



The INTERSTATES in the HEARTLAND

By Tom Kuennen

Midwest, near-West states lead
in system starts and technology

Travelers in America's Heartland rode on rivers and rails until the Good Roads Era, but it wasn't until the coming of the Interstates that the distances between its farms and cities were tamed. Here's how America's Midwest and near-West states built their Interstates for now and the future, compiled from American Association of State Highway & Transportation Officials (AASHTO) state DOT questionnaires distributed exclusively for this publication early in 2006.

ILLINOIS: AASHTO Road Test Set Interstate Pavement Designs

Illinois made a major contribution to the Interstate program, as the American Association of State Highway Officials (AASHTO, predecessor to AASHTO) Test Road Site was the largest pavement research project in history, and was conducted near Ottawa, Ill. Construction of the site, later to become I-80, began immediately after the 1956 act was signed, and lasted from August 1956 to September 1958. The actual test traffic took place from October 1958 through November 1960, and studies continued into 1961.

This federal test road site examined the various types of surfaces that could be used for Interstate road construction, and the materials' capability to withstand the elements and wear and tear due to motorists' use. This was a major contribution to construction material being used to build the Interstate system.

Illinois' first Interstate section was apparently that portion of the Calumet Expressway (I-94) from Sibley to the Kingery Expressway (I-80/94), and the Kingery Expressway from the Calumet Expressway to the Indiana line, built in 1950 by the Illinois



Upgrade 74 in the Peoria area is the largest highway construction project in Illinois history outside the Chicago area, and is near completion in May 2006. At a cost of nearly \$460 million, Upgrade 74 will provide new overpasses, all-new pavement, and safer entrance and exit ramps on I-74 there, including the complete rehabilitation of the Murray Baker Bridge over the Illinois River, shown here in 2005.

Department of Public Works & Buildings. Interstate numbers were assigned after the signing of the Federal-Aid Highway Act.

Federal and state governments coordinated efforts to complete certain routes first; work was progressing on nearly every route in the state. Sections of future Interstates were under construction early on from Marion to Dongola, around Effingham, between

ILLINOIS DOT PHOTO





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Champaign and Danville, in and around Chicago, in Will and DuPage Counties, near East St. Louis, and in Peoria. Today, the Illinois Department of Transportation feels it was most likely I-70 that was the first contract signed under the 1956 Federal-Aid Highway Act.

The first truly urban segment of Interstate was the Eisenhower Expressway, I-290 in Chicago, but the first circumferential Interstate in Illinois was I-270 in the eastern St. Louis metro area.

The Poplar Street Bridge approach system carrying I-55, 64, and 70 across the Mississippi River at downtown St. Louis is a complex composed of 16 elevated roadways and ramps that carry traffic to and from the east end of the Poplar Street Bridge. This complex is one of the largest interchanges in Illinois and was recently retrofitted for seismic loads.

The upgrade of I-74 is one of the largest “downstate” construction projects in the history of Illinois. The upgrade includes the construction of new overpasses, all new pavement, and safer entrance and exit ramps. Construction is scheduled to be completed by December 2006. This project has earned numerous awards, including one from AASHTO.

In the meantime, on Chicago’s South Side, the Dan Ryan Expressway’s (I-90/I-94’s) pavement and local access roads are falling apart. The Dan Ryan has surpassed its original design life by more than 20 years. The ongoing Dan Ryan reconstruction will add local lanes, install collector sewers, add a northbound entrance ramp connecting to express lanes, and relocate the Chicago Skyway’s southbound two-lane exit.

A new Mississippi River crossing and the I-70 connector to the bridge at downtown St. Louis are in the planning and design phases, in cooperation with the Missouri DOT (the financing of this project is discussed in the article on tollways).

IDOT has had incident-management programs in place in both the Chicago and East St. Louis areas for several decades; in addition, the department is in the planning phase for a statewide intelligent transportation system.

INDIANA: ‘Crossroads of America’ Shows Why

The first section of Interstate completed and opened to traffic with funding from the Federal-Aid Highway Act of 1956 by the State Highway Department of Indiana was I-65 from a temporary connection with U.S. 52 near Royalton northwest of Indianapolis, to U.S. 52 northwest of Lebanon, a distance of 13.4 miles. This 13.4-mile section of I-65 opened to traffic in December 1960, although 8.6 miles from S.R. 267 to U.S. 52 northwest of Lebanon were completed in 1959.

However, it should be noted that an additional 3.5-mile segment of the Tri-State Highway (now I-80/94, the Borman Expressway) from Burr Street to S.R. 53 (Broadway) opened to traffic one month earlier in November 1960, but it was not funded with the 1956 Interstate funds.



The interchange of I-74 and I-465 in Indiana nears completion in 1963.

S.R. 420, the Tri-State Highway – then a four-lane divided freeway – was opened to traffic from the Illinois line to Indianapolis Boulevard (U.S. 41/S.R. 152) in 1952, a distance of only 2.4 miles. In August 1956 (after the signing of the Federal-Aid Highway Act of 1956), the next four miles of S.R. 420 opened to traffic from Indianapolis Boulevard to Burr Street. This northwest Indiana freeway now is designated I-80/94, the Borman Expressway. Separately, the 157-mile Indiana Toll Road opened to traffic in four phases between August and November 1956. The toll road later was incorporated into the Interstate system.

The first Interstate contract awarded by the predecessor of the Indiana Department of Transportation (INDOT) was on Feb. 14, 1958, for the construction of the northbound lanes of I-65 from the south end of the U.S. 52 Lebanon Bypass to the Pennsylvania Railroad bridge north of S.R. 39 at Lebanon, a distance of 2.4 miles.

I-465, the circumferential Interstate at Indianapolis, opened to traffic in segments between 1961 and 1970, with the West Leg opening to traffic first. The first segment opened to traffic on Sept. 26, 1961.

Thousands of dedicated employees of the State Highway Department of Indiana/Indiana State Highway Commission – as well as the consulting engineering community and road construction companies – all played an outstanding role in constructing the Interstate system in Indiana, INDOT reports.

