Spartan Superway Response to City of San José
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Bid Contact

Jill North
Innovation Program Manager
DOT
650-451-8065
jill.north@sanjoseca.gov

Responder

Spartan Superway
San Jose State University, Mechanical Engineering Department
888-482-2378
spartansuperway@gmail.com

Prepared by

AJ Snytsheuvel & Eric Hagstrom

Summary

The Spartan Superway is a research program performed by the Mechanical Engineering Department at San José State University. The program focuses on developing technology for Automated Transit Networks (ATN) with the added benefit of providing an avenue for multidisciplinary students within the College of Engineering to develop practical engineering skills. The project itself has reached a point where the next step is to develop a full-scale model to begin testing for system fatigue, noise, power consumption, as well as practical system capabilities.

The Superway consists of car-sized or minivan-sized vehicles suspended from a network of elevated guideways, which in turn have photovoltaic solar panels mounted above them. The solar arrays provide sufficient energy for the entire transportation network. The Superway and other Automated Transportation Networks enable people to travel between any pair of stations in their network without waiting, line transfers, or intermediate stops. ATN thus offers a ride experience comparable to personal automobile but with significant advantages – reducing parking, accidents, and congestion, while liberating urban space for pedestrians, bicyclists, sidewalk cafés, and farmers' markets. The Superway has two key features that increase efficiency: on-demand pickup through mobile phone application or in-station kiosks, and off-line stations providing non-stop origin-to-destination for all passengers.

There is a section of land that has been donated to the project at 1555 South 7th Street, San José, CA 95112. Design elements have been drawn up to envision and refine a project for this site. Some preliminary designs can be found below in Figure 1. This project would operate a small number of vehicles (3-5) for the purpose of full scale testing. Testing would be done during the hours of 9AM-7PM. Once implemented as a full scale service, such a system would be capable of operating 24/7 with primarily remote human oversight and mobile security personnel.

