Pennsylvania Turnpike Commission

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Welcome to the 2004 International Bridge Conference. The Pennsylvania Turnpike Commission is proud to be this year's Featured Agency and the first "Agency" to be featured by this prestigious Conference in its history. We are excited to share the many chapters of our history, and to present our current and future plans to reconstruct, improve, and expand the Turnpike.

The origin of the Pennsylvania Turnpike Commission (PTC) goes back to the glory days of the railroads. A new east-west passage through Pennsylvania called the South Penn Railroad was to be constructed to compete against the formidable Pennsylvania Railroad. The alignment was cleared, the railroad bed surveyed, and the boring of nine tunnels started. However, due to a settlement between the competing railroad owners, work on the South Penn Railroad was stopped and the rail line was never completed. One of the design engineers, bitter over ending the project, wrote "And here, for the time being, and probably for a long time to come, is buried the best route ever devised, or that can be devised, between the Ohio Valley and the Atlantic." The abandoned railroad bed sat idle for many years. Then, in 1934, two individuals, one from the Pennsylvania State Planning Commission, and the other from the Pennsylvania Motor Truck Association, proposed the idea of building a four-lane, all-weather, toll road utilizing the old abandoned South Penn Railroad bed. Many thought the idea of building a highway, and a toll road at that, through the rugged barriers of the Alleghenies and across so many waterways, was "hairbrained". Especially, since two trans-state highways already existed in the Lincoln highway (U.S. 30) and the William Penn Highway (U.S. 22).

South Penn Railroad construction, 18??

On May 21, 1937, Act No. 211 was signed into law, authorizing the construction of a 160-mile toll highway between Middlesex, Cumberland County, and Irwin, Westmoreland County, both termini linking to existing roads (U.S. 11 and the Lincoln highway). It also created the Turnpike Commission to supervise the project. The law stipulated, however, that not a cent of State tax money should be spent; it was up to the Commission to handle the financing through the sale of bonds. The bonds were to be paid off by revenues generated through tolls.

Ground was broke on October 27, 1938, and in 23 months time, motor vehicles were traveling the "Dream Highway". The original section employed over 1,100 design engineers and 155 contractors from 18 states for a total work force of 20,000. More than 5,000 men worked on seven tunnels at one time, an engineering and construction feat never again known to man.

It was an exciting time to be an engineer or constructor involved with the project. The engineers developed and used design criteria and safety standards that were only dreamed about before in this country. Some of the new criteria included a maximum grade of 3 percent and a maximum curvature of 6 degrees. Travelers were provided with super-elevated curves and a minimum sight distance of 600 feet.

Pennsylvania Turnpike, circa 1940

On October 1, 1940, the road built on the South Penn Railroad alignment was officially opened to traffic at a total cost of $70 million. America's first long-distance superhighway was an immediate success. More than 26,000 vehicles were using it daily. That skyrocketed to over 2.4 million in twelve month's time. This was far more than the 715 cars per day estimated in a 1939 study by the Bureau of Public that also stated toll roads would be big money losers (so much for studies).

For the first time in the history of roads in Pennsylvania a superhighway existed which provided free flow of traffic 160 miles across the State. The Turnpike was termed the foundation of a nationwide system of superhighways and sixteen years later the National System of Interstate and Defense Highways was legislated and funded by Congress. The PTC was the forerunner of all other toll roads in the country.

Due to the success of the original section of the Turnpike, other extensions followed. It was extended to Valley Forge in the east in 1950, and then onto the New Jersey border in 1954. To the west, the Turnpike was extended to the Ohio line in 1951. The Northeast Extension opened in 1957, and took the Turnpike north to Scranton. In 1992, the Beaver Valley Expressway was completed, and in 1993, the Amos K. Hutchinson Bypass was completed, both in the western part of the state, bringing the total mileage to approximately 500 miles of toll road.

The original section of the Turnpike contained 307 bridges and culverts. The current Turnpike system has over 1300 structures, many of which are original construction. We are currently rehabilitating or replacing of many of these original structures including some of our largest bridges.

