Solar-Powered Automated Transit Networks:

A Truly Sustainable Vision for
Bid RFI 2019-DOT-PPD-4 - New Transit Options:

Airport-Diridon-Stevens Creek Transit Connection

Burford Furman
burford.furman@sjsu.edu

Ron Swenson
solarnations@gmail.com

Respondent Profile

• Name of company

Spartan Superway

A project at San José State University ("SJSU"), in collaboration with the College of Engineering, the College of Social Sciences, Mineta Transportation Institute, the International Institute of Sustainable Transportation, Inc. ("INIST"), Southern Illinois University Department of Architecture, and numerous industry sponsors.

• Addresses

Spartan Superway: 1 Washington Square, San José, CA 95192

INIST: P O Box 7080 Santa Cruz, CA 95061

• Legal Status

San José State University is a California State-owned University

INIST is a registered tax-exempt 501(c)(3) California non-profit Corporation

• Contact Email

Burford.Furman@sjsu.edu

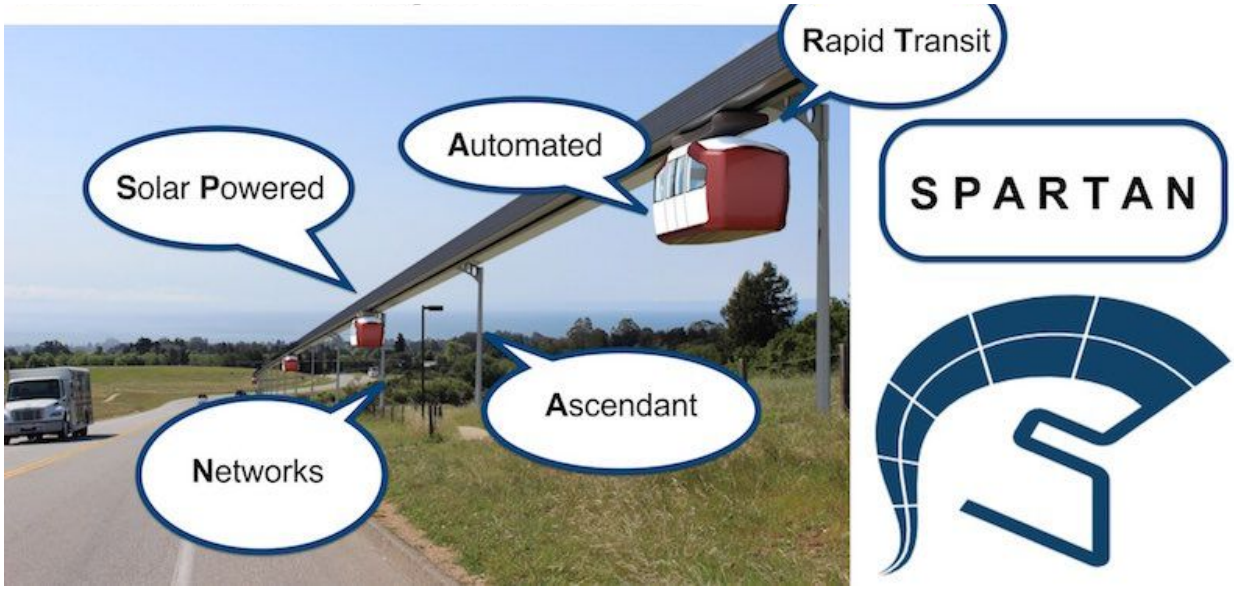
• Contact phone number

408-924-3817

• High Level Description

Green Vision Zero • Carbon-Free, Collision-Free Public Transit

The Spartan Superway vision for public transit in Silicon Valley features a network of grade-separated, elevated guideways below which captive, autonomous vehicles travel non-stop from origin to destination between off-line stations.



The proposed system uses photovoltaic (PV) panels mounted along the entire guideway and at stations to collect the energy the system needs—without energy sources tied to fossil fuels.

The envisioned system serves not only the corridors outlined in the RFI, but it extends far beyond that narrow band to serve a large "economic catchment area" of major trip generators in the general vicinity of the defined corridor, to provide convenient distributed non-stop origin-to-destination service throughout the local community. Off-line stations enable non-stop service, so that when moving at ordinary urban speeds (25-35 mph / 40-55 km/hr), travel time can be cut in half compared to automobiles in stop-start traffic, and even better compared to buses and light rail which make frequent stops for riders.

• High Level Description of Business Plan

The Spartan Superway offers to provide innovation, engineering, research, testing, policy development, safety, security, economic analysis, and assessment services on behalf of the City of San José, other local agencies, project developers, technology companies, and manufacturers, consistent with the objectives of solar powered, zero-carbon zero-collision elevated public transit.

Proposed Concept

• Provide a high-level description of your concept

Guideway, solar canopy, podcars, station at Shark Tank [illustration courtesy of GTF]

Green Vision • Carbon-Free Public Transit

Spartan Superway offers comprehensive technical support services to empower the City of San José to focus its quest for New Transit Options toward viable technologies with Zero Carbon Emissions.

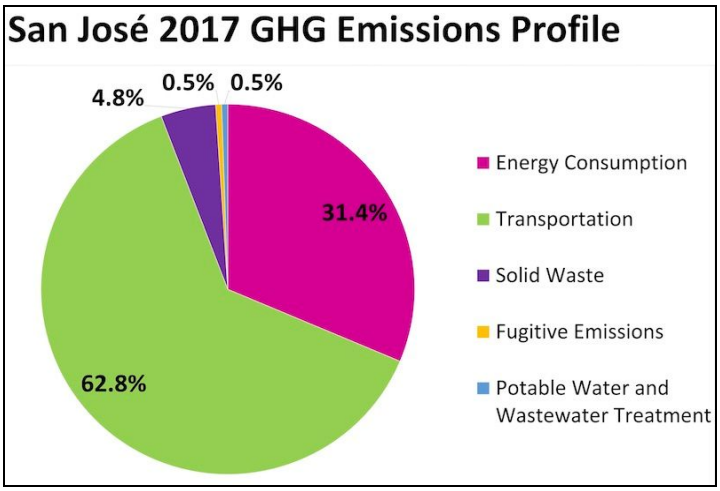
San José is one of 25 US cities selected for its vision and leadership on climate action as a participant in the American Cities Climate Challenge[1].

> "The Climate Challenge is a Bloomberg Philanthropies initiative that aims to accelerate and deepen U.S. cities' efforts to create the greatest climate impact through 2020 and showcase the benefits – good jobs, cleaner air, and cost savings – that climate solutions bring."[2]

[1] American Cities Climate Challenge. (n.d.). Retrieved September 28, 2019, from https://www.bloomberg.org/program/environment/climatechallenge/.

[2] Ken Davies, Climate Smart San José, SPUR presentation, September 12, 2019 https://www.spur.org/events/2019-09-12/climate-smart-san-José https://www.spur.org/sites/default/files/events_pdfs/Climate%20Smart%20SJ%20FINAL.pdf

As can be seen from its emissions profile, with transportation at 62.8% of all emissions, carbon-free transportation is the City's predominant climate challenge. Yet, in the RFI itself and in the RFI's Question and Answer exchange, the City's Department of Transportation staff has acknowledged that the City policy for Climate Smart transit is inadequate. This deficiency is nearly ubiquitous worldwide and represents an unparalleled global economic opportunity for the City of San José, first to build, and then to export, solar powered public transit with "Silicon Valley inside."



Specifically, in the RFI's Q&A, the following responses were given.

> *14: "The project intent is to provide a significant transit option for a large number of trips that currently are taken by single-occupancy vehicles. Moving people to mass transit options will significantly decrease the carbon output of each trip and support denser land use which produces less carbon per person than lower density land uses.*

Evidence demonstrates that public transit in general is unfortunately *more* carbon-intensive than the automobile per passenger-mile. While denser land use can reduce trips, local land use regulations and market forces require new Transit-Oriented-Development ("TOD") projects to provide a high ratio of parking spaces per dwelling unit at exorbitant cost.

> *16: "We have not selected a sustainability metric."*

As its first priority, the Spartan Superway can assist the city to establish and substantiate a sustainability metric for public transit … with global import.

In light of the contemporaneous UN Climate Action Summit and the School Strike for Climate (Swedish: Skolstrejk för klimatet) which manifested on September 20th at City Hall and continues every Friday around the world, and in keeping with its climate emergency resolution, the City of San José has a unique opportunity to establish an aggressive initiative (beyond resolutions and talk) to achieve zero-carbon public transit, putting Silicon Valley on the map as a leader in community action to mitigate the climate emergency.