This dedication, coupled with an innovative financing program in the mid-1970s – the Accelerated Construction of Interstates Program, in which Indiana paid the full costs of construction of its remaining mainline Interstates (\$50 million) and was later reimbursed by the federal government for its share – allowed for the completion of Indiana’s mainline Interstates in 1976, well before many other states, with the final segments of Interstate 65 and Interstate 70 opening to traffic on Oct. 15, 1976.

While most of Indiana is relatively flat, engineers designed I-64 in the hilly portions of southern Indiana to conform to





existing topography, resulting in a beautiful drive that surprises many motorists who think of Indiana as flat.

The Hoosier State has great plans for improving its National Highway System segments, including the Interstate system. Many projects are currently in the environmental and design phases, including new I-69 from Evansville to Indianapolis, two new bridges over the Ohio River at Louisville, and the associated improvements to I-65 and I-265. These improvements will enhance and solidify Indiana's position as "The Crossroads of America," its state motto.

In addition to these projects, the Indiana DOT has programmed approximately \$2.5 billion in "Added Travel Lanes" projects on its existing Interstate system, plus additional projects identified in the INDOT Long Range Transportation Plan. INDOT also plans to invest approximately \$70 million in Intelligent Transportation Systems devices on and near the Interstate system over the next 10 years, including full Advanced Traffic Management Systems in northwest Indiana (essentially complete), the Indianapolis area, and southern Indiana near Louisville, as well as a system of closed-circuit TV cameras and dynamic message signs on its heavily traveled rural Interstates, namely I-65, I-69, I-70, and I-94.

IOWA: Hawkeyes Lead in Engineering Expertise

On Sept. 21, 1958, the first section of Interstate in Iowa opened to traffic, a section of I-35/I-80 from the Douglas Avenue interchange in Polk County south to the Iowa 92 interchange in Warren County. But it was the culmination of decades of engineering progress undertaken by residents of the Hawkeye State that benefited highway users all across America.

Among them was Thomas H. MacDonald. A Texas native, he joined the Iowa State Highway Commission in 1904 and served as its first chief engineer. In 1919, he received an appointment as chief of the federal Bureau of Public Roads, a position he held for 34 years. In the late 1930s and early 1940s, MacDonald helped launch the Interstate highway system and nurtured the project through its early years until his retirement.

James "Jimmy" Whitmore Johnson, lab chief of the Iowa Highway Commission, and two other commission employees, Rudy Schroeder and Willis Elbert, were responsible for inventing the slipform paver and slipform paving method. The first prototype was built and tested in 1947. The slipform paver revolutionized the method of placing portland cement concrete pavement. The procedure laid highway pavements without the need for forms to support the vertical sides of the concrete. Used nationally, the slipform paver provided for the expeditious construction of the U.S. Interstate system.

And Frank B. Francois, an Iowan and 1956 engineering graduate of Iowa State University's College of Engineering, was awarded the Marston Medal by his alma mater. He served for many years at the U.S. Department of Transportation, as former commissioner of Kitsap County, Wash., and as executive director of AASHTO for 18

years, retiring in 1999. He initiated the AASHTO resolution that allowed states to use federal funds to buy Superpave equipment, and thus accelerated Superpave implementation. He helped create the SHRP Lead States teams, which are considered a model for future technology transfer efforts. In his honor, AASHTO bestows a \$10,000 graduate fellowship to be conferred by a state department of transportation that has implemented an outstanding innovative program. Winners are picked by AASHTO's Standing Committee on Quality; the award is named the Francis B. Francois Award for Innovation.

In 1957, the Des Moines City Council voted 5-0 in support of its 14-mile I-235 freeway plan. In April of that same year, the Federal Bureau of Public Roads provided the Iowa State Highway Commission with final approval for construction of the freeway. The first section of roadway was opened to traffic on Dec. 14, 1961; and the final section on Oct. 30, 1968. Originally, the project was to be completed in 1972. However, in 1963 the Iowa State Highway Commission announced it planned to complete the freeway in 1968, four years ahead of schedule.

Iowa claims a number of Interstate "firsts," including

- Aluminum I-Beam Bridge (1958). The world's first welded-aluminum, girder-type highway bridge was built over I-35/80 northwest of the city of Des Moines. This aluminum bridge was built due to a delay in receiving steel.
- Polyurethane Pavement Joints (1964). The use of polyurethane joints for pavement was developed in Iowa, originally for bridge approaches. The Iowa Highway Commission worked jointly with Phelan (Midwest Manufacturing Co., Burlington, Iowa) in development of this method.
- Full-Depth, Hot-Mix Asphalt for Interstate (1962). A section of I-80 east of Iowa City in Cedar County built in 1962 is thought to be the first section of Interstate designed with hot-mix asphalt as the full depth of the pavement structure, placed directly on the soil subgrade. The section continues to perform very well as a part of I-80 and received a Perpetual Pavement Award in 2002 from the Asphalt Pavement Alliance.
- Continuous Reinforced Paving/No Transverse Bars (1966). This method pioneered the development of machinery to place reinforcing steel without chairs (cross frames) to support it. The method eliminated a great amount of hand labor and saved time in paving Interstate highways.
- Two twin suspension bridges crossing the Mississippi River from Moline, Ill., to Bettendorf, Iowa, were converted from toll to free-travel facilities, retrofitted, and subsequently included in the I-74 Interstate system (1971). While it was impossible for the existing structures to meet Interstate design standards even after the modifications were made, the bridges were allowed into the Interstate system under a significant design exception.
- I-380 Cedar River Combination Bridge and Dam in Cedar Rapids. The structure that carries I-380 over the Cedar River in downtown Cedar Rapids combined several existing structures that were in conflict with the crossing location.





Celebrating 50 Years of the Interstate Highway System
Interstates in the Heartland



Top: The I-70 westbound viaduct over the Kansas River between Kansas City, Mo., and Kansas City, Kan., nears completion in November 1962. Above: I-64 is constructed west of Grayson, Carter County, Ky., in 1967.

Designed by Howard, Needles, Tammen, and Bergendoff of Kansas City, Mo., the structure carries I-380 northbound and I-380 southbound on the top level, two city streets at mid-level, and has a flood-control dam in its base. This structure, which has become known simply as the “5-in-1,” was awarded an Engineering Excellence Award by the Consulting Engineers Council in 1978.

