Multimodal Level of Service for Medium Size Cities

Proposed Methodology for Multimodal Score Estimation

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Agenda

- Background
- Literature Review
- Problem Statement (Challenge for Medium Size Cities)
- Proposed Multimodal Score Methodology
- Case Study and Findings
- Conclusions
- Questions and Comments
Background

TTI is assisting the El Paso MPO to develop a multimodal plan consisting of the following tasks:

1. Background Study
2. Data Collection and Assessment
3. Travel Behavior Analysis
4. Development of Policy Recommendations
5. Action Plan for Prioritization and Implementation
6. Support to Local Government Staff on Public Outreach Efforts
7. Deliverables
Task 2 Goals of Multimodal Study

- Assessment of multimodal transportation facilitates in the El Paso MPO area
- Provide a framework to analyze and prioritize multimodal projects in the El Paso MPO area
- Identify needs for various alternative transportation modes
Current Methodologies:

- National Cooperative Highway Research Program (NCHRP) Report 616: Multimodal Level of Service (LOS) Analysis for Urban Streets (Highway Capacity Manual and Transit Capacity and Quality of Service Manual provide other methodologies)
- Auto LOS Model
- Transit LOS Model
- Bicycle LOS Model
- Pedestrian LOS Model
Multimodal LOS Concept

Level of Service (LOS) is a qualitative measure used to relate the quality of traffic for the various modes.

Source: FDOT Quality/Level of Service Handbook
NCHRP Report 616, Auto LOS Data Requirements:
- Space mean speed
- Number of stops
- Stops per mile
- Presence of median
- Presence of exclusive left-turn lane
- Presence of trees rating
- Pavement quality rating
Literature Review (Cont.)

NCHRP Report 616, Transit LOS Data Requirements:

- Service frequency (headways)
- Travel time (speed)
- Crowding
- Reliability (headway variability/schedule adherence)
- Presence of stop amenities documented to reduce perceived wait time
NCHRP Report 616, Some Bicycle Segment LOS Data Requirements:

- Total number of directional through lanes
- Directional motorized vehicle volume (vph)
- Average running speed of motorized vehicles (mph)
- Proportion of heavy vehicles in motorized vehicle volume
- FHWA’s five point pavement surface condition rating
- Average effective width of outside through lane (ft)
- Percentage of segment with occupied on-street parking
- Width of paving between the outside lane stripe and the edge of pavement (ft)
- Effective width as a function of traffic volume (ft)
- Width of outside through lane plus paved shoulder (including bike lane where present) (ft)
NCHRP Report 616, Bicycle Intersection LOS Data Requirements:

- Perceived hazard of shared-roadway environment through the intersection
- Total width of outside through lane and bike lane (if present)
- Crossing distance, the width of the side street (including auxiliary lanes and median)
- Volume of directional traffic during a 15-minute period
- Total number of through lanes on the approach to the intersection
NCHRP Report 616, Pedestrian (segment, intersection, midblock) LOS Data Requirements:

- Total width of outside lane (and shoulder) pavement
- Width of shoulder or bicycle lane, or, if there is un-striped parking
- Percent of segment with on-street parking
- Buffer width (distance between edge of pavement and sidewalk, in feet)
- Width of sidewalk
- Directional volume of motorized vehicles in the direction closest to the pedestrian (vph)
- Total number of through lanes for direction of traffic closest to pedestrians.
- Sum of the number of right-turn-on-red vehicles and the number of motorists making a permitted left turn in a 15-minute period
- The number of lanes being crossed by the pedestrian
- Average number of seconds the pedestrian is delayed before being able to cross the intersection
- Number of right turn channelization islands on the crossing
Challenge for Medium Size Cities

Why current methodology not viable:

- Extremely data intensive
- Would be impractical and very expensive to acquire all necessary data for regional analysis
- Lacks consideration for a complete multimodal ‘trip-based’ evaluation
Proposed Multimodal Score Methodology

Data available and retrieved for analysis:

- Transit routes and stops Geographic Information System (GIS) files and Transit Survey, Sun Metro
- City of El Paso GIS sidewalk files, El Paso Department of Transportation (EPDOT)
- City of El Paso GIS bicycle lanes (City of El Paso & TxDOT)
- Travel Demand Model (TDM) which includes census and employment data for years 2014 and 2030 (El Paso MPO)
Proposed Multimodal Score Methodology (Cont.)

Multimodal score methodology advantages:

- Captures the total trip efficiency in its form and use
- Considers treatment of each transit stop as the focal point of trip activities, waiting, boarding, and alighting.
- Transit stops will also function as the primary origin/destination locations for commuters in a multimodal environment
- This approach considers a trip-based multimodal score
Proposed Multimodal Score Methodology (Cont.)

Multimodal Network Configuration (ArcGIS)

- Transit network in green
- Bicycle network in red
- Transit stop
- Sidewalk network
Proposed Multimodal Score Methodology (Cont.)

Multimodal score components, bicycle and walking (calculated and ideal):

1. Population of TAZ in AM:
   \[ \text{Score Comp.} = \frac{\text{Population 1}}{\text{Travel Time 1}} + \frac{\text{Population 2}}{\text{Travel Time 2}} + \ldots \]

2. Employment of TAZ in PM:
   \[ \text{Score Comp.} = \frac{\text{Employment 1}}{\text{Travel Time 1}} + \frac{\text{Employment 2}}{\text{Travel Time 2}} + \ldots \]
Proposed Multimodal Score Methodology (Cont.)

Multimodal score components, Transit

Threshold = 45 min.

\[
\text{AM Score Comp.} = \frac{\text{Population } I}{\text{Travel Time } J} + \frac{\text{Population } I}{\text{Travel Time } K} + \ldots
\]

\[
\text{PM Score Comp.} = \frac{\text{Employment } I}{\text{Travel Time } J} + \frac{\text{Employment } I}{\text{Travel Time } K} + \ldots
\]
Case Study: City of El Paso Texas
Normalized Transportation Analysis Zones Structure
Case Study: City of El Paso Texas
Findings, Walking Demand- Supply Assessment for 2014
Case Study: City of El Paso Texas
Findings, Bicycle Demand- Supply Assessment for 2014
Case Study: City of El Paso Texas.

Findings, Transit Demand- Supply Assessment for 2014
Case Study: City of El Paso Texas
Findings, Combined Demand- Supply Assessment for 2014
Conclusions

- A ‘trip-based’ multimodal score suits the El Paso region due to its distinct demographics.
- Developed customized scores are sensitive to time of the day and give detailed performance measures of the multimodal transportation facility in the region.
- Scores indicate that bicycle infrastructure needs significant improvements in the city and its surrounding rural cities of Socorro, San Elizario, Horizon City, Vinton, Anthony and Sunland Park to facilitate last-mile connectivity.
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Questions and Comments
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