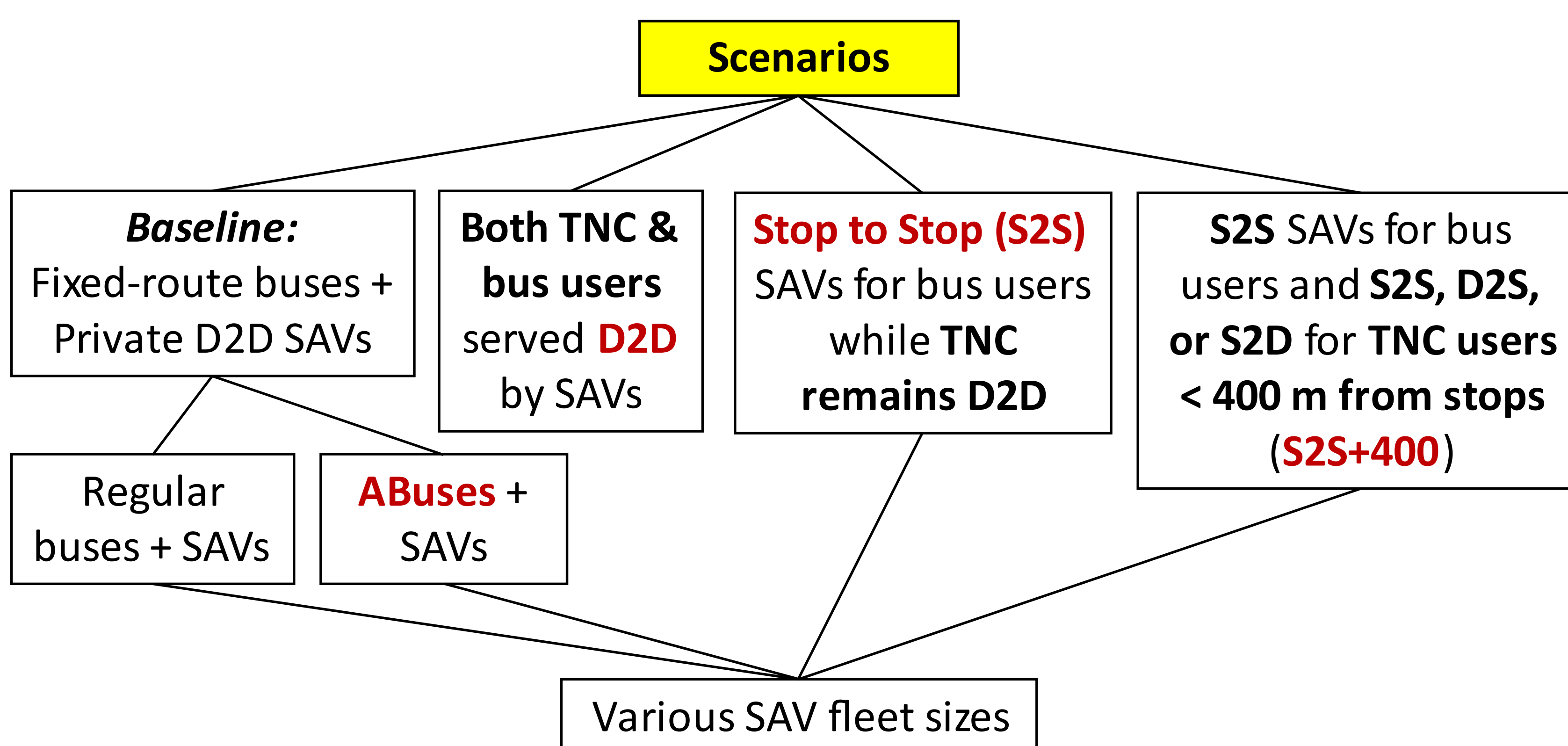




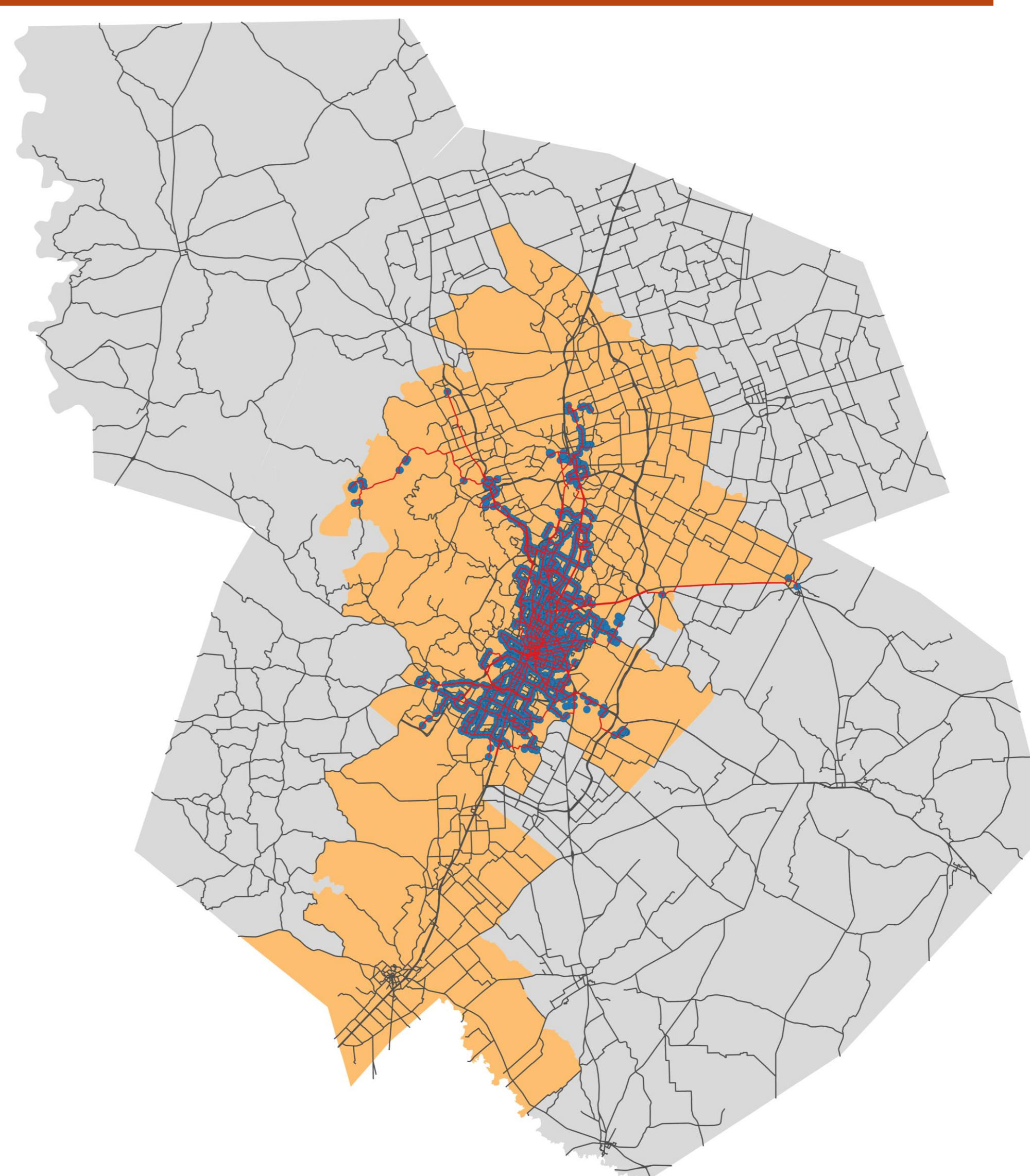
### Introduction

- Can SAVs **lower agency costs** & **improve transit experience**?
- This study examines the costs & benefits from serving Austin's **current bus users** with **subsidized SAVs**.
- POLARIS** agent-based activity-based simulator is used to generate travel demand and route travelers and vehicles through network.
- Using **existing bus stops** as pickup & dropoff (PUDO) points (stop to stop = **S2S**) may help manage demand & improve operations.



