CITY OF SAN JOSE
DEPARTMENT OF TRANSPORTATION

REQUEST FOR INFORMATION 2019-DOT-PPD-4
NEW TRANSIT OPTIONS: AIRPORT-DIRIDON-STEVENS CREEK TRANSIT CONNECTION

September 30 2019

BYD
Build Your Dreams®

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09/12/2019

City of San Jose
Department of Transportation, 8th floor
200 E. Santa Clara Street
San Jose, CA 95113
Attn: Maricela Avila

RE: RFI 2019-DOT-PPD-4
New Transit Options:
Airport-Diridon-Stevens Creek Transit Connection

Dear Ms. Avila:

BYD is especially pleased to submit the enclosed response to the subject Request for Information. As we mention in the response, we have long believed that BYD's SkyRail (advanced, automated straddle-type monorail) and SkyShuttle (autonomous, battery-electric people mover) technologies are remarkably well suited for implementation in the Stevens Creek and Diridon to Airport Corridors – including potential future extensions to other major travel destinations in the Silicon Valley.

BYD ("Build Your Dreams") is a pioneer in achieving a Zero Emission Energy Ecosystem, offering affordable solar power, reliable energy storage, and electrified transportation. Founded in 1995, BYD is a private (non-government owned or controlled) entrepreneurial company that has grown from a start-up rechargeable battery manufacturer with only 20 employees into a $20 billion dollar per year global company with over 220,000 employees today.

BYD has established over 30 industrial parks across six continents and has played a significant role in industries related to electronics, automobiles, new energy and rapid transit. From energy generation and storage to its applications, BYD is dedicated to providing one-stop, zero-emission energy solutions.

BYD is one of the world's largest manufacturers of rechargeable batteries and battery-electric vehicles, selling more than 50,000 pure battery-electric buses, 8,000 electric trucks, and 20,000 electric forklifts; and for four years in a row (2015-2018), BYD has been ranked No. 1 on the global new energy vehicles (NEV) market, which includes plug-in hybrid and pure electric automobiles.

One of the world's largest manufacturers of cell phones and tablets, BYD already is a strong corporate citizen in the Silicon Valley, working directly with Apple through our high-tech electronics office in Cupertino; and working with our battery-electric bus and truck customers in the region through our BYD Service Center in San Carlos, including Stanford University and Facebook.

In addition, BYD has invested five years and $ 2.2 billion on automated rapid transit system development: SkyRail and SkyShuttle. These are highly cost-effective alternatives to traditional subway and light rail systems for addressing traffic congestion and mobility problems in urban areas. Both provide strong advantages, including high-capacity, high-speed driverless operation, and can be constructed far faster and with far less impact than other systems.

An ongoing innovator and investor, BYD owns 15,000+ patents, and has applied for 24,000 patents globally. BYD's stock is publicly traded, and Berkshire Hathaway, based in Nebraska, is the largest public shareholder of BYD's H-Shares. We are committed to our BYD mission: "Technological Innovations for a Better Life."

This submittal highlights the fact that we already are working together on this initiative with two of the most respected design firms in the world: Norman Foster, designer of the new Apple Park complex in Cupertino (we are working through The Norman Foster Foundation), also serving as master planner for the Related Santa Clara Project; and Gensler, the world's largest design firm, with a long history working with San Jose International Airport, and now also working on the Related Santa Clara Project and a major new complex in downtown San Jose.

Through this working relationship, we together have studied the corridors and identified two potential alternatives for the Airport-Diridon-Stevens Creek Transit Connection, and we have described them in this submittal. As we mention, while this is not a "one size fits all" undertaking, our sense is that the proposed project(s) might best be implemented through a Private/Public Partnership (P3) – where the project would be designed, financed, constructed, operated and maintained by the private sector in partnership with the City (or VTA, or perhaps even a Joint Powers Authority).

If the undertaking moves ahead, BYD envisions forming a highly qualified and experienced P3 Team, just as we are doing in other cities, including some of North America's and the region's leading engineering and construction firms, and global leaders in providing equity investment and long term debt for P3 transportation projects.

As we also mention in the submittal, we have refrained from including proprietary details, understanding that this will be a public document. Therefore, we are suggesting that following review of the submittals, the City (and perhaps other stakeholders) may find it in their best interest to conduct one-on-one discussions with the major firms responding to the RFI. Please let us know if this would be of interest, and if there are any questions regarding our submittal.

Sincerely,

Patrick Duan
Vice President, Operations
North America

TABLE OF CONTENTS

SECTION A- RESPONDENT PROFILE

LEGAL NAME OF COMPANY: (INCLUDE DBA IF APPLICABLE)

BYD Motors LLC

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1800 South Figueroa Street, Los Angeles, CA 90015

LEGAL STATUS (I.E. SOLE PROPRIETORSHIP, PARTNERSHIP, CORPORATION)

Limited Liability Company

CONTACT NAME AND TITLE:

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HIGH LEVEL DESCRIPTION OF CONCEPT:

As in many other of the nation's fastest growing cities, the low-cost at-grade rights of way that are most suitable for light rail transit implementation already have been developed in San Jose. This results in a situation where such cities are seriously considering grade-separated solutions to help expand their mass transit systems into corridors where at-grade solutions may not be viable, and may not be acceptable to the community. For such corridors, BYD can provide the lowest cost, least obtrusive, highest capacity, grade-separated solutions: SkyRail and SkyShuttle. Therefore, subject to further detailed design and operational analysis, we can envision two alternative ways of deploying our candidate technologies in the two corridors described in the RFI, namely:

1) A single, interconnected, high speed, high capacity, expandable line using SkyRail advanced, automated monorail technology, thereby providing a one seat ride between the Stevens Creek Corridor, the Diridon Station and its surrounding mixed use development, and to downtown and the airport. Providing high frequency service end-to-end from the outset, likely at two minute peak period headways and roughly five minute off-peak headways, this automated, straddle-type monorail solution also would provide more than adequate speed and capacity capability for major future regional extensions, primarily northward from either or both ends of the line.

2) Two lines that would meet at Diridon Station, both operating at high frequency to facilitate transfers. Most likely, as the longer corridor, SkyRail would be used for the Stevens Creek Line and SkyShuttle, BYD's autonomous, battery-electric automated people mover, would be used for the Diridon to Airport Line. Both lines could be extended at a future date.

In either case, the system would be designed to facilitate transfers at the Diridon Station (to and from BART, CalTrain, ACE, and Capitol Corridors), as well as to and from VTA's light rail system.

HIGH LEVEL DESCRIPTION OF BUSINESS PLAN:

While this is not a "one size fits all" undertaking, our sense is that the proposed project might best be implemented through a Private/Public Partnership (P3) – where the project would be designed, financed, constructed, operated and maintained by the private sector in partnership with the City (or VTA, or perhaps even a Joint Powers Authority). P3 is a proven method of delivering and financing major infrastructure projects that in the simplest of terms, can deliver projects sooner, shift all major project risks to the private sector, and provide cost certainty to the public sector. P3s have become increasingly common around the world as a viable method for delivering large infrastructure projects in an expedient manner for many reasons, including:

- The P3 approach is best suited for projects that are unique, typically using stand-alone operating technology, including the guideways, stations, and maintenance facilities.
- The P3 process is very well suited to situations where the public entity does not have sufficient up-front funding available to implement the project on a pay-as-you-go basis, but would have sufficient funds to implement the project through a combination of private equity and long term debt.
- By using the P3 approach, projects can be completed much more rapidly.
- Under a P3, construction still could be done under a project-wide Project Labor Agreement (PLA), just as if it were performed under a more traditional process.

HIGH-LEVEL QUESTIONS

A. ARE THERE NEW TECHNOLOGIES, PROJECT DELIVERY, OR OPERATING MODELS THAT CAN PROVIDE GRADE-SEPARATED, HIGH-CAPACITY, HIGH-SPEED TRANSIT?

(Appendix 1) Provides an overview of BYD (Build Your Dreams),In this response, BYD describes briefly (with greater detail in Appendix 2), our two state-of-the art technologies that are strong candidates for either or both of the corridors described in the RFI – Stevens Creek and Diridon Station to San Jose International Airport. Both our automated straddle-type monorail (SkyRail), and our innovative battery-electric powered autonomous people mover (SkyShuttle), provide industry leading, grade-separated, high capacity, high speed transit within their respective technology classes.

Our response also describes the project delivery approach that may represent the best match to the situation described in the RFI: a Private/Public Partnership (P3), coupled with a Pre-Delivery Agreement (PDA) process that shifts all major project completion and performance risks to the private partner, delivers the construction and ongoing operations and maintenance services under fixed price contracts to assure cost certainty, and provides long term equity and debt financing as needed to best match the anticipated public revenue stream over time.

B. DO THESE SYSTEMS HAVE LOWER CONSTRUCTION, OPERATIONS, AND / OR MAINTENANCE COSTS THAN TRADITIONAL SYSTEMS?

Absolutely yes, they do. These economies are applicable to both SkyShuttle and SkyRail, stemming from a number of important factors, including:

- Smaller, simpler structures due largely to the significantly lighter weight of the vehicles and the fact that the beams that support the vehicles also guide them, which makes the structures far smaller, thereby requiring a fraction of the concrete, structural steel, and construction labor of any other technology family.
- When coupled with the use of pre-cast and prefabricated elements, including the columns, crossheads, and beams, this smaller, lighter structure yields not only the lowest construction

cost, by far, it also is the fastest to construct, with the smallest footprint, smallest foundations, least utility conflicts, and the least obtrusive construction process.

- Lighter weight, simpler vehicles that operate in very clean operating conditions, which greatly reduces maintenance requirements.
- Nearly maintenance-free guide beams,
- Much simpler maintenance facilities and maintenance procedures, including the fact that the vehicles are much easier to maintain, with no “pits”, utilizing a rapid unit change-out design philosophy.
- High frequency service, made possible through state-of-the-art, communications-based, moving block, fully automated, positive train control, which in turn increases peak line capacity, while reducing station length, thereby making stations much less costly to build and maintain (and easier to fit into the urban fabric).

C. CAN THESE SYSTEMS BE DEPLOYED FASTER THAN TRADITIONAL PROJECTS?

Yes, they can. When coupled with innovative project delivery such as made possible through the P3/PDA approach, the simpler, faster construction process can dramatically reduce the time from inception to revenue service – and it does so with proven, modern, attractive technology that is consistent with the technological leadership and progressive image of San Jose and the entire Silicon Valley.

D. DO THESE SYSTEMS HAVE VIABLE FINANCIAL OUTLOOKS?

From the perspective of financial viability, SkyRail clearly provides by far the lowest capital and operating cost of the grade-separated, medium capacity line haul class – with peak line capacity of up to nearly 19,000 passengers per hour per direction (at North American standee levels), operating at two minute scheduled headways, and at high speed (up to 75 mph). Yet, it is an alternative that is proven and readily available, and can easily meet or exceed Buy America, manufactured and constructed in California.

And SkyShuttle provides the same advantages within the automated people mover class, providing un-matched performance, including peak capacity of up to 12,000 passengers per hour per direction at 90 second scheduled headways, and speeds up to 50 mph – with no power rails and no wayside power substations, due to its green, sustainable, yet proven, battery-electric propulsion technology.

For either technology, this translates into the lowest public funding requirement and the least burden upon the taxpayers. Further, our analysis of all similar systems we are proposing elsewhere in the United States shows that it is highly likely that farebox and advertising revenues will exceed operations and maintenance costs, thereby eliminating the need for ongoing subsidies.

