

Effect of CAV on Freeway Operations as Assessed by the Highway Capacity Manual and Simulation Models

Presenter: Md Mahmud Hasan Mamun (mmamu010@fiu.edu), Florida International University

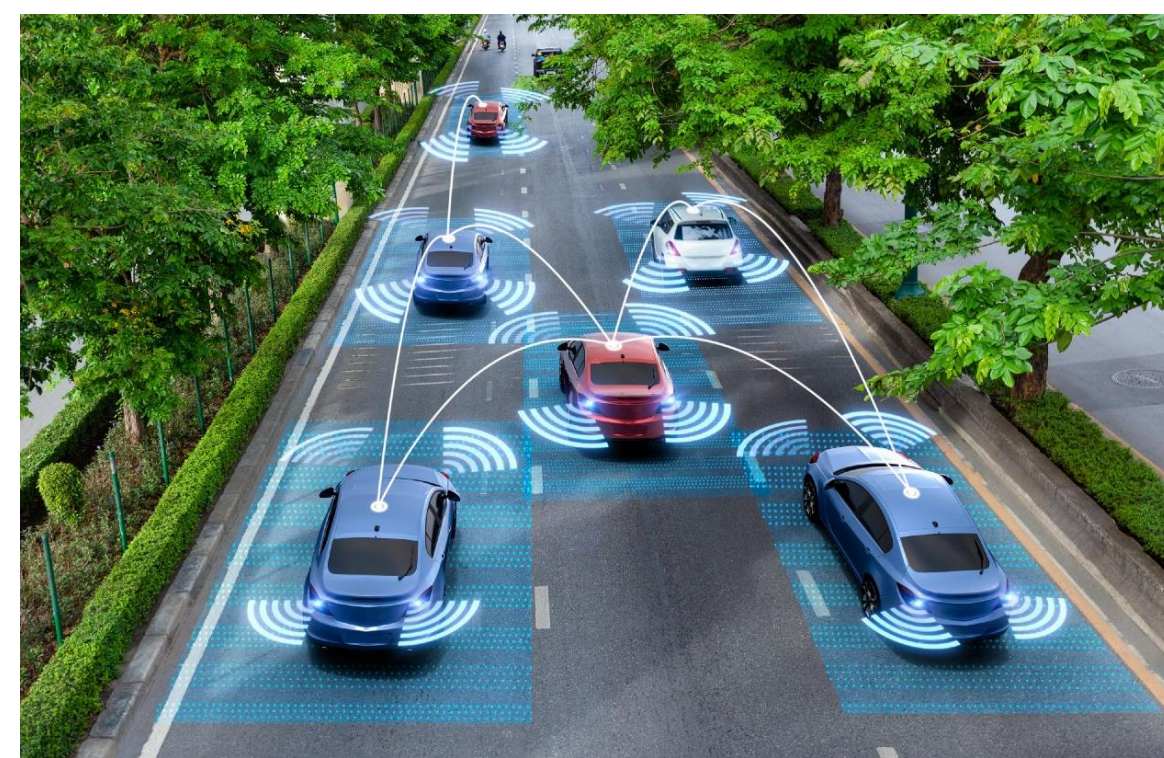
Advisor: Dr. Mohammed Hadi, Professor, Florida International University

Background

- Emerging vehicle technology like **Connected and Automated Vehicle (CAV)** is expected to have **potential benefits** over **mobility** and **safety** by enhancing the traffic dynamics and **roadway capacity**.
- However, it is unclear to **what extent** the capacity or throughput will be increased due to the **presence of CAV** on a roadway.



