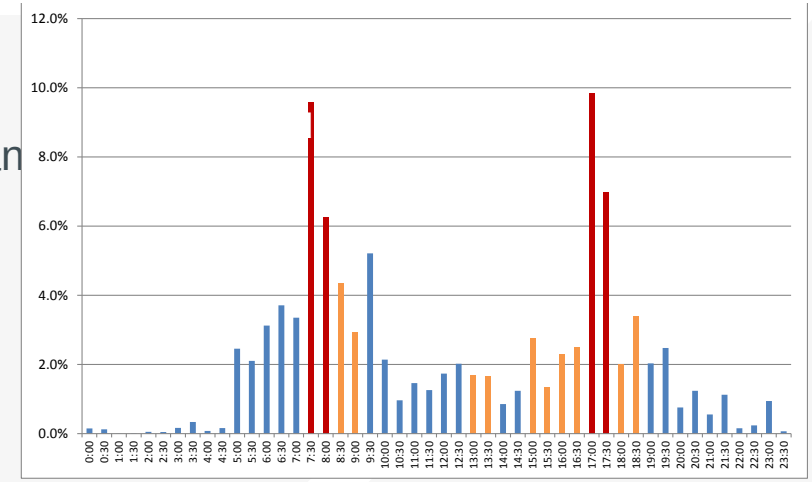
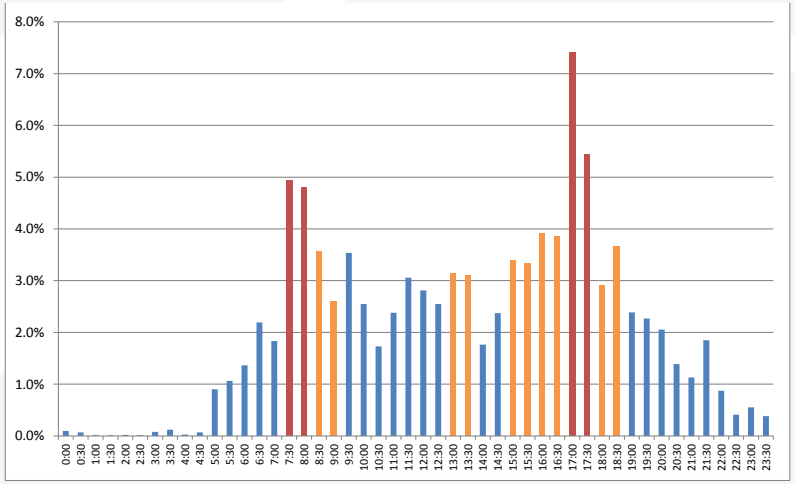
Assignment

CAMBRIDGE SYSTEMATICS

Traffic Assignment: *What Route?*

- Auto trips are assigned to the highway network
  - Transit trips and non-motorized trips can also be assigned to their respective networks as separate processes





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Traffic Assignment

- Traffic assignment can be done at the daily level where all vehicle trips are assigned to the highway network or at the peak period/peak hour level
  - Typically models have 4-5 traffic assignment periods including AM peak, Midday, PM peak, Evening, and Off peak
- Traffic assignment results allow the modeler to identify congested segments of the roadway and calculate VMT on highway facilities

Traffic Assignment

- Vehicles are allocated between roadways depending on the assignment algorithm
  - All-or-nothing assignment calculates the shortest path between each origin and destination pair and assigns all the vehicles to this path; it's not iterative
    - Not capacity constrained
  - User Equilibrium assigns vehicles in a way that no trip can improve its travel time between an origin and a destination; assumes perfect knowledge of the network
    - Capacity constrained
  - System Optimal assignment loads vehicles in such a way as to minimize the total travel time of all vehicles in the system
    - Capacity constrained