E. HOW WILL THESE SYSTEMS BE CONSTRUCTED AND DELIVER SERVICE ON THE SPECIFIED CORRIDORS?

While this requires a great deal more detailed engineering, architectural, and operational analysis, we can envision two alternative ways of deploying our candidate technologies in the two corridors described in the RFI, as follows:

1) A single, interconnected, high speed, high capacity, expandable line using SkyRail technology, thereby providing a one seat ride between the Stevens Creek Corridor, the Diridon Station and its surrounding mixed use development, and to downtown and the airport. Providing high frequency service end-to-end from the outset, likely at two minute peak period headways and roughly five minute off-peak headways, this solution would provide more than adequate speed and capacity capability for major future regional extensions, primarily northward from either or both ends of the line.

2) Two lines that would intersect at Diridon Station, both operating at high frequency to facilitate transfers. Most likely, as the longer corridor, SkyRail would be used for the Stevens Creek Line, and SkyShuttle would be used for the Diridon to Airport Line. Both lines could be extended at a future date.

In either case, the system would be designed to facilitate transfers at the Diridon Station (to and from BART, CalTrain, ACE, and Capitol Corridors), as well as to and from VTA's light rail system.

SECTION B PROPOSED CONCEPT:

PROVIDE A HIGH-LEVEL DESCRIPTION OF YOUR CONCEPT(S):

This is discussed in response to previous question item E above. BYD proposes two concepts using SkyRail and SkyShuttle technology (Appendix 2 -3)

SECTION C PHYSICAL ELEMENTS:

A.DESCRIBE THE GUIDEWAY:

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

Please refer to (Appendix 4) for photographs of SkyRail guideways. And Appendix 5 for SkyShuttle. In general, SkyRail and SkyShuttle have the smallest aerial guideway structures of any proven technology, by far.

II) HOW IT IS GRADE-SEPARATED?

Please refer to (Appendix 6) for additional photographs.

Both SkyRail and SkyShuttle are fully grade separated, automated technologies. Both can be placed underground, at-grade, or on elevated structures. Any at-grade sections would need to be placed in an exclusive, protected right-of-way, to preclude vehicular and pedestrian conflicts. Typically, however, they both are placed on pre-cast or pre-fabricated elevated structures. This smaller, lighter weight structure is made possible not only by the lighter weight vehicles they employ, but also by the fact that they uniquely are supported and guided by a narrow, light weight beam.

For such elevated sections, SkyRail typically is grade separated by pre-cast or cast-in-place concrete columns, with typical spans ranging from 70 to 150 feet. The minimum typical height from grade to the bottom of the column cap is 16.5' over interstate freeways, and for most local jurisdictions, 14.5 feet over local roads and arterials. The pre-cast beams are only 27.5 inches wide and typically range from a constant depth of about 5 feet to haunched beams ranging from about 4.5 feet to 7.5 feet deep. The dual load tires ride on top of the beams, with lateral guidance tires running horizontally on the sides of the beams. Typically, an emergency evacuation walkway is in mounted between the beams.

SkyShuttle typically is grade separated by pre-fabricated steel or pre-cast concrete guideways, with typical spans of 80', with the same minimum typical height from grade to the bottom of the guideway. The SkyShuttle guideway typically is 67 inches wide and 39 inches deep (outside to outside), in a channel section. The vehicles run on dual rubber tires, one each on top of each side of the channel, with lateral guidance tires that run inside the channel. The center channel, with no power rails, also serves as a safe emergency evacuation walkway.

III) WHAT ARE ITS RIGHT-OF-WAY NEEDS?

Please refer to (Appendix 7) for additional photographs.

SkyRail's column footprint at the ground ranges between 3.5 to 6 feet, depending on geologic conditions such as soil and seismicity, as well as alignment conditions such as guideway span length, and height.

SkyShuttle's column footprint at the ground ranges between 3 and 4 feet, also depending on geologic conditions such as soil and seismicity, as well as alignment conditions such as guideway span length, and height.

As with any grade-separated technology using columns, it is recommended a type-60 (or other "Jersey barrier") crash protection barriers be used to protect the columns from automotive impact in urban environments with streets. This adds up to about 1.5' feet of space requirement on each side of the columns for any technology.

B.DESCRIBE THE STATIONS/PASSENGER ACCESS POINTS.

I) WHAT DO THEY LOOK LIKE FOR A PERSON WALKING BY, AND FOR A PERSON USING THE SYSTEM?

This section is written from the perspective of an elevated system with elevated stations. In doing so, however, it is important to note that the stations also can be at-grade, if protected from crossing vehicle and pedestrian traffic; or even underground.

From an architectural perspective for both SkyRail and SkyShuttle, aerial stations can be designed to be compatible with any number of built environments. This is generally achieved by modifying the more visible portions of the stations to be architecturally compatible with the setting. Those elements include the canopies, materials (i.e. flooring, column design, wall finishes, glazing, etc.), lighting, signage, and so forth.

However, the size and configuration of the functional/operational elements of the station are largely dictated by several key factors other than architectural treatments, including:

- The specified peak hour line capacity and service frequency, which in turn dictates the maximum train length, hence, the platform length
- The platform width, which is determined largely by short term passenger volumes as well as the space required for vertical circulation elements such as stairways, elevators, and escalators.
- Emergency evacuation requirements such as those specified by local fire codes and the National Fire Protection Association's applicable standards – which in turn determine the size, number, and placement of emergency evacuation stairways

Accordingly, one important over-arching factor that greatly affects the visual and urban impact of stations is the ability of the system to operate at high service frequency levels. This reduces the length and even the width of the stations by reducing the length of the trains and the short term peak passenger loads within the station.

In the case of SkyRail, for example, its communications-based, moving block, automatic, positive train control system readily enables trains to be scheduled on two minute headways. And for SkyShuttle, similar train control technology allows for scheduled headways as short as 90 seconds. This translates into shorter trains, and shorter and less obtrusive stations. In addition, the lighter weight of these two technologies means that the structural elements of the stations themselves are much smaller and less obtrusive.

In our experience, the compatibility of an elevated transit system with its surroundings is even more an urban design issue than it is a "pure" architectural design issue. Successful urban design requires the stations and the guideway structures to be designed to be fully integrated into and compatible with the urban fabric, and this requires that special attention be paid to such factors as station accessibility, fare collection treatments, entry/exit plazas, stairway and escalator landing points, materials selection, landscaping, lighting, and integration of key station elements into buildings and plazas.

Integration into buildings, both existing and new, is greatly facilitated with SkyRail and SkyShuttle, primarily due to their very low noise and vibration levels, lighter structural loads, and attractive exterior designs. With SkyShuttle, in particular, its small footprint, very light weight, extraordinarily short turning radius, small guideway switches, and lack of power rails, all combine to make the stations much easier to place within or immediately adjacent to buildings.

Relevant Local Design Experience

BYD is working with two of the world's most respected and experienced architectural firms, Gensler and Norman Foster, in the planning and design of several of our projects in the United States, including the two potential projects described in this RFI. Further, both Gensler and Foster are currently active in the Silicon Valley, working with the Related Company on the master planning for the proposed Related Santa Clara Project (at the golf course site diagonally across from Levi Stadium and adjacent to the VTA light rail line and the ACE and Capitol Corridor commuter rail lines). They are both working with us on SkyRail and SkyShuttle alternatives for all of the potential projects in the Silicon Valley. And Lord Norman Foster himself was the lead architect for the new Apple world HQ campus in Cupertino. Finally, Gensler not only is working on the design of a large new building complex in downtown San Jose, they also have a long history of working at San Jose International Airport.

Similarly, one year ago BYD co-hosted a week-long international Urban Mobility Symposium with the Norman Foster Foundation in Madrid, and not coincidentally, developing new mobility solutions for the Silicon Valley was one of the case studies investigated by the symposium. With the help of carefully selected graduate students from across the world, we laid out potential SkyRail and SkyShuttle routes for the Valley – and remarkably, they included both the Diridon to San Jose Airport and Stevens Creek lines – almost exactly like those described in the RFI.

Below we have included several station photos, as well as a renderings that were recently prepared for us by Gensler for both SkyRail and SkyShuttle projects, (Appendix 8)

II.)WHAT ARE THE RIGHT-OF-WAY AND LAND NEEDS OF A STATION/ACCESS POINT?

If necessary, stations for both SkyRail and SkyShuttle can be constructed completely within public street rights of way, even including the "touch-down" points for stairways, elevators and escalators. Specifically, the primary station structures, including both the guide beams and platforms in an integrated structure, can be supported by a single row of columns placed within a relatively narrow (typically less than 10 feet wide) street median, while the stairs, elevators, (and escalators, if needed), can touch down on one or both sidewalks in those areas where sidewalks are fairly wide – and at locations where sidewalks actually are part of entry plazas for adjacent buildings. In many cases, depending upon the street right of way width, this can be done without taking any roadway lanes – but the specific answer always is highly site-specific. We have examples of both center and side-platform stations being supported and sited in this manner.

In many cases, it may be beneficial to place the primary station structure within the public street right of way, but to have the station access come from a pedestrian plaza at ground level, or even from the second level on adjacent private property. This facilitates creation of transit-oriented development in those locations, if the property owner is motivated and understands the intrinsic value of doing so.

As a general rule, we agree with our architectural partners that whenever possible, stations should be designed without mezzanines, thereby reducing visual and construction impacts, lowering construction costs and construction duration, and most importantly, activating the street level by placing station entrances and exits, and supporting shops and restaurants, at the plaza level.

III.)HOW WILL STATIONS/ACCESS POINTS INTEGRATE WITH THE SURROUNDING URBAN FABRIC ON THE STEVENS CREEK LINE?

As mentioned above, our objective will be to develop stations that are compatible with the urban fabric along the line. To do so, we will work with the cities of Cupertino and San Jose, community leaders, major property owners and employers, and other stakeholders, to place the stations in accordance with the following key criteria, all in an effort to reduce or eliminate altogether first mile/last mile issues:

- Place them adjacent to compatible existing land uses, such as shops, restaurants, offices, and multi-family residential
- Encourage transit oriented development
- Locate them to provide for convenient pedestrian access to bus and rail transit lines
- Minimize impacts to existing circulation patterns
- Facilitate private access by pedestrians and cyclists, as well as innovative electric propelled modes such as ride sharing app autos, electric bikes and scooters, and future autonomous cars
- Minimize the need for station area parking by doing all of the above

In general, we feel that the average station spacing should be in the range of one-half to one mile in order to maximize the opportunity for walk-in access. While we do have some specific ideas already developed for the stations for this line, the fact that this will be a public document (accessible by our competitors) discourages us from doing so here. As we mention elsewhere in our submittal, we are suggesting that the City should schedule one-on-one work sessions with the top-rated teams so such ideas can be discussed openly.

IV.)HOW WILL THE SYSTEM INTEGRATE WITH EXISTING TRANSIT SYSTEMS?

Our team believes that this question addresses one of the most important issues and opportunities for the system. In short, these two corridors provide an outstanding opportunity to significantly expand the reach of the existing and proposed regional transit systems, thereby greatly reducing their first mile/last mile challenges. Transfers to and from these existing systems will be greatly facilitated by the extraordinarily high service frequency of SkyRail and Sky Shuttle.

V.)HOW WILL THE PROPOSED SYSTEM CONNECT WITH RAIL PLATFORMS (EITHER BART OR OTHER HEAVY RAIL) AT DIRIDON STATION?

While the high service frequency of both SkyRail and SkyShuttle in and of itself facilitates inter-modal transfers more than any other single factor, a very sound planning principle is to reduce transfer time and increase the convenience of the transfer. This is best achieved in three ways:

- Shortening the walking distance between the rail platforms and the SkyShuttle or SkyRail platform;
- Reducing or eliminating altogether the need to change levels in making the transfer; and
- Minimizing exposure to the elements.

