



## Beacon Hill Station, Running Tunnels and West Portal Wall Washington Sound Transit

**Location:** Seattle, Washington  
**Date:** 2005 – 2007  
**Structure:** Light Rail Station and Running Tunnels  
**Length:** Running Tunnels: 4,200 feet (1,280 meters)  
Station / Platform Tunnel: 380 feet (115 meters)  
**Cross Section:** Width: 21 feet (6.4 meters)  
Height: 21 feet (6.4 meters)  
**Geology:** Firm to Hard Clays, Water-Bearing Sand and Silt Zones  
**Cost:** \$350 Million  
**Client:** Obayashi Corporation (Contractor)  
**Owner:** Sound Transit (ST)



Figure 1. View of West Portal cut and break-out eye for the TBM.

### Tunnel Redesign Consulting:

Gall Zeidler Consultants (GZ) provided consulting and design services to the contractor on the breakout eye redesign for the Tunnel Boring Machine (TBM) start of the West Portal. The West Portal support wall stood close to bridge structures for a prime highway artery. Walers were cut, removed from the breakout area, and replaced by a series of cast-in-place (CIP) concrete beams. To facilitate cutting through these beams by the TBM, fiberglass bar reinforcement was used in the area of the breakout eyes.

During construction, the TBM had to pass through the previously built station platform tunnel. The contractor opted for the construction of the waterproofing system and final concrete invert prior to the TBM walk-through. A specially-formed and reinforced concrete invert was developed with particular waterproofing protection provisions and non-standard stabilization methods for the TBM transport and re-launched frame. The waterproofing system was carefully protected from damage while moving the TBM. To re-launch the TBM at the other end of the station platform tunnel, GZ developed a custom system to allow transfer of the TBM's thrust forces into the station platform tunnel's shotcrete lining and surrounding ground during the launching operation.

GZ further developed shop drawings involving Sequential Excavation Method (SEM) driven ventilation adits, break-outs from the ventilation shaft, and several station tunnel ancillary structures.



Figure 2. TBM walk-through within the station tunnel.