

Showing Their Age: The Nation's Bridges at 40

*Strategies to improve the condition of our
bridges and keep them in good shape*

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**The Road Information Program
1726 M Street, NW, Suite 401
Washington, DC 20036
Phone: (202) 466-6706
Fax: (202) 785-4722
www.tripnet.org**

Founded in 1971, The Road Information Program (TRIP)® of Washington, DC is a nonprofit organization that researches, evaluates and distributes economic and technical data on highway transportation issues. TRIP is supported by insurance companies, equipment manufacturers, distributors and suppliers; businesses involved in highway engineering, construction and finance; labor unions; and organizations concerned with an efficient and safe highway transportation network.

Executive Summary

In this report, The Road Information Program (TRIP) examines the condition of the nation's bridges, based on data updated regularly by the Federal Highway Administration (FHWA). TRIP also gathered information on the condition of the nation's 100 bridges carrying high volumes of traffic that have the highest levels of deficiencies. Information on the conditions of bridges in each state is also contained in the study.

America's 587,964 bridges are a vital link in the nation's transportation system, connecting communities and regions of the country. The continued high level of deterioration on the nation's bridges is a visible sign of an aging and over-burdened transportation system.

Ratings for bridges and data on individual bridges have been taken from the FHWA's National Bridge Inventory, which maintains condition data for all bridges longer than 20 feet. The major findings of the report are:

As the average age of the nation's bridges reaches 40, significant deterioration exists, with many bridges carrying high volumes of traffic in need of either significant rehabilitation or replacement.

- Approximately one in four bridges nationally – 28 percent -- are in need of repair or replacement because of deterioration or because they no longer meet current design standards.
- 14 percent of the nation's bridges are structurally deficient, showing significant deterioration to decks and other major components.
- 14 percent of the nation's bridges are rated as functionally obsolete. These bridges no longer meet modern design standards for safety features such as lane widths or alignment with connecting roads or no longer are adequate for the volume of traffic being carried.
- The Woodrow Wilson Bridge, which connects Maryland and Virginia over the Potomac River, is functionally obsolete. Designed to carry 75,000 vehicles per day, the 40-year-old bridge now carries nearly 200,000 vehicles daily.
- Many heavily-traveled bridges, particularly in older cities, including Boston, New York and St. Louis have significant deficiencies. Some of these bridges include the Williamsburg Bridge in New York, the Washington Boulevard Bridge in the Washington, DC suburbs, the US 1 bridge in Boston over Storrow Drive and the Interstate 70 bridges over the Wabash River in St. Louis. A listing of the nation's 100 high-volume bridges with the highest deficiency ratings and a description of what the ratings mean can be found in appendices A and B.

- The ten states with the highest percentage of its bridges rated as structurally deficient are: Oklahoma, Missouri, Rhode Island, Pennsylvania, South Dakota, Mississippi, Iowa, North Dakota, Michigan and Louisiana. A listing of bridge conditions for all states and the percentage of bridges deficient can be found in appendices C and D.
- 60 percent of the nation's bridges are at least 30 years old, and 41 percent are at least 40 years old.
- The decade that saw the most bridges built was the 1960s, when 19 percent of the bridges open to traffic today were built. Nearly half of the nation's bridges – 48 percent – were built from 1950 to 1980.

While there has been a reduction in the percentage of the nation's deficient bridges since 1995 as a result of increased funding, the tremendous growth in car and truck travel combined with a possible cut in federal and state highway funding, may reverse recent gains in overall bridge conditions. The decline in the percentage of bridges that are deficient may also mask the fact that a large number of major bridges remain deficient because state and local governments do not have adequate resources to make the costly repairs that are necessary.

- From 1995 to 2001, the percentage of bridges rated as either structurally deficient or functionally obsolete decreased from 32 percent to 28 percent as a result of an increase in bridge maintenance, repair and replacement expenditures by federal, state and local governments. The reduction in the number of deficient bridges was a result of a decline from 18 to 14 percent of bridges rated functionally obsolete. The percentage of bridges rated as structurally deficient has remained unchanged at 14 percent.
- Vehicle travel nationally increased by 28 percent between 1990 and 2000. Similarly, travel by large commercial trucks increased by 40 percent between 1990 and 2000, significantly increasing the load being carried by bridges.
- Vehicle travel by all vehicles is expected to increase by another 50 percent by the year 2020 and travel by large commercial trucks is expected to increase by 90 percent by the year 2020, according to FHWA forecasts. This significant increase in traffic volumes, particularly of commercial trucks, will accelerate bridge deterioration.
- Current proposals in Congress call for cutting federal highway investment in 2003 from between \$3 to \$5 billion, a significant reduction from the \$32 billion invested in roads and bridges in 2002.