The Susquehanna River Bridge, in the middle part of the state, is the longest span on the Turnpike at over 4,500 feet, and will be replaced in its entirety starting next year by dual concrete seg-

The Susquehanna River Bridge

Lehigh and Pohopoco River Bridges

mental bridges. These will be the first major concrete segmental bridges in Pennsylvania.

The Allegheny River Bridge is located in western Pennsylvania, and is approximately 2,600 feet long. It is currently in preliminary design for total replacement.

The Lehigh and Pohopoco River Bridges, two of our larger structures on the Northeast Extension of the Turnpike, are in final design and will also be replaced in their entirety.

Many of our other lesser bridges are being replaced as part of our Total Reconstruction Program. Just like many of our bridges, the Turnpike roadway is nearing the end of its life expectancy, and has to be rehabilitated or replaced. Our Total Reconstruction Program calls for completely rebuilding the Turnpike roadway from the sub-grade up. The original Turnpike provided for two 12-foot wide travel lanes in each direction with 10-foot shoulders and a 10-foot median for a total width of 78 feet. The reconstructed roadway section provides for a future third lane in each direction, full 12-foot shoulders, and a wider median for a total width of over 110 feet. This requires almost all the bridges crossing over the Turnpike to be replaced with longer structures. The majority of the mainline brides are also being replaced for the wider widths.

To date, over 24 miles have been reconstructed and another 21 miles are in construction. Future plans call for over 16 miles to be reconstructed every year for the next ten years. Many things have changed since the Turnpike was originally constructed, most noticeably the cost. Today, reconstruction of one mile of Turnpike roadway is averaging at $10 million compared to $500,000 per mile when the Turnpike was originally constructed, which included the construction of seven tunnels.

From the original seven tunnels, only four remain operational. A duel tube was constructed at each of the remaining four tunnel locations to handle the increased traffic volume. The other three original tunnels were bypassed at some time to reduce operational expenditures. The Northeast Extension also has a set of tunnels in Lehigh County, for a total of five active tunnel locations on the current Turnpike system. We are currently studying the feasibility of bypassing the Allegheny Tunnel and major rehab is planned for the other tunnels.

Today, the Turnpike continues to expand with its newest sections of toll highway in western Pennsylvania. The Mon/Fayette Expressway will stretch about 65 miles south of Pittsburgh and connect to Interstate 68 in West Virginia. The Southern Beltway will form an arc about 30 miles long with a radius reaching approximately 15 miles out from Pittsburgh's Golden Triangle.

At the eastern end of the state, a new connection between the Turnpike and Interstate 95 is being designed by way of a high-speed interchange. The project will involve widening nine miles of the Turnpike and the construction of a new bridge crossing the Delaware River. The project will also incorporate the latest in intelligent transportation systems.

Electronic Toll Collection (E-Z Pass) is another relatively new feature to be implemented throughout the Turnpike system providing for efficient traffic movements at all interchanges. And an even newer "high-speed" E-Z Pass system is currently being planned and installed at certain locations.

Lehigh County Tunnel

All these projects, the large bridge replacements, the total reconstructions, the new expansions and interchanges, and many others, make it an exciting time again at the Turnpike. We welcome you to hear more about Turnpike and these projects during our Featured Agency Session and by stopping by the Featured Agency Room. We hope you enjoy the Conference!

E-Z Pass System

Bridge Name?

Pennsylvania Turnpike - Interstate 95 interchange

The Overbrook Era: From Freight to Transit

By: John M. Stasko
DMJM/Gannett

The Birth of a Railroad

Since its inception in the early 1870s, rail service through the Saw Mill Run Valley was mostly on a single-track steam line strung through a right-of–way that consisted of forested valleys and steep hillsides. Most of the rail traffic in that period consisted of coal freight, but The Pittsburgh and Castle Shannon Railroad (P&CSRR) also occasionally transported passengers between fourteen stations along its route. Although called The Pittsburgh and Castle Shannon Railroad, passengers were brought to Warrington Avenue where they had to take two incline trips to get up and over Mt. Washington and arrived at Carson Street where they all diverted to their separate ways.

