Understanding the Impacts of Autonomous and Connected Vehicles Through Scenario Modeling

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Policymaker Interest in Understanding the Potential Impacts of Autonomous Vehicles

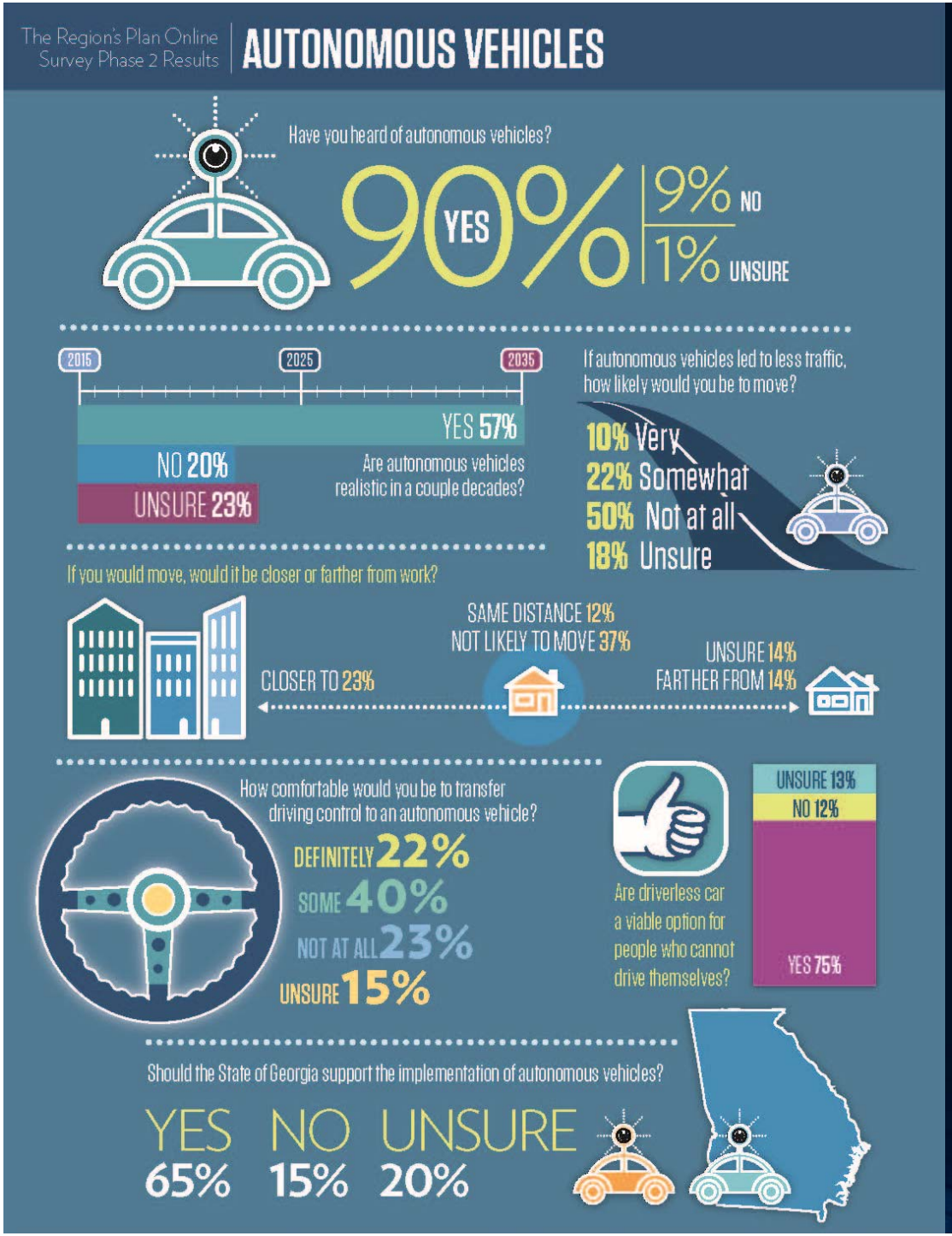
How long will it take to convert our existing fleet?

Could true self-driving cars increase throughput capacity on our roads?

Could this technology increase the number of trips being made?

Will road conditions be a major variable in the effectiveness of the technology?

Will our view of cars evolve into more of a personal rapid transit service rather than something we each own?



