September 25, 2019
revised from 9-14-2019
revised from 8-26-2019

To: City of San Jose
Department of Transportation

Attn: Maricela Avila

Thank you for the opportunity to respond to this exciting challenge. The knowhow exists to achieve more with less. It just needs to be applied. This response attempts to show that.

Features:

- SJC and Stevens Cr. as one 12-mi. small diameter twin bore.
- Demand driven with capacity comparable to BART and LTR.
- No rails or high kV power in this system.
- Fully autonomous and system controlled EV SBPs (Small Bore Pods) are used.
- 7 stations west of Diridon and 3 north of Diridon.
- Station passing is capable on 6 Stevens Creek Line stops.
- All SBPs will stop at Diridon and end points.
- No standing or sardine crowding.
- ADA and bike friendly SBPs have been modeled.
- 100+mph but 90mph works well in this system.
- Features of rail PTC (positive train control) embedded.
- Quiet, comfortable, safe and efficient.

Driving this design:

- 40% cost/mile of BART Phase II.
- P3 opportunities; independent operator possible.
- Lower O&M cost; multi-sourced commercially available materials and skills.
- Energy generation, storage and delivery included.

High level view:

- 300 SBPs in the system, ~200 of them at work in the 12-mi twin-bore system.
- Each with 15-seat capacity; average 12-seats including ADA and bike friendly pods.
- Can move 1,800 to 5,400 per hour through one station in one direction.

Technologies:

- Google Maps, AI technology used in traffic management systems, PTC, AV Level 3 &4 capability from Waymo, GM, Ford, Toyota and others have sensing, tracking and SoC (system on chip) technologies required for this closed system. (See page 19 attached)

Again, thank you for the opportunity to share this vision with the City of San Jose.

Respectfully,

// DDD//

David Dearborn

Response

RFI 2019-DOT-PPD-4

New Transit Options:

Airport-Diridon-Stevens Creek Transit Connection

Due: September 30, 2019

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Concept:

A 12-mile, high speed, small diameter, twin bore, connector line running from the Airport long term parking through Diridon to Midtown and west under Stevens Creek to past De Anza College. System would move passengers via autonomous EV with sub-minute head times providing capacity comparable to 4 to 5-car bart trains or 3-car LRT. This model has 7 stations west of Diridon; 3 stops north of Diridon.

Business Plan:

1) Develop a vision for low cost, low impact small diameter twin bore transit link from SJC to west valley under Stevens Creek Road based on high speed autonomous EV transporters and sub-minute head times. 2) Establish capacity and performance objectives. 3) Identify key technologies required for such. 4) Develop and publish three RFPs: one for design and construction; one for O&M; and one for design, build and operate. 5) Structure incentives for public private participation and partnership.

Airport-Diridon-Stevens Creek Transit Connection

A vision for a 12-mile, high speed, small diameter, twin bore, connector line is presented. A solid model has been created and placed in Google Earth confirming alignment and station locations. Typical station models have been created to confirm general fit and functionality.

For this application, a small bore pod SBP or transport vehicle has been modeled to illustrate the SBP concept and confirm size, seating and fit in the tunnels and stations.

Modeling of SBP capacity, head-times, acceleration, run speed and deceleration have been developed to understand both system capacity and rider experience.

Cost estimates for major elements have been developed and key technologies, features and benefits are discussed.

Purpose

Design objectives behind this concept:

- keep capital investment simple, practical and cost effective
- design for flexible low impact construction
- capacity comparable to LTR or BART within these corridors
- design for both congestion relief and service-level demand pricing
- where possible use existing technologies and multi source components
- provide 24/7 demand-driven service
- make it as seamless as possible with surface modes and Diridon connections
- design for 3P funding, optimal fare-box recovery and other benefits

Background

Grade separating efficient public transportation modes in dense or developing urban areas makes underground increasingly attractive. Selecting the best underground solution for each application can be daunting. Balancing size, capacity and cost for the corridor or service area is key.

Landing a stage-1 Falcon 9 booster rocket bottom-first on a space no larger than City Hall Plaza was impossible until it wasn't. Mass transit in the South Bay has been synonymous with BART, Caltrain and LTR until it's not.

Technologies in creating grade separated mobility do exist. EV, AV, systems management, renewable energy generation and storage can make urban heavy rail and LTR uncompetitive for some applications.

Design Objectives

Grade separation underground:

- small twin bore construction cost is half to one third that of BART or heavy rail
- ROW for small diameter twin bore would cost less than conventional larger bore
- station cavern construction would be comparable to or less than for larger bore

Operations and Maintenance:

- capacity comparable to LTR or 4-to-5 car BART
- commercially availability materials, processes and technologies

- safe, programable or variable sub-minute head times
- 24/7 demand driven service
- energy independent or carbon neutral
- low maintenance tunnel, stations and transporter system

Funding and fare-box return:

- 3P capital investment opportunities
- competitive O&M equipment, materials, skills and power
- fare-box revenue opportunities and incentives

Required Technologies

- tunneling, tunnel boring machines – commonly available
- station and access excavation – NATM, SEM, SCL – proven and available
- flexible design EV AV transporters – approved for conditional testing
- solar PV power generation – available and advancing
- high density battery storage packs – available and improving
- gravity storage charging systems – more efficient than storage cells – recently funded
- demand driven system control:
  - EV auto technology – commercially available
  - AV auto technology – Level 3-4 in beta test; Level 5 expected 2023-4
  - variable sub-minute head times – provable with computerized models
  - demand controlled direction escalators for optimum flow – proven and available
  - redundant PTC (Positive Train Control) – used in Europe; others could design

Benefits to Owner Operator

- reduced construction cost, risk, soil removal and construction impacts
- shorter, efficient station caverns reducing construction disruption
- sealed mined stations and escalator tubes extend life and reduce maintenance
- availability of EV technologies:
  - expand supply and design options
  - simplify maintenance and repairs
  - reduce supply chain lead times
- 24/7 demand driven service level improves operating efficiency
- PTC-like system oversight provide safety and reliability

Benefits to pubic

- less capital outlay for critical 12-mile transit link
- less construction disruption with NATM, SEM, SCL staton construction
- quiet station, tunnel and ride. No steel-on-steel or large rail in tunnel sounds
- no standing like on crowded BART or LTR cars. All travelers are seated
- faster more comfortable ride between stops

User Experience – Stevens Creek Line

At Diridon or SAP location you'll approach the Stevens Creek Line boarding area, board a waiting SBP. When comfortably full, Pod will close, station access doors will close. The SBP will take its place in the on-ramp departure line. Within a seconds to a minute your pod will enter the tunnel, gently ramp to 90+mph to seemingly coasting speed. You'll feel a slight increase weight-on-seat as the SBP enters and makes the large radius curve west to San Carlos and Midtown Station at Race St. Your SBP will slow and deliver you to a docking area where you step out (level) onto the station floor. You'll walk to escalator or lift most convenient to your destination. Or, you could remain seated and move on west to another stop.

