

TO: Alec Williamson

FROM: Gordon Clark

SUBJECT: Scenario Hybrid O – Single Bore Tunnel
Preliminary Cost for Ballard Connection

DATE: January 12, 2009

Per your request, we have prepared a conceptual configuration and cost estimate for a SB/NB connection from Elliott & Western Avenues to the 54' single bore tunnel.

The connection tunnel would have approximate outside dimensions of 42 feet wide by 48 feet tall and 2,700 feet long. The planning level cost estimate of \$770 million is a very preliminary number based on limited engineering and no geotechnical information. We believe a good range of cost would be \$650-\$850 million at this early stage. The planning level cost estimate includes risk, escalation and contingency see attached.

The intent of this concept was to provide direct access to the large bored tunnel, to and from Ballard via Elliott and Western Avenues. It is thought that one lane in each direction would have enough capacity for these movements. Further traffic analysis would be needed to confirm this assumption. A rough cross section was developed that assumed a Sequential Excavation Method (SEM) construction technique that involves the extensive use of grouting to stabilize the ground, followed by sequential mining and application of shotcrete and ribs to support the longitudinal cavern. This was thought to be the most economical approach given the short alignment. The cost was estimated based on an alignment that connects to the proposed single bore tunnel at approximately Union Street with a dual level roadway to match the proposed large diameter tunnel. The SEM section would stack single lanes and shoulders and would unbraided at Virginia Street. The SEM tunnel would require a vent shaft to be located near Union Street and Post Alley that would be approximately 230 feet deep. The SEM tunnel would be ventilated using jet fans at 300 feet on center in conjunction with the vent shaft.

This concept will require a SB on-ramp portal in Elliott Avenue south of Bell Street. Elliott Avenue would be three lanes southbound prior to the portal, with one lane diverging to the on-ramp to the tunnel and two lanes merging to one lane as a surface through lane to downtown. South of the portal on Elliott Avenue one lane would expand back to three surface lanes southbound. The NB off-ramp portal would be located in Western Avenue north of Bell Street. Western Avenue would be two lanes northbound

prior to the portal, with one lane merging from the off-ramp of the tunnel and two lanes merging to one lane as a surface through lane just prior to the portal. North of the portal, Western Ave would expand to be three lanes northbound. Please advise if there is any additional information or further explanation needed on this subject.

CC: Mike Rigsby
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Norm Petersen
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