TECHNICAL MEMORANDUM

CHSTP Candidate Trainsets - Vehicle Width
TM 600.01

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Prepared by for the California High-Speed Rail Authority
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ABSTRACT

This technical memorandum presents several key factors for consideration relative to specifying the width of the trainsets. As the CHSTP will be constructing new and upgrading existing infrastructure to meet the program requirements, a decision relative to vehicle width is necessary to allow designs and specifications to be further developed.

The High-Speed Rail Authority has previously adopted two key criteria relative to the trainsets which will influence system design. First, the trainsets, once in operation, must be able to travel at speeds of 220 mph (354 kph) in revenue service. Second, the procurement process should encourage competition and facilitate opportunities for a wide variety of manufacturers.
1.0 INTRODUCTION

1.1 PURPOSE OF TECHNICAL MEMORANDUM

The purpose of this memorandum is to present several key factors for consideration relative to specifying the width of the trainsets.

1.2 GENERAL INFORMATION

The CHSTP is in a unique position in that it will be designing and constructing infrastructure and associated systems that are purpose built to support a high speed (HS) operation. The CHSTP has an opportunity to specify a trainset configuration that would best meet the current and future requirements of the CHSTP operating plan.

The CHSTP system definition has been developed around the premise that the system will procure a nominal 1312 ft (400 m) trainset configuration, comprised of 2 – 656 ft (200 m) trainsets coupled together, capable of accommodating between 900 – 1000 passengers and of traveling at an operating speed of 220 mph (354 kph). The trainset is to be an existing service proven platform that either currently operates at the desired CHSTP operating speed of 220 mph (354 kph), or will be proven to operate in service at the desired speed prior to the start of CHSTP revenue service.

2.0 DEFINITION OF TECHNICAL TOPIC

None Applicable

3.0 ASSESSMENT / ANALYSIS

3.1 TRAINSET WIDTHS

Through our investigation into existing HS trainset designs, we have identified two main classifications of vehicle width. The first classification, termed as standard width, represents vehicle widths that range from 9.51 ft – 9.84 ft (2.9 m – 3.0 m). The second classification, termed as wide body width, represents vehicle widths that range from 10.50 ft – 11.15 ft (3.2 m – 3.4 m). The standard width trainsets typically operate throughout Europe, whereas the wide body configurations typically operate throughout Asia.

3.2 POTENTIAL CANDIDATE TRAINSETS

There are several trainset designs that can potentially meet CHSTP requirements in either a standard or wide body width configuration. Refer to Appendix A for a listing of these trainsets. It should be noted that the wide body width specification configuration would result in an increased level of competition as compared with the standard width candidate vehicles (see attached Appendix A with trainsets highlighted in green that can meet CHSTP requirements).

3.3 CAPACITY

The CHSTP operating plan is based on a nominal 656 ft (200 m) trainset having the capability of accommodating a minimum of 450 passengers. The operating plan also identifies two classes of service (e.g. first class and business class).

A standard width trainset typically is configured for a 2X1 first class seating arrangement and a 2X2 business class seating arrangement. A wide body width trainset can accommodate a 2X2 first class seating arrangement, as well as a high density 2X3 seating arrangement, should the Operator decide this seating configuration is necessary. The wide body width configuration provides an option for increasing seating capacity in the future as a 2X2 business class configuration will be specified initially.
FRA regulations for ADA (e.g. 49CFR38) identify spatial requirements to accommodate passengers in wheelchairs, and require accessible seating locations and toilet facilities to be distributed throughout the trainset. The wide body width trainset can better accommodate the ADA requirements, and can also provide for improved circulation through the trainset (e.g. wider aisles).

3.4 INTEROPERABILITY

The FRA has advised the CHSTP that it is seeking compatible solutions for HS trainsets, regardless of the project location. Although the scope of interoperability is currently being defined, it is possible that this will include compatibility of vehicle width and platform height. CHSTP’s decision relative to vehicle width may influence other high speed rail (HSR) programs where interoperability might be envisioned.

In addition to the CHSTP, the FRA is evaluating the Florida and DesertXpress HSR programs. Although the current operating plans for these programs identify trainsets with differing performance characteristics (e.g. seating capacity, and maximum operating speed), the FRA is investigating areas of interoperability relative to the trainsets. Our understanding is that the DesertXpress has indicated that it would prefer to utilize a wide body width trainset, whereas the Florida program may seek a standard width solution due to the clearance limitations associated with operating within the I-4 highway median.

