West Virginia DOT

GIS Enhancement Project & Project Prioritization Process

presented to

WVDOT/MPO/FHWA Transportation Planning and Programming Conference

presented by
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October 3, 2012

Transportation leadership you can trust.
Agenda

- Project Background and Overview
- Components of Project
- Approach to Prioritization Process
- Stakeholder Input
- Presentation of Results
- Next Steps
Overview

Five Components of Project

» GIS Enhancement Project
» Project Prioritization Process
» Benefit/Cost Calculator
» Performance Measures Dashboard
» Project Mapping Application
Overview (GIS Enhancement Project)

GIS Enhancement Project

» Geospatial Integration and Implementation Strategy
  • Broad Assessment of GIS for the WVDOT

» Project Mapping Application Tool
  • To Display and Track Current, Past and Future Transportation Projects in the LRTP, STIP and TIPs

» Project Prioritization Process Based on State and/or MPO Priorities

» Future Modules
  • Benefit/Cost Calculator
  • Greenhouse Gas Calculator
  • Project Conformity
  • …etc.
Project Mapping Application Tool - Functionality

- Application access and security
  - Web application accessible by public, WVDOT, MPO, and other agency staff with different permission levels

- General capabilities
  - View transportation and demographic data on a map
  - View and query projects (retrieve relevant documents, attributes, and history)

- Redlining tools

- Reporting
Project Prioritization Process - Overview

- Purpose and Background
- Types of Projects
- Scoring Approach
- Prioritization Weights for Goals and Criteria
- Benefit/Cost Index
- Next Steps
Project Prioritization Process – Purpose and Background

Purpose

» Prioritize potential projects based on a combined project score and benefit/cost index to assist WVDOT with programming projects

» Integrate the approach into the GIS Project Mapping Application in order to display all potential projects, their scores, locations, history, etc.

Input

» Statewide Goals from WV Multi-Modal Statewide Transportation Plan

» Interviews with WVDOT Staff

» Best practices from the region and across the nation

» Stakeholder workshops – February 2012 and August 2012
Support West Virginia’s economic development goals with multimodal access to markets in West Virginia, the U.S., and overseas;

Support the health and well-being of West Virginians, as well as the environment and overall quality of life, with a range of mobility options;

Preserve past investments by maintaining the existing system; and

Promote efficient use of resources, especially in light of diminishing revenues.
Stakeholder Input – Interviews

- WVDOT Stakeholder Interviews
  Fall 2011
  - 25 DOT staff participated
  - Confirmed transportation goals
  - Defined project categories
  - Identified potential project prioritization criteria
  - Determined available data
Project Prioritization Process

**Scoring Approach**

1. Separate the projects into scoring groups;
2. Assign goals to project categories and develop weighting;
3. Develop criteria for each goal under each project category and assign weights;
4. Quantify a relative score for each project prioritization criterion for each project;
5. For each criterion, multiply each project’s relative score by that criterion’s weight;
6. For each project, sum weighted scores for all criteria; and
7. Assign projects to priority tiers, based on total project score and B/C index.
Stakeholder Input - Workshop

- Stakeholder Workshop #1 - February 2012
  - 30 participants
  - Defined project prioritization criteria by project type
  - Weighted project prioritization criteria and goals by project type
Step 1: Separate Projects into Scoring Groups

- Capacity Expansion
- Operational Improvement
- Maintenance & Preservation bridge/pavement
- Safety
Step 1: Separate Projects into Scoring Groups

- All Projects
  - Urban
    - Capacity Expansion
    - Maintenance and Preservation (Bridge)
    - Maintenance and Preservation (Pavement)
    - Operational Improvement
    - Safety
  - Rural
    - Capacity Expansion
    - Maintenance and Preservation (Bridge)
    - Maintenance and Preservation (Pavement)
    - Operational Improvement
    - Safety
Step 2: Assign Goals to Project Categories and Weight

- Identified goals addressed by each project type
- Defined weights for goals by project type at February Stakeholder Workshop
Step 2: Assign Goals to Project Categories

