

How much time does an EMU or Electric Loco
save on the peninsula corridor from SJ to SF?

Aren't Electric Locos almost as good as EMUs?

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Assumptions

Start at SJ Diridon

20 intermediate stops

End at SF 4th & King

Speed limit = 79 mph (Case A) or 110 mph (Case B)

Station dwell = 45 sec

Schedule pad = 7%

Simulate 3 different trains:

Case 1 – Diesel – MP36 + 6 Bombardier cars + 600 pax

Mass = 488 t, Power = 2.7 MW

Power-to-weight = 5.5 kW/t, Adhesion factor 27%

Case 2 – Electric loco – Siemens ACS-64 + 6 Bombardier cars + 600 pax

Mass = 452 t, Power = 6.4 MW

Power-to-weight = 14.2 kW/t, Adhesion factor 22%

Case 3 – Electric multiple unit – Stadler KISS 6 + 600 pax

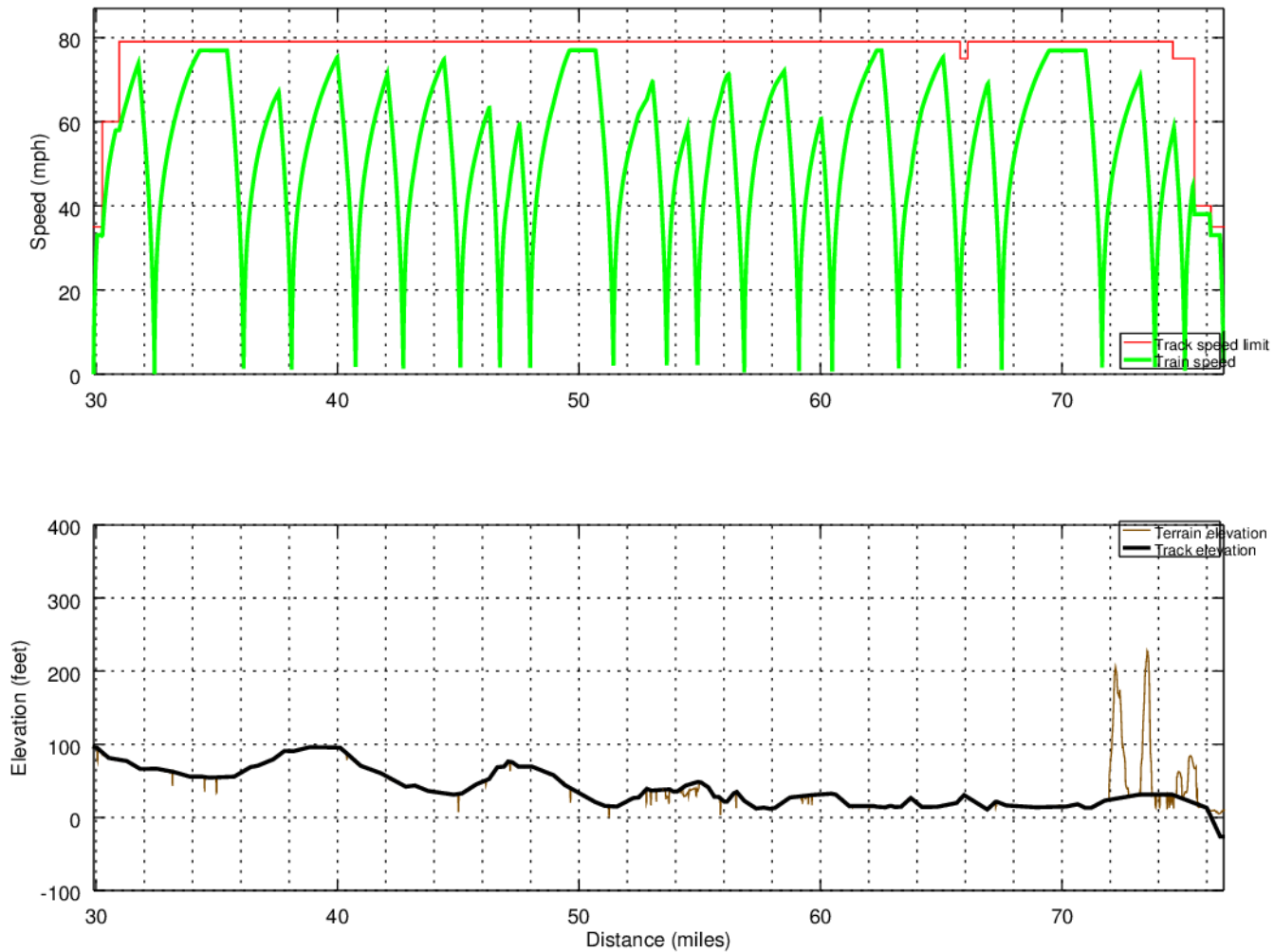
Mass = 382 t, Power = 6.0 MW

Power-to-weight = 15.7 kW/t, Adhesion factor 42%

Case 1 – Diesel Loco 79 mph

$$1:09:29 * 1.07 + 20 * 0:45 = 1:29:21$$

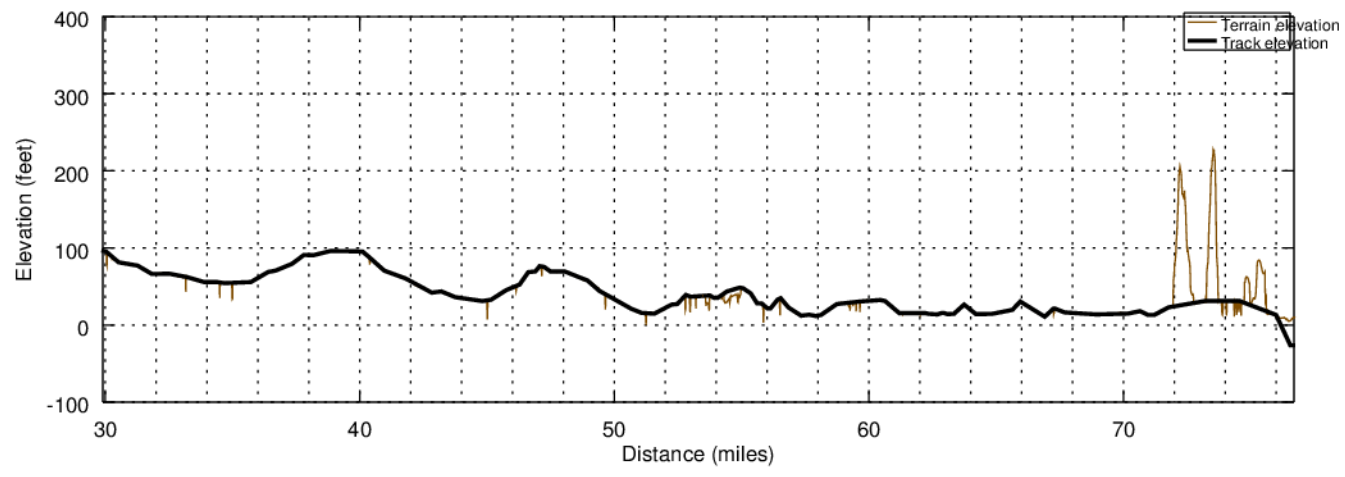
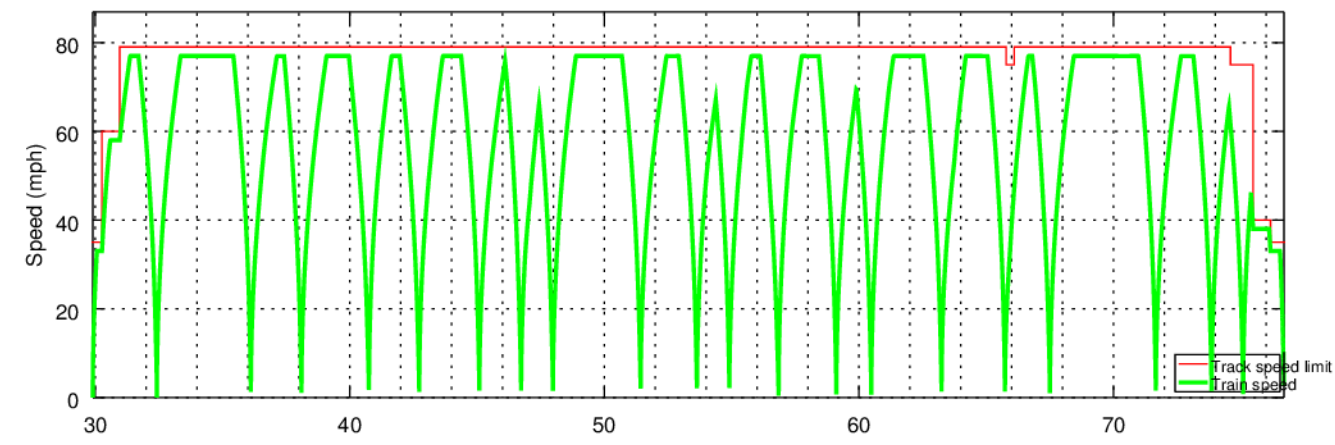
MP36 + 6 Bombardier; Peninsula Corridor NB; 46.8 miles in 1:09:29 at 40.4 mph average