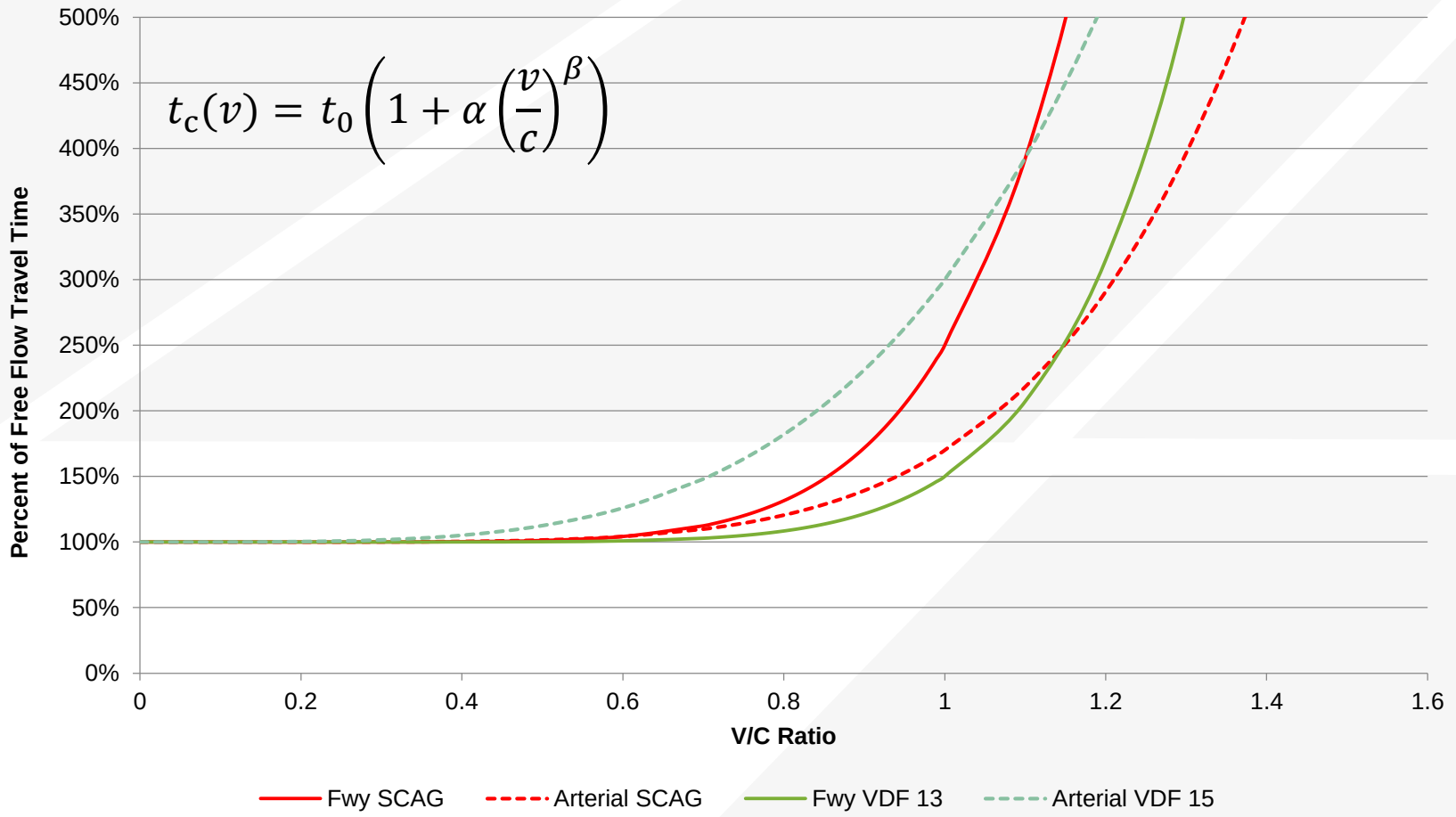
Traffic Assignment

- Static traffic assignment
  - All vehicles are loaded on the network at the same time for a specified time period (peak hour or peak period)
  - Used in most models
  - Can predict volumes that exceed roadway capacities
  - Can’t capture queuing behavior
- Dynamic traffic assignment
  - Traveler optimizes travel time based on congestion levels along different paths while en route
  - Travel times are updated every few seconds
  - Very time consuming for larger networks

Volume Delay Functions

- VDFs relate increases in volumes to travel time changes
- Some of the most common VDF curves include:
  - BPR – Bureau of Public Roads
  - Akcelik
  - Conical
- VDFs are equations that are in the model script by facility type
  - Freeway
  - Expressway
  - Arterial, etc.

