Summer 1990

RSIO

Volume 4 No. 3

Case History Report

Don Valley Parkway/CP Rail Grade Separation

Having "Tunnel Vision" is not always desirable, but there is a highly visible exception to the rule which can be found on the Don Valley Parkway.

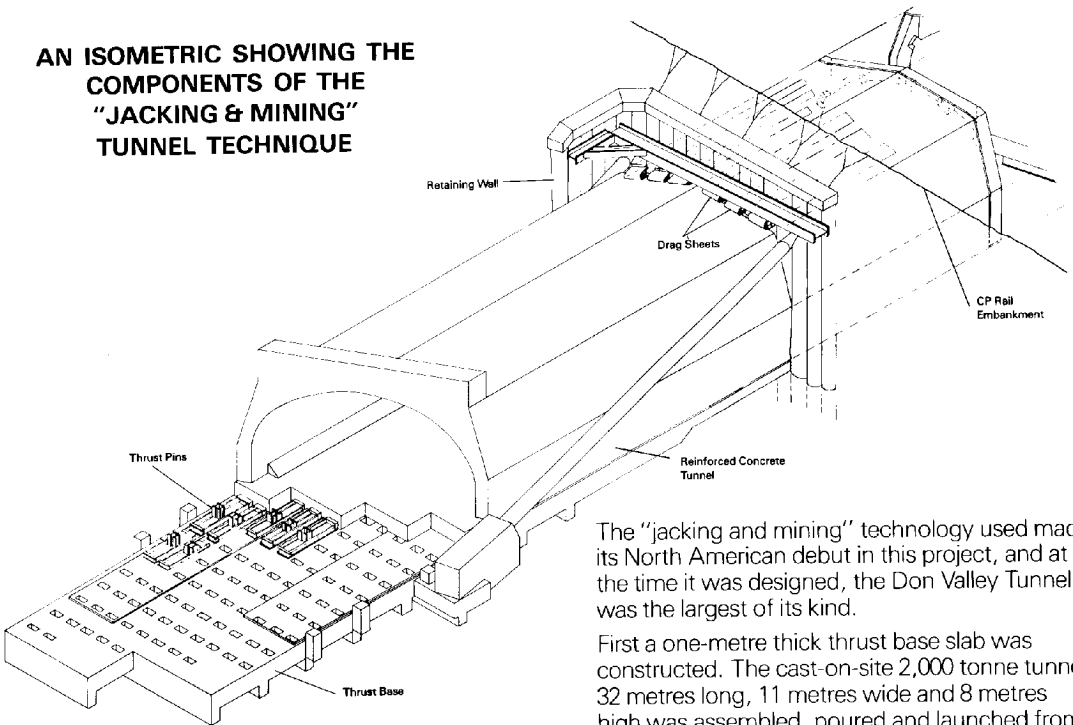
Increased numbers of condominiums and, therefore, residents, necessitated additional access to the Don Valley Parkway at Wynford Drive. The proximity of a CP Rail embankment dictated a tunnel to provide the access.

The owner, The Municipality of Metropolitan Toronto Transportation Department and CP Rail agreed that there was to be no interruption of rail service operating on the tracks above the embankment, nor were the two existing arches to be disturbed.

In the Fall of 1988, engineers from Delcan Corporation, North York, used a technology imported from the U.K. to construct a tunnel, which was to be known as the Don Valley Parkway/CP Rail Grade Separation.

A tunnel provided the CP Rail Underpass without rail or highway disruption. ▼

AN ISOMETRIC SHOWING THE COMPONENTS OF THE "JACKING & MINING" TUNNEL TECHNIQUE

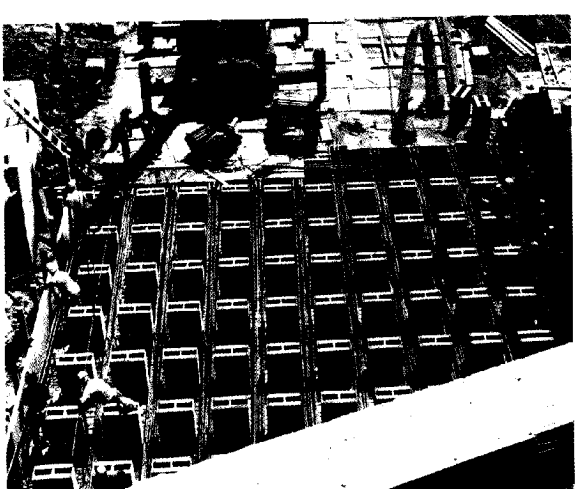


The "jacking and mining" technology used made its North American debut in this project, and at the time it was designed, the Don Valley Tunnel was the largest of its kind.