VI.)HOW WILL THE PROPOSED SYSTEM CONNECT WITH AIRPORT FACILITIES AND PARKING AT SJC?

Now the nation's 10th largest city, and with the City-owned airport once again experiencing very rapid growth in commercial passenger enplanements (+10.2% in 2016; +15.6% in 2017; +14.7% in 2018), this proposed project (to link the airport to downtown and to the existing and proposed regional rail and bus network, primarily at the Diridon Station), is rapidly taking on increased relevance and importance. While such a connection long has been discussed, envisioned, and even planned, it is very clear that now is the time to make it a reality.

This connection also is very timely in view of the City's decision to amend the Airport Master Plan by extending the Airport planning horizon by ten years, from 2027 to 2037. By planning and implementing the transit link in this context, it becomes much more feasible to develop much more sustainable ground transportation future for the airport – as well as for downtown and the entire region.

When considering the effectiveness and efficiency of a transit link to any large airport, it is important to remember that air passengers usually are not the only important potential users of the transit link. As a matter of fact, careful analysis of fixed guideway transit lines serving airports in this country shows that work trips to and from airport-area employment centers often represent an even better opportunity for "capture" than do air passenger trips. This occurs for many reasons, not the least of which is that air passenger trips generally originate over a very wide drawing area, making it challenging to capture them on fixed guideway transit lines – not to mention the inconvenience of air passengers having to deal with baggage on airport access trips.

However, we recognize that San Jose International Airport may represent the nation's most significant exception to the experience cited above. The obvious reason for this exception is that San Jose International Airport is located so much closer to major employment, residential and business centers than most other major international airports. This suggests that the proposed airport transit link has the potential to attract a much higher than typical percentage of both air passenger and work trips to and from the airport – if it is planned, located, and operated properly – using the most appropriate transit technology.

In our view, one over-riding challenge in siting the airport station or stations is the fact that this primary attribute of the airport – its proximity to downtown San Jose and to the major employment centers in the Silicon Valley – also could be its curse. This could be the case because the site is so constrained and there is little room for growth, especially for any major reconfiguration. This constrained site led to the development of two parallel runways that do not meet the desired separation guidelines, and a lengthy linear terminal configuration that creates long walking distances through relatively narrow corridors.

This fact makes it even more important, in our opinion, for the selected transit technology to provide maximum alignment flexibility: specifically, by providing: a small footprint on the ground; a tight turning radius; maximum grade- climbing ability; and short stations resulting from state-of-the-art automatic train control operation at high service frequencies. SkyRail and SkyShuttle both meet these requirements.

Understanding this reality, we believe that if only one airport station is to be developed, ideally, that airport station should be located:

- As close to the mid-point of the terminals/gates, preferable directly between Terminals A and B
- As close to ticketing (for outbound passengers) and baggage claim (for inbound passengers) as possible

In this context, a case can be made for at least two stations to best serve the airport and the business complex and VTA light rail station located immediately east of the terminal complex. We have developed some initial alignment and station location concepts for the airport that we look forward to discussing with the City. (We do not include them herein because this will become a public document and we do not wish to share our ideas with our competitors).

By working closely with airport and city transportation planning officials, and in conjunction with our colleagues from Gensler (who worked on an earlier airport master plan as well as the design of Terminal B), we are confident that the best alternative for airport station(s) will be developed.

VII.)HOW DO THE SYSTEM'S VEHICLES OPERATE WITHIN THE NETWORK?

Both SkyRail and SkyShuttle use communications based, moving block, and positive train control technology to achieve very frequent, completely autonomous service. Over a 4+ year development period, BYD developed its own version of this technology using a redundant 5G wireless backbone architecture – and all of the nearly 20 SkyRail and SkyShuttle projects that have been either already constructed or awarded use this technology. Such high frequency service not only provides the highest level of safety, it also greatly simplifies transfers to and from the system. Passengers literally will not need to have a timetable.

Both technologies also can be configured into a wide range of minimum consist lengths, and both have the ability to couple or uncouple those consists autonomously to match changes in demand over the day or for special events.

In general, both technologies operate on fixed schedules in pinched loop configurations, with on-line stations. However, SkyShuttle, in particular, provides an opportunity for off-line stations, hence, a more demand-responsive operating plan could be used.

VIII.)IS THERE LEVEL BOARDING?

Yes. There is level boarding throughout. Both technologies are fully ADA compliant.

IX.)HOW WILL THE SYSTEM BE DESIGNED TO BE COMPATIBLE WITH "COMPLETE STREETS" IF THE SYSTEM IS AERIAL?

In cooperation with our urban design and architectural partners from both Gensler and Norman Foster, BYD already had been investigating this question – not only from the perspective of integrating aerial systems into the urban fabric, including incorporating stations within or attached to existing and new buildings -- but also from the perspective of enhancing the pedestrian and passenger experience. In doing so, it has become quite apparent that this is greatly facilitated by the uniquely smaller and lighter weight structures that both SkyRail and SkyShuttle employ.

We have identified a number of innovative design concepts for achieving the above objective, including the development of multi-use guideway structures to support safer, grade-separated pedestrian and cyclist pathways, and environmentally sustainable air cleansing measures. (Appendix 9)

X.)IF THE MAIN GUIDEWAY IS AERIAL OR UNDERGROUND, HOW DO PASSENGERS GET TO GRADE LEVEL?

Elevators are provided wherever there is such a change of grade (ADA compliance so dictates). If station platforms are located above or below grade level, they are provided with stairways and escalators (assuming the City would wish the stations have escalators, not just stairways). As we mentioned previously, our team prefers not to use mezzanines, rather, we will strive to develop station designs where the entrances and exits are located in public spaces at the plaza/ground level.

C.DESCRIBE THE VEHICLES

I.)WHAT DO THEY LOOK LIKE FOR A PERSON WALKING BY, AND FOR A PERSON USING THE SYSTEM?

Please refer to (Appendix 10) for photographs.

II.)HOW MANY PASSENGERS AND HOW MUCH BAGGAGE CAN FIT IN A VEHICLE?

SkyRail cars hold 75-79 passengers per car, calculated per the ASCE 21 APM standard using North American design standee levels. Vehicles can be designed with flexible seating arrangements including lateral or perimeter seating configurations, which vary the overall car capacity.

In addition to passengers keeping bags in their possession during transportation, vehicles can be designed with racks to accommodate airline checked baggage size bags. In this regard, we can provide up to 8 designated checked baggage size locations per car for mid-cars, and 12 designated spaces for end cars. In addition to this, overhead storage space is available the length of the car on each side, for storage of airline carry-on size items.

SkyShuttle cars hold 50 passengers per car, calculated per the ASCE 21 APM standard using North American design standee levels.

Vehicles for both technologies can be designed with flexible seating arrangements including lateral or perimeter seating configurations, which vary the overall car capacity.

Typically, at areas such as airports, Automated People Movers do not come equipped with designated baggage storage areas, given the short travel time of these systems and passengers preference to often be in possession of their luggage. However, BYD can work with the City on baggage storage locations to develop the preferred solution.

III.)HOW DO PASSENGERS BOARD AND ALIGHT FROM THE VEHICLE? HOW LONG DOES IT TAKE?

Passenger enter and exit from SkyRail and SkyShuttle cars via automatic, bi-parting fixed station doors (or tall gates) on the platforms, and automatic bi-parting doors on the vehicles. SkyRail cars have two doors per side per car, while SkyShuttle have one door per side per car. This meets specifications and requirements for rapid ingress and egress in normal and peak period operating conditions, as well as for emergency evacuation.

For ingress, passengers will be ready to board from the station platform, and platforms are always equipped with platform station doors (options available in ¾ height or full floor-to-ceiling height). As the train arrives, the communications-based train control system communicates to the station platform audio and visual system that the train is arriving, which in turn issues an audible and visual notification to passengers to prepare to board. Once the train is stopped, the fixed platform doors (or gates) start to open slightly before the vehicle doors open, and passengers may enter.

For egress from the vehicle, as the train is approaching the station, passengers will be notified via the onboard audio and visual system that the train is arriving at a certain station to prepare them to exit. Once the vehicle is stopped at the station, the platform doors open slightly before the vehicle doors, and the passengers egress.

SkyRail vehicles are equipped with load-leveling suspensions to ensure ADA complaint boarding between station platform and train, or vice versa.

Vehicle standard exit times and rates are in compliance with procurement guidelines used recently in other mega projects. Specifically, under normal peak design capacity, the vehicles are designed to be completely unloaded in 25 seconds or less assuming a limited exit rate of one passenger exiting per 2.2 seconds per 30" of clear width doorway.

IV.)WHAT IS THE TOP SPEED, AND HOW QUICKLY IS IT ACHIEVED?

SkyRail's top operational speed is 75 mph. We recommend operating at scheduled top speeds of about 65 mph to save energy and still provide for a speed adjustment capability to stay on schedule in the event of passenger-induced delays. Of course, the station spacing and alignment geometry combine to determine what the actual top speed will be at each point of the line.

SkyShuttle's top operational speed is 50 mph. As above, we recommend a scheduled top speed of about 45 mph for the same reasons.

Though SkyRail and SkyShuttle vehicles can accelerate faster, their longitudinal operational acceleration is governed by the ASCE 21 standard, which states the maximum sustained acceleration that can be exerted on standing passengers is 0.16g under normal operations. This results in a time of about 18.5 seconds from zero to 65 mph for SkyRail and 12.8 seconds for zero to 45 mph for SkyShuttle, on straight and level sections.

V.)ARE VEHICLES AUTONOMOUSLY OPERATED?

Yes. Vehicles are autonomously operated using state of the art, moving block, communications-based automatic train control technology developed by BYD as described previously.

VI.)WHAT DO VEHICLES DO WHEN THEY ARE NOT OPERATING?

When not in operation, vehicles usually are domiciled at a storage facility/depot. In some cases, however, it is efficient to store "hot standby" vehicles at intermediate or end-of-line pocket "tracks". Often, the best solution is to integrate the vehicle storage facility along with maintenance, parts stores, administration offices, and the Operations and Maintenance Facility (OMSF) and Operations Control Center (OCC), to utilize the most efficient amount of space.

VII.)DO THE VEHICLES REQUIRE SPACE OFF THE GUIDEWAY FOR STORAGE?

Given the anticipated fleet size for a project the size of the Steven's Creek corridor, it is advisable to have an integrated OMSF. For the Diridon to Airport line, if it is a separate SkyShuttle system, it may be possible to maintain those vehicles at or directly behind (and below) the airport and or the opposite end-of-line station.

VIII.)HOW VEHICLES ARE POWERED (E.G. BATTERY, CATENARY, THIRD RAIL, ETC.)?

SkyRail is powered via permanent magnet, synchronous AC motors, supplied by power rails mounted to the guidebeam, with one rail on each side of the beam (positive on one side, negative/ground on the other). Further, SkyRail cars are equipped with on-board backup batteries, so in the event of regional power outage where all substations (which provide power to the power rails) were offline, vehicles still can be operated to the nearest station and safely discharge passengers. This also means that maintenance bays in the OMSF are not required to have power rails, which eliminates the risk of electrical shock for workers.

BYD SkyRail systems also provide a unique opportunity to install containerized, rechargeable battery energy storage units along the alignment. As trains slow down into a curve or into a station, the train "re-gens" energy and it is stored in BYD's unique Iron-Phosphate batteries in containers, which is estimated to reduce vehicle energy consumption by 30%.

SkyShuttle, to our knowledge, is the world's only fully proven, battery-electric automated people mover. SkyShuttle's permanent magnet, synchronous AC motors are powered by onboard BYD iron-phosphate batteries. Charging occurs at stations online while passengers are ingressing/egressing, and or offline via a tail track behind terminus stations; as well as offline at the OMSF. Fully charged vehicles have a range of over 100 miles, and online or tail-track offline charging provides an additional 0.6 miles of range for every 30 seconds of charge. Thus, SkyShuttle vehicles can operate continuously for the full operating day, roughly 20+ hours per day.