In response to this international awakening to the grave threat of runaway climate change, the Silicon Valley community has responded assertively:

The Santa Clara County Board of Supervisors has declared a climate emergency[3]:

> "Santa Clara County Supervisor Dave Cortese's resolution to declare a climate emergency was approved by the Board of Supervisors [on August 27]. The declaration acknowledges that global climate change is "caused by human activities" that have resulted in a climate emergency that impacts the well-being health and safety of Santa Clara County residents. It demands immediate action to address the causes and effects of global warming..." [Katie Lauer, San José Spotlight, August 30, 2019][4]

The San José City Council has followed suit[5]:

> A RESOLUTION OF THE COUNCIL OF THE CITY OF SAN JOSÉ DECLARING A CLIMATE EMERGENCY
>
> "WHEREAS, humans burning carbon-based fossil fuels – including coal, oil, and natural gas – is the primary cause of substantial and continuing increase of carbon dioxide ("CO2"), a greenhouse gas ("GHG"); ...
>
> "NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF SAN JOSÉ THAT:
>
> 1. The City of San José urges there be a regional just transition and emergency climate action mobilization collaborative effort consisting of concerned residents, youth, faith, labor, business, environmental, economic, racial and social justice organizations as well as other community groups, and all elected officials in and from San José and nearby Counties and especially all mayors who have signed on to enact the Paris Agreement...." [Resolution No. 79251 adopted. (10-0-1. Absent: Jones.) September 17, 2019]

A recent news article highlights Mayor Liccardo's remarks leading up to the resolution[6]:

> "The growing affliction of wildfires, hurricanes, floods and other natural disasters sharpens our focus on our new reality: we live in a climate emergency and must

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[3] Santa Clara County Board of Supervisors, August 27, 2019 Meeting Minutes. (n.d.). Retrieved September 26, 2019, from http://sccgov.iqm2.com/Citizens/FileOpen.aspx?Type=12&ID=8000&Inline=True.

[4] Lauer, K. (2019, September 28). Santa Clara County lawmakers declare a Climate Emergency. Retrieved from https://sanJoséspotlight.com/santa-clara-county-lawmakers-declare-a-climate-emergency/.

[5] San José City Council Meeting, 9/17/2019. (n.d.). Retrieved from https://sanjose.legistar.com/MeetingDetail.aspx?ID=709095&GUID=5DC7077A-961B-4559-9D20-CF53AF742DC7&Options=&Search= (Accessible at: http://sanJose.legistar.com/gateway.aspx?M=F&ID=db67b0f4-64fd-4299-abf1-2c315f002616.pdf)

[6] Hase, G. (2019, September 12). San Jose Lawmakers Ask to Declare a Climate Emergency. Retrieved from http://www.sanjoseinside.com/2019/09/11/san-jose-lawmakers-ask-to-declare-a-climate-emergency/

> accelerate our efforts to combat it," Liccardo said. "In the absence of federal leadership, San José will continue to carry the standard for US cities in reducing greenhouse gas emissions and promoting sustainability."

In the face of these formidable concerns, the City must promptly ascertain the feasibility of creating a robust zero-carbon public transit system as defined here. Any proposal which does not include a 100% renewable energy solution must be put on hold while the solar option offered by the Spartan Superway is thoroughly explored and vetted. Spartan Superway can bring its expertise to bear on that due diligence process. Furthermore, if the SJ DOT staff responds in a timely fashion, the City can benefit from having the Spartan Superway's available grant funding applied to the City's interests to thereby accelerate the process.

Spartan Superway's Experience with the City of San José Department of Transportation

In 2010-2012, the City of San José conducted an extensive Automated Transit Network Feasibility Study. In his concluding letter of recommendation to the City's Transportation and Environment committee on October 17, 2012, Director of Transportation Hans Larsen included the following statement[7]:

> *"Provide mentorship to San José State University for their research and development efforts related to ATN systems*

Indeed, since 2012 the Spartan Superway has received mentorship from San José DOT and has participated in a study of ATN for an envisioned Almaden-Oakridge Urban Village that was sponsored by the SJ DOT. Spartan Superway has also interacted extensively with local elected officials and transit agency staff for more than five years. Spartan Superway has simultaneously advanced the research and development of solar-powered ATN and now has sufficient depth to provide meaningful technical and policy support to the City of San José.

Due diligence for feasibility

Spartan Superway has recently been offered a grant up to $70,000 from the Mineta Transportation Institute under the framework of SB1, the Road Repair and Accountability Act of 2017, to further develop the Spartan Superway.

As stated above, if the City of San José responds promptly with matching funds combined with internal staff support from San José's DOT and Climate Smart staff, Spartan Superway can apply its funding to the City of San José as the leading case study under the grant.

[7] Larsen, H. (n.d.). Memorandum - Automated Transportation Network Feasibility Study. Retrieved from http://www.sanjoseca.gov/DocumentCenter/View/14332 .

Furthermore, longstanding Spartan Superway sponsor Barry Swenson Builder has offered two alternative parcels of land in the City of San José for demonstration, testing, and quality control purposes. Details can be provided upon request.

1555 South 7th Street

115 Terraine Street

In collaboration with Barry Swenson Builder, Spartan Superway presented a preliminary enhanced review including preliminary building review to the City Department of Urban Planning for the above South 7th Street site in August 2017. (Planning staff gave a green light with modest stipulations; however, failing to receive assurance of benign requirements from Public Works, the project was put on hold.)

Test Track planned for 1555 South 7th Street [rendering courtesy of Barry Swenson Builder]

This project could be revived to aid in the due diligence directly or with other prospective vendors that are participating in the RFI.

Vision Zero • Collision-Free Public Transit

Traffic deaths in the USA dropped some years ago with the broad adoption of airbags, but due to increased cell phone use, the USA continues to endure an upward trend of traffic injuries and fatalities. The common response is rhetoric – campaigns to change driver habits — without giving attention to changing traffic design engineers' "habits." In that respect the City has done a remarkable job of engineering greater safety for bicyclists, but collision avoidance is not only pertinent to automobiles. Public transit deaths are also a consequence of bad design.

The Mercury News

BAY AREA TRACKS

Big solutions a long way off in train deaths

BART, Caltrain and Amtrak have all seen fatal collisions this month

September 28, 2019

By Nico Savidge

nsavidge@bayareanewsgroup.com

Less than 90 minutes after a man was killed by a Caltrain in San Jose on Tuesday, a woman was fatally hit by a Capitol Corridor train in Hayward. Both fatal collisions took place less than a week after a BART train struck and killed a man at the Powell Street station in San Francisco on Sept. 19, in an apparent suicide.

The number of deaths involving Caltrain and BART trains is rising. Caltrain has recorded 13 fatal collisions so far this year, while BART has had six. As of this week, the number of deaths for both agencies was as high as in all of last year, and the 2018 total was higher than that in 2017.

Fortunately, the primary requirements of a zero emission ATN system — elevated, solar powered, automated, personalized on- demand service with off-line stations — concomitantly function as a robust platform for collision-free transit. The Morgantown PRT system established in 1972 has operated for 40 years safely serving over 80 million passengers (with only two minor injuries in 2016).

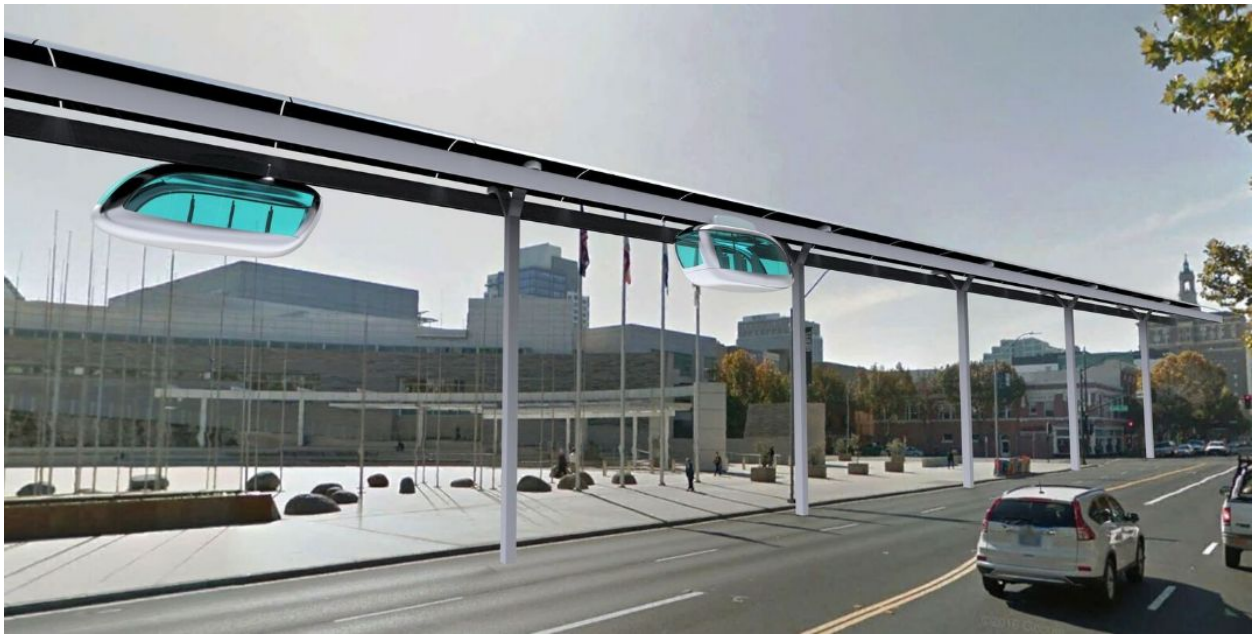
Spartan Superway is the technology pathway to Zero-Carbon Zero-Collision public transit.

