Subject: Public Input to Dumbarton Rail Corridor Project
To: dumbartonrail@samtrans.com

San Mateo County Transit District Board members,

During my 17 years in the electric transportation business, I came across another class of electric transport - Personal Rapid Transit (PRT). Over the years, I learned a lot about PRT and other advanced transit systems.

Thus, I was excited to hear of the Public Meeting held on March 15th about the Dumbarton Rail Corridor proposal. This is a worthy project I hope to see completed as soon as possible. While you are in the process of making decisions about which technology to use, I would like to share my knowledge and viewpoint which aligns with some of the consultant's data regarding Autonomous Vehicle Transit (AVT). While I realize project decision makers are being bombarded with opinions and ideas, I believe this read will be worth your valuable time.

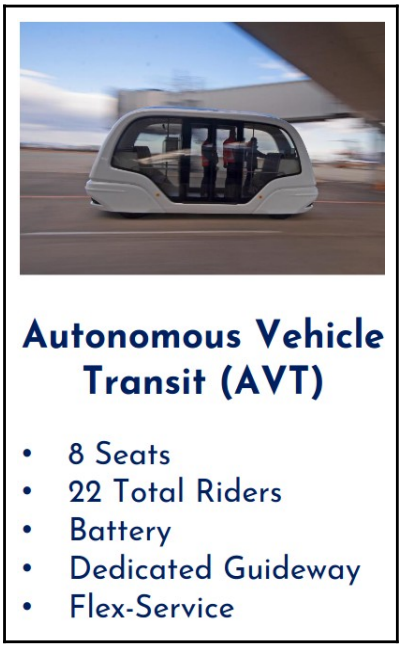
These are the main points elaborated below:

1. AVT vehicles comes in large, medium and small sizes.
2. The small size, Personal Rapid Transit (PRT), creates a boom in transit use when included with existing transportation options.
3. Because PRT vehicles (cabs) bypass all stations between the rider's starting and ending station, every ride is an express ride.
4. At the origin station, even more time is saved because awaiting PRT cabs are ready to go – which adds another level of personal security much appreciated by many people these days.
5. PRT has substantial advantages in real estate purchases, parking structure costs and O&M. The presentation excludes all three.
6. PRT can do the job for dramatically less cost. (See details below.)

The presentation slides were very useful in comparing technology options. They also helped me understand why AVT seems comparable to the other three technologies. Like the term "model train" which include gauges ranging from G (1:24) through S (1:64) to HO (1:87), AVT is an umbrella term that includes large, medium and small advanced transit systems:

- Automated People Movers (APM)
- Group Rapid Transit (GRT)
- Personal Rapid Transit (PRT)

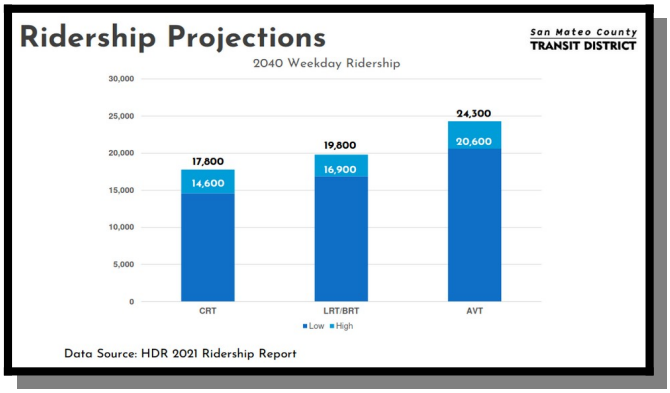
Slide 8 shows an AVT vehicle with a carrying capacity that puts it in the medium-sized GRT category. PRT vehicles are much smaller and - most importantly - much lighter weight. The ITNS (Intelligent Transportation Network System) version of PRT (shown on the left) uses vehicles capable of carrying up to 4 passengers – like many cars.