With increasing passenger traffic in the early 1900s, the single-track steam line went through electrification and the addition of a second track over a significant part of the route. P&CSRR was then restricted to hauling coal at night, so that the newly reconfigured line could serve the increasing population growth. A short connection from Overbrook to Brookline was added in the early 1900s. This corridor quickly became known as the Overbrook Line. In 1964, Port Authority of Allegheny County (PAAC) began using this line as part of its ever-expanding transit line in order to better serve the surrounding communities.

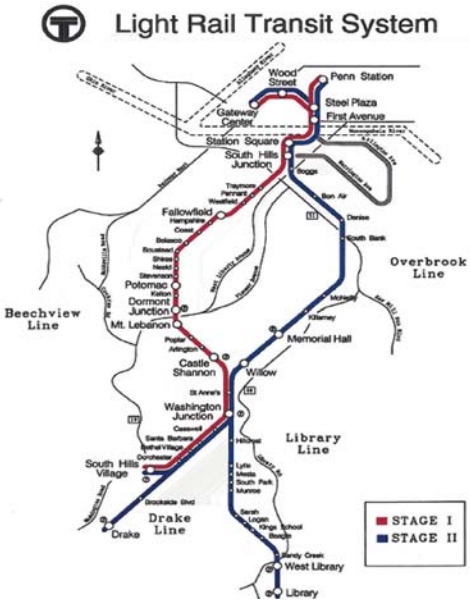
The Overbrook Line started at South Hills Junction, where at one time, eight different lines converged and traveled out in four different directions, and went to the ever-growing borough of Castle Shannon. Leaving the junction, early passenger trains, known as Presidential Conference Committee Trolley (PCC), began their ascent to a single track aligned along hillside trackbeds and wound its way through narrow forested hillsides and valleys and across an old fashioned wooden trestle bridge.

For many passengers that traveled this route in the rounded, old fashioned, PCC trolleys, a romance for rail travel quickly developed for the railway purist. Once across the single track and the wooden trestle bridge over Saw Mill Run Boulevard, the line returned to double tracks, which quickly transported passengers into Castle Shannon and Mt. Lebanon.

The Beginning of the End

PAAC began introducing newer Light Rail Vehicles known as LRVs to their transit operations in the 1980s. These newer LRVs were heavier and also articulated and could not travel on the ever-aging Overbrook Line. PAAC transferred the LRVs to the recently improved and rebuilt Mt. Lebanon-Beechview Line. The resulting effect was that the existing PCC cars continued to age and deteriorate while some remedial work was being done to keep the Overbrook Line in operation. In 1988 PAAC could no longer continue the costly maintenance on their fleet of PCC cars. Unable to keep up with the continued deterioration of the PCC cars and the rising costs associated for this maintenance, PAAC could not continue with their scheduled runs on the Overbrook Line. As the fleet of PCC cars dwindled and the tracks and structures continued in their decline and the steep hillside maintenance continued to increase, all service on the Overbrook Line was suspended on June 6, 1993 and replaced by bus service between Castle Shannon and Pittsburgh. While PAAC was funding numerous other projects going on including Stage I and the Mt. Washington Transit Tunnel they could not fund a complete upgrade on the Overbrook Line and soon the romance with the Overbrook Line was gone.