Physical Elements

• Describe the Guideway

The following descriptions are representative, based on an aggregation of the characteristics of prototype and commercial systems which have been designed by the Spartan Superway team and/or co-developed with commercial sponsors who have supported the Spartan Superway initiative over the past several years.

• What does it look like for a person walking by, and for a person using the system?



Depiction of elevated guideway and podcars associated with a solar-powered automated transportation system (rendering courtesy of Albulet Design)

• How it is grade-separated?

As shown above, the guideway is supported by small vertical members that are spaced approximately 10 - 20 m (30 - 75 ft.) apart.

Suspended vehicles

Another fundamental feature of the Spartan Superway is the highly advantageous configuration of suspended vehicles. Advantages include the following:

1. Maintenance is much lower, because, unlike supported systems, the guideway is not a trough and therefore does not collect debris, leaves, thrown objects, ice and snow (in other climates), etc.
2. Aesthetics are better, with much smaller visual impact
3. Solar is much easier, more economical to accommodate with solar attached to the guideway as compared to the requirement for two structures—the guideway and detached roof above—as would be the case with supported systems
4. There will be much better ride comfort, as riders will not experience “bobble-head” with the center of gravity above the rider rather than below
5. Suspended vehicles offer unobstructed views; the rail is not obstructing the rider’s view of the landscape
6. There will be no obstructions on the guideway, including people standing accidentally or deliberately in the pathway of vehicles

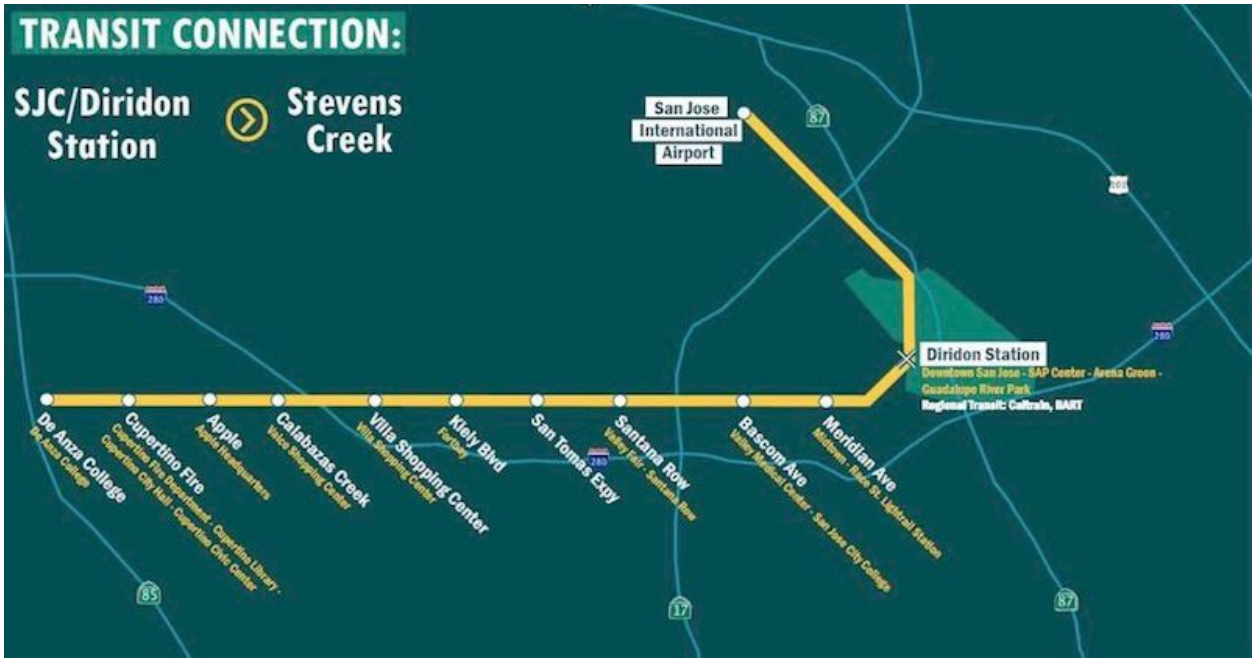
7. A proposed safety chute would make evacuation easier than walking on the guideway in the case of supported systems.

• What are its right-of-way needs?

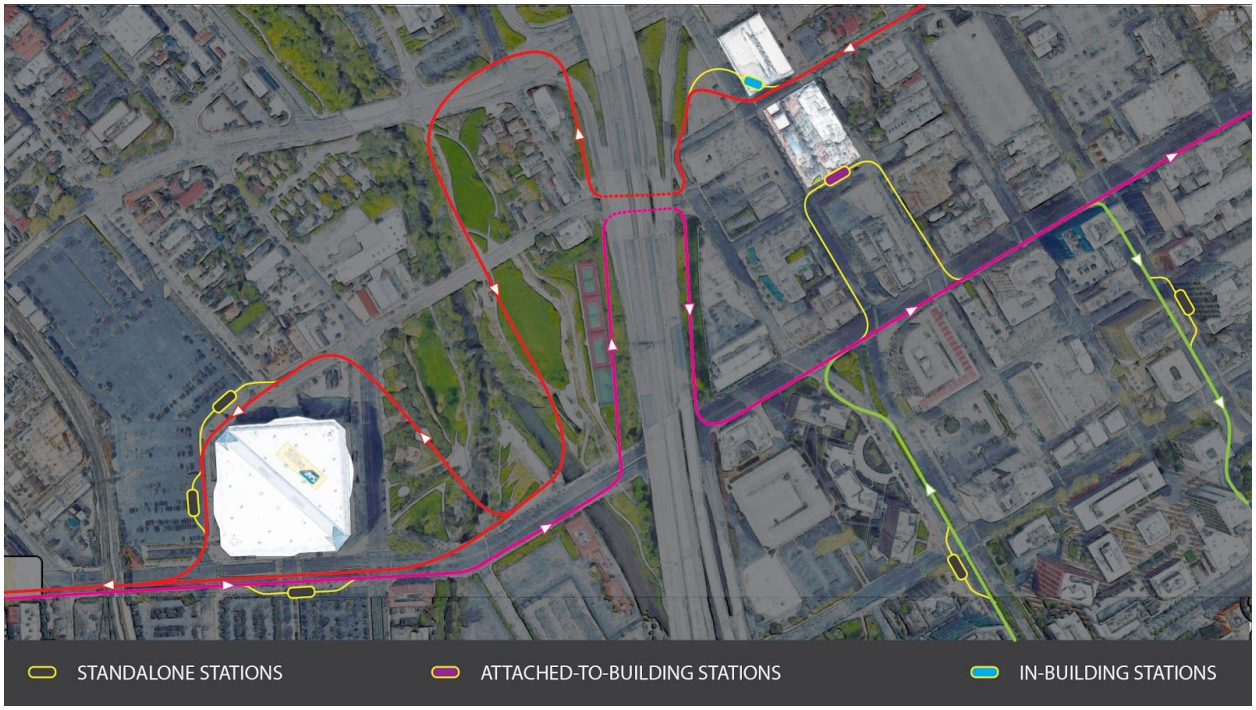
The guideway support posts are expected to be 16 - 24 in. in diameter, and could be placed where street lamp posts are along sidewalks. (Street lights could be integrated into the guideway, so there need not be additional posts for lighting). The guideway will be 8m to 10m above grade. The vehicles hang below the track and require an unobstructed cross-sectional area of approximately 3m in width by 3m in height.