Case 2A – Electric Loco 79 mph

$$1:08:13 * 1.07 + 20 * 0:45 = 1:28:00$$

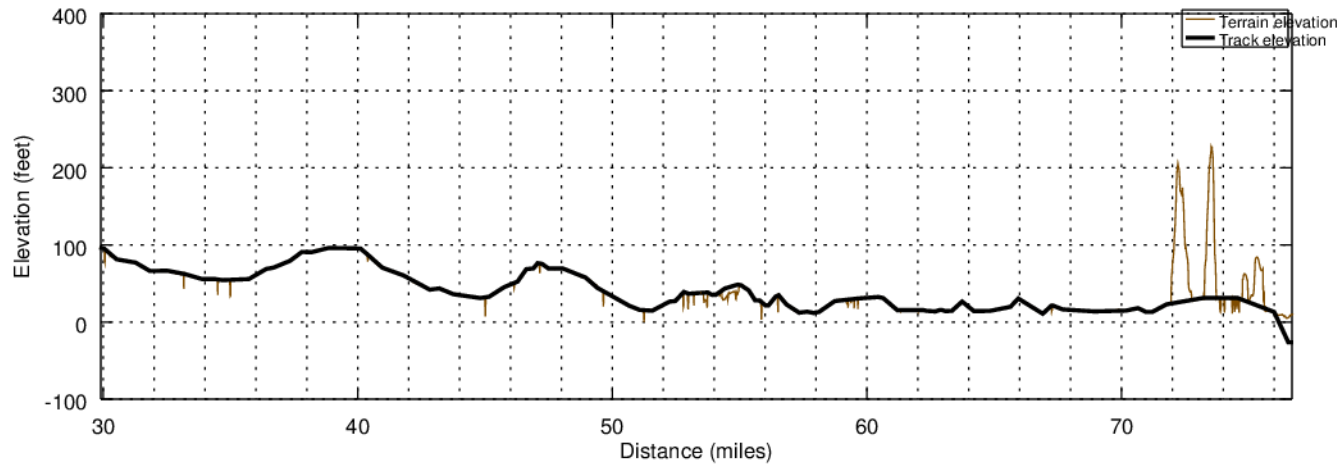
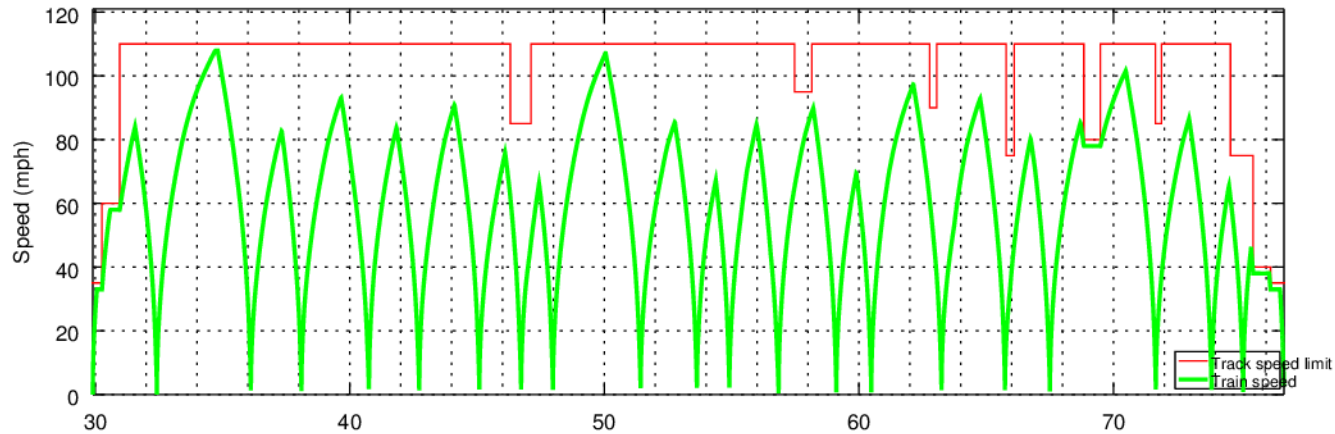
ACS-64 + 6 Bombardier; Peninsula Corridor NB; 46.8 miles in 1:08:13 at 41.2 mph average