The stop (or station) would be about 300-350-ft long and 50-60-ft wide. There would be no platforms in the traditional rail sense. On the south side of San Carlos, passengers going east or back to Diridon would have a similar experience but from the north side of Stevens Creek.

If it were desired or deemed a good value, stops (or stations) could be designed with an additional connecting level between opposing bore stops so riders could access opposite sides of the corridor below grade. (This feature is illustrated in the SAP and SJC stations.)

User Experience – Airport Connector

At Diridon you'll approach the Airport Connector boarding area. This could be south of W Santa Clara St. or north of that below the now SAP event center parking area. You'll will check your bags if provided, board a waiting SBP. Carry-on could stay with you; checked bags might be checked there or in the Diridon Hub area if that is designed withing that area.

When your transporter is comfortably full, its doors will close, station access doors will close, your SBP will depart to the airport terminals and on to the long term parking area. Your SBP will gently ramp to 100+mph and seemingly coast. As you approach the terminal, you will slow and be delivered to the terminal.

You'll step out onto the station floor, walk to escalator or lift most convenient to your destination. Or, you could remain seated and move on to the next terminal or LTP long term parking. For loaded SBPs destine for LTP, your SBP may pass airport terminals.

These stations would be 300-400ft long and maybe 50-60-ft wide.

Checked baggage would be transferred to the handling area for you.

From terminals or LTP or terminals, the trip to Diridon and beyond would be much the same. Baggage handling and transport to Diridon can be designed in coordination with the City DOT and Airport agency.

Essential Technologies, Expertise and Processes

<u>Excavation:</u> NATM, SEM, SCL for station caverns, escalator, lift and access ways.

<u>Systems Management:</u> software, algorithms, AI and such used by Google Maps, Uber, Lyft, PTC, etc.

<u>Autonomous Vehicle</u> technologies like those being developed by Waymo, GM, Ford, Toyota, BMW and others

<u>Solar PV power</u> generation and charging systems

<u>Hi capacity storage</u> like Tesla high-density cells and newly funded gravity power storage systems using smart programs with old technology

Response to RFI questions

11.B.i **Proposed high-level concept** see above

11.C **Physical Elements**

11.C.a Describe the guideway
11.C.a.i From the street this presents like a normal metro system. Below, Autonomous EV transport vehicles pick up and deliver passengers.
11.C.a.ii Tunnels and stations are below street level.
11.C.a.iii Under roadway and sidewalks with escalators and lifts to street level

11.C.b Describe station/passenger access points
11.C.b.i From grade: typical subway escalator or lift access; below, smart AV EV pods.
11.C.b.ii Sidewalk or adjacent building or developed area. Stations mostly under street.
11.C.b.iii Much like current metro access or bus stops.
11.C.b.iv System access would be escalator or lift to other modes.
11.C.b.v Integration with other modes described herein.
11.C.b.vi Integration with SJC and long term parking described herein.
11.C.b,vii Vehicle operation described herein.
11.C.b,viii Level boarding illustrated herein.
11.C.b.ix System will not be aerial.
11.C.b.x Below grade system is accessed by escalators and lift.

11.C.c Describe the vehicles
11.C.c.i Illustration of basic concept is modeled and shown herein.
11.C.c.ii Capacity examples are modeled and presented herein.
11.C.c.iii Vehicle access boarding and alighting is estimated 20-40 seconds.
11.C.c.iv Vehicles can accelerate 0 to 120mph max speed in about 20 seconds.
11.C.c.v Vehicles are AV.
11.C.c.vi Vehicles would autonomously return to an SJC long term parking, dock and charge from master battery storage at the garage powered by rooftop PV solar farm
11.C.c.vii see above
11.C.c.viii see above
11.C.c.ix Cleaning and light maintenance possible in SJC LTP; major repair off site.
11.C.c.x System managed AVs would move and be allocated on a demand basis.

11.C.d Provide pictures Illustrations of solid models provided herein.

11.D Operational Elements
11.D.a Describe the operational model.
11.D.a.i Vehicles are designed to travel within the system.
11.D.a.ii Travel from Diridon to SJC is less than 3 minutes.
11.D.a.iii Frequency of service is demand driving typically 15 to 30 seconds.
11.D.a.iv Illustrations provided herein.
11.D.a.v Capacity is demand-driven scalable via head-times and speed.
11.D.a.vi Vehicle dwell time at station is demand-driven. See enclosed detail.
note: System operation could allow non-stopping station bypassing vehicles.

11.D.a.vii Reliability is a function of SBPs and systems management and control.
note: Specifications shall meet or exceed existing standards for fixed guideway.
11.D.a.viii Service Sould be ticketless – clipper card or equivalent.

11.E Current Status of Concept Technology
11.E.a – Demand driven transport systems exists today in Uber and Lyft
– Tunnel boring technology is mature and numerous sources exist today
– EV auto, truck and bus technologies exist today
– Level 4 AV is in late development and testing today.
– Airless synthetic rubber tires have been developed and are available today.
– Elements of AC system navigation exist today.
– Solar PV power generation technologies exist and numerous sources exist.
– Hi-density battery storage is being tested today.
– Funding has been secured for proving high-efficiency gravity storage systems.
– positive train control PTC systems have been developed and exist in Europe
11.E.b unknown
11.E.b unknown
11.E.c Key areas of risk: System management software and PTC-like safety applications.

11.F **Concept Requirements**
11.F.a 1) geotechnical expertise, 2) Tunnel boring expertise, 3) NATM, SEM and SCL technologies, 4) EV / AV vehicle development, 4) solar PV power generation, storage and charging technologies, 5) systems software, algorithms and machine learning software for systems management. To understand ROM lead times, best target RFI to 1 thru 5.
11.F.b This model is designed for underground. At or above grade is inappropriate.
11.F.c This system could be extended.
11.F.d Stations could be added.
11.F.d Maintenance for vehicle pathway – minimal; cleaning, lights and communications;
Maintenance for the transport vehicles – normal cleaning and lubrication for EV.
Maintenance for stations would be comparable to simple metro stations today.