- Potential budget shortfalls forecast in 38 states may further reduce the amount of funding available for bridge maintenance, repair and replacement.

Improving all the nation's bridges to good condition will require an increase in funding for bridge repairs. Keeping bridges in good shape can also be enhanced by the use of improved bridge maintenance practices and the use of improved construction materials.

- Investment in our nation's bridges should be increased by 44 percent from \$8.1 billion annually to \$11.7 billion – an increase of \$3.6 billion per year – according to the most recent U.S. Department of Transportation Report to Congress on the funding needs of the nation's surface transportation system.
- A regular schedule of preventative maintenance on bridges has been found to be a cost-effective way to extend the service life of a bridge and delay the need for costly repairs or reconstruction.
- The use of more high-performance materials, including steel, concrete and fibers, may result in lower lifecycle costs by building or reconstructing bridges that can last longer and carry larger traffic volumes.

Few bridges are likely to collapse (such bridges are closed or, if they can safely carry lighter traffic volumes, they are posted to prohibit larger vehicles). The more critical safety problem of older bridges is that they often do not meet current safety standards for lane widths and street and highway approaches (alignments) that may reduce the safety of the bridge.

- A FHWA study of 20 years of roadway improvements found that widening or modifying a bridge had been found to reduce traffic fatality rates on that structure an average of 49 percent.

Introduction

The nation's 587,964 bridges are critical to our transportation system, allowing people and goods to move around the country in a safe and efficient manner. Bridges provide communities and individuals with access to employment, schools, shopping and medical facilities, as well as facilitating commerce and access for emergency vehicles.

Bridges in the United States are reaching middle age – with the average age reaching 40 this year. And like many individuals at 40, they are showing signs of fatigue and are often operating under more stress than they were designed to handle.

Fortunately, as a result of recent increases in funding and improved maintenance and construction practices, some progress is being made in improving overall bridge conditions. While the percentage of bridges that are deficient has declined somewhat since 1995, numerous large, heavily-traveled bridges have not been repaired significantly because states and local governments do not have adequate funding to pay for such expensive projects. The problem of funding high cost bridge repairs is further exacerbated by the tremendous increases in traffic volumes occurring, particularly of large commercial trucks. Recent proposals to cut both federal and state transportation funding are likely to increase the number of deficient bridges in the country.

This report by The Road Information Program (TRIP) looks at conditions on the nation's busiest deficient bridges, overall bridge conditions in each state and finally at a set of strategies that can significantly improve bridge conditions nationally. Data for this

report have been obtained from the National Bridge Inventory (NBI), an inventory of the condition of all bridges that are at least 20 feet in length, maintained by the Federal Highway Administration (FHWA). Bridge condition data are submitted by the state departments of transportation that regularly inspect each bridge in their state, whether it is actually the responsibility of the state or local government. Other sources of information include the U.S. Department of Transportation.

Bridge Conditions

Based on FHWA's inspection data for 2001 (the most recent data available), 28 percent of the nation's bridges are rated as structurally deficient or functionally obsolete. Approximately one in seven bridges – 14 percent – are rated structurally deficient and another 14 percent are rated as functionally obsolete.

A bridge is structurally deficient if there is significant deterioration of the bridge deck, supports or other major components. Bridges that are structurally deficient are often posted for lower weight or are closed if they are found to be unsafe. Bridges that are functionally obsolete no longer meet current highway design standards, often because of narrow lanes, inadequate underclearances or poor alignment, all of which reduce highway safety. The Woodrow Wilson Bridge, which connects Maryland and Virginia over the Potomac River, is a good example of a functionally obsolete bridge. Designed to carry approximately 75,000 vehicles a day, the bridge now carries nearly 200,000 vehicles daily.

Oklahoma leads the country in the percentage of its bridges rated structurally deficient, with 33 percent. The next nine states with the highest percentage of its bridges rated structurally deficient respectively, are Missouri, Rhode Island, Pennsylvania, South Dakota, Mississippi, Iowa, North Dakota, Michigan and Louisiana.