Case 2B – Electric Loco 110 mph

$$1:07:05 * 1.07 + 20 * 0:45 = 1:26:46$$

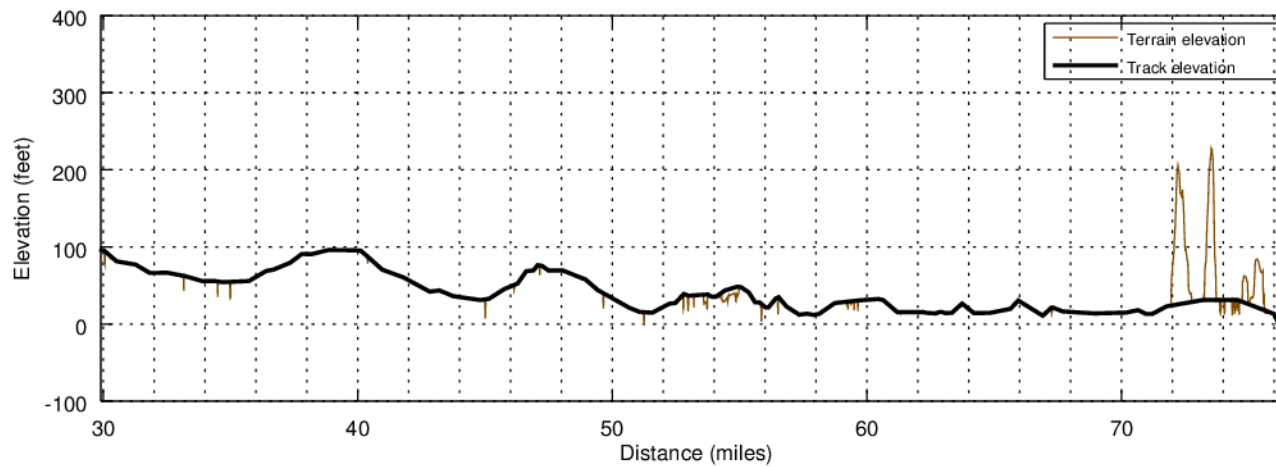
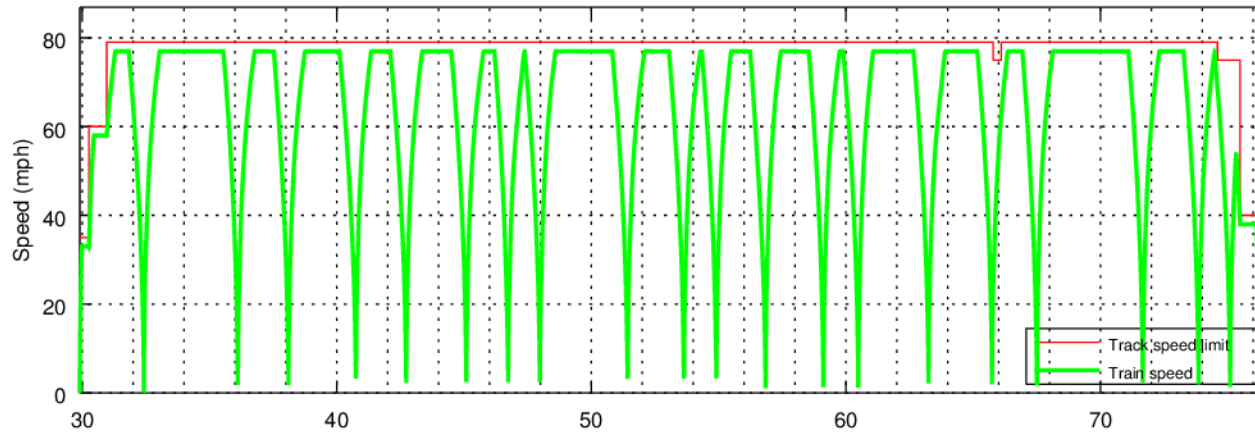
ACS-64 + 6 Bombardier; Peninsula Corridor NB; 46.8 miles in 1:07:05 at 41.9 mph average