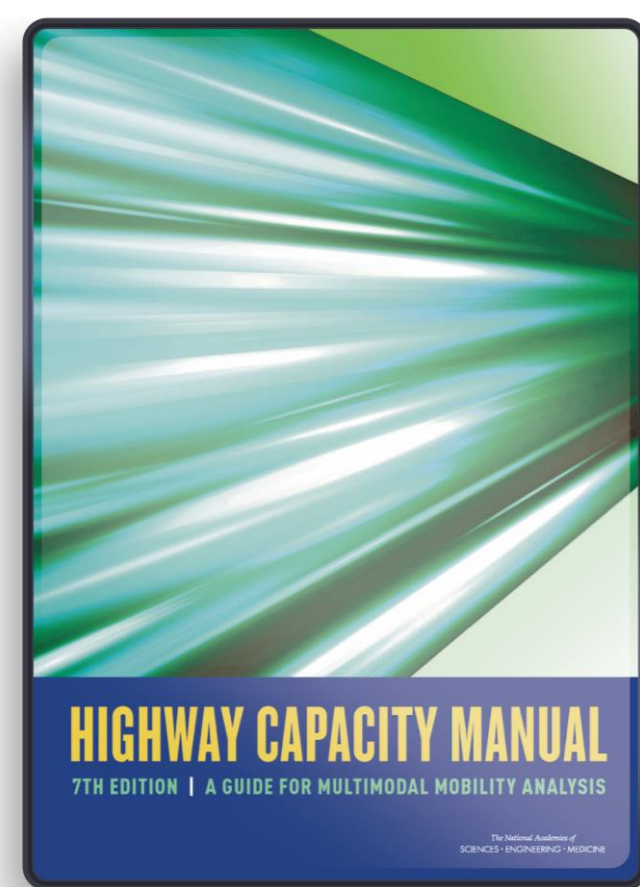
Problem: Queue \leftrightarrow Crash \leftrightarrow Delay



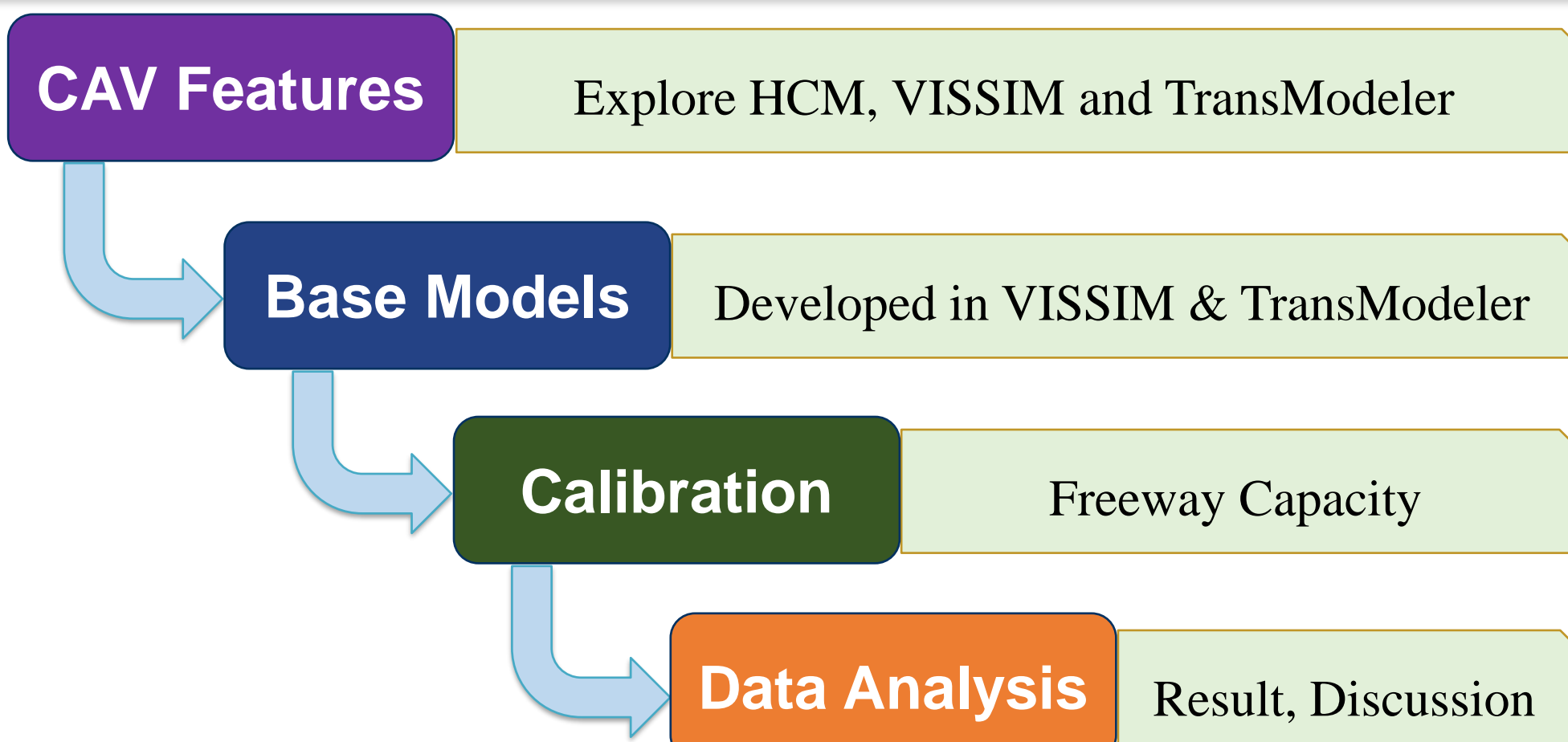
Solution: ITS \leftrightarrow CAV \leftrightarrow AV