**Capacity Projects**
- Goal 1: Economic Development
- Goal 2: Multimodal, Mobility, Environment & Safety
- Goal 3: System Preservation
- Goal 4: Efficient Use of Resources

**Operational Projects**
- Goal 1: Economic Development
- Goal 2: Multimodal, Mobility, Environment & Safety
- Goal 4: Efficient Use of Resources

**Maintenance & Preservation Projects**
- Goal 1: Economic Development
- Goal 2: Multimodal, Mobility, Environment & Safety

**Safety Projects**
- Goal 2: Multimodal, Mobility, Environment & Safety
**Project Prioritization Goal Weights**

**Pairwise Survey Exercise**

1. Compare each item to every other item
2. Write preference in space provided
3. Add item values to get score

### Example for Goals:

<table>
<thead>
<tr>
<th>A. Economic Development</th>
<th>B. Multimodal, Mobility, Environment, &amp; Safety</th>
<th>C. System Preservation</th>
<th>D. Efficient Use of Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>C</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Totals:**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Step 2: Assign Goals to Project Categories & Weight

Goal Weighting: Capacity Expansion Projects

- Goal 1: Economic Development
- Goal 2: Mobility, Environment & Safety
- Goal 3: System Preservation
- Goal 4: Efficient Use of Resources

26% of the goals are assigned to Goal 2: Mobility, Environment & Safety, 31% to Goal 4: Efficient Use of Resources, 18% to Goal 1: Economic Development, and 25% to Goal 3: System Preservation.
Step 2: Assign Goals to Project Categories & Weight

Goal Weighting: Operational Improvements

- Goal 1: Economic Development (25%)
- Goal 2: Mobility, Environment & Safety (31%)
- Goal 3: Efficient Use of Resources (44%)
Step 2: Assign Goals to Project Categories & Weight

Goal Weighting: Maintenance and Preservation

- Goal 1: Economic Development
- Goal 2: Mobility, Environment & Safety
Step 2: Assign Goals to Project Categories & Weight

Goal Weighting: Safety

Goal 2: Mobility, Environment & Safety

100%
Step 3: Develop Criteria Under each Goal for each Project Category and Assign Weights

**Project Type**
- Urban/Rural
- Capacity
- Maintenance and Preservation (bridge)
- Maintenance and Preservation (highway)
- Operations
- Safety

**Goal Weighting**
- Economic development
- Mobility, environment, safety
- System preservation
- Efficient Use of resources

**Criteria Development and Weighting**
- Develop Weight for each Criterion
- Multiply Goal Weight by Criteria Weight for Overall Weight

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Step 1

Step 2

Step 3
Capacity Projects Criteria Weighting for Goal 1: Economic Development

- Criterion A: Commercial/industrial development potential
- Criterion B: Truck AADT
- Criterion C: Designation as economically distressed area
- Criterion D: Significance to tourism industry
- Criterion E: Number of employees within 20 miles of project
- Criterion F: Population within 20 miles of project
- Criterion G: Number of municipalities over 5,000 in population and number of employment centers within 20 miles
Capacity Projects Criteria Weighting for Goal 2: Mobility, Environment, Safety

- Criterion A: Total AADT
- Criterion B: Reduction in crash rate
- Criterion C: Travel time, delay reduction
- Criterion D: Evaluated for Complete Streets and incorporated into projects as appropriate
- Criterion E: Location on or within 3/4 mile of an existing or new fixed route transit route
- Criterion F: Air quality conformity
- Criterion G: Number of environmentally sensitive areas per mile through which project passes
Capacity Projects Criteria Weighting for Goal 3: System Preservation

- Criterion A: Compatibility with Land Use
- Criterion B: Contribution to completion of key corridor
- Criterion C: Pavement index; bridge sufficiency rating
Capacity Projects Criteria Weighting for Goal 4: Efficient Use of Resources

- Criterion A: Consistent with Local & Regional Priorities
- Criterion B: Local dollars contributed to Project as percentage of total project cost
Operations Projects Criteria Weighting for Goal 1: Economic Development