11.G Costs
11.G.a ref: spreadsheet provided
11.G.b ref: spreadsheet provided (basic station separate from elevators and lifts)
11.G.c ref: spreadsheet provided
11.G.d ref: model and spreadsheet provided
11.G.e Estimates for tunnels, stations, vehicles and system not included.

11.H Business Plan
11.H.a 1) City could set the vision, general design and operating performance objectives.
2) Invite private operator(s) or operator partnership(s) to present a DB&O plan.
3) Formalize and RFP for 2) above.
11.H.b Ideally an operator like Brightline Virgin in partnership with GM, Ford, Tesla or such.
11.H.c Passenger fair strategy could be based on service-level provided.
11.H.d Fare system would be set on value to user and frequency of use.
11.H.e Marketing, special rates, express service, ADA, bicycle friendly SBPs, timely bus and feeder connections, good music and right colors would all contribute to maximum ridership.

11.H.f   Setting fares for full capital and O&M recovery could result in social equity issues. However, the closer to full capacity the greater the opportunity for cost recovery.

11.H.g Opportunities to maximize fare-box recovery might be through software, programming and algorithms that would enable point-to-point high speed express pods from like Apple to the SJC as an example; or high-density high-value residential areas to key employment destinations, or Diridon, or the Airport. Advertising and sponsorship provide opportunities for recovering capital and O&M costs; such as but not limited to: 1) station wall space, 2) street level entry wall space, 3) transport pod capsule space, 4) in-pod video displays on seat-backs. 5) station naming rights to mention a few.

11.I   **Impacts**

11.I.a Negative impacts during construction would be primarily at stations.
11.I.b Negative impacts during operation would little to none.
11.I.c Mitigation for construction would be like most utility or development near intersections.
11.I.d Community outreach and engagement strategy might be to invite the public:

- challenge the assumptions and logic of this concept;
- voice ideas resulting better service at lower lower costs;
- suggest changes or improvements for this plan.

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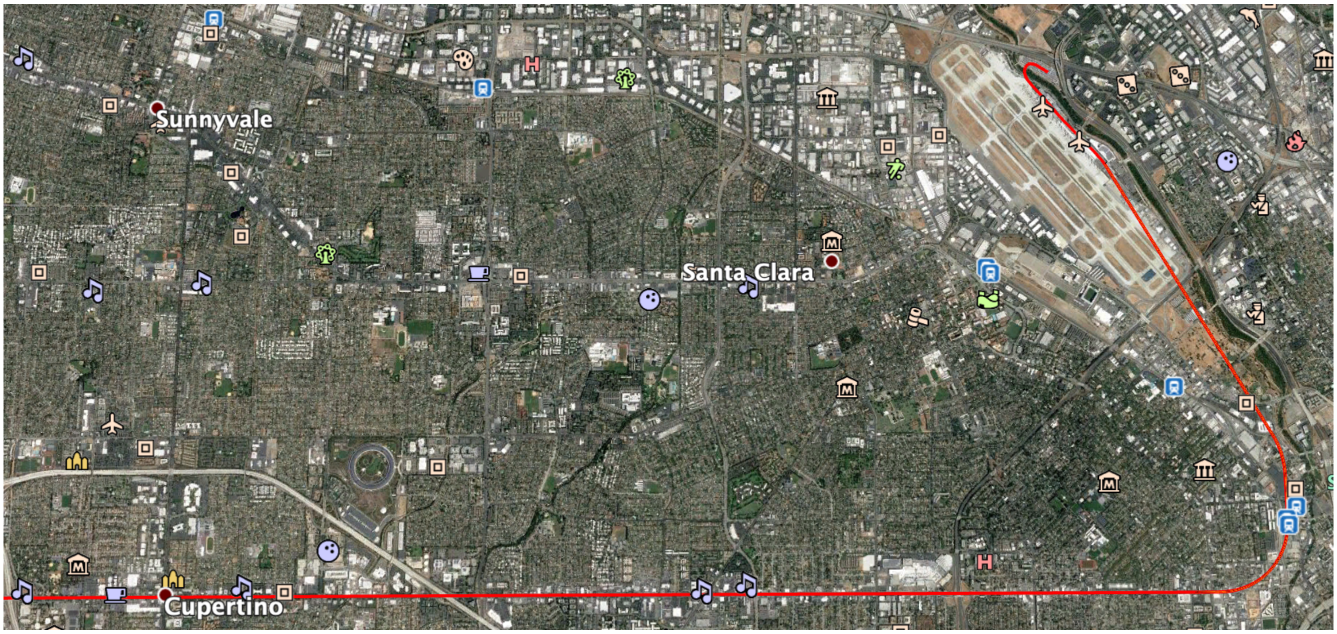
New Transit Options:

Airport-Diridon-Stevens Creek Transit Connection

APPENDIX

(*) Costs summary herein is from a spreadsheet of costs based on research of materials, products, processes and projects using principles estimation based on procurement, manufacturing, project management and product design experience.

Fig. 1 12-mile alignment



Alignment is red line starting upper right in Airport Long Term Parking, then south with stations at both terminals then south under open space, Market Place and SAP parking area.

Fig. 2 Video link to alignment flyover from Diridon to SJC Long Term Parking
https://www.youtube.com/watch?v=b7dh4a_QIBw

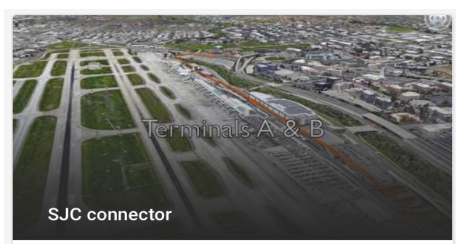


Fig. 3 Alignment, Diridon to Midtown and San Carlos and west under Stevens Creek Rd. Showing 7 stations from De Anza to Midtown and relative spacing.

