How Do You Solve the Unsolvable Problem?

Innovative Designs in Urban Areas

Christa Greene, PE
Western District ITE & Texas District ITE Annual Meeting
June 26, 2018
Agenda

1. Introduction
2. Defining the Issue
3. Methodology
4. Research and Results
5. Conceptual Designs
6. Where We Go From Here....
1 Introduction

Project Partners:
Stantec (Research & Development Fund)
NCDOT
Grubb Ventures
Multi-Office Team

Raleigh, NC
Troy Peoples, PE

New Orleans, LA
Christa Greene, PE

Boston, MA
Mike Lindgren, PE

Atlanta, GA
Amy C. Sackaroff, AICP

Plymouth Meeting, PA
Anthony Isley, EI
Kellie Reep, PE
Sam Williams, PE
Dean Sarvis, PE
Ellen Klooz
Joey Lefante, PE, PTOE
Chuck Lounsberry
Ed White
Tunde Agunbiade
Anthony LaBella
Kim Williams, EI
Jun Yao
Defining the Issue

Multi-phase Signalized Intersection

Major Thoroughfare
Retail Center
Interstate
Close Proximity
Case Study

Crabtree Valley
Raleigh, NC
Defining the Issue
Existing Conditions
Existing Conditions

Transit Services at Crabtree Valley Mall

Route 6 Crabtree

Outbound from Downtown
Saliendo del centro de la ciudad
Para cuba rumbo al centro ver el reverso

Route 6

Crabtree Valley Mall
Pleasant Valley Shopping Center

Legend:
- Regular Route / Ruta de servicio
- Transfer Point / Punto de transferencia
- Connecting Route / Rutas que conectan
- Park & Ride Lot / Parqueo para traslado
- Point of Interest / Punto de interés

Stantec
Existing Conditions

Blue Ridge Road at Glenwood Avenue
Projected volumes

2020 AM (PM) Peak Hour Traffic Volumes

Stantec
Level of Service – Afternoon Peak Hour
Queues
## 5-year Crash History

<table>
<thead>
<tr>
<th>Location</th>
<th>Total Number of Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glenwood Avenue at I-440 (interchange)</td>
<td>424</td>
</tr>
<tr>
<td>Glenwood Avenue at Blue Ridge Road / Lead Mine Road (signalized)</td>
<td>275</td>
</tr>
</tbody>
</table>

- **275 reported crashes in 5 years**
- **424 reported crashes in 5 years**
5-year Crash History

<table>
<thead>
<tr>
<th>Crash Facts</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear End Crashes</td>
<td>67%</td>
</tr>
<tr>
<td>Same Direction Side Swipe</td>
<td>13%</td>
</tr>
<tr>
<td>Property Damage Only</td>
<td>80%</td>
</tr>
<tr>
<td>Crashes Occurring between 4pm and 6pm</td>
<td>24%</td>
</tr>
</tbody>
</table>

Location Crash Rate – 1112 Crashes / 100 Million Vehicle Miles

Statewide Average Crash Rate – 313 crashes / 100 Million Vehicle Miles

Severity Index – 2.64 (8.4 or higher indicates serious crashes)
Constraints

• Narrow right of way
• Dense Urban Development
• Must support bicycle and pedestrian traffic
• Cannot add impervious surface due to flooding and water quality issues
Alternatives Considered

Glenwood Avenue / Blue Ridge Road / Lead Mine Road
Methodology

Various Alternative Intersections Considered

• Review Previous Study

• Evaluate Alternative Intersection Designs
  • Superstreet
  • Continuous Flow Intersection
  • Center Turn Overpass
  • Echelon Intersection
Methodology

Various Alternative Intersections Considered
Glenwood Avenue at Blue Ridge Road / Lead Mine Road

Superstreet
Methodology
Various Alternative Intersections Considered
Glenwood Avenue at Blue Ridge Road / Lead Mine Road

Center Turn Overpass Interchange
Methodology

Various Alternative Intersections Considered
Glenwood Avenue at Blue Ridge Road / Lead Mine Road

Continuous Flow Intersection
Methodology

Various Alternative Intersections Considered

Glenwood Avenue at Blue Ridge Road / Lead Mine Road

Echelon Intersection

Source: FHWA.
Research

Echelon Intersection

Echelon intersection in Aventura, Florida
Research
Echelon Intersection

Echelon intersection in Aventura, Florida
Research

Echelon Intersection

Google Street View of Pedestrian Facilities on 203rd Street
## Results

### CAPACITY ANALYSIS RESULTS

Glenwood Avenue at Blue Ridge Road / Lead Mine Road

<table>
<thead>
<tr>
<th>Approach Delays</th>
<th>2020 No-Build LOS</th>
<th>2020 Echelon LOS (Upper)</th>
<th>2020 Echelon LOS (Lower)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AM</td>
<td>PM</td>
<td>AM</td>
</tr>
<tr>
<td>Eastbound Glenwood Ave</td>
<td>F (217.2)</td>
<td>F (146.4)</td>
<td>- (-)</td>
</tr>
<tr>
<td>Westbound Glenwood Ave</td>
<td>F (129.3)</td>
<td>F (126.1)</td>
<td>A (5.3)</td>
</tr>
<tr>
<td>Northbound Blue Ridge Rd</td>
<td>E (75.1)</td>
<td>F (165.0)</td>
<td>C (23.2)</td>
</tr>
<tr>
<td>Southbound Lead Mine Rd</td>
<td>F (74.1)</td>
<td>F (100.9)</td>
<td>- (-)</td>
</tr>
<tr>
<td><strong>OVERALL DELAY</strong></td>
<td>F (138.9)</td>
<td>F (132.6)</td>
<td>A (7.3)</td>
</tr>
</tbody>
</table>
Results

QUEUING ANALYSIS RESULTS
Glenwood Avenue at Blue Ridge Road / Lead Mine Road

Less than 600 feet in any direction

Echelon Intersection
Results

Echelon Intersection Signal Operations

- Upper Level Traffic Movement
- Lower Level Traffic Movement
- Stopped Traffic
Conceptual Designs
Conceptual Designs
Echelon Intersection Operations
Preliminary Findings

- Traffic Level of Service
- Geometric Considerations
- Aesthetics
- Multimodal Accommodation
- Safety
- Environmental
- Consistency with Local Plans
Possible changes could include:

- **Reconfiguring** the Glenwood Avenue interchange at the Beltline.
- **Improving** the intersection of Glenwood with Lead Mine and Blue Ridge roads.
- **Extending Crabtree Avenue**, the street that runs behind the mall, to the east and creating new exit and entrance ramps with the Beltline.

NCDOT Project: I-5870

Cost: $238.3 M

Final Design and Construction Award: Spring 2019

Project Completion: 2022
Questions?