Testimony of

Harry Lee James
Deputy Executive Director and Chief Engineer
Mississippi Department of Transportation

Member, Standing Committee on Highways
American Association of State Highway and Transportation Officials

Regarding

Bridge Safety:
Next Steps to Protect the Nation's Critical Infrastructure

To

U.S. House of Representatives

Committee on Science and Technology

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AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO

THE VOICE OF TRANSPORTATION

Introduction

Mr. Chairman, my name is Harry Lee James. I am the Deputy Executive Director and Chief Engineer for the Mississippi Department of Transportation. I am a member of the Standing Committee on Highways of the American Association of State Highway and Transportation Officials (AASHTO), and I am a registered Professional Engineer in the State of Mississippi.

On behalf of AASHTO, I want to express my appreciation for your focus on infrastructure needs in America. The State Departments of Transportation (State DOTs) consider bridge safety and bridge preservation to be one of our highest priorities, and we take this responsibility to preserve the safety and mobility of the traveling public very seriously.

I am here to provide you and the public with the answers to some critical questions that have been posed by the House Committee on Science and Technology since the tragic collapse of the Interstate 35W bridge in Minneapolis.

Question 1

A) What technologies and techniques do state departments of transportation currently use to inspect bridges? What are the benefits and disadvantages?

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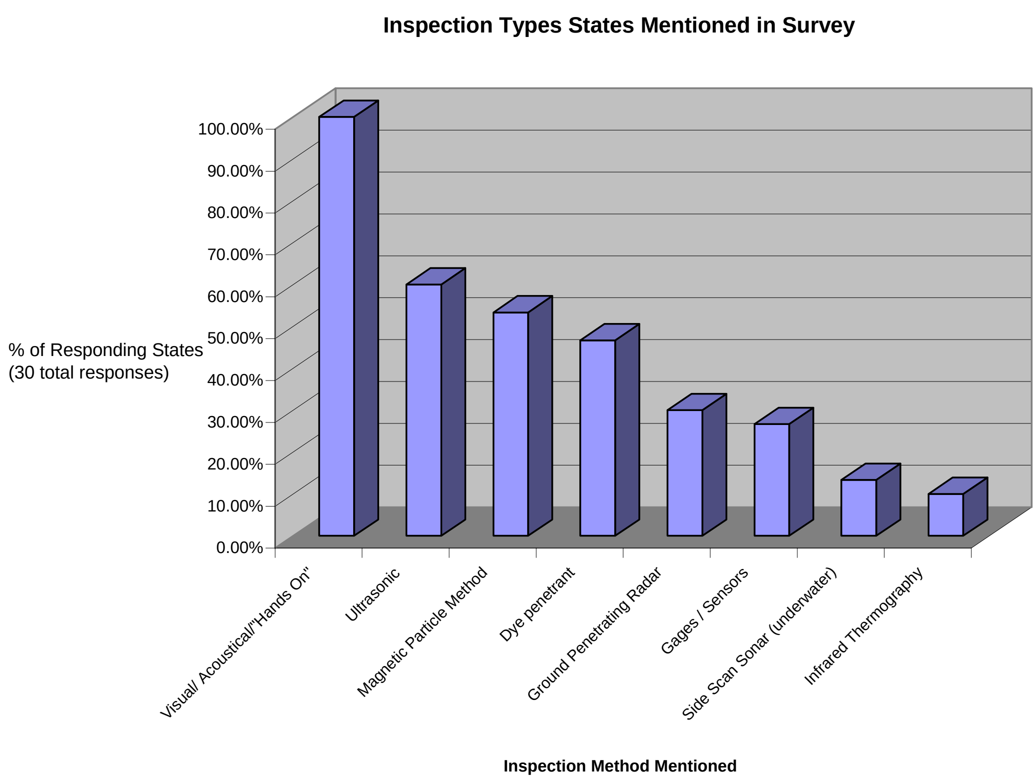


Every state conducts a thorough and continual bridge inspection and rehabilitation program. America's bridges are inspected every two years by trained and certified bridge inspectors, conditions are carefully monitored, and, where deterioration is observed, corrective actions are taken.

The most common and widely used method of inspection is by far the visual inspections by teams led by Professional Engineers. These can be described as using Sight, Sound and Touch for General Inspections. Sight is the normal visual inspection technique used by all states, Sound refers to the sounding technique (use of hammer sounding and chain drag) on concrete to integrity of the concrete (does it crumble), and Touch refers to the 100% hands on Fracture Critical Member inspection included in every General Inspection. If needed, these inspections are supplemented by other non-destructive testing methods.

The benefit of visual inspections is that we can collect a large volume of data on the condition of the components of every bridge. The disadvantage is that inspections are costly and time consuming. In addition to qualitatively documenting visible damage, degradation, and distress in structural elements, visual inspection can include quantitative measurements such as loss of steel due to corrosion or the size of cracks in concrete.

Some other common Non-Destructive testing (NDT) techniques are Magnetic Particle method for detection of cracks in suspected areas, ground penetrating radar to evaluate bridge decks with overlays, infrared thermography and ultrasonic testing to identify cracks that are either too small to be seen, or are beneath the surface of the metal and dye-penetrant tests which also detect cracks that are not visible to the naked eye. Dye-penetrant tests are inexpensive and very simple to perform. Mag-particle is fairly easy to perform. The disadvantages are that dye-penetrant only identifies cracks that have broken the surface of the steel. Mag-particle testing requires relatively flat and smooth surfaces. Almost all the common technologies are applicable to steel, not concrete or timber. All the techniques require specialized training and often times expensive equipment.

