Performance Based Programming Using GIS Data

Keith Dotson and Eileen Vaughan
Highway Plan Development in Kentucky

KYTC Develops Initial Project List

KYTC Develops Draft Highway Plan for Governor

Governor Finalizes, Presents Recommended Plan to General Assembly

General Assembly, Governor Enact Highway Plan
Kentucky Transportation Cabinet

Documented Highway Needs

3,500+ Active PIFs (Identified Projects)
Kentucky Transportation Cabinet

Documented Highway Needs

- 3,500+ Active PIFs (Identified Projects)
- 1,400 Current Hwy Plan Projects
Kentucky Transportation Cabinet

Documented Highway Needs

- 3,500 Active PIFs (Identified Projects)
- 1,400 Current Hwy Plan Projects
- 140 + Awarded Current Hwy Plan Projects
State Projects Vastly Exceed Funding

- More than 90 percent of the state-funded projects in the current Highway Plan don’t have state dollars to pay for them.
- In other words, Kentucky has 10 TIMES as many state-funded highway projects budgeted as dollars available.
- Overpromising creates expectations that cannot be fulfilled for many years – if at all.

![Bar chart showing State Funding in Current Highway Plan (in Millions)]

- Listed: $7,165
- Anticipated Funds Available: $690
SHIFT Kentucky Ahead

STRATEGIC HIGHWAY INVESTMENT FORMULA FOR TOMORROW
Proven Approach

- KYTC studied successful data-driven models for transportation funding in five other states (NC, VA, MN, FL, UT)
- Work group of state and district transportation professionals developed a model tailored for Kentucky
- Combines objective measures (quantitative) with insights of local, regional leaders (qualitative)
- Designed to be refined each biennium
SHIFT Priorities

- Manage existing assets
- Improve safety
- Reduce congestion
- Fuel economic growth
- Spend dollars wisely
Formula Components

- Safety
- Asset Management
- Economic Growth
- Congestion
- Benefit / Cost
## Formula Measurements

<table>
<thead>
<tr>
<th>Priority</th>
<th>Examples of Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety</strong></td>
<td>• How many crashes? How frequent?</td>
</tr>
<tr>
<td></td>
<td>• How does that compare to similar roads?</td>
</tr>
<tr>
<td></td>
<td>• Does roadway design impact number, frequency of crashes?</td>
</tr>
<tr>
<td><strong>Congestion</strong></td>
<td>• How many vehicles daily?</td>
</tr>
<tr>
<td></td>
<td>• How does volume impact service level?</td>
</tr>
<tr>
<td><strong>Economic Growth</strong></td>
<td>• What is the potential job growth? (accessibility, connectivity, economic competitiveness, etc.)</td>
</tr>
<tr>
<td></td>
<td>• What’s the daily traffic volume? Daily freight volume?</td>
</tr>
<tr>
<td><strong>Benefit / Cost</strong></td>
<td>• How much travel time could be saved?</td>
</tr>
<tr>
<td></td>
<td>• What’s the financial value of time savings?</td>
</tr>
<tr>
<td></td>
<td>• How much could be saved by reducing crashes?</td>
</tr>
<tr>
<td></td>
<td>• What’s the project cost?</td>
</tr>
<tr>
<td><strong>Asset Management</strong></td>
<td>• What are the pavement repair, replacement costs?</td>
</tr>
<tr>
<td></td>
<td>• What’s the condition of bridges, overpasses?</td>
</tr>
</tbody>
</table>
Focus ➔ Address Congestion and Bottlenecks

Eligible Projects
- Statewide type Projects (Interstates/NHS)
  • Selection 100% Data
  • Projects Programmed prior to Area Planning Input

Focus ➔ Improve Connectivity within Regions

Eligible Projects
- Projects Not Selected in Statewide Mobility Category
  - Regional Projects
  • Selection based on 70% Data & 30% Area Planning Input
## Statewide Funding Formula

<table>
<thead>
<tr>
<th>Priority</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve Safety</td>
<td>25%</td>
</tr>
<tr>
<td>Reduce Congestion</td>
<td>20%</td>
</tr>
<tr>
<td>Fuel Economic Growth</td>
<td>20%</td>
</tr>
<tr>
<td>Spend Tax Dollars Wisely (benefit /cost)</td>
<td>20%</td>
</tr>
<tr>
<td>Preserve Infrastructure (asset management)</td>
<td>15%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
</tr>
</tbody>
</table>

![Pie chart showing distribution of priorities](chart.png)

- **Safety 25%**
- **Congestion 20%**
- **Econ Growth 20%**
- **Benefit/Cost 20%**
- **Asset Mgmt 15%**
### Regional Funding Formula

