Highway Capacity Software 2010

Version 6.50
April 8, 2014
Highway Capacity Software

Developed and maintained by McTrans

- Originally founded by the FHWA in 1986 as the Center for Microcomputers in Transportation (McTrans)

- Now a full-service software support center, associated with the University of Florida

HCS 2010

- HCS 2010 implements the procedures defined in the Highway Capacity Manual (HCM) 2010 published by the Transportation Research Board (TRB)

- This release includes the new Streets module that combines the Signalized Intersections with the Urban Streets Segments, Facilities and Multimodal procedures.
Fourteen Modules

Intersection Module

Highway Module

Streets
TRANSYT-7F
TWSC
AWSC
Roundabouts
Warrants
DAITA

Facilities
Freeways
Weaving
Ramps
Multilane
TwoLane
LOSPLAN

McTrans
Moving Technology

HCS
2010
Demonstration
Street Module

Signalized Intersections

- Signal analysis
- Interchange analysis
- Multimodal analysis
- LOS
Signalized intersections

- **Capacity**
  - Defined for each lane group
    - Lane group: one or more lanes that accommodate traffic and have a common stop-line and traffic move together
  - Lane group capacity: maximum rate of flow for the subject lane group that may pass through the intersection under prevailing traffic, roadway and signalized conditions
Signalized intersections

- Traffic Conditions
  - Approach volumes (left, through, right)
  - Vehicle type
  - Location of bus stops
  - Pedestrian crossing flows
  - Parking movement
Signalized intersections

- Roadway Conditions
  - Number and width of lanes
  - Grades
  - Lane use
    - Including parking lanes

- Traffic Signal Characteristics
  - Signal phasing
  - Signal timing
  - Type of control
  - Signal progression
Signalized intersections

- Delay experienced by a motorist includes many factors:
  - Signal control
  - Geometrics
  - Incidents
Signalized intersections

- **Total delay:**
  - Difference between actual travel time and ideal travel time
    - In the absence of traffic control, delay due to roadway geometries, incidents and when there are no vehicles on the road
  - In HCS control delay is quantified
    - Initial deceleration delay
    - Queue move-up time
    - Stopped delay
    - Final acceleration delay
Level of Service (LOS)

- Defined in terms of delay as a function of:
  - driver discomfort
  - Driver frustration
  - Fuel consumption
  - Lost travel time
Level of Service (LOS)

- LOS criteria are stated in terms of average control delay per vehicle
  - Delay on signal control depends on
    - Quality of progression
    - Cycle length
    - Green ratio
    - V/c ratio for lane group
- Designated by letters A - F
## Level of Service (LOS)

<table>
<thead>
<tr>
<th>LEVEL OF SERVICE</th>
<th>CONTROL DELAY PER VEHICLE (SEC/VEHICLES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>≤ 10</td>
</tr>
<tr>
<td>B</td>
<td>&gt;10 and ≤ 20</td>
</tr>
<tr>
<td>C</td>
<td>&gt;20 and ≤ 35</td>
</tr>
<tr>
<td>D</td>
<td>&gt;35 and ≤ 55</td>
</tr>
<tr>
<td>E</td>
<td>&gt;55 and ≤ 80</td>
</tr>
<tr>
<td>F</td>
<td>&gt; 80</td>
</tr>
</tbody>
</table>

Source: Highway Capacity Manual 2010
Operational Analysis Procedure

1. INPUT
   - Roadway conditions
   - Traffic conditions
   - Signalization conditions

2. VOLUME ADJUSTMENT
   - Peak hour factor
   - Establish lane groups
   - Assign volumes to lane groups

3. SATURATION FLOW RATE
   - Ideal saturation flow rate
   - Adjustments

4. CAPACITY ANALYSIS MODULE
   - Compute lane group capacities
   - Compute lane group v/c ratios
   - Aggregate results

5. LEVEL OF SERVICE MODULE
   - Compute lane group delays
   - Aggregate delays
   - Determine levels of service
Getting Started:

1. Open HCS 2010
2. Select the Streets *(handles signals and signalized corridors)*
Getting Started:

3. Complete The Quick Start Screen
4. Enter Information in the **General** Section
5. Enter **Lane Configuration**
6. Enter **Traffic** Data