The Interstate system in Iowa is reaching a critical juncture, Iowa DOT reports. Much of the pavement is approaching the end of its useful life, and the volume of traffic is such that lanes cannot be closed for repair without significantly affecting travel. In addition, the growth of traffic in many rural, and especially metropolitan, areas is resulting in near-capacity operations.

Both of these issues are forcing an evaluation of the Interstate system’s ability to meet existing and future demands. This evaluation will have to consider work-zone management, congestion management, utilization of intelligent transportation systems for operational improvements, and multimodal solutions. Future improvement needs will far exceed available revenues, requiring an examination of alternative financing options and revenue enhancement.

Iowa was one of the initial states to deploy a 511 travel information system. The Iowa DOT is deploying ITS in the cities of Des Moines, Iowa City, and Council Bluffs to aid with issues involved with the reconstruction of the Interstate system. In high-traffic areas, the focus will be on congestion and incident management. In areas of lower-traffic issues, ITS will be targeted for travel-information concerns.

KANSAS: First Segment Completed Under 1956 Act

With a native son like Ike – after whom the Dwight D. Eisenhower National System of Interstate and Defense Highways is named – the state of Kansas is proud to hold the distinction of having the first segment of Interstate highway in the United States completed under the provisions of the Federal-Aid Highway Act of 1956. This portion of I-70 was an eight-mile section between Valencia and Maple Hill Roads in Shawnee and Wabaunsee Counties, just west of Topeka, and was opened to traffic by the State Highway Commission of Kansas on Nov. 14, 1956.

At the time the entire stretch of I-70 was finished in Kansas in June 1970, it constituted the longest continuous segment of Interstate highway to be completed by any one state in the nation, and made Kansas one of only three states to have I-70 multi-lane traffic from border to border (the other states were Missouri and Pennsylvania). In Kansas, I-70 is 474 miles long, border-to-border.

Kansas’ first urban Interstate segment was on I-35 in Kansas City (Johnson County), and was completed in November 1959. The full route of I-470 (6.7 miles) in Topeka, Shawnee County, was completed in October 1960, and constitutes Kansas’ first circumferential highway.

Kansan Dwight D. Eisenhower had a tremendous impact on our transportation system as we know it today, reports the Kansas Department of Transportation. He saw firsthand the importance of good roadways numerous times, from his Transcontinental Motor Convoy of 1919 to his experiences on the Autobahns in Germany during World War II. President Eisenhower’s dedication and perseverance for improved roadways throughout the United States helped to shape the country and that is why the Interstate system bears his name.

In 1964, engineers from Europe made a number of trips to Kansas to watch construction on the world’s largest asphalt project on I-70, when the section from Salina west to Wilson was under way. Six asphalt plants turned out 1,650 tons of hot mix asphalt per hour. Another item of interest on this project was an innovation

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called an “automatic grade line guide,” a form of a string line, developed by a former highway commission engineer in Kansas, allowing the contractor to build a smoother roadway faster, resulting in overall savings to the state and the traveling public. Contractors still use an enhanced version of this procedure today on paving projects across the state.

Kansas was one of the first states to use post-tensioning on concrete slab bridges on Interstates. The KDOT started constructing post-tensioned haunched slabs on the Interstate system in 2002, and this year has three post-tensioned slabs on I-70, one in Shawnee County and two in Wabaunsee County. Post-tensioning pre-compresses the slab concrete both longitudinally and transversely, allowing a designer to extend the maximum span length about 45 percent, from 64 feet to 92 feet.

The Kansas Department of Transportation has put together an aggressive plan to preserve I-70, a plan that’s nearly complete today. Over the last decade, KDOT has spent approximately \$625 million to rebuild or rehabilitate KDOT’s portion of I-70. KDOT is proud to have rebuilt and rehabilitated I-70 when necessary rather than just resurfacing for a smooth, temporary fix. KDOT is now approaching the completion of the rebuilding of I-70 with a 6.5-mile project to be let in summer.

The largest project in KDOT’s history was let to construction in August 2005 at an estimated \$122 million. The project in Johnson County (suburban Kansas City) will involve construction of a new interchange at I-435 and Antioch Road, widening 2.5 miles of I-435 from six to eight lanes between Metcalf Avenue and U.S. 69 with auxiliary lanes between interchanges, partial reconstruction of the U.S. 69/103rd Street interchange, and construction of noise walls. These freeway corridors and the surrounding interchanges operate beyond the capacity for which they were designed, causing significant motorist delays and congestion. The desired results are fewer delays, safer roads, and faster travel times.

Kansas expects that its primary mode of travel will remain cars, and Kansas values its Interstates as assets that must be maintained, with capacity improvements made as needs arise and resources are available. However, KDOT says the major transformation for Interstate travel will occur as a result of technology to enhance interaction between the vehicle and the roadway, including vehicle guidance systems, run-off-the-road warning systems, traffic management systems that alert motorists of accidents and congestion and direct to alternate routes, and location-based devices such as GPS to reduce driver confusion and maximize attention.

KENTUCKY: Green Parkways Supplement Interstate System

The first section of Interstate in the Commonwealth of Kentucky – as executed by the then-Kentucky Department of Highways – was from the Henry Watterson Expressway (I-264 inner beltway) in Louisville, south to U.S. 62 in Elizabethtown, now I-65, the Kentucky Turnpike.

The Kentucky Turnpike was a 39-mile highway between Elizabethtown and the Watterson Expressway. Ground was broken on the turnpike on July 25, 1954, and it opened to traffic on Aug. 1, 1956. Tolls were removed on June 30, 1975, some 19 years ahead of schedule, at which time the turnpike became part of I-65, which already connected to the northern and southern ends of the highway.

That same Watterson Expressway was in existence as a limited-access highway prior to the 1956 Federal-Aid Highway Act, and also was the commonwealth’s first urban segment and first circumferential highway.