Objectives

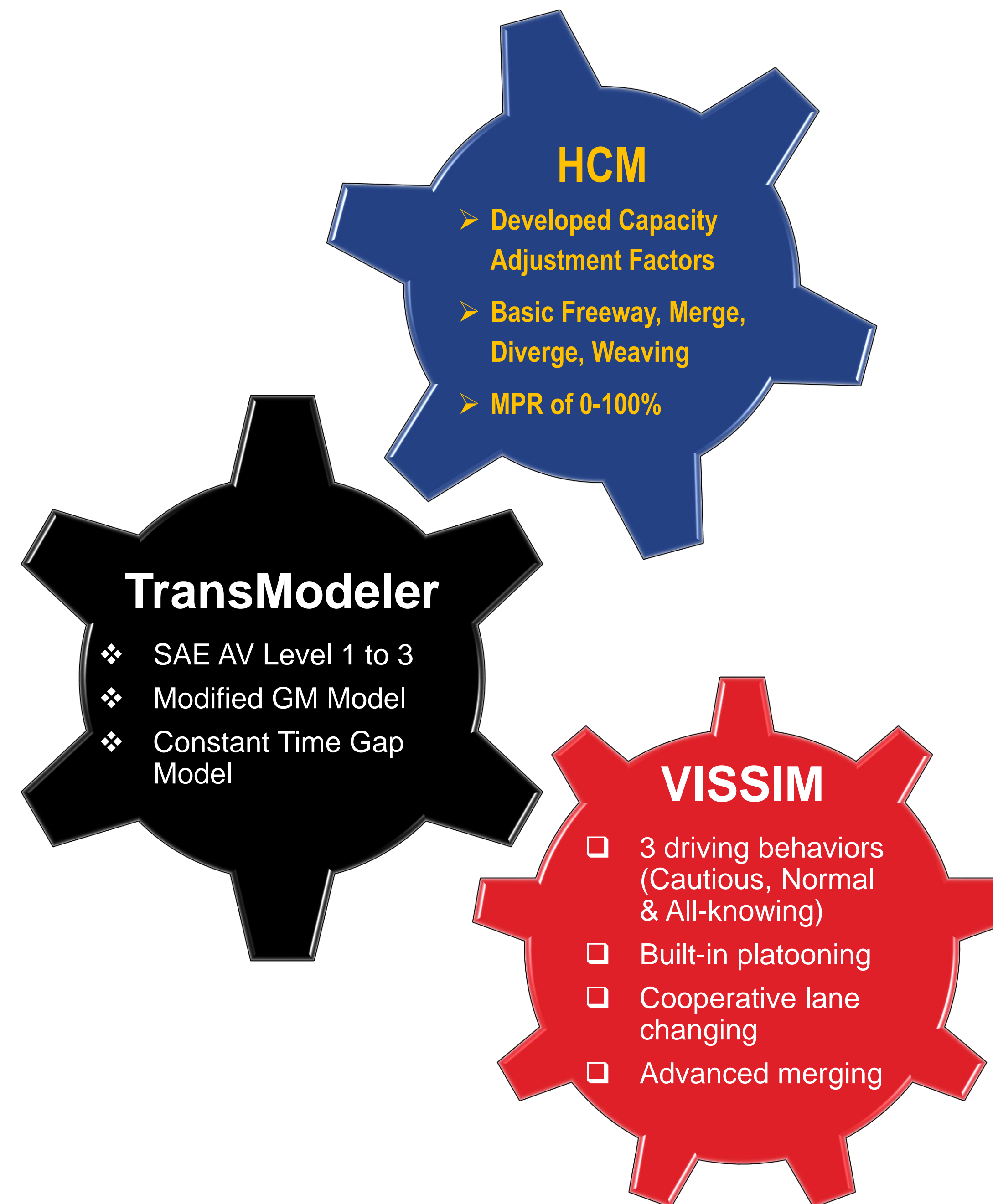
- Examine modeling of CAV features incorporated in the 7th edition of **HCM** and two widely used microscopic simulation tools (**VISSIM** and **TransModeler**)
- Compare the **capacity estimates** assessed using simulation tools' **built-in CAV** model features with the HCM procedure results



