



DESIGN

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FRA Waivers – An Alternative Approach The Caltrain Experience

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Caltrain sought a waiver to operate 'non-compliant' EMUs.

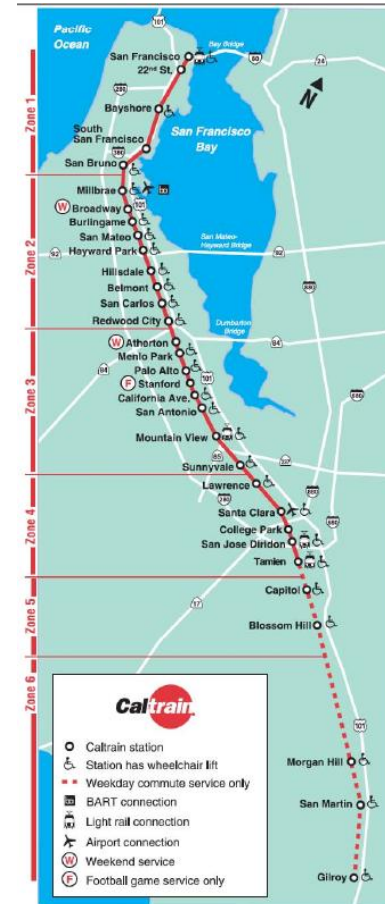
- The effort began in early/mid 2007.
- The waiver was granted on May 27, 2010.
- Caltrain found that existing electric multiple units (EMUs) would best meet their operating goals of increased service, improved environment, reduced capital and operating costs, and equipment reliability.
- The process involved early and close cooperation with the FRA.
- It also included close cooperation with several car builders.

Caltrain operates between San Francisco and San Jose, California.

Current
Baby-Bullet
configuration



Concept EMU
(four car
configuration)

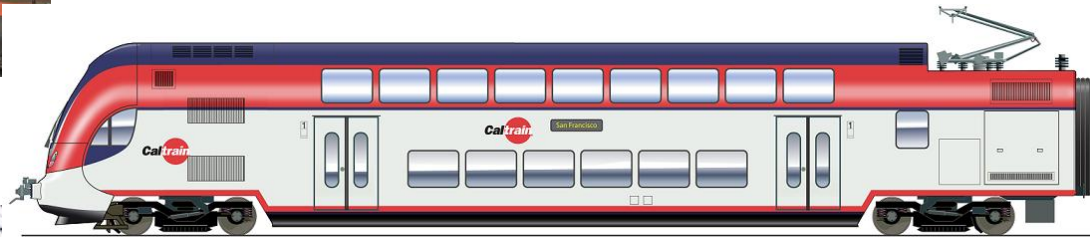


There were several off-the-shelf EMUs available at the time the waiver was being sought, but they did not satisfy all CFR requirements.

Examples



Siemens Desiro

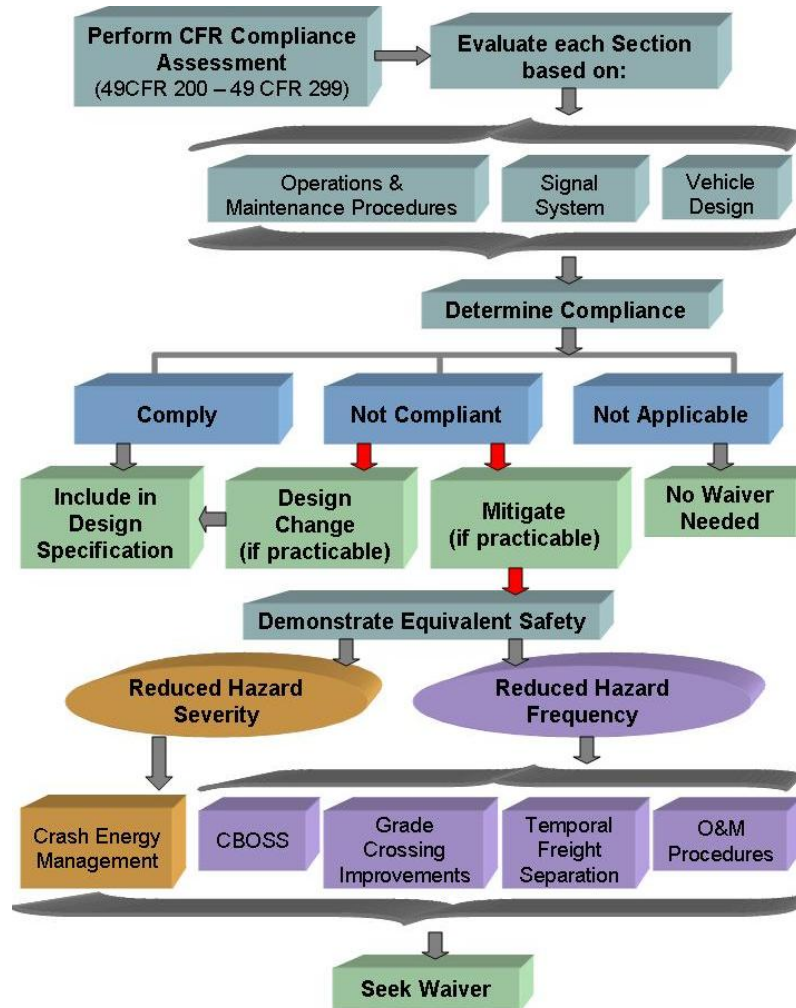


Bombardier Multi-Level



Alstom Coradia

The process for seeking the waiver included many steps.



