FEHR & PEERS

Multi-Modal Level of Service Toolkit

HCM 2010 – Pedestrian LOS

Overview

The 2010 *Highway Capacity Manual (HCM 2010)* provides detailed instructions on calculating LOS for pedestrians on urban streets (at the link, segment and facility levels) and at signalized and 2-way stop intersections. (It also offers instructions on calculating LOS on off-street facilities, which are not discussed here.) Pedestrian LOS is integrated into HCM 2010's multi-modal LOS, allowing analysts to compare trade-offs between modes.

How to measure

HCM 2010 provides three performance evaluation measures for pedestrian LOS on urban street facilities:

1) Average pedestrian space (also called "circulation area") is the amount of sidewalk available to pedestrians traveling along a segment. It is on based pedestrian flow rate, average walking speed, and effective sidewalk width (total width - obstructions on and abutting the walkway). Average pedestrian space is measured in $feet^2$/person.

2) Average pedestrian speed is a measure of pedestrian walking speed along the segment length, taking into account intersection delay. Pedestrian walking speed is estimated at 4.4 feet/second for most conditions, but should be reduced for locations with changes in grade or a high percentage of elderly or school-age pedestrians.
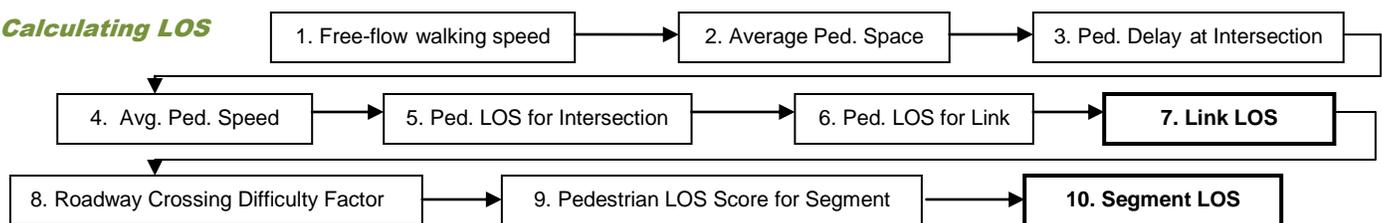
3) Pedestrian LOS score is based on the typical pedestrian's perception of the travel experience; it incorporates the previous two measures. Better pedestrian environments result in lower pedestrian LOS scores. The equation for pedestrian LOS score includes:
- Number of auto lanes in roadway
- Volume and speed of auto traffic
- Circulation area (based on pedestrian flow and effective sidewalk width)
- Pedestrian travel speed
- Space and buffering available to pedestrians on sidewalk (bicycle lanes, parked vehicles, street trees, etc.)

Local jurisdictions frequently calculate LOS at the link level (on a single block). In order to calculate the Pedestrian LOS score for a segment that contains several links, the equation adds:
- Crossing difficulty at intersections and midblock, including time spent diverting to a crosswalk
- Pedestrian LOS for the intersection, which incorporates curb geometry, turning traffic slows and signal times.

Calculating LOS

1. Free-flow walking speed → 2. Average Ped. Space → 3. Ped. Delay at Intersection

4. Avg. Ped. Speed → 5. Ped. LOS for Intersection → 6. Ped. LOS for Link → **7. Link LOS**

8. Roadway Crossing Difficulty Factor → 9. Pedestrian LOS Score for Segment → **10. Segment LOS**

Levels of Analysis

- Link (single block within a street facility)
- Urban Street Facility
- Urban Street Segment
- Signalized Intersection
- Two-way intersection

How to calculate LOS

To calculate LOS from A-F for pedestrians for a segment or facility, compare the Pedestrian LOS score to the Average Pedestrian Space (using Exhibit 17-3 in *HCM 2010*). LOS must be calculated separately for each side of the street.

Potential Applications

- Development review
- Transportation Master Plans
- Pedestrian Master Plans

Advantages

- Provides a comprehensive evaluation of pedestrian LOS at different scales.
- Easy to compare with motor vehicle, bicycle and transit LOS for the same segment/facility
- Quantifies the benefits and drawbacks of roadway design alternatives for a single segment.
- Focused on factors within the public right-of-way, which can be addressed through planning and engineering.

Disadvantages

- Requires extensive data inputs, many of which must be measured in the field.
- May not be feasible as a stand-alone measure (significantly integrated with HCM 2010 Auto LOS measure).
- Pedestrian LOS score is heavily influenced by auto traffic volumes, which are difficult to mitigate in a planning or engineering context.

Sample Applications

HCM 2010 Pedestrian LOS evaluation methods have been incorporated into transportation modeling software, including Complete Streets LOS (CSLOS) and Synchro Studio 8.

Fehr and Peers applied the NCHRP 370 methodology, which HCM 2010 is based on, for various projects in San Diego that included a corridor study, community plan update, and infill development. Fehr & Peers has recently applied the HCM 2010 methodology using CSLOS software as part of the West Los Angeles Mobility Plan.

Data Requirements

Pedestrian LOS requires data inputs also used in *HCM 2010*'s auto and bicycle LOS calculations.

To calculate pedestrian LOS of a link:

- Midsegment auto traffic speed and volumes
- Pedestrian flow rates
- Width and number of travel lanes
- Segment length
- Sidewalk extent and dimensions
- Size and location of obstructions in and beside the sidewalk (telephone poles, utility boxes, etc.)
- Proportion of segment adjacent to window displays, building faces and/or low walls or fences
- Pedestrian LOS for intersection (see below)
- Bicycle lane/shoulder width
- Number of trees/bushes between sidewalk and motorway
- Presence and percent occupancy of on-street parking
- Median type/presence and curb presence

To calculate pedestrian LOS of an intersection, you will also need

- Length of signal phases for pedestrians and cross-traffic (green, yellow, red)
- Walkway width and corner curb radii at intersections
- Number and flow rates of turning vehicles

To calculate pedestrian LOS of a segment, you will also need:

- Crossing length at intersections, including islands/medians
- The delay incurred by diverting travel to a signalized intersection, or waiting for traffic to clear at an uncontrolled crossing point
- The legality of mid-block crossings