APTA Rail Conference

Positive Train Control

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Operating Characteristics

PNWR

- Class III Freight
- Subsidiary to Genesee & Wyoming
- Operates in Eugene – Portland – Astoria triangle
- 27 Locomotives
- 40 mph max speed

TriMet WES

- 6 Diesel Multiple Units
- Service began in 2009
- Weekday service – morning and afternoon peak
- 30 minute headways
- 60 mph max speed

Automatic Train Control (ATC) / Centralized Traffic Control (CTC)
PNWR Dispatch - St. Albans, Vermont

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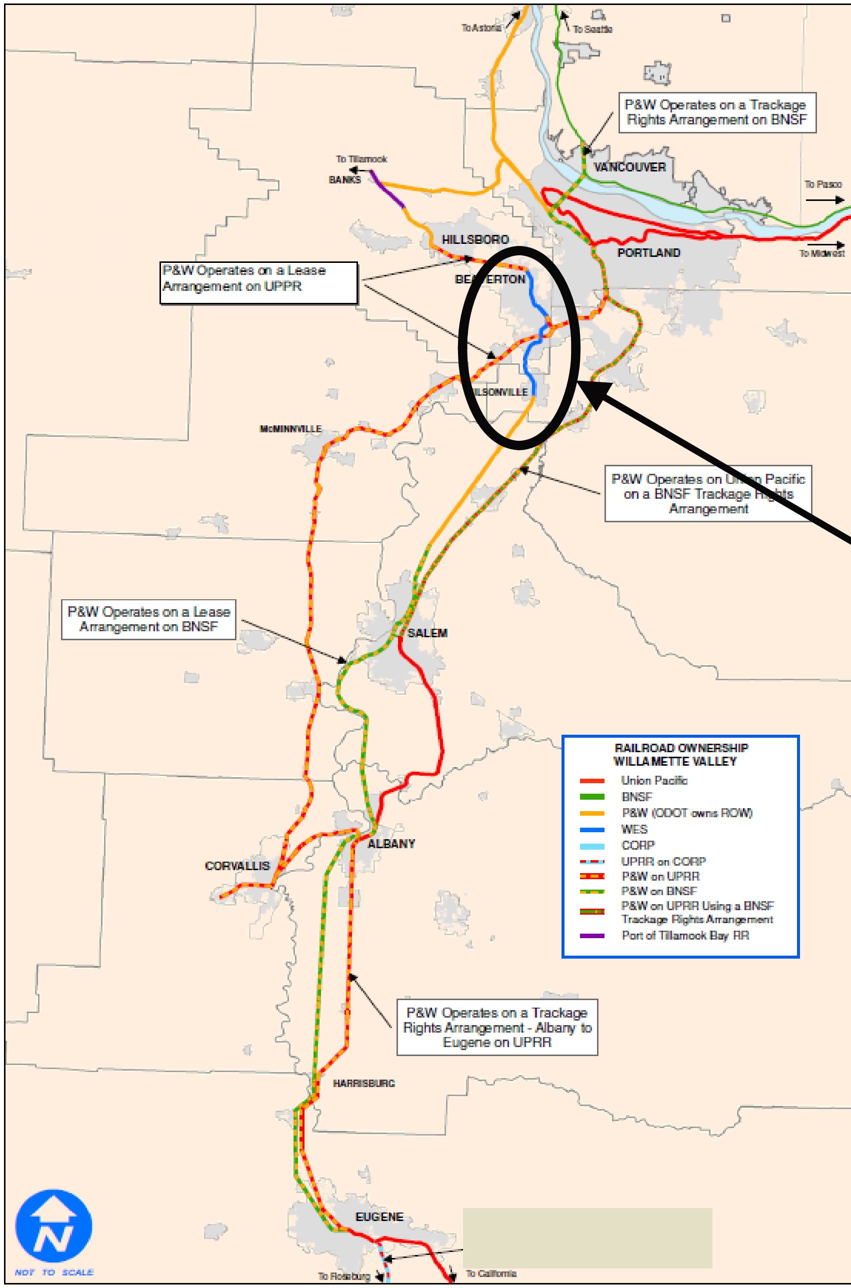
WES Commuter Rail

- 14.3 mile corridor shared <u>exclusively</u> with PNWR
- 5 stations, mix of single and double track



PORTLAND P&W WESTERN

a Genesee & Wyoming Company

Shared Corridor

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Why E-ATC, not I-ETMS?

In 2009 TriMet opened it's Westside Express Service with ATC technology.

