Implementation of an ODOT Ramp Clear Project in a Non-urban Area

Presenters:
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Session Overview

► Background

► Scope and Sequence

► Initial Stop-and-Go Operation

► Optimal Timing Development and Evaluation

► Takeaways
BACKGROUND
BRO-68-30.72 (PID 93801)

SR 32 & US 68 Interchange Village of Mt. Orab
BRO-68-30.72 LOCATION
Mount Orab Background

20 miles on SR 32 east of I-275
MOUNT ORAB BACKGROUND

- Experiencing increased development
  - Recently expanding north of SR 32.
- Started seeing need for transportation improvements
  - Discussion of signalizing SR 32 ramps at US 68.
  - Resistance due to creating short signal spacing with existing Village signals.

Approximately 1990

Current
April 2012: Request for safety funding submitted by ODOT District 9 & the Village of Mt. Orab.
Project good candidate for ODOT’s new Ramp Clear Program

ODOT Ramp Clear Program

- Developed in summer of 2012 as a low cost method to reduce congestion on interchanges where traffic frequently backs up onto the freeway.
- The goal of Ramp Clear is to be under construction in less than one year from the time a solution is analyzed.

Park-and-Ride Access Removed
BRO-68-30.72 BACKGROUND (Cont.)

- ODOT Central Office performed preliminary engineering including utility information.
- Transystems performed Interchange Modification Study (IMS)
  - Complete 2/25/2013
- Mead & Hunt developed Design-Build Scope
DESIGN BUILD SCOPE
PRELIMINARY CONCEPT
IMPROVEMENTS

- Add left turn lanes on US 68 at SR 32 Ramps (Restriping)
- Radius Improvements at Ramps
- Add eastbound right turn lane at SR 32 EB Exit Ramp
- Signalize Ramp Intersections
- Coordinate new traffic signals with existing signals to the north and south of the interchange.
  - Hardware
  - Signal Timing Scope
    - Timing Plans
    - Travel Time Studies
DESIGN BUILD PROJECT TEAM

- Construction Letting 10/24/2013
  - BUDS, Inc. (Contractor)
    - ADR & Associates, LTD. (Engineer)
    - Smart Services, Inc. (Survey and Traffic Engineering)
    - Capital Electric Line Builders (Signal Contractor)
INITIAL
STOP-AND-GO OPERATION
SYSTEM

BRO-68 & SR 32 EB RAMPS
TRAFFIC SIGNAL SYSTEM
UNEXPECTED RESULTS!

- Long queues on US 68 reported during weekday afternoons.
- ODOT did not anticipate queueing to the extent observed.
- IMS typically focus on freeway operations
CHALLENGES

- Expectations
  - IMS showed with improvements all intersections would operate at LOS C.
  - Signals should solve problems not create them.
  - Non-Urban locations do not experience as much queuing.

- Traffic not just commuting to Cincinnati
  - Wed. 7-9 AM: To West 666 vehicles; From West – 396 vehicles
  - Wed. 4-6 PM: To West 598 vehicles; From West – 928 vehicles

- Storage b/w critical two southern intersections is 575 feet.

- Arrivals cannot be controlled south of critical intersections.

- Northbound Through trucks cause excess delay and platooning
  - Wednesday 6 AM – 6 PM: 6.7% Trucks
  - Wednesday 3-6 PM: 5.3% Trucks
  - Friday 3-6 PM: 4.0% Trucks
EXAMPLE TRUCK OPERATION
SEQUENCE OF RESPONSES

- Developed Weekday PM Peak timing plan
- Field Observed with Village Personnel
- Traffic Counts Collected per the Scope
  - Added Friday afternoon (3-7 PM) to scope.
- Implemented Detection Zone Change on SR 32 EB Ramp
INITIAL WEEKDAY PEAK HOUR TIMING PLAN

- Based on Certified Volumes in IMS and using Synchro
- RESULT: Still Northbound queuing reported for Thursday and Friday evenings.

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<th>INTERVAL OR FEATURE</th>
<th>CONTROLLER MOVEMENT No.</th>
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<tr>
<td>INTERSECTION MOVEMENT</td>
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**NOTES:**
OFFSETS START AT END OF COORDINATED GREEN PHASE

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<tr>
<th>COORDINATION TIMING (SECONDS)</th>
<th>TBC</th>
<th>OFFSET</th>
<th>1</th>
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**Initial PM Peak Timing**

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**Final Friday PM Peak Timing**
FIELD OBSERVERVATIONS

Results

- Reports of queuing verified.
- Long queues at times but short in duration.
- EB to SB right turns calling signal during certain cycles when vehicles had opportunity to turn right on red.
- Once EB is called SB LT has opportunity to be called.
FIELD OBSERVATIONS