- Criterion A: Number of employees within 20 miles
- Criterion B: Population within 20 miles
- Criterion C: Truck AADT
- Criterion D: Designation as an economically distressed area
- Criterion E: Significance to tourism industry
- Criterion F: Number of freight intermodal transportation hubs within 20 miles
Operations Projects Criteria Weighting for Goal 2: Mobility, Environment and Safety

- **Criterion A**: Reduction in crash rate
- **Criterion B**: Reduction in travel time/delay reduction
- **Criterion C**: Total AADT
- **Criterion D**: Evaluated for Complete Streets and incorporated elements into project as appropriate
- **Criterion E**: Location on or within 3/4 mile of a fixed route transit route
- **Criterion F**: Number of environmentally sensitive areas per mile through which project passes
Operations Projects Criteria Weighting for Goal 4: Efficient Use of Resources

- Criterion A: Compatibility with land use
- Criterion B: Contribution to completion of a key corridor
- Criterion C: Pavement index; bridge sufficiency rating
- Criterion D: Consistent with local and regional priorities
- Criterion E: Local dollars contributed as a percentage of total project costs
Maint. and Pres. – Bridges Criteria Weighting for Goal 1: Economic Development

- **Criterion A**: Importance to Economic Development
- **Criterion B**: Whether the bridge is on the historic preservation program
- **Criterion C**: Detour length
- **Criterion D**: Truck AADT
- **Criterion E**: Posted for reduced weights below threshold for heavy trucks
- **Criterion F**: Number of freight intermodal transportation hubs within 20 miles
Maint. and Pres. – Bridges Criteria Weighting for Goal 2: Mobility, Environment & Safety

- Criterion A: Increases capacity
- Criterion B: Reduction in crash rate
- Criterion C: Evaluated for Complete Streets and incorporated elements into project as appropriate
- Criterion D: Sufficiency Rating Score
- Criterion E: Total AADT
Maint. and Pres. – Pvmnt. Criteria Weighting for Goal 1: Economic Development

- Criterion A: Truck AADT
- Criterion B: Number of freight intermodal transportation hubs within 20 miles
Maint. and Pres. – Pvmt. Criteria Weighting for Goal 2: Mobility, Environment & Safety

- Criterion A: Total AADT
- Criterion B: Evaluated for Complete Streets and Incorporated elements into project as appropriate
- Criterion C: Reduction in Crash Rate
- Criterion D: Composite Pavement Index
Safety Projects Criteria Weighting for Goal 2: Mobility, Environment & Safety

- Criterion A: Reduction in crash rate
- Criterion B: Total AADT
- Criterion C: Population within 20 miles of project
- Criterion D: Number of employees within 20 miles
- Criterion E: Addresses an existing bike/ped or transit safety issue
Develop Overall Weighting (example exercise)

- Multiply Goal Weight by Criterion Weight for overall weight

<table>
<thead>
<tr>
<th>Capacity Projects</th>
<th>Goal 3: System Preservation</th>
<th>Goal 4: Efficient Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal Weight</td>
<td>Goal Weight</td>
<td>Goal Weight</td>
</tr>
<tr>
<td>Criterion A:</td>
<td>Criterion A:</td>
<td>Criterion A:</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Consistent w/Local and</td>
<td>Consistent w/Local</td>
</tr>
<tr>
<td>with Land Use</td>
<td>Regional Priorities</td>
<td>Regional Priorities</td>
</tr>
<tr>
<td>Criterion B:</td>
<td>Criterion B:</td>
<td>Criterion B:</td>
</tr>
<tr>
<td>Contribution to</td>
<td>Contribution to completion</td>
<td>Local dollars</td>
</tr>
<tr>
<td>completion of</td>
<td>of key corridor</td>
<td>contributed to Project</td>
</tr>
<tr>
<td>key corridor</td>
<td></td>
<td>as percentage of</td>
</tr>
<tr>
<td>Criterion C:</td>
<td>Criterion C:</td>
<td>total project cost</td>
</tr>
<tr>
<td>Pavement index;</td>
<td>Pavement index;</td>
<td></td>
</tr>
<tr>
<td>bridge sufficiency</td>
<td>bridge sufficiency rating</td>
<td></td>
</tr>
<tr>
<td>Overall Weight</td>
<td>0.061</td>
<td>0.120</td>
</tr>
<tr>
<td>Criterion Weight</td>
<td>0.244</td>
<td>0.667</td>
</tr>
<tr>
<td>Overall Weight</td>
<td>0.078</td>
<td>0.333</td>
</tr>
</tbody>
</table>

