Guide to Pedestrian Analysis
Pedestrian Operations Analysis
What’s in this Chapter?

- Design and operation of pedestrian facilities
- Operational measures support quality-of-service measures
- Methods for evaluating pedestrian flow and storage needs
- Macroscopic analysis
  - Sidewalk, crosswalk, bus stop, and so on.

Delay, flow, speed, storage, and circulation area concepts
Pedestrian Delay

• “Ideal” and “actual” walking time
• Signalized intersections and uncontrolled crossings
• HCM currently uses delay for pedestrian LOS determination

Research team revised pedestrian delay calculation methodology as part of NCHRP 17-87
Uncontrolled Crossings

• Chapter 20 of the HCM 6th Edition
  • Two-way stop-controlled intersections, mid-block locations
• Delay reducing effects of motorist yielding was revised by the research team

• Step 1 – Identify two-stage crossings
• Step 2 – Determine critical headway
• Step 3 – Probability of delayed crossing
• Step 4 – Average delay calculation to wait for gap
• Step 5 – Estimate average delay for crossing stage
• Step 6 – Calculate average delay
Uncontrolled Crossings

NCHRP 17-87: Guide to Pedestrian Analysis
Uncontrolled Crossings – Input Data

- Crosswalk length
- Number of through lanes crossed
- Presence of two-stage crossings
- Conflicting vehicular flow rate
- Average pedestrian speed
- Pedestrian start-up and end clearance times
- Average motorist yielding rate
Signalized Crossings (1)

• Chapter 19 of the HCM 6th Edition
  • Current method addresses delay for a one-stage crossing of an intersection leg of a pre-timed signal, assuming random pedestrian arrivals
  • Guidance for multiple-stage crossings and multiple crossings is to calculate delay for individual stage/crossing and sum the results
Signalized Crossings (2)

- Methods in Guide and proposed for HCM
  - Crossing one intersection leg in one stage (current method)
    - Assumes random arrivals and pre-timed
  - Crossing one intersection leg in two stages (median island)
    - Based on Wang and Tian (2010)
  - Crossing two intersection legs in two stages (diagonally opposite corner)
    - Based on Zhao and Liu (2017)
- Two-stage crossing delay data
  - First-stage crossing length
  - Average pedestrian speed
  - Effective walk time for second stage
  - Start time of the walk phase for first and second stages
Signalized Crossings (3)

• Possible extensions being considered for HCM
• Have a theoretical basis, but no supporting data as of now
  • Delay for semiactuated and actuated signals & hybrid beacons (Kittelston on behalf of PBOT 2015)
  • 3-stage crossing delay, extra delay associated with crosswalk closures (extensions of Zhao & Liu)
• Exclusive pedestrian phase/Barnes dance
  • Lower of diagonal crossing delay (current method) and performing a two-stage crossing (if feasible) (Zhao & Liu)
Signalized Crossings (4)

- Proposed change in methodology step sequence
  - Calculate delay, then LOS
  Crosswalk & corner circulation area calculations are optional

Current

- Step 1: Determine Street Corner Circulation Area
- Step 2: Determine Crosswalk Circulation Area
- Step 3: Determine Pedestrian Delay
- Step 4: Determine Pedestrian LOS Score for Intersection
- Step 5: Determine LOS

Proposed

- Step 1: Determine Pedestrian Delay
- Step 2: Determine Pedestrian LOS Score for Intersection
- Step 3: Determine LOS
- Step 4: Determine Street Corner Circulation Area
- Step 5: Determine Crosswalk Circulation Area
Pedestrian Flow

• Number of pedestrians served per unit width in a given period of time
Design Applications

- Pedestrian circulation facilities
  - Sidewalks (effective width)
Pedestrian Speed

- For signal timing applications
  - MUTCD guidelines – 3.5 ft/s

- Sidewalks and signalized crossings
  - HCM criteria – 4.0 ft/s
  - 20% are elderly – 3.3 ft/s

- Uncontrolled crossings
  - HCM criteria – 4.4 ft/s
  - NCHRP 17-87 field data – 4.7 ft/s
Pedestrian Circulation Area Analysis

• Performance measures
  • Pedestrian flow
  • Effective width

• Sidewalks and walkways (HCM 2000)
  • Average flow and platoon flow

• Stairways (HCM 2000, TCQSM)
  • Stairway capacity by lane width – TCQSM
Pedestrian Circulation Area Analysis

- Ramps and grades
- Crosswalks
  - HCM Chapter 19
- Transit station corridors (TCQSM)
  - Space, Flow rate
Pedestrian Storage Area & Traffic Signal Warrants

• Transit platform and signalized intersection corner storage

• MUTCD pedestrian volume traffic signal warrant

• MUTCD school crossing signal warrant