IX.)DO THE VEHICLES REQUIRES REQUIRE A MAINTENANCE FACILITY? IF SO, DESCRIBE THE FACILITY REQUIREMENTS (E.G. NUMBER OF FACILITIES, CONNECTION TO THE SYSTEM, SIZE OF FACILITY, ETC.).

Given the fleet size expected for these corridors, an integrated OMSF that contains train storage, maintenance, spare parts stores, the OCC and administrative offices likely will be the most space efficient layout for this type of facility.

Because the technologies are elevated and the structures that guide and support them are small and light weight, vehicle storage and maintenance facilities are much easier to integrate into the urban environment than those of other technologies. Maintenance and storage typically occurs on the second or third floor level above grade. Thus, at the ground level, covered parking typically is provided. At an intermediate level directly above the parking level, spare parts stores served by a maintenance elevator, along with the OCC and administrative offices, can be provided.

Because both technologies operate in very clean, low noise environments, and maintenance activities also are cleaner, simpler, and quieter, it is very realistic to incorporate the OMSF directly into mixed use developments. This is further facilitated by the fact that the structural loads needed to support the vehicles and the facility are consistent with the structures needed to support mixed use buildings.

A specific example of such a facility design concept developed by Gensler that we have prepared for another project is shown in (Appendix 11), along with a photo of an existing facility.

Initially, only one OMSF is required per technology. As and when the lines are extended, at some point it may become desirable to add another storage and light maintenance and inspection facility to minimize non-revenue "deadheading": shuttling of vehicles before and after operating hours. Operationally, an OMSF operates best when it is place near the terminus of the alignment.

X.)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.

Typically, vehicles are deployed autonomously to the ends of the line early in the morning in advance of revenue service, and then again back to the storage facility late at night at the conclusion of revenue service. While transitioning from off-peak service to peak service, additional trains are introduced online from the OMSF. This process occurs autonomously with oversight via the OCC.

D.PROVIDE PICTURES OR RENDERINGS OF ALL PHYSICAL ELEMENTS OF THE SYSTEM

Please refer to (Appendix 12) for additional photos of system not shown already in earlier appendices.

SECTION-D OPERATIONAL ELEMENTS

A. DESCRIBE THE OPERATIONAL MODEL

I.)CAN THE VEHICLE TRAVEL OUTSIDE THE GRADE-SEPARATED GUIDEWAY (E.G. PROVIDE POINT-TO-POINT SERVICE UTILIZING CITY STREETS?)

SkyRail and SkyShuttle operate on fixed schedules on exclusive, grade separated alignments. They are not designed to operate off the guideway in mixed traffic. This is completely intentional, because the introduction of mixed traffic operation creates serious safety issues as well as very significant operational constraints that dramatically reduce capacity, reduce service frequency, and increase travel time.

As to point-to-point service such as with PRT, these systems provide far more capacity, and greatly reduce wait times due to the very frequent service, as compared to the only true, real-world PRT system in operation today (at Heathrow Airport). That said, it is possible to configure SkyShuttle with off-line stations and introduce different operating scenarios at different times of the day, including express or skip-stop service.

II.)WHAT IS THE POTENTIAL TRAVEL TIME FROM SJC TO DIRIDON?

Potential end to end travel time from SJC to Diridon station is approximately five and a half minutes. Of course, this depends upon the details of the actual alignment and station locations.

III.)WHAT IS THE POTENTIAL FREQUENCY OF THE SERVICE?

BYD proposes to operate in the peak period SkyRail at 2 minute scheduled headways, and SkyShuttle at 90 seconds to provide frequent and convenient transit to other modes. During the off peak period, we propose 5 minute headways for both technologies.

IV.)WHAT IS THE POTENTIAL PASSENGER CARRYING CAPACITY?

SkyRail can easily carry over 18,000 passengers per hour per direction (at US design standee levels), which is roughly three to four times that of a light rail system with three car trains operating at peak passenger loading.

SkyShuttle can carry up to 12,000 passengers per hour per direction at US standee levels (4 standees per square meter of standing space plus all seats occupied).

V.)HOW CAN CAPACITY SCALE UP IF DEMAND EXCEEDS INITIAL SUPPLY?

There are two fundamental approaches to increasing capacity for both technologies:

1) To decrease headway /increase service frequency of trains by introducing more trains online in the system.

2) To increase the number of cars per train consist (either via semi-permanently coupling of trains autonomously, or permanently adding cars to a train consist).

Because we believe strongly that high service frequencies will dramatically alter the way people in San Jose and Cupertino will view (and use) the system, from the outset BYD proposes to operate at 2 minute scheduled peak period headway for SkyRail and 90 second scheduled headway for SkyShuttle. In future years, if additional peak line capacity is needed, we would propose to add cars to train consists. The best way to do this is:

- Take a holistic approach to understanding how the demand may increase due the addition of a high frequency, reliable system such as this, to understand potential increases in ridership.
- Design stations that are easily expandable for longer length trains.
- Design the systems with expansion in mind.

- Procure vehicles with options for expansion to obtain best price, and/or add the San Jose vehicle order to other procurements being undertaken in other cities.

VI.)WHAT IS THE DWELL TIME OF A VEHICLE AT A STATION?

At the system planning stage, we initially assume a 20 to 30 second dwell time at stations. In reality, transfer and end-of-line stations typically have slightly longer dwell times, and intermediate stations typically have shorter dwells.

VII.)WHAT IS THE RELIABILITY OF THE SERVICE?

Both SkyRail and SkyShuttle have been proven to have operational availability of over 99.97%.

VIII.)CAN THE SERVICE BE TICKETLESS? IF SO, HOW WILL FARES BE COLLECTED?

The fare system can be integrated into the current system used by VTA, and allow passengers to utilize the same methods of payment and limit additional equipment or additional infrastructure cost. BYD designs, manufactures, installs and maintains its own ticketless fare collection system, and can provide systems for this project if desired – or procure them from VTA's preferred vendor, if required.

If the question relates to whether the service should be free to all passengers, we view that as a public policy question that will require consideration of many factors -- not an issue that the private partner can determine unilaterally.

SECTION-E CURRENT STATUS OF CONCEPT TECHNOLOGY

A.PROVIDE A DESCRIPTION OF THE CURRENT DEVELOPMENT STATUS OF YOUR CONCEPT (E.G., CONCEPTUAL, DESIGN, DEVELOPMENT, PRE-PRODUCTION TESTING OR PRODUCTION).

Both SkyRail and SkyShuttle technologies are in production, with BYD having built five SkyRail projects and manufactured SkyRail vehicles and systems for revenue service operation since 2016. In addition, there are new systems under contract, as well as several new projects in various stages of planning.

BYD has been implementing complete SkyShuttle projects since 2017, with several more in the pipeline.

As a uniquely vertically integrated company, BYD has designed, manufactured, installed, tested and commissioned these systems. BYD also is responsible for operations and maintenance on an ongoing basis. BYD's work includes manufacturing and installing the power supply system (including substations and power rails and the train control and communications systems, as well as casting the guidebeams for SkyRail and manufacturing the beams for SkyShuttle).

B. INCLUDE A SCHEDULE FOR DEVELOPMENT OF A FULLY DEPLOYABLE SYSTEM, IF APPLICABLE. IDENTIFY KEY ASSUMPTIONS FOR THIS SCHEDULE.

Assuming this question is in reference to technology readiness, a development phase is not applicable to SkyRail or SkyShuttle as vehicles are proven and deployed.

C. INCLUDE EXAMPLES OF SUCCESSFUL SIMILAR IMPLEMENTATIONS IF AVAILABLE.

PROJECT NAME	LENGTH (MILE)	STATION	TYPE	STATUS
BYD SHENZHEN	2.7	3	SkyRail	In Operation
YINCHUAN	3.5	8	SkyRail	In Operation
GUANGAN	6.8	7	SkyRail	Testing and Commissioning
JINING	5.9	6	SkyRail	Testing and Commissioning
SHANTOU	3.1 +9.1	4 + 11	SkyRail	Under Construction
SALVADOR, BRAZIL	12.4	19	SkyRail	Under Construction
BYD SHENZHEN	1	5	SkyShuttle	In Operation
XIANLINE	2.3	8	SkyShuttle	Testing and Commissioning
PINGSHAN	5.4	11	SkyShuttle	In Planning

D.IDENTIFY AREAS OF NOTABLE RISK THAT WOULD BE INVESTIGATED FURTHER.

In general, implementing a state-of-the-art urban rapid transit system inherently involves at least three major risk areas:

1. Construction Schedule adherence
2. Cost certainty
3. System performance

Please note that we do not include technology risk because SkyRail and SkyShuttle are proven, operational technologies. As we have previously mentioned in this response, we are suggesting the adoption of a P3 approach to shift these risks to the private partner – under fixed price contracts for design/construct and operate/maintain.

That said, there are some risks that may remain with the public sector, including the cost and schedule impacts of changing the design after the fixed price contract is executed, as well as the risk of less than forecasted farebox revenues. These and related public sector risks could be the subject of further discussion.

SECTION-F CONCEPT REQUIREMENTS

A.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 recognize that a significant amount of design work is necessary to be able to make decisions on such key elements as the alignment and station locations, the system performance requirements (such as the required peak line capacity), and key urban design and street restoration requirements. In addition, completion of a California EIR (and potentially a federal EIS if any federal funds are envisioned) also will require a significant amount of time. Finally, regardless of which technology is selected, California PUC safety certification will be required.

At a minimum, we probably could assume that the above would require at least one to two years to complete, in parallel with the P3/PDA process that we have previously discussed in this submittal. If we assume that the selected P3 team would receive notice to proceed at that point, below is a conceptual-level time frame for implementation for Steven's Creek & Diridon to SJC:

1) Final design and permitting	12 months (from NTP)
2) Manufacture trains	18 months (from NTP, concurrently with Task 1))
3) Construct guideway, stations, and OMSF	20 months (following Task 1)
4) Install and test systems	6 months (following Task 3)
5) System testing and commissioning	6 months (following task 4)

Total from NTP = 44 months

- Schedule based on both projects receiving NTP at same time
- Project is environmentally cleared by time of NTP issuance
- Assumes no delays to due to litigation

B.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?

SkyRail can be used in an exclusive right-of-way, in an elevated, at-grade, or underground configuration, and can transition between any of those three configurations. The maximum gradeability for SkyRail is 10%.

SkyShuttle also can be used in an exclusive right-of-way elevated, at-grade, or underground, and can transition between any of those three configurations. The maximum gradeability for SkyShuttle is 12%.

BYD has typically proposed both SkyRail and SkyShuttle technologies for the use only in an elevated guideway configuration for the following reasons:

- At-grade rights-of-way are rapidly disappearing (if not already gone), and taking automotive vehicle lanes is contentious, and worsens congestion.
- Operating at-grade greatly reduces the service frequency of trains, due to at-grade crossings with automotive vehicles, which negatively affects system capacity, and ridership experience.
- Operating at-grade is much less safe for train passengers, automotive vehicles, and pedestrians in comparison with a grade-separated exclusive right-of-way and vehicles operated by positive train control.
- The cost and environmental/community impact associated with tunneling usually is quite contentious and leads to major cost and schedule overruns for projects.
- For these reasons and the fact that SkyRail and SkyShuttle, among all other grade-separated technologies has:
    - The smallest column footprint at the ground, and can be fit in urban environments often without having to take automotive vehicle lanes
    - The lowest environmental impact due to low noise and vibration emission
    - The lowest cost of construction, due to less material in guideway
    - The fast construction time, due to pre-cast methods for constructing the guideway

For these and other important reasons, BYD envisions that these corridors for SkyRail and SkyShuttle likely would be built in an elevated guideway configuration.