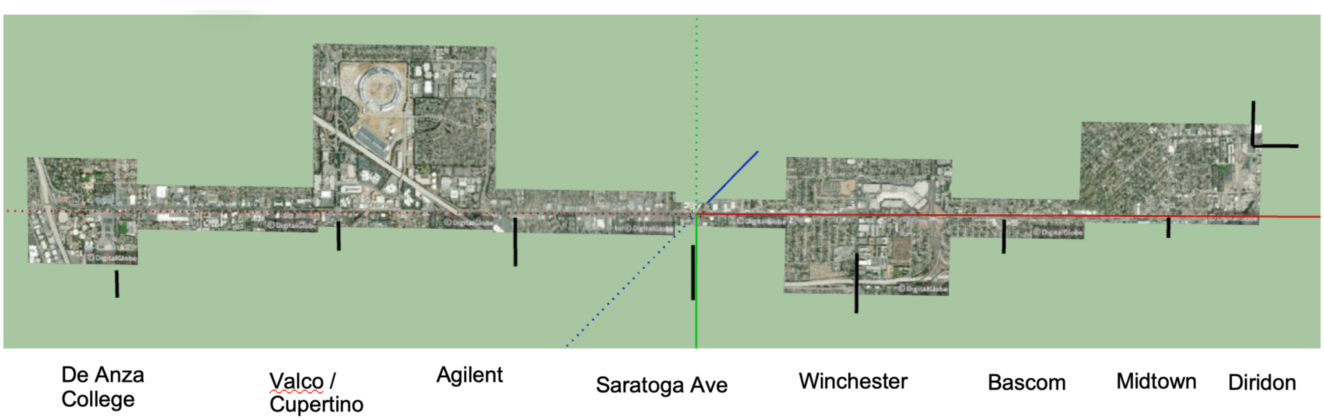
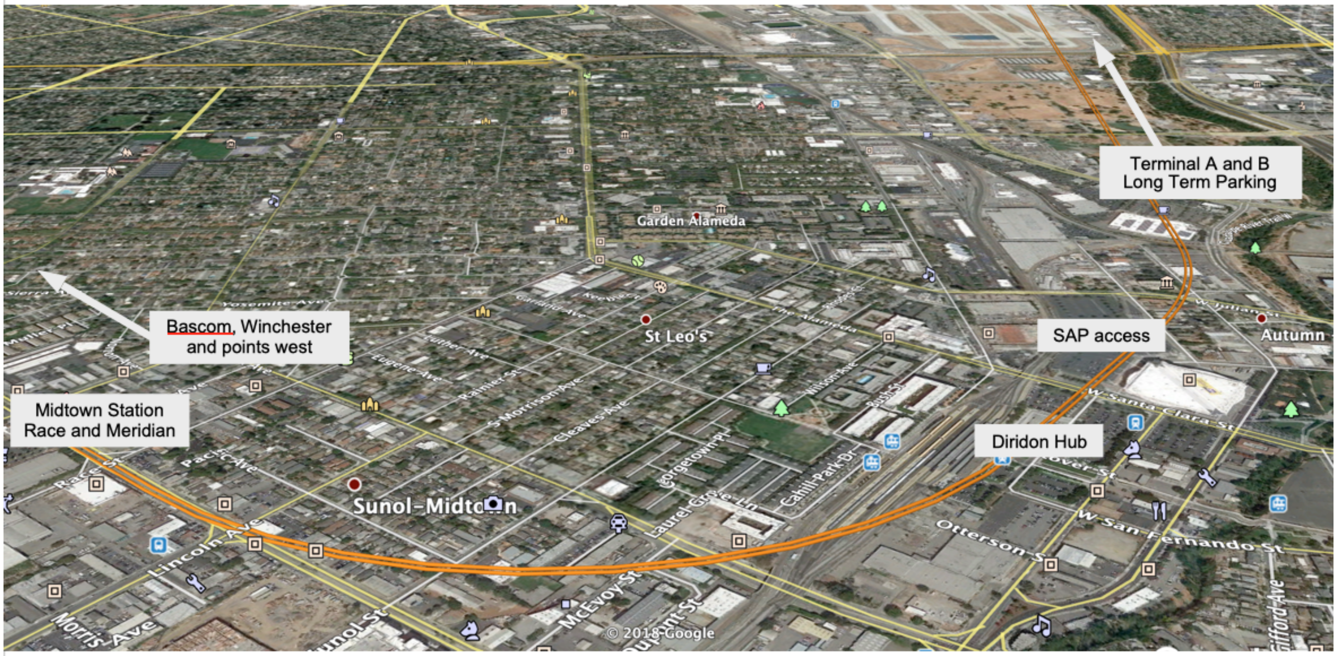


Fig 4

12 mile High Speed Connector from SJC long term parking to SAP Center / Diridon Hub to Midtown, Santana Row, Apple, Cupertino to SR85.

14-ft dia twin bore, 7 stations west of Diridon/SAP, 3 stops north; Terminal A and B and long term parking. Long term parking could house, charge and maintain high speed transporter pods.



This large radius between Midtown and Diridon Hub could be banked to neutralize lateral 'g' force giving passengers a smooth efficient trip through this south to west transition.

Additional transporter pod storage, staging, operations control center and security could be housed below open space just south of 880 freeway.

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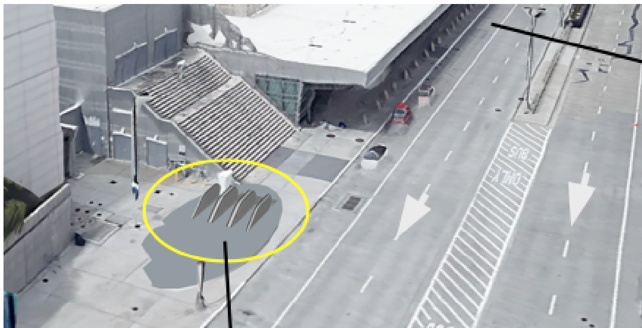
Fig. 5

SJC Terminal A escalator access to Diridon Connector

This model was developed without knowledge of
underground utilities and soil conditions.



South end of Terminal A entrance passenger drop off area.

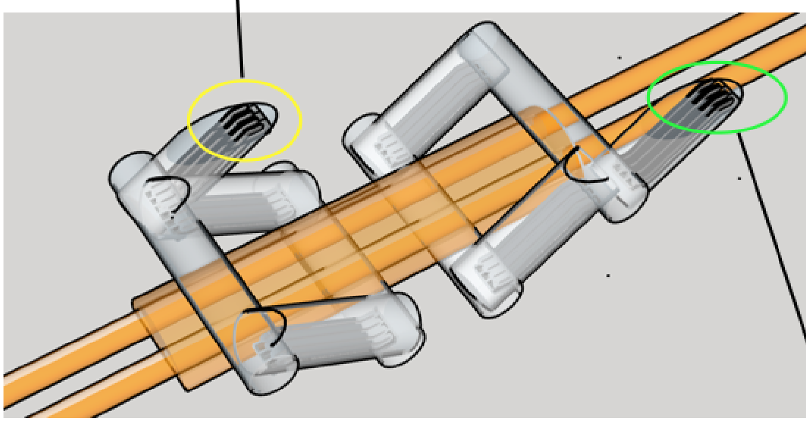
Sidewalk area is wide enough for escalator boarding and is inline with normal pedestrian flow.