In the meantime, the Kentucky Turnpike Authority, a commonwealth agency, constructed Kentucky’s handsome, scenic parkway system of nine highways. Built

Hawaiian dredge

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during the 1960s and 1970s, there are over 650 miles of freeway-grade highways.

Kentucky's Clay Ferry Bridge is a memorable structure, where I-75 crosses the Kentucky River near the community of Clay's Ferry. Though from I-75 the bridge appears to be one structure, the bridge is actually the combination of three different structures. The first part of the current structure was completed as part of U.S. 25 in August 1946. When the bridge opened, it was the seventh-highest bridge in the United States.

A parallel structure opened in 1963 when the road became part of I-75. From 1993 to 1998, a third structure was completed between the two existing bridges. This combined the two parallel bridges into one six-lane structure as part of the effort to widen I-75 to at least six lanes through the entire state.

Coming projects for the Kentucky Transportation Cabinet include the future I-66 as a new freeway from Wickliffe to Paducah; then following I-24, the Western Kentucky and Natcher parkways, I-65, the Louie B. Nunn Parkway; then construction of a new freeway parallel to Ky. 80 and the Hal Rogers Parkway. The proposed roadway will cross the state line near Phelps.

An ongoing project is the Louisville-Southern Indiana Ohio River Bridges Project, which addresses the long-term cross-river transportation in the region. The project includes a new downtown bridge just east of the Kennedy Bridge (I-65); an east end bridge about eight miles from downtown, connecting the Gene Snyder Freeway (Ky. 841) to the Lee Hamilton Highway (I-265); and a rebuild to the south of the Kennedy Interchange where I-64, I-65, and I-71 converge in downtown Louisville. The project is now in the design phase.

Also, different options for replacing or repairing the Brent Spence Bridge, which carries I-75 and I-71 over the Ohio River, are currently under review. Roadway improvements, including associated approaches and interchanges, are estimated to cost \$750 million.

MICHIGAN: Early Expressways Prenated Interstate System

It seems to reason that Michigan – home to the Motor City – would already be building limited-access highways prior to the Interstate system. Prior to the passage of the Federal-Aid Highway Act in 1956, the Michigan Department of State Highways already had constructed 89 miles of future Interstate, all open to traffic by then.

These included the Willow Run Expressway, the Detroit Industrial Expressway, part of the Edsel Ford Expressway, and the Jackson, Ann Arbor, and Ypsilanti bypasses, all of which became part of I-94. Part of the Detroit to Toledo Expressway became part of I-75. The oldest segment incorporated into the system was the 8.7-mile-long Willow Run Expressway, opened to traffic in September 1942.

And some 54 miles of future Interstate were all under construction prior to the passage of the 1956 act, including part of the U.S.

12 Expressway (between Kalamazoo and Galesburg), later part of I-94; part of the U.S. 2 Expressway, the Mackinac Bridge and its approaches, part of the Fenton to Clio Expressway, and an additional 5.5 miles of the Detroit to Toledo Freeway, all to become part of I-75. And two parts of the U.S. 16 Expressway (Coopersville to Marne and Portland to Lansing) would become part of I-96.

The Michigan DOT reports it had a number of other expressways already constructed and open to traffic in 1956 that were not absorbed into the Interstate system.

Michigan's first section of the Interstate system constructed with Interstate funding was a 4-mile segment of the 22-mile-long Brighton to Farmington Expressway, which was completed in 1957 from U.S. 23 on the east side of Brighton to east of Farmington. The shields bearing the I-96 insignia were not erected until 1959.



In Michigan, the interchange of I-75, the Walter Chrysler Freeway (right), with I-94, the Edsel Ford Freeway (top to bottom), nears completion in June 1964.

Michigan was intimately involved in the Good Roads movement. Horatio S. Earle was the driving force behind the creation of the Michigan Department of Transportation (the Michigan Highway Department back then), and was the first director of the department. In 1903, two years before the Michigan Highway Department was formed, he proposed a national system of good roads connecting all of the state capitals to each other and to the national capital in Washington, D.C. The American Road and Transportation Builders Association (ARTBA), another organization he founded, credits that proposal as the first expression of what is today the Interstate highway system.

In addition, the 1939-40 General Motors "Futurama" pavilion at the New York World's Fair – designed by futurist Norman Bel Geddes – presented in model form the vision of 100-mph intercity auto travel uninterrupted by stop lights. This exhibit is credited as inspiring the Interstate system in the Federal Highway Act of 1944;



A rendering of the proposed new Mississippi River crossing on I-70 from Illinois (left) to Missouri at downtown St. Louis. The massive bridge project needs a funding compromise between the two state DOTs.

however, funding for construction of the system would not be included until the passage of the Federal-Aid Highway Act in 1956.

The Mackinac Bridge (I-75) connecting Upper and Lower Michigan still is one of the longest suspension bridges in the world. The three pedestrian plazas on I-696 are often credited as being an early example of the principles of context sensitivity.

The I-94/Mich. 10 interchange in Detroit was the first freeway-to-freeway interchange in the country to feature left-hand exits and entrances. Grand Rapids was the first city to have an Interstate-to-Interstate interchange within its boundaries (I-96 and I-196).

In 2006 the Michigan DOT will begin work on the "Gateway Project," which will improve the connection between the Interstate system and the Ambassador Bridge to Canada in downtown Detroit. The project includes the reconstruction of the I-75/I-96 interchange, an expanded bridge plaza, and a new pedestrian walkway over the expressway.

In the meantime, during the next five years, MDOT will replace or rehabilitate 302 bridges on the Interstate system, reconstruct or resurface 305.2 miles of Interstate highway, and will refurbish or reconstruct 21 rest areas on the Interstate system. Capacity improvements are currently planned for portions of I-94 in Detroit and I-75 in Oakland County. In addition, Congress has authorized the construction of a new I-73, and Michigan is part of that proposed routing. But for now, Michigan's focus is on managing and maintaining the existing Interstate network, and there are no active plans in Michigan to add I-73 at this time.

With the full buildout of the Interstate complete, the MDOT's focus now shifts to the operations and management of these facilities, and working to continue to integrate the operations of the Interstate system with the surface arterial street network, including ITS technologies.