PNWR/TriMet ATC system already met 6 of 8 PTC requirements per 49 CFR 236.1005:

- Prevent train to train collisions
- Prevent movement of trains through a mainline switch in the improper position
- Provide an appropriate warning or enforcement when a derail or switch protecting access to the mainline is its derailing or protecting position
- A hazard detector integrated into the PTC system that is required, detects an unsafe condition or transmits an alarm
- Limits speeds of passenger/freight to 59/49 mph in areas without broken rail detection or equivalent safeguards
- Prevent over speed derailments
  - **with Permanent Speed Restrictions (PSR)**

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E-ATC

PNWR/TriMet E-ATC system meets the remaining two requirements:

- Prevent incursions into established work zones

  with Temporary Speed Restrictions (TSR)

- Provides an appropriate warning or enforcement when a mandatory directive is issued associated with a highway-rail grade crossing warning system malfunction as required by 234.105, .106, .107

  with Mandatory Directives (MD)

How have statutory requirements affected *operational performance* in our fixed block, cab signal based system

- **Pre E-ATC: Manually enforced *civil* speed restrictions.**
- **Post E-ATC: Required to positively enforce every speed**

Civil Restrictions

- With E-ATC, a civil speed different than existing code rates will be positively enforced at the next lower cab rate. (e.g. A 55 mph civil speed restriction will be enforced at a 50 mph cab rate.)

- Any posted civil speed restriction will be enforced by the cab signaling system as a PSR.

How we addressed maximizing civil speeds noting that any change to a cab code has to be within the defined E-ATC code structure, i.e., only 16 available codes:

- Superelevation
- Cant deficiency

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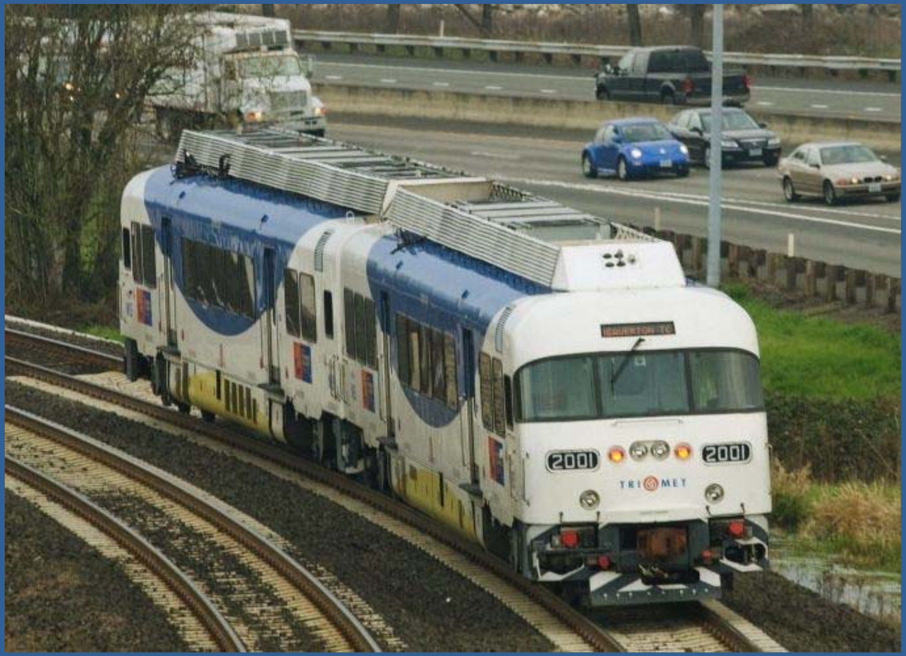
Code chart showing 16 codes available

100 Hz Code Rate (PPM)	Aspect / Mode	Speed Limit (Commuter)	Target Speed	Overspeed Protection Point	Speed Limit (Locomotive)	Target Speed	Overspeed Protection Point
306.43	EOB Proceed	10 MPH	" 0"	12 MPH	10 MPH	" 0"	12 MPH
306.43	EOB	Stop at End of Block	" 0"	3 MPH	Stop at End of Block	" 0"	3 MPH
306.43	Restricted	10 MPH	" 0"	12 MPH	10 MPH	" 0"	12 MPH
262.66	20/EOB	20 MPH	"20"	22 MPH	Stop at End of Block	" 0"	3 MPH
229.82	30/EOB	30 MPH	"30"	32 MPH	Stop at End of Block	" 0"	3 MPH
196.77	40/EOB	40 MPH	"40"	42 MPH	Stop at End of Block	" 0"	3 MPH
175.10	50/EOB	50 MPH	"50"	52 MPH	Stop at End of Block	" 0"	3 MPH
156.48	60/EOB	60 MPH	"60"	62 MPH	Stop at End of Block	" 0"	3 MPH
141.43	60/40	60 MPH	"60"	62 MPH	40 MPH	"40"	42 MPH
129.02	60/30	60 MPH	"60"	62 MPH	30 MPH	"30"	32 MPH
116.74	50/30	50 MPH	"50"	52 MPH	30 MPH	"30"	32 MPH
106.58	40/40	40 MPH	"40"	42 MPH	40 MPH	"40"	42 MPH
96.77	40/30	40 MPH	"40"	42 MPH	30 MPH	"30"	32 MPH
87.55	30/30	30 MPH	"30"	32 MPH	30 MPH	"30"	32 MPH
64.51	15/15	15 MPH	"15"	17 MPH	15 MPH	"15"	17 MPH
79.94	Yard/FEB	15 MPH	"15"	17 MPH	Stop at End of Block*	" 0"	3 MPH
72.82	Freight Non-Cab	0 MPH	" 0"	3 MPH	60 MPH	"- -"	62 MPH
None	No Code	0 MPH	" 0"	3 MPH	0 MPH	" 0"	3 MPH
None	No Code Proceed	10 MPH	" 0"	12 MPH	10 MPH	" 0"	12 MPH
None	Yard	15 MPH	"15"	17 MPH	0 MPH	" 0"	3 MPH
None	Freight Non-Cab	0 MPH	" 0"	3 MPH	60 MPH	"- -"	62 MPH
Unknown Code or Constant Carrier	Invalid Code	0 MPH	" 0"	3 MPH	0 MPH	" 0"	3 MPH