Prior to service ending on the Overbrook Line, plans were already underway for a complete overhaul of this scenic route into the city of Pittsburgh. PAAC's Stage I Improvements comprised of upgrades to the Beechview Line and a new subway system into and around the city of Pittsburgh. In the late 1970s, PAAC knew that upgrades to the Overbrook Line would have to be included in a new Capital Improvement Program to be called Stage II Improvements. Stage II included upgrades to the PAAC Operations Control Center, new Park and Ride Lots, improvements to existing stations along the Beechview line and most importantly to the residents of the Overbrook section, the reconstruction and modernization of the 5.5 mile Overbrook Line. With funding in place and the preliminary engineering completed, PAAC held numerous community meetings during the end of the 1990s. The rebirth of the Overbrook Line was a dream about to begin. In 1997, the first evidence of activity on this once proud line saw the removal of existing bridges along the Overbrook Line. The removal of the Oak Avenue Viaduct over Route 51 and the wooden trestle structure over Bausman Street quickly changed the landscape of Saw Mill Run Boulevard. It appeared to many that the absence of these two prominent structures signaled the end of the Overbrook Line. Their removal truly signified that this was only the start of dream to come true for many of the residents of the Overbook area.



A New Era Begins

In April 2000, the single track alignment and forested hillsides and deep valleys that previously saw coal freight cars, passenger cars and finally only occasional birds and deer along its once busy tracks came to life again. Now there were the sounds of voices talking of alignments, new struc-

tures and looking towards the future all while remembering her past 150 years of history. The new line will include new inbound and outbound tracks, construction of eight major structures, eight raised platform stations, a new power distribution system and thousands of feet of rock anchored and mechanically stabilized earth walls.

February 2001 saw the first shovels driven into the ground for the first of three sections to be reconstructed. The first section to be started was Glenbury to Willow. This section can be thought of as the section that brings you from forested hillsides of Overbrook to the city life of Castle Shannon. Starting with the new Oak Avenue Viaduct, the line takes passengers from the outlying areas of Pittsburgh and transports them into the suburban small town city landscape of Castle Shannon. Included in this section are five at grade crossings and the reconstruction of the Oak Avenue Viaduct. The viaduct was reconstructed to current standards in almost the exact same location as its predecessor. The rebirth of the Overbrook Line was underway.

September 2001 saw groundbreaking for the second section known as Denise to Glenbury. This quiet and serene section winds its way through the forested hillsides and valleys of McKinley Park located in the City of Pittsburgh. The scenic route has an alignment that follows the same route as the previous and includes three new raised platform stations, each serving

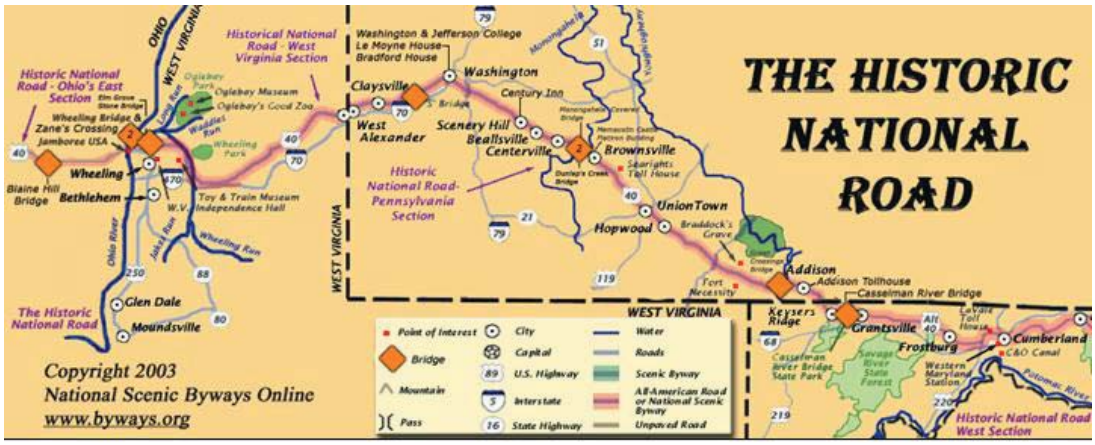
Edgebrook, Carrick and Mt. Oliver sections of the City of Pittsburgh. Section 2 includes the reconstruction of two new structures including the 90-foot tall structure over Bausman Street, known as McKinley Park Bridge, replacing the old wooden trestle bridge that stood there proudly for 130 years.