Case 3A – EMU 79 mph

$$56:26 * 1.07 + 20 * 0:45 = 1:15:23$$

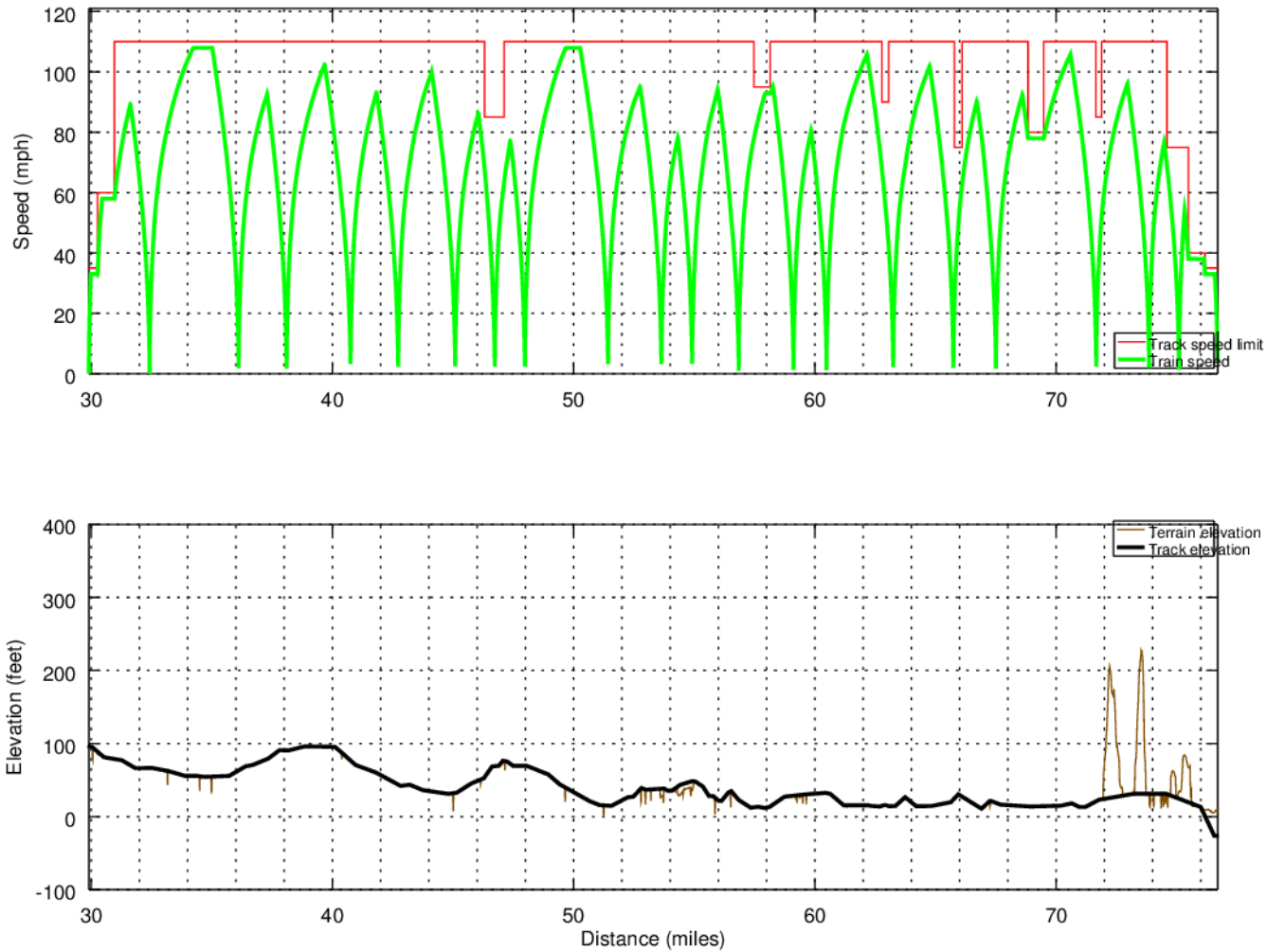
Stadler KISS EMU-6; Peninsula Corridor NB; 46.8 miles in 0:56:26 at 49.7 mph average



