Calibration of the HCM 2010 Roundabout Capacity Equations for Georgia
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INTRODUCTION
Roundabouts provide operation and safety benefits over traditional intersection designs. When examining alternative intersection designs, the ability to accurately predict capacity is important. The current method for determining roundabout capacity in the United States is found in the 2010 Highway Capacity Manual (HCM) drawn primarily from the National Cooperative Highway Research Program (NCHRP) Study 3-65. The default capacity equations can be calibrated to local conditions using locally determined values of critical headway, \( t_c \), and follow-up headway, \( t_f \).

The purpose of this study is to calibrate the HCM 2010 model to driving conditions in Georgia by determining the critical headway and follow-up headway at single-lane roundabouts in Georgia.

BACKGROUND
HCM 2010 SINGLE LANE ROUNDABOUT CAPACITY EQUATION

\[
C_{pe} = Ae^{-Bv_t},
\]

where \( C_{pe} \) = entry capacity, \( t_e \) = entry time, \( t_c \) = critical headway, \( t_f \) = follow-up headway, \( s \) = vehicle, and \( v_t \) = traffic volume rate.

\[
A = \frac{3600}{B} = \frac{t_c - t_f}{3600}
\]

CRITICAL HEADWAY, \( t_c \)
- “The minimum headway an entering driver would find acceptable” – NCHRP 572
- Estimated from accepted and rejected gaps
- NCHRP 572 presents three different methods for determining critical gap:
  1. Inclusion of all observations of gap acceptance, including rejected gaps
  2. Inclusion of only observations that contain a rejected gap; and
  3. Inclusion of only observations where queuing was observed during the entire minute and the driver rejected a gap
- Gap: the time between the passing of the rear of the leading vehicle and the front of the following vehicle in a traffic stream
- \( t_e \): the time between when a vehicle arrives at the entrance point and the next circulating vehicle

FOLLOW-UP HEADWAY, \( t_f \)
- “The headway maintained by two consecutive entering vehicles using the same gap in the conflicting stream” – NCHRP 572

RESULTS

FOLLOW-UP HEADWAY
- Found by subtracting the timestamp of the following vehicle at the entrance point from the leading vehicle at the entrance point
- Used a follow-up time threshold of 4.0 seconds to expand the number of follow-up headway observations because few sites were under consistent capacity constrained conditions
- Average follow-up headway: 3.269 seconds

DATA COLLECTION
CAMERA PLACEMENT
- Recorded 36 approaches over 14 roundabouts
- Collected 65+ hours of video

CAMERA VIEW

SITES
- Alpharetta
- Covington
- Columbus
- Dahl
- Douglasville
- Emory

RESULTS OF THIS STUDY
- CALIBRATED EQUATIONS VS. CURRENT EQUATIONS

FINDINGS
- Results indicate that calibrating the HCM 2010 single-lane roundabout capacity equation to Georgia conditions generally increases the predicted capacity.

IMPACT OF EXITING VEHICLES
- This NCHRP 572 capacity equations did not account for exiting vehicles in the final model
- Results of this study indicate the inclusion of exiting vehicles decreases critical headway.

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