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Autor: Kollmar, R.B.
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11. Eisenhower Avenue Station, Alexandria (Virginia, USA)

Owner: *Washington Metrop. Area Transit Auth.*
General Architectural Consultant:
Harry Weese & Associates
General Engineering Consultant:
De Leuw Cather & Company
Section Design Engineer/Architect:
Howard Needles Tammen & Bergendoff
Contractor: *Ohio Valley Constr. Co., Inc.*
Work Duration: 40 months
Service Date: 1982

Radiating from the Nation's Capital District to the surrounding suburbs, the Washington Metro when completed will comprise 162 km of underground, at-grade and aerial tracks. The desire that the Metro stations harmonize with the architecture of the Capital resulted in an arched vault design for all underground stations, and maintained this theme with a gull wing canopy design for elevated stations.

The elevated Eisenhower Avenue Station in the City of Alexandria has 183 m-long side platforms. Aerial tracks through and adjacent to the station are connected to reinforced concrete slabs which act compositely under live load with single-cell structural steel boxes to form the two supporting longitudinal track girders. The steel boxes have vertical webs and are composed mainly of ASTM A588 low-alloy steel with a minimum tensile strength of 480 N/mm^2. The 4.1 m wide side platforms are the paved top surfaces of longitudinal prestressed concrete tee-shaped girders. The track girders and the platform girders span between piers consisting of transverse prestressed concrete cap beams supported by cylindrical reinforced concrete columns. Part of the station has two tiers of cylindrical shell canopies. Through the canopy covered length of the station, the piers are spaced 15.2 m center to center, and beyond the covered length, the spacing is increased to 25.4 m. The transverse spacing between the cylindrical columns is 9.1 m.

Four canopy configurations are used. Typically, the platforms are covered by single-cantilevered can-

