High-speed rail (HSR) is not about the trains. The ultimate objective of a HSR project is to convince travellers to get out of their cars and off the airplane and to ride the train instead - taking full advantage of the potential HSR services can bring to a region’s economy. From the very beginning of development, a focus on passenger experience, convenience and comfort has been a key driver for the California high-speed rail program.

From a customer perspective, HSR is not a one size-fits-all proposition. Door-to-door trip time, reliability, station services, amenities, creature comforts and train aesthetics must all be addressed to match the perceived market needs, the traveller profile and the competition. It is essential to understand the market from the outset and then to shape the service. In this respect, passenger experience drives the engineering.

The California High-Speed Rail Authority is responsible for planning, designing, building and operating the first modern high-speed rail system in the United States. California high-speed rail will connect the mega-regions of the state, contribute to economic development, a cleaner environment, create jobs, and preserve agricultural and protected lands. The system will run services from San Francisco to the Los Angeles basin in under three hours at speeds capable of over 200 miles per hour.

The system will eventually extend to Sacramento and San Diego, totaling 800 miles with up to 24 stations. In addition, the Authority is working with regional partners to implement a state-wide rail modernisation plan that will invest billions of dollars in local and regional rail lines to meet the state’s 21st century transportation needs.

Transit Oriented Development
As the initial passenger interface, it is important that stations and surrounding areas be enjoyable and functional. High-speed rail stations, by their nature are an effective and powerful tool to influence local market conditions, attract jobs to the station areas and encourage regional development patterns. The Authority's objective is to build the system in a way that minimises impacts to the natural and man-made environment, and encourages compact land development around its rail stations.

Many of the station sites are located in the heart of downtown areas or near downtown central areas of California’s major cities, meeting the system’s objectives of minimising potential impacts on the environment and maximising connectivity with other travel modes. There is also the possibility to create beautiful and desirable places that function well for residents, visitors and passengers alike.

The California High-Speed Rail Authority’s objectives for station location and development offer an opportunity for the Authority to work cooperatively with local governments, environmental and public interest groups, developers and others to pursue common development objectives. The Authority recognises that the land use decisions will be made by local communities and the real estate market, and has initiated a funding agreements program for station area planning to support local agencies in transit oriented development (TOD) planning efforts.
Station Planning
High-speed train passenger stations fulfill multiple roles. Stations provide the required functional services for the high-speed train system, accommodate the needs of passengers, and support the administrative and security requirements for train operations. Safe, secure, and comfortable stations that are of high quality and aesthetics enhance the passenger experience, and can promote and encourage ridership.

While sustainability is incorporated into all aspects of the high-speed rail system, stations can serve as a more public presentation and reminder of the inherently globally friendly nature of high-speed rail travel. The placement and flow between the specific elements, such as waiting areas and platforms, and amenities that make up a station need to support a logical internal movement, minimise conflicts and support security.

Standardisation of critical design elements for stations throughout the high-speed train system is important in order to simplify design, procurement and maintenance. Some stations may require distinct facilities and amenities to reflect the type of station (intermediate or terminal), location and category of station, anticipated passenger demand and the surrounding environment.

Rolling Stock Considerations
Consistent with emerging Federal Railroad Administration (FRA) safety regulations for high-speed trains, the California high-speed rail trainsets will take advantage of proven and modern high-speed rail technologies, using distributed power cars and an overhead contact system capable of revenue service operating speeds of 220 mph. The trains must be able to integrate into existing conventional rail lines where shared-use is expected to occur in dense urban areas.

Passengers will access the trains from platform level with the trainset floor providing smooth and efficient transitions for boarding and egress. To address the wide range of passenger needs, the trains are expected to offer a range of configurations (first class/business/tourism/economy). They will also be sealed to mitigate aerodynamic pressure changes and be fully compliant with the U.S. Americans with Disability Act.

Other trainset amenities under review include vehicle body width, at-seat meal/beverage services, toilet arrangements, video and wifi services and accommodation for bicycles and luggage.

Passenger Ride Experience and Comfort
The passenger ride experience is more than a consideration in the development of engineering standards and criteria - it is a key driver for critical infrastructure elements such as alignment, track, tunnels and bridge structures. Horizontal and vertical alignment criteria is driven by world-class standards for lateral and vertical acceleration effects. Vehicle attenuation criteria allows the vehicle motion to stabilise after crossing a point of change in the nature of the alignment, particularly important at the higher speeds for passenger comfort as well as vehicle performance.

Preliminary tunnel designs and sizes are designed to address passenger discomfort from pressure variation as well as address the aerodynamic and micropressure considerations at very high speeds. For structures, passenger comfort criteria dictates that aerial structures will be stiff and rigid to minimise excessive deformations and vibrations that can lead to passenger discomfort, as well as technical concerns for structural fatigue, excessive rail stress, and vehicle performance.

Parsons Brinckerhoff’s Role
In May 2013, The California High-Speed Rail Authority awarded a two-year $120 million contract extension to Parsons Brinckerhoff for program management services on the California High-Speed Rail project, one of the largest, most ambitious public transportation programs in U.S. history.

Parsons Brinckerhoff has served as the project’s program manager since 2006 and is assisting the California High-Speed Rail Authority with all aspects of the program, including planning, environmental review, preliminary engineering, testing and commissioning. Other key responsibilities include developing the criteria and technical standards that will define high-speed rail systems, procurement of system-wide design-build contracts, and supporting the Authority on a range of project development activities, including economic impact analyses, business planning and grants.

This IET Transport Sector Insight was written by Ken Jong, Deputy Program Director for Engineering on the California High-Speed Rail Project and Vice President and Principal Project Manager for Parsons Brinckerhoff. Photos courtesy of the California High-Speed Rail Authority.