BPR Curve



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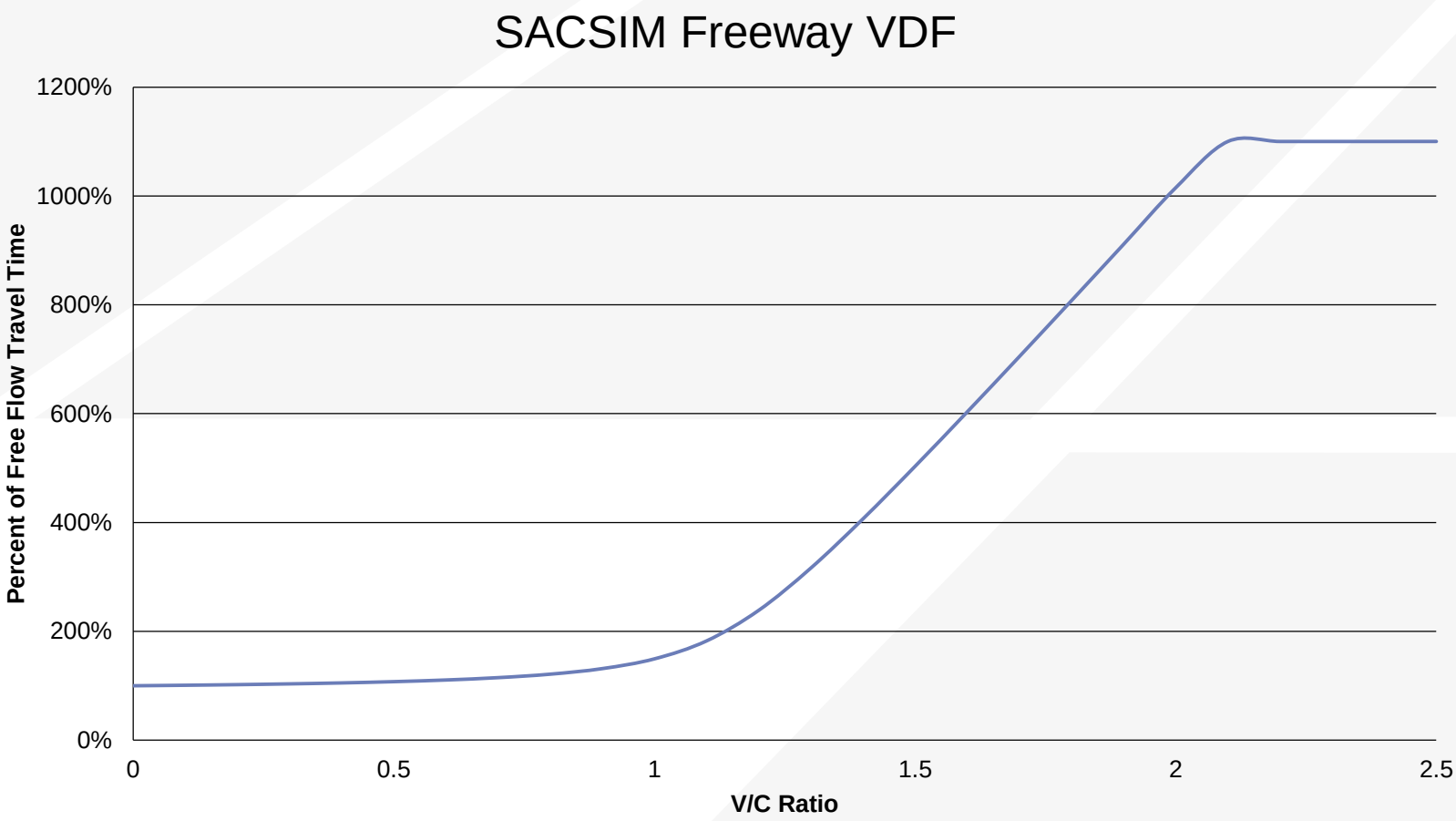
Freeways SacSIM

