Reconstructing America's First Super Highway Asphalt

"he Pennsylvania Turnpike, America's first Superhighway, turned 60 years old on October 1, 2000.

When the first stretch opened to traffic in 1940, it ran from Middlesex near Harrisburg to Irwin near Pittsburgh. It was America's first limited access, four-lane, divided highwayno stoplights, stop signs or cross traffic. It cut three hours off the trip from Harrisburg to Pittsburgh.

The \$70 million,160-mile Turnpike offered long straight-aways, relatively gentle curves and easy grades. Its original Portland cement concrete (PCC) pavement consisted of two 12-foot traffic lanes in each direction. It is this stretch of 9-inch-thick PCC all of it overlaid with asphalt—that is being totally reconstructed by the Pennsylvania Turnpike Commission.

Early Pavement Problems

After WWII, the Turnpike's original roadway was extended east to connect with the New Jersey Turnpike and west to the Ohio state line. A 110-mile northeastern extension was added in

grated. Also, freeze-thaw conditions in the Pennsylvania mountains caused severe scaling of the PCC. Maintenance costs were high and increasing traffic loads cracked the pavement in many places.

At first, maintenance crews used hot mix asphalt (HMA) to reduce the forces of expansion and contraction on the original PCC. Crews cut out 10-foot widths of concrete every 1,500 feet and replaced them with 14-inch-thick sections of HMA. The maintenance cuts eased the pressure on the original 47-foot-long PCC slabs.

First HMA Overlay

The first HMA overlay occurred in July 1954, a little less than 14 years after the Turnpike opened. This 22mile-long stretch was the first of a series of resurfacings on the then 327mile Turnpike system. On this overlay, the paving contractor maintained twoway traffic on one side of the median strip while resurfacing the other side.

Two pavers working in tandem placed the 2-inch leveling course and the 1-inch surface course, which

> consisted of fine slag and aggregate. Maintenance crews also undersealed many of the 47-foot-long PCC slabs with liquid asphalt. By 1966, most of the original pavement was undersealed.

1957, bringing the total to 470 miles. Another 42 miles were added over the years in small expansion projects, bringing the Turnpike's current mileage total to 512.

Because the original 160 miles of PCC pavement was constructed on relatively poor subsoil, much of it disinte-



Widening the Turnpike

Sixty Years Later

Now, after 60 years of heavy use, the Pennsylvania Turnpike Commission has decided to rebuild America's Superhighway. It has thus far established eleven locations on the original stretch for total reconstruction. All eleven project locations will involve removing the existing pavement and replacing it with new pavement.

Currently, one of the eleven projects is complete. Two others will be complete by the fall of 2002. Eight others are in one of three stages—feasibility, preliminary design or final design.

Total turnpike reconstruction includes:

- ▲ Widening the median (up to 40 feet) where feasible
- Straightening curves, making slopes more gentle and adjusting roadway geometrics where feasible
- ▲ Widening the roadway using appropriate cuts and fills for the subgrade
- Installation of an all-new roadway plus drainage
- ▲ Construction of all new overhead and mainline bridges and other structures

Subgrade cuts and fills are important because soil conditions on the

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Rebuilding America's First Superhighway

original 160 miles are often unstable. Some of these soil conditions have caused significant problems on current projects where temporary roads were necessary.

First Project

Begun in 1998, the first total reconstruction project of the original Turnpike was completed in August 2000. It went from Milepost 94 to Milepost 99. This five-mile stretch of

totally reconstructed roadway is the benchmark for subsequent total reconstruction projects. The project cost \$28 million, approximately 40 percent of the total estimated cost of the original Turnpike in 1938.

Lane Construction
Corporation of Meridian,
Connecticut, completed the
staged construction project in
two years. Stages two and
three were the complete reconstruction of the three eastbound
travel lanes and the shoulder.
Stage four was reconstruction
of the westbound travel lanes
and shoulder.

Smooth Ride?

This project specified a 36-inchper-mile rideability index using a zero blanking band. Lane Construction used a K. J. Law lightweight profilometer to measure smoothness. The ride number for the eastbound pavement averaged 23 inches of roughness per mile.

Turnpike engineers and Lane targeted several aspects of the project where they could lower the 23 inches of roughness per mile. Lane began paving the westbound lanes in June 2000. They decided that continuous paving with equipment and delivery trucks accessing the work area ahead of the paving train would limit the amount of travel on the prepared surface.

Lane decided to pave one lane of asphalt-treated permeable base (ATPB) in one day, usually one mile in length. They paved the adjacent lane the following day. Then Lane placed the first 3-inch lift of HMA base course over both lanes. This operation continued until all five miles of ATPB and the first 3-inch lift of HMA base course was in place. Subsequent lifts of the HMA

base course were then placed in lengths of 2.5 miles per day on the travel lane and shoulder.

Super Smooth Superpave

Lane also used a sonic leveling ski attached to the paving machine during the placement of the HMA base course. With each layer of base course, Lane measured the profile index. Lane noted a marked improvement over the previous lift index although they didn't use a materials transfer buggy.