3.5 INFRASTRUCTURE

If wide body width trainsets are used, there will be no need for special provisions at stations to permit standard North American freight cars and maintenance equipment to pass an ADA compliant platform. Conversely, station platforms built to be ADA compliant for standard width trainsets will not permit passage of standard North American maintenance and freight equipment. To do so will require special provisions in the track, namely two extra rails and two sets of switch points, and the required space on the side opposite the platform will need to be larger.

Due to the rounded body shape of candidate HS trainsets, the trainsets will clear the standard low platform height and offset, 8 in (203 mm) above the top of rail and 5.08 ft (1.5 m) from centerline. There will be no difficulty in operating wide body equipment or transporting such equipment over any track built to pass standard North American freight equipment.

The use of wide body equipment permits a lower track cost, both initially and in operations, and simplifies operation in the Caltrain Corridor.

3.6 WEIGHT

The Siemens Velaro E (standard width) trainset and Velaro CN (wide body width) trainset have a total weight of 483.9 tons (439 tonnes) and 492.7 tons (447 tonnes) respectively. This equates to a 1.8% increase in weight for the wide body width trainset, with high density seating (2x3). The CHSTP vehicle specification will identify a maximum static axle load of 18.74 tons (17 tonnes) for either a standard or wide body width configuration.

3.7 COSTS

Accurate comparable capital costs of HS trainsets are difficult to establish. Manufacturers have been very reluctant to divulge the cost of their trainsets in the past. The information in the public domain is usually combined with costs for a HSR system or includes additional power cars or passenger coaches combined with complete trainsets.

Due to the limited cost information available relative to HS trainset procurements, it is difficult to develop an accurate comparison of standard width versus wide body width trainset costs. However, based on the number of potential wide body width trainset candidates, as shown in the attached matrix, and the fact that the wide body width design is a service proven platform, it is reasonable to conclude that the level of competition would remain high should the CHSTP decide
to procure wide body width trainsets. Appendix A identifies trainset costs gathered from our review of issued press releases.

4.0 SUMMARY AND RECOMMENDATIONS

4.1 CHSTP RECOMMENDATION

The CHSTP recommends that the Authority adopt the wide body width trainset configuration as it will provide:
- Increased passenger comfort utilizing a 2X2 first and business class seating arrangement
- Improved placement and configuration of ADA facilities
- Improved circulation throughout the trainset
- Increased competition
- Potential for increased capacity utilizing a 2X3 high density seating arrangement

As shown on the attached matrix, there are at least five manufacturers of trainsets who have designed/produced a wide body width trainset that are either in service, or will be designed to meet the CHSTP operating requirements.

5.0 SOURCE INFORMATION AND REFERENCES

None Applicable

6.0 DESIGN MANUAL CRITERIA

None Applicable
## APPENDIX A

### California High-Speed Train Project

**Erhe E 6 series utilize a narrow body configuration designed to accommodate travel on conventional routes in Japan.**

8N700 trains have various seating configurations per car; average shown. Train weight is average calculated from the 16-car weight (715 tons).

<table>
<thead>
<tr>
<th>TRAIN HORSE POWER</th>
<th>11800 hp</th>
<th>8800~11800 hp</th>
<th>8800~8050 hp</th>
<th>6000~8800 hp</th>
</tr>
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<tbody>
<tr>
<td>1st Class</td>
<td>186 mph/300 kph</td>
<td>218 mph/350 kph</td>
<td>199 mph/320 kph</td>
<td>224 mph/360 kph</td>
</tr>
<tr>
<td>2nd Class</td>
<td>205 mph/330 kph</td>
<td>249 mph/400 kph</td>
<td>261 mph/420 kph</td>
<td>260 mph/420 kph</td>
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<tr>
<td>3rd Class</td>
<td>249 mph/400 kph</td>
<td>261 mph/420 kph</td>
<td>261 mph/420 kph</td>
<td>260 mph/420 kph</td>
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### Abbreviations
- AP: APPROX. TRAIN COST $35 million

### Floor Height
- 45.67 in/1160 mm

### Fall Block
- 4.30 ft/1300 mm

### Train Weight
- 451.9 tons/410 tons

### Train Characteristics

#### Siemens Velaro CN
- Exchange rate used: 1 USD = 0.80 EUR (2005 annual average)

#### Bombardier Zefiro 380
- Exchange rate used: 1 USD = 6.83 CNY (Sep 28, 2009)

#### Siemens Velaro D
- Exchange rate used: 1 USD = 0.79 EUR (Dec 1, 2008)

#### 2nd Class
- 16 seats/car
- 2x2 configuration

#### 1st Class
- 40 seats/car
- 2x2 configuration

#### 3rd Class
- 52 seats/car
- 2x2 configuration