

Application II:

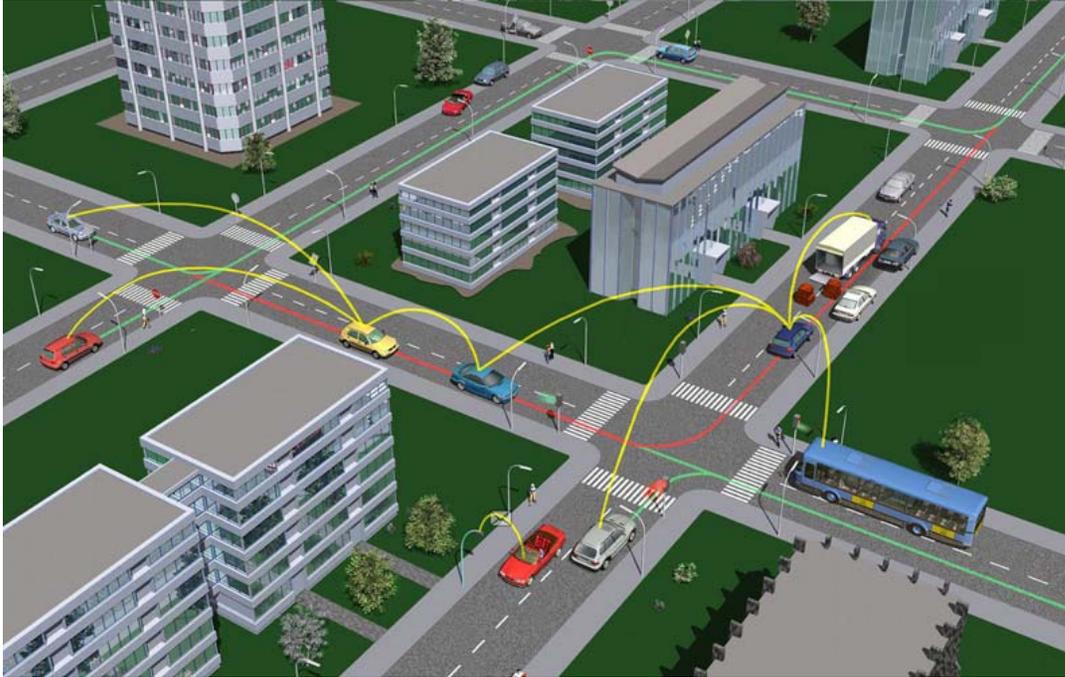
Network-wide Mobility Benefits of Connected Vehicle Technology Mobility and Network Routing

Presenter: Shangjia Dong

Outline

- Background
- Objective
- Methodology
- Preliminary Results
- Conclusion

Background



<http://www.automotiveworld.com/analysis/dot-suggests-us-standardisation-of-connected-vehicle-devices-and-roadway-systems/>

- Vehicle speed (v)
- Vehicle density (k)
- Communication range (R_t)
- Market penetration (MP)
- Probability of Connectivity (CP)
- ...