MINNESOTA: Leader in Engineering, Environment

The first segment of Interstate completed by the old Minnesota Department of Highways was I-35 between Owatonna and Medford; likewise, the first segment under contract was I-35 at Owatonna. The first urban segments in that state were I-35 in Minneapolis, Richfield, and Bloomington, while Minnesota's first circumferential highways were I-494 and I-694, forming the Interstate ring around the Twin Cities metro area.

In 1978, completion of I-90 in Minnesota also completed that route between Boston and Seattle, reports the Minnesota Department of Transportation. The celebration occurred in Blue Earth, Minn., on Sept 23, 1978, and was inspired by the "Golden Spike" used in Utah to link the first transcontinental railroad. The event featured placing gold-colored concrete panels to mark the place where the freeway was joined from west to east.

In the fall of 1992, the Mn/DOT completed extension of I-35 through downtown Duluth. The project created strong controversy among citizens, business leaders, environmentalists, preservationists, and others. Because of the intense scrutiny, the freeway design used a "cut and cover" tunnel that provided a scenic, landscaped connection between the downtown area and the shore of Lake Superior. Because the freeway reduced congestion in Duluth, and due to the pleasing aesthetics of the park-like cover and the landscaping and beautification done in concert with the project, I-35 in the downtown area earned acceptance and praise from its supporters as well as many former detractors.

The Minnesota Road Research project, incorporating a 3.5-mile section of I-94 as a testing ground for various pavement designs, was completed in 1994 by the Mn/DOT and several partners. In addition to its active segment on I-94, the research facility also includes a 2-mile loop to test pavements such as those used on low-volume roads. The facility uses thousands of sensors to measure factors such as temperature, ground frost levels, and pavement performance.

The I-94 segment contains 52 test cells using different pavement designs and materials to measure their behavior and durability in the state with its extremes of temperatures and other weather conditions. Since its inception, the Mn/ROAD facility has shared test data with scores of other states and nations in cold-weather climates to help them improve the strength and durability of pavements they use.

In the Twin Cities metro area, the Mn/DOT built Interstate-394, a 10-mile section of freeway linking Minneapolis with its western suburbs. The design features a two-lane, reversible HOV section reserved for buses, carpools, and motorcycles. In 2005, Mn/DOT opened its first toll lanes on I-394 to allow single-occupant vehicles to use the HOV lanes by paying a fee. Prices for using the HOV vary according to the prevailing level of congestion on the freeway. Fees are paid by drivers using transponders that automatically track their vehicles' use of the lane and issue a monthly bill.



When building the Interstate system, Mn/DOT engineers faced challenges with building in areas that contained vast deposits of muck, with fragile limestone deposits, and with building tunnels and bridges in the heavily urbanized Twin Cities metro area. In the Twin Cities area, builders installed a refrigeration system to strengthen the soil near a church and other buildings to tunnel in Minneapolis' historic Lowry Hill area.

Current and future projects include the elimination of several freeway bottlenecks in the Twin Cities area, such as the interchange of I-35E and I-694 in the region's suburbs. A new bridge now under construction will carry I-494 over the Mississippi River.

The Mn/DOT established the face of future traffic management when it opened its Regional Transportation Management Center in 2003. The RTMC coordinates several methodologies. They include traffic-management techniques such as video monitor tracking, loop detectors, and electronic signs advising motorists about crashes, detours, and other traffic conditions. Similar systems are also in use or under development in cities such as St. Cloud, Rochester, and Duluth.

MISSOURI: First Contract Under Interstate Program

On Aug. 2, 1956, the Missouri State Highway Commission approved several projects that would be financed using funds from the recently passed Federal-Aid Highway Act. One of the projects was located along U.S. 66 in the northeast corner of Laclede County, to add a lane to Route 66 and convert it to a controlled-access highway, including grading and paving for approximately 21 miles of the future I-44.

On the same day, two contracts were let for segments of the Mark Twain Expressway (U.S. 40), later to be known as I-70, in the St. Louis area. One segment of about two miles was to be built in the City of St. Louis, while another segment of about two miles was to be built in St. Charles.

Prior to the Interstates, U.S. Routes 66 and 40 were controlled-access highways in certain segments, including the Red Feather

Expressway in the city of St. Louis, now part of I-64. Interstates 270, 435, 470, and 229 are all circumferential Interstates. Missouri boasts the largest number of major river bridges of any state, with 55.

Missouri's Rex Whitton was Federal Highway Administrator during the peak of the Interstate program, 1961-66. A photo gallery depicting some of his achievements can be found at <http://www.fhwa.dot.gov/infrastructure/whitgal.htm>.

In 2006, Missouri is in the second year of a major construction boom, thanks to the passage of Amendment 3 in November 2004, which gives the MoDOT a larger portion of existing vehicle sales taxes. It also redirects existing highway taxes and fees that used to go to other state agencies to road and bridge construction. The MoDOT is using the additional funding to implement its Smoother, Safer, Sooner program, which has three components: Smooth roads, accelerated projects, and new construction. As part of the Smooth Roads Initiative, the MoDOT is working to improve 2,200 miles of the state's most heavily traveled highways and bring them up to good condition by the end of the year.

In St. Louis and its suburbs, Missouri is undertaking its first design-build project with a 12-mile stretch of I-64 in St. Louis, the largest road construction project in Missouri history. Some of the major projects on the national highway system included in the department's five-year statewide construction program are a U.S. 40 upgrade to Interstate standards in the St. Louis area, the Paseo Bridge replacement over the Missouri River (I-35/I-29 Design/Build) in the Kansas City area, reconstruction of the U.S. 71/I-435/I-470 interchange in the Kansas City area, 45 miles of U.S. 65 upgrade to dual divided roadway from Branson to Arkansas, from Springfield to Buffalo, and from Cole Camp to Warsaw in southwest Missouri; and 60 miles of Rte. 60 upgrade to dual divided roadway from Willow Springs to Van Buren in south-central Missouri.