Extensive network

The City's RFI provides a route map indicating a narrow transit corridor with minimal stations that might accommodate 5% of the ridership demand, a configuration which could never become economically viable, comparable to the current untenably low VTA light rail ridership described elsewhere in this document.



In contrast, the Spartan Superway will require extensive rights of way to bring riders within easy walking distance of their starting points and their destinations. The following small section of the route map is only indicative to demonstrate the extent of the rights of way that will be necessary to create a viable system. Routing, station placement, trip generation, and more will require extensive planning, community outreach, stakeholder coordination, entitlements, and financial development.



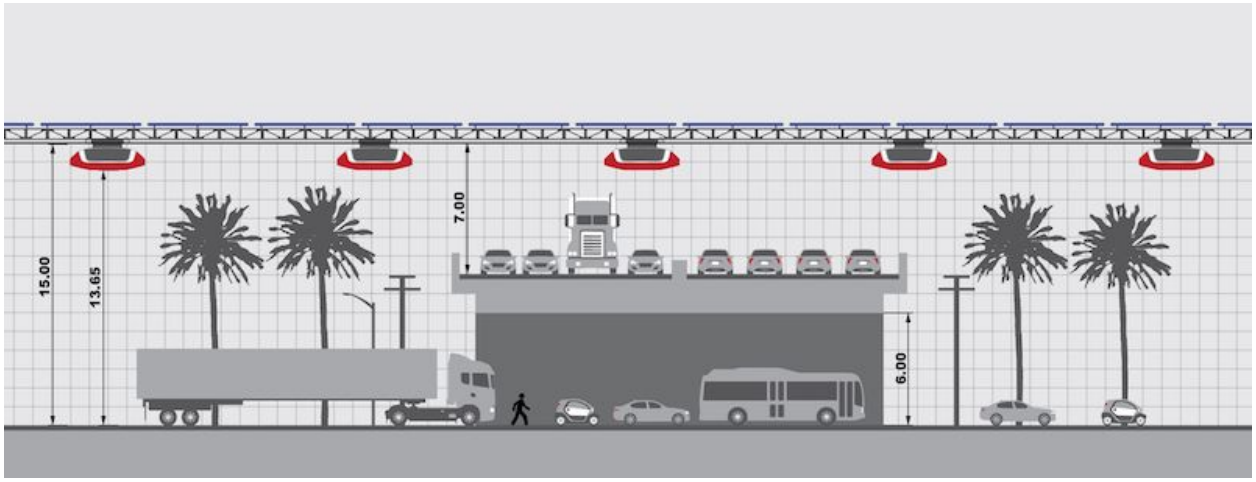
Example section of route map [map courtesy of GTF]

Solar air rights

Solar panels above the guideway will form a canopy ranging from 1m wide (minimally matching the beam width) to 10m wide (for added rain protection, shade, and exportable solar capacity), approximately centered on the guideway. In the photo at right, the center array is 10m wide, the ones at left and right are 6m wide. The solar arrays in this example are curved, creating an uplifting, aesthetically appealing appearance.

Freeway crossings

One challenge in downtown San José, as partially depicted in the route map above, is the dominance of two freeways (I-280, CA-87) which would interfere with an elevated system, requiring either fly-over bridges (illustration below, very costly) or tunnels underneath the freeways (also costly).



Fly-over bridge [illustration courtesy of GTF]

Fortunately there are several bridging sections along both of these freeways, which potentially offer economical and convenient pathways under the elevated freeways. To demonstrate this potential, a design is provided for a selected location which would minimize disruption of major thoroughfares such as Santa Clara Street.

Depiction of elevated guideway and podcars passing under Highway 87 at St. John Street (rendering courtesy of GTF)

Describe the stations/passenger access points

• What do they look like for a person walking by, and for a person using the system?

The stations will vary in aesthetics and overall shape depending on the specific location of the station, but most podcar stations will closely resemble a bus rapid transit station. Podcar

stations can be elevated above-grade with access for ADA compliance, at-grade, or even retrofitted into the 2nd floor of an office building for quick drop off and pick up. All podcar stations will be aesthetically pleasing and blend into their surrounding environment providing foliage and shade for user enjoyment and comfort. Where appropriate, small retail stores and special services may be incorporated into stations.

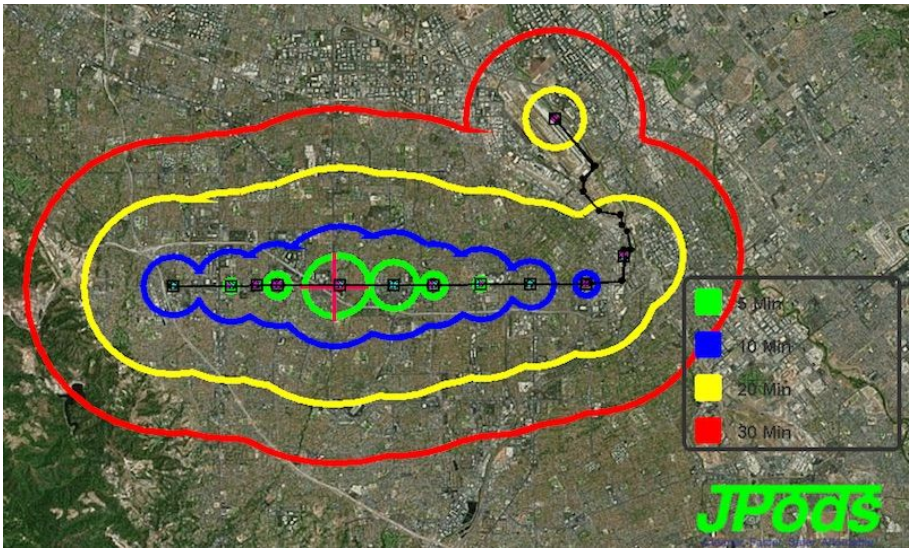
Example of an in-building station [rendering courtesy of GTF]

• What are the right-of-way and land needs of a station/access point?

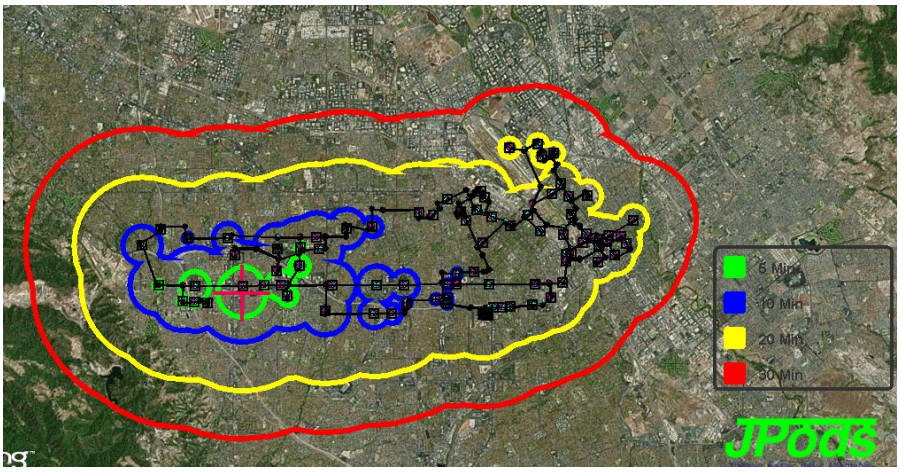
Off-line stations will be a major benefit to public and private buildings, thus it is anticipated that property owners will be eager to offer space for stations. Where public property is preferred, a station can be fit within one or a few parking spaces or even directly over a sidewalk.

• How will stations/access points integrate with the surrounding urban fabric on the Stevens Creek Line?

The network with its small off-line stations will be distributed to numerous destinations along the entire route, fundamentally not dropping riders onto hazardous congested street environments. For example, at the location identified as “Santana Row” there are large shopping centers set back on both sides of Stevens Creek. Multiple stations will be positioned within those centers, providing shoppers with direct access, to avoid walking across busy streets or through parking garages with very limited accommodation to pedestrians.



Linehaul



Robust Network
[graphics courtesy of JPods]

The figure above illustrates the limited coverage area of a line-haul / corridor-style transit system. The colored lines indicate how far a rider can reach on the system and/or walking in 5, 10, 20, and 30 minutes starting from the crosshairs at the center-left of the map.

• How will the system integrate with existing transit systems?

The Spartan Superway podcar system will provide user pick-up and drop-off points close to existing transit systems such as the VTA light rail and CalTrain locations (Diridon, Tamien). A sufficient number of podcars will be readily available at or near stations for peak transit periods.