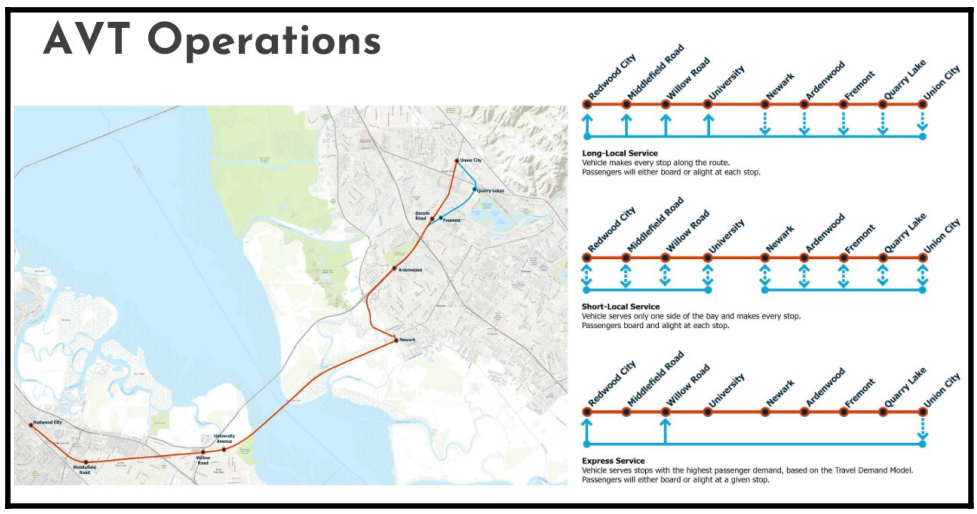


PRT uses a dedicated pathway like commuter rail and light rail. Unlike those two rail systems that move along a corridor on a fixed schedule that includes stops at every

station, PRT offers flexible service. PRT cabs await users, depart immediately, and don't stop between the origin and destination stations.

Slide 16 shows ridership projections (high/low) of 3 technologies; as you can see in the charts at https://milpitasprt.com/technology/capacity/, all are within PRT's capacity. However, the AVT ridership projections may be low. Many studies predict a remarkable increase in public transit ridership when PRT is added to the existing transportation options. See charts and studies at https://milpitasprt.com/technology/service-levels/#ridership In short, PRT will improve the level-of-service so much that ridership will boom.





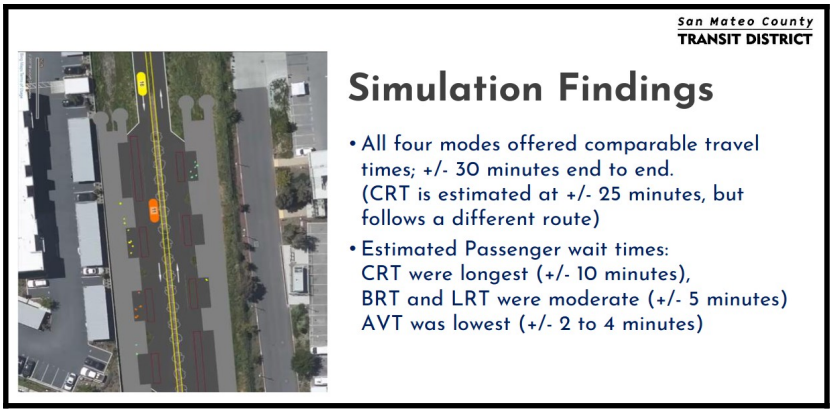
For various reasons, transit experts tend to think in traditional corridor ways. PRT is different, and requires different thinking. For example, **slide 21**, shows 3 potential operating modes, none of which reflect the way PRT is designed to operate. The first 2 show AVT stopping at every station along the route just like a mass transit system would with on-line stations. This frequent stopping and waiting is why BART trains that can go 80 mph only deliver 40 mph service to users.

The third operating mode on slide 21 compensates for such slow stop-and-go service by providing an express service between those few stops with "the highest passenger demand". While this makes sense for a mass transit corridor system with online stations, PRT operates differently. Because all PRT stations are off-line, PRT cabs bypass all stations between the user's origin and destination stations. Thus, every trip is an express trip.