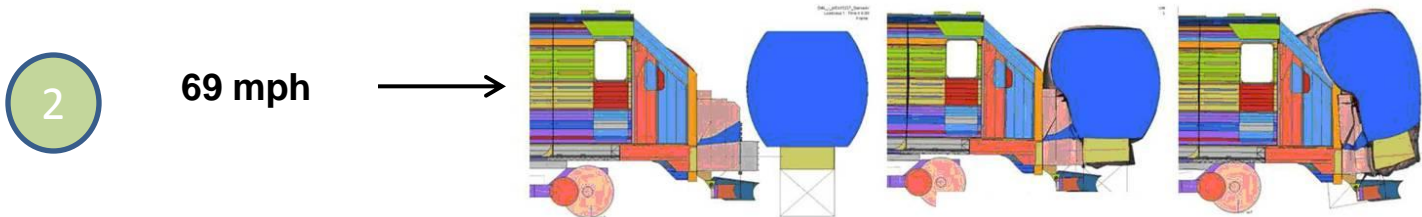
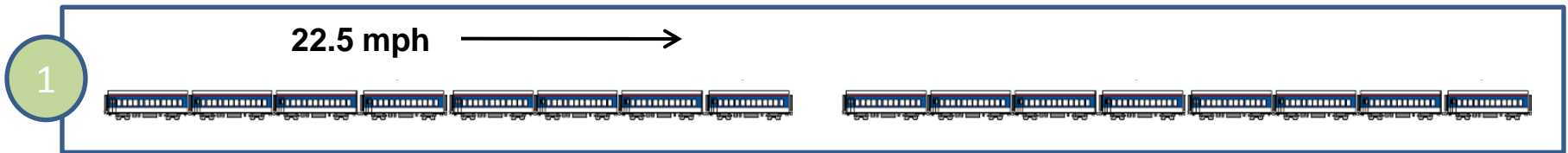
Caltrain's original waiver requests were for five areas.

- 1) 49 CFR 238.203, Static end strength.
- 2) 49 CFR 238.205, Anti-climbing mechanism.
- 3) 49 CFR 238.207, Link between coupling mechanism and carbody.
- 4) 49 CFR 238.211, Collision posts.
- 5) 49 CFR 238.213, Corner posts.



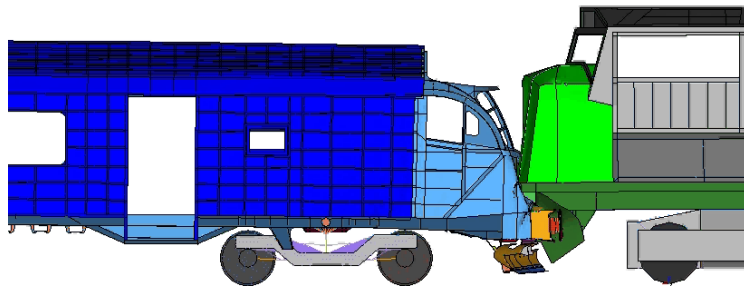
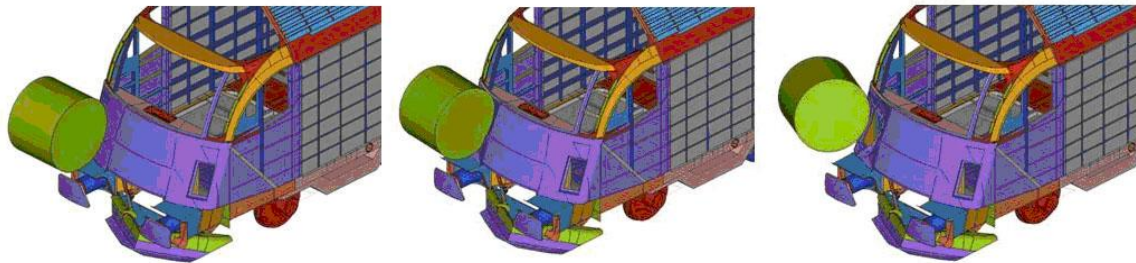
The use of Crash Energy Management (CEM) on the available trains was a key factor in demonstrating equivalent safety.

- The available trains are designed to the European Norm, EN15227, Crashworthiness requirements for railway vehicle bodies.
- They are designed for three collision scenarios, two of which are applicable to U.S. operation.
- However, they have a buff strength of 1500 kN (337 kips) or 2000 kN (450 kips).