Objective

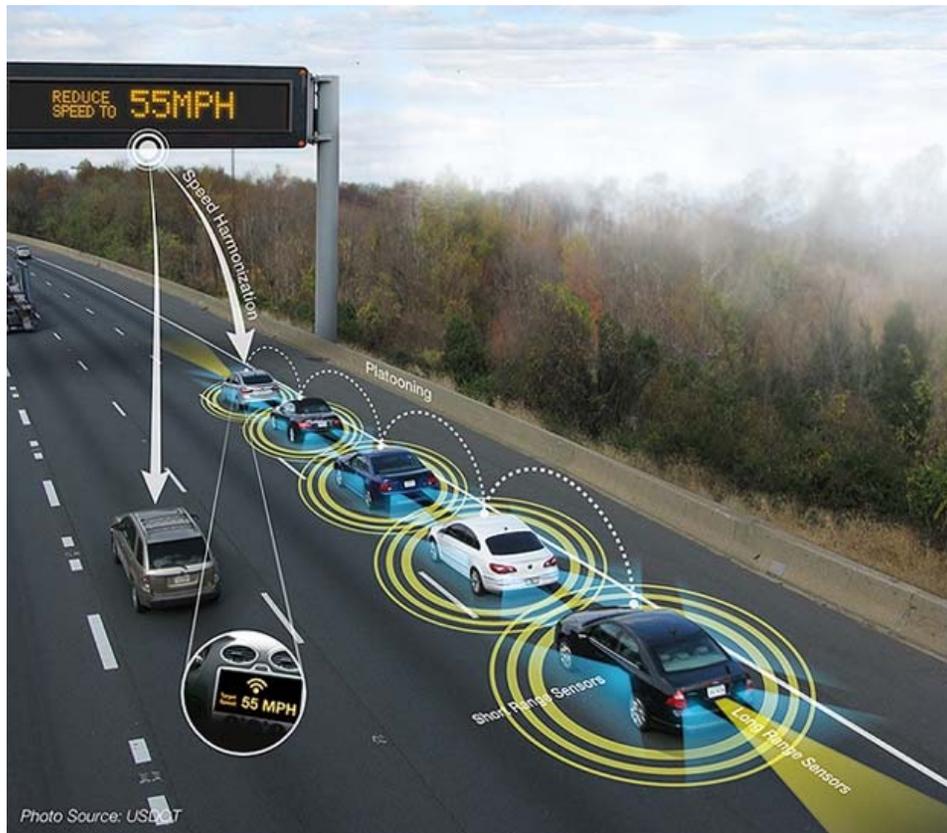
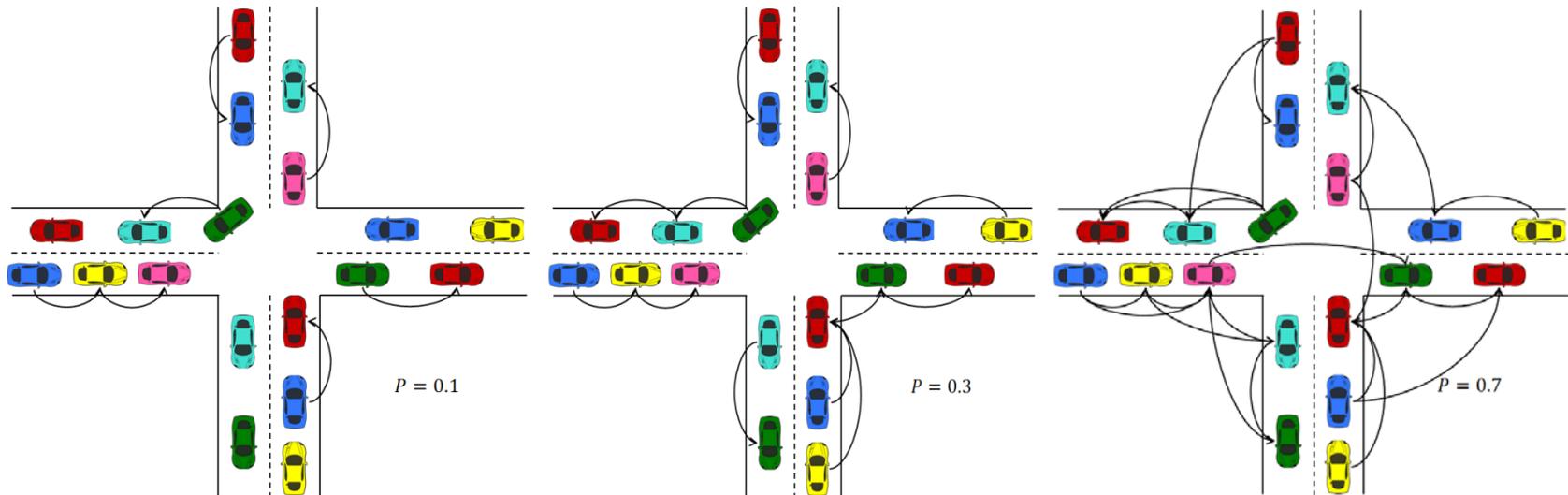