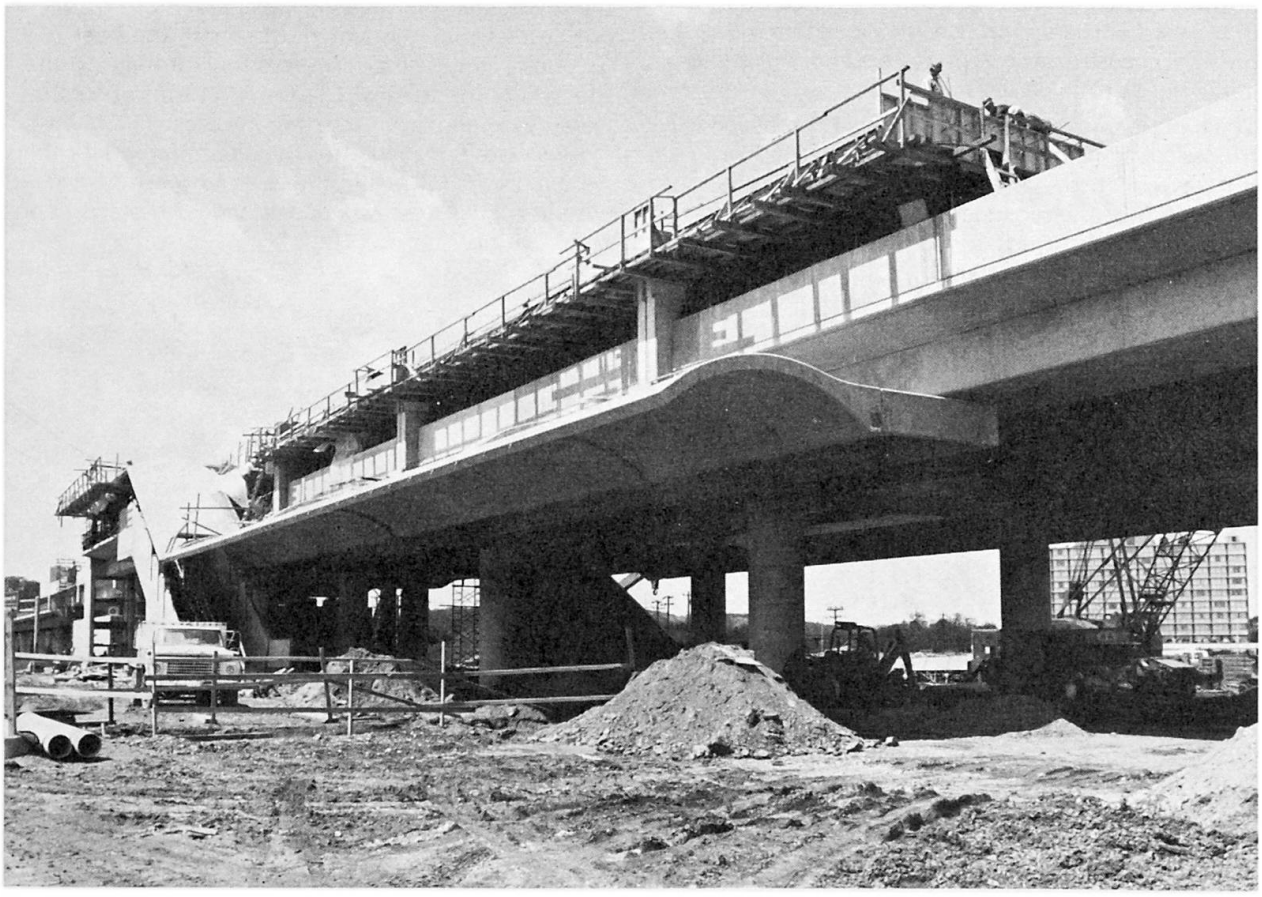

Fig. 1 Elevated station during construction

Fig. 2 Side platform and upper tier canopy

Fig. 3 Canopy over sidewalk

opies with supporting columns located at the outside edges of the platforms. For widened portions of platforms, leading to escalators which rise from street level, double-cantilever (gull wing) canopies are used, supported by center columns. The escalators are covered by sloping canopies, and sidewalks at street level are covered by canopies at the level of the pier cap beams. All canopy columns of the upper tier are framed into the ends of piers cap beams and the ribs of sidewalk canopies extend out from the ends of pier cap beams.

Alternate spans of platform girders were cast in place, posttensioned with 15 mm strands, and framed into the pier cap beams with 36 mm Dywidag bars to form grids. Pier cap beams were cast in place and post tensioned with multi strand cables using 13 mm and 15 mm, 1,860 N/mm² strands. Remaining drop-in platform girders were cast and post tensioned on the ground, and lifted onto seats on the pier cap beams.

The 10.2 cm thick canopy shells were cast in place and post tensioned in both directions with 13 mm monostrands. Each upper tier canopy, stiffened longitudinally with 250 mm by 250 mm posttensioned edge beams, is suspended between variable depth, posttensioned, transverse ribs cantilevered from canopy columns. Posttensioning tendons fix the canopy ribs into canopy columns and the columns, in turn, are fixed to the pier caps by tendons. Canopies at the lower tier have ribs posttensioned by cables extending into the cap beams.

Careful coordination was required to avoid interference of posttensioning tendons with mild steel reinforcement, drainage pipes, structural steel weldments which act as seats for track girders, and conduits for lighting and communication. Because the canopy shells, columns and platform grids form a space structure, the sequence of casting and posttensioning was critical in the successful construction of the station.

(R. B. Kollmar)

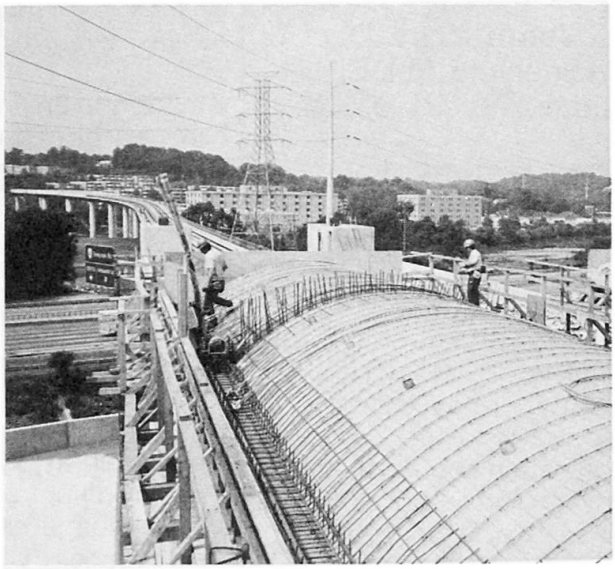

Fig. 4 Upper tier canopy before concreting

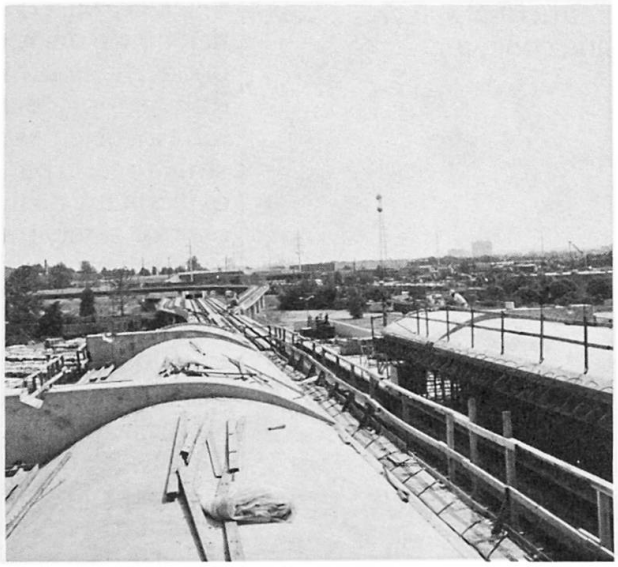

Fig. 5 Upper tier canopy after concreting