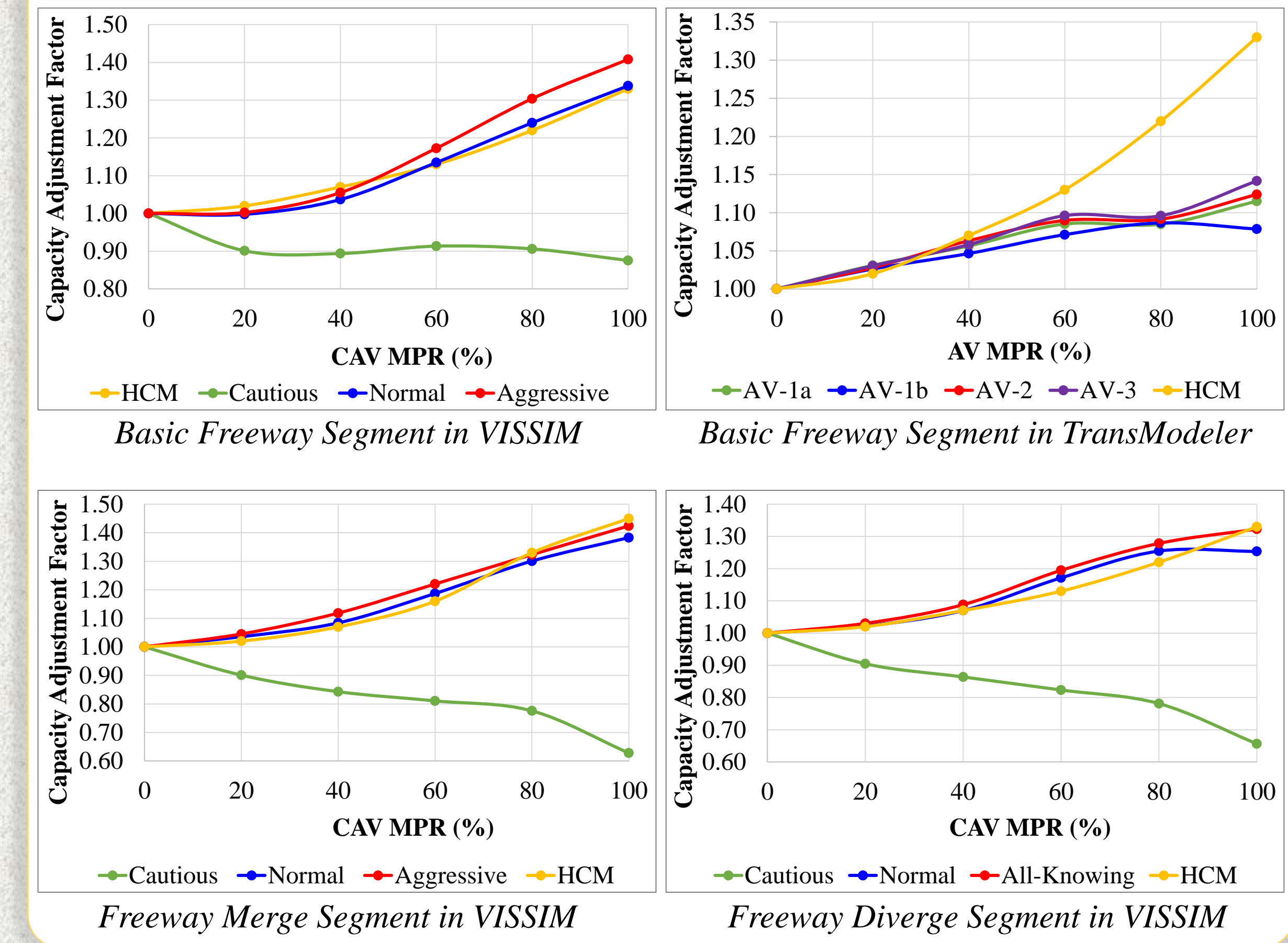
Research Approach



CAV & AV in HCM & Simulation Tools



Data analysis

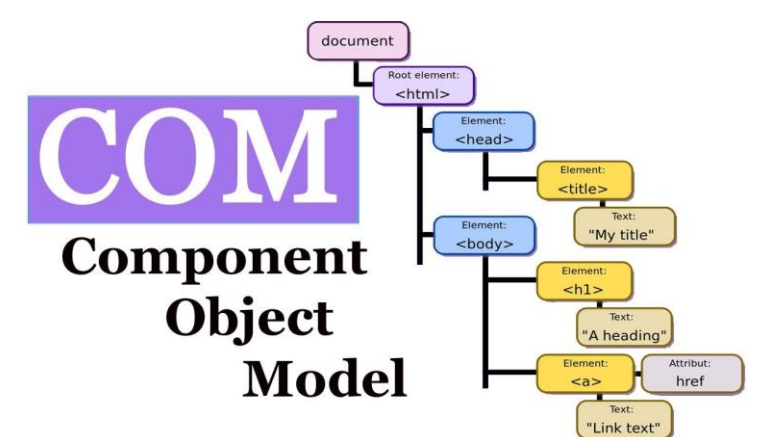
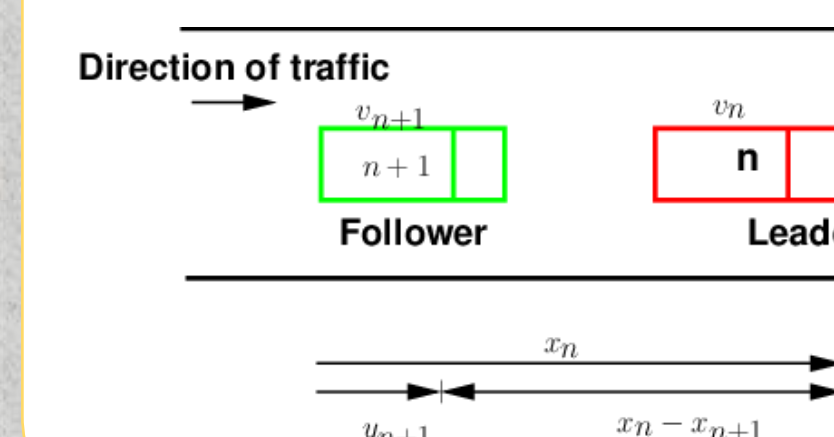


Conclusion

- The **capacity increased** with the **normal and all-knowing** driving behavior model and declined with the **cautious** model for all three freeway segments in VISSIM.
- VISSIM shows that the **capacity increased** when the market penetration of CAV was between 20% and 30% depending on the type of the highway segment.
- VISSIM's **normal driving behavior model** produced similar CAF compared to the HCM values
- TransModeler shows that the CAFs of all SAE levels were **increasing gradually** up to **60% MPR** of AV
- TransModeler produced **smaller CAFs** compared to HCM and VISSIM

Future Scope

- Utilize **external driving behavior models** or **driving simulators** to control lane changing and lateral movement of CAV.
- Apply modified car-following models by **COM scripting** to observe and compare the impact of CAVs on the capacity with respect to HCM procedure and VISSIM models
- Expand for freeway weaving segments, arterial roadway sections, and intersections



Simulation Model Developments

