Integrating Context Sensitive Solutions with the Transportation Planning Process

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Outline

• Project descriptions
• Highway 49 project
• I-269 project
• Integration and next steps
Corridor planning

- The old
  - improved traffic flow
  - reduced travel time
  - safety
  - economic development
  - environmental concerns
  - etc.....

- CSS
  - USDOT
  - FHWA
  - Streamlining innovative approaches
  - Further understands the corridor/context interface and devises more responsible solutions
Highway 49

- US Highway 49, Mississippi
- Advancement of:
  - Remote sensing
  - Spatial technologies
  - Economic Development
- Investigates innovative planning techniques
- Identifies data types and analysis methods that offer viable alternatives to corridor by-pass development and design.
- Matrix of impacts development
This project

- Explores the integration of Smart Growth principles into the transportation corridor planning process.
- So that with increasing development, we can:
  - better address the impacts of construction and transportation developments on the landscape and context
  - Recognize specific community features so that they can be incorporated into the planning process.
    - Public involvement
    - Accountability
    - Adding value
United States Highway 49

Lifeline between Mississippi Coast and the State Capital, Jackson.

Primary evacuation route.

Largely rural matrix

Bypasses multiple small communities

Post-Katrina population surge
Not just rubber tire corridors.

- Wildlife
- Greenway (existing and potential)
- Historic and cultural corridors
- Social corridors at urban nodes
- Bike/Pedestrian corridors
- Other transportation corridors
  - These all influence the economic, social, and environmental success of a corridor’s development
Two objectives

- Use remote sensing to identify community features and transportation related issues within rural communities, in the context of Smart growth planning.
- Assess the feasibility of adding innovative planning approaches to MDOT’s current transportation corridor planning process.

Analysis goal

- Integrate smart growth into transportation corridor planning.
Methods

• Data collection and assimilation
  – On-site reconnaissance
    • Land use
    • Context
    • Aesthetics and culture
  – Remotely sensed data
    • Aerial imagery
    • Feature extraction via digitization
    • Various vector data sets
• Development of selection matrix
  – Model community selection
  – Based on scale and existing infrastructure
  – With hopes of developing a more detailed matrix of impacts
## Smart Growth America

1. Housing  
2. Economy  
3. Children and Schools  
4. Environment  
5. Preservation and Revitalization  
6. Social Equity  
7. Transportation  
8. Open Space and Farmland  
9. Health and Aging

## CSS - characteristics

- Purpose and need from all stakeholders  
- Safe for user and community  
- Harmony with community  
- Level of excellence in people’s minds  
- Efficient and effective use of resources  
- Minimal community disruption  
- Adds value to community
Smart Growth

- From the 9 general principles, 8 specific principles directly related to the project area were developed
  - These principles help develop a matrix of impacts

1. Provide a variety of transportation choices
2. Direct development towards existing communities
3. Mix land uses
4. Take advantage of compact building design
5. Preserve open space, farmland, and critical environmental areas
6. Create a range of housing opportunities
7. Create walkable neighborhood
8. Create distinctive, attractive communities with a strong sense of place.

- Through evaluation and testing, we found that principles I-IV, VIII were the most relevant for transportation corridor planning.
Smart Growth principles and sub-criteria

- **I. Provide a Variety of Transportation Choices**
  - a) community bisected by Hwy 49 corridor
  - b) community by-passed by Hwy 49 corridor
  - c) public transportation available within Hwy 49 town/corridor interface*
  - d) bicycle paths present within Hwy 49 corridor town/corridor interface
  - e) pedestrian paths present within Hwy 49 town/corridor interface
  - f) separated circulation infrastructure present within Hwy 49 town/corridor interface
  - g) multi-modes present within Hwy 49 town/corridor interface
  - h) at-grade railroad crossings present within Hwy 49 town/corridor interface

*For the purposes of this study the Hwy 49 town/corridor interface consists of Hwy 49 itself and the one-mile buffers extending from each side of its centerline in accordance with the 2005 aerial imagery.*
Smart Growth principles and sub-criteria

• **II. Direct Development Towards Existing Communities**
  – a) low density development (<7 units/acre)
  – b) high density development (>7 units/acre)
  – c) sprawl development*
  – d) no development
    • *Within the context of this study "sprawl" is defined as single-use zoned, low density, automobile oriented development

• **III. Mix Land Uses**
  – a) mixed use zoning exists within Hwy 49 town/corridor interface
  – b) single use zoning exists within Hwy 49 town/corridor interface
Smart Growth principles and sub-criteria

• **IV. Preserve Open Space, Farmland, and Environmentally Critical Areas**
  – a) presence of public open space*
  – b) presence of private open space**
  – c) waterbodies >25 acres
  – d) waterbodies <25 acres
  – e) major rivers/perennial streams
  – f) intermittent streams
  – g) wetlands
  – h) open space bisected by transportation infrastructure
    • *Refers to publicly accessible open space such as parks, plazas, courtyards, greenspace, cemeteries, Etc...owned by public or private entities
    • **Refers to privately owned land not open to the public
Smart Growth principles and sub-criteria

- VIII. Create Distinctive, Attractive Communities with a Strong Sense of Place
  - a) architectural variety
  - b) historical features/attractions
  - c) street trees
  - d) green space/parks
  - e) water bodies
  - f) unique neighborhoods/districts
  - g) distinctive town center
# Community Comparisons

<table>
<thead>
<tr>
<th></th>
<th>Florence</th>
<th>D’Lo</th>
<th>Mendenhall</th>
<th>Magee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population &lt;5000</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>By-Passed by Hwy 49</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Grid-Based Street Network</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Intersected by Railroad</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Strip Development along Corridor</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>No Development along Corridor</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Part of larger Metro sprawl pattern</td>
<td>X</td>
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</tbody>
</table>
## I. Variety of Transportation Choices