Chart 1. Top ten states with highest percentage of bridges rated structurally deficient, 2001

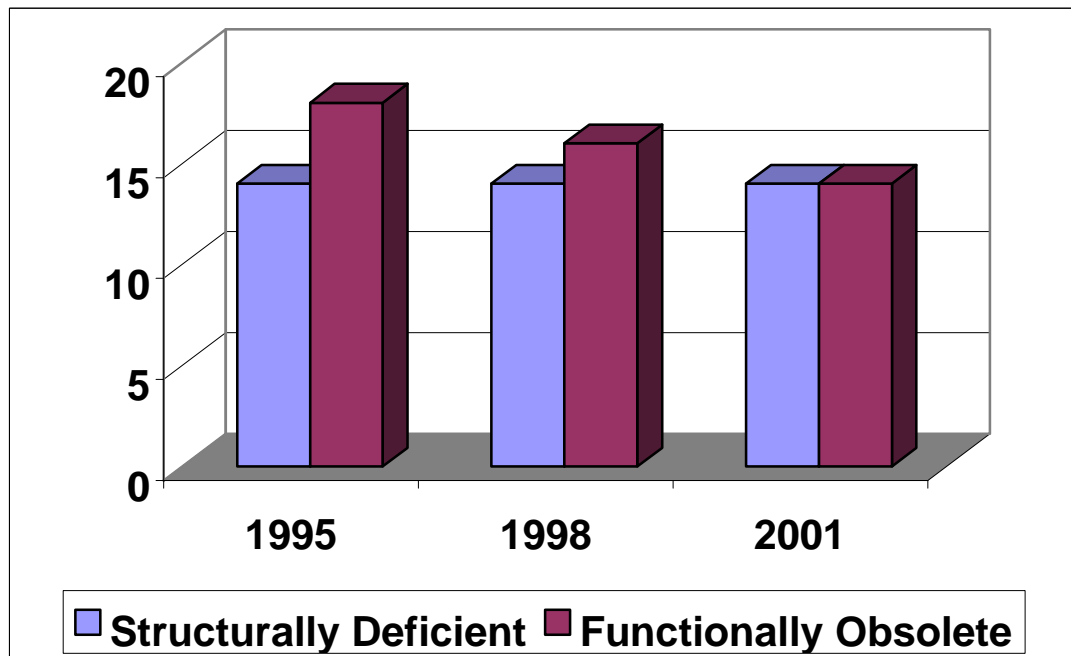
Oklahoma	33
Missouri	26
Rhode Island	25
Pennsylvania	25
South Dakota	23
Mississippi	22
Iowa	20
North Dakota	19
Michigan	19
Louisiana	18

Source: TRIP analysis of Federal Highway Administration (FHWA) data

Bridge deficiencies have an impact on mobility and safety. Restrictions on vehicle weight may cause many vehicles – especially emergency vehicles, commercial trucks, school buses and farm equipment – to use alternate routes to avoid these bridges. Narrow bridge lanes, inadequate underclearances and poorly aligned bridge approaches reduce traffic safety. Redirected trips lengthen travel time, waste fuel and reduce the efficiency of the local economy.

The condition of the nation's bridges has improved slightly since 1995 primarily because of a reduction in the percentage of bridges rated as functionally obsolete, which decreased from 18 percent to 14 percent. The percentage of bridges rated structurally deficient, however, has remained at 14 percent. As a result, the percentage of all bridges rated deficient has declined from 32 to 28 percent from 1995 to 2001.