• How will the proposed system connect with rail platforms (either BART or other heavy rail} at Diridon Station?

Knowing that very costly, extensive planning and design are underway for these systems at Diridon Station, a sophisticated and adequate answer to this question will require significant funding for engineering. Spartan Superway sponsors have professional staffing with deep expertise to address the city's requirements. Remembering that the target budget for a standard small stand-alone station is $500,000, one goal is to make such rail interfaces very economical, based on modular components that can be readily integrated with a variety of platforms and building configurations. Exemplary drawings of stations are provided within this document.

• How will the proposed system connect with airport facilities and parking at SJC?

As above, this question can be handled with funding of professional design work. In all such complex locations, multiple distributed stations will provide far better economic returns with greater usage and convenience, at both Terminals A and B, and at both parking garages, plus offsite stations at freight centers, remote parking facilities, and nearby hotels.

A high priority for this design question is airport security. Spartan Superway sponsors have professional staffing with deep expertise to address Federal, State and City requirements in this realm as well.

• How do the system's vehicles operate within the network?

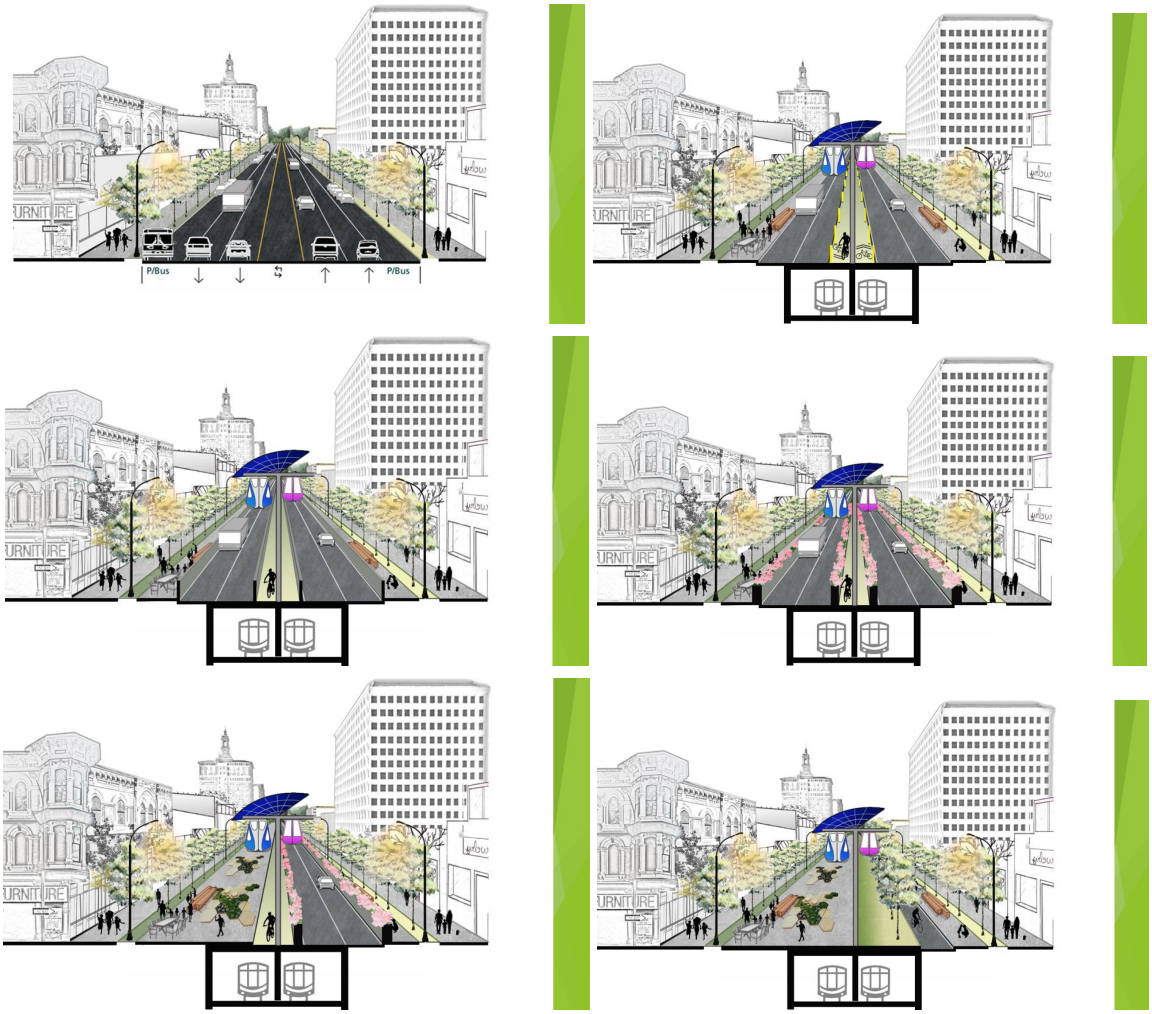
Podcars within the network will operate on-demand and autonomously. A master control room will monitor podcar routing, location and travel.

• Is there level boarding?

Yes, passage between the station platforms and the podcars will be on the same level, with full wheelchair compliance. Normally access from the street will be by stairs or elevators, but depending on the specific location, there can be level (at-grade) boarding. However, this will require a longer station area for ramp-up and ramp-down of guideways.

• How will the system be designed to be compatible with "complete streets" if the system is aerial?

As stated above, the vertical columns will be minimal and thus will interfere minimally with pedestrian, scooter, bicycle, or vehicular traffic. The street design can be "dialed in" to accommodate the entire spectrum of street completeness -- from vehicular dominance to human-friendly natural park-like settings.



Toward Greenspace [Drawings by Ingrid Lopez, courtesy of INIST]

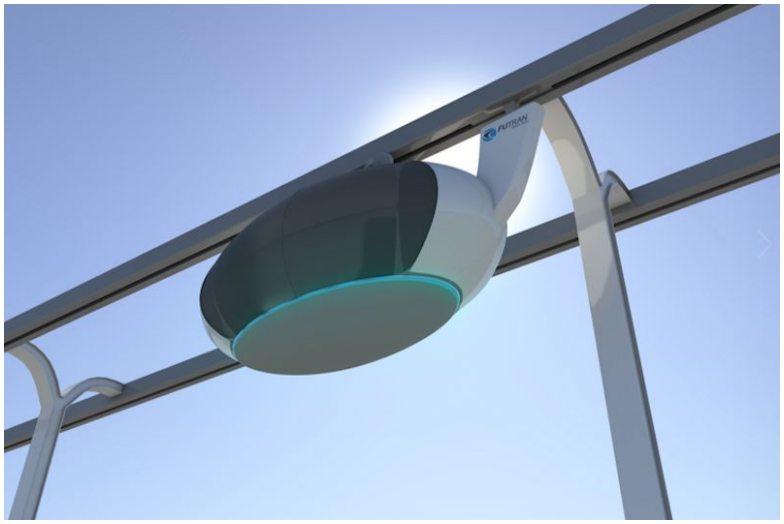
• If the main guideway is aerial or underground, how do passengers get to grade level?

Since the guideway is above-grade, passengers will either be able to transverse stairs or ramps (ADA) and elevators where needed to reach the podcar entrance. Stations are also planned to become retrofitted into buildings where the guideway can enter the building mezzanine level to pick up and drop off passengers — at an office building, mall, stadium, or other popular destination.

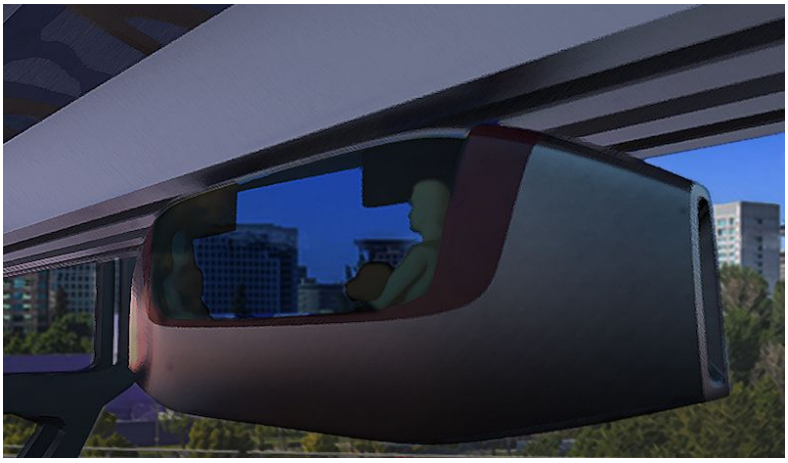
Describe the vehicles

• What do they look like for a person walking by, and for a person using the system?

