

# Westside Light Rail MAX Blue Line extension



TriMet's first extension of its light rail network headed for the fast-growing high-tech corridor on the Westside. One of the largest public works projects in Oregon's history, the line bored through the West Hills, inspired extensive transit-oriented development and infused community-focused public art into its innovative design.

## Background

In 1979, studies began on transit options and alignments to connect downtown Portland to Beaverton as far west as SW 185th Avenue. By 1983 the studies were complete, and



local jurisdictions selected light rail as their preferred alternative along the Sunset Highway (Hwy. 26) corridor. At this point the TriMet Board suspended further work,

awaiting completion of the 15-mile Eastside MAX light rail project, which opened in 1986.

## The tunnel option

By 1988, Eastside MAX light rail had met with wide approval and planning resumed on Westside light rail. The first hurdle was crossing the West Hills, which rose 700 feet above downtown Portland and required a six percent grade along Hwy. 26. While the original MAX light rail vehicles were designed to handle such a grade over short distances, concerns arose that the grade would reduce reliability, particularly during icy weather, and increase travel times and maintenance costs. After prolonged debate, a decision was reached to construct a three-mile tunnel under the West Hills.

In 1993 construction began on the tunnel, and in 1994, track construction began in downtown Portland, where the Westside line tied into the existing line on Morrison and Yamhill streets. Work began soon after on the Beaverton segment to SW 185th Avenue, including a new maintenance facility for low-floor cars at Elmonica.

## Hillsboro signs on

The 1979 studies for the Westside anticipated that the line would eventually extend from SW 185th Avenue to the suburban city of Hillsboro. In 1989, the local jurisdictions asked to add that extension to the Westside project because of rapid development. The environmental studies for this 6.2-mile addition, mostly located on an abandoned rail right-of-way, progressed rapidly, and in 1994, Hillsboro became the western terminus of the Westside project.

## Design and construction highlights

### Twin tunnels

- The West Hills tunnel is actually twin tubes, each three miles long and 21 feet in diameter.
- Because its geology consists of hard rock from ancient lava flows up to 16 million years old, layered with soft ground and rock fragments, the tunnel has several horizontal and vertical curves as designers tried to follow the best rock conditions.
- Excavation began at the west end, where varied

## Beaverton Central

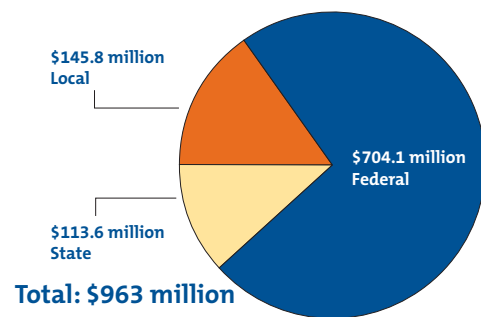
Beaverton Central Station was sited on vacant land once occupied by a sewage treatment plant to act as a catalyst for redevelopment. A project known as The Round was built around the station, featuring a mix of office and high-density residential units, surrounding a circular plaza that includes the MAX station.

## Orencia

Orencia was once a small company town that supported a large nursery by the same name, located on the old interurban electric railway. With the nursery and most of the population having long since moved away, the City of Hillsboro designated Orencia for transit-oriented development as part of the light rail project. Today it is a showcase community with over 1,800 for-sale units, condominiums and apartments.

## Snapshots

### Westside MAX Funding



## Timeline

- 1979 Alignment and environmental studies begin, to be postponed in 1983
- 1988 Preliminary engineering and environmental studies begin again
- 1990 Voters overwhelmingly approve a bond measure for the Westside extension
- 1993-1997 Tunnel construction
- 1994-1998 Alignment construction

- July 1996 First low-floor car arrives
- April-August 1998 Testing, training, service simulation
- September 1998 Opened

## Facilities

- Length 18 miles (MAX Blue Line: 33 miles total)
- Stations 20
- Surface Park & Rides 7 with 2,733 total spaces
- Parking garages 2 with 880 total spaces
- New maintenance facility Elmonica

## Annual Ridership

- FY03 - 21.55 million
- FY04 - 20.77 million
- FY05 - 21.14 million
- FY06 - 20.88 million
- FY07 - 21.23 million

## Frequency

Trains run every 5-15 minutes, roughly between 4:30 a.m. and midnight.

## Travel times

- Downtown Portland (Pioneer Square) to Beaverton Transit Center 23 minutes
- Beaverton Transit Center to Hillsboro end of line 28 minutes
- Downtown to Hillsboro end of line 51 minutes

## Bus connections

Includes 37 connections with TriMet bus lines along the Westside alignment and numerous bus lines downtown.

