

NEW YORK CITY'S ROUTE 9A

by William Snyder

A major ongoing New York State Department of Transportation (NYSDOT) pavement reconstruction project consists of seven contracts, covering 8 km of Route 9A along the Hudson River in New York City from Battery Place to West 59th St.

For this work, a 275-mm thick concrete urban pavement was designed to achieve a 50-year service life, slightly modified from the rural pavement standards specified in NYSDOT's *Thickness Design Manual for New and Reconstructed Pavements*. The 5.5-m slab length recommended in the *Manual* for rural highways was shortened to range from 3 to 5 m for this city project, so as to minimize stresses resulting from nonuniform support.

The photo on the cover of this *Bulletin* shows a recently completed section of Rte 9A's Segment 4, running from Clarkson St. to Horatio St. (with the cover of a telescoping manhole in the right foreground and a typical isolated catch basin further back). Because this Manhattan location has silty soil with potential for considerable long-term settlement, a lightweight fill was placed at several of the worst locations in anticipation of that problem. Further complicating the design were existing pile-supported structures, including abandoned Miller Highway viaduct footings, located directly beneath the new pavement. In addition, numerous existing pile-supported utility structures within and beneath the pavement might also exhibit varying support. Concrete pavement was selected because, when

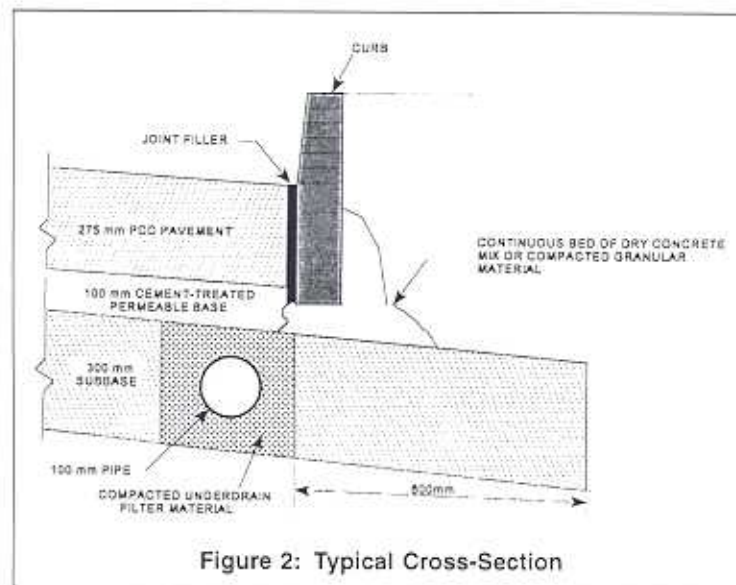


Figure 2: Typical Cross-Section

properly designed, it could span these nonuniform-support areas, providing superior long-term service. A typical cross-section (Fig. 2) of this jointed plain-concrete pavement (JPCP) includes 275 mm of unreinforced concrete having a compressive strength of 28 MPa, 100 mm of cement-treated permeable base, and 300 mm of dense granular subbase. Edge drains are located beneath the pavement curb line for positive drainage of the cement-treated permeable base.

Utility Isolation and Joint Layout

JPCP requires closely spaced joints – usually from 3 to 6 m – for effective control of cracks that may develop. Plain concrete pavement has a natural crack pattern – it wants to break up into small rectangular pieces – and joints effectively determine and control where cracks may occur. Transverse joints are normally equally spaced, but in urban locations utilities located within the pavement often dictate other

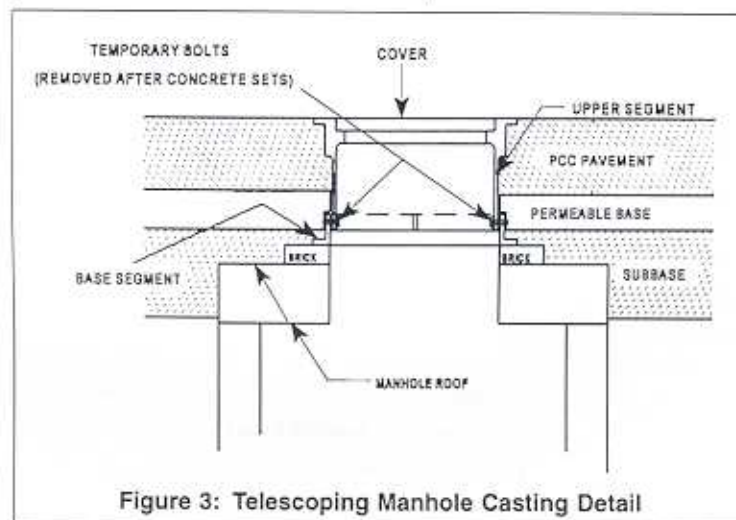


Figure 3: Telescoping Manhole Casting Detail

(continued on page 12)

joint spacings. The Rte 9A project is an extreme example – it contains numerous utilities: pile-supported manhole structures and shallow concrete electrical vaults projecting into the 275-mm thick slabs, as well as curb-line catch basins, all directly exposed to traffic loads. Together and separately, they significantly complicate joint layout.