### Baseline Demand

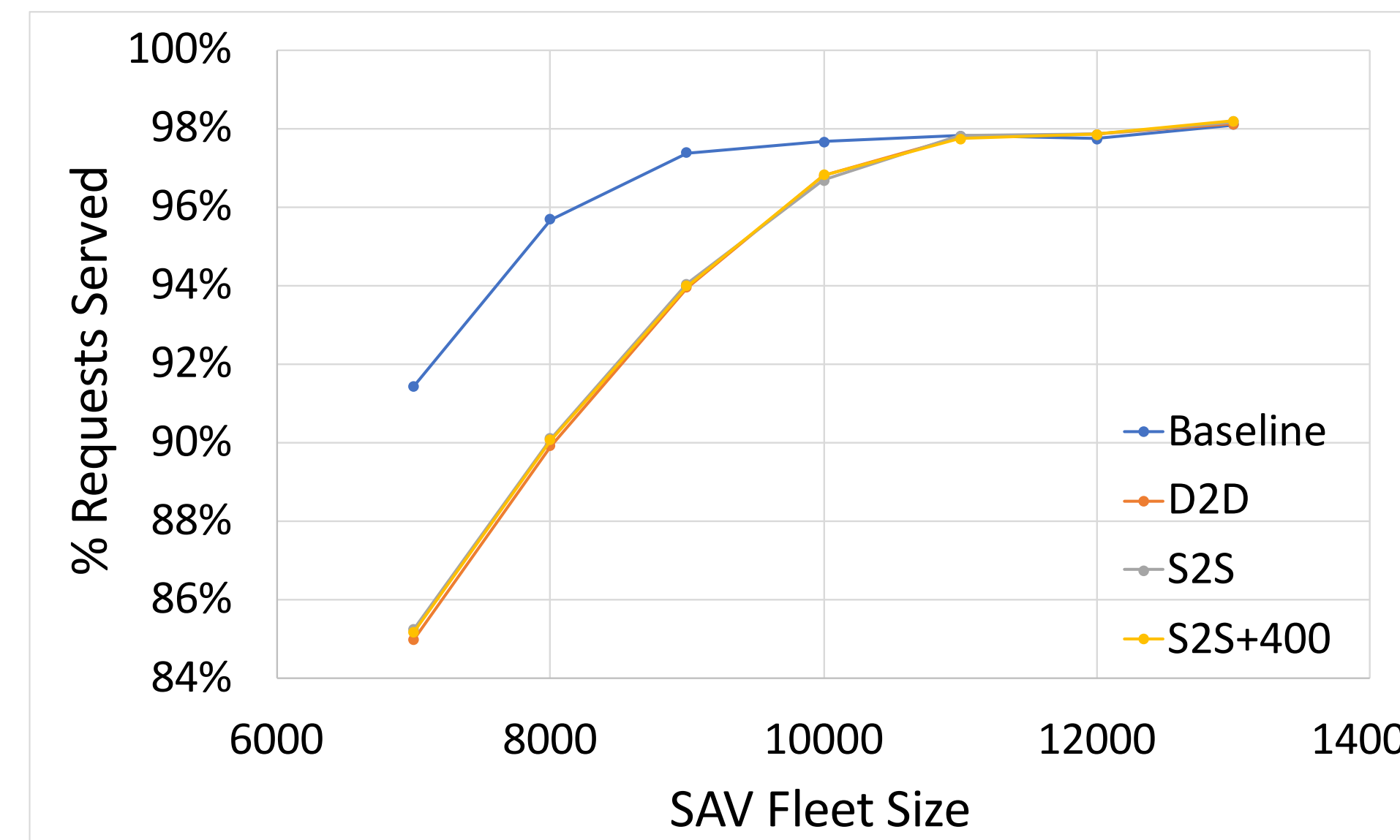
- 100% of travel** by **2.0 M persons** (+ external & commercial trips) across 6-County Austin region simulated.
- 53,543 bus trips** generated to mimic actual CapMetro boardings.
- 5% SAV mode share** → **299,277 SAV trip requests**.
- Average bus-ride = **3.3 miles**, & average vehicle occupancy (AVO) = just **6.3 riders**.
- Bus riders' walk + wait times > half** of 43 min average travel time.
- 91.5%** of SAV trips have origin and/or destination **within 400 m (0.25 mi) of transit stop**.
- These demands are **fixed & used** as inputs for scenarios.