Triple set escalators throughout this model are assumed to be one up, one down and the center demand driven base on traffic patterns and need.

Mini-station cavern in this model is 200-ft long 50-ft wide. Escalator tubes are 20-ft dia.

Twin connector bore are approximately 14-ft dia od and 40-ft below street.

This is a <u>very rough concept</u> model and depth of twin bore and cavern could be deeper to provide more soil above upper pedestrian crossover tubes.



This escalator access is located outside the baggage claim area and inline with normal pedestrian flow.

Sidewalk is not wide enough for escalator boarding and would require using a section of passenger loading parking lane to make this work.

Required size, configuration and design of underground cavern is not known. This will depend on peak demand projections, queuing needs and efficiency of load-offload design.

Fig. 6 Early model of small diameter twin bore looking west. Model is elevated to view location relative to streets and structures. Mined stations not show in this view.

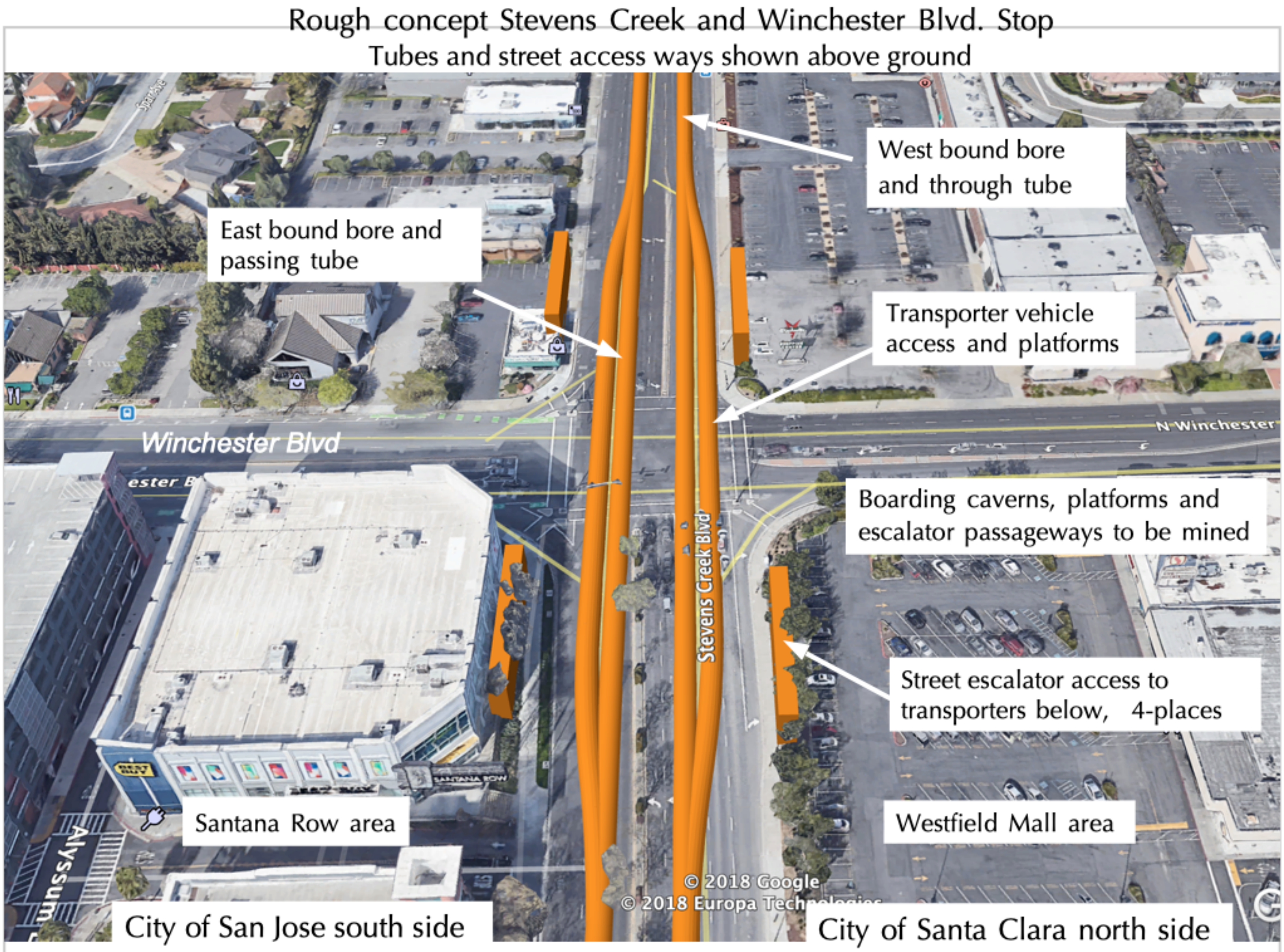


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Fig. 7 Looking north into Santa Clara from above Saratoga – Stevens Cr. intersection.

