Columbia River CROSSING

Road Map Item #: 5.17

Product Name: **OPERATING PLAN**

PMP Appendix: APPENDIX U

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ABSTRACT: This deliverable describes the TriMet LRT system, service design of existing and proposed LRT extensions, shared transitway operations, and operating requirements for auxiliary tracks, crossovers and the traction electrification (TES) system.

Tri-County Metropolitan Transportation District of Oregon

Columbia River Crossing LRT Project
Yellow Line Extension

Operating Plan 2019 to 2030
For the FFGA Application

April 12, 2013

Draft

Photo: Single track operation at emergency crossover on the MAX Blue Line

Introduction

This operating Plan consists of four parts:

1. Service Design for the MAX system and Yellow Line extension
2. Operating Environments
3. Operating Requirements for Crossovers, Auxiliary and Connector Tracks
4. Operating Requirements for the Traction Electrification System (TES)

1. Service Design

TriMet's light rail system is referred to as MAX, for Metropolitan Area Express. The 33-mile long east-west Blue Line that connects Gresham, Gateway, Rose Quarter, downtown Portland, Beaverton and Hillsboro opened in stages during 1986, 1997 and 1998. The 5.6-mile Portland Airport (PDX) extension project north of Gateway is part of the Red Line that opened from PDX to downtown Portland via the Gateway Transit Center (TC) and Blue Line trackage in September of 2001. The Red Line was extended west via Blue Line trackage to the Beaverton TC in 2003. The 5.8-mile Interstate Ave. extension project to north Portland is part of the Yellow Line that opened in May of 2004 and shared Blue Line trackage from Rose Quarter into downtown Portland until 2009. The 8.3-mile I-205/Portland Mall extension project, the Green Line, opened for service in September of 2009 from Clackamas Town Center to Portland State University (PSU) in downtown Portland sharing Blue Line trackage between Gateway and the Steel Bridge just west of Rose Quarter. The Yellow Line was rerouted to share the downtown Portland Mall alignment with the Green Line. All MAX lines cross the Willamette River on the Steel Bridge on tracks built for the first MAX line that opened in 1986. Figure 1.1 is a map of the regional rail system with actual and proposed opening years. It includes light rail as well as commuter rail and streetcar lines.

The 7.3-mile Milwaukie extension is under construction from the south terminus of the Green and Yellow Lines on the Portland Mall near PSU to a Park Ave. terminus south of Milwaukie. The Milwaukie extension is designated as the Orange Line and is scheduled to open in the Fall of 2015.

The proposed 2.8-mile CRC extension will be constructed from the north terminus of the Yellow Line at Expo to a new terminus at Clark College north of Vancouver, Washington. This Yellow Line extension is scheduled to open in the Fall of 2019.

The MAX light rail system's service design is based on the use of daybase trains to provide the base service, 15-minute headways throughout the system. These 15-minute policy headways are provided for most of the service day until about 10:30 PM when there is a transition to 30-minute headways. As a supplement to the daybase trains peak tripper trains are added during peak periods where peak passenger demand is such that daybase trains alone cannot carry the

passenger loads. Trains currently are all 2-car consists, but single-car trains may be scheduled if passenger demand permits. The downtown block length, tunnel station platform lengths and the station design criteria limit train length to a maximum of two cars.

Peak passenger demands are caused primarily by work trips and are greatest inbound, to downtown Portland, in the AM peak and outbound in the PM peak. As a result the Blue and Red lines have two peak load points, one east of downtown at Lloyd Center and one west of downtown at Goose Hollow. The Yellow Line's peak load point is north of Rose Quarter while the Green Line's peak load point is east of Lloyd Center. These are the points where most trains have their heaviest passenger loads and are used to apply TriMet's loading standards to determine the peak vehicle requirement (PVR). Figure 1.2 is a travel time-scaled schematic diagram of the MAX system.

Yellow Line Extension Service Design

For the passenger demand modeling it was assumed that the Yellow Line's 15-minute headway daybase trains will be through routed with Yellow/Orange Line trains from the Park Ave. terminus south of Milwaukie to the Clark College (Central Park) terminus north of Vancouver, Washington and back.

The PM peak load point for the CRC extension is forecast to be north of the Rose Quarter Station near downtown Portland. Trains traveling northbound in the PM peak two hours are forecast to be carrying 3,021 passengers in 2019 and 4,092 passengers in 2030 past the peak load point. Daybase trains, 4 per hour, plus the peak hour tripper trains, 4 per hour in 2030 provide a 7.5-minute average two-hour headway with an achievable capacity of 4,256 passengers for two hours in the peak direction in 2030 (16 trains x 266 passengers per train at a load factor of 2.08). Achievable capacity, an average of 266 passengers per 2-car train during the peak hour, is 80% of the design capacity of 332 passengers per 2-car train with standees at 4 per square meter of standing space.