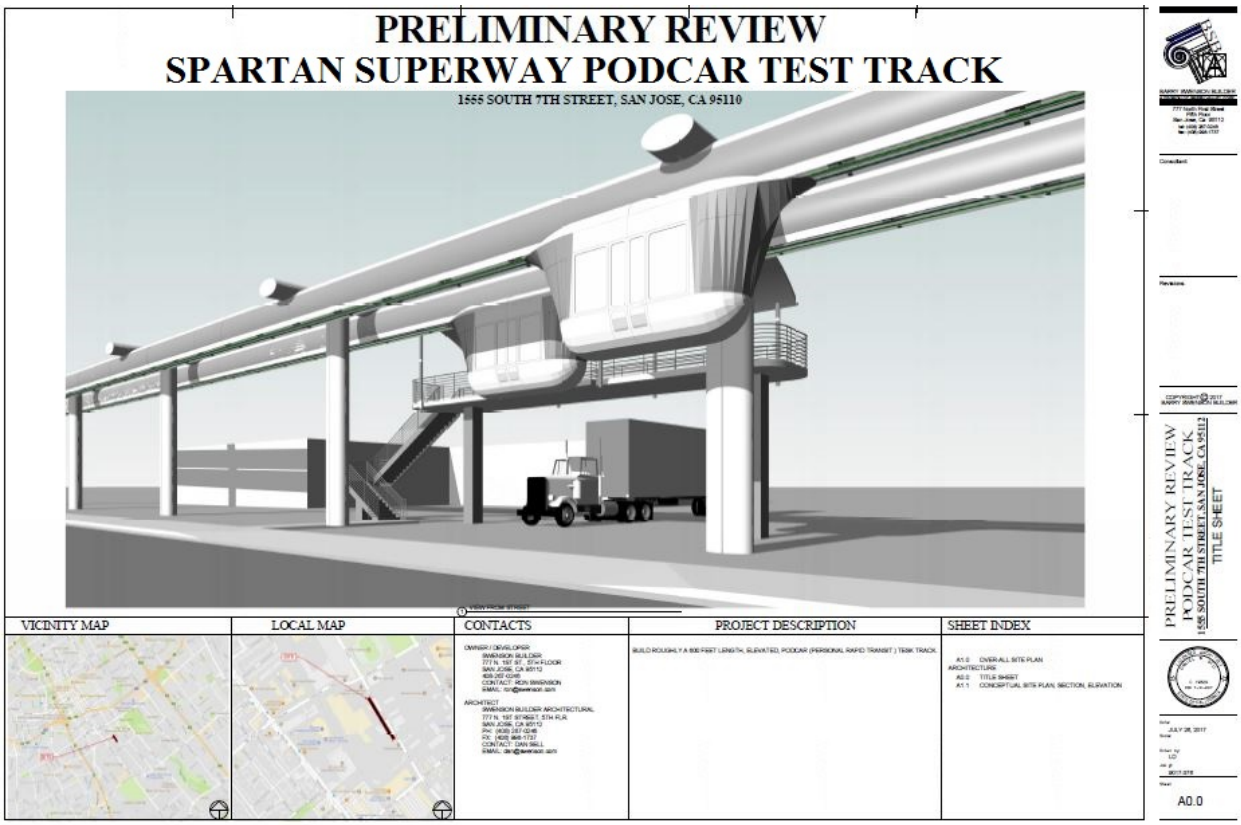

Figure 1. An architectural drawing for preliminary review.

Response Objective

This response is written to the City of San José with the main intention of providing information about the potential of our system. At our current stage of development, we are advocating for a project that is specifically used for testing purposes. From the location of the test site, we would eventually like to expand to a fare-oriented network. For the purpose of this document, it would be safe to assume that the phrase “pilot track” or “pilot project” refers to a project for the purpose of student testing, and the phrase “expanded network” refers to a fare-oriented network that would provide a transit service.

Project Timeline

Preliminary design work is nearing completion and will be submitted to the City’s Planning Department in early August. Following a preliminary review, we expect to learn what exact types of permits will be required to begin construction. The results of the preliminary review can greatly alter our expected timeline to begin construction and testing. Once entitled, a full-scale unit will be fabricated and shipped to site. On-site construction has been estimated to take about 14-28 weeks depending upon the experience of the construction crew.

The duration of testing has yet to be determined. The intention is to operate as long as students have the ability to gain knowledge on these types of systems.

Location

The proposed location of the pilot concept will be at a reserved property located at 1555 South 7th Street, San José, CA 95112. This property was recently vacated by the City and transferred to Piedmont Partners and Swenson Builders who have allowed Spartan Superway to use it for a pilot project. On the 1555 South 7th Street address, there is a long strip of land that runs parallel to 7th street. The Superway pilot concept is designed as a 180 meter long track with one station and two switches along the guideway. The pilot concept will begin a few meters north of the southern property boundary, extend over a central gate, and end a few meters south of the northern boundary. An elevated station will be constructed above the central gate. Refer to Figure 2 for a site map.

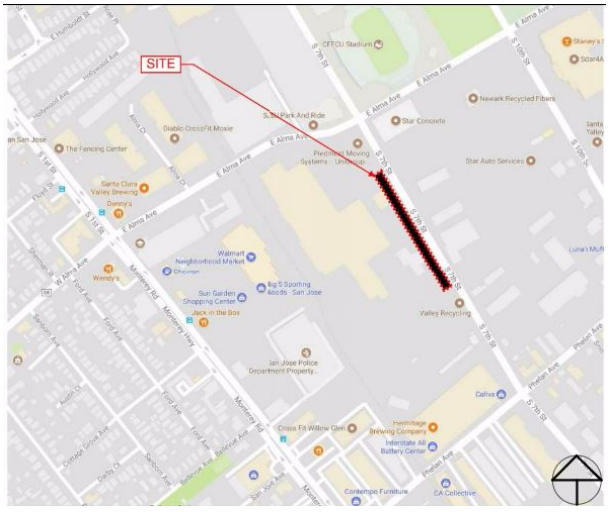

Figure 2. Above is a site map for the project

The property schematics list a few “proposed public easements” that would be underneath the track. It has been determined that these listed easements are fire hydrants. The Superway footings would avoid them, with more than sufficient clearance for city personnel to access the fire hydrants at any time.