By April 2002, the third section, known as Glenbury to Castle Shannon, was underway. This section wound its way through Castle Shannon and finally tied back into PAAC's Stage I Line. This section was the final section of the original Overbrook Line and completed the route for passengers from Downtown Pittsburgh and into Castle Shannon. This section's highlights are four at grade crossings, three new overhead structures, four new raised platforms and improvements to a park and ride all while in the urban area of Castle Shannon.

What started out as a coal transportation route and developed into a route that could provide quick and easy transportation into the growing Pittsburgh region has developed into a new more convenient, efficient and quicker way into and out of Pittsburgh. From early planning stages in the 1970s to ground breaking in early 2000 to the first passengers to board an Overbrook Car, the Overbrook Line has come full circle.

When the first customer boards the new LRVs that are to call the Overbrook Line their route, the romance for the railway purists will be alive once more. From its humble beginnings in 1870 when it first transported coal and the first fourteen stop trip, the Overbrook Line will offer to its patrons a new more convenient, efficient and quicker way into and out of Downtown Pittsburgh all the while renewing its romance for a peaceful and everlasting trip to the past.

The Bridges of the National Road — Our Nation's First Toll Road



A leisurely day trip along U.S. 40 through the mountains of western Maryland, the ridges and river valleys of Pennsylvania and West Virginia, or the farmlands of Ohio will bring a twenty-first century traveler in close contact with the last visible vestiges of our nation's first national toll roadway. These vestiges — the mile marker monuments, the bridges, the tollhouses, and the hotels — are a reminder of the spirit of travel of our forefathers and remain an archeological record of the technologies of the day.

Casselman River Bridge

By: Thomas G. Leech, P.E., S.E.
and Amanda L. Skocik
Gannett Fleming, Inc.

How It All Began …

In 1818, the National Road, or then known as the Cumberland Road, was opened to foot and stagecoach traffic. This was the first important road built in the country using federal funds. Its location, originally winding through the Allegheny Mountains from the Chesapeake River in Cumberland, Maryland to the Ohio River at Wheeling, (then) Virginia, was selected by a group of Commissioners under the direction of Thomas Jefferson. Its location was carefully selected utilizing natural topography to best form a route through the arduous mountain terrain. A significant portion of the road's alignment carefully followed Native American Indian paths such as the Mingo Path and the old Braddock Trail used by General Braddock and his young assistant, George Washington, during the pursuit of the French at Fort Duquesne, located in present day Pittsburgh, during the French and Indian Wars of the 1760's. In the 1820's, the toll road was extended to Illinois. The federal government turned the road over to the individual states in the 1830's due to its costly maintenance. The states decided to collect fees, or tolls, from travelers to defray the cost, hence, America's first toll road was born.

Mile Marker

Present day Route 40 follows, and in many locations, lies on the same alignment as the original National Road. Remarkably, many of the bridges built in the 1818-1840 era still remain — several in very close proximity to present day Route 40. Tollhouses, grand hotels and mileage markers have been restored along the corridor. As we consider the present day complexities of commerce and utilization of our modern toll roads, it is interesting to reflect back to the technology of almost 200 years ago at our nation's infancy and consider the challenges and solutions facing the design and construction of bridges along this original National Toll Road.

Our journey follows the original course of the National Road from the terminus of the C&O Canal in Cumberland and winds westward through the mountains and hill country of western Maryland, southwestern Pennsylvania, the panhandle of West Virginia, and into the farmlands of Ohio. Along the way we will visit many unique and individual structures.

Somerfield Bridge

The Early Bridges of the National Road

Casselman (or "Little Youghiogheny") River Bridge. The National Road quickly rose from the lowlands of Cumberland, Maryland and ascended Savage Mountain, Maryland, crossed the Allegheny Mountain divide and faced it's first formidable river crossing, then known as the "Little Youghiogheny". The resulting 80-foot stone arch bridge, erected in 1813, was the largest stone arch in America at the time of construction and was continuously used from 1813 to 1933. The large span and high profile anticipated the C&O Canal through the mountains and along the river. This beautiful elliptical arch, now located in a state park, is a Registered National Historic Landmark.

