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Dunsmuir Tunnel Eastern Diversion, Vancouver ALRT

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Vancouver's advanced light rapid transit system, in the central business district of the City, utilizes the old single-line CPR Dunsmuir Tunnel built in 1931. The inbound and outbound ALRT lines are stacked one above the other in the tunnel which required the lowering of the tunnel invert to achieve the necessary increase in height, as shown by "A" in the figure.

At the eastern end a re-alignment of the tunnel was required which resulted in an underground break-out section, "B", twin bored tunnels, "C", and a twin reinforced concrete box tunnel section, "D". The tunnel portal is located at Stadium Station, "E". Over the lengths of sections "B" and "C" the guideways move progressively from the stacked configuration of section "A" to the side-by-side arrangment of section "D". The maximum track gradient over this "roll-out" length is 5.08% along the lower (outbound) guideway.

The geological strata in the area consist of fill materials and dense glacial till overlying shale and sandstone of the Kitsilano Formation, together with occasional andesite dyke intrusions, as illustrated in the figure. At the start of the re-alignment the tunnel invert lies approximately 20 m below street level.

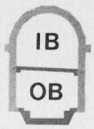
Dunsmuir Street is a main artery for vehicular traffic into the City and the use of underground excavation for "B" and "C" allowed the traffic to flow without disruption. The tunnel driving work employed an AEC 330 continuous miner tunnelling machine. Each advance of the excavated face was limited to a distance of 1m when a system of primary support was installed. This was to the design of Swan Wooster - Lea and comprised a nominal 50mm thickness of shotcrete followed by light steel ribs (W150 x 37) as shown in View "X". Demolition of the 600 mm thick concrete lining of the existing tunnel was by controlled blasting. For each driven tunnel the diameter of excavation was nominally 5.8 m, and the internal diameter of the final lining is 4.8 m. Careful survey monitoring during construction indicated that settlement of the ground surface was within acceptable limits.

Over the length "D" the concrete box tunnels were built in open cut excavation. The construction here also included a pedestrian subway under Beatty Street where a temporary bridge structure was used to carry two lanes of road traffic and to support some major utility duct banks. The open cut excavation was supported by a system of shotcrete and ground anchors. View "Y" shows the end of the open cut and the start of the driven tunnels.

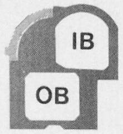
In the design of the driven tunnel lining both traditional hand methods and finite element techniques were used. Full overburden loading was adopted for the design of both the primary support system and the final lining. Allowances were made for the effects of future building development on both the driven and box tunnels.

The design and construction supervision of this work was by a joint venture of consulting engineers Swan Wooster Engineering Co. Ltd. and N.D. Lea and Associates. Geotechnical advisors were EBA Engineering Consultants Ltd. All firms are located in Vancouver, B.C.

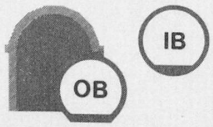
DUNSMUIR TUNNEL EASTERN DIVERSION, VANCOUVER A.L.R.T.



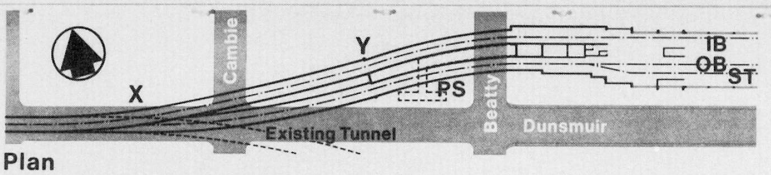
A. Existing Tunnel



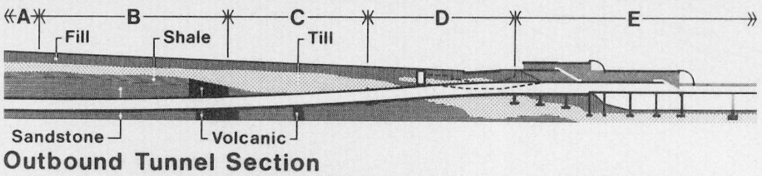
B. Tunnel Modifications



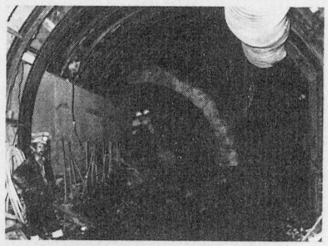
C. Driven Tunnels



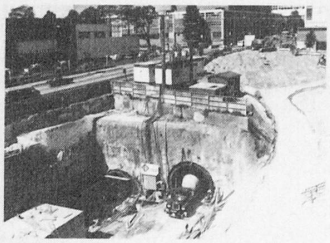
Plan



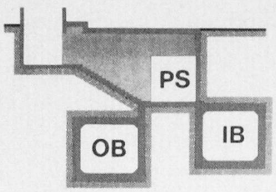
Outbound Tunnel Section



View X

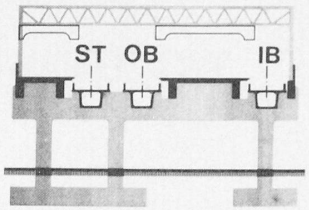


View Y



D. Box Tunnels

LEGEND
OB : Outbound Track
IB : Inbound Track
ST : Storage Track
PS : Pedestrian Subway



E. Stadium Station