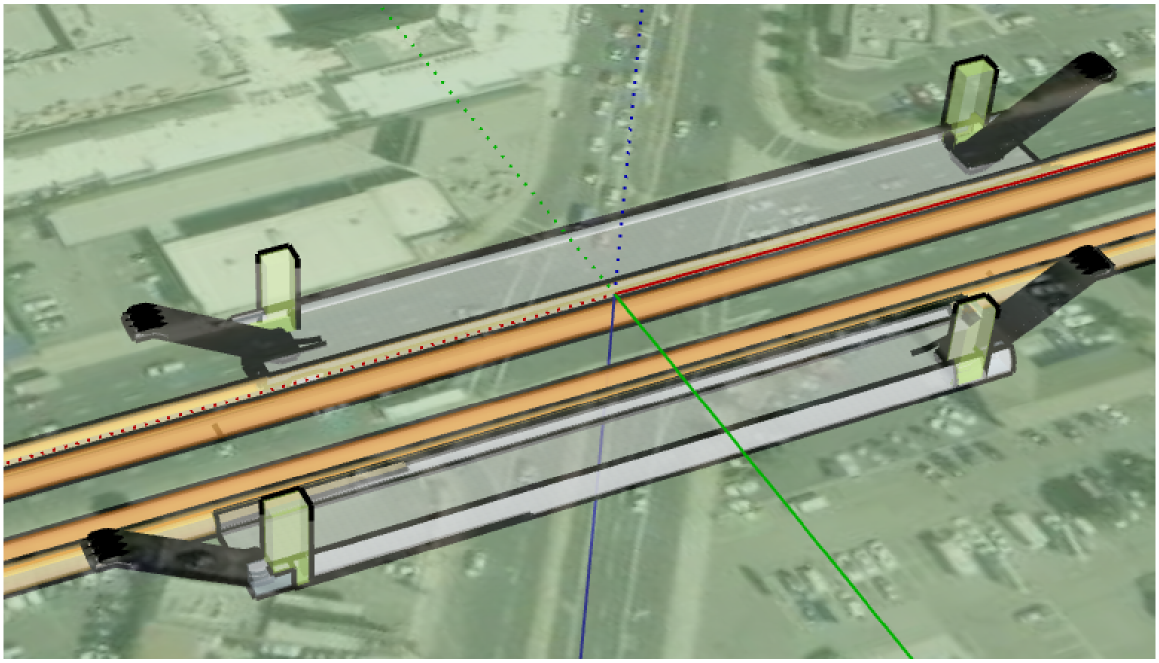

Fig. 8 Typical off mainline station boarding area.

Escalators and lift at each of the station take people to street level.

This station design is mirrored on the other side of Stevens Creek Blvd for travelers in the opposite direction.

15-seat small bore pods (SBP) in loading area. Station doors and SBP doors automatically open allowing passengers to exit or board.

SBP (pod) design was developed ONLY to illustrate how 15 seats on an autonomous EV would appear in this 14-foot diameter bore. Actual design TBD.

Realtime signage over SBP queueing stations would inform and direct passengers.

Fig. 9 Capacity calculation

	Reference Notes								
	LTR	**BART**							
tack gage	1,435 mm	1,676 mm		assume 300-ft long stations				People /hr	People /hr
power	750 vDC	1000 vDC		on Steves Creek Line		capacity	capacity	full seated	standing
	overhead	3rd rail			bore dia	seated	standing	10min hd time	10min hd time
top speed	62 mph	80		Lt Rail – 3 cars at station	24-ft	192	510	1,152	3,060
capacity seated/total	64/170	56/ 200		BART – 4 cars at station	20-ft	224	3,200	1,344	4,800
length	88ft 6in	70 ft /car							
width	8ft 8in	10ft 6in						30 sec	15 sec
height	11 ft	10ft 6in						head time	head time
weight	99,980 lbs			SBP seating 15 people	14-ft	15	n/a	1,800	3,600
acceleration m/s*m/s	1.34	3.0 mph/s							
deceleration m/s*m/s	1.56	3.0 mph/s		Note: 15 seats /pod and 30 to 10-sec head times, this system can move 1800 to 5400 people per hour					
Cost / car		$2.19 mil							

Fig. 10 Possible Diridon Area integration (see next page)

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12-mile Twin Bore SJ Airport to De Anza College Line Running Through Diridon

This small bore Airport – Steven Cr. connector line passes through Diridon. All-pods-stop at the event center. Escalators from both the north and south lines access SAP main entrance.

If VTA can adapt their station complex to allow these twin 16-ft OD bore through Diridon, 12-mile connector would provide 7-stops on Stevens Cr line access as well as the Airport.

Twin bore crown is 20-ft below LTR tunnel and BART crown is 20-ft below twin bore tunnels.

Pedestrian underpass could be mined under W Santa Clara St. connecting SAP station with BART and the Diridon Hub, rail and other modes.

This station could cut-&cover or mined.

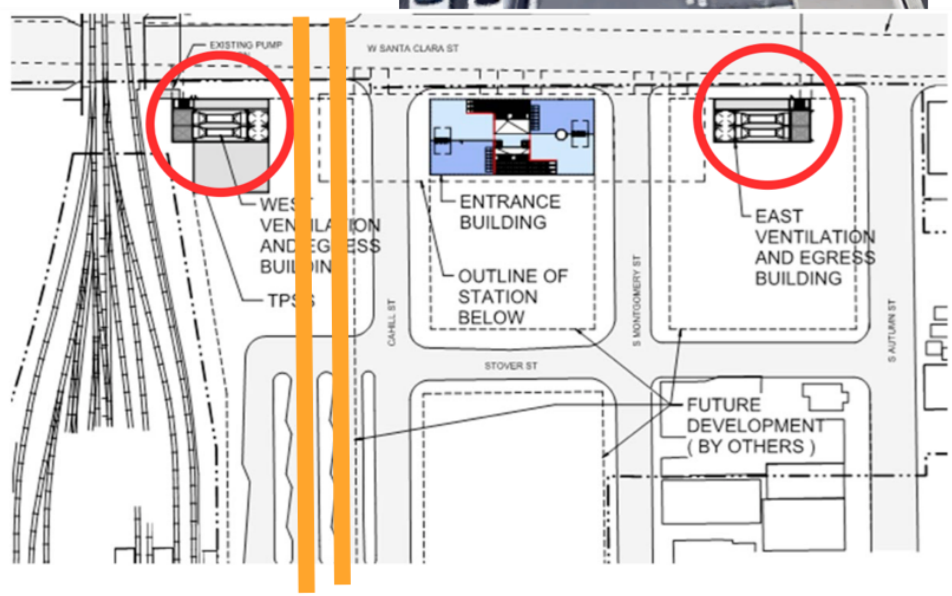


Fig. 11 Summary from spreadsheet (not shown) of detailed cost buildup.

Summary Cost Estimates			
15% Project Design	- - -	- - -	1,000,000
50% Project Design	- - -	- - -	3,600,000
Pre-entitlement work	- - -	- - -	500,000
Daft Project level EIR	- - -	- - -	300,000
Final 35% Design	- - -	- - -	1,500,000
Twin bore 14-ft dia, 12 miles	12	108,333,333	1,300,000,000
Station caverns, sealed less			
escalators, lifts and detail	22	134,090,909	2,950,000,000
Small Bore Pods in transit	76	150,000	11,400,000
Pods in queue or storage	220	150,000	33,000,000
Escalators: (4/stop x20, installed)	80	430,000	34,400,000
Escalators: SAP/Diridon, installed)	24	430,000	10,320,000
Lifts: 2/stop, installed, 4-story	46	75,000	3,450,000
System control programming	lot	10,000,000	10,000,000
sensing /monitoring	lot	5,000,000	5,000,000
fiber, RF links	lot	3,000,000	3,000,000
Pod charging stalls in LT pkg	100	50,000	5,000,000
Roof top Solar PV system	1 MW	1,000,000	1,000,000
battery storage system	lot	1,000,000	1,000,000
Pod elevator in LT pkg garage	lot	100,000	100,000
		total est'd	4,374,570,000
		cost /mile	364,547,500