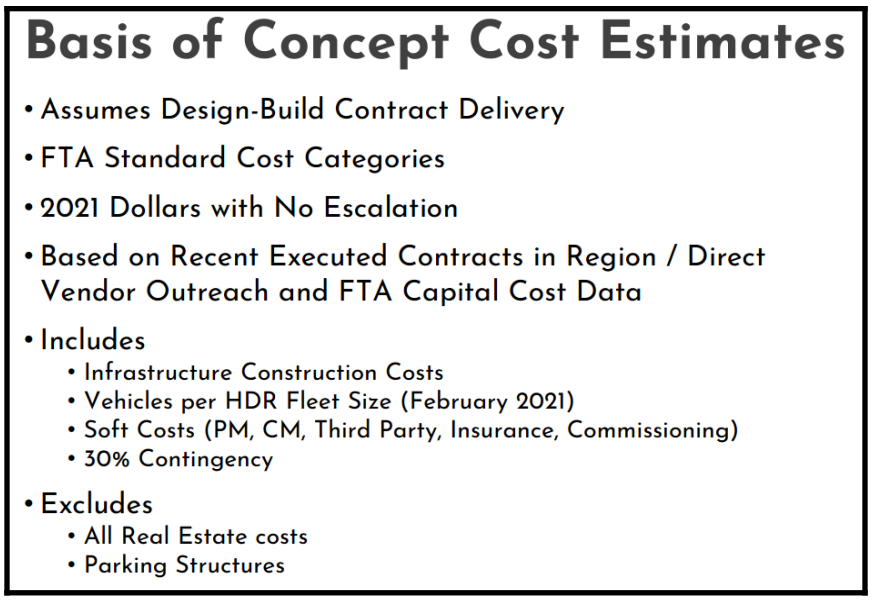
Because PRT is ready to go at the origin station, and goes directly to the rider's destination station, time is saved, frustration is avoided, and personal security is increased. For a daily commuter, 10 to 15 minutes per ride adds up over a year. This high level of service helps explain the ridership boom mentioned above.

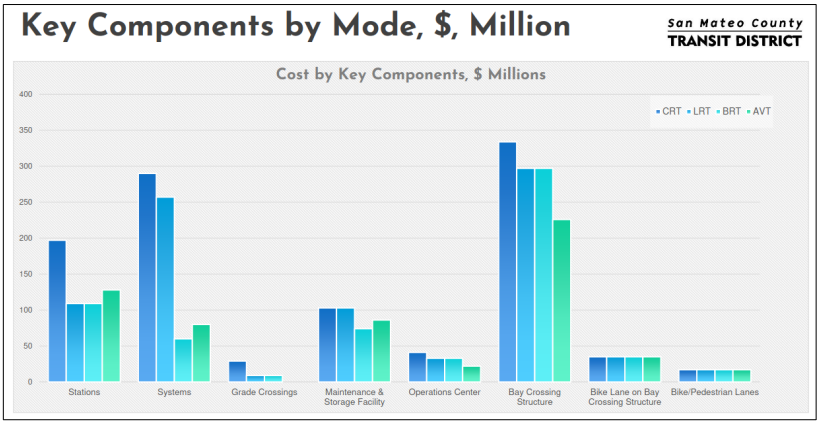
Which brings us to **slide 22**, *Simulation Findings* that shows all four modes offered comparable travel times of about 30 minutes. For non-stop PRT, the 40 mph design speed will carry users the full 18-mile end-to-end distance in 27 minutes.

While AVT trip times are comparable to CRT, LRT and BRT, a big difference shows up in the *Estimated Passenger wait times*. The slide's estimate for CRT (+/-10 minutes) and BRT/LRT (+/-5 minutes) are possible during times when frequent service is provided. AVT wait times of 2-4 minutes means that a rider's overall trip time is shorter; being computer controlled, PRT service is available all day long. Even better is that 90% of the time there is zero wait time because PRT cabs are already there at the station, ready to go when you get there. This time savings for a commuter adds up to many hours over the course of a year.