First a one-metre thick thrust base slab was constructed. The cast-on-site 2,000 tonne tunnel, 32 metres long, 11 metres wide and 8 metres high was assembled, poured and launched from this heavily reinforced working platform. The tunnel was constructed with a 12 metre steering and cutting segment at the front and a 20 metre section which followed.

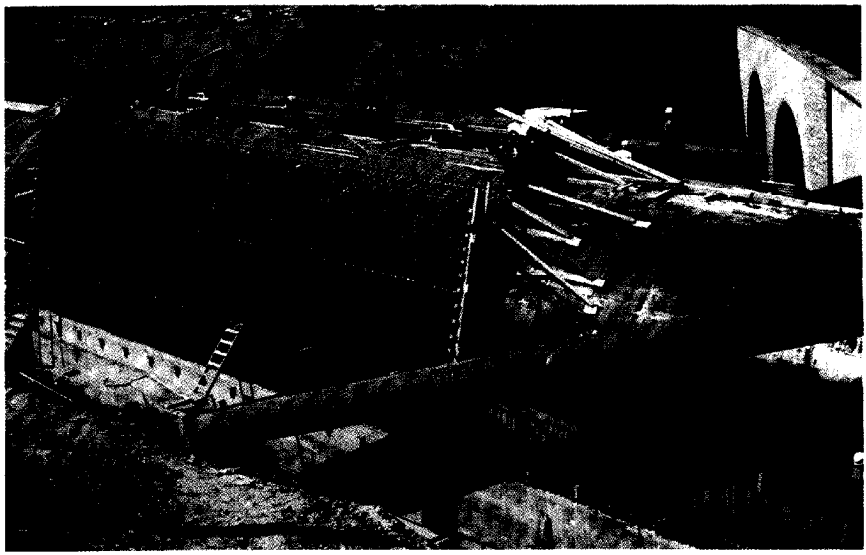
To make way for the tunnel, the railway embankment had to be made secure. This was achieved by constructing a reinforced concrete retaining wall on both sides assisted by compression struts and rock anchors.

100 tonnes of rebar were placed in the heavily reinforced thrust base. ▼



Contributing to an already unique structure was the shape of the tunnel. In all previous projects, a rectangular configuration was used. This time, a curved arch was produced, thanks to the versatility of reinforced concrete.

The requirement of placing the reinforcing steel for the circular arch at a skewed angle across the top resulted in elliptical bending patterns which had to be specially treated. To accommodate this particular shape, special radius rebar was sent to the site and placed in the formwork. Adjustments were made by field-bending the bars, thus establishing a template which was returned to the fabricator's shop, where it was used as the standard bending pattern. Epoxy coated rebar was used on all exposed faces of the tunnel to minimize corrosion damage caused by winter deicing salts.