Photo Source: USDOT

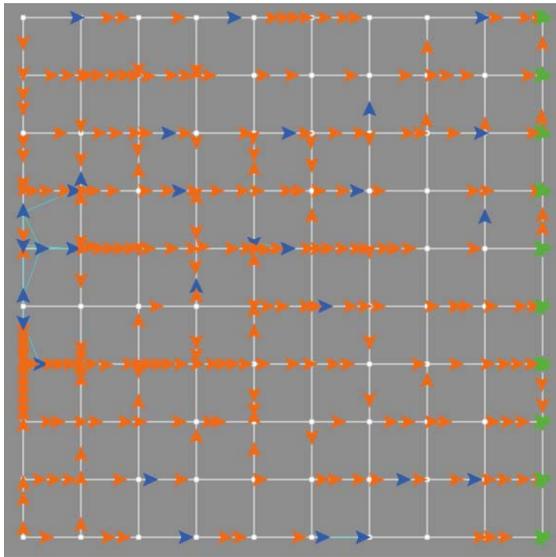
http://autocaat.org/Technologies/Automated_and_Connected_Vehicles/

- Cost (i.e., market penetration) and benefits (i.e., safety and mobility) in a mixed traffic environment (connected vehicle & non-connected vehicle)
- Critical market penetration and probability of connectivity in terms of the system travel time.