Chart 2. The condition of U.S. bridges by percent, 1995-2001



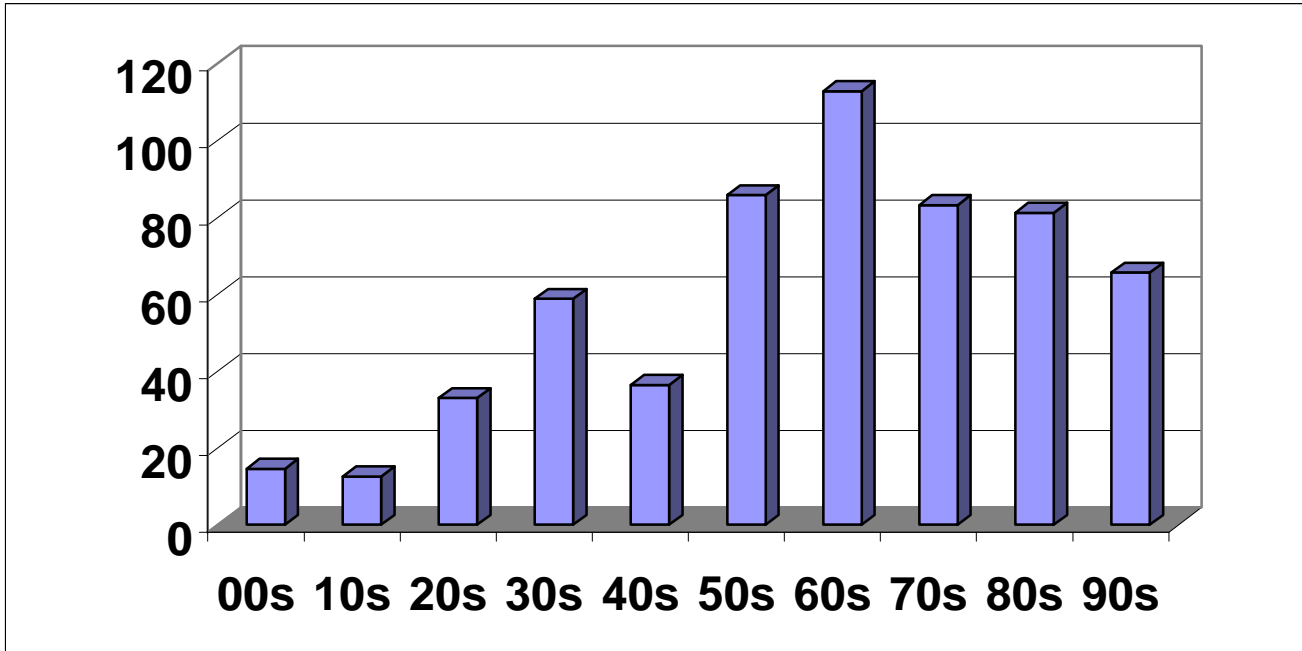
Source: TRIP analysis of FHWA data

The average age of the nation's bridges currently open to traffic is 40 years. This is an age at which many bridges have reached the end of their initial service life and when significant repairs become necessary.

Currently, 60 percent of the nation's bridges are at least 30 years old and 41 percent are at least 40 years old. The decade that saw the most bridges built was the

1960s, when 19 percent of the bridges open to traffic today were built. Nearly half – 48 percent – of the nation’s bridges were built from 1950 to 1980.

Chart 3. The decades when U.S. bridges were built (in thousands)



Source: TRIP analysis of FHWA data

Deficient High-Volume Bridges

Bridges that carry a significant level of traffic are of particular concern to the state and local governments responsible for maintaining them. Bridges carrying high volumes of traffic have significant stress generated by the heavy traffic of cars and trucks crossing them every day. These bridges are also quite often larger, more heavily traveled and thus more costly to repair. And finally these bridges are typically crucial to a region’s transportation system, thus any traffic disruptions caused by construction need to be minimized, making it more difficult to repair these bridges.

Using data in the NBI inventory, TRIP gathered rating data for all structurally deficient bridges that carry at least 50,000 vehicles a day. Data such as the year the bridge was built, length and daily traffic counts was gathered as well as bridge inspection ratings for the bridges structural, deck superstructure and substructure. The full explanation of each rating can be found in Appendix A. For example, a structural evaluation of two indicates the bridge's condition is "basically intolerable, requiring high priority of replacement." Similarly, a structural evaluation of three indicates that the bridge's condition is "basically intolerable, requiring high priority of corrective action."

Many heavily-traveled bridges, particularly in older cities, such as Boston, New York and St. Louis have significant deficiencies. Some of these bridges include the Williamsburg Bridge in New York, The Washington Boulevard Bridge in the Washington, DC suburbs, the US 1 bridge in Boston over Storrow Drive and the Interstate 70 bridges over the Wabash River in St. Louis. A listing of the nation's top 100 high-volume bridges with the highest deficiency ratings and a description of what the ratings mean can be found in Appendices A and B.