The MoDOT has been studying the rural portion of I-70 between Kansas City and St. Louis since 1998. An internal feasibility study

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Celebrating 50 Years of the Interstate Highway System Interstates in the Heartland

prompted the need to launch a tiered environmental impact statement on the 200-mile corridor. The first tier, completed in 2001, determined the need to reconstruct and widen the highway to six lanes (eight in urban areas) to meet the needs of 2030. By that time, traffic is expected to have doubled, with the entire corridor operating in a stop-and-go condition.

The MoDOT, however, does not have funding identified to begin building the project. The plan, though, is not an all-or-nothing proposition and could be implemented in phases. It can also guide other work in the corridor, like the replacement of cross-road bridges or interchange improvements.

The department will soon be using cell phone data to collect information on traffic movement, patterns, and congestion. This state-of-the-art (but anonymous) technology will help keep Missouri motorists better informed about which roads to use and how long the drive will take.

NEBRASKA: Urban Work Gets Green Light in Farm State

The first Interstate highway section in Nebraska completed by the Department of Roads and Irrigation – predecessor of today's Nebraska Department of Roads – was 6.4 miles of I-80 near Gretna in Sarpy County, just southwest of Omaha. It was the agency's first contract under the system as well.

The first urban segment was on I-80 in Omaha, and the first circumferential Interstate was I-680 around central Omaha.

In Nebraska all mainline Interstate was concrete pavement. Nebraska is noted for its clean and conveniently located Interstate rest areas, which are considered by some to be the best in the nation.

Today, Nebraska is finishing the first year of work of a four-year reconstruction phase for rebuilding the I-480/U.S. 75 (28th & Dodge) interchange south of downtown Omaha. This work provides lane balance, eliminates most of the left-side entrance ramp, and rebuilds and removes bridges in the interchange. This interchange was originally configured to accommodate the future West Expressway, which was later abandoned.

Nebraska continues its rebuild of the urban Interstate in Omaha, starting with a 10-year reconstruction completed in 1999. This plan included 17 miles of Interstate, two interchanges, and seven service interchanges. Since 1999, the state has extended the urban rebuild to a total of 23 miles and has rebuilt four more service interchanges. The next major step is to expand the rural Interstate to six lanes (or more) in each direction from Omaha to Lincoln, the capital, a total of 44 miles. This work, which started in 2002, is planned to be completed by the end of 2012.

The future of Nebraska highways include improved Intelligent Transportation System resources, cameras, and signs to assist in managing traffic flow. Technology will be the difference in the improved highway system.

NORTH DAKOTA: Badlands Posed Challenge to Builders

I-94 (formerly U.S. 10) between the Woodbury interchange for the city of Jamestown and the East Valley City interchange was the first Interstate segment opened by the North Dakota State Highway Department. Work was completed on the 39-mile segment on Nov. 22, 1958. Contracts were let in 1956 for that first segment, making it the first segment under contract, as well as the first opened.

The first urban segment of Interstate in the Peace Garden State was I-194, from I-94 Exit 156 to Memorial Highway, in Mandan, N.D., across the Missouri River from Bismarck, the capital.

In 1964, when I-94 was built across Sweet Briar Creek, it was one of the first projects to utilize the Interstate roadway embankment to function as a dam. The resulting lake provides a recreation area and assists in flood control. The project was a cooperative partnership effort between the North Dakota Water Commission, the North Dakota Game and Fish Department, Morton County, and the North Dakota State Highway Department (which, in 1990, became the North Dakota Department of Transportation).

The Badlands scenic area constituted a significant challenge to the development of North Dakota's Interstate system. The effort to preserve the beauty of the North Dakota Badlands while engineering an Interstate through this natural scenic and historic area was an example of what would now be called context-sensitive engineering.

North Dakota honors Walter Hjelle, state highway department director, and Bob Bradley, chief engineer, both leaders in the effort to complete North Dakota's portion of the Interstate project. Hjelle served 23 years (from 1961-1981 and again from 1985-1988) as state highway director, longer than any other in North Dakota history, and was responsible for the greatest period of roadway system expansion in the state's history. He served as an AASHTO regional vice president and on several national committees.

Bradley served as chief engineer from 1957 through 1981, working alongside Hjelle during the formation of North Dakota's Interstate system and through the greatest period of expansion in the history of the state's roadway system.

All but a few segments of North Dakota Interstate have been completely rebuilt. ND DOT is focusing on maintaining its Interstate system and improving ride quality through use of preventive maintenance treatments such as milling and overlay, and concrete pavement repair with minor grinding. In the meantime, the state is using ITS for safety enhancements, such as the automated de-icing systems in place on the I-29 Buxton railroad over-crossing north of Hillsboro, and the I-94 Red River bridges between Fargo, N.D., and Moorhead, Minn.

OHIO: Buckeyes Tackle Complications of Congestion

The first Interstate contracts let by the Ohio Department of Highways were for I-71 north from Columbus in Franklin County, in





OHIO DOT PHOTO

1957. But the oldest Interstate sections precede that, including a 6.5-mile stretch of U.S. 25 north of Dayton in Montgomery County – now I-75 – that was built in 1942. Contracts for parts of future I-75 in Hamilton County (Cincinnati area) were sold in 1941, 1942, and 1943. Others include part of I-280 in Lucas County, and part of I-76 in Summit County.

Today's Ohio Department of Transportation describes I-71 in Columbus – also known as the Columbus Innerbelt, on the east side of downtown – as the first urban Interstate, the contract for which was sold in 1957. Contracts for Ohio's first circumferential Interstate – I-275 in Hamilton County – were sold in 1958.

The Veterans' Glass City Skyway Bridge on I-280 in the city of Toledo is the largest single construction project ever undertaken by the ODOT. At a construction cost of \$220 million, the bridge will replace the outdated Craig Memorial lift bridge that carries I-280 traffic across the Maumee River into downtown Toledo and has been a source of congestion and traffic-safety problems.

Intended to be a lasting landmark and a new gateway for Toledo and the region, the new bridge has a cable-stayed design consisting of a large center pylon and stainless steel cables radiating down from the pylon that support the bridge deck. The center pylon was designed to light up at night. The entire design gives the bridge a sail-like appearance. The bridge's decorative themes were chosen by the community to reflect the industrial history of Toledo. Construction of the new bridge began in 2002 and is expected to be completed by late this year or early 2007.

