Developing Public Health Performance Measures to Capture the Effects of Transportation Facilities on Multiple Public Health Outcomes

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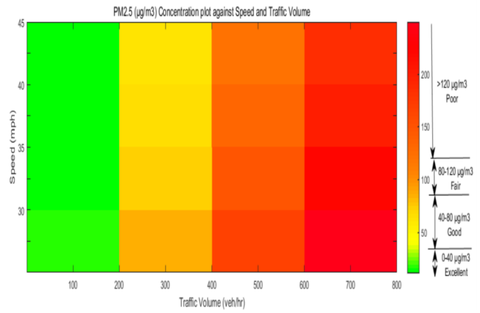
Introduction

Active commuting has seen a growth of 300% in some U.S. large cities [McLeod & Murphy, 2014]. This trend improves the public health measures such as safety, physical activity, and air quality and has benefits like reducing vehicular transportation and fuel consumption.

Study	Performance Measure	Affecting Infrastructure Variables
Zeeger et al., 2006	Pedestrian Intersection Safety Index (PISI)	Signal and stop controlled crossings, No. of through lanes, Speed, Main traffic ADT, Land use
Carter et al., 2006	Bike Intersection Safety Index (BISI)	Roadway geometry, Traffic control, Motor vehicle traffic, Bicycle facilities
Texas Transportation Institute (TTI)	Great Pedestrian Street	Total sidewalk area, Curb extensions, Crosswalk length, Median width, Pedestrian refuges, Perceived safety, Aesthetic components, streetscape features and lighting
Wellar, 1998	Walking Security Index (WSI)	No. of lanes, Grade, Presence of turning lanes, curbs at intersections



Research Objectives

Research Objective 1: Investigate performance evaluation strategies that consider the joint effects of transportation facilities on public health factors such as safety, physical activity and air quality.
Research Objective 2: Develop decision making tools for evaluating competing public health objectives.
Research Approach 1: Develop project level performance measures for evaluating the effects of transportation facilities on different public health objectives of safety, air quality and physical activity.
Research Approach 2: Develop easy to apply sketch planning tools to aid decision-makers in evaluating different transportation facilities with respect to multiple public health outcomes.

Methods and Materials

Survey details: Performance measures captured and calibrated using expert survey of professionals with transportation engineering, safety and public health expertise.
Fuzzy Technique: The study calculates the element weights for the performance measures with a geometric mean technique using a fuzzy scaling approach and expert feedback (i.e. four levels of importance as least important, moderately important, important, and most important and they are not given Likert scale weights).

Concordance Technique: A concordance technique is used to evaluate the safety impact of each element. The researchers use data from the expert survey for the concordance analysis, which derives the safety influence of each element.

Conflicts: Surrogate safety performance measure for crashes

- **Non-overtaking:** Separation distance and vehicle speed, time to react
- **Over-taking:** Lateral separation and vehicle speed

Air Quality: PMs for evaluating the relationship between air quality along arterials. Performance measures consider the pollutant concentration levels of CO, NO2 and PM10/PM2.5 along the activity route of major urban arterials (independent variables are speed limit and traffic volume).

1-hr PM10 (µg/m³) boundaries	Zonal Criteria
0-40	Excellent
40-80	Good
80-120	Fair
>120	Poor

1-hr PM2.5 Concentration and Threshold Boundaries

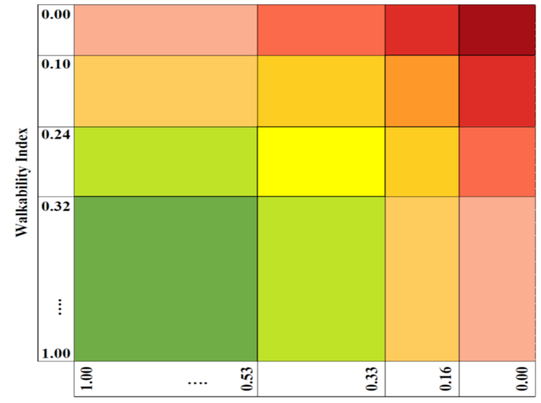
Outcomes

- Transportation Infrastructure Safety Performance Measures for Pedestrians and Cyclists: The Pedestrian Safety Assessment Index (PSAI) and the Bicyclist Safety Assessment Index (BSAI)
- A Methodology for Analyzing Pedestrian, Cyclist and Vehicle Conflicts
- Transportation Infrastructure Physical Activity Performance Measures for Pedestrians and Cyclists: The Walkability Assessment Index (WAI) and Bikeability Assessment Index (BAI)
- Performance Measures for Air Quality Assessment of Pedestrian and Bicycling Routes
- The Development of Field-Based Data Collection Tools to Improve Decision Making

Spelling, or press F7.

Safety Impact	Color Code	Walkability and/or Bikeability
Negative Impact on Safety		Discourages
Negative – Minimal Impact on Safety		Discourages - Neutral Effect
Minimal - Positive Impact on Safety		Neutral Effect - Definitely Improves
Positive Impact on Safety		Definitely Improves

Safety Zones and Physical Activity Levels Color Coding Scheme



Conclusion & Future Directions

The study calibrates new public health performance measures using surveys of transportation engineering professionals and formulates the relationship between transportation elements and public health using a fuzzy scaling approach. The safety impact was evaluated using a Concordance Technique. The measures presented in this poster can be used to evaluate transportation infrastructure needs and the impacts of different improvements.

The performance measures developed in this study focus on road segments and intersections. However, the indices can be easily expanded to corridors and transportation networks. Adjusting the indices in this manner enables transportation agencies to evaluate two or more corridors, regions and networks, which in turn help in the investment decision making process, strategic planning, and policy or programming analysis. Future research may consider the operating characteristics, network connectivity and land use; however, these “enhancements” may decrease the current utility of the performance measures for non-expert decision-makers

The tools can help decision makers evaluate any potentially competing public health objectives. The research team recommends that transportation agencies use the developed safety and physical activity indices as an evaluation tool to assess the impacts of policies and planning.

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