C. COULD THE SYSTEM BE EXTENDED IN THE FUTURE?

SkyRail and SkyShuttle systems can be designed to be extendable in the future and would be proposed with future expandability in mind. We have developed some specific extension concepts that we are prepared to discuss in a one on one work session.

D. COULD STATIONS BE ADDED TO THE SYSTEM IN THE FUTURE?

SkyRail and SkyShuttle stations can be added to the system in the future. However, they would need to be added in areas where the alignment is straight and level – or very close to that.

E. WHAT ARE THE MAINTENANCE REQUIREMENTS FOR THE GUIDEWAY, VEHICLES, STATIONS, ETC.?

SkyRail & SkyShuttle costs significantly less to operate and maintain than comparable bus and rail rapid transit lines. There are at least three key reasons for this:

1) Smaller, much more efficient, nearly zero maintenance aerial structures.

2) Lower vehicle operating costs.

3) Complete automation

The aerial structure itself is nearly maintenance-free, with no rails to inspect and maintain. The SkyRail guide beams themselves are passive, utilizing long life, pre-cast concrete construction. SkyShuttle beams can either be pre-cast concrete or rust-resistant prefabricated steel.

SkyRail and SkyShuttle vehicles operate in a clean, controlled environment and are much easier to maintain. Through millions of miles of service, the maintenance regimes and inspection requirements are known and very straightforward. All of the on-board equipment is readily accessible, and proven, transit grade components are used throughout.

SIGNIFICANTLY REDUCED ENERGY CONSUMPTION.

BYD's SkyRail offers a completely integrated, zero emissions, highly energy efficient power supply and distribution system. Further, the energy created through on-board regenerative braking is stored in very low maintenance wayside batteries to ensure that the regenerated energy will be saved and passed on not only to other vehicles operating on the line, but also to the passenger stations and to the electric power grid. The power substations and stations can be equipped with solar panels and energy controllers to again maximize energy efficiency.

As a uniquely green, sustainable technology, SkyShuttle vehicles are light weight and as such consume much less energy. Further, the charging infrastructure itself is very efficient and there are no large power substations required along the route.

SECTION-G COST

A.WHAT IS THE COST PER MILE TO DELIVER THE FIXED INFRASTRUCTURE NEEDED TO OPERATE THE SYSTEM, NOT INCLUDING STATIONS AND LAND ACQUISITION COSTS?

Straddle-type monorail (SkyRail) and battery power automated people mover (SkyShuttle – the world's only such technology) are simply the lowest cost, proven, grade separated technologies capable of moving well over 10,000 passengers per hour per direction (pphpd) at high service frequencies.

That said, overall project capital costs can vary widely due to factors that are not yet known, including the details of the alignment, the size, number, and design of the stations, utility relocation requirements, and so forth.

As the proposed projects gain momentum, BYD will fill out our top-level implementation team, develop preliminary assumptions regarding such form-giving factors, prepare conceptual level capital and O&M cost estimates, and develop a preliminary plan of finance.

B.WHAT IS THE INCREMENTAL COST OF A STATION AND/OR ACCESS POINT?

Station cost is highly dependent on design, architectural treatments and also project site specific conditions. However, due to these as yet unknown factors, we can't provide a realistic estimate until those factors are defined. That said, our high service frequency translates into shorter trains, hence, shorter, lower cost stations.

C.WHAT IS THE COST OF THE VEHICLE FLEET NEEDED TO BEGIN OPERATIONS?

Respectfully, due to confidentiality, BYD will not be submitting a cost for the vehicle fleet for this RFI. We look forward to doing so upon issuance of an RFP for these corridors. However, SkyRail and SkyShuttle vehicles are competitive in cost to other elevated, automated vehicles. Further, the cost of the vehicle fleet itself is a small percentage of the total capital cost of the project, usually less than 10 percent.

D.SUMMARIZE THE CAPITAL COSTS FOR DELIVERING THE FULL SYSTEM FOR EACH POTENTIAL PROJECT, AIRPORT CONNECTOR AND STEVENS CREEK LINE. ASSUME SIX STATIONS ON THE STEVENS CREEK LINE AND THREE STATIONS ON AIRPORT CONNECTOR, PLUS DIRIDON STATION FOR BOTH ROUTES.

Because the key factors mentioned above that contribute greatly to the overall cost are not yet defined, BYD has not yet prepared capital cost estimates. To further underscore this point, we can state that our estimates for other proposed projects in this country, as well as for projects in other countries in the Americas, are ranging from SkyRail well under $100 million per mile up to as much as $300 million per mile, including all project costs. SkyShuttle projects are significantly less costly.

We look forward to developing corridor-specific capital and O&M estimates as these factors come into definition.

E.PROVIDE A HIGH-LEVEL ESTIMATE OF THE ONGOING OPERATIONS AND MAINTENANCE COSTS, AS WELL AS EQUIPMENT REPLACEMENT COSTS AND SCHEDULES.

For the same reasons stated above with respect to the capital costs, it is impossible to provide realistic O&M estimates until a number of key factors are defined.

We can say that we are quite confident that both SkyRail and SkyShuttle inherently represent much lower O&M cost technologies than traditional rail and airport people mover technologies that already have been built in the Bay Area. This translates into much lower ongoing operating deficits, or the elimination of such deficits altogether.

SkyRail operations and maintenance costs are competitive and improved over other, older, straddle type monorails. An example of costs for 20 year-old monorail technology can be found on Las Vegas Monorail's website, where audited financial statements are available.

As a relatively simple and light weight, energy-efficient system, with no power rails and no substations, SkyShuttle operations and maintenance costs are much improved over other, older, people mover technologies.

SECTION-H BUSINESS PLAN

A.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.

While this is not a "one size fits all" undertaking, our sense is that the proposed project might best be implemented through a Private/Public Partnership (P3). In stating this, we must first point out that P3 should not be viewed as a source of funds, per se. Rather, it is a proven method of delivering and financing major infrastructure projects that in the simplest of terms, can deliver projects sooner, shift all major project risks to the private sector, and provide cost certainty to the public sector.

In the urban rapid transit sector, projects can be designed, financed, constructed, operated and maintained by the private sector in partnership with public authorities, local and state governments, and/or special purpose or joint powers agencies. These types of P3s have become increasingly common around the world as a viable method for delivering new and reconstructed projects in an expedient manner for many reasons, especially for the following four key reasons:

- First, the P3 approach is best suited for projects that are unique, typically using stand-alone operating technology, including the guideways, stations, and maintenance and storage facilities. This means that there typically would be no interoperability with existing rail or BRT projects. Hence, all initial and ongoing capital costs and ongoing O&M costs are known up-front, and are contracted for on a total turnkey basis through fixed price contracts, thereby enabling the public partner to shift all major project risks to the private partner -- thereby gaining the cost assurance needed to secure the required funding and stakeholder support. This also enables the public partner to make the final team and technology selection in an open and transparent way, whereby all aspects of the proposed project are considered in a competitive procurement process.
- Second, the P3 process is very well suited to situations where the public entity does not have sufficient up-front funding available to implement the project on a pay-as-you-go basis. Thus, the selected private partner can arrange for long term private debt and any required private equity, and to: a) incorporate into the project financing structure whatever public debt the public partner and to decides to use, and to supplement any state or federal grant funds the public partner may be able to attract; and b) provide the best match to the projected public revenue stream needed to repay the debt over the long term, often up to 30 to 35 years.

- Third, by using the P3 approach, projects can be completed much more rapidly. This can be realized through the use of a negotiated Pre-Development Agreement (PDA). This type of P3 agreement is suitable when the following five conditions pertain:
    - The project is not yet completely defined.
    - Financial feasibility is not yet fully determined, but preliminary financial assessment indicates good potential for project economic viability.
    - A public authority sponsor seeks private sector innovation, especially in providing the most appropriate technology and identifying accelerated approaches to designing and constructing the project.
    - The environmental analysis and clearance process has not commenced or is in early phases such that the selected P3 Team can provide timely input to the environmental documents, thereby accelerating that process as well.
    - Fifth, the P3 construction could be done under a project-wide Project Labor Agreement (PLA), just as most would likely be the case if it were performed under a more traditional process. Further, the vehicle manufacturing also could be done with a unionized work force (just as BYD is doing already through its state-of-the-art electric bus manufacturing plant in Los Angeles County – meeting or exceeding Buy America requirements and confirming such through regular audits performed by the Federal Transit Administration).

BYD can provide a great deal more information about the P3/PDA approach and we are prepared to do so in a one-on-one work session.

B.WHO WILL OPERATE THE SYSTEM ONCE CONSTRUCTED (VTA, THE BUILDER, PPP, OTHER)?

While any one of these entities could operate and maintain the system once it is constructed, the P3 approach enables the public partner to gain O&M cost certainty, while at the same time requiring the private partner to meet or exceed all operating standards and specifications. This yields the benefit of shifting the risk and responsibility of high quality, reliable, on-time completion, and ongoing performance of the system, to the private partner. A few key points to highlight in this regard include:

- The financial aspect of the P3 agreement usually relies upon mutually agreed "Availability Payments" that are established to cover both debt service and all or a specific portion of the O&M costs. If the actual performance within a payment period (e.g., monthly, quarterly, or annually) fails to meet specified levels, the contract includes penalties for under-performance (and in some cases, incentives for performance superior to the contract requirements).
- Participation of the technology supplier in the O&M organization is highly desirable, because they have the greatest motivation to take corrective actions to meet specified reliability and performance specifications. BYD actually prefers to lead or take a major role in the O&M organization.

- That said, if public policy dictates that the public sector eventually would need to operate and maintain the system, it still could be done after the initial O&M period where the service would have been provided by the private partner. In this manner, any "teething" problems encountered in the initial operating period, typically five years, would have been addressed and solved by the private partner prior to its turnover to the public sector.
- In addition, it is very important to note again that under the P3 approach, the ongoing O&M labor force could be unionized, just as would be the case if it were a public operator.

C. WHAT IS THE PASSENGER FARES STRATEGY?

For many reasons, including such considerations as social justice and political and community acceptability, we view the fare policy to be a public policy issue, not to be established by the private partner – simply as will be agreed to in the PDA/P3 agreement.

D. WHAT ARE THE EXPECTED FARES FOR PASSENGERS TO USE THE SYSTEM?

As mentioned immediately above, we believe that the fare structure would be established by the public partner, at a level that is generally consistent with other comparable transit services in the region. If there are no other "comparable" transit services in the region, the fares for the system still should be established to be consistent with what is equitable and appropriate with respect to the public partner's mandate and social policies.

E. WHAT IS THE STRATEGY TO MAXIMIZE RIDERSHIP?

First and foremost, we believe strongly that the characteristics of the project itself will have the greatest impact upon ridership – a much greater impact than any promotional program of any sort could provide. These include:

- Providing very high frequency service, especially as compared to service frequencies typically available on the region's existing bus, light rail, rail rapid transit, and commuter rail lines. We believe this is made possible only through the adoption of a fully grade separated, automated system that uses proven but advanced, moving block train control technology – as do BYD's SkyRail and SkyShuttle systems.
- Taking full advantage of high service frequency. Our view is that passengers using the system should not need to have a timetable – rather, they should be able to simply show up at the station at any time of the day, and wait no more than a couple of minutes, on average. We view this as a huge "game-changer" for mass transit in the region. Further, such high service frequency also will greatly facilitate transfers to and from the existing transit lines in the region – thereby greatly extending the reach of those systems.
- Laying out the alignment and station locations to minimize walking distance from major trip attractors and origins along in the two corridors. This greatly reduces the "first mile, last mile"

problem that plagues mass transit systems in the newer, more auto-oriented urban development patterns of our nation's fastest growing western cities.