Critical Segment
FIELD OBSERVATIONS

Conditions to the South
Traffic Counts per Scope

- **Link Counts**
  - 2 sets of 7 Day volume counts on US 68

- **Turning Movement Counts at all Intersections**
  - Weekday 6am to 6 pm
  - Saturday 6 am to 6 pm (3 hours in AM, Midday, and PM for a total of 9 hours)
  - Sunday 6 am to 6 pm (3 hours in AM, Midday, and PM for a total of 9 hours)
  - Friday 3 pm to 7 pm *(Added to original Scope)*
TRAFFIC COUNTS PER SCOPE - RESULTS

- Weekday AM Peak – 7:15 to 8:15 am
- Weekday Midday Peak – 11:45 am-12:45 pm
- Weekday Off Peak – 2:00 – 3:00 pm
- Mon.-Wed. PM Peak – 4:15 – 5:15 pm
- Friday PM Peak - 5:30-6:30 pm
- Weekend Peak – Saturday 12:15-1:15 pm
WEEKLY TRAFFIC VOLUMES
US 68 south of SR 32 EB Ramps
FRIDAY TRAFFIC VOLUMES
US 68 south of SR 32 EB Ramps

Date & Time

Vehicles per Hour

0 200 400 600 800 1000 1200 1400 1600 1800

12:00 AM 1:00 AM 2:00 AM 3:00 AM 4:00 AM 5:00 AM 6:00 AM 7:00 AM 8:00 AM 9:00 AM 10:00 AM 11:00 AM 12:00 PM 1:00 PM 2:00 PM 3:00 PM 4:00 PM 5:00 PM 6:00 PM 7:00 PM 8:00 PM 9:00 PM 10:00 PM 11:00 PM

10/3/2014

Friday

SB
NB
TOTAL
FRIDAY TRAFFIC VOLUMES
3:00-7:00 PM

Sterling Run Boulevard

SR 32 EB Ramps
KROGER – FRIDAY AFTERNOON

5:45 pm on Friday, May 1, 2015
Weekly Traffic Volumes
Sterling Run Blvd. EB west of US 68

Date & Time

6:00 AM  6:00 PM
10/5/2014  Sunday
10/6/2014  Monday
10/7/2014  Tuesday
10/1/2014  Wednesday
10/2/2014  Thursday
10/3/2014  Friday
10/4/2014  Saturday

Vehicles per Hour

0  100  200  300  400  500  600

WB
EB
Weekly Traffic Volumes
SR 32 EB Exit Ramp west of US 68

Date & Time

<table>
<thead>
<tr>
<th>Time</th>
<th>Date</th>
<th>Day</th>
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<td>Sunday</td>
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<tr>
<td>6:00 PM</td>
<td>10/6/2014</td>
<td>Monday</td>
</tr>
<tr>
<td>6:00 AM</td>
<td>10/7/2014</td>
<td>Tuesday</td>
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<tr>
<td>6:00 AM</td>
<td>10/1/2014</td>
<td>Wednesday</td>
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<tr>
<td>6:00 PM</td>
<td>10/2/2014</td>
<td>Thursday</td>
</tr>
<tr>
<td>6:00 AM</td>
<td>10/3/2014</td>
<td>Friday</td>
</tr>
<tr>
<td>6:00 AM</td>
<td>10/4/2014</td>
<td>Saturday</td>
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Vehicles per Hour

EB-LT
EB-RT
Video showed not one northbound vehicle arrived while Sterling Run was served. Prior to peak 15 minutes no queues.
Sterling Run Boulevard traffic competing to get into critical area.
DETECTION ZONE CHANGE
SR 32 EB Ramps
DETECTION ZONE CHANGE
SR 32 EB Ramps

Detector Assignments Table:

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<th>DET</th>
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<th>Prelim</th>
<th>Assoc.</th>
<th>Delay</th>
<th>Data (Sec)</th>
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<td>Varies x 30'</td>
<td>Presence</td>
<td>Rs1</td>
<td>65</td>
<td>20</td>
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<tr>
<td>DZ1B</td>
<td>8' x 20'</td>
<td>Presence</td>
<td>Rs1</td>
<td>65</td>
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<td>DZ2A</td>
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<td>DZ3A</td>
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<td>DZ4A</td>
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<td>Rs2</td>
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<td>DZ5A</td>
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<td>Presence</td>
<td>Rs3</td>
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Note: DZ1A, DZ1B, DZ2A, DZ3A, DZ4A, DZ5A are detector assignments.