Some other innovative techniques include special “health monitoring” of bridges using special gauges and sensors. Some of these include strain gauges, inclinometers, load cells, weather stations, corrosion sensors, humidity sensors, and accelerometers.

Oregon is out front when it comes to using advanced technology to assess the condition of bridges. Currently they have instruments on seven bridges and have installed a device that uses air pressure to measure scour at bridge foundations on one other bridge.

Equipment or Technique	Material Tested			Desired Information, Measured Defect or Material Property
	Concrete	Steel	Timber	
Visual Inspection	X	X	X	Overall external material deterioration.
Audible Inspection	X	X	X	Concrete delamination, steel bolt and rivet looseness, timber integrity.
Infrared Thermography	X			Concrete deck delamination

Ground Penetrating Radar	X			Concrete deck voids, overlay thickness, and reinforcing steel location; soil/foundation engineering and underwater profiling/scour location.
Acoustic Emission	X	X	X	Crack, corrosion, weld defects and member embrittlement.
Ultrasonic Testing	X	X	X	Non-homogenous investigation, delamination, surface crack and weld discontinuity detection.
Dye Penetrant		X		Crack or flaw detection in non-porous metals.
Magnetic Particle		X		Crack or flaw detection in ferrous metals.
Monitoring Systems	X	X	X	Measurement of strains to calculate stresses in members.
Video Camera	X	X	X	Devices, such as Aqua-Vu, can be used for visual inspection of underwater as well as hard to reach components.

B) What research is needed to improve inspections?

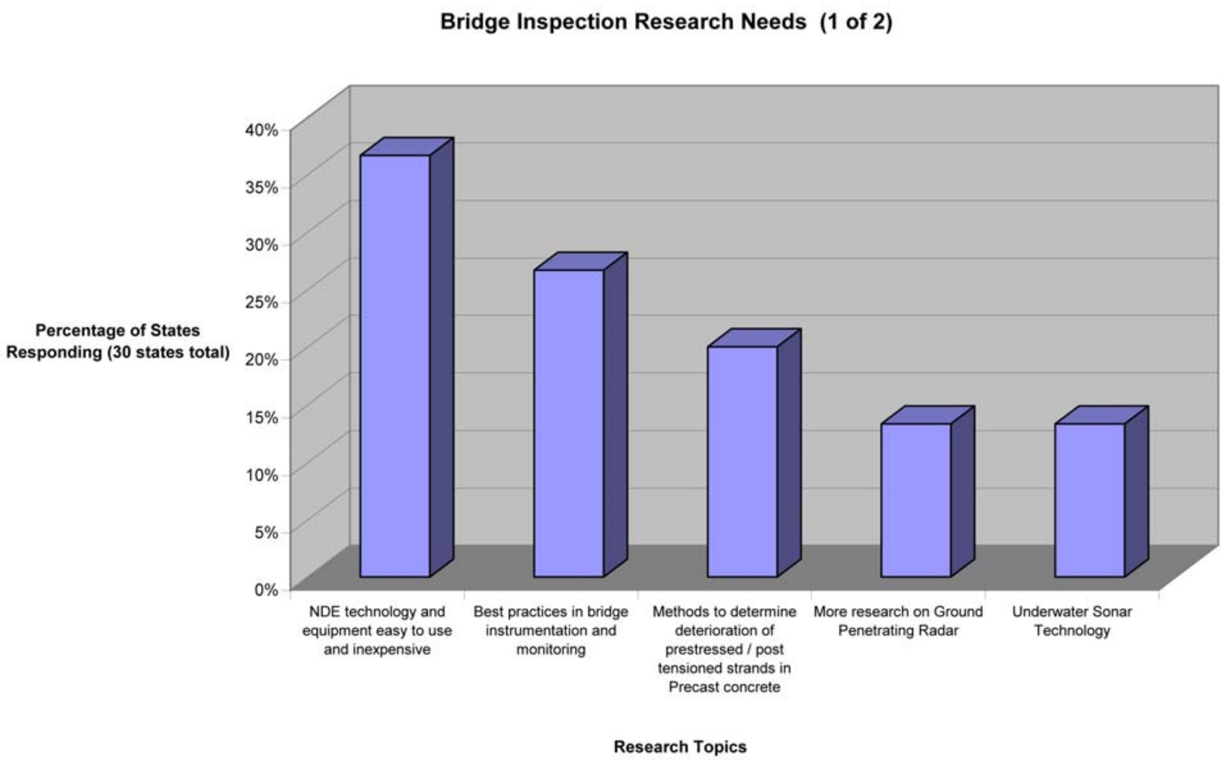
The National Bridge Inspection Standards are periodically reviewed and updated to reflect the latest knowledge. The last update was implemented in January 2005. The program was changed significantly in several areas:

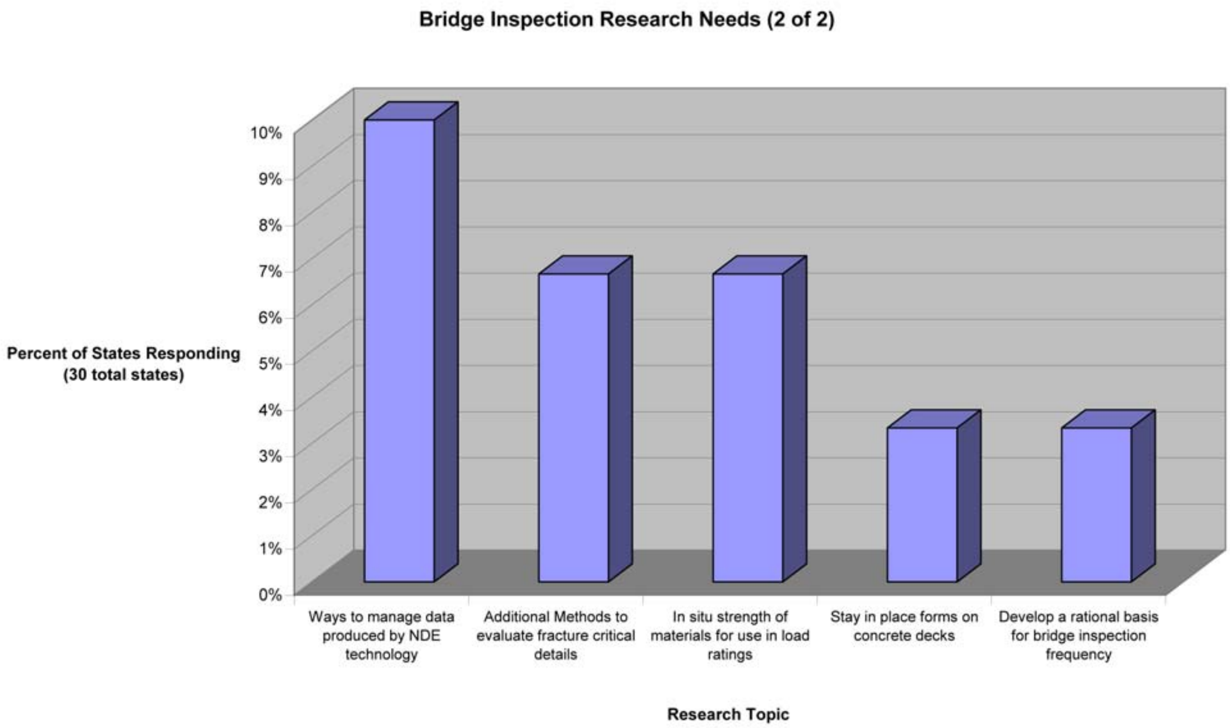
- The fracture-critical inspection interval was shortened (not to exceed 24 months) and the qualifications for underwater inspectors were increased (80 hours of training are now required).
- The qualification requirements for Program Managers and Team Leaders were increased. For example, non-licensed engineers must take a 10-day class and have 5 years experience, with most of that experience taking place directly in field inspection, to become a Team Leader.
- States must have a quality control and assurance program in place for their bridge inspection program. The program should include periodic field review of inspection teams, periodic bridge inspection refresher training for program managers and team leaders, and independent review of inspection reports and computations.

These recent updates to the National Bridge Inspection Standards demonstrate that the Federal Highway Administration is diligent in updating and advancing inspection standards based on input from the states. In addition, states frequently supplement federal inspection requirements with more detailed data collection and analysis. For example, 40 states currently employ an element-level inspection process that focuses on individual components of a structure.

In an informal AASHTO survey conducted on Sept. 1st to which 27 states and the USDA Forest Service replied, several areas of research were determined to be high priority. The one most often mentioned was the need for non-destructive testing technology/equipment that is inexpensive and easy to operate for a "typical" inspector. Also needed are ways to effectively manage and interpret the immense amount of data that is produced by bridge monitoring systems. In addition, with all of the pre-stressed and post-tensioned structures currently being built, it will be necessary to inspect the strands in these structures to determine the operating structural capacity of these bridges after they have been in service and exposed to the environment for some time. An effective way to inspect this and deterioration of pretensioned, prestressed strands in precast beams and boxes is needed. Loss of prestress concrete capacity can occur rapidly and lead to collapse such as the I-70 bridge in Pennsylvania.

Additional research in is also needed in ways of yielding cost-effective, efficient methodologies for the identification and monitoring of fatigue cracks in steel members. Lastly, many states would like to see the reinstatement of the HERMES ground penetrating radar research now tabled at Turner Fairbanks.





C) How is FHWA helping to meet these research needs?

The Federal Highway Administration (FHWA) has been a strong supporter of bridge research and bridge inspection and evaluation standards. Due to small staff and limited resources, many local governments do not have the expertise to use the technologies or review the research that is generated.

FHWA works cooperatively with the American Association of State Highway and Transportation Officials (AASHTO) to fund bridge related research projects through the Transportation Research Board TRB and National Cooperative Highway Research Projects (NCHRP). They also fund bridge research projects through SHRP2.

FHWA funds have been used by the states and by AASHTO for software development projects to perform structural evaluation of existing bridges and to develop bridge management tools. Most notably, FHWA funded a pilot project with Caltrans in the early 1990's to develop bridge management software that contains advanced asset-management decision-making capabilities. This software is now funded by AASHTO and is known as PONTIS. It is used nationally and internationally.