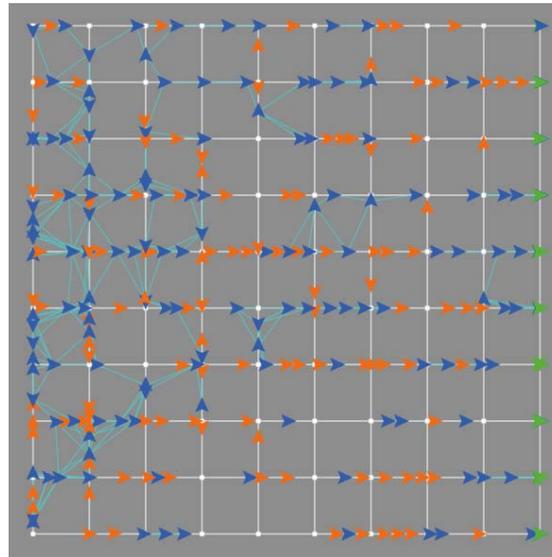
Connected Vehicle Network



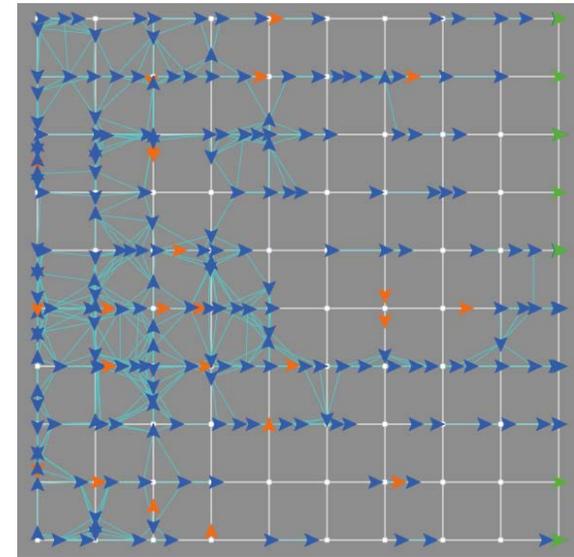
Methodology



MP = 10



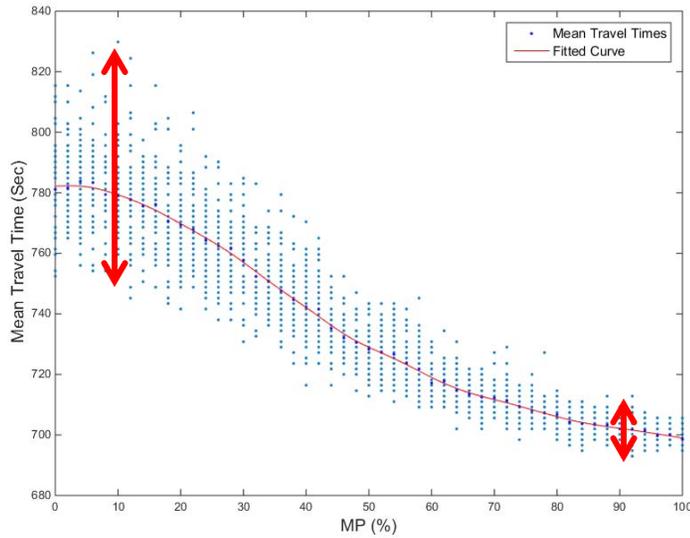
MP = 50



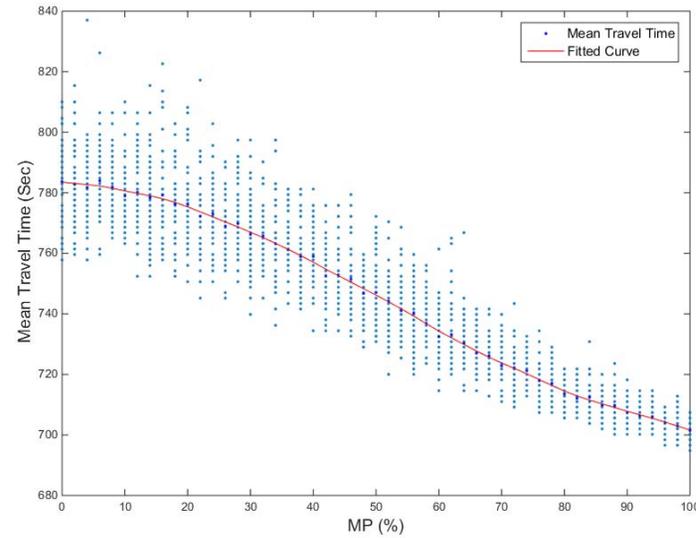
MP = 90

- Orange agent: normal vehicle
- Blue agent: connected vehicle
- 10 × 10 lattice (5 miles × 5 miles) with 1,000 vehicles
- 10 origin and 10 destination 100 agents in each origin
- Vehicle arrival: Poisson distribution with $\lambda = 1800$ veh/hr
- Maximum driving speed 40 mph