Systems Cost Comparison				cost /mile
Line	Type	$ Billion	Length Miles	mil$
BART Phase II **	83% underground	5.58	6.0	$930
SF Central	underground	1.57	1.7	$924
LA Regional	underground	1.75	1.9	$921
LA Purple 1&2	underground	5.20	6.5	$800
Seattle U-Link	underground	1.80	3.0	$600
Honolulu ART	Elevated	10.00	20.0	$500
Boston Grn Ln X	Trench	2.30	4.7	$489
SJC-Diridon-SR87	underground	4.37	12.0	$365
DC Metro Silver II	Fwy median	2.80	11.5	$243
Atlanta I-20 EHRail	Fwy median	3.20	19.2	$167

** revised 4/22/19 and may go higher with bore diameter increase

Fig. 12 Example: Level boarding 15-seat transport pod. **Actual form and design TBD.**

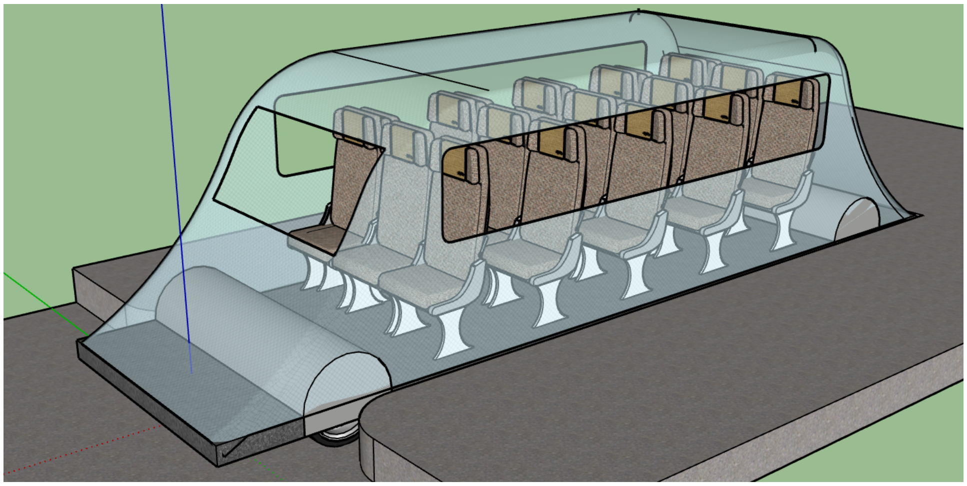


Fig. 13 Example: Level boarding and ADA compliance. Wheelchair securing feature TBD.

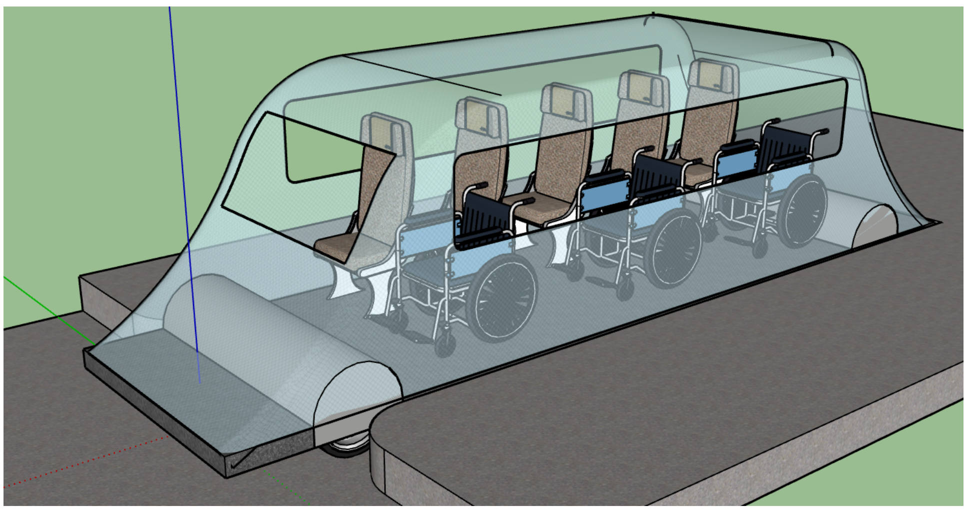
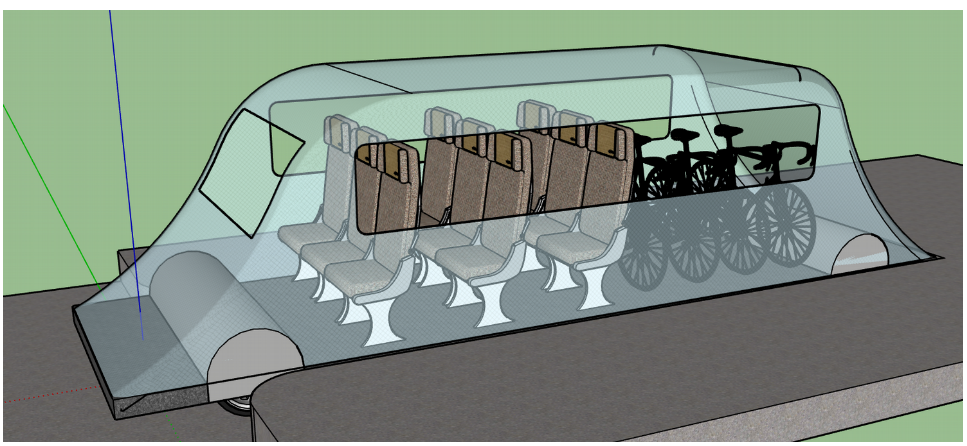


Fig. 14 Example: Bike friendly option or room for baggage to airport.



Small Bore Transport System Timing Model
Diridon to SJC not shown but principles apply

Illustration of speed profile showing transport pods departing every 10 seconds.

Shortest distance between 2 stops is 1-mile.

Distance between pods at 85mph is 1247-feet.