Case 3B – EMU 110 mph

$$54:14 * 1.07 + 20 * 0:45 = 1:13:02$$

Stadler KISS EMU-6; Peninsula Corridor NB; 46.8 miles in 0:54:14 at 51.8 mph average



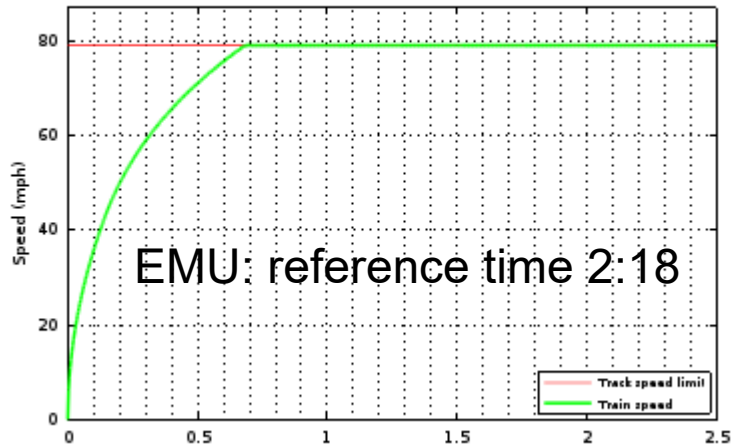
Why does Electric Loco suck?

- Rail friction coefficient is assumed 0.2 (rain)
- The electric loco's adhesion factor is low, which prevents the available power from being laid to the rail.
 - Diesel is adhesion-limited to 23 mph and out-pulls the electric loco to that speed thanks to its higher weight on driving axles
 - Electric loco is adhesion-limited to 73 mph due to its low weight on driving axles (98 t). At 43 mph it is only laying down 3.8 MW to the rail... it is rarely able to use its full power capability, and acts like a diesel
 - EMU is adhesion-limited to 43 mph and can lay down a full 6 MW above that speed. EMU reaches 43 mph in about half the distance of the Electric Loco.

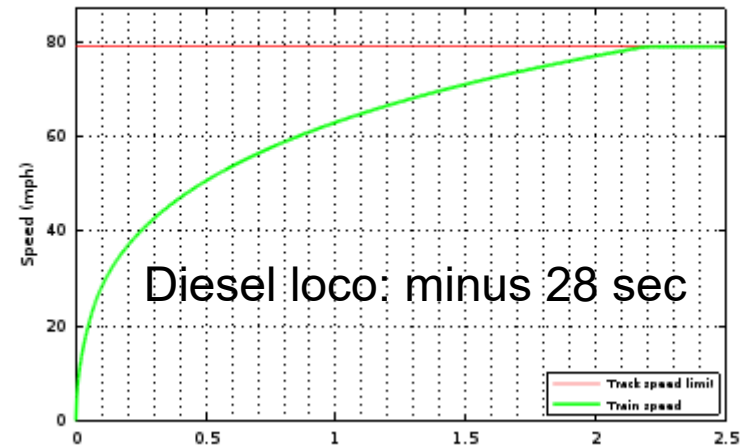
Acceleration side-by-side

0 – 79 mph standing start, timed to 2.5 miles on flat track

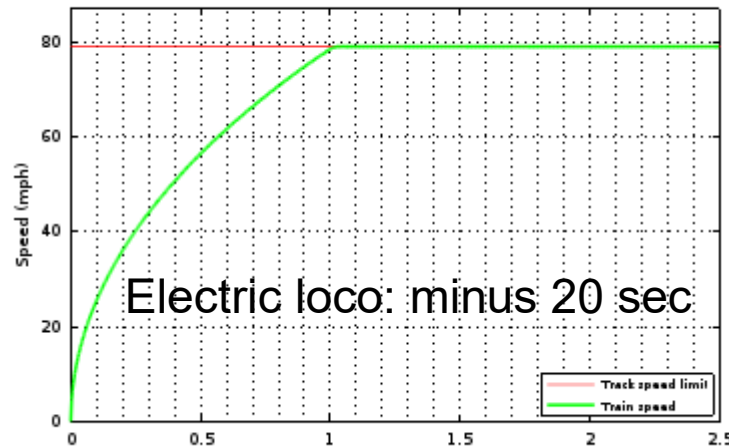
Stadler KISS EMU-6; Flat and straight test track; 2.5 miles in 0:02:18 at 65.4 mph average