Somerfield (or "Great Crossings") Bridge. One large river valley penetrates the heart of the Allegheny Mountain range in southwestern Pennsylvania. Braddock's Trail forded this river at its shallowest point and the National Road constructed a handsome 40-foot high, 375-foot long three-span stone arch at this "Great Crossing" of the Youghiogheny River. In 1940, the river valley was flooded for flood control and recreational purposes and remnants of this once marvelous stone bridge and the ruins of the village of Somerfield are visible only in seasons of severe drought. On the eastern end one can see the inscription "Kinkead, Beck & Evans, builders, July 4th, 1818".

Patrick Connors

The Brown Collection, Ohio County Public Library, Wheeling, WV

The Brown Collection of Photographs

Dunlap's Creek Bridge. After penetrating the mountain barrier, the National Road made a beeline for the Monongahela River community of Brownsville, at that time the largest city of western Pennsylvania. The Dunlap's Creek Bridge, within the city of Brownsville, was a scene of particularly unfortunate bridge accidents; until 1839, several bridges crossed this small 80-foot gorge including a chain suspension bridge, which collapsed under the weight of snow. In 1839, the use of an arched iron bridge was conceived by Capt. Richard Delafield due to the close proximities of the Brownsville Foundries. "The Neck" (nickname of downtown Brownsville due to high traffic congestion) was crossed with America's first iron bridge, which remains in vehicular use to this day and is designated as a National Historic Civil Engineering Landmark.

Monongahela River Crossing. The Monongahela River was a laborious river crossing in the early days of the National Road; by 1830, the ferry was replaced with a three-span wooden covered bridge. This remarkable structure with approximately 200-foot wooden arch spans was the first bridge across a major river west of the Appalachian Mountains. In 1910, the bridge was declared an obstruction to river traffic and was pulled down by a cable wrapped around its timbers connected to a moving steamboat. The sound of the cracking wood was heard for miles, and spectators along the bank were soaked by the mighty splash!

Jay W. Mohney

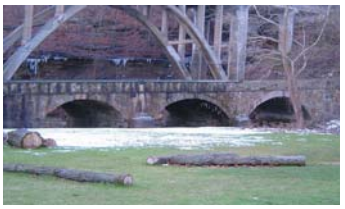
"S-Bridge". As the toll road followed the winding ridges and valleys to the Ohio River, many small tributaries were crossed. As typical of the era, the streams were crossed in their shortest direction, regardless of the general path or direction of the roadway. An entire series of stone "S-bridges" were built along small tributaries such the "S-bridge" located 5 miles west of Washington, Pennsylvania over Buffalo Creek. For this two-span arch bridge, the main span was aligned at right angles to the stream; the minor span and approaches were aligned in the east to west direction of the roadway, confronting the likely weary traveler with a contorted "S" pathway.

Elm Grove Stone Bridge. As the National Road entered present-day West Virginia, it followed the tributary system of Wheeling Creek and crossed this branch of the Ohio River with a series of unusual stone elliptical arches for its time of construction. Built in 1818 by Moses Shepherd, it is also known as the Monument Place Bridge due to the memorial nearby dedicated to Henry Clay by Shepherd for his support of the National Road. The bridge remains intact to this date; however, the beautiful stonework has been covered by a rather sterile concrete facing.