- Using low impact, small footprint, sustainable technology(s) that convey a modern and attractive image -- which by their very nature makes them much more acceptable and feasible for closing that first mile, last mile gap. Such technology enables much closer penetration of major trip-generating employment, residential, and commercial areas. BYD's SkyRail and SkyShuttle clearly fit the bill in this regard.

Of course this is not to say that the manner in which the system is branded and promoted is insignificant; and it also is important that ticketing, in particular, be made as user-friendly as possible. We do have some relevant experience in this regard with some of the higher technology solutions that are available for these two lines.

F.CAN CAPITAL AND OPERATIONS COSTS BE FUNDED THROUGH PASSENGER FARES?

Regardless of what advocates of some specific transit technology may say about this question, in short, the answer almost certainly is no. These are highly capital intensive projects, and farebox revenues can't reliably be counted on to amortize the cost of construction.

Not only was the only American urban rapid transit project in the modern era that tried to do this financially unsuccessful (the Las Vegas Monorail), the most experienced transportation infrastructure equity investors and lenders here and abroad are unwilling to accept any significant degree of ridership and revenue risk on mass transit projects.

Our Senior Strategic Advisor for BYD's SkyRail and SkyShuttle projects, Dr. Thomas Stone, was intimately involved in the technical and financial formative stages of the Las Vegas project, and he is prepared to provide the City with some fundamental insights into what transpired and how it has shaped the financial community's view of such undertakings – even though it was refinanced and its farebox revenues still do exceed its basic annual O&M costs.

This reality strongly suggests that to be successful, the financing structure for this project needs to be designed to cap the financial exposure for farebox revenues to a specific amount through a public sector "financial backstop", or even better yet for the overall financing, for the public partner to simply accept all of the farebox revenue risk.

That said, it is very important to note in this regard that BYD's SkyRail and SkyShuttle technologies are inherently the lowest O&M cost alternatives available within their respective class. There are many key reasons for this, all of which we can delve into in some detail in a one-on-one meeting.

Accordingly, on all of our proposed projects here in the United States, our projections are showing that fares set at reasonable and realistic levels, when combined with realistic projections of advertising revenues, <u>will exceed operations and maintenance costs, thereby minimizing or completely eliminating any need for ongoing operating subsidies.</u>

G.DESCRIBE OPPORTUNITIES OR STRATEGIES TO MAXIMIZE FAREBOX RECOVERY AND/OR OFFSET OPERATIONS AND MAINTENANCE COSTS.

As mentioned above, our analysis to date on other proposed SkyRail and SkyShuttle projects in the United States indicates that there is a very high likelihood that fares and advertising revenues can exceed operations and maintenance costs – and our initial view is that this would be the case with this project as well. Strategies to maximize revenues and maximize overall project financial performance include not only fares and advertising revenues, but also a number of additional potential measures, including, but not limited to:

- Employ innovative measures to attract corporate sponsors and naming rights partners, similar to those used by professional sports franchises all around the world, and/or by public sector stadium and arena owners. Not only can this be done tastefully and professionally, just as is being done in many other areas of business, BYD has hands-on experience with some of the most experienced firms and individuals who arrange these deals – experience that has shown us how to make them a reality.
- Incorporate stations into new or existing mixed use developments in such a manner as to create supplemental revenue streams from the private sector developers, property managers, and/or lessees. Such "joint development" agreements can take many forms, depending upon the particulars of each station location. The unique nature of the SkyRail and SkyShuttle technologies actually facilitates such agreements, because of their attractive and modern image, their low noise and vibration characteristics, and their much smaller guideway structures.
- Design the operations and maintenance facility to be incorporated into a mixed use development. Unlike rail maintenance facilities, SkyRail and SkyShuttle O&M facilities are elevated, thereby allowing for surface or structured parking underneath, and vertical development above. And these facilities are much quieter and cleaner, and convey much more of a "high tech" image. Hence, they can very good neighbors – thereby allowing them to quite literally be "out of sight, out of mind". BYD can show the City an example of such a facility that we are proposing in another city in California.
- Use innovative funding mechanisms to capture some of the value that the project will create. One of the more promising of such measures in California is the Enhanced Infrastructure Financing District (EIFD), which can be created by the City with Santa Clara County concurrence. EIFDs can provide a mechanism whereby a portion of the increase in assessed valuation of the property immediately adjacent to the transit station can be captured through property tax based, tax increment financing. And used to help fund the transit project.

The BYD Team looks forward to discussing our responses to all of these questions with you.

SECTION-I IMPACTS

A. WHAT ARE POTENTIAL NEGATIVE IMPACTS DURING CONSTRUCTION?

Depending upon the specifics of the alignment, the single biggest impact during construction could be the temporary closure of up to one traffic lane in each direction, should the guideway be constructed in the median of the roadway. If the alignment is on the shoulder/side of a road-way, most likely, only one traffic lane would need to be temporarily closed. The closure at any one time would be temporary and would be approximately 1000 feet in length. The adjacent lane is used for constructing the footings and erection of the pre-cast guidebeams for SkyRail or pre-fabricated guideway beams for SkyShuttle, which are manufactured at an offsite batch plant or fabrication facility.

As a general rule, the dual-beam elevated guideway can be constructed at a rate of about 0.6 miles per month (excluding site/utility relocation work), meaning the temporary closure of lane(s) in a specific area lasts for only a relatively short period of time.

BYD's construction scheduling proposes to ship precast guidebeams or pre-fabricated guideway "just in time" to environmentally sensitive jobsites to minimize site lay-down area and reduce the number of transportation vehicles and their traffic impact.

For the footings, depending upon the actual geotechnical conditions, quite often the drilled shaft (caisson) method is used, rather than driven piles. This greatly reduces noise to the surrounding community.

Other noise from construction equipment such as backup alarms and engine idle are similar to what is typically found for other infrastructure construction. Utility re-location due to column and footing placement is minimized by BYD SkyRail and SkyShuttle, due to the smaller, lighter weight vehicles and beams, which yields smaller foundations. Cantilevered columns can be built around utilities and left turn bays much more readily as well. This eliminates the number and duration of planned utility relocations, as well as reduces project cost.

B. WHAT ARE POTENTIAL NEGATIVE IMPACTS DURING OPERATIONS?

Because both SkyRail and SkyShuttle are rubber-tired straddle type monorail and battery powered APM technologies respectively, the noise and vibration emitted from the vehicles is substantially less than any steel-wheeled technology. As a matter of fact, the noise emitted by the vehicles is substantially less than the ambient noise levels created by the existing automobile, bus, and truck traffic. In addition to the lower noise associated with electric propulsion and rubber tires, our vehicles are equipped with side skirts that cover the tires to further reduce their low noise emissions. As a result, it can be expected that environmental impacts will be low and community acceptance of these technologies will be quite positive.

As to visual impact, BYD is not ignorant to the fact that elevated transportation systems can create a "visual impact". Fortunately, due to the light weight and small size of both SkyRail and SkyShuttle vehicles and beams, the guideway, stations, and OMSF's are the least visually impactful due to substantially less material, even in seismic areas. BYD works with the Norman Foster Foundation and Gensler Architects on thoughtful design of the guideway, stations, and the OMSF to mitigate the visual impact associated with SkyRail and SkyShuttle systems. We look forward to submitting these proprietary designs and visuals to you in response to an RFP.

C.HOW CAN NEGATIVE IMPACTS BE MITIGATED?

This is certainly a site-specific issue. As a general rule, however, unlike other conventional steel wheel and rubber tire technologies, SkyRail and Sky Shuttle do not require noise barriers of any kind.

D.WHAT MIGHT THE COMMUNITY OUTREACH AND ENGAGEMENT STRATEGY LOOK LIKE?

We suggest a series of transparent and interactive workshops with the community in areas of the potential alignment, whereby our representatives and yours would work hand-in-hand, but under your overall direction. Regardless of who presents them, we will provide accurate visuals of the guideway and station concepts, as well as accurate facts on the technology's noise and vibration levels. This engages the community by inviting feedback on alignment and design concepts, and such a collaborative process can greatly enhance the likelihood of achieving a broader base of community consensus.

Our team stands ready to assist in this critical effort in several ways. For example, we can provide high quality graphics to help explain the technology, demonstrate its compatibility with the corridor, and describe its construction methods and operating characteristics. We can designate highly experienced people to participate and directly answer questions, should you so desire.

In parallel, we can provide high quality briefings to identified business and community leaders, describing the companies comprising the BYD team, reviewing our experience, showing the technology, and conveying images and information to clearly describe our vision for the project. In these briefings, we always try to create an informal dialogue whereby the participants are comfortable offering comments and suggestions. In our experience, this often leads to follow-up meetings where we report back on our findings regarding the comments and suggestions made in the initial meetings.

This approach not only builds mutual trust and respect, in our experience it also results in better projects – projects where the stakeholders in the corridor gradually develop a sense of ownership of the design concepts, if not of the project itself.

APPENDIX TABLE OF CONTENTS

APPENDIX 1 BYD CORPORATE SUMMARY

BYD is a pioneer in achieving a Zero Emission Energy Ecosystem, offering affordable solar power, reliable energy storage, and electrified transportation. Founded in February 1995, BYD is a private (non-government owned or controlled company) and has grown from a start-up rechargeable battery manufacturer with only 20 employees into a multi-billion dollar global company with 220 thousand employees today. Throughout its 24 years of high speed growth, BYD has established over 30 industrial parks across six continents and has played a significant role in industries related to electronics, automobiles, new energy and rail transit. From energy generation and storage to its applications, BYD is dedicated to providing one-stop zero-emission energy solutions.

BYD is now one of the world's largest manufacturer of batteries and battery-electric vehicles, selling more than 50,000 pure battery-electric buses, and 8,000 electric trucks, and 20,000 electric forklifts. For four years in a row (2015-2018), BYD has been ranked No. 1 on the global new energy vehicles (NEV) market, which includes plug-in hybrid and pure electric vehicles.

BYD's global transportation strategy is designed to address the climate crisis, the increasing air pollution and worsening traffic congestion from rapid urbanization. The universal adoption of electrified vehicles can reduce the consumption and dependence on fossil fuel, and further reduce the greenhouse gases emission. As such, BYD has focused on the mass market adoption of zero-emission, battery-electric vehicles. BYD's initial efforts focus on transit buses, coaches, taxis, consumer vehicles, logistic vehicles, construction vehicles, and waste management vehicles; with a specific focus on vehicles in the warehouse, mining, airport, and port & terminal environments.

In addition, BYD has invested five years and $2.2 billion on automated rapid transit system development, including $700+ million on SkyRail -- this autonomous monorail system is a cost-effective alternative to traditional subway systems and addresses traffic congestion problems in urban areas. It has strong advantages including high-capacity, high-speed, driverless operation, and constructed far faster and with far less impact than other systems.

An ongoing innovator and investor, BYD owns 15,000+ patents, and has applied for 24,000 patents globally. BYD's stock is publicly traded, and Berkshire Hathaway, based in Nebraska, is the largest public shareholder of BYD's H-Shares. We are committed to our BYD mission: "technological innovations for a better life."

BYD FIVE BUSINESS SECTORS SUMMARY a World Health Organization study of 3,000 cities in 103 countries showed more than 80% were above unhealthy air pollution levels. A total energy solutions company, BYD's goal is to help solve this global crisis by developing mass-market green technologies. To achieve this vision, BYD created five business sectors: Batteries, Commercial Vehicles (Bus, Truck, Forklifts, and Taxis), Rail Transit, Electronics, and Passenger Vehicles.