FHWA owns and operates the Turner-Fairbank Highway Research Center, which provides research and development related to new highway technologies. Current bridge inspection technologies being developed include ground penetrating radar (Hermes II), acoustic emission monitoring. Bridge technology programs operated under this research center include Non-Destructive Evaluation (NDE) Validation Center, the Long-Term Bridge Performance Program and Paint and Corrosion Laboratories.

The NDE Validation Center is designed to act as a resource for state transportation agencies, industry, and academia concerned with the development and testing of innovative nondestructive evaluation (NDE) technologies.

The Long-Term Bridge Performance Program (LTBP) was launched earlier this year. It is 20-year research effort that is strategic in nature with specific short- and long-term goals. The program will include detailed inspection, periodic evaluation and testing, continuous monitoring, and forensic investigation of representative samples of bridges throughout the United States to capture and document their performance. We feel this is an important program because it has the potential to provide a better understanding of bridge deterioration and to provide better deterioration models than are now used in Pontis.

FHWA sponsors studies to develop inspection techniques and remedies for common problems found in the nation's inventory of bridges such as arresting fatigue cracks, detecting and preventing protecting bridge with chlorides in concrete, detecting and preventing development of reactive aggregate.

Recently, the Federal Highway Administration's Transportation System Preservation program, an initiative of the Asset Management division, has added Bridge Preservation to the program. Several workshops have been held in 2007 and these workshops have helped to identify needed research in the area of bridge preventative maintenance.

Also, the International Activities office of FHWA has sponsored several international scan tours in the area of Bridge inspection and quality control. Most recently, a European Scan was undertaken in June 2007 in the area of Bridge Quality Control and Quality Assurance. Additionally, FHWA works to help sponsor Transportation Pooled Funds which support specific research projects Federal Highways also provides training through the National Highway Institute and helps to disseminate information through many publications, reports, memos and announcements.

While substantial funding has been devoted to bridge research, since the passage of SAFETEA:LU research funding has been constrained. Two factors give rise to that constraint. First, overall research funding was less than recommended by AASHTO and second, earmarks exceeded the total dollars made available for FHWA research and thus constrained overall discretionary research.

The pending SAFETEA:LU Technical Corrections bill that passed the House and is pending in the Senate would free up additional funds for the FHWA research program with no need to increase the overall cost of SAFETEA:LU. AASHTO has urged passage of this important legislation.

Bridge Research under SHRP 2

Recent events have again demonstrated that America's highways, once the envy of the world, are deteriorating, sometimes disastrously so. Through age and overuse their capacity to safely serve

America's transportation needs is being compromised. The Renewal focus area of the Second Strategic Highway Research Program (SHRP 2) seeks to develop the tools needed to systematically "renew" our highway infrastructure to serve the 21st century in ways that are rapid, minimally disruptive to users, communities, and the environment and that yield much longer-lived bridges and roadways.

Highway infrastructure largely comprises three basic elements: bridges, pavements and earthworks. All three elements are showing the deterioration of age and over-use and all three are addressed in the SHRP 2 research plans. While all three elements are vulnerable to deterioration that might compromise the physical safety of highway users, bridges are, by far, the most vulnerable. This fact was not lost on the committees of experts that guided the formulation of the SHRP 2 research, and renewal of America's highway bridges remains a key element of the SHRP 2 research, despite the dramatic reduction in funds actually authorized in the SAFETEA-LU legislation. Unfortunately, some of the originally planned research -- directly applicable to safety assessment and the maintenance and repair of existing structures -- proved unaffordable.

Bridge Research Currently Included in SHRP 2

Three current projects, with total funding of $5 million, directly address bridge renewal, including "Durable Bridges for Service Life beyond 100 Years: Innovative Systems, Subsystems, and Components."

Two other projects, valued at $8 million, address bridge renewal in part, including one project related to "A Plan for Developing High-Speed, Nondestructive Testing Procedures for Both Design Evaluation and Construction Inspection."

Table 1: Projects Directly Addressing Bridges

Project No.	Renewal Bridge Research Projects	Total budget (x1,000)	Estimated duration (months)
R04	Innovative Bridge Designs for Rapid Renewal	$2,000	48
R19-A	Durable Bridges for Service Life beyond 100 Years: Innovative Systems, Subsystems, and Components	$2,000	48
R19-B	Durable Bridges for Service Life beyond 100 Years: Service Limit State Design	$1,000	30

Table 2: Projects Partly Addressing Bridges

Project No.	Renewal Research Projects	Total budget (x1,000)	Estimated duration (months)
R06	A Plan for Developing High-Speed, Nondestructive Testing Procedures for Both Design Evaluation and Construction Inspection	$5,000	60 (Estimated)
R07	Performance Specifications for Rapid Highway Renewal	$3,000	60

Bridge Research Included in the Original SHRP 2 Research Plans

TEA-21 called for the Transportation Research Board (TRB) to conduct a study to determine the goals, purposes, research agenda and projects, administrative structure, and fiscal needs for a new strategic highway research program or a similar effort. Among the recommendations of the committee as detailed in *TRB Special Report 260*, was that "Highway Renewal" be included as one of the four focus areas of SHRP 2. A subsequent detailed analysis of highway renewal research needs alone indicated a funding need of approximately $95 million.