Basis of Concept Cost Estimates (**slide 23**) clearly states that real estate costs and parking structures are excluded. While not specifically mentioned, operating and maintenance (O&M) costs are also excluded. Eliminating these 3 factors makes estimates easier, but it also skews the results. This decision excludes advantages of all AVT technologies, especially PRT. Being much smaller and easily routed around or over obstacles, elevated PRT substantially reduces costs that other options may incur.





Key Components by Mode (**slide 26**) correctly notes that the AVT cost for *Grade Crossings* is $0 because AVT and PRT use elevated guideways that don't incur additional costs going over roads. The other AVT estimates seem to assume a medium- or large-sized vehicle using road-like guideways. For the much-smaller PRT cabs and guideways, those numbers seem unreasonably high.

Additionally, what if ITNS guideways are light enough to affix them to the existing automobile bridge with minimal reinforcement? Such an approach would substantially reduce costs. While ITNS guideways do not provide 2-way bike/ped dedicated paths, a fraction of the enormous savings (see below) could be used to fund that amenity.

Slide 26 also estimates the total cost for AVT stations at $125M, a surprisingly high figure for just 9 small stations ($14M/station). Because ITNS PRT stations are generally elevated and occupy only as much space as 4 car parking places, the estimated cost for stations is $1M each. This order-of-magnitude difference in station costs demonstrates the broad scope of AVT options. Selecting the smallest and lightest viable type of AVT technology makes a huge difference in project cost, thus a critical factor when assessing options.

Estimated Project Costs by Mode (**slide 27**) for the Decoto Road Alignment, when converted to a per-mile basis, works out to CRT $184M/mile, LRT $179M/mile, BRT $135M/mile, and AVT $138M/mile. Again, the AVT estimate far exceeds the ITNS estimate. What if PRT only costs $30M/mile (bi-directional) as various studies have shown? Then the 18-mile Dumbarton Corridor project could be built for only $0.54B (18 miles X $30M/mile). That would result in potential savings of about $2.5B ($3.0B - $0.54B). Even a doubling of cost to $60M/mile makes it a bargain compared with the other options.

Estimated Project Costs by Mode

San Mateo County TRANSIT DISTRICT

All Costs in 2021 Dollars ($, Billions)

	CRT / Decoto Road Alignment				Quarry Lakes Alignment			
Mode	Infrastructure	Vehicles	Soft Costs	Total	Infrastructure	Vehicles	Soft Costs	Total
CRT	$2.43 B	$0.14 B	$0.75 B	**$3.32 B**	N/A			
LRT	$2.39 B	$0.10 B	$0.74 B	**$3.22 B**	$2.36 B	$0.10 B	$0.73 B	**$3.18 B**
BRT	$1.84 B	$0.03 B	$0.57 B	**$2.43 B**	$1.82 B	$0.03 B	$0.56 B	**$2.42 B**
AVT	$1.82 B	$0.11 B	$0.56 B	**$2.49 B**	$1.86 B	$0.12 B	$0.57 B	**$2.55 B**

Notes:
- CRT Project costs exclude UPRR Trackage Rights Fees
- BRT Project costs assume similar infrastructure requirements as LRT Project
- Source: HNTB, February 2021

Does PRT Make a Big Difference?

The low cost and high service levels of PRT may influence the Board's choice of which alignment to select, Decoto Road or Quarry Lakes. Or it may lead to new options like a dumbbell-shaped system with multiple square miles (both Decoto Road and Quarry Lakes?) served by PRT at each end of the 18-mile corridor. Because PRT is so easy to site and extend, many transit configurations are possible that are unworkable when using difficult-to-route technologies like CRT, LRT or BRT. Find more detailed information at the Milpitas PRT website (MilpitasPRT.com).

Working together for transit that works for all,

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