The following chart shows the top 25 major bridges that are rated as structurally deficient. Deficient bridges are further rated by a composite score determined for each bridge by the FHWA based on the condition of the bridge, the level of use, the adequacy of the bridge's design and how critical the bridge is to the local transportation network. TRIP has ranked the bridges based on their overall sufficiency score, with the bridge with the lowest score being rated first.

Chart 4. The 25 most deficient U.S. bridges carrying at least 50,000 vehicles a day

Deficiency				Features		Average	Structural
Rank	State	County	Route	Intersected	Year built	Daily traffic	evaluation
1	NY	New York	WILLIAMSBURG BR	FDR.DRIVE ,EAST RIVER	1903	98,746	2
2	NJ	Middlesex	US 1	CONRAIL (ABANDONED)	1929	74,000	2
3	NY	Queens	25 X	AMTRAK&LIRR YARD	1910	58,887	2
4	VA	Arlington	WASHINGTON BLVD.	COLUMBIA PIKE	1944	67,000	2
5	NY	Kings	RTE 907C	MILL BASIN	1941	131,795	2
6	NY	Bronx	FR MACDAM	METRONORTH	1951	83,294	3
7	MA	Suffolk	US 1 SB STORROW D	US 1 NB STORROW DR	1951	57,770	2
8	NY	New York	WILLIS AVE.	HARLEM RVR D,HARLEM RIVER	1901	92,406	3
9	NJ	Union	US RTE 1+9	ELIZABETH RV & LOCAL STS	1929	60,790	2
10	NY	Bronx	TO MACDAM	RELIEF	1951	83,294	2
11	NY	New York	THIRD AVENUE	HARLEM RIVER,HARLEM RIVER	1900	56,619	2
12	MA	Norfolk	I 495 NB	RR MBTA PASSENGER	1966	53,000	3
13	MA	Worcester	I 495 SB	ST 9	1964	56,410	3
14	NY	Kings	RTE 907C	GERRITSEN INLET	1939	130,326	2
15	NY	New York	FDRD SB	907L907LX4M1,60 TH STREET	1941	133,325	3
16	NJ	Hudson	RTE 1&9 TONNELLE	AMTRAK	1927	67,500	4
17	NY	Westchester	HRP	HUTCHINSON RIVER	1926	89,578	3
18	NY	Richmond	OBX	BOGGS STREET,STATE STREE	1928	94,000	3
19	MA	Suffolk	I 93 BNT 22-9	HWY E BERKLEY BROADWAY	1960	203,730	2
20	MA	Suffolk	ST 1A	RR MBTA & BMRR	1932	76,600	2
21	MO	St. Louis	IS 70	WABASH RR	1957	63,060	3
22	MO	St. Louis	IS 70	WABASH RR	1957	68,030	3
23	NY	Kings	RTE 907C	OCEAN PKWY	1941	156,519	3
24	WI	Milwaukee	IH 94 WB-MARQUETTE	LAND	1967	74,600	3
25	MA	Suffolk	N. WASHINGTON ST.	CHARLES RIVER	1900	66,000	2

Source: TRIP analysis of National Bridge Inventory (NBI) data

Trends in Travel

Significant growth in passenger vehicle travel and, in particular, of commercial trucking during the 1990s has tremendously increased wear and tear on the nation's bridges. From 1990 to 2000, overall vehicle travel in the U.S. increased by 28 percent and travel by large commercial trucks increased by 40 percent. Similar levels of growth are projected over the next 20 years, according to TRIP analysis of FHWA data. By the year 2020, overall vehicle travel is expected to increase by approximately another 50

percent and large combination-truck travel is expected to increase by another 90 percent. The significant increase in passenger vehicle and combination-truck travel will accelerate the rate of deterioration on bridges, increasing the need for timely maintenance, repairs and reconstruction.