Podcars are sleek, aerodynamic, and provide minimal eye intrusion for persons walking by. Podcar windows will utilize programmed electrified frosted glass to provide privacy for residents for whom the podcar travels too closely. Conceptual examples of what the pods could look like are shown below.



[Rendering courtesy of Futran Group]



[Rendering courtesy of GTF]

[Rendering courtesy of INIST]

Equally important will be the extraordinary view for riders. Instead of looking at asphalt and congestion, riders in elevated vehicles will have wide views of natural landscapes. Views of climate-smart city living, as afforded by the calming of streets, will be exhilarating.

• How many passengers and how much baggage can fit in a vehicle?

Typical podcars can fit 4 to 6 passengers with carry-on baggage. Podcar seats can be moved into an upright position if larger baggage or bicycles are needed to be transported. Double or triple-coupled podcars or larger bus-style podcars are also possible to rapidly move passengers from peak-traffic areas to their destinations.

• How do passengers board and alight from the vehicle? How long does it take?

Passengers board having used a cell phone app or local kiosk to purchase a ticket. Passenger load out and load on would typically take 40-60 seconds.

• What is the top speed, and how quickly is it achieved?

We anticipate that vehicles on the guideway will move at approximately 25 to 40 mph non-stop in urban settings (which is nearly twice as fast as ordinary stop-and-go surface traffic) ... and faster (60 mph) for inter-city travel. The primary constraint is the speed at which it is comfortable for riders to navigate corners between urban streets. Acceleration to 40 mph (18 m/s) can be achieved with about 75 meters of ramp in five seconds. Of course podcar are agile because loads are very small in comparison to trains.

• Are vehicles autonomously operated?

Yes, vehicles will operate autonomously on the guideway.

• What do vehicles do when they are not operating?

Non-operating vehicles will sit at stations or be located on parallel ‘sidings’ near stations, especially those with heavy passenger utilization.

• Do the vehicles require space off the guideway for storage?

No. The guideway is designed to have additional ‘sidings’ for podcar station in between peak hours or are used to move passengers quickly from peak origin locations.

• How are vehicles powered (e.g. battery, catenary, third rail, etc.)?

Podcars are powered via a third rail that is supplied energy from solar panels (with local grid connections during night time). Podcars will have backup emergency batteries in case the third

rail has any issues. Local microgrid storage will also provide energy during night time if the electricity grid is not available.

• Do the vehicles require a maintenance facility? If so, describe the facility requirements (e.g. number of facilities, connection to the system, size of facility, etc.).

Maintenance facilities will be required, but can be placed in industrial areas away from major travel locations. The number of maintenance facilities will scale depending on the size of the network and the number of podcars. There will be guideway connections to these maintenance stations.

• Do the vehicles need to move or be moved in order to be redistributed to meet demand on a regular basis? Describe how this is performed {by operator, autonomously, by user, etc.) and how often.

High demand travel locations will be studied and analyzed providing necessary ridership data to determine how many podcars will need to be at a particular location and when.

• Provide pictures or renderings of all physical elements of the system

See illustrations throughout this document. Detailed drawings of system components by Spartan Superway and its commercial sponsors are proprietary and can be made available for inspection.

Operational Elements

• Describe the operational model

Riders can pre-book reservations using a phone app for a specific time at the nearest station, the same as ride-hailing services, or they may proceed to the station and book their ride from a station kiosk. Their podcar is then routed automatically to that station, with sufficient inventory of vehicles in the system that theirs will arrive within approximately 2 minutes. Then as they enter the platform by stairs, ramp, or elevator, their podcar is identified by signage, they enter the cabin (whether shared or private) and proceed non-stop to their destination.

• Can the vehicle travel outside the grade-separated guideway (e.g. provide point-to-point service utilizing city streets?)

No. Guideway networks and stations will be designed to give a user no more than a five to ten minute walk to or from the nearest podcar station. Dual mode systems are not economically viable and cannot meet safety or security requirements.

• What is the potential travel time from SJC to Diridon?

Given that a podcar travels non-stop at 25 mph throughout the network, travelling 5 miles will take approximately 12 minutes.

• What is the potential frequency of the service?

This is an on-demand system that provides users a 'Uber' or 'Lyft' experience where the user determines when a podcar should come to them, typically 2-5 minutes.

• What is the potential passenger carrying capacity?

18,000± passengers per hour along any given guideway section. Overall system capacity will depend upon the number and size of stations. For example, at a high volume location (e.g., a stadium) the capacity per station might be:

10 podcars (station bays) × 6 pax/podcar × 2 loadings/min × 60 min/hr = 7,200 pax/hr

• How can capacity scale up if demand exceeds initial supply?

The network can be extended and more stations can be installed. Podcars can be added to the system along with 'sidings' that allow podcars to wait at ideal locations for passenger pick up.

• What is the dwell time of a vehicle at a station?

Approximately 1 minute or less. If a handicapped passenger boards, the time may increase.

• What is the reliability of the service?

Very reliable. This system uses on-demand features, allowing users to order a podcar when ready, and off-line stations are utilized to reduce congestion for those passing by a station.

• Can the service be ticketless? If so, how will fares be collected?

Yes, the service can run via a phone app to provide ticketless ridership. However, there will be additional methods for accessing a podcar similar to the "Clipper Card" and other popular compatible apps or by using a station kiosk to obtain a ticket.

Current Status of Concept Technology

• Provide a description of the current development status of your concept (e.g., conceptual, design, development, pre-production testing, or production).

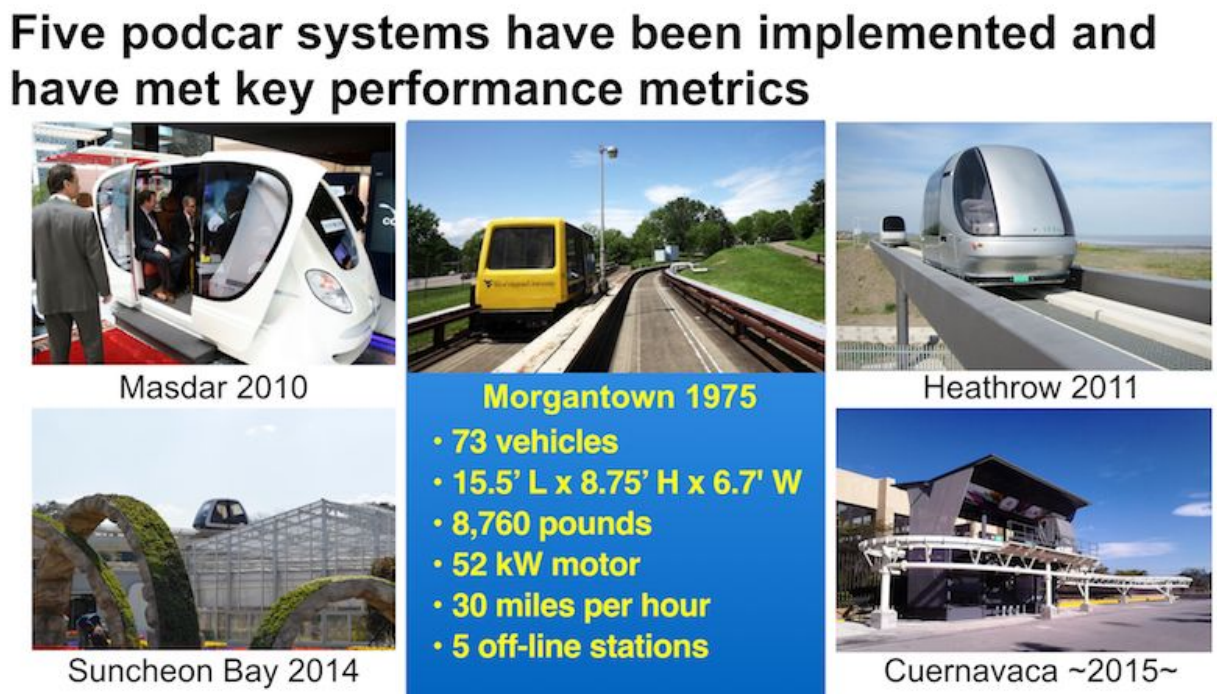
The current development of the Spartan Superway system includes prototyping and testing on a variety of scales (1/10, ½, and full scale). One Sponsor has a 1 km test track that has been operational for three years.

• Include a schedule for development of a fully deployable system, if applicable. Identify key assumptions for this schedule.