However, the passage of SAFETEA-LU provided only $150 million for the entire SHRP 2 research effort; thus serious cutbacks were made in all four research focus areas. Funding available for highway renewal research was reduced to $30 million. Efforts to optimize the research plans and combine projects were undertaken. Nonetheless, five important bridge research projects were dropped from the SHRP 2 program, including such topics as "Bridge Repair/Strengthening Systems," "Techniques for Retrofitting Bridges with Non-Redundant Structural Members," and "Monitoring and Design of Structures For Improved Maintenance and Security."

Table 4: Bridge Research Projects Dropped from SHRP 2 due to Lack of Funding

Project No.	**Renewal Research Projects**	**Total budget (x1,000)**	**Estimated duration (months)**
R20	Design for Desired Bridge Performance	$2,000	36
R24	Development of Rapid Renewal Inputs to Bridge Management and Inspection Systems	$2,000	72
R25	Monitoring And Design Of Structures For Improved Maintenance And Security	$1,500	72
R27	Bridge Repair/Strengthening Systems	$500	24
R28	Techniques for Retrofitting Bridges with Non-Redundant Structural Members	$1,000	36
	Total Budget	**$7,000**	

These projects would be as valuable to the safety assessment, maintenance management, and repair of existing bridges as they would be to a program of systematic renewal. Statements of work have already been developed for these research projects. The cost estimates shown are bare minimums and may require some upward adjustment.

TRB is ready to coordinate the SHRP 2 research with any program pursuing this research. The research remains significant to the achievement of the overall SHRP 2 goals.

Question 2

A) For those bridges deemed structurally deficient, how do state and local governments prioritize repairs and replacements?

The states use a number of different methods to prioritize their bridge needs.

While there is no "single approach" to prioritizing bridge program candidates, all approaches consider safety, then preservation and serviceability. Many states use a priority type of formula or a ranking system. These formulas and rankings taking into effect a combination variables of many different types. Some of the common considerations, in addition to the structurally condition ratings, are load ratings, field conditions, available funding, importance (criticality) of the bridge, average daily traffic, and alternate or detour route length. In addition to asset management programs and rankings, projects are scrutinized and approved through the normal STIP process that includes approvals from state and local transportation leaders and the transportation commissions where applicable.

One example is Oregon's project selection method. It integrates inspection data from PONTIS with other bridge condition data, specifically non-deterioration based needs, including, as examples; seismic, scour, and functional deficiencies. ODOT links various data collections to identify projects in twelve categories. Data primarily from Pontis is used to select problem bridges in the substructure, superstructure, and deck condition categories. Data outside of Pontis is used to select problem bridges in the seismic, scour, bridge rail, deck width, load capacity, vertical clearance, paint, coastal bridge (cathodic protection), and movable bridge categories.

Many states are moving away from a strictly "worst first" project selection process. Increases in the costs of traffic mobility and project staging have also influenced the move toward targeting route segments for repair and replacement projects.

However, several states are also still using a "worst first" selection method, sometimes with consideration for traffic load, social effects and politics. Overall, there is no "norm" in the area of prioritization.

Michigan's Well Developed Bridge Management System

Michigan DOT has a well developed asset management program that preserves Michigan's bridge through a balanced approach of doing capital preventive maintenance, rehabilitation, and replacement. They use a forecasting tool called Bridge Condition Forecast System to determine the best implementable strategy of the three types of work. Today the mix of fixes is 18% Preventive Maintenance, 30% rehabilitation, and 48% replacement.

The department also uses AASHTO CoRe elements and Pontis smart flags to make project level decisions, track deterioration rate of bridge elements (transition probabilities). Progress is monitored each year towards defined condition state goals, and strategy is modified as needed. By slowing the deterioration rate of fair bridges (keeping them from becoming structurally deficient (SD)) and concentrating on rehabilitating (first option) and replacement of SD bridges, the state has been able to make good progress at eliminating Structurally deficient bridges. Local agencies have reengineered their program (once called critical bridge program, but today called local agency bridge program), following the lead of the state trunkline program, and they are now managing their network of local agency structures.

While doing this the state has found the federal regulations regarding the Highway Bridge Program (HBP) are still too restrictive (although improving). This has resulted in several states transferring money out of the HBP program into other less restrictive programs. This gives a false impression that bridge money is not needed, which is very misleading. The HBP program is becoming more flexible with the allowance to use HBP funds for painting bridges and preventive maintenance, however, it is still built upon the framework of the 30 year old sufficiency rating formula that assigns a rating based upon structural deficiency and functional obsolescence.

In the latest federal highway legislation, SAFETEA-LU, the name of the portion of the act providing funding for bridge improvement and preservation was changed from "Highway Bridge Rehabilitation and Replacement Program" (HBRRP) to "Highway Bridge Program" (HBP). Along with the name change, came increased flexibility for states, counties, and cities to fund a broader assortment of bridge preservation projects. For example, "systematic preventive maintenance" now qualifies for HBP funds. With this change, it now appears that the three broad categories of bridge preservation are covered; i.e., replacement, rehabilitation and preventive maintenance. However, there remains at least one important exception that prevents the HBP program from becoming what it can and should be. As it currently stands, HBP funds still cannot be used for rehabilitation or replacement of bridge decks when only the deck is in poor condition. The reason for this is explained below.