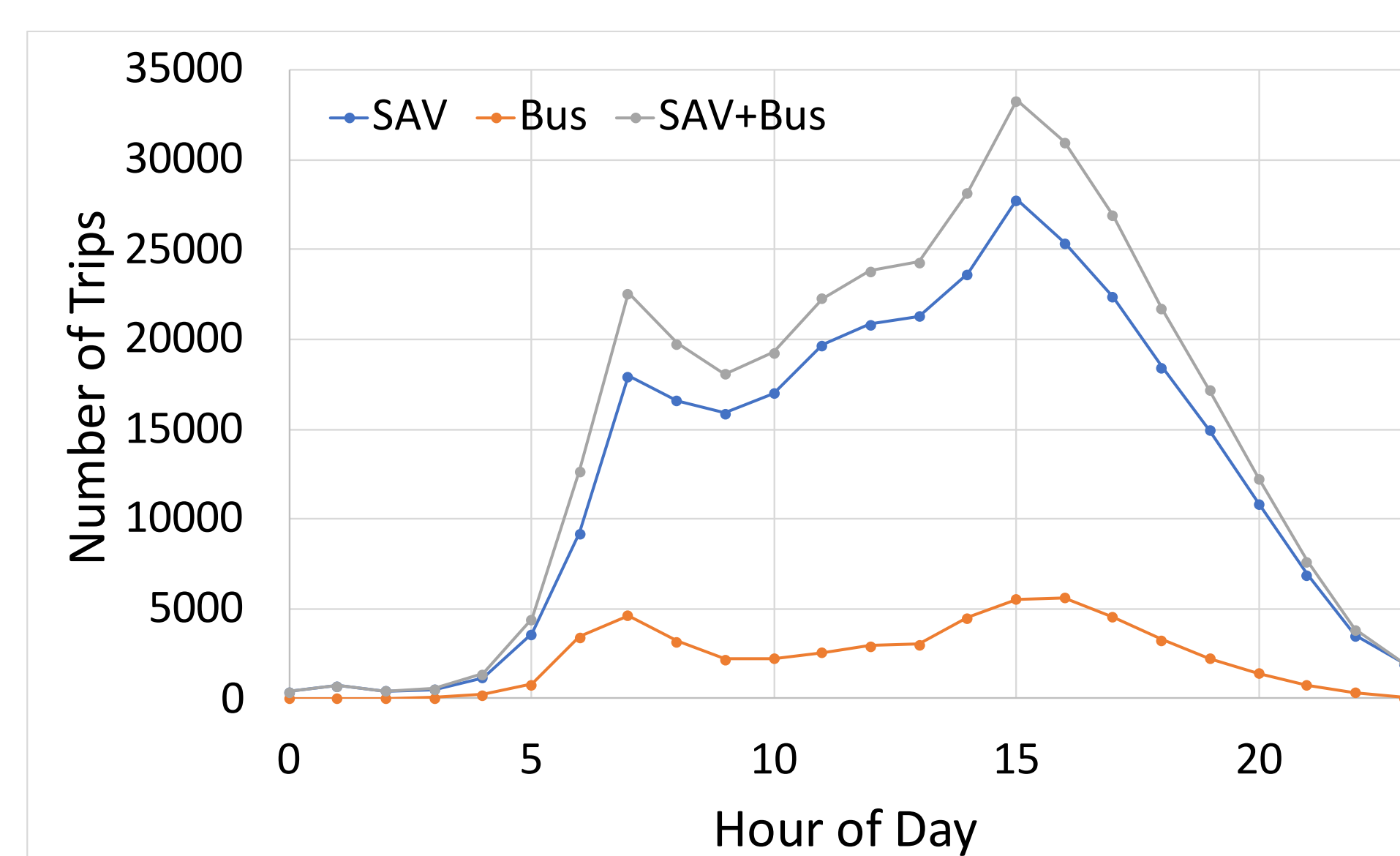
6-County Austin Region Network with **Transit Stops** (blue dots), **Transit Routes** (red lines), & **SAV Geofence** (orange area)

### Fleet Size Requirements

- Serving bus users with SAVs (**17.9% increase in demand**) requires **at least 10% increase** in fleet size.
- Fleet sizing becomes **more sensitive**, likely due to increased peak time demand.
- S2S does not improve operations**, even when 78.7% of trip ends are assigned to stops (**S2S+400**).
- Network may not be detailed enough** to model appreciable changes in first/last-mile travel or **dynamic corner-to-corner directing strategy** responsive to vehicle trajectories needed for **effective demand aggregation**.