* Only upon transition from Freight Non-Cab mode to receiving a Yard/FEB code rate.

We strategically identified curves where raising the superelevation would result in an efficiency improvement



Cant Deficiency

Title 49 Code of Federal Regulations Section 213.57, Curves: Elevation and Speed Limitations:

- Dictates maximum authorized speed through curves at the standard 3” cant deficiency
- Defines procedures for operating at cant deficiencies up to and over 3”

We set out to demonstrate that TriMet's DMUs, RDCs, and Budd cars meet the criteria of the CFR to allow operation at up to 5" inches of cant deficiency

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Measuring wheel lift during cant deficiency testing

Car 1002 at 6” Superelevation

Received approval from FRA to operate up to 5” cant deficiency

As a result, TriMet was able to modify cab code enforcement:

Curve C-36 (Both Directions) from **30/30 to 40/30**;

Curve C-33 (Both Directions) from **50/30 to 60/30**,

Curve C-751 (Eastbound Direction Only) from **40/30 to 50/30**.

Mandatory Directives and Temporary Speed Restrictions

- Regulation around MDs and TSRs result in operational inefficiencies.
- Manipulation of Time Code Change Points (TCCPs) help recover time.

Time Code Change Points
Pre E-ATC

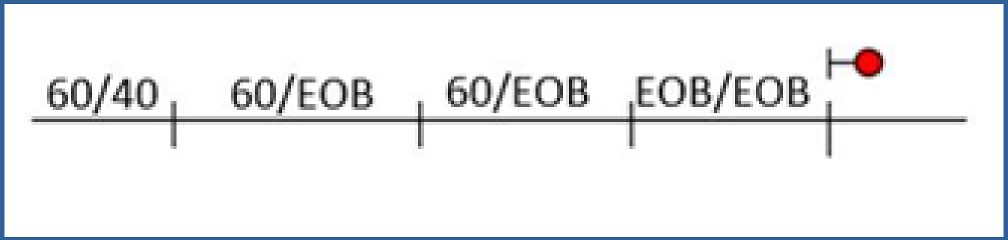
- TCCP's have been in common use on the WES system from its opening date in 2009
- WES is a fixed block boundary system which utilizes cab signals for speed control.
- TCCP's are employed to mitigate situations where a train may run at a reduced speed for an unnecessarily long period of time.
- Without a TCCP, when a train occupies a block, the track circuit reacts to that occupancy and the new cab code is immediately received by the train.

- A TCCP is used to delay the “downgrade” of the cab codes that are transmitted by the wayside equipment to each train as it enters a block.

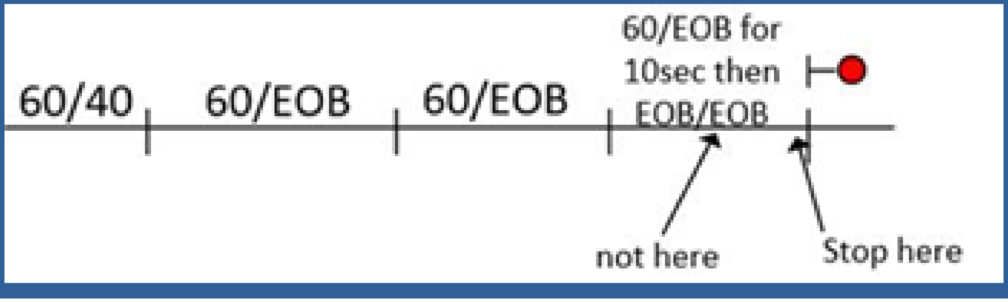
- These time-delayed reductions in enforced speed are used by the block designer to optimize travel time though each block, while still providing braking distance for safe enforcement of speed restrictions.

TCCPs with E-ATC

Each vehicle gets it's own braking curve based on UCII vehicle selection. The block design codes provided account for the different braking profiles. In the sketch below, the DMU interprets the codes as 60 until the last block but the locomotive sees the EOB starting in the 2nd block.



The TCCP are provided to allow the DMU to either pull up to a stop location or hold out braking prior to a restriction. The braking curve doesn't change, it is just delayed.



We are currently working with our integrator, MRS, and Alstom to identify and implement further block design efficiencies.

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Questions?