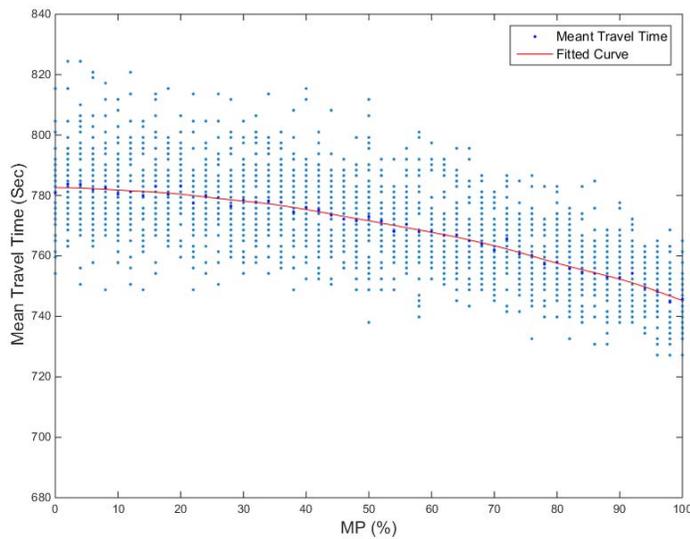
Preliminary Results - I



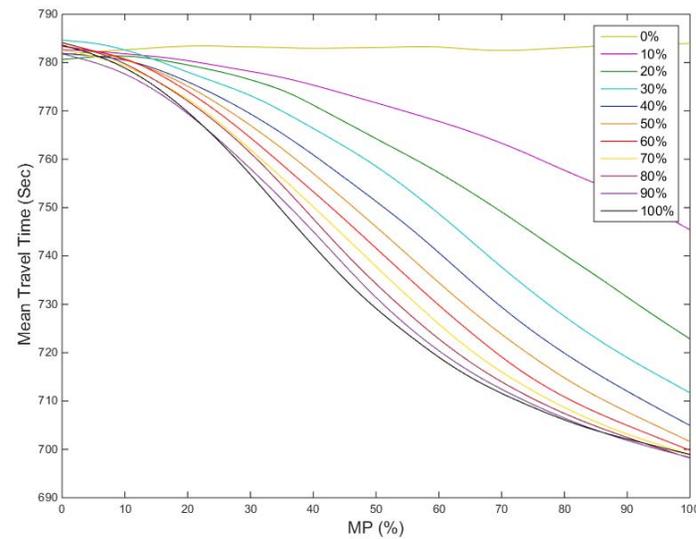
PC = 100



PC = 50