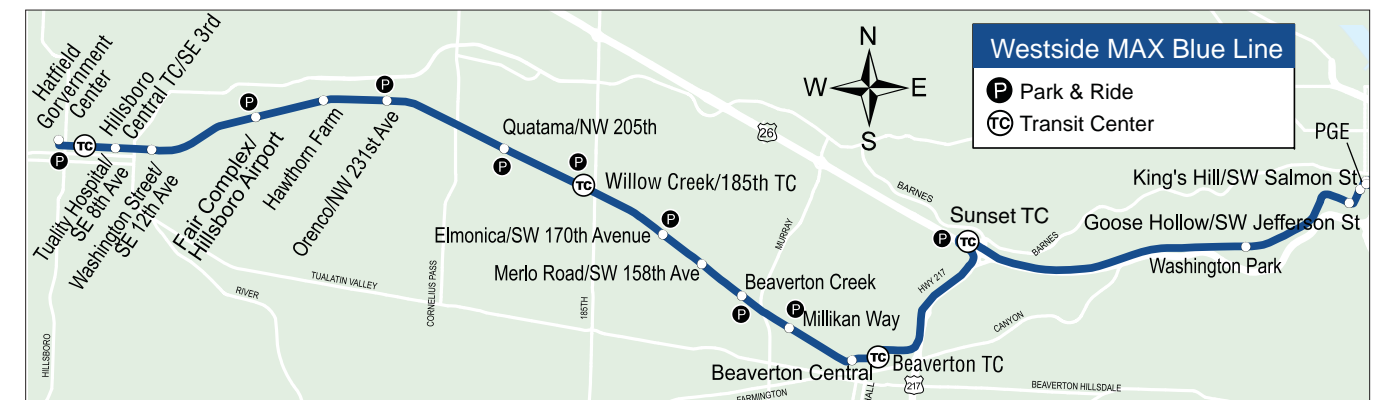
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geologic material required the use of conventional drill and blast mining techniques.

- The eastern two-thirds of the tunnels, composed primarily of Columbia River basalt, were excavated using a 278-foot-long tunnel-boring machine.

### Tunnel boring machine

- Designed to bore through solid rock, the boring machine used hydraulically driven arms to press against the tunnel walls and propel itself forward.
- The 42 hard metal cutting blades on the front of the machine ground the rock, which was caught in buckets and sent out on a conveyor belt that stretched as much as two miles long.
- In many places, the rock turned out to be highly fragmented, falling into the boring machine and jamming it. After months of delays, modifications to the machine eventually overcame the problem.
- Crews of a dozen people operated the boring machine three shifts per day, six days a week.
- The first tunnel was excavated in 17 months, the second in five and a half months. Following excavation, crews lined the tunnels with concrete. The finished tunnels measure 19 feet in diameter.
- Cross passages between the tunnels were built every 750 feet.
- Trains travel through the twin tunnels at speeds up to 55 mph.

### Washington Park Station

- Washington Park Station, the only stop in the three-mile tunnel, is the deepest transit station in North America at 260 feet below ground.
- Station elevators and stairwells are monitored through closed-circuit video cameras. Staff has direct 9-1-1 access and can operate fire doors, air

vents and electricity in case of an emergency.

- The underground station's unique public art has helped make the stop a destination in itself.
- The station serves the Oregon Zoo, World Forestry Center, Portland Children's Museum and the Vietnam Veterans Memorial, and offers access to the rest of Washington Park.

### Sunset Transit Center

Leaving the tunnel, the rail line follows Hwy. 26 to the Sunset Transit Center, then turns abruptly south along Hwy. 217 and descends a six percent grade for almost a mile. The Sunset Transit Center includes a 630-space Park & Ride and provides connections to five TriMet bus lines, as well as to bus service to the Oregon Coast.



### Beaverton

The alignment approaching Beaverton Transit Center crosses a previously developed area and is the only place on the MAX light rail system where an entirely new right-of-way had to be created. Beaverton Transit Center was built 10 years before light rail opened, with space reserved on its south side for future light rail. As it turned out, final alignment ran along its north side. (TriMet's WES—Westside Express Service—Commuter Rail will use the south side when it opens in October 2008.) The transit center was rebuilt at the same time, incorporating new amenities and facilities to support bus/rail connections.

### Hillsboro

At 12th Avenue in Hillsboro, the tracks move from a former railroad right-of-way and enter Washington Street, which they follow for 14 blocks to the Hillsboro end of the line, mostly on a 24-foot-wide paved

median. Here an alternative design gives light rail reserved lanes on a narrower street while still allowing other vehicles to turn across the tracks at driveways and intersections. As there is no room for turn pockets,



trains pass through these intersections on an "all-red" phase, with traffic stopped in all directions. When the train is not

present, the intersection functions like any other, with left turns permitted.

The configuration in downtown Hillsboro copies that in Gresham, with a transit center adjacent to the pedestrian downtown, and a Park & Ride at the end of the line to divert traffic from entering the downtown.

### A first for art

The Westside MAX was the first light rail project to



include a substantial budget for art. All of the 20 stations are embellished with artworks by a variety of artists and are designed to reflect the character,

diversity and history of the surrounding community.

## Technical Highlights

### Vehicles and accessibility

The original Eastside MAX line used platform-mounted lifts to allow customers using mobility devices to access light rail vehicles. Increasing use led to service delays, and many in the disabled community felt the

lifts focused attention on them as the cause of delays. In Europe, light rail systems were introducing low-floor cars to enhance access for all users, including users with mobility devices.

In 1991 TriMet began to study alternatives to the lift system. After meetings with the community, plus field trips to several North American and



European systems, the study recommended converting the whole system to low-floor cars. By 1992, TriMet had begun procurement for low-floor cars, the first such cars to be ordered in North America.

### Main Street Bridge

At Main Street in Hillsboro, a former railroad trestle that crossed over the street at an oblique angle had been the site of numerous accidents. The City of Hillsboro did not want a pier in the center of the street, so a light rail bridge was built with a dramatic overhead arch straddling the road and the track.

## Transit-oriented development

Westside MAX Blue Line traveled through stretches of undeveloped land, as well as the cities of Beaverton and Hillsboro. The line has become a magnet since opening in 1998, with over \$1 billion worth of residential and commercial development, including 8,500 housing units, launched within walking distance of the line.