Bridges qualify for rehabilitation and replacement based upon the "Sufficiency Rating Formula, as explained in Appendix B of the FHWA's "*Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*." The sufficiency rating formula is a 100-point scale. A bridge in new condition, having no deficiencies, has 100 points, and each deficiency on a bridge reduces the structure's sufficiency rating by a predetermined value. When a bridge's sufficiency rating falls below 80 points, the bridge qualifies for rehabilitation, and when the sufficiency rating falls below 50 points, the bridge qualifies for replacement.

The problem, as it relates to bridge decks, is the formula gives very little weight to the condition of a bridge deck. The formula only lowers a bridge's sufficiency rating 3 points when the deck condition (NBI Item #58) is four (poor). It only lowers the sufficiency rating 5 points when the deck condition is three (serious) or below. In comparison, the formula lowers a Bridge's sufficiency rating 25 points when, either, the superstructure (NBI Item #59) or the substructure (NBI Item #60) conditions are four (poor). The formula lowers a bridge's sufficiency rating 40 points, and 55 points, when the condition of the superstructure or substructure is three (serious) or two (critical), respectively. As a result, if only a bridge deck is rated poor, the bridge does not qualify for HBP funds.

To qualify preventive maintenance activities for HBP funds, states must work with their FHWA division office to demonstrate they have a "systematic plan" for maintaining their bridges. Once a "systematic plan" is demonstrated, a list of HBP eligible preventive maintenance activities can be developed. In Michigan, preventive maintenance activities relating to bridge decks include deck patching, expansion joint replacement, epoxy overlays, and hot mix asphalt overlays. Rigid overlays (i.e. * concrete, latex modified concrete, or micro-silica concrete) are classified as rehabilitation projects, therefore a bridge must meet the more stringent sufficiency ratings as discussed above.

Rigid overlays are a well-proven cost effective preservation activity for bridge decks, especially those that receive large traffic volumes. Likewise, it is easily shown that it is cost effective to rehabilitate or replace structurally deficient bridge decks before more extensive damage is done to the superstructure and substructure. It simply does not make sense to exclude rehabilitation and replacement of bridges decks from HBP funds when the rest of the structure is in fair to good condition. This is like saying you should not replace or repair the shingles on your home's roof until moisture has been allowed to penetrate and destroy the drywall or crack the foundation.

By definition, a bridge is "structurally deficient" if any one of the three major elements is rated four (poor) or below. Consequently, if only the bridge deck is rated four (poor) or below, the bridge is structurally deficient. This is an important point to be aware of because Section 1114 of SAFETEA-LU "declares that it is in the vital interest of the United States that a highway bridge program be carried out to enable States to improve the condition of their highway bridges over waterways, other topographical barriers, other highways, and railroads through replacement and rehabilitation of bridges that the States and the Secretary determine are structurally deficient or functionally obsolete and through systematic preventative maintenance of bridges". Therefore, allowing rehabilitation or replacement of structurally deficient bridge decks is consistent and directly supported by SAFETEA-LU.

It is also important that to remember and convey that bridges do not exist in a vacuum. Bridges are always tied to the roads they connect. Many of the structurally deficient bridges we have are located on major freeways that are tied up in long term corridor improvement studies, or there simply is not enough money to do the needed improvement to the corridor or interchange. The bridge may need replacement, but that must go along with a freeway widening (adding lanes), or redesign of an interchange. In many cases, we can not just simply fix the bridges without doing major road improvements also.

Bridge Management Software

Currently, 43 states plus Puerto Rico and the District of Columbia, along with several local agencies (including Los Angeles and Phoenix) and six international agencies, use an AASHTO BRIDGE*Ware*® software program called *Pontis*®. This is a computer-based bridge management system developed to assist in the challenging task of managing an agency's structures. Pontis can store bridge inventory and inspection data, formulate network-wide preservation and improvement policies for use in evaluating the needs of each bridge in a network, and make recommendations for what projects to include in an agency's capital plan for deriving the maximum benefit from limited funds.

Once inspection data have been entered, Pontis can be used for maintenance tracking and federal reporting. Pontis integrates the objectives of public safety and risk reduction, user convenience, and preservation of investment to produce budgetary, maintenance, and program policies.

Additionally, it provides a systematic procedure for the allocation of resources to the preservation and improvement of the bridges in a network. Pontis accomplishes this by considering both the costs and benefits of maintenance policies versus investments in improvements or replacements.

Responses from an informal August 2007 AASHTO survey[1] found that 17 of 37 states use an in-house computerized bridge management system that allows for prioritization and monitoring of elements in conjunction with either Pontis data collection or an in-house database. In some cases, Pontis is used by the states as a data collection system only, but many states are also using the management capabilities of Pontis, which allow them to predict bridge element deterioration levels and prioritize spending.

As noted, most states have some form of computerized bridge management system in place; however, the complexity and abilities vary. The goal of this effort may be to better define the abilities a state should have within its bridge management system and allow for flexibility within each state to accomplish these goals in the most efficient manner possible.