- Route and system planning (8 mo.)
- Public comment (3 mo.)
- Engineering development (guideway, vehicles, controls, etc.) (24 mo.)
- Engineering validation (3 mo.)
- Engineering verification (6 mo.)
- Engineering certification (12 mo.)
- Implementation planning and permitting (20 mo)
- Construction (13 wks/km) per crew
- System testing (6 mo.)
- Initiation of passenger service

This schedule represents a 5-10 year process. The estimated duration of these tasks assumes appropriate levels of funding and professional teams with suitable expertise. Fast-tracking can be achieved to some extent by doing certain steps in parallel. Acceleration of construction can be accomplished by establishing multiple teams. Ultimate buildout is likely to take 20 years with an extensive network throughout Silicon Valley.

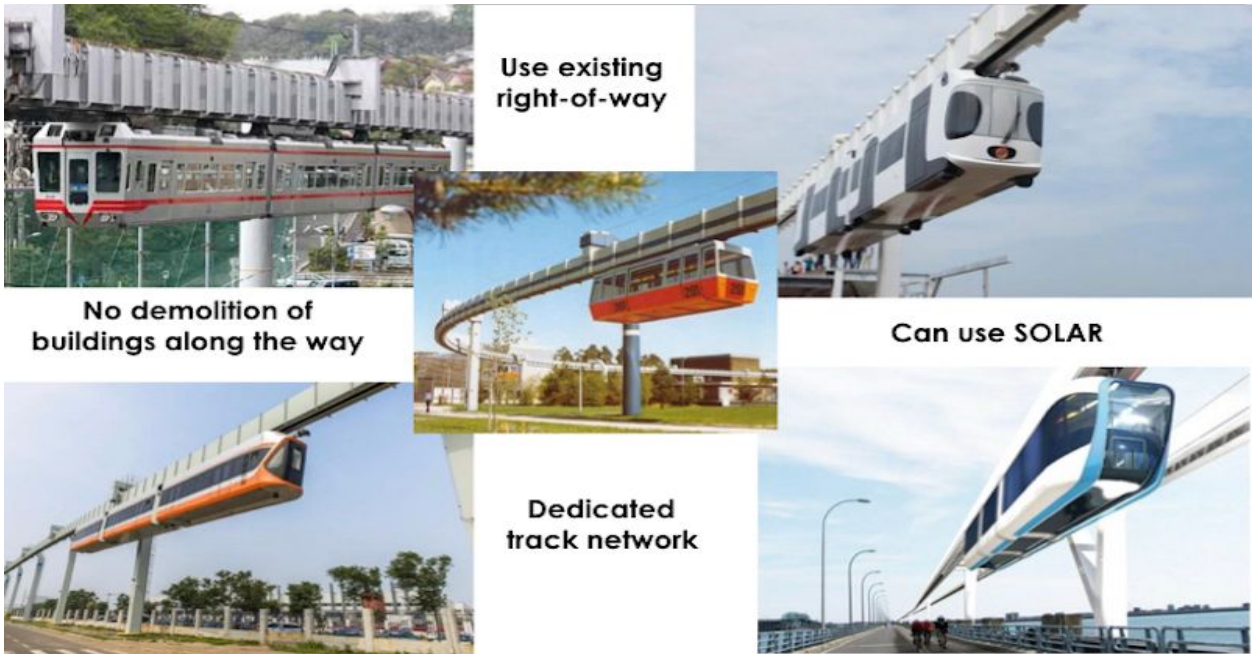
• Include examples of successful similar implementations if available.



https://en.wikipedia.org/wiki/Personal_rapid_transit

Suspended systems

Suspended transit systems are safe and viable, having been in use for over 100 years, beginning with the Wuppertal system which has been in operation since 1901 with typical ridership of 80,000 passengers per day.



• Identify areas of notable risk that would be investigated further.

Sound and visual intrusion mitigations will be investigated further.

Concept Requirements

• Describe key requirements for implementation of the system (e.g., infrastructure, utilities, regulatory and/or policy) and estimated length of time required to implement the system.

We see the key requirements for implementation to include:

1. Identify and streamline regulatory / entitlement requirements
    a. Investigate compatibility of private sector interests (especially financial institutions) to establish a regulatory framework which meets their requirements. Then...
    b. Adopt modifications to ASCE standard 21-13 created in 2018 for Automated Transit Networks, and/or ..
    c. Adapt ASTM International Technical Committee F24 standards on Amusement Rides and Devices

2. Establish a sustainability metric that levels the playing field to require all proposed systems to deliver systems with 100% renewable energy
3. Vigorously pursue public-private financing
4. Work collaboratively with utility companies and special districts to fast-track infrastructure installation
5. Streamline bid process
6. Access funding from cap and trade carbon offsets
7. Develop public private partnerships for operation and maintenance
8. Integrate with Clipper Card to manage fare collection
9. Work with PG&E for solar energy grid integration

• Could the system function in either an aerial or underground configuration? Could it transition between aerial and underground? What are the maximum allowable grades for the system to ascend/descend?

The system operates above-grade with the exception of transversing stations and potentially passing under a freeway as illustrated in this document. The system can be designed to ascend/descend at approximately 15 degrees, exceeding grade limitations of conventional rail and even automobiles.

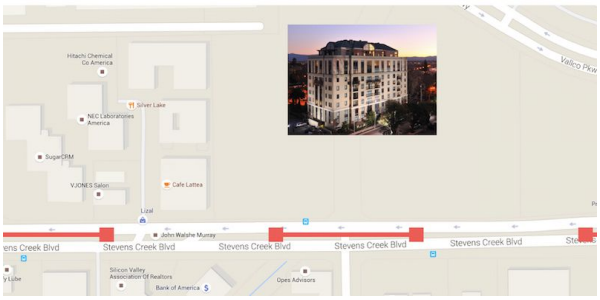
• Could the system be extended in the future?

Yes. The network is designed modularly allowing for future expansions. Note, the Spartan Superway's use of <u>off-line</u> stations means that additional stations can be added to the planned network without impacting the throughput of the system. This is a significant advantage over corridor or line-haul systems where additions of new stations along the line ***<u>decrease</u>*** throughput, because additional stations means that vehicles must stop more frequently to service added stations.

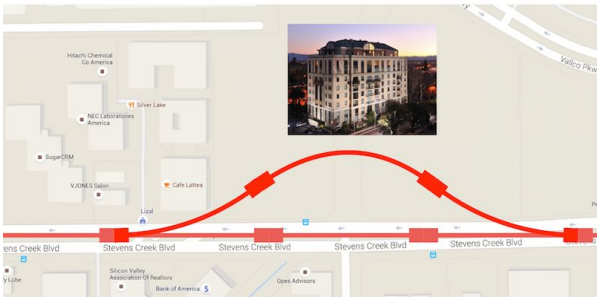
• Could stations be added to the system in the future?

Yes. Expanding the network will allow for new stations to be added at any time with minimal disruption. A robust network has multiple pathways to most destinations, so a short segment can be closed and riders routed around a construction project within the system. Two guideway segments would be detached, new "Y" sections installed rapidly, and the system can be reconnected directly, as shown here.

Stations can be rapidly added for new development



Stations can be rapidly added for new development



• What are the maintenance requirements for the guideway, vehicles, stations, etc.?

Guideway maintenance will be accomplished with specialized on-track vehicles with movable personnel platforms, automated and manual armatures for painting, trimming trees and washing solar arrays, and push/tow mechanisms.

Vehicle maintenance facilities (as further described herein) will be placed in industrial areas away from major travel locations. Vehicles requiring maintenance will be automatically routed to these maintenance facilities.

Stations will employ security personnel and surveillance equipment. They will also have maintenance crews operating on a regular schedule.

• What is the cost per mile to deliver the fixed infrastructure needed to operate the system, not including stations and land acquisition costs?

Speculation about cost is premature for this level of inquiry. Guideway costs -- substantially less than $10m per mile —- will be a small fraction of the cost of at-grade light rail and orders of magnitude less costly than tunneling. Cost of geotech (relocating utility infrastructure — electricity, water, sewer, telecommunications, etc.) will be minimal in some locations and extensive (conceivably several million dollars per mile) in other cases. The solar canopy will be bankable and cost-competitive with current commercial-scale solar installations, with costs varying according to canopy width.

• What is the incremental cost of a station and/or access point?

The goal is to build small modular stand-alone stations at $500,000 or less. This will not be possible in the beginning but over time there will be powerful motivation to keep costs low in order to realize broad community-wide access.

• What is the cost of the vehicle fleet needed to begin operations?