The I-70/I-71 South Innerbelt corridor in downtown Columbus, the "Downtown Split," was originally designed to accommodate 125,000 vehicles per day, but now serves 192,000 per day. The ODOT is reviewing plans to improve the corridor and will select a specific approach by this summer.

I-90, and its northern terminus with I-71 and I-77 in downtown Cleveland, is a high-capacity highway facility extending throughout the city. Commonly known as the "Cleveland Innerbelt," the highways serve as a fundamental component of Cleveland's commuter routes. The ODOT is studying the most effective approach to renew the infrastructure and increase capacity without undue burden to the public, with the start of the first Innerbelt project expected in fall 2009.

Gov. Bob Taft unveiled the Jobs and Progress Plan for Ohio in 2003. It is the largest transportation initiative in the state since the original creation of the Interstate highway system. The plan devotes \$5 billion over the next 10 years toward Ohio's highway network, rebuilding urban freeways and completing macro-corridors to connect rural regions. The improvements will include widening of highways and interchange improvements to increase capacity. The ODOT typically works on a six-year construction and planning cycle, adding a year of new projects annually. Currently, the department has \$3.4 billion and 121 projects under construction or development for FY 2007 to 2012.

In Ohio, 42 percent of freeway crashes occur on 12 percent of the freeway system, and all within urban areas. Urban Freeway



Ohio's Innerbelt Bridge carries I-90 over the Cuyahoga River just south of downtown Cleveland.

Management Systems (FMS) or Intelligent Transportation Systems are a part of how the ODOT is working to manage congestion.

OKLAHOMA: First to Connect Interstate with Adjoining State

Oklahoma was active in constructing toll-financed turnpikes prior to the Interstate system. Turner Turnpike, a fully-controlled access toll road, was completed on May 16, 1953, from Oklahoma City to Tulsa, approximately 86 miles. This tollway later was designated I-44.

Also before the 1956 Federal-Aid Highway Act, the first section of Oklahoma Interstate to be built was U.S. 66, from the end of Turner Turnpike in Tulsa, northeast to Skelly Drive, and from there to the Arkansas River Bridge. This approximately 4-mile section later became I-44.

After the 1956 Federal-Aid Highway Act, the first section of Oklahoma Interstate to be built by the Oklahoma Highway Department – and the nation's first dedication of an Interstate highway connection with an Interstate in an adjoining state – was a portion of I-35 near the Kansas state line. There, 3.99 miles of I-35 linked the Kansas Turnpike to U.S. 177 near Braman in Kay County.

Kansas' turnpike was completed in 1957 and became part of I-35, which spans the north-South length of Oklahoma; but it wasn't until the next year that Oklahoma's portion of the highway was completed.

Before this, motorists traveling south would often miss the turnoff (onto a county road) that would take them to U.S. 177. Many who missed the turn wound up in the wheat fields of Amos Switzer and his wife. It has been estimated that more than 500 vehicles ran off the road and into Switzer's field, ruining his wheat



Celebrating 50 Years of the Interstate Highway System Interstates in the Heartland

crop and tearing his fence, forcing him to sell his cattle, which, of course, would not stay in a field with no fence.

Oklahoma was fast on Missouri's heels in early Interstate lettings. Its first let date was Sept. 11, 1956, for I-35 in McClain County at the Canadian River. The state's first urban segment of Interstate was the I-44 Arkansas River Bridge in Tulsa, December 1951, which since has been replaced.

In 1983, a stretch of I-40 from Oklahoma City to Shawnee was renamed the "Tom Steed Memorial Highway." Steed, a respected and admired member of the U.S. House of Representatives for 32 years, worked diligently to promote federal programs – including highway programs – which have benefited all citizens. While serving on the House Public Works Committee in 1956, he was instrumental in creating the nationwide Interstate highway system when he helped write the bill authorizing the original \$51 billion, 13-year highway program. He was also chairman of the Subcommittee on Appropriations, the most powerful position regarding federal appropriations at the time.

The largest bridge on an Oklahoma Interstate is the I-40 Crosstown in downtown Oklahoma City, measuring more than 8,800 feet in length. The bridge is currently being relocated several blocks south of its current alignment.

Eastern Oklahoma is mountainous, where the plateaus of Arkansas spill across the border. I-35 in southern Oklahoma was built by cutting directly through the Arbuckle Mountains there. Until then, motorists were forced to travel U.S. 77 at reduced speeds along sometimes treacherous hairpin turns through the mountainous terrain. Mountains that were cut away now flaunt their brilliant hues of Oklahoma clay to the delight and awe of the traveler.

Current and future Oklahoma projects include reconstruction of I-44 from the Arkansas River Bridge on the west to Yale Avenue on the east in Tulsa; and the I-40 Crosstown project in downtown Oklahoma City, which will ultimately place I-40 approximately five blocks south of its current alignment, and also provide a new boulevard into downtown along the existing Interstate. Widening of I-35 through Norman also is planned.

Oklahoma has a commitment to reconstruct and rehabilitate most of its rural Interstates, which it has been undertaking over the past three years, and will continue in the coming eight years. Oklahoma utilizes dynamic message boards on urban Interstates to manage traffic flow to congested corridors.

SOUTH DAKOTA: Taming the Miles, Border to Border

A state with intensive pass-through traffic on its Interstates, South Dakota is hard-pressed to generate the revenue needed to construct and maintain highways. That's why the Coyote State marks the completion of its east-west and north-south Interstates as a major milestone.

The first section of Interstate completed by the then-South Dakota Department of Highways was part of I-29 near Sioux

Falls. This also was the first contract awarded in the program. I-229 around Sioux Falls was the state's first urban and circumferential Interstate, reports the South Dakota Department of Transportation.

While its highways are essential for South Dakota's agricultural and manufacturing economies, they also facilitate tourism. Total visitor spending for the state of South Dakota totaled \$809 million in 2005, continuing a long-term upward trend.