Because NYSDOT had no standards to address the influence of utilities on joint layout in urban settings, for this project engineers from NYSDOT's Technical Services Division developed special details for joints and isolation of utilities to minimize the potential for cracking. Technical information from the American Concrete Pavement Association (ACPA) was helpful at the outset, but final joint layout and selection of joint types were based on results of finite-element analyses that had to consider *in situ* support, temperature from top to bottom of slab, and traffic loading.

Telescoping Manhole Castings

At the recommendation of John Roberts of ACPA, special castings were selected to minimize effects of pile-supported manhole structures. Such castings have been used in various central and western states for a number of years, but until now never in New York State. Normally, utilities can be isolated by building large boxouts, but given the numerous manholes within this pavement and the concern regarding differential settlement, these castings appeared particularly appropriate. The telescoping feature (Fig. 3)

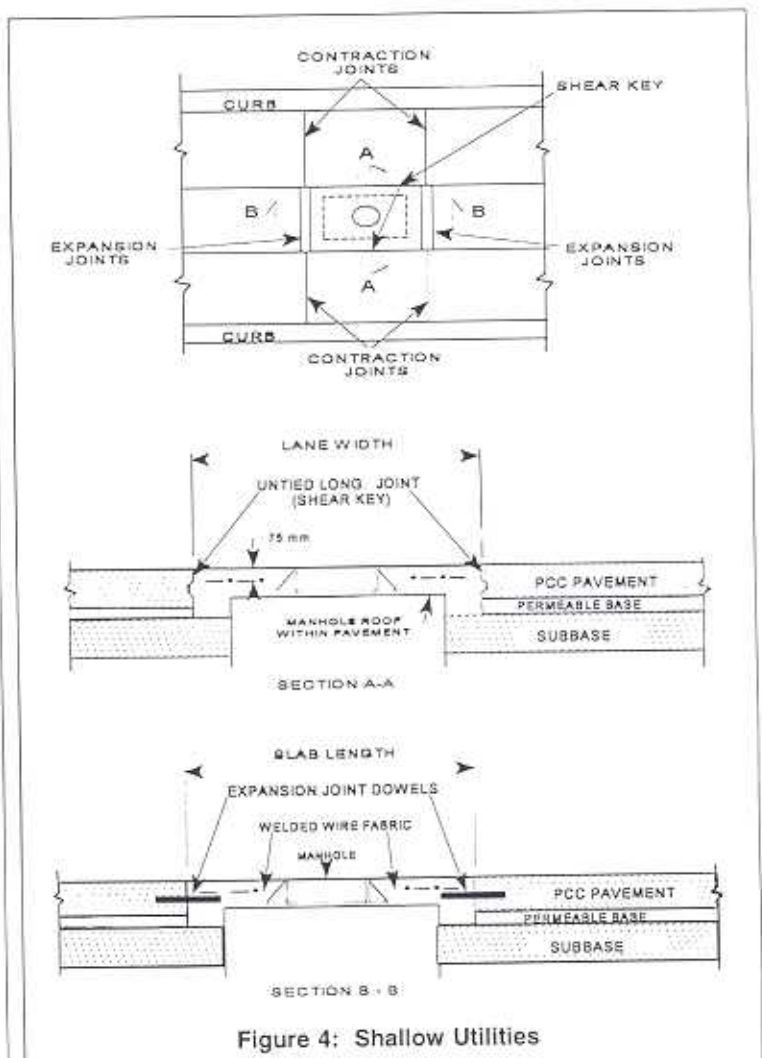


Figure 4: Shallow Utilities

provides sufficient horizontal and vertical isolation when centered within a short slab (typically about 3 m long). The castings have three parts: base segment, upper segment, and cover. The two segments act independently because the base is secured to the roof of the concrete manhole structure, with the cover set into the top of the upper segment, which is cast integrally into the concrete pavement. The upper segment is temporarily secured to the base with four bolts, and has four corresponding slots providing for up to 50-mm adjustment of elevation to

accommodate setting to the final grade. All four bolts are removed immediately after the concrete pavement hardens to allow the base and upper segments to act independently, thus achieving the required utility isolation within the pavement.

Shallow Utilities

When utilities project up into the concrete pavement, telescoping castings will not function as intended, and another detail is required. To complicate matters, shallow utilities are often located in travel lanes exposed to traffic.

Details shown in Fig. 4 were developed to isolate the entire slab containing a utility. Expansion joints at both ends, and longitudinal joints at either side, using a keyway with no steel bars, provide total isolation of the slab containing the shallow utility. Mesh is included in this isolated slab to reinforce it and bridge any cracks that occur, allowing the slab to behave as a single unit. This isolation prevents it from affecting performance of the surrounding pavement. The design thus maximizes performance in spite of undesirable conditions.

