COMPREHENSIVE HIGHWAY CORRIDOR PLANNING WITH SUSTAINABILITY INDICATORS

Problem
In order to improve transportation, environmental, and livability conditions for Maryland residents and visitors, the Maryland State Highway Administration (SHA) has initiated major planning efforts to improve critical highway corridors and promote sustainable transportation systems. The SHA is also committed to integrating safety, mobility, environmental stewardship, and socio-economic objectives in its transportation planning process and Comprehensive Highway Corridors (CHC) program. To support these SHA sustainability initiatives, it is necessary to develop quantitative models that can comprehensively estimate the impact of various highway improvement options on sustainability early in the transportation planning process.

Objective
1. Define sustainability indicators that are relevant to SHA’s Comprehensive Highway Corridors (CHC) program.
2. Develop a high-level planning Model Of Sustainability And Integrated Corridors (MOSAIC) that helps SHA integrate the identified sustainability indicators into the CHC program at the project/corridor level.
3. Provide guidance documents for integrating sustainability objectives into SHA’s corridor planning process.

Description
The sustainability indicators considered in MOSAIC include mobility, safety, energy and emissions, natural resources, socio-economic impact and cost (6 broad indicator categories comprised of more than 30 performance measures). MOSAIC can help SHA identify the corridor improvement option that best balances these sustainability indicators, and avoid improvement options with major negative environmental impacts that often lead to costly and lengthy environmental screening and mitigation procedures. Based on best practices and original research, various quantitative models have been developed to analyze the impacts of alternative corridor improvement options on identified sustainability indicators.
Results

The current version of MOSAIC runs within a Microsoft Excel spreadsheet environment (the menu page is shown in the previous page), and includes: (1) A user input module where users can select a corridor and candidate highway improvement options for that corridor; (2) Analysis modules that quantitatively estimate the impact of user-specified improvement options on all sustainability indicators; and (3) An output module providing numerical and graphical outputs.

MOSAIC has been applied to the U.S.-15 corridor north of Fredrick, MD, to demonstrate the feasibility and usefulness of this comprehensive tool for sustainable highway corridor planning. Two improvement options were considered for this case study: (1) Adding one general purpose travel lane in each direction; and (2) Upgrading all at-grade intersections to grade-separated interchanges. The final summary report MOSAIC produces includes graphical visualizations of the impact of each improvement option at both the section and corridor levels (see graphs below). The user-defined weights represent how decision-makers value the relative importance of the six sustainability indicator categories (e.g. mobility versus natural resources). The final evaluation results suggest that converting at-grade intersections to grade-separated interchanges along the U.S.-15 corridor would be more effective in enhancing sustainability than constructing additional travel lanes on all sections.

Section-by-Section Results (Green-Positive impact; Red-Negative; Yellow-Neutral)

<table>
<thead>
<tr>
<th>SECTION</th>
<th>Mobility</th>
<th>Natural Resources</th>
<th>Energy and Env.</th>
<th>Socio-Economic</th>
<th>Safety</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 1</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Section 2</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Section 3</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Section 4</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Section 5</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
</tr>
</tbody>
</table>

Corridor-Level Results (Normalized to a score between -10 to 10 for each indicator)

Report Information

Lei Zhang (Project P.I.), Assistant Professor, Dept. of Civil and Environmental Engineering, University of Maryland, Phone: 301-405-2881, Email: lei@umd.edu

Maryland State Highway Administration Research Division, 707 N. Calvert Street, Baltimore MD 21202 Tel: 410-545-2916 or 1-888-204-0157