The Brown Collection, Ohio County Public Library, Wheeling, WV

Wheeling Suspension Bridge. Originally the National Road ended near the mouth of Wheeling Creek along the Ohio River, the destination for travelers continuing by water to the interior of the country. The city of Wheeling was quickly extended across the main channel of the Ohio River to Zane's Island (now known as Wheeling Island) by a 1010-foot long suspension bridge, but it was not an easy task. The Commonwealth of Pennsylvania led by Edwin M. Stanton (later to become Abraham Lincoln's Secretary of War) filed a suit in the U.S. Supreme Court to prevent construction because the bridge would obstruct river traffic. The designer, Charles Ellet, Jr., the father of suspension bridges, pressed forward with the design and construction of this wrought iron structure and managed to complete and open the bridge in 1850. Stanton, upset about the bridge, drove the steamer "Hibernia No. Two" into it to prove the bridge was a hindrance. The court ordered Ellet to substantially raise his bridge, but he succeeded to have the bridge declared a post road, which has seniority over all transportation arteries. Tragically, after this fight, the suspension bridge collapsed when a severe gale induced undulatory motion in the superstructure on May 17, 1854. This increasing twisting motion, caused by aerolastic instability, directly led to collapse of the superstructure in a violent and sudden state. The superstructure was promptly reconstructed in 1860, and in 1872 further strengthened with stayed cables by John A. Roebling and Sons. The structure remains in service to this day.

Zane's Crossing. Zane's Island was a strategic location for crossing the Ohio River. This large island made a natural crossing point for early settlers seeking a path to the west. From 1830, the Zane family maintained a ferry service across the main channel (which ended when the Wheeling Suspension Bridge was completed). Across the back channel of the Ohio River at Zane's Island, the Zane family constructed a wooden, covered toll bridge in 1836. The toll keeper lived on the bridge at the Ohio end.



Ohio and Beyond. As the National Road extended from the hilly provinces of western Ohio to the gently sloping farm country of eastern Ohio, Indiana and Illinois, many vestiges of the National Road era remain intact. These bridges lie almost immediately adjacent to US 40 and are easily visible to all travelers. These bridges include the three-span stone arch in Blaine, Ohio (pictured above) and the "S-bridges" in Cambridge and New Concord, Ohio.

Conclusion

Today, U.S. 40 extends from Atlantic City to San Francisco. In 2002, our first tollroad earned the status of National Scenic All-American Byway, one of the highest honors bestowed on a traveled route. With its spectacular scenery, breathtaking bridges, and historic charm, the National Road possesses the unique ability to transport present-day society back into time, relive the birth our transportation industry, and appreciate the milestones encountered along the way.

2004 IBC Bridge Awards

ESWP in association with Roads and Bridges Magazine, Bayer Corporation, Bridge design & engineering Magazine and the International Bridge Conference®, will host the Sixteenth Annual International Bridge Conference® Bridge Awards at the Pittsburgh Hilton on Monday, June 14. The following honorees will be recognized:

John A. Roebling Medal
William Brown

Brown Beech & Associates Ltd.

A lifetime commitment to bridge engineering and a recognized world expert on long span suspension bridges.

Photograph courtesy of Ian Masterton

Eugene C. Figg Jr. Medal
Lupu Bridge, China

The world's largest arch bridge was chosen by the city of Shanghai because they wanted a design that was different; a landmark bridge and a structure that would act as a symbol for the city.

George S. Richardson Medal
Al ZampaMemorialBridge (New Carquinez Bridge), California

The first suspension bridge to be built in the USA in almost 3 decades, the New Carquinez Bridge incorporates the latest advancements in seismic analysis and design criteria balanced with an aesthetic and graceful appearance that is in perfect harmony with the surrounding environment and communities.

Aurthur G. Hayden Medal
Esplanade Riel Pedestrian Bridge, Canada

Winnipeg's exciting new foot bride creates a dramatic addition to the city's skyline. The concept for the bridge was the result of an unprecedented level of public consultation for a public works project.

Gustav Lindenthal Medal
Mingo Creek Viaduct, Pennsylvania

The Mingo Creek Bridge's rustic setting required a harmonious balance with the surrounding hillsides. The rise-to-span and height to thickness ratio of the piers created a perfect proportion to its environment. The passing drivers are presented with panoramic views.

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

By Chad E. Knavel, PE, Structural Task Leader, DMJM+HARRIS, Inc., Pittsburgh, PA
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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