B) What are the possible short- and long-term consequences of maintaining the current level of bridge repair and replacement efforts (if no changes are made to the current systems)?

Most states responding to the AASHTO informal survey cite that their systems will not be affected greatly in the short term if there are no changes made. However, most stated that long term effects of an unchanging system would be significant. One example can be seen in Utah, where approximately 5% of the State system is Structurally Deficient. UDOT has developed and maintains strategic goals and performance measures for the overall health of its bridge system, as do many other states. Historically, funding from the Federal Bridge Programs (HPRR) is not adequate to address all of the needs. Therefore Utah's program is supplemented with State funds for both bridge replacement and preventive programs. Even with the supplemental State funds, resources are not adequate to address all of the Structurally Deficient bridges.

The consequence of inadequate funding includes increased risk. Typically states manage the risk of structurally deficient bridges with a variety of processes including; more frequent inspections, and consideration for load restrictions, shoring, and possible closure of a bridge. There are a large number of bridges that were built during the "Interstate Era". Many of these bridges are already functionally obsolete, and many more will become functionally obsolete as traffic volumes increase. More importantly, the volume of freight is expected to double in the next 20 years, and the long term trend in the industry has been for increased vehicle weight and axle loads. Improvements in tire technology will allow even greater axle loads, and the expanded use of drop axles has resulted in vehicles with concentrated loading that far exceeds the standard vehicles used for load rating.

There has been insufficient funding to replace bridges at a sustainable rate. If the funding is maintained at current levels, this trend will continue and the average bridge age will continue to increase, while the conditions continue to decrease. Bridges will deteriorate faster than they can be repaired and/or replaced. This will require load limiting (posting) of bridges and/or the closing of bridges. Thus limiting the use of the existing transportation system – significantly impacting the nation's economy.

A funding program is needed that will allow states to "sustain" an efficient transportation system for the distant future. Since bridges have a 50 to 100 year lifespan, the results of a non-sustainable funding program are not immediately apparent, but will nonetheless result in significant impacts to the economy if not dealt with at a level that will "sustain" the efficiency needed for economic growth.

Some states report that, in the short term, failure to maintain SD bridges will necessitate costly "emergency" repairs to allow routes to remain open at required functional levels. These emergency repairs reduce funds available for more permanent and cost effective rehabilitations

Is Current Bridge Investment Adequate?

It should be noted that currently states are spending dramatically more money on bridges than is provided under the federal Bridge Program. For example, in 2004 the federal Highway Bridge Program provided $5.1 billion to the states. That year, states actually spent $6.6 billion in federal aid for bridge rehabilitation. State and local funding added another $3.9 billion for bridge repairs. FHWA reports that in 2004 a total of $10.5 billion was invested in bridge improvements by all levels of government.

Oregon's 10-year state bonding program is providing $1.3 billion of state funding for the rehabilitation of hundreds of deficient bridges. This is twice the amount received in federal bridge funding.

According to U.S. DOT's *2006 Conditions and Performance Report*, the backlog of needed repairs on National Highway System bridges alone total over $32 billion, which includes over $19 billion needed on Interstate Highway System bridges. Structurally deficient bridges on the National Highway System only represent one-tenth of the total number of structurally deficient bridges on the U.S. road network. As wear and tear on our nation's infrastructure continues, it will only continue to increase the needs in coming years.

The *Conditions and Performance* report also states that maintaining the current investment level of $10.5 billion annually would reduce the backlog of bridge needs by half over the next 20 years. An increase in that investment level to $12.4 billion per year for bridge system rehabilitation would eliminate the backlog by 2024, excluding any kind of necessary spending on expansion or enhancements.

In addition to providing needed additional funding, we recommend investigating what can be done to streamline processes that delay the implementation of needed repairs on our nation's highway system, including reducing environmental red tape and allowing the use of proprietary engineering-related products that could spur innovation in long-term solutions.

During the last reauthorization of the federal transportation bill, SAFETEA-LU gradually increased annual funding levels for the Highway Bridge Program by 6 percent over the life of the bill (from FY 2005 to FY 2009). However, far outpacing that increased funding have been dramatic increases in materials costs for steel, concrete, fuel, asphalt. States report that prices jumped 46 percent over the years from 2003-2006. In addition, the *Conditions and Performance* report attributes increases in the "cost to maintain highways" to the rising cost of construction in large urbanized areas due to environmental mitigation and construction strategies (such as night work) intended to reduce the impacts of work zones on users.

Aside from the well-documented dramatic increases in construction costs, there have been equally dramatic increases in traffic, especially heavy trucks, on the nation's major highways. Today, the average mile of Interstate highway carries 10,500 trucks per day. By 2035, that number is expected to more than double to 22,700 trucks per day.

The truck issue also extends to overweight vehicles. As an example, in Iowa, the DOT's Bridge Office issues an average of 50 permits per day for trucks weighing over 156,000 pounds, or approximately 7,500 permits per year. These trucks are roughly twice the standard "legal" weight limit, causing significant wear and tear on the system, but are necessary for the economic health of our country. And these numbers are only anticipated to increase.

Thus, we are left with a system that has challenges to meet, and a program that does not have enough funding to overcome the current backlog.

Question 3

A) How do state and local governments use the results of research and technology development by the Federal government?