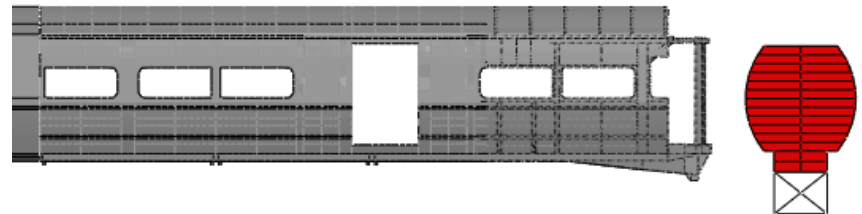


The car builders and Caltrain examined several other collision scenarios to help demonstrate that the EMU's have equivalent crashworthiness to CFR compliant cars.

EMU-coil

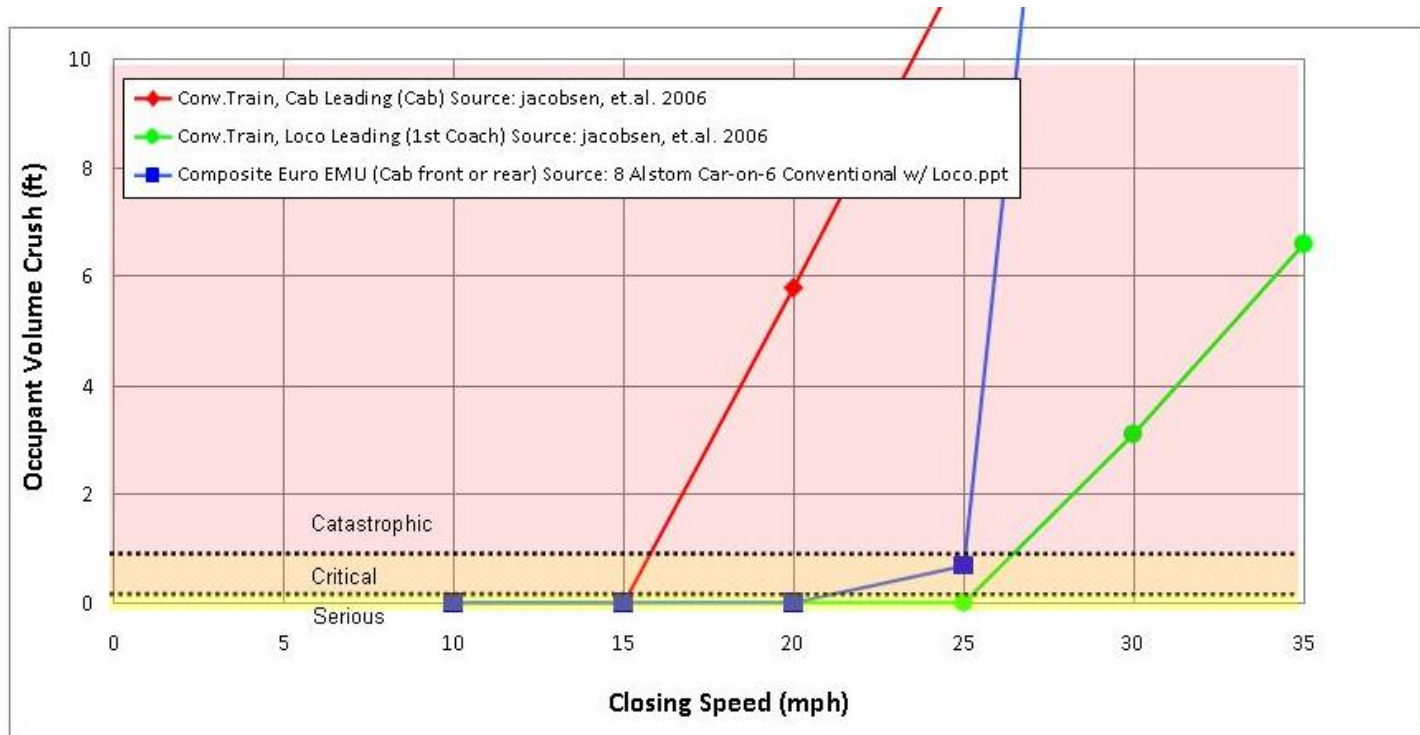


EMU-U.S. loco



Conventional cab car – EN deformable obstacle

Simulated train-to-train collisions were used to show equivalence of occupant volume integrity.



These train-to-train collisions were also used to demonstrate anti-climbing resistance.

Caltrain received a waiver by demonstrating equivalent safety.

- Several analyses were conducted for comparison to conventional trains.
- The waiver also cited improvements to the system, including PTC and grade crossing improvements.
- The specifications for the cars will be written to incorporate the conditions of the waiver.
- The Caltrain waiver exercise had direct utility for the Railway Safety Advisory Committee (RSAC) Engineering Task Force (ETF) on Tier I equipment.