![Traffic Data Table]

| Traffic          | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Demand, veh/h    | 350 | 1315| 285 | 385 | 740 | 125 | 130 | 320 | 240 | 225 | 780 | 310 |
| Lane Width, ft   | 12.0| 12.0| 12.0| 12.0| 12.0| 12.0| 12.0| 12.0| 12.0| 12.0| 12.0| 12.0|
| Storage Length, ft| 350 | 0   | 300 | 0   | 0   | 190 | 0   | 300 | 200 | 0   | 370 |
| Saturation, pc/h/ln| 1900| 1900| 1900| 1900| 1900| 1900| 1900| 1900| 1900| 1900| 1900| 1900|
| Heavy Vehicles, %| 10  | 10  | 0   | 10  | 10  | 0   | 10  | 10  | 10  | 10  | 0   | 10  |
| Grade, %         | -2  | 0   | 1   | 6   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | -2  |
| Buses, per h     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Parking, per h   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Bicycles, per h  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Pedestrians, per h| 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Arrival Type     | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   |
| Upstream Filtering (I)| | | | | | | | | | | | |
| Initial Queue, veh| 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Speed Limit, mi/h| 45  | 45  | 45  | 45  | 45  | 45  | 45  | 45  | 45  | 45  | 45  | 45  |
| Detector, ft     | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  | 40  |
| RTOR, veh/h      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
7. Enter **Phasing** data
8. Enter **Timing**

![Timing Table]

<table>
<thead>
<tr>
<th></th>
<th>EBL</th>
<th>EBT</th>
<th>WBL</th>
<th>WBT</th>
<th>NBL</th>
<th>NBT</th>
<th>SBL</th>
<th>SBT</th>
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</thead>
<tbody>
<tr>
<td>Phase Split, s</td>
<td>150</td>
<td>40.0</td>
<td>15.0</td>
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<td>0.0</td>
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<td>4.0</td>
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<td>ET</td>
<td>WL</td>
<td>WT</td>
<td>NL</td>
<td>NT</td>
<td>SL</td>
<td>ST</td>
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<td>Dual Entry</td>
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<td>WL</td>
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<td>NL</td>
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<td>SL</td>
<td>ST</td>
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<td>Dallas Phasing</td>
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<td>N/S</td>
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<tr>
<td>Simultaneous Gap</td>
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<td>N/S</td>
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</table>

![Green Settings Table]

<table>
<thead>
<tr>
<th></th>
<th>Green</th>
<th>Yellow</th>
<th>Red</th>
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<tbody>
<tr>
<td></td>
<td>40.0</td>
<td>4.0</td>
<td>1.0</td>
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<tr>
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</tbody>
</table>
9. Enter the **Detailed** Data
10. Run **Full Optimization**
11. **Optimization Results**

![Optimization Results](image)

- **Overall Delay**
  - Original: 263.7 sec/veh
  - Optimum: 169.1 sec/veh
  - Average: 175.0 sec/veh
  - Improvement: 35.9%

- **Run Status**
  - Generation Number: 200 out of 200
  - Generation Optimum: 101
  - Total Time Elapsed: 43 sec

- **Diagnostic Messages**
  - No messages to report at this time.
## HCS 2010 Signalized Intersection Results Summary

### General Information
- **Agency:** DOT
- **Analyst:** Design Engineer
- **Analysis Date:** Aug 12, 2012
- **Area Type:** Street
- **Jurisdiction:** Clayton County
- **Time Period:** 2012 PM
- **Analysis Year:** 2012
- **Analysis Period:** 7:30 PM

### Project Description
- **Project Name:** Signalized Design Year Traffic

### Demand Information
<table>
<thead>
<tr>
<th>Approach Movement</th>
<th>EB</th>
<th>WB</th>
<th>NB</th>
<th>SB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Approach</strong></td>
<td>L</td>
<td>T</td>
<td>R</td>
<td>L</td>
</tr>
<tr>
<td>**Demand (veh/h)</td>
<td>300</td>
<td>1815</td>
<td>289</td>
<td>395</td>
</tr>
</tbody>
</table>

### Signal Information
- **Cycle, s:** 110.0
- **Phase, s:** 2
- **Reference Phase:** 12
- **Reference Time:** 12
- **Undirected:** No
- **Simulated:** Yes
- **Pulse Mode:** Fixed

### Timer Results

### Movement Group Results

### Notes
- The report details the analysis of 12. View/Print **Results** Summary Report.
13. View Messages Report

- Look for any warnings

--- Messages ---

WARNING: Since queue spillover from turn lanes and spillback into upstream intersections is not accounted for in the HCM procedures, use of a simulation tool may be advised in situations where the Queue Storage Ratio exceeds 1.0.

--- Comments ---
RESULTS