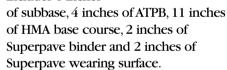
Lane then paved the Superpave intermediate course non-stop with no transverse joints using a transfer buggy. The profile index on the intermediate course of the westbound lanes averaged 19 inches of roughness per mile. The final smoothness analysis on the westbound Superpave surface course measured a low 13.3 inches of roughness per mile.

Materials used in this first project included approximately 44,000 tons of ATPB, approximately 151,000 tons of HMA base course, approximately 36,000 tons of Superpave intermediate course, and approximately 35,000 tons of Superpave surface course. Approximately 41,000 tons of RAP and 77,000 tons of recycled concrete pavement were used in the reconstruction of the roadway.

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Second Reconstruction Project

Major features of the second reconstruction project-from Milepost 185 to Milepost 197 included the total reconstruction of ten miles of roadway and the milling and resurfacing of three dual tunnels. This phase of the project will be complete in the summer of 2002. The original pavement on this project was reinforced concrete with asphalt overlays. The new pavement structure is totally asphalt. The new pavement design includes 6 inches



Contract specifications gave Lane Construction the option of bidding asphalt or reinforced concrete. Lane chose asphalt because they believed they could complete the project quicker and at less cost and inconvenience to the motorist. Lane also believed that the asphalt pavement would be easier to maintain.

Lane began work in May 1999 on the project. The Turnpike Commission developed the construction phasing of the project so that inconvenience to the summer Turnpike motorist was minimized. Consequently, the spring and fall months became the heavy construction periods for this two-andone-half-year project.



Staged Construction for Turnpike Widening

Tight Window, High Tonnage

Because of the large tonnage required on the project, Lane set up a HMA plant adjacent to the New Enterprise Dry Run Quarry, four miles from the project. With traffic in single-lane patterns and a work force nearing 180 workers, Lane rebuilt the project's eastern six miles of the westbound roadway between the Labor Day and Thanksgiving Day holidays.

During the October 8 to November 17 timeframe, Lane placed a total of 153,388 tons of HMA on the roadway. This included 18,482 tons of ATBP, 89,239 tons of HMA base course, 24,656 tons of Superpave intermediate course, and 18,013 tons of Superpave surface course. The project paving team set company records by placing 49,710 tons in a week and 10,051

tons in 24 hours. Transfer vehicles were used for placing the Superpave mixes on the travel lanes and the outside shoulder.

Lane recycled all existing roadway materials on the project. The concrete pavement was crushed and used as a subbase for the new pavement base and the existing asphalt surface was being used as RAP in the HMA base course and Superpave mixes.

Durable Overlays

Over the years, the typical thickness for Turnpike HMA overlays has been 4 inches—a 1-inch leveling course, a 2-inch intermediate course, and a 1-inch surface course. The Commission has had good success with these HMA overlays. In 1991 they were getting between 8 and 15 years out of them. Turnpike rehabilitation typically includes redecking bridges, reconstruction of shoulders, and milling and resurfacing with HMA.

For widenings, the Turnpike uses a Deep-Strength® design, composed of 10 inches compacted subbase material plus up to 15 inches of HMA. When adding new lanes in sections where soils are weak, design engineers specify Full-Depth asphalt. Shoulders are normally reconstructed with 8.5 or 9.5 inches of HMA.

Traffic Control

During rehabilitation projects, the Turnpike Traffic Control Department uses staging and phasing because Turnpike policy encourages the maintenance of four traffic lanes at all times. Turnpike engineers like HMA because it gives them the speed and flexibility to keep high volume traffic moving.

"Our goal is to keep four lanes open at all times," says Carl DeFebo, technical spokesman for the Turnpike's Public Relations Department. "We don't allow single lanes at all in the summer—especially in August, which is our busiest month. Any lane closures we do in the summer have to be off-peak."

New Approach

DeFebo says that late last year Turnpike engineers came up with a new design approach. It is based on widening the medians so the contractor does not have to build temporary roadways.

The new approach is a two-stage process geared to providing the driving public with maximum service. "We keep four lanes open at all times," says DeFebo. "We use the shoulder and median as part of the new passing lane. Then we switch traffic to this newly reconstructed lane. Next we construct the median—up to 40 feet wide. Finally, when we add the third lane, the median lane is used to carry traffic.

"We are a customer-driven facility," says DeFebo. "They pay to use our road and our first priority is to accommodate them."

Increasing Traffic

Currently, more than 160 million vehicles are using the Pennsylvania Turnpike per year. Of that 160 million-plus vehicles, 21.3 million or 13 percent are trucks. In 1999, more than 156 million vehicles used the Turnpike, 19.8 million were trucks. In 1998, more than 151 million used the road and 18.6 million were trucks. Traffic is increasing by about 3 percent per year.

Despite increasing traffic and tight reconstruction deadlines, the Pennsylvania Turnpike Commission is committed to making its road the number one east-west artery in the state for the next 40 years.

Information and photos for this article were provided by the Pennsylvania Turnpike Commission's Public Relations Department and the Pennsylvania Asphalt Pavement Association.

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