Goal 3: System Preservation
- 25% Goal Weight
- Criterion A: Compatibility with Land Use
  - 0.244 Criterion Weight
  - 0.061 Overall Weight
- Criterion B: Contribution to completion of key corridor
  - 0.311 Criterion Weight
  - 0.078 Overall Weight
- Criterion C: Pavement index; bridge sufficiency rating
  - 0.444 Criterion Weight
  - 0.111 Overall Weight

Goal 4: Efficient Use
- 18% Goal Weight
- Criterion A: Consistent w/Local and Regional Priorities
  - 0.667 Criterion Weight
  - 0.120 Overall Weight
- Criterion B: Local dollars contributed to Project as percentage of total project cost
  - 0.333 Criterion Weight
  - 0.060 Overall Weight
### Step 4: Assign Project Scores (Example Exercise)
### Step 5: Multiply Relative Score by Criterion Weight

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Criterion Weight</th>
<th>Project Score (0-100)</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criterion A: Commercial/industrial development potential</td>
<td>0.036</td>
<td>50</td>
<td>1.8</td>
</tr>
<tr>
<td>Criterion B: Truck AADT</td>
<td>0.027</td>
<td>40</td>
<td>1.1</td>
</tr>
<tr>
<td>Criterion C: Designation as economically distressed area</td>
<td>0.015</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Criterion D: Significance to tourism industry</td>
<td>0.024</td>
<td>60</td>
<td>1.5</td>
</tr>
<tr>
<td>Criterion E: Number of employees within 20 miles of project</td>
<td>0.034</td>
<td>40</td>
<td>1.4</td>
</tr>
<tr>
<td>Criterion F: Population within 20 miles of project</td>
<td>0.036</td>
<td>50</td>
<td>1.8</td>
</tr>
<tr>
<td>Criterion G: Number of municipalities over 5,000 in population and number of employment centers within 20 miles</td>
<td>0.043</td>
<td>40</td>
<td>1.7</td>
</tr>
<tr>
<td>Criterion H: Number of freight intermodal transportation hubs within 20 miles</td>
<td>0.035</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Goal 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criterion A: Total AADT</td>
<td>0.041</td>
<td>60</td>
<td>2.5</td>
</tr>
<tr>
<td>Criterion B: Reduction in crash rate</td>
<td>0.074</td>
<td>30</td>
<td>2.2</td>
</tr>
<tr>
<td>Criterion C: Travel time, delay reduction</td>
<td>0.054</td>
<td>30</td>
<td>1.6</td>
</tr>
<tr>
<td>Criterion D: Evaluated for Complete Streets and incorporated into projects as appropriate</td>
<td>0.038</td>
<td>100</td>
<td>3.8</td>
</tr>
<tr>
<td>Criterion E: Location on or within 3/4 mile of an existing or new fixed-route transit route</td>
<td>0.023</td>
<td>100</td>
<td>2.3</td>
</tr>
<tr>
<td>Criterion F: Air quality conformity</td>
<td>0.031</td>
<td>100</td>
<td>3.1</td>
</tr>
<tr>
<td>Criterion G: Number of environmentally sensitive</td>
<td>0.048</td>
<td>50</td>
<td>2.4</td>
</tr>
<tr>
<td><strong>Goal 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criterion A: Compatibility with Land Use</td>
<td>0.061</td>
<td>70</td>
<td>4.3</td>
</tr>
<tr>
<td>Criterion B: Contribution to completion of key corridor</td>
<td>0.078</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Criterion C: Pavement index; bridge sufficiency rating</td>
<td>0.111</td>
<td>37</td>
<td>4.1</td>
</tr>
<tr>
<td><strong>Goal 4</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criterion A: Consistent w/Local and Regional Priorities</td>
<td>0.120</td>
<td>100</td>
<td>12.0</td>
</tr>
<tr>
<td>Criterion B: Local dollars contributed to Project as percentage of total project cost</td>
<td>0.060</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