Again, speculation about cost is premature for this level of inquiry. Understanding that a given vehicle will provide service to easily 50-200 people per day, obviously the system operator can afford to spend much more than the price of an automobile to optimize utility and quality.

• Summarize the capital costs for delivering the full system for each potential project, Airport Connector and Stevens Creek Line.

Capital cost is beyond the scope of this inquiry, but furthermore, initial cost cannot be the only concern of either the government sector or the banking investment community. A core issue is revenue, which is driven by *ridership*, and the key to that ridership is wide, convenient economical *area* coverage, not corridors.

A linehaul corridor between the Airport, Diridon Station, and De Anza College (via Stevens Creek Boulevard) with only a few stations would be an economic disaster, capturing only a small portion of the potential ridership, and will likely mimic VTA's poor economic performance of approximately 9.3% overall farebox recovery and 7.6% recovery for light rail.

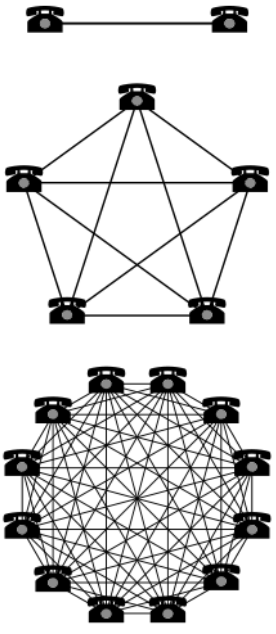
> **Grand jury report blasts VTA for inefficiencies, poor oversight**
>
> "... VTA is losing about $9.30 per rider...
>
> "The light rail line extends more than 42 miles, running from Mountain View south through much of San Jose, yet it has failed to link to many obvious destinations such as jobs centers, shopping districts or the San Jose International Airport."[8]
>
> "Farebox recovery [nationwide] for light rail systems (combined bus and light rail data was not available) ranged from 7.6% to 47.2% with VTA's light rail system farebox recovery of 7.6%, the lowest in the nation, requiring taxpayers to subsidize 92.4% of the cost of light rail service."[9]

Spartan Superway has identified approximately 100 significant ride generation locations in the general reach of the area proposed for consideration in the RFI. Once $500,000 per station is achieved, for example, 100 stations would cost $50 million, only half the cost of the single Millbrae station ($70m at the time, $100m in current dollars).

• Assume six stations on the Stevens Creek Line and three stations on Airport Connector, plus Diridon station for both routes.

No. Six stations is not tenable. Viable economic performance depends on a robust network.

> "A network effect (also called network externality or demand-side economies of scale) is the effect described in economics and business that an additional user of a good or service has on the value of that product to others. When a network effect is present, the value of a product or service increases according to the number of others using it.[10]



[8] Noack, M. (2019, July 8). Grand jury report blasts VTA for inefficiencies, poor oversight. Retrieved from https://www.paloaltoonline.com/news/2019/07/04/grand-jury-report-blasts-vta-for-inefficiencies-poor-oversight .
[9] INQUIRY INTO GOVERNANCE OF THE VALLEY TRANSPORTATION AUTHORITY. (2019, June 18). Retrieved from http://www.scscourt.org/court_divisions/civil/cgj/2019/CGJ VTA Final Report - 06.18.19.pdf
[10] Network effect. (2019, September 8). Retrieved from https://en.wikipedia.org/wiki/Network_effect

• Provide a high-level estimate of the ongoing operations and maintenance costs, as well as equipment replacement costs and schedules.

Spartan Superway is offering the City a pathway to success by providing insights and deep financial / economic / technical expertise to develop an economically viable project topology. In collaboration with City staff and industry experts, questions of this nature can be framed and resolved in such a way that the key stakeholders will be able to deliver economical services, minimize risk, and perform according to City requirements.

Business Plan

• Describe the business plan to deliver and operate the proposed project. The City is looking for innovative ways to fund and operate new transit systems.

We are very pleased to learn that the City is looking for innovative ways to fund and operate public transit, as intense new social and political realities are reshaping transportation policies. Climate change is no longer an abstraction. President Trump is manipulating the system to undermine California's emissions standards which were intended for climate mitigation. The Federal and State governments are pulling back from transportation project financing. Traffic congestion in Silicon Valley is unbearable. Autonomous vehicles are competing for space on the road, with the prospect of making traffic even worse for people walking or biking on urban streets. Downtown San José is going vertical. In the wealthiest, smartest community, legendary for innovation, VTA is in the spotlight and struggling with low ridership and the worst economic performance of any transit system in the most endowed country in the world. What's wrong with this picture?

The private sector is looking for large economically viable infrastructure investments. With innovatively structured public-private partnerships and cost-effective technology, investors can be attracted to new transit systems. With its sponsors and affiliates, Spartan Superway can support the City with the necessary expertise to develop a framework of policy, procedures, and incentives for the private sector to participate.

With the support of faculty and students in San José State's College of Business, College of Social Sciences (e.g., Department of Economics, Political Science, Urban and Regional Planning) and our industry advisors, the Spartan Superway can assist the City to create a framework and business plan that works for the City and their private sector counterparts in a Public-Private-Partnership.

Additional revenue generation, besides ticket fares, can include paid advertising and marketing at stations, in podcars, and along the guideway in well-traveled areas, retail at station stores, and more.

• Who will operate the system once constructed (VTA, the builder, PPP, other)?

Given VTA's track record of managing a transit system[11], it seems that an improved model for operation is needed. Spartan Superway can assist the City in researching and adopting worldwide best practices for transit system operation.

• What is the passenger fares strategy?

As noted herein, a revolution is taking place in the way public transit is financed. Spartan Superway is working actively with experts in finance, transportation policy and planning, etc. We can bring this expertise to the table to assist the City DOT and private parties to develop ridership projections, ridership guarantees, and other instruments to establish bankability of the network infrastructure and operations going forward.

• What are the expected fares for passengers to use the system?

In a free-market framework, riders would pay fares sufficient for capital recovery, operations costs, and maintenance costs. Thus the key to low fares is the combination of low capital cost, low operating and maintenance cost, and high ridership. The first step to low cost is new technology; the key then to high ridership is a widely distributed network with conveniently located stations. The Spartan Superway can assist the CIty to create an innovative framework that encourages these ingredients.

See also the response above for the passenger fares strategy.

• What is the strategy to maximize ridership?

In a nutshell, hundreds of low-cost off-line stations in a true mesh network with small podcars configured for the customary patterns of ridership (i.e., 1-5 people riding together in a car to a common destination).

• Can capital and operations costs be funded through passenger fares?

Yes, provided that the above principles are realized.

• Describe opportunities or strategies to maximize farebox recovery and/or offset operations and maintenance costs.

As above, farebox recovery is dependent upon a complete reconfiguration of the topology of public transit in Silicon Valley. This is the kind of question that could be subjected to in-depth analysis within the framework of the pending Spartan Superway grant, provided that the City responds rapidly to the offer of collaboration.

[11] INQUIRY INTO GOVERNANCE OF THE VALLEY TRANSPORTATION AUTHORITY. (2019, June 18). Retrieved from http://www.scscourt.org/court_divisions/civil/cgj/2019/CGJ VTA Final Report - 06.18.19.pdf

Impacts

• What are potential negative impacts during construction?

Traffic congestion due to detours. Temporary shut-offs due to utility relocations. This can be mitigated by undertaking construction during non-busy hours. Assembling system components remotely and installing large sections when traffic is light.

• What are potential negative impacts during operations?

Potential negative impacts include:

1. Noise
2. Visual intrusion
3. Security at stations and in podcars
4. Privacy

• How can negative impacts be mitigated?

1. Use of noise mitigating materials in the guideway
2. Engage the local artist community in dynamic exhibits and design
3. Security cameras in stations and podcars
4. User education
5. Security and maintenance staffing at stations
6. Design podcars (cabins) with privacy screens

• What might the community outreach and engagement strategy look like?

Spartan Superway has engaged in community outreach with local elected officials for over five years. One of our sponsors, Encitra, has developed a robust 4-dimensional visualization tool which has advanced considerably since it was employed as a tool for the San José DOT Almaden-Oakridge Urban Village study.

The Spartan Superway team has expertise in urban planning, business, and the social sciences, architecture, and they will contribute in this area.

... in Conclusion ...

The Spartan Superway program at San José State University has been deeply immersed in research and development of sustainable ATN (Automated Transportation Networks) since 2012, and is prepared to provide the City of San José and stakeholders with the expertise and tools needed to create the policy framework and develop the technology -- a Green Vision for carbon-free public transit, a Vision Zero for collision-free public transit.

🎶 **Happy trails to you ... till we meet again** 🎶

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