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BOARD MEMORANDUM

TO: Santa Clara Valley Transportation Authority
Board of Directors

THROUGH: General Manager, Nuria I. Fernandez

FROM: Chief Engineering & Program Delivery Officer, Carolyn M. Gonot

SUBJECT: VTA's BART Phase II Tunneling Methodology Analysis and Peer Review Results

FOR INFORMATION ONLY

Phase II of VTA's BART Silicon Valley extension would extend BART from the San Jose Berryessa station into downtown San Jose and then into the City of Santa Clara. In 2014, planning efforts were renewed for Phase II and VTA staff identified as a viable option in delivering the next six miles of track a single-bore tunneling methodology, a configuration made practical by recent advancements in the use of large bore tunnel boring machinery. This memorandum summarizes further steps VTA will undergo to fully explore the single-bore design following input by a panel of its peers.

BACKGROUND:

Twin-bore tunnels, with a single track running in each tunnel and in opposite directions, are used in many subway systems, including the existing BART system. In a single-bore configuration, a single tunnel would house two tracks, each running within separate compartments and in opposite directions.

VTA staff spent the past two years engaging BART staff in exploring and undergoing a complete study of the viability of operating the BART system through a single-bore tunnel configuration for a section of Phase II of the BART Silicon Valley extension into downtown San Jose. VTA also engaged a number of third party consultants to conduct a comprehensive analysis of the single-bore tunneling configuration. During that analysis, evaluation criteria were established, with BART, to provide a qualitative and quantitative assessment of the single-bore option, and conduct further review of the twin-bore configuration. The draft environmental documents released for public review included an analysis of impacts related to both single-bore and twin-bore construction methodologies. Under consideration and study were the following: the feasibility to build and operate a single-bore tunnel design; specific fire/life/safety elements of each configuration with respect to most recent codes and standards; and the costs, schedule and risks associated with each tunnel configuration.

The various studies conducted by VTA indicate that the single-bore configuration can provide substantial advantages over the twin bore configuration in key areas, including safety, operational flexibility, passenger experience, and construction impacts. Attachment A includes information about the single-bore configuration that describes key benefits and advantages that VTA has identified for the single bore configuration, making it a viable option for the Phase II Extension.

Once the studies were complete, VTA and BART agreed to engage a panel of peers from public transit agencies currently operating heavy rail subway systems with deep stations to review the single-bore concept with a focus on operations and safety. The peer review panel met the week of November 13, 2017, and included current and retired managers from Los Angeles Metropolitan Transportation Authority (LAMTA), Washington Metropolitan Area Transit Authority (WMATA), Metropolitan Atlanta Rapid Transit Authority (MARTA), New York City Transit (NYCT), New York Metropolitan Transportation Authority (NYMTA), and San Francisco Municipal Transportation Agency (SFMTA). The key question asked was what are the risks and/or challenges associated with the single-bore option; and, can it be operated and maintained safely as an extension of the BART system?

After three days of meetings where VTA and BART staff presented relevant aspects of the single-bore and twin-bore options, the panel opined that with some adjustments to address BART's operational safety concerns: *the single-bore tunnel can be operated safely as an extension of the BART system.*

However, due to timing constraints related to the current federal funding schedule combined with BART's strong preference for operating what it is familiar with, the panel advised that at this time, twin-bore would be a preferred option for Phase II of VTA's BART Silicon Valley Extension.

DISCUSSION:

As the County of Santa Clara's Transit Agency and Congestion Management Agency and as the owner and builder of the BART Silicon Valley Extension, VTA has a responsibility to fully explore options that will result in the safest and most efficient system being built with the least amount of impact on its customers, businesses and the community.