$$T_c = T_0 * min\left[\left(0.9 - 6 * (1 - 0.88 * VC) + \sqrt{36 * (1 - 0.88 * VC) + (1 - 0.88 * VC + 1.21)}, 11\right)\right]$$



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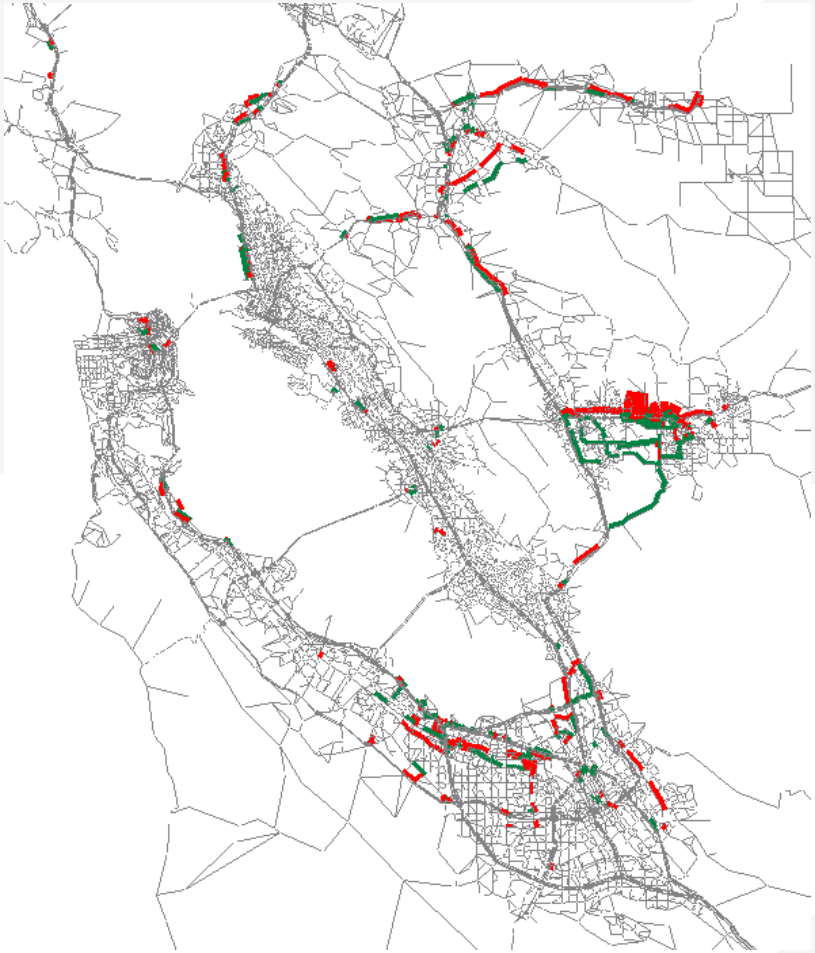
Traffic Assignment Convergence

- It's not possible to calculate what volumes on each highway will result in the same travel times along all paths between and O-D pair
- Hence, the volumes are adjusted a little bit it a time until the travel times are the same and convergence is reached
- At the end of each iteration a relative gap parameter is calculated that represents the change from previous iteration- the smaller the change, the closer you are to convergence
  - Many models use relative gap of 0.01, which usually is insufficient to reach convergence
  - Some other models model use a maximum number of iterations, instead of relative gap, which is not ideal
- When the assignment is not well converged, a local change to the highway network results in volume differences far away

Traffic Assignment Convergence

MaxIters=50



Relative gap=0.0001