Specific Technologies

There are three key structures that the Spartan Superway is comprised of: the infrastructure on which other Spartan technologies operate, the podcar and bogie systems, and the stations.

From the bottom to top, the infrastructure contains concrete footings and tie-down clamps that stabilize the vertical support columns. The vertical support columns are steel and concrete composite and currently patent-pending. The columns are designed to be modular so different guideway elevations can be achieved, and the modular vertical columns can be interlocked together with sheet metal clamps that provide additional stability. Horizontal supports will resemble a T-shape, allowing podcar traffic to flow in both directions as seen below in Figure 3. Suspended from the horizontal support structures is the guideway on which the podcar travels along. Assembled along the guideway is the racking system for solar panels (not shown in Figure 3).

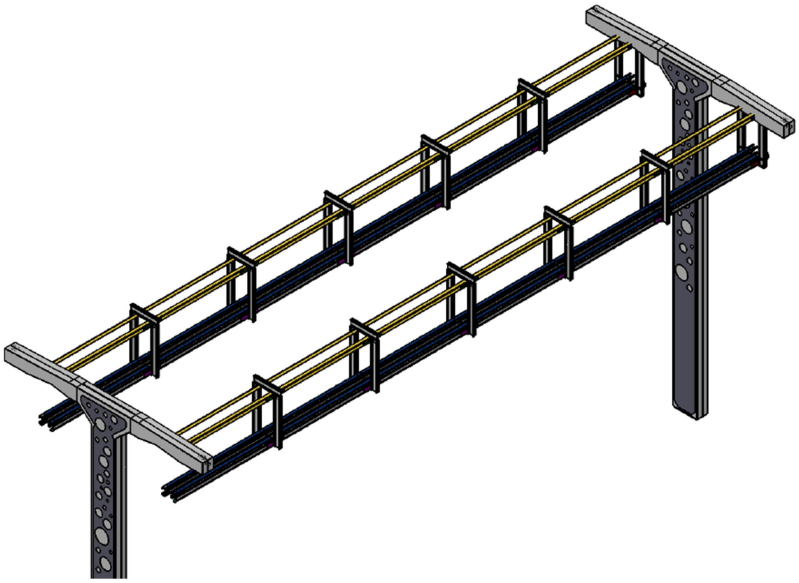

Figure 3: Vertical and horizontal supports for the guideway

The bogie system acts as a chassis that contains the steering, propulsion, braking, suspension, and control software system for the podcar to function correctly. There are two slave bogies that are connected together and tethered to a single master bogie. The slave bogies provide a connection point for the suspension system of the podcar, while the master bogie houses the propulsion, braking, steering, and control software systems.

The podcar is designed to hold four to six passengers depending on passenger luggage. There have been several design concepts over the years, and the most recent concept for preliminary review can be found in Figure 4.

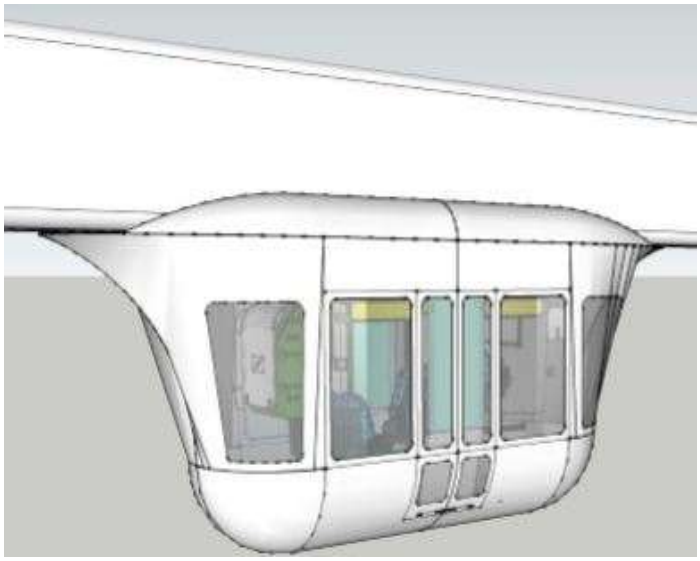

Figure 4. Preliminary podcar design

The stations can be versatile and transformed to fit into a variety of locations. A station can either be at-grade where the guideway will begin to decline to reach it, or the