Typical Vehicular Signal Heads:

- Yellow inside of visors black polycarbonate with 3' LED lamps and back plates with yellow reflective tape border per CHS T52-22.
OPTIMAL TIMING
DEVELOPMENT AND EVALUATION
GOALS OF OPTIMAL TIMING

- The typical goal of establishing green band for US 68 traffic through the system.
- Field evidence and data pointed to a different goal.
- The scope allowed for attention to traffic issues.
- Two different tools required by the scope.
  - Synchro 9 – (Optimizes Total Delay)
  - Bandwidth Optimization Program (To maximize Band width)
    - TruTraffic 10 (FKA TSPDD) utilized.
    - Traffic Engineering Services/Smart Services had history of utilizing TSPPD in Signal Optimization.
PROCEDURES OF OPTIMAL TIMING

- Timing plans were produced by *Synchro 9*.
- All intersections had “3 phase” operation so lower cycle lengths could be considered.
- The data was imported into *TruTraffic 10* and the green band was optimized.
- The optimized Green Band was placed into *Synchro 9* and *SimTraffic* analysis was performed on both the *Synchro* optimized and *TruTraffic* optimized timing. The critical queuing (northbound at the SR 32 eastbound ramps) location was compared.
- Generally, the optimization with the shorter northbound queue at the SR 32 eastbound ramps was selected.
BASIS OF OPTIMAL TIMING

- Weekday AM Peak (100 second cycle)
  - *TruTraffic* optimized

- Weekday Midday Peak/Off Peak (90 second cycle)
  - *TruTraffic* optimized

- Mon.-Wed. PM Peak (90 second cycle)
  - *Synchro* optimized

- Friday PM Peak (90 second cycle)
  - *Synchro* optimized

- Weekend Peak (90 second cycle)
  - *TruTraffic* optimized
TIME SPACE DIAGRAM
Weekday AM Peak

BRO-68-30.72 TBC 2/1/1 (Based on Weekday AM Peak)

Sterling Run  SR 32 EB Ramps  SR 32 WB Ramps  Leininger St.

100 sec
66 sec
50 sec
16 sec
32 sec
60 sec
75 sec
415 sec
63 sec
78 sec
32 sec
71 sec
71 sec
32 sec
35 mph
66 sec
50 sec
16 sec
15 sec
32 sec
60 sec
75 sec
32 sec
63 sec
56 sec
35 mph
TIME SPACE DIAGRAM
Friday PM Peak

90 sec  BRO-68-30.72 TBC 1/4/1 (Based on Friday PM Peak)  Thu. 4/30/2015 4:53 PM
57 sec  14 sec  17 sec  43 sec  66 sec  55 sec  73 sec
13 sec
18 sec
54 sec  54 sec
57 sec  17 sec  54 sec
35 mph
35 mph
35 mph

Sterling Run  SR 32 EB Ramps  SR 32 WB Ramps  Leininger St.
TRAVEL TIME
Northbound

<table>
<thead>
<tr>
<th></th>
<th>Travel Time (sec.)</th>
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<tr>
<td>NB Weekday AM Peak</td>
<td>2/1/1</td>
</tr>
<tr>
<td>NB Weekday Midday Peak</td>
<td>1/3/1</td>
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<tr>
<td>NB Weekday Off Peak</td>
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<tr>
<td>NB Mon.-Wed. PM Peak</td>
<td>1/1/1</td>
</tr>
<tr>
<td>NB Friday PM Peak</td>
<td>1/4/1</td>
</tr>
<tr>
<td>NB Weekend Peak</td>
<td>1/2/1</td>
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TRAVEL TIME
Southbound

<table>
<thead>
<tr>
<th>Type</th>
<th>Time (sec.)</th>
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<tbody>
<tr>
<td>SB Weekday AM Peak</td>
<td>2/1/1</td>
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<tr>
<td>SB Weekday Midday Peak</td>
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<tr>
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<td>1/4/1</td>
</tr>
<tr>
<td>SB Weekend Peak</td>
<td>1/2/1</td>
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</tbody>
</table>
TRAVEL TIME VIDEO
Friday PM Peak
FINAL SYSTEM ADJUSTMENT

- Delay on detector zone 1A at US 68 & SR 32 EB Exit Ramp was changed to operate by Time of Day Plan
  - Purpose to ensure SB Left Turn phase to operate.
  - Based on Saturday Observation
    - SB LT Phase omitted during thru phase
    - US 68 volumes similar but ramp volumes lower
  - Delays
    - Mon-Fri PM Peak Plans delay is 30 sec.
    - All other Timing Plans delay is 15 sec.
CURRENT STATUS

- Traffic signals have been operating for two years.
- Final timing has been in place approximately a year and a half.
- Recent Village of Mount Orab feedback:
  - “Won’t say there are never any backups.”
  - “Not a noticeable problem.”
  - “The minor adjustments made after last observation made a big difference”
TAKEAWAYS
**TAKEAWAYS**

- Scopes should specify that an initial coordination plan be operating during at least weekday peak periods when the signal is placed in stop-and-go operation.

- Typical Tuesday-Thursday weekday counts may not be enough data to assess conditions. In this project, Friday afternoon was the critical time.

- Feedback from local agencies is valuable.

- Today’s technology provides flexibility.

- “Not an ultimate fix – address safety concerns” - The safety issue of high speed traffic encountering stopped traffic was mitigated.
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