What are we hearing from the public?

From Regional Survey (7000 respondents)

Scenario Planning

- Limited to "What-if" scenarios
- A number of factors affecting AV modeling
- Restricted to select factors, while assuming others constant
- Any modeling components in AV require in-depth analysis

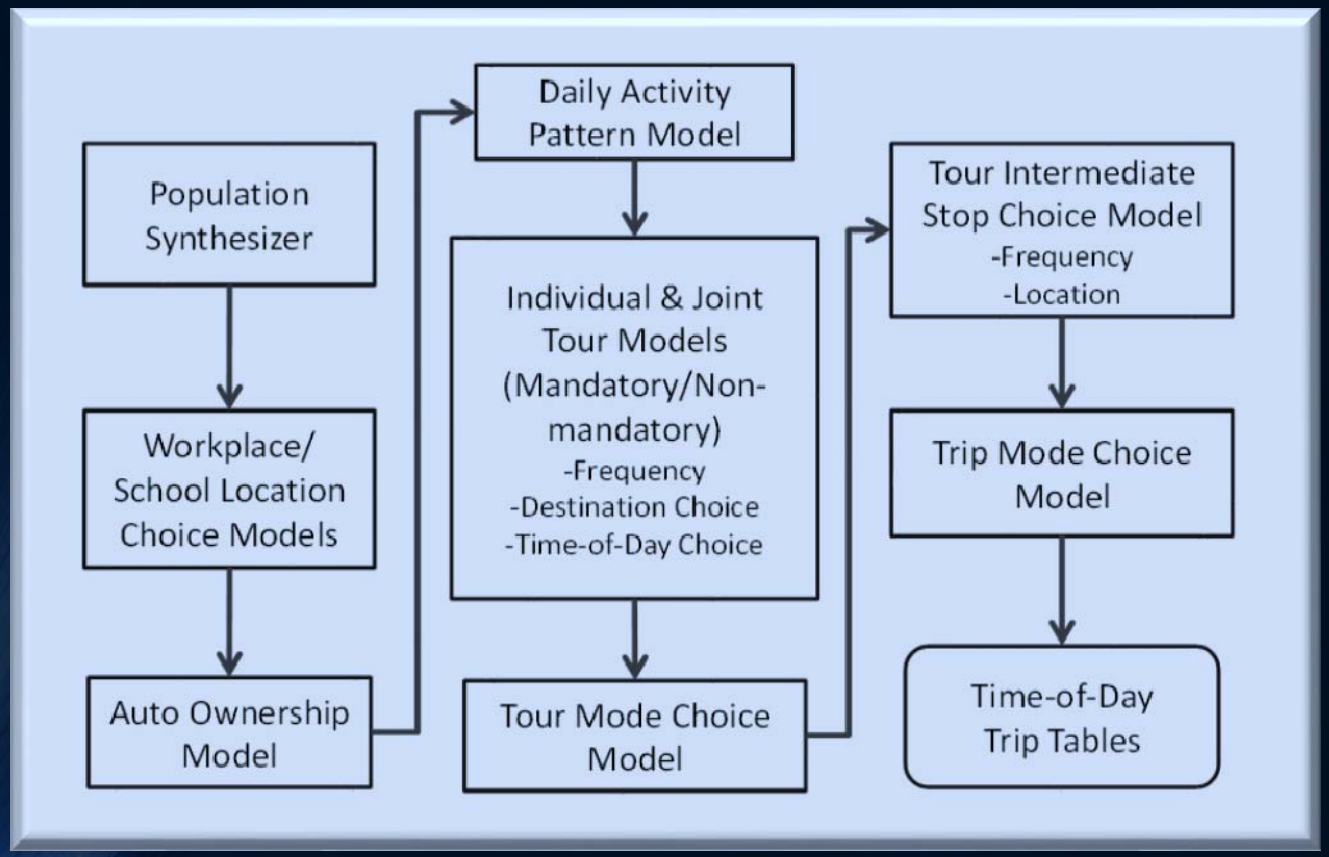
Modeling Assumptions

- Fuel efficiency
  - Based on the trend in CAFE standards and annual energy outlook by U.S. Energy Information Administration
  - Extrapolated to 2040 (light and heavy duty)
- Perceived travel time disutility
  - Less onerous in-vehicle travel time
  - In-vehicle productivity – Reduced disutility
- Parking cost
  - Driverless cars significantly reduce the need for paid parking