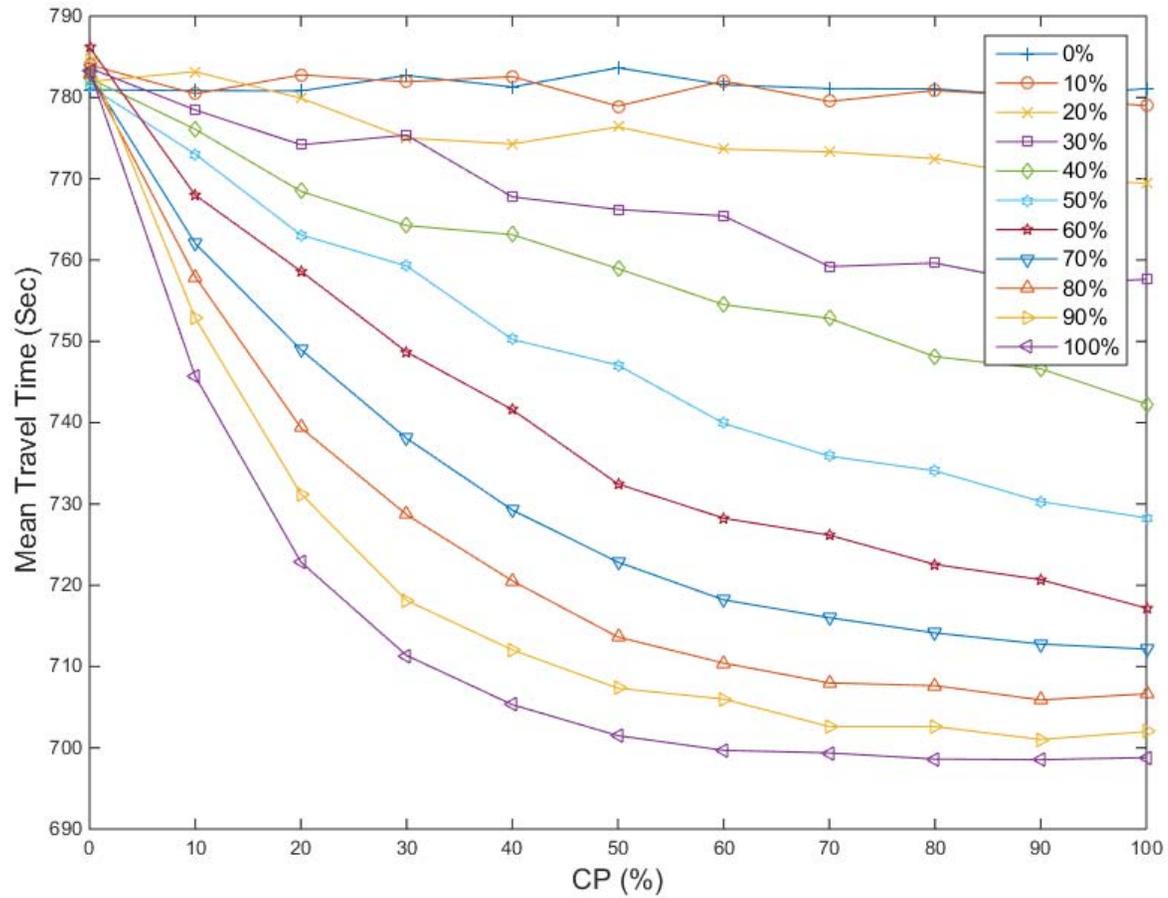


PC = 10

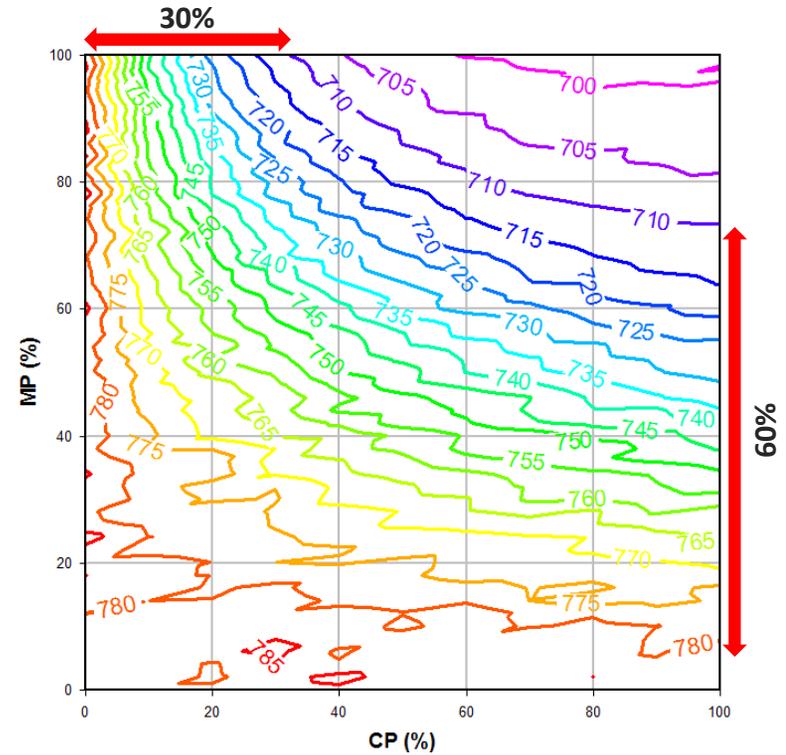
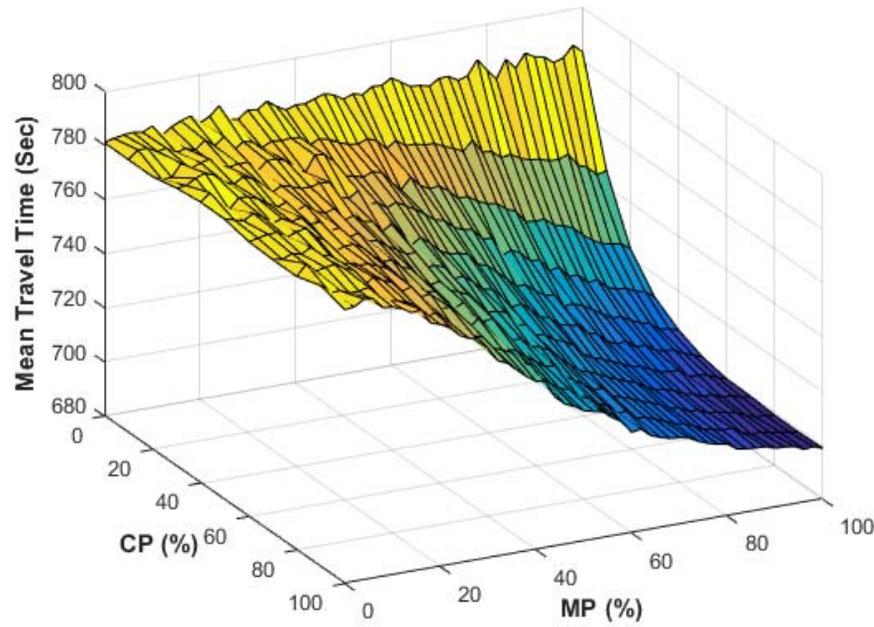