station can be elevated where the guideway elevation does not change, as showcased in Figure 1. There can be multiple in-station guideway configurations for both types of stations, such as parallel or series. These can vary depending on the location and size of each station. Elevated stations can be constructed when at-grade real estate cannot be altered. In addition, elevated stations can either be integrated or retrofitted into a building's second floor if the building's transit demand is high enough for Superway technologies.

Alignment with City Goals

This particular pilot project serves the purpose of furthering the development of Superway technologies. The development of this project will help better understand PRT systems, which in turn are expected to achieve the following goals. A full-scale expanded network would have the intention and potential to actually achieve these goals beyond rhetoric:

Safety is a crucial issue for transportation. Currently, trolleys, trucks, buses, automobiles, pedestrians, and bicyclists all compete on the same plane, resulting in more than a million fatalities and several million injuries around the world every year. The Spartan Superway is designed on an elevated guideway to eliminate collisions and traffic, and thereby provides room for bike paths and pedestrian walkways.

Environmental problems associated with transportation include greenhouse gas emissions (GHGE) from all forms of vehicles[1], which are some of the leading causes of climate change. It is essential to eliminate our dependence on fossil fuels and instead focus on renewable energy to combat climate change. The Spartan Superway provides a solution by being completely solar powered, therefore reducing emissions, while also supporting the renewable energy industry.

Convenient public transit is rare due to infrequent, slow service, and wide separation between origin points and stations. The Spartan Superway is faster because passengers can go directly to their destination, with minimal wait time in between stops. ATN vehicles are on demand and available 24/7, and a user can schedule a vehicle at any time by use of a mobile app or in-station kiosk. The first and last mile of transportation is what hinders many from taking public transit. The Spartan Superway network will connect to other transit systems and extend to communities lacking frequent public transit, thus reducing the need for cars to bridge the last mile gap between homes and stations.

Economical transit is an issue due to expensive fares that compete with cheap gas prices and parking fees. Also, there is a growing need to replace aging transit infrastructure, which requires investment and support. The Spartan Superway will have fair, dynamic pricing to incentivize ridership. This will also provide access for lower socioeconomic communities whose citizens cannot afford the increasing costs of transit or car ownership. There must be fare integration with other transit agencies to make transferring easy and affordable.

[1] This includes electric vehicles, which largely rely on grid power, which for the most part is generated from fossil fuels.

Livability in cities remains a challenge, especially for transportation. Cars are noisy, create smog, and they waste enormous amounts of space. The Spartan Superway will allow more relaxing, green environments for social spaces, as well as health benefits from cleaner air. Because Superway vehicles operate 24/7 like a city-wide fleet of automated taxis, the need for parking lots and structures is reduced, and this creates space for affordable, transit-oriented housing development. Additionally, automated transit provides passengers with more time to socialize and relax rather than adding stress as a driver having to fight congested traffic.

Data Sharing

As a student project conducted by San José State University, there are many opportunities to provide public data on this project. Most results from research can be found in a number of reports sponsored by the Mineta Transportation Institute as well as published student reports found on http://spartansuperway.blogspot.com/. The International Institute for Sustainable Transportation also has a library of information that can be found at http://www.inist.org/library/.

The results of the pilot project will be published on either or both websites and could easily be made available to the City. Test results will consist of data that includes, but not limited to, achieved speeds and accelerations, vehicle occupancy, dwell time, vehicle availability, system fatigue, noise, vehicle response time, and energy usage.