Modeling Assumptions

- Increased roadway capacity
  - Vehicle to Vehicle Communications
  - Tighter spacing between AVs
  - Steady flows with limited traffic interruptions
- Level 4 - 100% market penetration in 2040

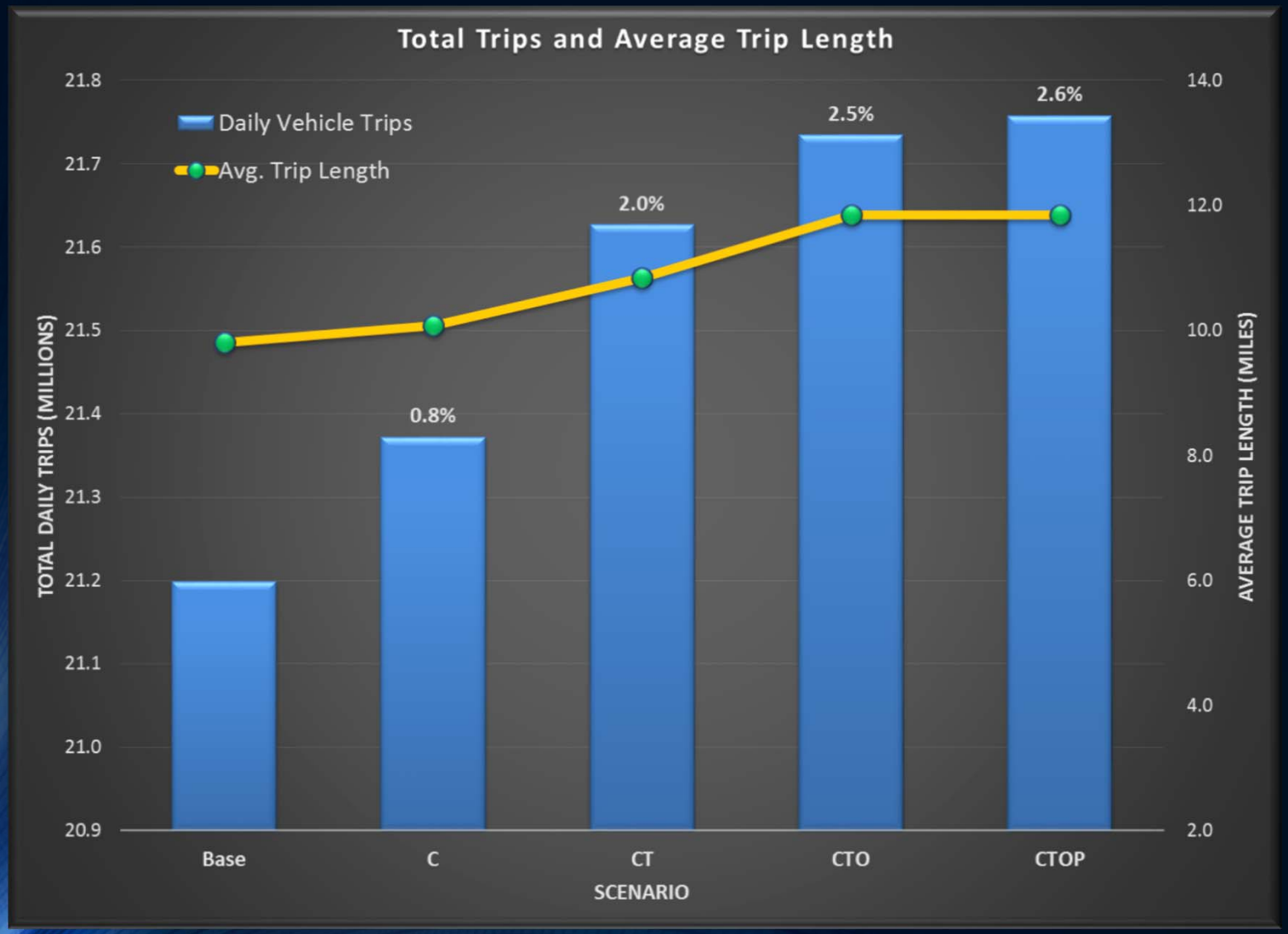
ARC Activity-Based Model



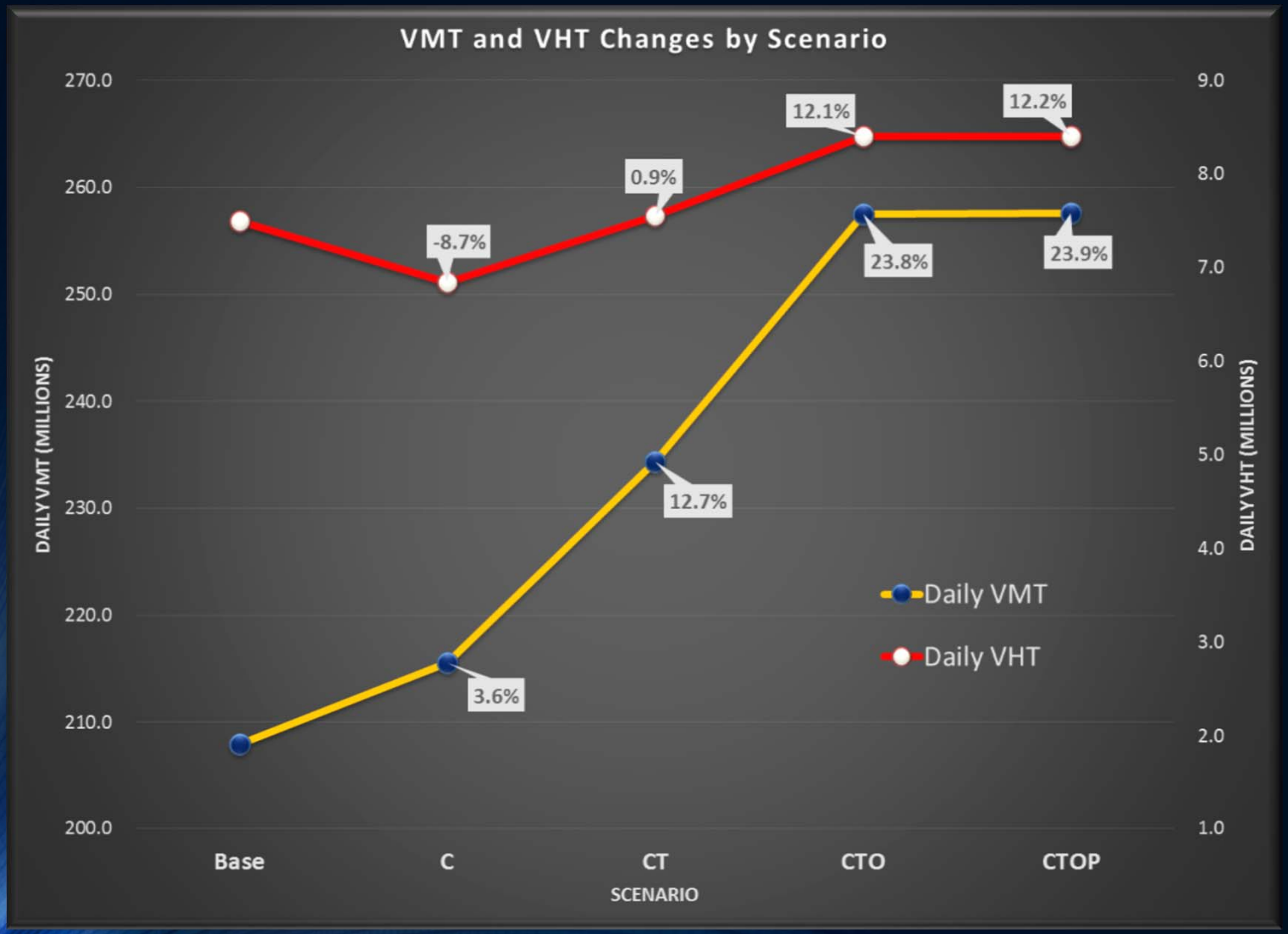
Scenarios

	Scenario			
2040 NB	C	CT	CTO	CTOP
baseline	• capacity increase	• capacity increase	• capacity increase	• capacity increase
		• decrease in travel time disutility	• decrease in travel time disutility	• decrease in travel time disutility
			• reduction in vehicle operating cost	• reduction in vehicle operating cost
				• reduction in parking cost