Mean Travel Time vs. Market Penetration

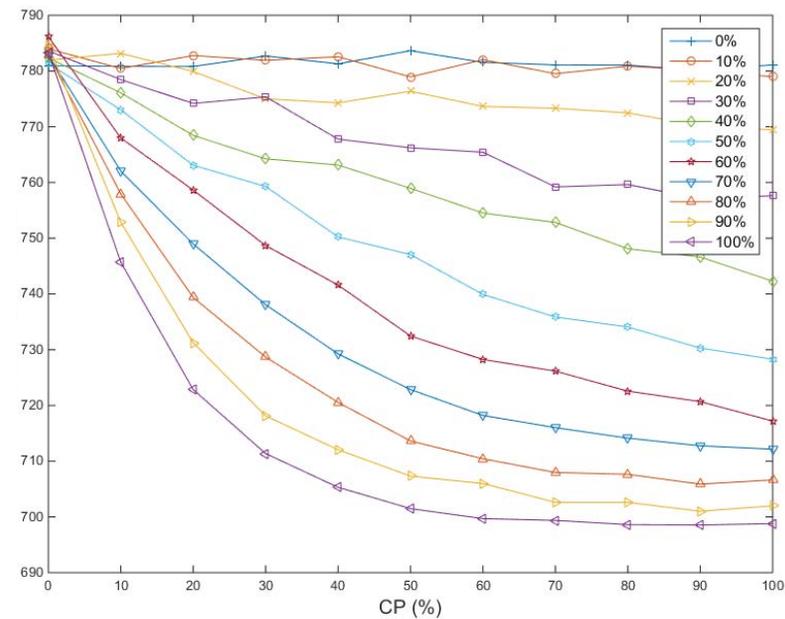
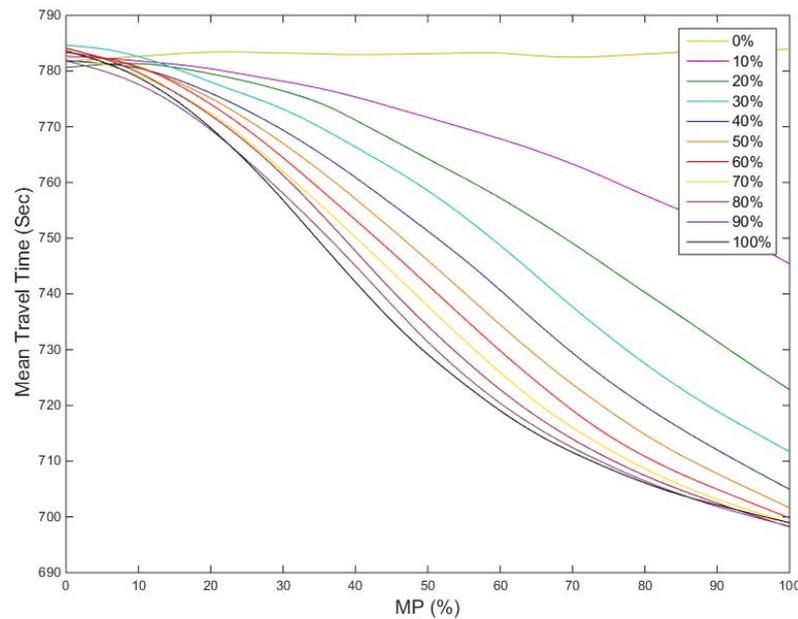
Preliminary Results - II



