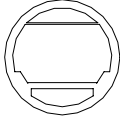


TUNNEL NAME/LOCATION/DATE COMPLETED: Parana (Hernandias) Tunnel; Between Santa Fe and Parana, Argentina; 1969		T.36 - Parana 	
TUNNEL TYPE AND USE: Circular reinforced concrete tube; Vehicular		LANES/TRACKS: One tube; two lanes	
NO OF ELEMENTS: 37	LENGTH: 36 - 65.4 m (one 10.75 m element was used on the Parana side)	HEIGHT: 10.8 m	WIDTH: 10.8 m
TOTAL IMMERSED LENGTH: 2,367 m		DEPTH AT BOTTOM OF STRUCTURE: 32 m	
UNUSUAL FEATURES:	Light elements, filled with water to induce final settlement, were held down with six outrigger pockets each. Backfill was vibrocompacted around the element. A jack-up barge was used for element and locking fill placement. Partial ballasting was accomplished by filling between light end bulkheads and interior bulkheads (the latter capable of taking submerged water pressure), spaced at 13-m intervals. The exterior bulkheads could be detached and floated to the dock for reuse.		
ENVIRONMENTAL CONDITIONS:	Design current: 1.35 m/s		
FABRICATION METHOD: A casting basin, designed for nine cycles, was excavated. Four elements were produced on a three-month cycle. The basin was 156 m long, 46 m wide, and 13 m high. The dock was closed by a 15 m high, 23 m dia floating cylindrical caisson acting against two fixed cylindrical tanks with 50 cm wall thickness.		JOINT TYPE: A tremie concrete joint using inflatable gaskets was used for all elements. A bottom slab was used to form the tremie. Concrete hoods and collars were used.	
WATERPROOFING METHOD:	4 mm preformed three-layer glass-fibre reinforced polyester resin waterproofing all around the cylinder. No protection was used.		
PLACEMENT METHOD:	Model tests were made. The element was first brought to the site parallel to the current to the centerline of the tunnel, using six 465-HP pusher rigs mounted on flexifloats. Two other similar elements were used to guide the element parallel to the current. At the jack-up rig, the element was turned transverse to the current using winches mounted on pontoons. A trolley running under the platform of the jack-up rig moved the element to its final position. It was then handled by four vertical and horizontal winches of the jack-up rig. Two ballast chambers under the roadway on both sides of the interior bulkheads were filled with water to produce 150 tons of negative buoyancy.		
FOUNDATION METHOD:	Sand fill was compacted around each element, using deep compactors.		
DREDGING METHOD:	A cutterhead suction dredge was used to dredge the trench and place backfill		
VENTILATION TYPE:	Fully transverse.		
COVER AND TYPE:	4.0 m of compacted sand fill		
ADDITIONAL INFORMATION:	OWNER: Argentine government DESIGNER/CONTRACTORS: Consortium of Hochtief AG, Vianini SpA and Sailav SA		