Based on the forecast 2030 passenger demand, Yellow Line service from Park Ave. to Clark College will be provided by 12 daybase trains and 11 peak period tripper trains in 2-car consists for a total PVR of 46 cars. The existing Yellow Line service projected for 2030 will have a PVR of 30 LRVs, so the net increase to the PVR for the extension is 16 LRVs. A fleet requirement of 19 cars results from applying the spare ratio goal of 15% to 18% to the 16-car PVR and yields a project spare ratio of 19% (3 spares divided by a PVR of 16 cars). At start-up in 2019 only four additional trains will be needed, resulting in a PVR of 8 cars. A fleet of 19 cars will accommodate the CRC extension's 2030 forecast passenger demand and therefore not degrade other MAX service as a consequence of the design and construction of the CRC project. See the Rail Fleet Management Plan for the PVR calculations, proposed vehicle purchases and the fleet-wide spare ratio.

2. Operating Environments

The Yellow Line will have several different operating environments along its length including: 1) exclusive fenced right-of-way with fixed block railroad signals, automatic train stop (ATS) and train-to-wayside communications via TWC loops embedded in the trackway for operating speeds up to 55 mph, 2) exclusive right-of-way with gated at-grade crossings, fixed block railroad signals, ATS and train-to-wayside communications via TWC loops embedded in the trackway, 3) exclusive ballasted track or diamond lanes in roadway medians with train-to-wayside communications via TWC loops embedded in the trackway and traffic preempt signals with speeds up to 35 mph or the speed limit of the adjacent traffic (whichever is lower) and 4) transit lanes running parallel to traffic lanes in roadways with traffic signals, traffic preempt signals and line-of-sight operation up to a maximum of 25 mph.

The sections with fixed block railroad signals will be designed to meet TriMet's design criteria to allow scheduled 3-minute headways. This is well below the 7.5-minute average peak 2-hour headways required by the 2030 passenger demand forecast, but is needed to allow scheduling flexibility in the system's shared track sections such as the Mall on 5th and 6th Avenues downtown (shared with the Green Line) and across the Steel Bridge between Union Station to the Rose Quarter TC (shared with the Green, Red and Blue Lines). This 3-minute headway design limits the line throughput to 20 trains per hour that is equivalent to an achievable capacity of 5,320 passengers per hour per direction (20 trains x 266 passengers per train at a load factor of 2.08).

3. Operating Requirements for Crossovers, Auxiliary and Connector Tracks

This is a review of the 30% (100% PE) Plan Set with regard to crossover, auxiliary and connector track location. MAX system operating goals related to crossovers, auxiliary and connector tracks are as follows:

1. Insure reliable on-time schedule performance by getting disabled peak period trains out of the way as soon as possible. They can then be fixed or towed back to the yard during non-peak hours.
2. Serve riders before and after events in a safe and efficient manner at the following locations; Rose Quarter/Convention Center, Civic Stadium, Washington Park (Zoo), Pioneer Square, Waterfront Park, the Washington County Fairplex/Hillsboro Airport, Portland International Raceway, the Exposition Center, Clackamas Town Center and OMSI (on the Milwaukie Line).
3. Maintain 15-minute headways during emergency or planned track outages.
4. Maintain severed MAX service with a bus bridge connection during emergency or planned closures of the Steel, Willamette and Columbia River Bridges.
5. Reduce the cost and resources needed for bus bridging to get customers to or from the Clark College terminus and its 1,910 space park and ride lot or other Vancouver stations when an incident closes a track north or south of the downtown Vancouver couplet.

The 30% Plan Set includes three crossover locations, access to an Expo station siding, a tail track at the Clark College terminus and short turn capability at each end of the downtown Vancouver couplet.

Analysis

This analysis will address each of the MAX system operating goals above by number.