1. BYD BATTERY AND ENERGY STORAGE SOLUTIONS

BYD is the world's largest lithium iron phosphate battery manufacturer. With more than two decades of continuous innovation, the firm offers a variety of battery products from consumer 3c batteries, power batteries, solar cells and energy storage batteries; and has a complete battery ecosystem (raw materials, R&D, design, manufacture, application and recovery). In addition to applications in new energy vehicles and rail transportation, BYD's batteries are widely used in solar power stations, energy storage power stations and many other new energy solutions. In 2020, BYD is forecasted to reach 65gwh of battery capacity. As the leading energy storage solution (ESS) provider, BYD is specialized in providing largescale energy storage, distributed energy storage and micro-grid systems. The ESS can be deployed in a variety of applications, including alternative energy generation, frequency regulation, emergency backup, peak load shifting, and capacity reservation. BYD is now supplying about 462MW/463MWh energy storage products to customers in the United States, Canada, France, Germany, Switzerland, Italy, Australia, Japan and South Africa.

2. BYD COMMERCIAL VEHICLES

According to the California's air resources board, transportation emissions make up 33% of the state's smog forming emissions, and are expected to increase if additional actions are not taken. And that is just one U.S. statistic. BYD recognized this growing global issue back in 2011 and developed a transportation electrification strategy that encompassed both commercial and consumer vehicles. BYD Battery-Electric Buses, With 50,000 buses sold to date, BYD is one of the world's largest manufacturer of battery electric buses (BEBs), in service across 300 cities, 50 countries and regions, and 6 continents. Per the U.S. DOT, every BEB eliminates 1,690 tons of CO2 over its 12-year lifespan, 10 tons of nitrogen oxides and 350 pounds of diesel particulate matter.

In North America, BYD has sold and/or leased more than 600 buses, with 280+ buses delivered to more than 50 municipal, transit agency, university, airport, federal and other commercial and private sector clients in 13 states, and across 4 provinces in Canada. Its diversified BEB portfolio includes 12 models that range in size from 30 to 60 foot buses, and motor coaches from 23 to 45 foot. BYD was the first firm in the world to design and manufacture a 60-foot BEB. Affordable, dependable, and American-manufactured, BYD's BEBs can integrate easily into a transit fleet, offering a clean, zero-emission alternative to diesel-fueled buses. The buses are powered by revolutionary iron-phosphate batteries that are non-toxic and environmentally friendly, as well as the safest in the industry. The firm's battery-electric, zero-emission buses not only meet but also exceed all current and future stated FTA "Buy America" requirements, incorporating 70%+ U.S. content.

BYD Battery-Electric Trucks, as the leading global provider in battery-electric trucks focused on logistics, retail and waste management, BYD has sold 8,000 electric trucks globally.

Medium and heavy duty vehicles represent a significant source of greenhouse gas emissions – 23% according to the U.S. Environmental Protection Agency. The U.S. battery electric truck market is in its initial growth phase with an estimated 100 or fewer electric trucks in 'commercial service,' more than 40 of which are BYD trucks. The BYD trucks team has paved the way for electrification by offering seven (7) vehicle models, including top handlers, yard tractors, drayage trucks, box trucks, and refrigerated trucks.

The leader in the U.S. market, BYD will deploy the U.S.' first 'commercially-available, mass produced' battery-electric heavy-duty trucks in 2019. BYD's electric trucks are designed and built from the ground up, specifically for the U.S. market. With the advantage of BYD's 20+ years of advanced battery technology experience, the firm's electric trucks are known for their best-in-class performance and reliability.

BYD Battery-Electric Forklift, BYD started development of its pure-electric forklift products in 2009, as an important movement to achieve zero-emissions for off-road applications, particularly at ports, airports, warehouses and storage facilities. To date, BYD sold 20,000 electric forklifts to 30+ countries around the world, including 1,000+ in the U.S./Canada/Mexico.

In North America, BYD's forklift practice focuses on food & beverage, logistic & storage, appliances and construction material industries, offering five (5)+ Forklift and three (3) Tugger models (GSE) and plans to double model offerings in 2019. BYD electric forklift benefits include elimination of fuel expenses, reduction of maintenance costs, 90% time savings in charging time compared with lead-acid forklifts; and charging options allow forklifts to run all shifts.

BYD Taxis, BYD is the first automaker to launch taxi fleet electrification in the world. Its first self-developed electric taxi, E6, was put into operation May 2010 for an 850-taxi fleet in Shenzhen. Applying this strategy to the rest of the world in 2014, BYD's electric taxi fleet began serving the major cities of Europe, including London, Brussels, Rotterdam, and Barcelona. Further expansion in 2017 and 2018 saw deliveries of e-taxi fleets in Southeast Asia and South America. BYD is pursuing several North America opportunities.

3. BYD RAIL TRANSIT

SKYRAIL is a fully integrated, driverless, state-of-the-art straddle type monorail system developed for rigorous line-haul urban transit applications. with an R&D team of 1,000+ engineers and investment of $700+ million over five years, SkyRail is the world's most advanced monorail system, with 200+ miles of systems already in planning, design, construction, or operation. The BYD system can be constructed far faster, with far less impact, and less costly than any other grade-separated urban transit system. SkyRail systems can move 18,000+ people per hour per direction (at U.S. standing space standards), at speeds up to 75 mph and with trains operating on two-minute scheduled headways. SkyRail incorporates the 60 years of evolutionary improvements found in other forms of rail transit. To date, BYD has conducted feasibility studies in urban cities and metropolitan areas in the globe, successfully attracted over 100 cities for future cooperation.

BYD's SkyShuttle is the world's first re-chargeable, battery-electric, grade separated, autonomous, sustainable, and higher speed solution to the "First Mile/Last Mile" and short urban line haul challenge that all cities face in striving to create a viable mobility alternative to the private automobile. SkyShuttle was developed specifically to meet this challenge through the full integration of proven components provided by the world's leading provider of green, sustainable, fully integrated transportation systems: BYD, the simple low cost, low profile, modular pre-fabricated elevated structure supports attractive small vehicles that can operate as a single car or in trains at very high frequencies (every 90 seconds), at speeds up to 50 mph (80 km/hr.). No costly and risky underground construction is required.

4. BYD ELECTRONICS

As one of the world's leading handset components and assembly services suppliers, BYD provides clients with "one-stop" services including design, R&D, manufacturing, logistics, and aftersales, with a product portfolio covering handsets, tablets, notebook computers, and other consumer electronic products. Among BYD's key clients are Apple, Google, Microsoft, Samsung, LG, Lenovo, and other global companies. In the future, BYD will continue to its presence in the markets of consumer electronics, automotive smart system, and smart devices with "internet of things" (IoT) applications.

5. BYD CONSUMER VEHICLES

BYD is the first and the only electric vehicle manufacturer in the world to have full expertise and self-owned integrated technology of batteries, electric motors, and electronic controls. The firm is one of the world's only automakers with full capability to mass-produce self-developed automotive-level insulated-gate bipolar transistor (IGBT) within its own industrial chain. In 2008 after releasing BYD's first production plug-in hybrid vehicle sold in the world, the firm has since launched a variety of new energy vehicles (NEV), including all-electric and plug-in hybrid models. For the last four years in a row, BYD has been ranked No. 1 on the global NEV market. Since 2010, BYD has sold 500,000 NEVs in the global passenger market. BYD international R&D force includes Wolfgang Egger, former Chief Designer of Audi and Lamborghini; JuanMa López, former Head of Exterior Design of Ferrari; Michele Jauch-Paganetti, former Head Advanced Design Interior of Mercedes Benz; former Mercedes Benz chassis designer Heinz Keck; and world-renowned noise/vibration/harshness expert Heebum Cha

APPENDIX 2 SKYRAIL SPECIFICATION

BYD SKYRAIL

State-of-the-Art, Driverless Monorail

BYD's SkyRail is a fully integrated, driverless, state-of-the-art straddle type monorail system that incorporates all of the features needed for rigorous line-haul urban transit applications.

The elevated fixed guideway means there are no at-grade passenger or vehicle collisions.

SkyRail is compliant with all applicable codes and standards, including NFPA 130 and ASCE 21 specifications.

BYD's Iron phosphate batteries are installed in all trains so in the event of a regional power outage, trains can still operate to the nearest station to safely discharge passengers. It also means that power rails are not required in maintenance facilities, greatly reducing electrical arcing risk to maintenance personnel.

SkyRail can be, and already is, constructed far faster, with far less impact, and less costly than any other comparable urban transit system technology because:

- It uses the smallest, lightest weight aerial structure
- Unlike any other comparable technology, SkyRail's aerial structure provides both the structural support as well as guidance for vehicles in a single guidebeam.
- This makes the footings much smaller and easier to fit into congested corridors with fewer utility relocations, while minimizing costly, time-consuming, and often contentious property acquisition.
- Uses pre-cast structural elements – including columns and beams – which greatly speeds the construction process and minimizes traffic and community disruption.
- As a result, SkyRail is much less costly to construct than conventional elevated technologies and a fraction of the cost of subways.

SkyRail's wide carbody and walk through design facilitates seamless ingress, egress and passenger flow through the train.

Configurable in up to an 8-car fixed consist, or smaller consists coupled automatically, SkyRail systems can move up to 37,200 people per hour per direction with trains operating on two minute scheduled headways (18,780 at U.S. standing space standards).

SkyRail incorporates the 60 years of evolutionary improvements found in other forms of rail transit, including: proven guide-beam switching utilizing transit grade components, state-of-the-art communications based, moving block train control, 5.8 GHz wireless communications, on-board Wi-Fi, and wayside battery energy storage.

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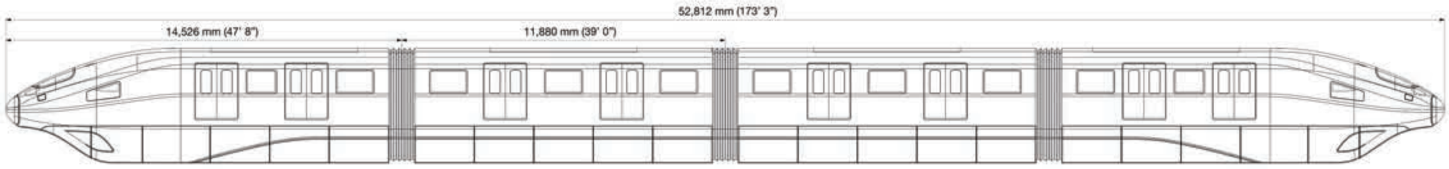