WISCONSIN: Pioneer in Recycled Paving Materials

Construction on Wisconsin's Interstate system by the State Highway Commission of Wisconsin began in 1956, on a 7-mile segment of I-94 in Waukesha County. One of the first contracts documented was to the A.F. Keyes Co. in the amount of \$806,398 on Oct. 16, 1956, for work in Waukesha County. The first section of Interstate highway was completed in 1958 – a one-mile segment of I-94 near Johnson Creek in Jefferson County.

Existing limited-access highways at this time included U.S. 51 (East Madison Beltline on Stoughton Road); U.S. 12 (South and West Madison Beltline); S.R. 30 (Madison to Milwaukee); and U.S. 41 (Milwaukee to Green Bay). Milwaukee was the site of the first urban Interstate in Wisconsin, I-94 (East-West Freeway) in Milwaukee County.

In December 1956, federal officials denied Wisconsin's request for a route between Genoa City and Madison, opting for Madison to Janesville instead. Initially, Wisconsin was to have only two major Interstate routes, I-90 and I-94. However, the state convinced the federal government to approve I-43 between Green Bay, Milwaukee, and Beloit.

Wisconsin is a pioneer when it comes to the conservation of natural resources through the recycling and reuse of both concrete and asphalt pavements. This is both an engineering and environmental landmark. Wisconsin also pioneered the use of thin-bonded concrete overlays of concrete pavements.

Ongoing construction includes the \$810 million Marquette Interchange project in Milwaukee, to be completed in 2008; work to I-94 between Milwaukee and Kenosha; the possibility of designating U.S. 41 Interstate status; and ongoing work to the southeast Wisconsin freeway system. Currently, there are about 20 major projects in active design or under construction, almost all of them non-Interstate.

Wisconsin's "Connections 2030" transportation plan will be developed to address long-term, statewide transportation needs for all travel modes, including highways. Per the State Highway Plan 2020, the department has three major emphasis areas: safety, traffic movement, and preservation. Increasing traffic volumes affect highway safety, and the department is committed to reducing crash rates by improved roadway design, enhanced driver education, and targeting enforcement. Traffic movement is enhanced using ITS and highway engineering.





Open-Graded Friction Courses Incorporating Asphalt-Rubber Are the Strong, Silent Type

By Doug Carlson

Open-graded friction courses with asphalt-rubber are finding a place on our nation's aged concrete highway infrastructure, improving driver safety through ride enhancements and reducing tire noise.

Nothing performs quite like asphalt-rubber. The modern version of asphalt-rubber is 20 percent recycled tire rubber and 80 percent liquid asphalt. Mixed with aggregate, this thick and sticky material can be placed in 1-inch overlays on top of concrete to provide a very durable and favorable driving surface. This can provide the greatest cost savings compared to other rehabilitation alternatives, such as thicker conventional asphaltic concrete (AC) overlays, diamond grinding, or reconstruction.

Arizona, California, and Texas have been using asphalt-rubber friction courses with success for some time, but now asphalt-rubber pavements have moved well beyond the far West, with placements in Connecticut, Florida, Tennessee, New Mexico, Colorado, Nebraska, Ontario, and elsewhere.

Asphalt-rubber pavements have gathered some exceptional long-term performance data. The Federal Highway Administration (FHWA) is experiencing its interesting crack-stopping or delaying characteristic in the Pooled Fund Study 5-19 at its Accelerated Loading Facility. The asphalt-rubber section never cracked, while every other asphalt modifier did so after 300,000 passes.

Here's why: Each square yard of hot mix has over 1.9 million discrete tire rubber particles scattered throughout the asphalt matrix that flex and do not crack. The cracks have to go around them.

Also, the material provides the engineer with a high binder mix and more "glue" to hold it down and to hold the aggregate. Open-graded mixes can have binder contents as high as 10 percent by weight of the mix without drain down or runoff or bleeding, flushing, or rutting.

Film thickness on the aggregate can be four times as high as conventional AC materials. The extra binder and solid rubber components help resist hardening from aging, keeping the hot mix soft and pliable even after 15 or more years in the hot Arizona sun. The first project on top of Portland Cement Concrete Pavement (PCCP) was placed in 1988 near Tucson. Sections on I-17 placed in 1990 were replaced in 2005, more for fixes of the concrete joints underneath.

The crack and seat operation in 1990 in Flagstaff, Ariz., on I-40's PCCP has performed with very little cracking to this day, and that's under weather conditions with more rainfall and colder conditions than Seattle, Wash. Many old concrete pavements are still serviceable, just beat up and rough; they are no good on top. Regular asphalt just can't stick or last long enough to be considered a viable option. But asphalt-rubber can make PCC pavements serviceable once again.

The added durability of asphalt-rubber allows the friction course to last longer while providing the best surface for skid resistance. Engineers are encouraged to use high quality, engineered aggregate to help tires grip the road in inclement weather. A study in San Antonio, Texas, showed that accidents can be reduced when a rough concrete pavement is cost-effectively resurfaced with an asphalt-rubber alternative. The use of a Permeable Friction Course on I-35 reduced the number of wet-weather accidents by over 50 percent, saving the public injury, time, and money. Sooner or later the insurance companies will work with DOTs to help reduce accidents and claims.

Although safety is my biggest concern when I drive my family on a road trip, nothing beats the quiet ride of asphalt-rubber on top of concrete. It is the best of both worlds: a durable, long-lasting concrete structure below, and a safe, quiet, and smooth asphalt layer on top. These are some of the quietest driving surfaces measured in the world, and that's without ever actually being designed to be quiet. I look forward to the results when engineers here actually design an asphalt-rubber friction course to be quiet.

The Quiet Pavement Pilot Program in the Phoenix area of Arizona has provided its 12 million annual visitors with a taste of the technology, and they are taking it home. They are asking the DOT, "Why can't we do this here?" There is no good "no" answer anymore. With the Internet, the information is at the public's fingertips.

The technology is not patented or proprietary; anybody can make it; and the costs only reflect a little more work and the added asphalt, rubber, and high quality aggregate in the mix.

Asphalt-rubber is worth it, resulting in quieter pavements and safer streets. Find out how at our Web site, <http://www.rubberpavements.org>.

Doug Carlson is executive director of the Rubber Pavements Association, Tempe, Ariz.