**TUTORIAL FOR VERIFICATION PERFORMANCE MEASURE (CONTROL DELAY & STOP RATE)**

**By**

**Shinya Maehara**

**Muhammad Saif Uddin**

**Anushka Seereeram**

**Tanay Datta Chowdhury**

**Performance Measures Calculation**

To <https://swashsim.miraheze.org/wiki/Performance_Measures>

* 1. **Control delay**

Avg. Control Delay (s/veh) = Total Delay (veh-s)/Total Vehicles

Total Delay (veh-s) = ∑Individual Vehicle Delay (s)

Individual Vehicle Delay (s) = Link Travel Time (s) – LinkLength (ft) / Vehicle Desired Speed (ft/s)

Link Travel Time (s) = Link Exit Time (s) - Link Entrance Time (s)

Vehicle Desired Speed (ft/s) = LinkFreeFlowSpeed (ft/s) × Vehicle Driver Type Desired Speed Multiplier

* 1. **Stop Rate**

Stop Rate (stops/h) = Total Stops/Simulation Duration (h)

Notes about Total Stops measure:

If a vehicle stops one or more times on the link, it only gets counted as one stop. In the case of cycle failures, this number will likely not reflect the actual number of stops. To be counted as a stop, SwashSim only considers the ‘StoppedInQueue’ status, not ‘SlowingInQueue’ or ‘QueueDischarge’.

**Verification**

Document to <https://swashsim.miraheze.org/wiki/Tutorials>

* 1. **Control delay**

“Control delay” can be calculated according to following step.

1. Open TSD output data for each link.
2. Remove/Delete the vehicle ID entered the link before duration time.

* Filter **column A** with less than warm up time.
* Identify the vehicle ID in **column B**.
* Remove/Delete entries with these vehicle ID from database

1. Remove/Delete the vehicle ID which didn’t depart the link within simulation time.

* Filter **column A** with duration time + warm up time (the last time step of simulation)
* Identify the vehicle ID in **column B**.
* Remove/Delete entries with these vehicle ID from database

1. Save filtered file as “*TSD\_1\_0\_1\_input.csv*”
2. Open R studio and run total\_delay.R

This script calculates total delay by following process.

* 1. Input *TSD\_1\_0\_1\_input.csv* file
  2. Link Travel Time = Link Exit Time - Link Entrance Time using time in **column A**.
  3. Vehicle Desired Speed =

LinkFreeFlowSpeed\* × Vehicle Driver Type Desired Speed Multiplier\*

* 1. Vehicle Desired Travel Time = LinkLength\* / Vehicle Desired Speed
  2. Individual Vehicle Delay = Link Travel Time - Vehicle Desired Travel Time
  3. Total delay = summation of individual vehicle delay
  4. Output *total delay.csv*

\* These values can be found in SwashSim model. Duration time & Warm up time can be found on simulation panel in SwashSim model.

1. Check the results in “*total delay.csv*”

* Total vehicle: Count the number of ID in **column B**.
* Total delay: summation of delay in **column F**.(Filter out the negative values)

**Note:** We verified only the through movement of the links. The Vehicle Desired Speed would be different for both left and right turning vehicles because of different LinkFreeFlowSpeed on downstream link than upstream link which affect the delay calculation for the vehicles turning left or right.

* 1. **Stop Rate**

“Total stop” can be calculated according to following step using Excel.

1. Open TSD output data for each link.
2. Remove/Delete the vehicle ID entered the link before duration time.

* Filter **column A** with less than warm up time.
* Identify the vehicle ID in **column B**.
* Remove/Delete entries with these vehicle ID from database

1. Remove/Delete the vehicle ID which didn’t depart the link within simulation time.

* Filter **column A** with duration time + warm up time (the last time step of simulation)
* Identify the vehicle ID in **column B**.
* Remove/Delete entries with these vehicle ID from database

1. Filter “Stoppedinqueue” in **column AU**.
2. Delete duplicate vehicle ID in **column B**
3. Count the number of vehicle ID