As noted above, the peer review panel concluded that while the single-bore design could be safely operated as part of the BART extension, the twin-bore design was preferred. However, after noting that the panel's conclusions were based on the time constraints imposed by the timeline for a federal project to make its way into the federal funding process and thereby be eligible for federal grant funds, VTA decided to extend the project development timeline. This would allow VTA to fully embrace the conclusions of the peer review panel and demonstrate more thoroughly how the single-bore configuration can satisfy BART's operational safety concerns. It would also allow VTA to further explore construction impact mitigation strategies for the Downtown San José stations.

VTA estimates the process to refine the relevant aspects of the single-bore design will take approximately three months. As such, VTA has requested from the Federal Transit Administration, the federal oversight and funding agency, an extension of the time within which to proceed through the federal funding process. This extension will assure exhaustive due diligence has been made before recommending a tunneling methodology. As with all activities related to VTA's BART Silicon Valley Extension, VTA will continue to engage BART engineers and operations representatives in this process.

Following a thorough examination of all the foregoing considerations, VTA staff will provide a recommendation regarding tunneling methodology to the VTA Board of Directors and complete the environmental and funding processes for this critical and highly anticipated infrastructure project for Santa Clara County.

The remainder of this memo outlines specific areas for further analysis.

Configuration Consistency

Based on information provided by BART, the peer review panel identified several aspects of the single-bore configuration that could be improved through the design process to better satisfy BART's operational preferences. The most important observation was the desire for a consistent configuration throughout the tunnel length to simplify training for train operators and first responders when implementing emergency procedures in the tunnel.

Although the single-bore tunnel option meets, and in some instances exceeds, all objective and regulatory fire/life safety requirements, the peer review panel acknowledged BART's concern that the trackway variations (stacked, transitions, and side-by-side) throughout the tunnel would result in additional training needed for train operators and first-responders. To address this concern, VTA will undergo additional analysis and characterization of the egress paths for operators, responders, and passengers.

Trackways at two different elevations

In the single-bore approach, some locations within the tunnel, including the stations, include the two trackways being configured one over the other versus side-by-side. Standard protocol for a disabled train in a tunnel is to conduct a train-to-train transfer of passengers from the disabled train to another train in the adjacent tunnel. When tracks are located one above the other in the single-bore configuration, the train-to-train transfer will be up or down and involve stairs. Though different than the side-to-side transfer, this approach is not entirely unprecedented in transit subways. In fact, even in the existing BART system, stairs are involved in train-to-train transfers within the Transbay tube running under the San Francisco Bay, as well as in other tunnels.

Another aspect of having the two trackways configured one over the other is that when evacuating a train in the upper level, passengers may need to go down to reach the non-disabled train in the trackway below. BART is concerned that going down to evacuate a system may be non-intuitive to its passengers and cause confusion. Although all egress paths and exits will be well designated, VTA will explore the use of ADA-compliant ramps and other egress configurations between upper and lower trackways which may improve the ease and

intuitiveness of egress.

Station Evacuation

The panel also identified important aspects of the single-bore configuration that significantly outperformed the twin-bore configuration. In particular, because the entire passenger space inside each ticketing halls (two per station) in the single-bore configuration can be maintained as a point of safety during a train fire emergency, passengers would not need to make their way all the way up to the street level to be safe. This aspect makes the single-bore an option which provides more rapid clearing of the boarding platform, and more rapid arrival to a point of safety than the twin-bore configuration. The panel recommended that if the twin-bore configuration is to be used, these aspects of the single-bore configuration should be adopted in its design.

Depth of the Stations

Although BART raised the depth of the stations as a major concern in various evacuation scenarios, the panel expressed that the depth of the station was not of particular concern for safety or passenger experience. In addition, as stated earlier, the more immediate point of safety offered in the single-bore configuration provided a model that could outperform the twin-bore configuration. The peer reviewers also expressed no particular concerns about the tunnel or station ventilation configurations.

To support its recommendation on tunneling methodologies for its Phase II BART Silicon Valley extension, VTA will examine these and other relevant topics during this extended project development period. VTA and BART are committed to continued cooperative and productive work in these efforts.

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