1. The CRC extension is planned to include two auxiliary tracks; a siding at the Expo station and a tail track at the Clark College terminus. These auxiliary tracks provide two locations where a disabled train can be temporarily stored. Experience with other similar extensions (such as the I-205 and Interstate extensions) demonstrates that this will allow most situations to be adequately handled. Compared with CRC's 2.8 route miles, I-205 includes 6.7 route miles and Interstate includes 5.8 route miles, each with one pocket track or siding and one tail track or 3rd track at their respective termini.
2. The siding at Expo and the tail track at Clark College provide places for southbound extra service trains to be staged for use after events at Expo and Portland International Raceway. In the northbound direction, existing auxiliary tracks at Union station and Rose Quarter can be used to stage extra service trains.
3. In order to maintain 15-minute headways during emergency or planned track outages, crossovers are needed that can be cleared by a northbound train in less than 7.5 minutes so that a southbound train can use the same track between each northbound train. The "Track Out Travel Times" between crossovers are shown in Figure 3.1. They are all less than seven minutes, which is good for this level of design. These travel times will continue to be monitored as the LRT design is refined.
4. If both tracks are closed on the Columbia River Bridge, a bus bridge will be set up between the 6th Street and Delta Park stations. The crossovers north of the Hayden Island Station and on either side of the 6th Street station will allow MAX service on either side of the river to turn back before the bridge for continued service incorporating the bus bridge.
5. The light rail connector track north of the downtown Vancouver couplet and the crossover between the couplet and the 6th St. station are vital to good customer service and the smooth operation of trains when incidents occur north or south of the couplet, especially if the CRC LRT alignment is extended further into Clark County in the future. When TriMet added LRT trains to the 5th and 6th Ave. Transit Mall couplet in downtown Portland, connector tracks were incorporated into the design based on lessons learned from operation of the Cross-Mall couplet on Morrison and Yamhill which does not have them. TriMet has a desire to add connector tracks to the Cross-Mall couplet, but the cost and service impact of doing so now is prohibitive.

Service Disruption Examples:

North Blockage – When the tracks northeast of Broadway and 17th become blocked, without the TA2 connector track, daybase trains (15-minute headway) would turn back at the 6th St. Station. The peak hour trippers that are forecast to be needed to provide a7.5-minute headway in 2030 would not be accommodated by the stub-end turn back at 6th and would therefore turn back at Expo station. Passengers on those trains would have to transfer to a daybase train and ride to 6th St. and transfer again to a bus bridge. The bus bridge would run from the 6th St. Station to the end of the line at Clark College. At least two buses would be needed to meet each train every 15 minutes. The cycle time in minutes and the number of buses needed for the bus bridge is yet to be determined.

With the TA2 connector track at Broadway and 17th, all trains will be able to proceed around the couplet. The bus bridge will only need to run between the couplet and Clark College. Since the trains will arrive every 7.5 minutes, the bus bridge will run continuously with many fewer buses since the load on each train will be much smaller.

South Blockage – If the tracks at the 5th Street grade crossing become blocked by an accident, a police investigation lasting many hours could result. Without the crossover, trains north of 5th St. would be stranded since there will not be enough supervisors to flag trains through every intersection in a direction reverse to the signal heads on the one-way couplet streets. Trains south of 5th Street would not be able to access the 6th Street station so they would turn back at the Hayden Island station. A bus bridge would run from the Delta Park station, which has easy access to I-5 to the end of the line at Clark College. At least two buses would be needed to meet each train every 7.5 minutes in 2030. The cycle time in minutes and the large number of buses needed for the bus bridge is yet to be determined.

With the crossover, trains will be able to continue operation from the Clark College Terminus to the 6th St. station and back. The bus bridge will only need to run between the couplet and Delta Park. Since the bus bridge would have a shorter travel time and have to carry fewer passengers, fewer buses would be required and fewer passengers affected.

4. Traction Electrification System (TES) Operating Requirements

To meet operational needs, the Design Criteria requires the TES to be designed to meet the following:

- a minimum functional life expectancy of 30 years,
- optimize the benefits of light rail vehicle regenerative braking capabilities, and
- meet the Design Parameters in Section 10.3 D including minimum system voltage, maximum rail-to-ground voltage and acceptable substation current loadings.

To meet the last listed requirement, the Design Criteria calls for a load flow study in Section 10.3 A.2 where train load, headway and substation outage requirements are given. That load flow study was performed, and is summarized in the "Columbia River Crossing Preliminary Load Flow Report" dated April 20, 2012. The Report concludes:

"Based on the results of these scenarios, rush-hour revenue service should not be impacted by the loss of one of the four substations (this includes the three new substations and the one substation, TPS 41 – Expo, that supplies power directly to the CRC extension). The lowest train voltage was 546V this occurred when TPS 63 was out-of-service; the train voltage is in marginally acceptable range. None of the substations were operating near their capacity so overloading was not an issue."

See the Report for further details.