### Step 6: Sum Weighted Scores for All Criteria (Example Exercise)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal 1</strong></td>
<td></td>
</tr>
<tr>
<td>Criterion A: Commercial/industrial development potential</td>
<td>1.8</td>
</tr>
<tr>
<td>Criterion B: Truck AADT</td>
<td>1.1</td>
</tr>
<tr>
<td>Criterion C: Designation as economically distressed area</td>
<td>0.0</td>
</tr>
<tr>
<td>Criterion D: Significance to tourism industry</td>
<td>1.5</td>
</tr>
<tr>
<td>Criterion E: Number of employees within 20 miles of project</td>
<td>1.4</td>
</tr>
<tr>
<td>Criterion F: Population within 20 miles of project</td>
<td>1.8</td>
</tr>
<tr>
<td>Criterion G: Number of municipalities over 5,000 in population and number of employment centers within 20 miles</td>
<td>1.7</td>
</tr>
<tr>
<td>Criterion H: Number of freight intermodal transportation hubs within 20 miles</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Goal 2</strong></td>
<td></td>
</tr>
<tr>
<td>Criterion A: Total AADT</td>
<td>2.5</td>
</tr>
<tr>
<td>Criterion B: Reduction in crash rate</td>
<td>2.2</td>
</tr>
<tr>
<td>Criterion C: Travel time, delay reduction</td>
<td>1.6</td>
</tr>
<tr>
<td>Criterion D: Evaluated for Complete Streets and incorporated into projects as appropriate</td>
<td>3.8</td>
</tr>
<tr>
<td>Criterion E: Location on or within 3/4 mile of an existing or new fixed-route transit route</td>
<td>2.3</td>
</tr>
<tr>
<td>Criterion F: Air quality conformity</td>
<td>3.1</td>
</tr>
<tr>
<td>Criterion G: Number of environmentally sensitive</td>
<td>2.4</td>
</tr>
<tr>
<td><strong>Goal 3</strong></td>
<td></td>
</tr>
<tr>
<td>Criterion A: Compatibility with Land Use</td>
<td>4.3</td>
</tr>
<tr>
<td>Criterion B: Contribution to completion of key corridor</td>
<td>0</td>
</tr>
<tr>
<td>Criterion C: Pavement index; bridge sufficiency rating</td>
<td>4.1</td>
</tr>
<tr>
<td><strong>Goal 4</strong></td>
<td></td>
</tr>
<tr>
<td>Criterion A: Consistent w/Local and Regional Priorities</td>
<td>12.0</td>
</tr>
<tr>
<td>Criterion B: Local dollars contributed to Project as percentage of total project cost</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL Project Score</strong></td>
<td><strong>47.6</strong></td>
</tr>
</tbody>
</table>
Step 7: Assign Projects to Priority Tiers
Calculate Benefit/Cost (B/C) Index

- Project Benefits (B)
  - Travel time savings
  - Fuel cost savings
  - Crash cost savings
  - Greenhouse gas cost savings
  - Economic Savings

- Project Costs (C)
  - Engineering
  - ROW
  - Construction
Step 7: Assign Projects to Priority Tiers

- High B/C Index and Low Project Score = Tier 2 Medium Priority
- High B/C Index and High Project Score = Tier 1 High Priority
- Low B/C Index and Low Project Score = Tier 3 Low Priority
- Low B/C Index and High Project Score = Tier 2 Medium Priority
Benefits of Approach

- Transparent

- Defendable

- Reflects established goals in the statewide plan

- Data-driven process that is quantitative when possible, qualitative when necessary

- Tiered approach provides flexibility to program projects
Next Steps

- Finalize B/C calculator tool
  - Test with sample of actual WV projects

- Develop project prioritization function within GIS mapping tool (as part of a future task order)

- Populate project prioritization GIS tool with projects currently included in the *West Virginia Multimodal Statewide Transportation Plan* and experiment with different funding allocation scenarios (as part of a future task order)
Questions?