The Keystone Shortway — Providing Mobility and Economic Opportunity to the Nation

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I-80 over Allegheny River looking North

Overview

Interstate 80 in Pennsylvania, commonly known as the Keystone Shortway, is one of the most heavily traveled interstate highways in the Commonwealth of Pennsylvania, and is often referred to as the "Gateway to the West". This 313-mile divided highway, with two travel lanes in each direction, is one of most important thoroughfares for the transport of people and goods in the entire country. This vital East-West connector was constructed in only 12 years, after more than 30 years of detailed planning, design and coordination.

Daily traffic varies from 22,000 to 66,000 vehicles on Interstate 80. Most who have traveled this highway will attest that a large percentage of this total traffic volume is trucks. Commercial truck traffic accounts for 18 to 44 percent of the traffic volume, evidence of the importance of Interstate 80 as a vital link for the movement of goods and services, not only within the Commonwealth of Pennsylvania, but also to destinations in the Northeast and west to Chicago and beyond.

In the Keystone State, there are 55 interchanges connecting Interstate 80 to numerous North/South Interstates (I-79, I-99, I-81, I-380), State Routes, the Northeast Extension of the Pennsylvania Turnpike (I-476), and other important arterials and collectors. Significant components of the Keystone Shortway are its 486 bridges totaling nearly 85,000 linear feet. Several of these structures are among the highest and longest in the state. At the time of its construction, the Allegheny River Crossing (Emlenton Bridge), 270 feet above water, was the highest bridge in the state and spans nearly 1670 feet. In addition to the statistical fame of the Keystone Shortway's bridges, several have won national awards for their design components and aesthetic treatments that complement the surrounding environment.

I-80 over Allegheny River looking South

Geological Considerations

The 313 miles of Interstate 80 pass through various types of geological formations. From the gorge cut by the Delaware River on the eastern terminus, to the glacial deposits of the Appalachian Plateau on the west, the topography encountered along Interstate 80 tells a history of geologic activity millions of years in the making. Sand, gravel, pebbles, cobbles of glacial till, boulder fields, tilted and folded beds of sandstones, limestone, shale, quartzite, conglomerates and coal — any and all of these materials may be encountered along the line and grade of this interstate highway.

44 Bridge Studies Evaluated for Widening

Pennsylvania Department of Transportation Engineering District 10-0 commissioned DMJM+HARRIS to perform conceptual-level bridge widening studies to determine if oversize vehicles could be accommodated on 44 bridges carrying I-80 in Butler, Clarion and Jefferson Counties during future rehabilitations. The rehabilitated bridges were required to meet current PENNDOT Design Manual, Part 2, roadway criteria for lane and shoulder width, and must provide a single 18-foot wide traffic lane (in each direction) during staged reconstruction of the bridges. These criteria negate the need for the time-consuming detour of oversize vehicles normally required during bridge rehabilitation or deck replacement. Eliminating detours also eases the burden placed on local municipalities and state roads used as detour routes. Widening options were evaluated with respect to geometry, construction methods, and safety criteria established in coordination with the Department. Of the 44 bridges investigated and evaluated in the three counties, it was determined that 40 bridges required widening in order to satisfy the Department's criteria.

The 44 bridges were divided into two broad categories by DMJM+HARRIS: single structures carrying four lanes of I-80 in both directions, generally over major rivers such as the Clarion and Allegheny; and dual structures carrying the eastbound and westbound lanes

on separate, parallel structures. The bridges studied included single and multiple spans in various configurations of steel and prestressed concrete structure types.

Constructibility and Design Issues

The study included several major long span bridges: three (3) single-structure steel deck-truss bridges; two (2) dual-structure steel multi-girder bridges; and four (4) dual-structure steel girder-floorbeam-stringer system bridges.

A multitude of constructibility and design issues were considered in development of the widening feasibility studies. Geometric and geographic constraints such as horizontal and vertical clearances, site distances, median-versus-outside shoulder widening, and the presence of interchange ramps could impact the proposed widening. Through numerous site reconnaissance field trips, the varying geological conditions were noted. Design issues such as time-dependent behavior, differences in material strengths, fatigue performance, and structural capacity were also key elements of the widening investigations. Various methods of superstructure and substructure widening were considered as part of the study for each bridge. Construction phasing and constructibility were evaluated, including site access, contractor staging and material laydown areas, material availability and transportation requirements. Cultural, environmental, and right-of-way issues were identified and addressed; and, where applicable, administrative issues regarding railroads, permits, and coordination with the Public Utility Commission were also considered.

Beyond the Keystone Shortway

This project is an important first step toward improving I-80, but attention must be focused beyond the 44 bridges of this study – there are 486 bridges on I-80 alone within Pennsylvania's borders. We must have the commitment of all stakeholders in order to provide a transportation network that significantly improves our nation's competitiveness in the world economy.

Most bridge engineers are keenly aware of the relationship between a well-planned, well-designed and well-built transportation infrastructure system and the economic growth and prosperity of our nation. In spite of the sincere and dedicated efforts of many transportation agencies, the condition of our roads, bridges and transit systems is, in many cases, deplorable, and development of new facilities has not kept pace with demands to reduce traffic congestion, provide access, and improve mobility for the motoring public.

I-80 east-bound over Canoe Creek looking East

The following facts and figures illustrate the need for dedicated funding to enhance our infrastructure system in Pennsylvania and other parts of the country.

- The existing transportation network is **fragile** and minor mishaps result in gridlock
- Urban area infrastructure is operating **at or near capacity** in many communities
- Level-of-service **demands exceed capacity** of the existing transportation system
- Roadway closings due to reconstruction, delays, accidents, bridge failures, storms, landslides and other emergencies frequently result in users' "road rage"
- As a nation we have been **underinvesting** in transportation infrastructure for decades

The No. 1 transportation problem in the country is **congestion** — 82% of all goods are moved by trucks. Manufacturers are adopting just-in-time delivery as a way of doing business. To illustrate the magnitude of the funding problem, there are **2,114 bridge**s in Allegheny County — more than in Venice, Italy.

- 1,154 owned by PENNDOT
- 512 owned by Allegheny County
- 85 owned by City of Pittsburgh
- 66 owned by PA Turnpike Commission
- 80 owned by Port Authority of Allegheny County
- 107 locally owned
- 80 railroad-owned
- 30 privately owned

We can address these problems in two ways: Provide a **multimodal transportation system** that is seamless between modes of transportation; and secure **additional revenues** to address shortfall of available transportation funding

As engineers and bridge industry professionals, we need to stress the need for dedicated funding, not only to fellow bridge engineers, but to elected officials and others with influence to secure such funding. Action taken today will ensure a better tomorrow for us, and for future generations.

I-80 west-bound over SR 0338 looking West