acceleration Length and/or Taper Rate Substandard
- Deceleration Length Substandard
- Exit Ramp Diverging Curvature Substandard
- Horizontal Alignment Substandard
- Vertical Alignment Substandard
- Limits of Mainline Section
- Limits of Ramp Section
- Location of Bridge

Mainline Section ID
Ramp Section ID
Bridge ID

SCALE
0 200 400
Beltway Strategic Plan

- Follows principles of Practical Design
- Focuses on purpose and need:
  - Traffic Operations/Congestion
  - Safety Performance
  - Infrastructure Condition
- Considers other constraints/priorities:
  - Environment
  - Fiscal responsibility
- Identify short, medium, long term improvement
- Prioritize entire Beltway from P&N and funding perspective
Principles of Practical Design

- Scope projects to address purpose and need
- Exercise flexibility in design guidance and regulations
- Consider value, need, and urgency of proposed solutions
- Use appropriate performance based analysis tools
- Consider short/long term project and system goals
- Plan and design for right-sized projects
- Address project purpose and need – i.e. congestion, safety, and asset/infrastructure condition
Conceptual alternative development/evaluation methodology:

- Infrastructure condition
- Identify sub-standard design components
- Improved operational efficiency:
  - HCS: LOS, capacity
  - VISSIM: LOS, travel time, congestion, % served
- Safety performance: new HSM analysis enhanced Interchange Safety Analysis Tool (ISATe) for potential for safety improvement
- Environment: impacts to known red flag issues
- Fiscal Responsibility: Benefit/cost and funding potential
Asset Conditions & Geometric Evaluation

- Bridges (68 total):
  - 46% are functionally obsolete
  - 27% eligible for rehabilitation funding
- 13 of 31 overpasses have sub-standard vertical clearance
- 70% of interchange ramps have sub-standard alignments and accel/exit geometries.
AKRON BELTWAY PROJECT
PROJECT STATUS

Operations/Capacity Analysis

1. HCS is standard methodology
2. VISSIM is appropriate for analyzing complex systems
3. Ultimately combination of Regional Travel Demand Model (TDM) output, HCS and VISSIM used to develop options for build concepts
HCS ANALYSIS
2015 EXISTING CONDITIONS – PM PEAK
HCS ANALYSIS

2015 EXISTING CONDITIONS – LANE ADDITIONS
HCS ANALYSIS

2040 “NO BUILD” – PM PEAK
HCS ANALYSIS

2040 "NO BUILD" – "LOS D" LANE ADDITIONS
VISSIM ANALYSIS

Evaluation Measures:

1. Volumes
2. Travel Time & Speed
3. Congestion – Bottlenecks and Queues
4. Percent Served
VISSIM ANALYSIS

STUDY AREA
VISSIM ANALYSIS

2040 NO-BUILD – NB & SB I-77 PM PEAK TRAVEL TIMES
VISSIM ANALYSIS
MODEL CALIBRATION – RESULTS (FIELD VS. EX MODEL)

Congestion (Back-ups and Queues) - PM Results

Legend
- 0 - 20 MPH
- 20 - 30 MPH
- 30 - 40 MPH
- 40 - 50 MPH
- 50 - 55 MPH
- > 55 MPH
VISSIM ANALYSIS

2040 NO-BUILD CONDITIONS LOS– AM PEAK
VISSIM ANALYSIS

2040 NO-BUILD CONDITIONS LOS – PM PEAK
Legend

- 0 - 20 MPH
- 20 - 30 MPH
- 30 - 40 MPH
- 40 - 50 MPH
- 50 - 55 MPH
- > 55 MPH
VISSIM ANALYSIS

2040 NO-BUILD (% SERVED) PM
Highway Safety Manual provides methods for predicting safety performance

- Freeway and interchange safety performance quantified by ISATe – *Interchange Safety Analysis Tool Enhanced*
  - Compare expected versus predicted crashes
  - May have crashes, but operating better than similar facilities
- Crash prediction helps identify/prioritize safety improvements
SAFETY PERFORMANCE

SUM 76 Study Area Ramp Crash Frequency (2009 - 2011)

Legend
Total Ramp Crashes
- 0 - 5
- 6 - 10
- 11 - 15
- 16 - 20
- 21 - 25
- 26 - 30
- 30+
- Mainline
- Fatal and Injury Crashes

NOTE: Callouts denote the fatal and injury (K-ABC) crashes for each ramp. Ramps with no callout have zero (0) fatal and injury crashes.
SAFETY PERFORMANCE

2015 FREEWAY AND INTERCHANGE EXISTING CONDITIONS

SUM-76 AKRON BELTWAY
ISATe Analysis - 2015
Fatal and Injury Crashes
Expected Excess Crashes • Expected - Predicted
(Potential for Safety Improvement)

KABC Crashes (2015) Per Year
- Less than or Equal to 0.00
- 0.01 - 1.00 Crashes
- 1.01 - 2.00 Crashes
- 2.01 - 3.00 Crashes
SAFETY PERFORMANCE

2015 FREEWAY AND INTERCHANGE EXISTING CONDITIONS
AKRON BELTWAY PROJECT

PROJECT STATUS—IN PROGRESS

Project development activities:
- Evaluation of Northeast Interchange
  - Greatest infrastructure need (ramp bridges)
  - Sub-standard left ramp geometry & decel
  - Highly congested area
  - Highest potential for safety improvement (EB and WB approaches to left exits)
  - Improvements possible with limited R/W and environmental impacts
AKRON BELTWAY PROJECT

EXISTING CONGESTION ISSUES

Looking east on I-76/I-77 near the Northeast Interchange in the PM
AKRON BELTWAY PROJECT

PROJECT STATUS— IN PROGRESS (NE INTERCHANGE)
PRELIMINARY VISSIM RESULTS
NE INTERCHANGE – OPTION NEA3 – 2040 A.M.

SUM-76 Akron Beltway Project
Year 2040 No Build and Build AM Peak Period Traffic Congestion

I-76 WESTBOUND CONGESTION PROFILE - 2040 NO BUILD
AM PEAK PERIOD (7:00 AM - 9:30 AM)

I-76 WESTBOUND CONGESTION PROFILE - 2040 NEA3+NWG3-i Without Loop
AM PEAK PERIOD (7:00 AM - 9:30 AM)

DIRECTION OF TRAVEL
- 0 - 20 MPH
- 20 - 30 MPH
- 30 - 40 MPH
- 40 - 50 MPH
- 50 - 55 MPH
- > 55 MPH
AKRON BELTWAY PROJECT

PROJECT STATUS – IN PROGRESS

Strategic Plan Development
- Evaluation of full build concept alternative
- Consideration of Active Traffic Demand Management Strategies to improve full build and/or extend performance of interim build conditions

Beltway Strategic Plan Document
- Results of existing, interim and full build solutions
- Project prioritization process using P&N and funding considerations
- Final plan for short, mid, long term projects
QUESTIONS AND DISCUSSION

Thank you!