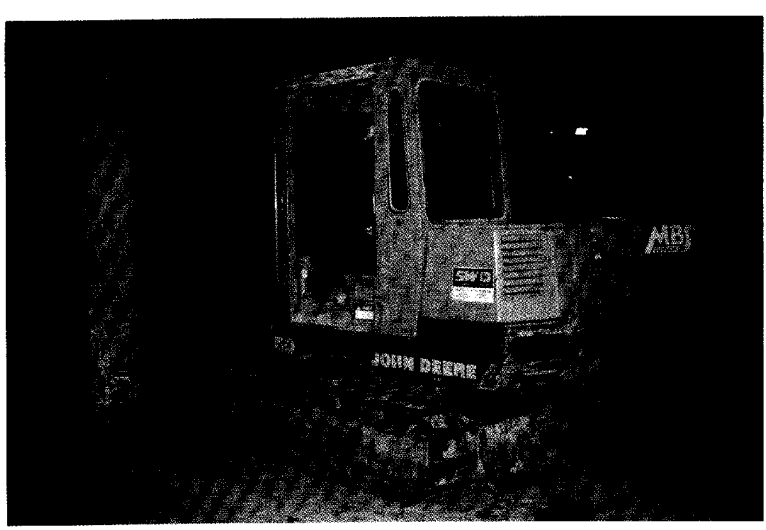


The rebar configuration was fabricated from a site-bent template. ►

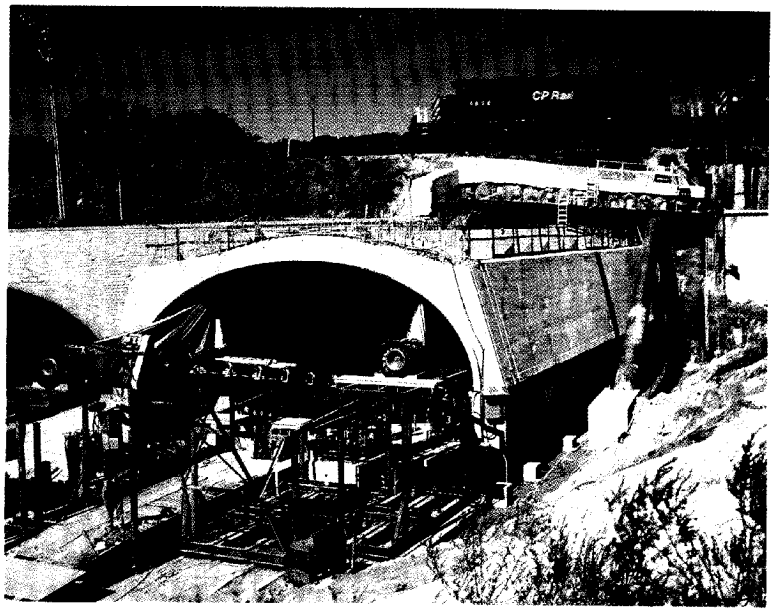
After 11 months of preparation, the tunnel was ready to be jacked into the embankment. Regularly spaced reaction "pockets" built into the thrust base served as bracing points for the 75 hydraulic jacks. For 11 days the tunnel pushed into the embankment in a slow-motion movement.

A tunnelling shield at the lead end and internal concrete working platforms provided the necessary protection and access for the workers excavating within the structure.

In order to minimize friction as the structure advanced into the embankment, layers of nylon reinforced drag sheets were placed between the arch units and the excavation roof. Pumping a bentonite slurry into the spaces between the structure and the excavation surface provided additional lubrication while ensuring stability by filling the voids. Once begun, the progress of the tunnel was a round-the-clock operation.



◄ The tunnel and concrete platforms provided safe working areas during excavation.

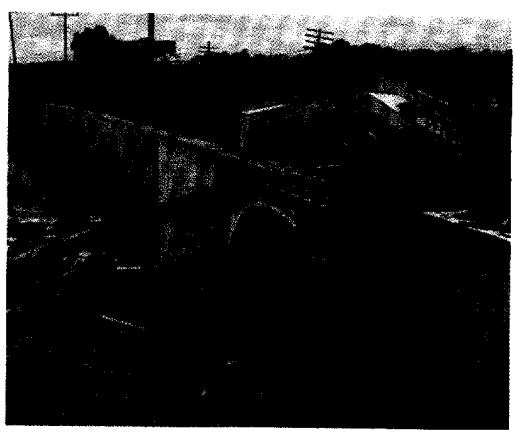


The 2000 tonne site-cast tunnel ready for the push. ➤

Throughout the entire project, CP Rail operated as usual, although during the 11-day "push", the trains running overhead were slowed to 35 MPH.

Movements of soil in the embankment were monitored constantly, as were the railway tracks and the two existing arches adjacent to the new structure. With a further nod to late 20th century technology, a laser beam was used to pinpoint the exact alignment.

The tunnelling technique proved excellent for accuracy of alignment, minimizing settlement, and speed of construction, proving once again the versatility of reinforced concrete.



11 days later the tunnel is ▲ through the embankment.

Credits:

Owner: Metropolitan Toronto Transportation Department
Consulting Engineers: Delcan Corporation
Sub Consultant: Cementation Company (Canada) Limited
Contractor: Mathews Contracting Inc.

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