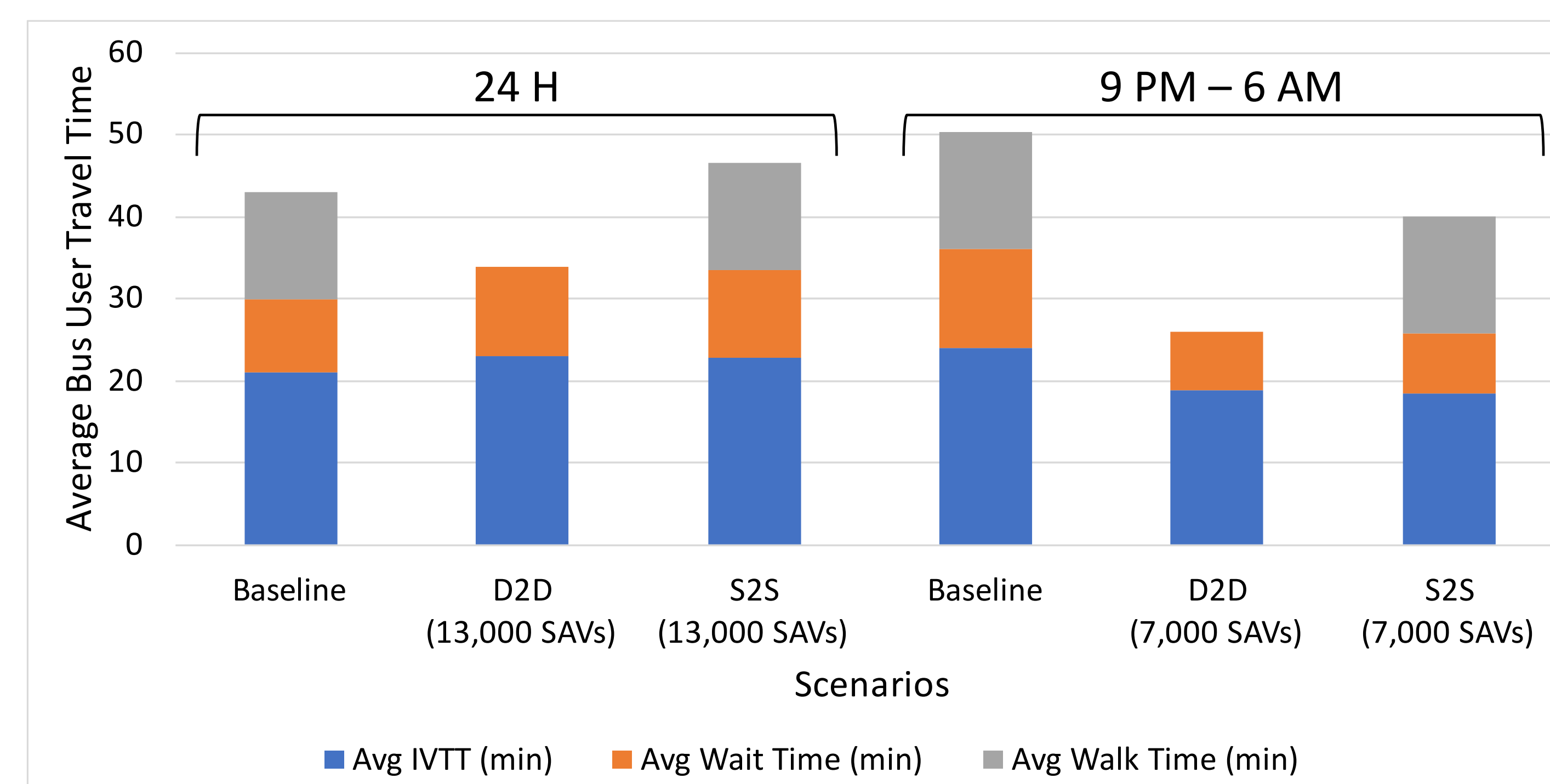
% Requests Met under Each Scenario



Temporal Distribution of Each Demand Type

### Transit Rider Experience

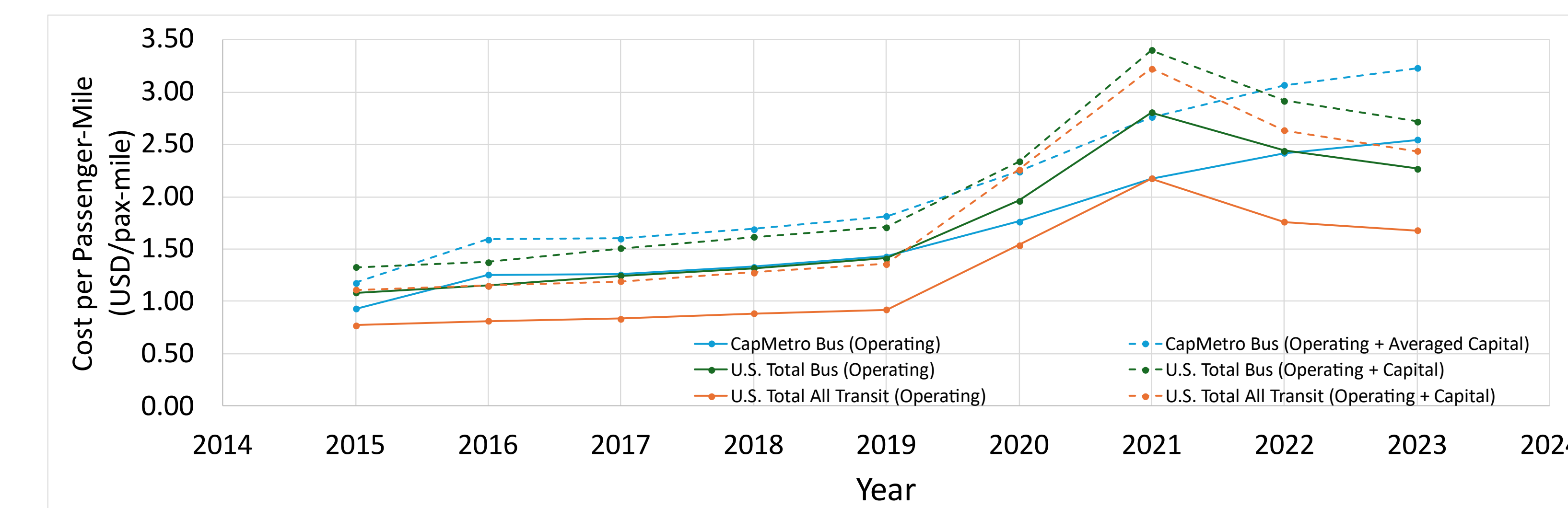
- Travel time savings only come from **eliminating walking** in **D2D**, even at largest fleet size tested.
- Frequent ridepooling** (revenue distance AVO = 1.75) leads to **higher in-vehicle travel time (IVTT)** compared to bus.
- Larger SAV fleet** needed for IVTT & wait time reductions.
- Travel times improve in all aspects for **nighttime bus riders** (9 PM – 6 AM), even at smallest fleet size tested.



Average Travel Times for Current Bus Users across Scenarios

### Cost Comparisons

- Transit cost items *directly impacted* by vehicle purchases and operations are compared (56% of total CapMetro bus costs on average).
- Autonomous battery electric bus (aBEB)** serving the same fixed routes appear to be most economical option for serving current bus demand.
- Subsidizing SAVs to serve current bus demand at \$1/pax-mile is **possible under current budget**, but does not beat aBEB even at \$0.50/pax mile.



U.S. Transit Costs

12-Year Lifecycle Costs for Bus Fleets