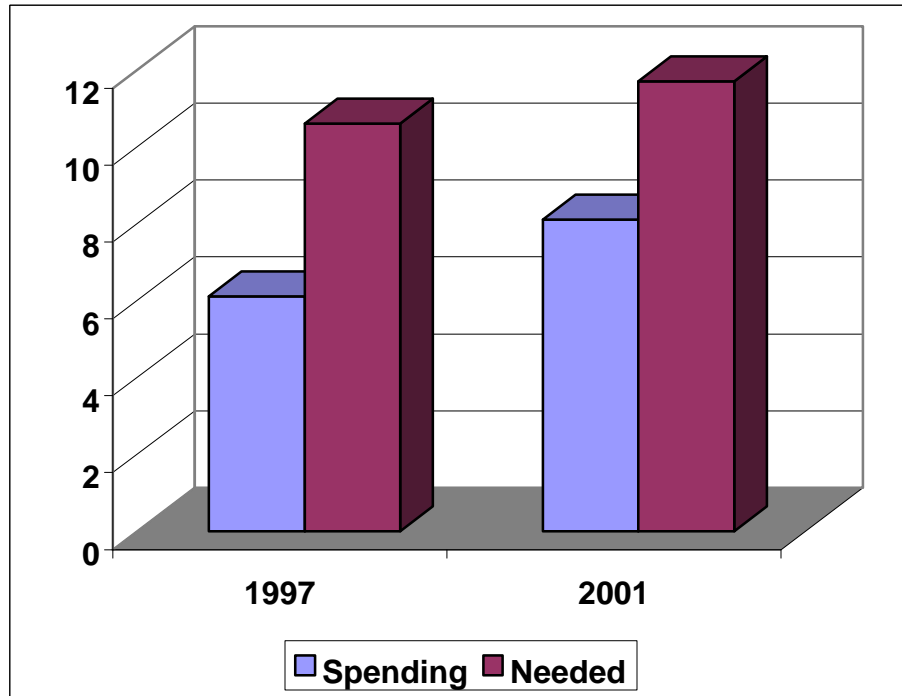
National Bridge Funding Needs

A 1999 U.S. DOT report for Congress estimated current levels of investment in the maintenance, repair and reconstruction of the nation's bridges and also estimated the level of funding needed to allow the nation, over a 20-year period, to improve all bridges into acceptable condition. The report, "1999 Status of the Nation's Highways, Bridges and Transit," found that in 1997, the nation spent \$6.1 billion on bridge repairs and reconstruction, but should have spent \$10.6 billion, to be investing at a level adequate to repair all bridges over a 20-year period.

By 2001, the nation invested \$8.1 billion in bridge repairs, but by 2001, should have spent \$11.7 billion on bridge repairs (based on converting 1997 dollars into 2001 dollars). As a result, the nation should be spending an additional 44 percent annually, or \$3.6 billion more to allow for significant overall improvement in the nation's bridges.

Finding adequate funds to improve our nation's bridges will be difficult because of current proposals in Congress to cut federal road and bridge funding from between \$3 to \$5 billion in FY 2003. Federal funding in FY 2002 was \$32 billion. On top of that, potential budget shortfalls in 38 states further threaten the ability of state governments to increase bridge repair funds.

Chart 5. National bridge spending and needed bridge spending to allow significant improvement in conditions, 1997 and 2001 (in billions)



Source: TRIP analysis of U.S. Department of Transportation data

Strategies to Improve Bridge Conditions

Improving the nation's bridges will require that all levels of government invest adequately in maintaining their bridges and that the money is spent wisely. Three steps that can help facilitate this are:

- ✓ Increase bridge investment by 44 percent nationally to allow for a sustained program of bridge repairs.
- ✓ Implement a bridge maintenance program that reduces the rate of bridge deterioration by reducing the amount of damage occurring from precipitation and traffic wear.

- ✓ Consider the use of high-performance materials, such as improved steel, concrete and fiber products, which may result in lower lifecycle costs by building or re-constructing bridges that can last longer and carry larger traffic volumes.

Conclusion

As the nation's bridges reach an average age of 40, their deterioration is a visible sign of an aging and over-burdened transportation system. The tremendous economic growth of the 1990s, coupled with the projected population growth over the next 20 years, has created a challenge to the nation's transportation system, and the bridges which link it together. Sustaining our citizens' quality of life will require an efficient and safe transportation system, but that system will perform only as well as its bridges allow.

Our bridges face two problems – they are aging very rapidly and traffic levels, particularly commercial trucking, are increasing at a significant rate, putting more wear and tear on many bridges than they were designed to handle.

State and local governments have been innovative in implementing improved practices to better maintain bridges and extend their useful lifespan. The increasing use of better and stronger materials may also allow the construction of bridges that will last longer and be able to carry larger volumes of traffic.

Bridges are indeed the vital link in the nation's transportation system. Spending adequately to improve their condition and insuring that the money is spent wisely will be rewarded many times over in the form of safe, reliable transportatio

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