Ease of Implementation

The Superway's structure will include concrete footings in which the 9 meter vertical support columns will sit. A concrete truck will be required to create these footings. The vertical support columns will be supported by standard sheet metal clamps. The guideway will extend 18 meters from column to column. Standard sheet metal sleeves will attach the guideway sections and provide stability. To ensure ease of assembly, the guideway will be pre-fitted with the solar system before being lifted 9 meters high. Once the columns are raised, the solar assembly and guideway sections will be lifted via crane section-by-section. Once the pilot track is erected, the podcars will be lifted onto the end of the guideway. Finally a simple, elevated station will be erected.

Further construction will include setting up sensors for data collection, and other data-capture technology. Since the pilot concept will be erected on private land, we plan to operate the Superway system until we retrieve sufficient data to confirm design criteria.

Improvement of City Infrastructure

The pilot program will be operated on private land at this time, so no known improvement of city infrastructure is required. As stated earlier, there is a possibility that a few fire hydrants may need to be relocated depending on city preference. As the project looks to expand to other locations, city infrastructure improvements may be required.

Pathway to Scale

The pilot project will primarily be for testing Spartan Superway technologies. Thereafter, a network could be expanded from this location to reach to the Tamien Light Rail and Caltrain Station. Further expansion would connect to Kelley Park and Downtown San José. The Downtown expansion may be challenging as it requires crossing a major freeway. However, this would provide connection from a sizeable transit hub to the area that includes the County Fairgrounds, Spartan Stadium, Sharks ICE, San José Giants, Kelley Park, Happy Hollow Zoo and Downtown San José. The pilot location is currently zoned as industrial use, and our system could also be capable of moving freight in and out of these areas over to the heavy rail located at Tamien.

Conceptualized Plan for 2017-2018

The plans developed in the summer of 2017 is based upon the work completed in 2016 for a full-scale test track. A plot of land near the corner of 7th and Alma Street, previously owned by the City of San José, has been vacated to the owners of the adjoining property at 1555 South 7th Street. Figure 5 shows the earlier proposed layout of the test track. The track is a 'squeezed loop' approximately 400 meters in circumference that had two planned stations (about 8 meters high).

Figure 5. Early design for the test track layout.

Conceptualized Plan for 2018-2019

Prototype testing and safety certification will be conducted during 2018-2019. Design will begin for an expanded ATN that will connect the North and South SJSU campuses as seen in Figure 6. Design work for extending the pilot network and connecting it to other parts of San José and other cities will begin.

Figure 6. Proposed expanded ATN connecting the North and South campuses of SJSU.

Conceptualized Plan for 2020-XXXX

The North-South SJSU campus network opens for passenger service, and expansion would continue to service various locations throughout the area.

Project Management

The construction of the project will be done by Swenson Builders on their property. The testing and maintenance of the project will be taken on by Spartan Superway, its management staff and students. At this time, the project has every intention of moving forward. The project will comply with any policies and guidelines set forth by the city. Design work is always ongoing and is the responsibility of Spartan Superway. Swenson Builders is playing a role in refining plans, permits, and construction. The management of ongoing testing will be performed by Spartan Superway.

Additional Information

As is the case with other methods of public transit, we expect property values to increase nearby our stations. This can aid in city revenue with higher property taxes. Without this system, parking lots would otherwise continue to be built to accommodate more at-grade vehicles when the parking lots could be used for livable areas instead. Reducing at-grade vehicles would also reduce the need for roadway expansion projects.

The Spartan Superway pilot concept will shed light on solar-powered automated rapid transit ascendant networks as a new paradigm of urban transportation. The Superway utilizes and integrates beneficial features of conventional personal and public transportation into a single system, creating ideal riding standards for all passengers. The Superway pilot concept will create a host for researchers to gather relevant testing data to perfect Superway technologies before wide-scale implementation. We must look past autonomous at-grade vehicles as a solution to the last mile problem, and explore the option of automated transit networks like the Superway to solve this issue.