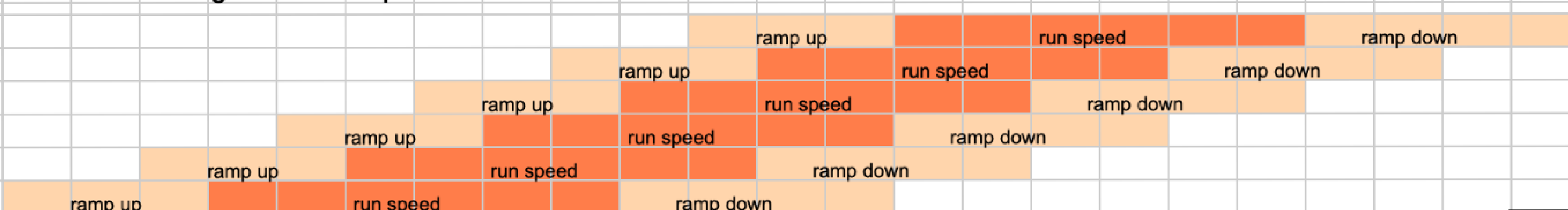
Ramp and slow profiles would be similar for other segments. Run times will vary.

Ramp and run speeds could vary as experience, AI and machine learning work to improve performance and efficiency.

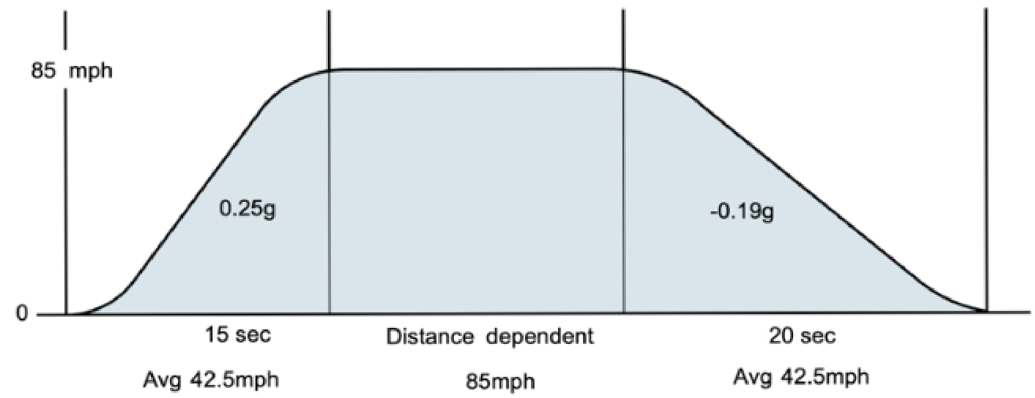
Relative distance between stops shown in the table below:

Diridon	Midtown	14,20	feet
Midtown	Bascom	5,900	feet
Bascom	Winchester	5,300	feet
Winchester	Saratoga	5,900	feet
Saratoga	Agilent	6,400	feet
Agilent	Valco	6,350	feet
Valco	De Anza	8,000	feet

Model showing 10-second departure intervals



Speed Time Profile Between Stops



time seconds	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	/////	115	120	125	130	
Diridon	0-85, 15sec, 0.26g				run 85mph for 96.4sec													85-0, 20sec, -0.19g				14,200-ft
midtown	0-85, 15sec, 0.26g				run 85mph for 29.8sec					85-0, 20sec, -0.19g							5,900-ft		65-sec			
Bascom	0-85, 15sec, 0.26g				run 85mph for 25sec				85-0, 20sec, -0.19g								5,300-ft		60-sec			
Winchester	0-85, 15sec, 0.26g				run 85mph for 29.8sec						85-0, 20sec, -0.19g						5,900-ft		65-sec			
Saratoga	0-85, 15sec, 0.26g				run 85mph for 33.8sec						85-0, 20sec, -0.19g						6,400-ft		69-sec			
Agilent	0-85, 15sec, 0.26g				run 85mph for 33.4sec						85-0, 20sec, -0.19g						6,350-ft		68-sec			
Valco	0-85, 15sec, 0.26g				run 85mph for 46.7sec								85-0, 20sec, -0.19g				8,000-ft		82-sec			

To manage safe, efficient, demand-driven flow, algorithms will adjust key operating variables within program limits.
Operating variables like: departure interval time, acceleration g-force, run speeds, deceleration g-force and station queue time.
Examples:

Departure interval time:	Maximum time might be 30sec with low demand to 10sec or less as safety and demand require.
Acceleration g-force:	Departure g-fore shall not exceed 0.35g or what is deemed safe and comfortable
Run speed:	Maximum run speed shall be determined by demand driven performance withing safe limits. In this case that would be sub 90mph to start. Speeds beyond that as proven safe.
Deceleration g-force:	Arrival g-force shall not exceed -0.2g or that deemed safe and comfortable
Station queue time:	This would be a key variable in leveling flow throughout the system and responding to demand.

Discussion added 9-14-2019

Key technologies – Software and Systems Management

Scope

This system would be considered an indoor, closed, LBS location-based system, managing a fleet of AV EV pod transporters about the size of a personnel transport van.

Imagine 24 miles of single lane, one way freeway (tunnel) in one direction in a loop (12-mi each direction (twin bore) having 12 to 16 small stations, each with offramp and onramp for passenger boarding; and 6 or 8 stations where all vehicles stop… none pass through the station.

Speed in the one way tunnel can range from 30 to 90+mph depending on distance, demand and traffic load. Headway between vehicles enough for safe stopping should the unexpected happen.

System management software would control all transporter pods: into station and queuing, into and off all mainline ramps, and vehicle speeds to optimize safety, capacity and efficiency 24/7.

This management/control system would assure availability of ADA and bike-friendly vehicles throughout the system on a demand basis and monitor vehicle EV charge levels rotating vehicles into and out of charging docks as required.

This master control system will monitor, report and manage real time dynamic signage from street to in-station queuing, and in transport pods informing and directing passengers using language, symbols and color as appropriate.

It would monitor, report and manage station and tunnel safety and environmental functions such as lighting, HVAC, sound and emergency evacuation processes.

If possible the (or a) master IT system would track and report energy consumption, passenger travel, realtime revenue and if possible fare revenue to O&M costs on a real time or routine basis.

This must be modeled in a manor to demonstrate functional capability and safeguards before moving into full contract implementation; and in a manor to represent a system control room simulation.

Sourcing

Tier 1 firms in computational fluid dynamics CFD related to traffic management and flow would be ideal sources to pair up with player(s) in the automated vehicle AV development space.

Add to that a Tier 1 or Tier 2 firm in data collection, analysis and reporting for back-end reporting of operations, trends, cost, and other metrics.

If the City finds this closed automated EV system worthy of further consideration, DOT may want to explore ways to pair up CFD, AV, LBS IT, and PV solar generation and storage resources to better understand the scope, resources and lead times associated with bringing this to market.

Once proven here in Silicon Valley with a diverse set of known players and possibly a private DB&O concern, San Jose could help give birth to a multi source-able urban metro solution applicable world wide.

David Dearborn