Isolating Catch Basins

In addition to manholes, this highway has numerous drainage catch basins located along the roadway's curb line. Most project out into the driving-lane's right wheelpath, and thus are directly exposed to traffic including heavy trucks. To address the problem of high stresses at these basins, special details were developed providing both isolation and load transfer. As shown in Fig. 5, an untied longitudinal shear key was formed at the front face of the isolation, with expansion joints at the sides. The length of the catch-basin isolation was extended for a minimum slab length of 3 m, creating a rectangle with a maximum aspect ratio (width to length) of 1.25. This also avoided the high stresses to which slab corners would be subjected at a conventionally isolated catch basin.

Isolating Intersections

With numerous intersections, this project needed details to account for their influence on mainline

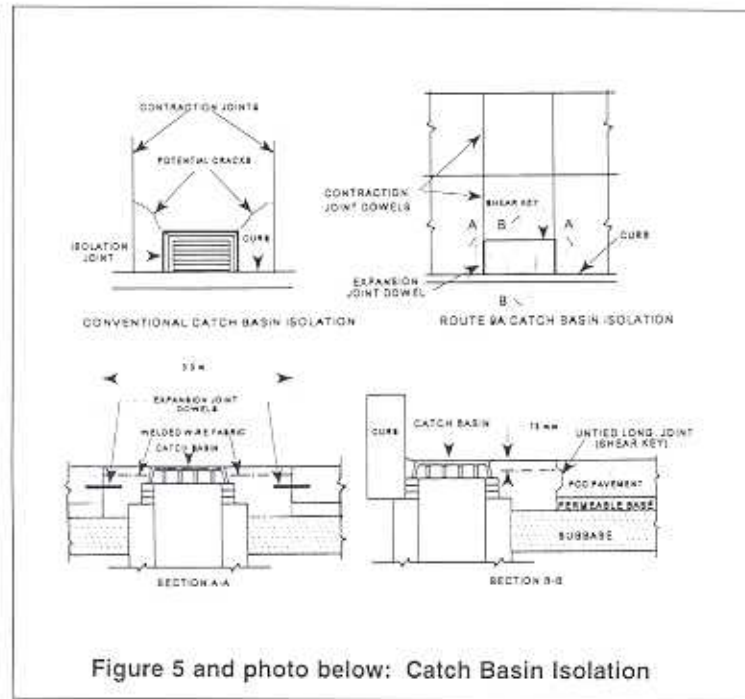


Figure 5 and photo below: Catch Basin Isolation



(continued on page 14)

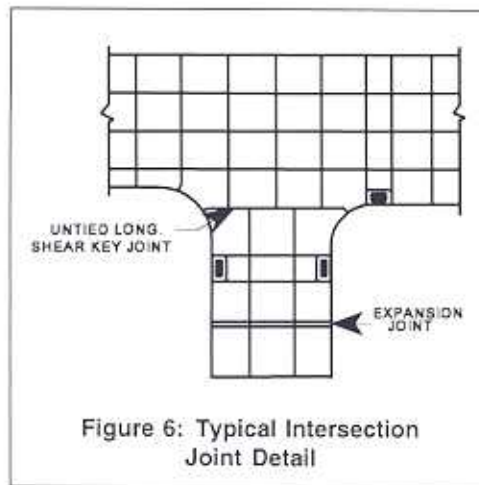


Figure 6: Typical Intersection Joint Detail

performance and joint layout. Untied longitudinal pavement joints (Fig. 6) isolate the mainline pavement from intersecting roadways. This compensates for possible misalignment of tied joints at two adjoining streets that are not laterally continuous. An expansion

joint prevents the temperature stresses within the intersecting pavement from projecting into the main line pavement.

Summary

Details developed for the Rte 9A pavement took considerable time and effort to evolve into their present form. A partnership of

NYSDOT and ACPA resulted in details considerably more sophisticated than those currently recommended nationally for isolation of utilities. They are now being incorporated into NYSDOT's standard detail sheets for urban concrete pavements. For addi-

tional information, contact William Snyder (518) 457-5956 or electronically at wsnyder@gw.dot.state.ny.us. ■

About the Author: *William Snyder, P.E., a 34-year veteran of the NYS Department of Transportation, is currently in charge of DOT's Materials Bureau's Field Engineering I Section which is responsible for PCC pavement specifications and standards. With John Roberts of ACPA, he chairs a recently-formed joint DOT/industry PCC Pavement Task Force.*

A Formwork Second

A system of formwork filled with wet concrete has its weight at the top and is not basically a stable structure.

Transportation

Bridges & Highways

Structural Engineering

Environmental

Planning

Construction Management



URBITRAN

71 West 23rd Street New York, N.Y. 10010 • 212.366.6200

• Fax: 212.366.6214

Offices Also in New Jersey & Connecticut