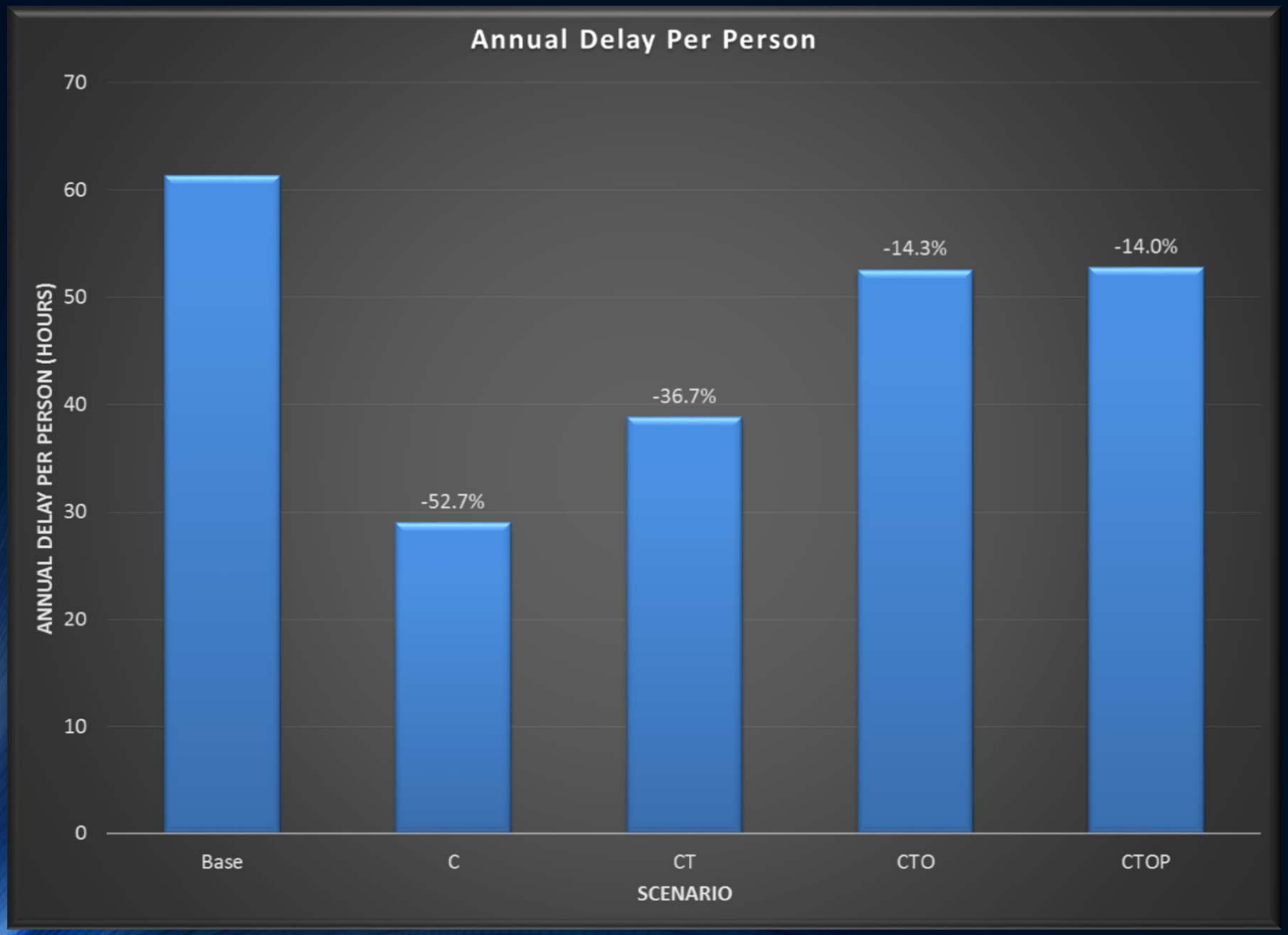
Total Trips and Trip Lengths



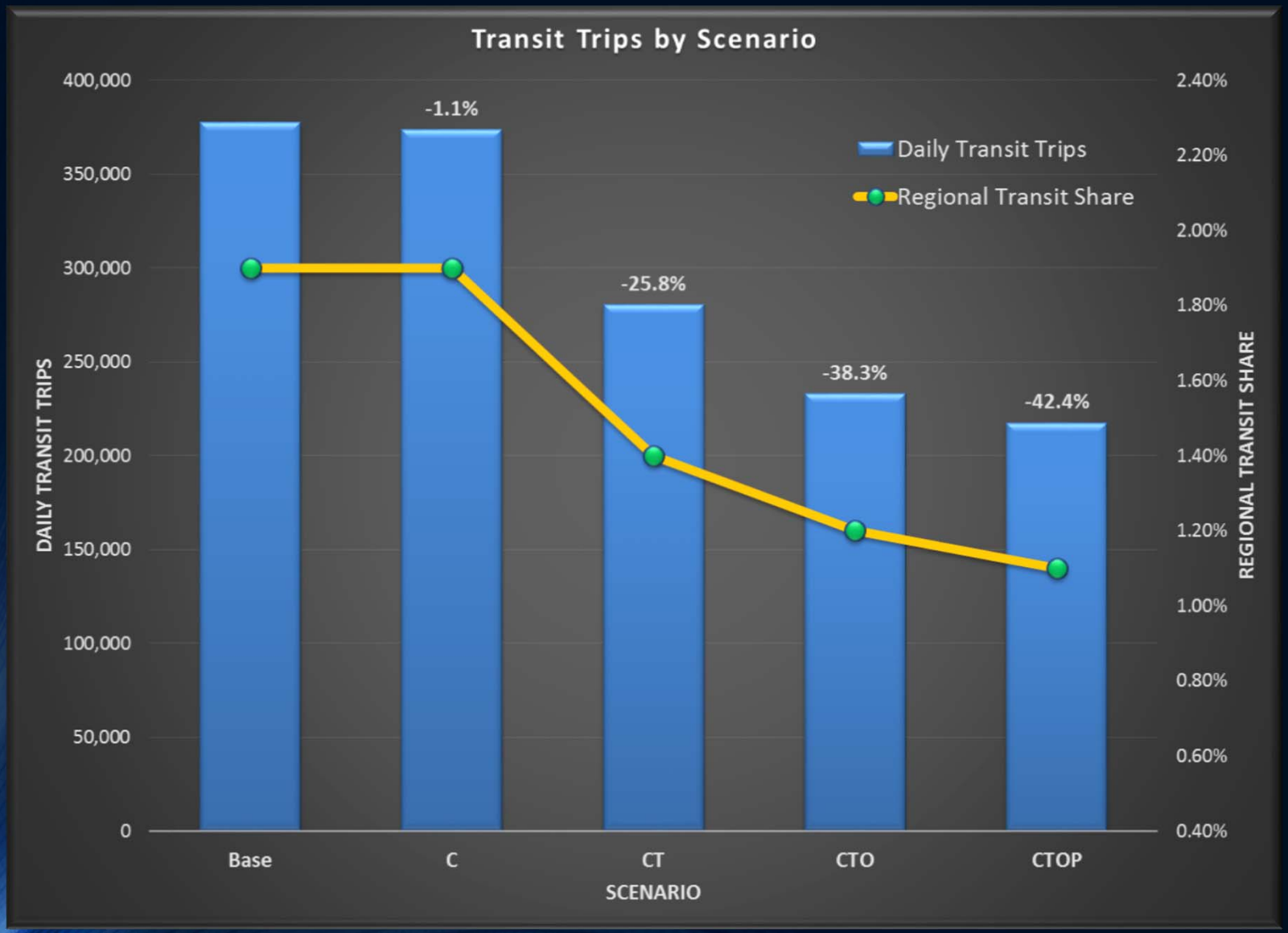
Vehicle Miles Traveled and Vehicle Hours Traveled



Annual Delay Per Person



Transit Trips



Other Potential Impacts

- Empty vehicle VMT due to self-parking
- Possible reduction in vehicle ownership due to efficient use of vehicles
- Availability of AVs for 0-car households
- A number of other potential impacts driven by autonomous vehicles

Concluding Remarks

- Travel demand modeling on AV addresses only recurrent delay
- Non-recurrent delay reduction
- Safety benefits would be greater
- Further research
  - Test different market penetration levels
  - Different assumptions for capacity, fuel economy, vehicle operating cost, parking cost, and 0-car household