<table>
<thead>
<tr>
<th>Priority</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve Safety</td>
<td>20%</td>
</tr>
<tr>
<td>Reduce Congestion</td>
<td>10%</td>
</tr>
<tr>
<td>Fuel Economic Growth</td>
<td>15%</td>
</tr>
<tr>
<td>Spend Tax Dollars Wisely</td>
<td>15%</td>
</tr>
<tr>
<td>(benefit/cost)</td>
<td></td>
</tr>
<tr>
<td>Preserve Infrastructure</td>
<td>10%</td>
</tr>
<tr>
<td>(asset management)</td>
<td></td>
</tr>
<tr>
<td><strong>SUBTOTAL</strong></td>
<td><strong>70%</strong></td>
</tr>
<tr>
<td>District Priorities (KYTC)</td>
<td>15%</td>
</tr>
<tr>
<td>Local Priorities (ADD/MPOs)</td>
<td>15%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

- **Econ Growth**: 15%
- **Benefit/Cost**: 15%
- **Asset Mgmt**: 10%
- **Congestion**: 10%
- **Safety**: 20%
- **Local**: 15%
- **District**: 15%

**District Priorities**: 15%

**Local Priorities**: 15%
Data!

Bringing the data we need together!
Data!

1. Locate PIFs into HIS Database to maintain locations
2. Gather Data Needed
3. Bentley’s Transportation Intelligence Gateway (TIG)
4. Verify Data Output
Data! – Locate PIFs

• Needed to locate PIFs from the PIF Database into the Bentley’s Assetwise (HIS) Database

• Database is Kentucky’s Linear Referencing System (LRS) which enables all data to a GIS

• HIS Database also contains Roadway Characteristic, System and HPMS Data
  • IE: Lanes, Median, Functional Class, State System, etc.

• With PIF locations updated regularly, we were confident we were exporting correct associated data for each PIF’s location
Data! – Gather Data Needed

• Data that was required was in different databases
  • BRM, OMS, etc.

• Checked with owners of data to determine accurate usage of data
  • IE: Checked with Maintenance to determine correct field and usage for Gross Weight for a particular bridge

• Created Views and Tables of the data that were not already inside HIS database in order to use inside TIG
Welcome to Bentley’s Transportation Intelligence (TIG) application

To access an existing definition, click on the tree menu located to the left.

If you are new to this application, you can begin to build your first extract definition by selecting one of the Create New options located on the upper left portion of the screen.

An extract definition contains all of the instructions the Bentley application needs to retrieve and export asset, group, and external data. Extract definitions are comprised of the following three components:

- **Location Fields**
  - The Location Fields data contains the route and milepoints along which extracted asset and group attributes are located.

- **Attribute Sets**
  - Attributes and Attribute Sets define the asset and attribute information that will be included in your extract. You can specify any number of attributes for each extract. Organizing attributes into attribute sets allows you to:
    -- perform calculations in one attribute set and extract the results from another
    -- copy attribute sets from one extract to another
    -- easily perform analytic functions such as Length Weighted Average and Most Common Value

- **Spatial Data**
Data! - TIG

• Created queries inside TIG using tables and views created of data
• Those queries determined LWA, MCV, MAX, etc. for the data selected over each PIF Project
  • This is a similar process to how we calculate and process for HPMS Data
• Query results were extracted into Excel Spreadsheet
**Data! - TIG**

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
<th>Include?</th>
<th>Rollup?</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>Lanes</td>
<td>N</td>
<td>N</td>
<td>All Locations (Outer Join)</td>
</tr>
</tbody>
</table>

Select the Attribute(s) to Include in this Set. Items listed in Blue are Point Items.

<table>
<thead>
<tr>
<th>Action</th>
<th>Asset or Group ID</th>
<th>Attribute</th>
<th>Include?</th>
<th>Formula?</th>
<th>Output Column</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCV</td>
<td>LN_H Highways View of LN</td>
<td>LANES</td>
<td>Yes</td>
<td>No</td>
<td>LANES</td>
</tr>
<tr>
<td>RANGE</td>
<td>PF_H Highways View of PIF</td>
<td>PIFKEY</td>
<td>Yes</td>
<td>No</td>
<td>PF_PIFKEY</td>
</tr>
</tbody>
</table>

**Attributes**
Data! – Verify Data Output

• Verify output data from TIG in Excel
  • IE: Was LWA of ADT for each PIF correct

• There were a few issues that needed to be corrected with the data
Kentucky Transportation Cabinet
Documented Highway Needs

- 3,500+ Active PIFs (Identified Projects)
- 1,400 Current Hwy Plan Projects
Projects Evaluated through SHIFT

1,152 Projects Evaluated through SHIFT
SHIFT Projects 2018 Recommended Plan

- 232 Projects in the Plan
- 220 Identified Priority Projects not in the Plan
QUESTIONS?

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