MP36 + 6 Bombardier; Flat and straight test track; 2.5 miles in 0:02:46 at 54.3 mph average



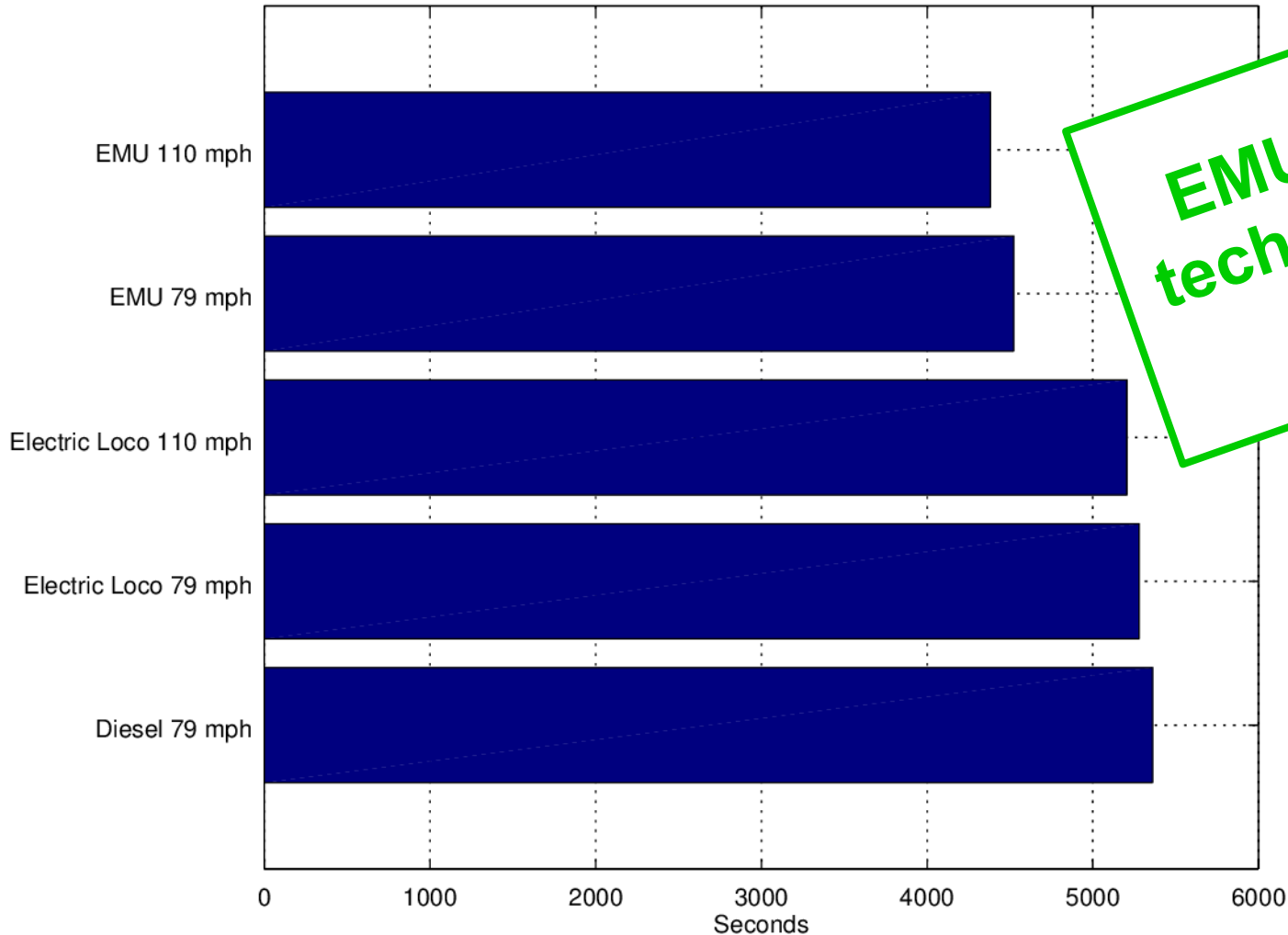
ACS-64 + 6 Bombardier; Flat and straight test track; 2.5 miles in 0:02:38 at 56.9 mph average



Summary

Electric Loco provides less than 1/3 the trip time savings of EMU
110 mph speed limit doesn't help much compared to 79 mph

SJ - SF run time with 20 intermediate stops



EMU is the right technology choice for Caltrain