	Purchase Price (USD)	VMT per Vehicle-yr	Fuel Cost per Veh-Yr	Mainten. \$ per Veh-Yr	Driver costs	12-Year Fleet Cost
Conventional diesel bus (Base)	\$350 K each	38,153 mi/veh/yr	\$19,076/yr	\$24,075/yr	\$271k per yr	\$1,940 M
Autonomous BEB	\$750 K	38,153	\$5,769	\$12,667	\$0	\$457 M

12-Year Costs of Subsidizing a Private SAV Operator to Serve Bus Demand

	Bus Demand PMT	Fare Charged to Transit Agency	12-Year Cost to Agency
SAV-D2D (11,000 SAVs)	439,803 pax-miles	\$0.50/pax-mile	\$963 M
		\$1/pax-mile	\$1,926 M
SAV-S2S (11,000 SAVs)	429,938 pax-miles	\$0.50/pax-mile	\$942 M
		\$1/pax-mile	\$1,883 M

### Conclusions

- Using **bus stops** to aggregate SAV demand **did not improve on-demand 4-seater SAV fleet operations** in Austin.
- No notable travel time savings** for bus users if served **S2S** by SAVs.
- Subsidizing SAV operators** likely possible under current budget but does not lower transit agency costs over **automating large buses**.
- Best use of SAVs seems to be serving **early-morning & late-night bus riders**, while shutting down large buses during those times.

Scan QR code for **full paper**:



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