Many states work closely with the FHWA, AASHTO, and other groups to share technology with local government agencies and consultants. In addition, training programs such as the National Highway Institute, Library sessions, and Webinar's, are used to exchange information. Similar to any field, advances in highway infrastructure typically are the result of cumulative improvements over time from many sources instead of major breakthroughs. The Departments of Defense, Energy, Commerce, and Transportation all contributed to the state-of-the-art in structural steels, corrosion-resistant materials, Portland cement concrete, and asphaltic concrete that are now routinely used for highways. In addition to the materials, designs, and practice that are currently in use, reports and research papers stemming from Federal government programs are routinely referenced by practitioners and researchers at state and local DOTs to make decisions on using a new technology or pursuing further research into a new technology

There are many excellent reports that are produced through the National Cooperative Highway Research Program, under the direction of the Transportation Research Board of the National Academies. These reports let states know what the leaders in certain areas are doing. Taking the time to read reports and learn about what others have done enables individual states to avoid the expense and time of learning the lessons that have already been learned by others. For example, the NCHRP "*Manual for Bridge Rating Through Load Testing*" has excellent guidance for bridge owners to test older bridges that have low calculated load capacity yet are not deteriorated and seem to be performing well.

The results of many federal research projects are used to implement changes to design philosophies and inspection techniques. Recent examples include the migration of our design philosophy to LRFD, the addition of new SU type rating vehicles to the current federal rating vehicles (Type 3, 3S2, 3-3), etc. States use the results of research from sources such as NCHRP for the inspection, testing and analysis of bridges, when the results of the projects are directly implemented into the AASHTO bridge design, maintenance and analysis codes or when the results of the research is published.

In addition, most states enroll DOT staff in National Highway Institute (NHI) courses for technical training. NHI courses are developed with the help of federal government and participate in federally sponsored conference and workshops to seek information on new technologies.

B) How do federal technology transfer programs for bridge-related research and technology development help the states?

Technology transfer programs, such as organizing conferences and NHI courses, assist states in being aware of the current state-of-the-practice. Peer exchange programs help peers to meet and discuss best practices and issues they face every day. The states encourage FHWA to develop periodic bridge inspection/management peer exchange programs and program peer reviews to facilitate more discussions and improvements.

The Technology Transfer (T2) program, National Highway Institute, and other program are extremely helpful in sharing information. The T2 program is very beneficial in that it has a dedicated staff to administer the program, reducing workload for DOT and FHWA personnel. More information on T2 can be found at: http://www.federallabs.org/. The Federal Laboratory Consortium for Technology Transfer (FLC) is the nationwide network of federal laboratories that provides the forum to develop strategies and opportunities for linking laboratory mission technologies and expertise with the marketplace. The FLC was organized in 1974 and formally chartered by the Federal Technology Transfer Act of 1986 to promote and strengthen technology transfer nationwide. Today, more than 250 federal laboratories and centers and their parent departments and agencies are FLC members

In many federally sponsored technology transfer events, individuals with many years of experience are able to share what technology had worked for them, and what technology had fallen short. This was an excellent forum to learn about the research being done on a recently developed paint that holds promise for a significantly longer service life. Without technology transfer programs, individual states would not benefit from the lessons of others and would have to rely exclusively on vendor information. One example of these types of events were two Bridge Preservation Workshops held earlier this year. These workshops enabled engineers from all states to gather together and discuss issues related to bridge management and maintenance.

In addition, technology transfer and programs such as the Innovative Bridge Research and Deployment Program (IBRD) provide a means to disseminate information, experience and "lessons learned" that allow states to use new materials such as high strength steel and high performance concrete more efficiently. More information on IBRD can be found at: http://www.fhwa.dot.gov/bridge/ibrd/

C) What technical assistance have state and local governments received from the U.S. DOT for steel truss bridge inspections following the bridge collapse in Minneapolis? Was this technical assistance helpful?

Since August 1, in compliance with federal requests, every state has reviewed or is in the process of re-inspecting its steel deck truss bridges.

Most states noted that although their FHWA division office let them know they were available to assist, no assistance from them was needed or solicited. However, several states noted and appreciated the numerous forms of technical assistance provided by FHWA ranging from Technical Advisories, copies of reports, updates on emergency efforts, national teleconferences, and meetings with the local FHWA office. A few states also noted that the technical advisories did provide a basis for a uniform national response in light of the I-35 collapse in Minnesota.

In Georgia, it was noted that the FHWA Division participated in the inspections of GDOT's two steel deck truss bridge structures and GDOT appreciated their participation in the inspections.

Conclusion

We continue to make progress in addressing bridge replacement and rehabilitation needs, but there just isn't enough money to close the gap. Each year, as bridges continue to age and deteriorate, it is an uphill battle to keep up with the demands.

AASHTO and the State DOTs stand ready to help Congress address the needs for transportation infrastructure in America. The tragic Minneapolis bridge collapse rightly raises concerns about the condition and needs of the nation's bridges. AASHTO and the State DOTs continue to work with NTSB and others as they investigate the cause of this tragic event, and when a cause has been identified we are committed to working jointly with Congress to address the issue head-on and to correct the situation in the most expedient way possible. Until that time, it is important to avoid premature speculations, and diligently obtain all relevant data to arrive at the appropriate solution.