NIAGARA FALLS TAILRACE TUNNEL

REHABILITATION—NIAGARA FALLS, NY

by James P. Crawford

Synopsis

As part of the overall plan for improvements to wastewater facilities in Niagara Falls, NY, a contract was let for rehabilitation of a 7000 foot long, 19'10" wide by 21 foot high tailrace tunnel. This tunnel, known as Adams Tailrace Tunnel, has a portal at Niagara River Gorge and extends inland 7000 feet to a shaft at Buffalo Avenue, site of a new wastewater treatment plant.

The original bids received in July 1973, were rejected. The second bids were received in October 1973. Albert Elia Building and Construction, Niagara Falls, NY was low bidder and was awarded the prime contract. Sansan Inc. was given a subcontract with Elia to do rehabilitation work involving Shotcrete, rock bolts, wire mesh, preparation of brick masonry and water diversion. All other items of work were done by Elia.

One of the requirements in the original bid was that work could not begin before Labor Day because of sightseeing boats on the Niagara River. All work was then to be completed in nine months. Since the first bids were rejected, the contract award in October meant wintertime

1 President, Sansan Inc., Chevy Chase, Md.
construction. The contract was completed in July 1974. The only access to the tunnel available to the contractor was at the tunnel portal and at a shaft near Station 70 + 00. The shaft could only be used for ventilation and Shotcrete material delivery.

An escarpment, 300 feet high, over the tunnel portal could not be used for lowering equipment by crane. Elia built a barge on the Canadian side of the Niagara River, on docking facilities of the sightseeing boats, to transport the equipment to the tunnel portal. The equipment was transported across Rainbow Bridge, between the US and Canada. Trucks were sealed by Customs. Permits were required on each piece of equipment.

Access for personnel was through the observation tower on the American side. Elia built a walkway, approximately ¼ mile long against the escarpment, for workers to reach the tunnel portal.

During the winter, when ice flows came over the falls, the tunnel was completely flooded out; the walkway was destroyed and work could not resume for three weeks.

There is a 45 foot rise in elevation from the portal at the Niagara River to Station 70 + 00. There was a continuous flow of water between 12 and 18 inches in the invert at all times. This required diversion of water to accomplish the work as specified.
Temperatures in the tunnel during construction ranged from $10^\circ F$ to $40^\circ F$. Water infiltration through the brick lining was considerable.

Water diversion was done in 200 feet segments. (See sketch). Sometimes the water handling only required 20 inch diameter pipes. But, for most of the time, the requirement was one 40 inch diameter and two 20 inch diameter pipes. This operation involved 33 moves.

A pipe jumbo, mounted on a truck frame, with telescoping sides left to right, was built at the tunnel portal and propelled by a D-4 tractor. Shotcrete was delivered from Station 70 + 00 through a 6 inch pipe from the top. The Shotcrete was transported in Young buggies to the Shotcrete machine.

At the end of the job time had run out on transportation of equipment back across the Niagara River by barge. The time set was June 1. To remove equipment from the tunnel portal, Elia hired helicopters, which transported the equipment above the 300 foot escarpment to trucks parked along the Robert Moses Freeway.
NIAGARA FALLS TUNNEL

NIAGARA RALLS TAILRACE TUNNEL
REHABILITATION--NIAGARA FALLS, NY

OWNER: City of Niagara Falls, NY
DESIGN & INSPECTION: Camp Dresser & Mc Kee
Boston, Mass
TUNNEL CONSULTANT: Jenny Engineering
South Orange, NJ
CONTRACTOR: Prime--Albert Elia Building & Construction Co.
Niagara Fall, NY
Subcontractor--Sansan Inc.
Chevy Chase, MD

Scope of Work

1. Remove and replace damaged steel plates at tunnel portal. Grout behind bulged plates.
2. Prepare brick masonry surfaces by removal of loose materials and replace with Shotcrete
3. Install wire mesh and Rock Bolts as required.

Contract Items of Work

<p>| 1. Mobilization and removal of equipment. Provision of site access (walkway) | Payment |
| Water handling | Lump sum |
| 2. Surface preparation | Square yard |
| 3. Removal &amp; replacement of steel plates | Lump sum |</p>
<table>
<thead>
<tr>
<th>Contract Items of Work</th>
<th>Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Furnish &amp; install pneumatically placed concrete</td>
<td>Per Cement Bag</td>
</tr>
<tr>
<td>5. Low Pressure Grouting</td>
<td>Per Cement Bag</td>
</tr>
<tr>
<td>6. Rockbolts</td>
<td>Per Lin. Ft.</td>
</tr>
<tr>
<td>7. Wiremesh</td>
<td>Per Square Ft.</td>
</tr>
<tr>
<td>8. Erecting Bulkheads</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>9. Diversion Chamber Modification</td>
<td>Lump Sum</td>
</tr>
</tbody>
</table>

**Sketches**

TYPICAL SECTION OF TUNNEL

TYPICAL SIDEWALL AND INVERT CONDITIONS

WATER CONTROL SCHEME

**Acknowledgements:**

Niagara Falls, NY

Bruce Kruckel--Camp Dresser & McKee, Boston, Mass.

Robert Jenny--Jenny Engineering Inc., South Orange, NJ
NIAGARA FALLS TUNNEL

TYPICAL SECTION OF TUNNEL

3" TIMBER LAGGING

12"X12" TIMBER ARCH

STONE DRY PACKING

TYPICAL ROCKBOLT

4 COURSE BRICK LINING

R=29'-5"

11'-7"
TYPICAL SIDEWALL AND INVERT CONDITIONS

- Sidewall Erosion
- Brick Courses Missing
- Sidewall Cracking
- Invert Erosion
- Invert Settlement
TUNNEL VIEW SHOWING WATER CONTROL SCHEME

FACED WITH SANDBAGS

STEEL PLATES

40" DIA. PIPE

2-20" DIA PIPES