<table>
<thead>
<tr>
<th>Feature</th>
<th>Town A</th>
<th>Town B</th>
<th>Town C</th>
<th>Town D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community bisected by corridor</td>
<td></td>
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<td></td>
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<tr>
<td>Community bypassed by corridor</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Public Transit available within corridor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bike paths within corridor</td>
<td></td>
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<tr>
<td>Pedestrian paths within corridor</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Separated circulation infrastructure</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Railroad present</td>
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<tr>
<td>At-grade railroad crossing</td>
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</tr>
</tbody>
</table>
## II. Direct Development toward existing communities

<table>
<thead>
<tr>
<th>Low density development (&lt;7 DU/acre)</th>
<th>Town A</th>
<th>Town B</th>
<th>Town C</th>
<th>Town D</th>
</tr>
</thead>
<tbody>
<tr>
<td>High density development (&gt;7 DU/acre)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sprawl development</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No development</td>
<td></td>
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</tbody>
</table>
### III. Mixed Land Uses

<table>
<thead>
<tr>
<th></th>
<th>Town A</th>
<th>Town B</th>
<th>Town C</th>
<th>Town D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed use zoning within corridor</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Single use zoning within corridor</td>
<td></td>
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</tr>
</tbody>
</table>
IV. Preserve open space, farmland, and environmentally critical areas

<table>
<thead>
<tr>
<th></th>
<th>Town A</th>
<th>Town B</th>
<th>Town C</th>
<th>Town D</th>
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</thead>
<tbody>
<tr>
<td>Existing open space</td>
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<tr>
<td>Public open space</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private open space</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waterbodies &lt;25 acres</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waterbodies &gt;25 acres</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>River/perennial streams</td>
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<tr>
<td>Intermittent streams</td>
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<td></td>
</tr>
<tr>
<td>Wetlands</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Bisected by transportation infrastructure</td>
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</tbody>
</table>
VIII. Foster attractive communities with a strong sense of place

<table>
<thead>
<tr>
<th></th>
<th>Town A</th>
<th>Town B</th>
<th>Town C</th>
<th>Town D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing aesthetic qualities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architectural variety</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Historic features / attractions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Street trees</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green space / parks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water bodies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unique neighborhoods / districts</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Distinctive town center</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Florence, MS

Suburban sprawl pattern

Car-oriented strip development

Multi-modal presence
D’Lo and Mendenhall, MS

D’Lo/Mendenhall, MS

Strong grid-based street network

Town Square development

Multi-modal presence
Magee, MS

Strong grid-based street network

Car-oriented strip development

Multi-grid network/corridor interfaces

Multi-modal presence
- US DOT RITA funded.
- I-69 Segment of Independent Utility 9
- Validating Commercial Remote Sensing and Spatial Information (CRS&SI) Technologies for Streamlining Environmental and Planning Processes in Transportation Projects
Streamlined Process
Multi-Criteria Decision Making

- A systematic approach of generating, ranking, comparing, and selecting multiple alternatives using multiple data sources and attributes.
- Enables stakeholder preferences to be modeled.
- Offers improved coordination and collaboration.
- When used with GIS, provides a powerful tool for transportation corridor planning.
- Automates methods for easily integrating varying stakeholder values and opinions to generate results that may be considered in a spatial information “decision-making” framework.
MCDM process.

1) Selecting factors
   "positive/negative impact for environment cost, etc."

2) Ranking criteria
   "quantifying degree of influence
   ex: density, land use, distance from Wetlands"

   single scenarios

3) Ranking factors
   "quantifying importance of factors
   ex: Wetlands X Agriculture"

   combined scenarios

4) From ranking to weights
   "mathematical approach based on pair-wise comparisons"

5) Least-Cost Path
   "GIS approach with map algebra"
Max distance from Memphis Urbanized area – least cost path
Max distance from wetlands– least cost path
slope– least cost path
hydrology– least cost path
Single factor – least cost path
Map Algebra

Max Dist MPO Urb.  
+ 
Dist Wetlands  
+ 
Dist Hydrography  
+ 
Slope

= Cumulative-Cost Surface
Cumulative multifactor - least cost path
Multi-Criteria weighting

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>MPO... Scenario 1</th>
<th>Resource Agency... Scenario 2</th>
<th>DOT... Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dist MPO</td>
<td>9 criteria: dist from 0 – 9 Km</td>
<td>4 criteria: dist from 0 – 3 Km</td>
<td>5 criteria: dist from 0 – 7 Km</td>
</tr>
<tr>
<td>Wetlands</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Hydrography</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Slope</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Multi Criteria- least cost path
Overlaying factor: MPO urban + Ag + wetlands + forest + existing roads
Why is understanding the context important during the Corridor Planning Process?
Proposed Alignment B3 of I-269
Aerial image: 1999

Alternative B3 – Why was it rejected in the EIS?
Proposed Alignment B3 of I-269
Overlay of Future Planned Developments
Aerial image: 2004
Proposed Alignment B3 of I-269
Aerial image: 2007
2007 “Highly Detailed” Image Shows Recent Development

3” Multi-spectral image data Provided by Desoto County Shows High Detail of Local Data!
So….

• Goal is the further integration of Smart Growth aspects with MCDM.
  – Is it possible to recognize smart growth features, identify and quantify them, and integrate them into the corridor planning process?
  – How can these processes be used to better integrate common stakeholder interest?
Thank You