Preliminary Results - III

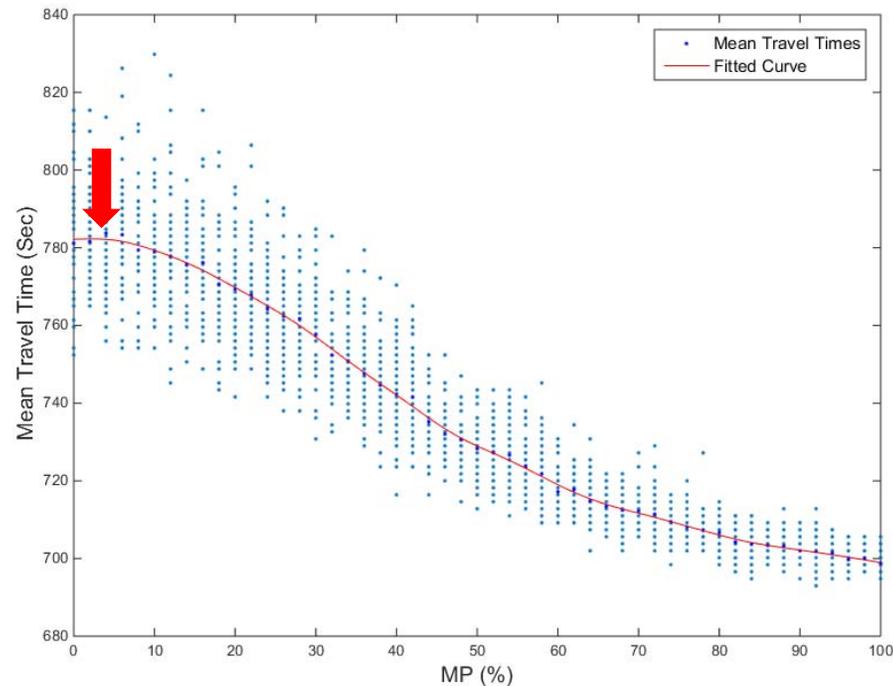


Conclusion - I



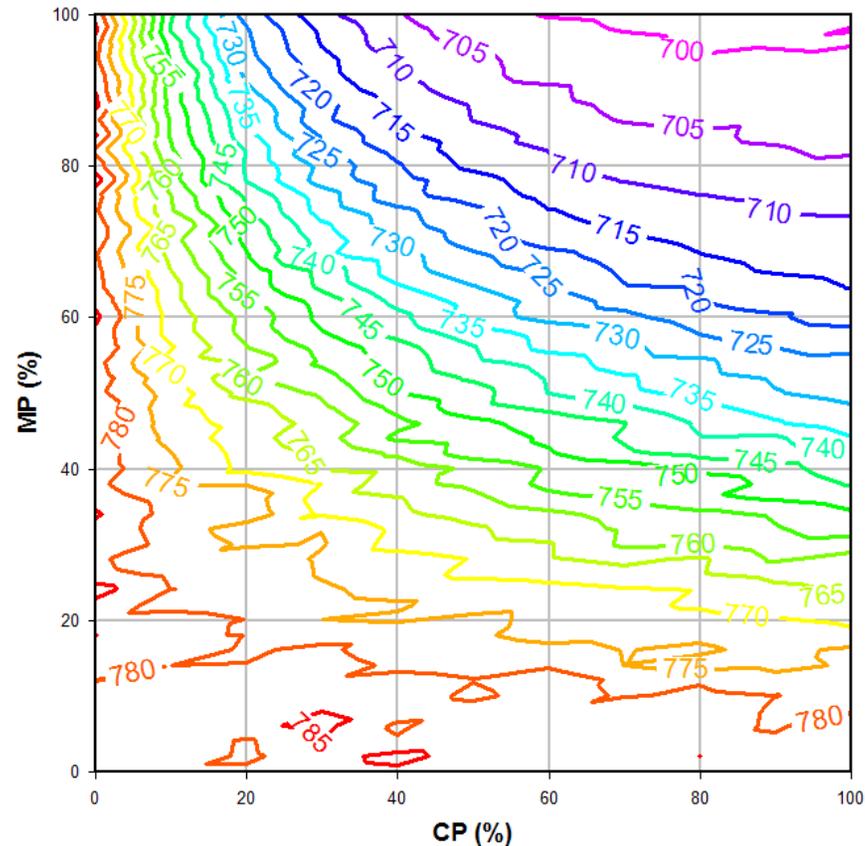
- Increase of market penetration and probability of connectivity will result in the decrease of the system mean travel time.

Conclusion - II



- Travel time reliability can be enhanced by the increase of market penetration.
- There is a critical market penetration under prevailing probability of connectivity where mean travel time of the system starts dropping.

Conclusion - III



- Probability of Connectivity has larger marginal effect on Mean Travel Time performance than Market Penetration.