	BYD SKY RAIL	HIGH SPEED AUTOMATED MONORAIL
Vehicle Data	Type of Vehicle	BYD SkyRail
	Maximum train consist	2-to 8-car trains
	Automatic coupling	2 to 8 car consists form 4, 6, or 8-car trains
Dimensions and Weight	Length (end car overall)	14,525 mm(47'8")
	Length (end car over coupler)	14,050 mm(46'1")
	Length (mid car)	11,880 mm (39' 0")
	Width (overall)	3,165 mm (10' 5")
	Rooftop to top of running surface	3,020 mm (9' 11")
	Doorway width (clear opening)	1,300 mm (51")
	Doorway height (at threshold)	1,850 mm (73")
	Wheelbase (centerline to centerline)	9,114 mm (29' 11")
	Vehicle weight empty (average)	14,000 kg (30,856 lb)
Technical Characteristics	Power distribution	750 Vdc or 1500 Vdc
	Propulsion system	3-phase AC permanent magnet synchronous motor, 2 per car
	Backup propulsion system/Maintentance facility propulsion	on-board rechargeable BYD iron-phosphate batteries
	Vehicle guidance	straddle beam monorail
	Vehicle operation	bi-directional
	Braking	regenerative/friction
	Energy storage	wayside containerized battery energy storage, BYD iron-phosphate batteries
	Suspension	pneumatic spring, self leveling load
	Bogies	2 single axle dual load tires per car with lateral guidance tires
	Carbody	aluminum carbody, steel underframe, composite end cap
	Windows	tinted, single glazed
	Doors	2 bi-parting doors per side per car
	Air-Conditioning	Roof-mounted module containing twin HVAC units
	Fire safety design	floor rating meets ASTM E-119, NFPA 130 compliant
Performance and Capacity	Maximum operating speed	120 km/h (75 mph)
	Nominal cruising speed	105 km/h (65 mph)
	Acceleration rate (service)	1 m/s2 (3.28 ft/s2)
	Brake rate	1 m/s2 (3.28 ft/s2)
	Minimum horizontal curve radius	46 m (150')
	Maximum sustained gradient	10%
	Recommended maximum gradient	6%
	Wheelchair locations	2 per car (flexible)
	Passenger seats per car	
	Perimeter (end car, mid car)	16, 16 (flexible)
	4-across (end car, mid car)	20, 16 (flexible)
	Vehicle capacity (standees + seated) (4-car train, 4-across seating)	
	@ 4 pass./m²	238 + 72 = 310
	@ 9 pass./m²	536 + 72 = 608
	Design capacity (4 standees/m² / 9 standees/m²)	
	2-car trains at 2 min scheduled headways	4,560 pphpd / 8,760 pphpd
	4-car trains at 2 min scheduled headways	9,300 pphpd / 18,240 pphpd
	8-car trains at 2 min scheduled headways	18,780 pphpd / 37,200 pphpd

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SKYRAIL

APPENDIX 3 SKYSHUTTLE SPECIFICATION

BYD SKYSHUTTLE

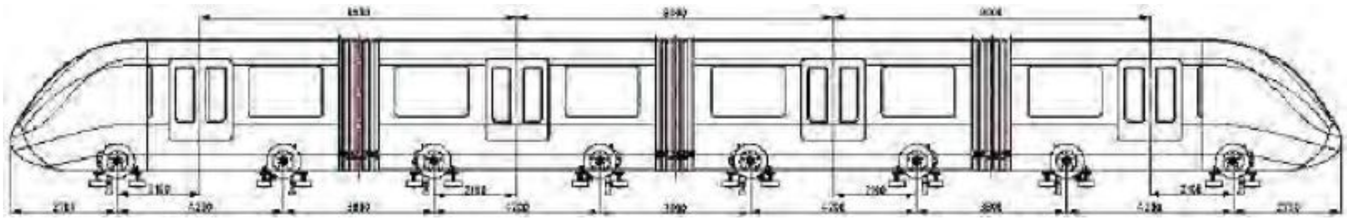
BYD's SkyShuttle is the world's first rechargable, battery-electric, grade separated, autonomous, sustainable, and higher speed solution to the "First Mile/Last Mile" and short urban line haul challenge that all cities face in striving to create a viable mobility alternative to the private automobile. SkyShuttle was developed specifically to meet this challenge through the full integration of proven components provided by the world's leading provider of green, sustainable, fully integrated transportation systems: BYD.

The simple low cost, low profile, modular pre-fabricated elevated structure supports attractive small vehicles that can operate as a single car or in trains at very high frequencies (every 90 seconds), at speeds up to 50 mph (80 km/hr). No costly and risky underground construction is required.

SkyShuttle vehicles may bepermanently coupled or semi-permanently coupled, autonomously. Vehicles can be permanently coupled in 2 to 6-car train consists. Alternatively, 1, 2, or 3-car consists can be semi-permanently coupled to create 2, 4, or 6-car consists.

No other First Mile/Last Mile technology provides all of these advantages:

- Short travel times due to higher speed operation
- Short wait times due to 5G wireless, communications-based, automatic train control technology achieving short headways
- Complete alignment and station location flexibility, unlike all cable propelled alternatives (including gondolas and cable people movers)
- Pre-fabricated structural elements – including columns and beams – which greatly speeds the construction process and minimizes traffic and community disruption.
- Fully rechargeable battery-electric propulsion using BYD's state-of-the-art iron phosphate, recyclable, long life batteries and proven, highly reliable permanent magnet AC synchronous motors, unlike other rubber-tire people movers.
- In-station battery charging, which extends the 90-mile range by 1 kilometer (0.6 miles) at every in-station charging stop, plus regenerativebraking.
- Due to battery propulsion. No guideway electrification required, which greatly reduces cost,
- Can traverse very steep grades and very short radius curves
- Fully compliant with applicable codes and standards, including continuous emergency evacuation walkway and wheelchair accessibility.
- Walk-through vehicles to evenly distribute passenger loads and provide rapid emergency evacuation access at both ends of the vehicles.
- Automatic coupling to adjust capacity for special events



	BYD SKYSHUTTLE	BATTERY ELECTRIC AUTOMATED PEOPLE MOVER
Vehicle Data	Type of Vehicle	BYD SkyShuttle
	Maximum train consist	1-to 6-car trains
	Automatic coupling	1, 2 or 3-car consists form 2, 4 or 6-car trains
Dimensions and Weight	Length (end car overall)	8,800 mm (28' 10")
	Length (end car over coupler)	8,300 mm (27' 3")
	Length (mid car)	8,000 mm (26' 3")
	Width (overall)	2,400 mm (7' 10")
	Rooftop to top of running surface	3,400 mm (11' 2")
	Doorway width (total)	1,300 mm (51")
	Doorway height	1,850 mm (73")
	Wheelbase (centerline to centerline)	4,200 mm (13' 9")
	Vehicle weight empty (average)	6,800 kg (15,000 lb)
Technical Characteristics	Power distribution	None required, uses onboard batteries
	Propulsion system	Permanent magnet synchronous motor, one motor, 110 KW per vehicle
	Backup propulsion system/Maintenance facility propulsion	Onboard batteries
	Vehicle guidance	Lateral Guidance Tires
	Vehicle operation	Bi-directional
	Braking	Regenerative/friction
	Energy storage	BYD iron-phosphate batteries
	Suspension	Spiral spring suspension
	Bogies	2 single axle dual load tires per car with lateral guidance tires
	Carbody	Aluminum alloy
	Windows	Tinted, single glazed
	Doors	1 bi-parting door per side per car
	Air-Conditioning	Ensure inside temperature ≤28°C±1°C when environment temperature is 35°C
	Fire safety design	Floor rating meets ASTM E-119, NFPA 130 compliant
Performance and Capacity	Maximum speed	80 km/h (50 mph)
	Nominal cruising speed	30-80 km/h (18-50 mph)
	Acceleration rate (service)	>1 m/s^2 (3.28 ft/s^2)
	Brake rate (service)	>1 m/s^2 (3.28 ft/s^2)
	Minimum horizontal curve radius	15 m (49')
	Maximum sustained sustained gradient	12%
	Recommended maximum gradient	6%
	Wheelchair locations	1 per car (flexible)
	Passenger seats per car	
	Perimeter (end car, mid car)	18,16 (flexible)
	Vehicle capacity (standees + seated) per 4-car train (flexible)	
	@ 4 pass./m^2	4*50=200
	@ 9 pass./m^2	4*90=360
	Design capacity (4 standees/m^2 / 9 standees/m^2)	
	2-car trains at 90 sec scheduled headways	4,000 pphpd/7,200 pphpd
	4-car trains at 90 sec scheduled headways	8,000 pphpd/14,400 pphpd
	6-car trains at 90 sec scheduled headways	12,000 pphpd/21,600 pphpd

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SKYSHUTTLE

APPENDIX 4 SKYRAIL GUIDEWAYS

Appendix 4 BYD Shenzhen Campus Line & YinChuang Flower Garden-SkyRail

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APPENDIX 5 SKYSHUTTLE GUIDEWAYS

Appendix 5 BYD Shenzhen Campus Line-SkyShuttle

APPENDIX 6 GRADE SEPARATIONS

Appendix 6 Grade Separation-SkyRail & SkyShuttle

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Appendix 6 Grade-Separation

Appendix 7- SkyRail JiNing First Vehicle

Appendix 7 Column fitting in the medium

APPENDIX 8 STATION PHOTOS

Appendix 8 Shenzhen Station-SkyRail

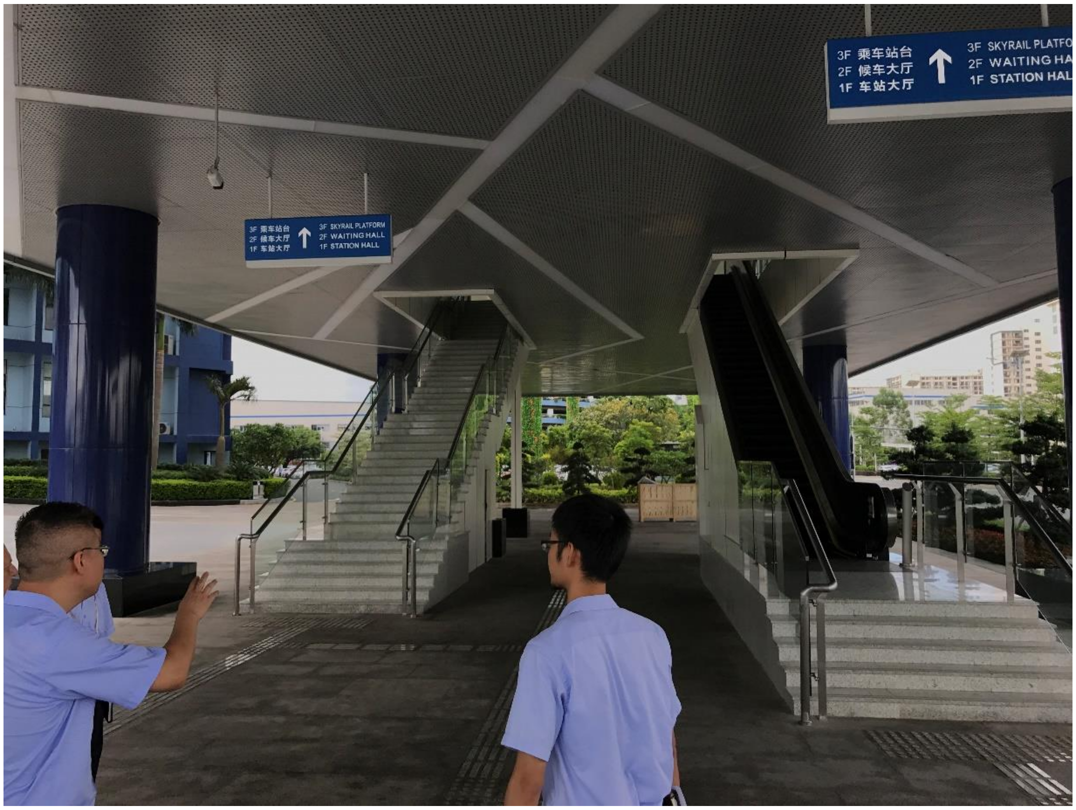
Appendix 8 SkyRail Station

Appendix 8 SkyShuttle Station

APPENDIX 9 COMPLETE STREET

0-1Appendix 9 Complete Street Concept- Norman Foster Foundation

APPENDIX 10 PEOPLE WALKING AND USING THE SYSTEM


3F 乘车站台
2F 候车大厅
1F 车站大厅
3F SKYRAIL PLATFORM
2F WAITING HALL
1F STATION HALL

Appendix 11 OMSF Facility YinChuang -SkyRail

Appendix 11 OMSF Design Concept

APPENDIX 12 PHYSICAL ELEMENTS OF THE SYSTEM

SkyRail in Operation

0-1Guangan Line- SkyRail