

October 1990

Bridge improvement hinges on better management systems

By Larry Mendenhall
Editor, Technology News

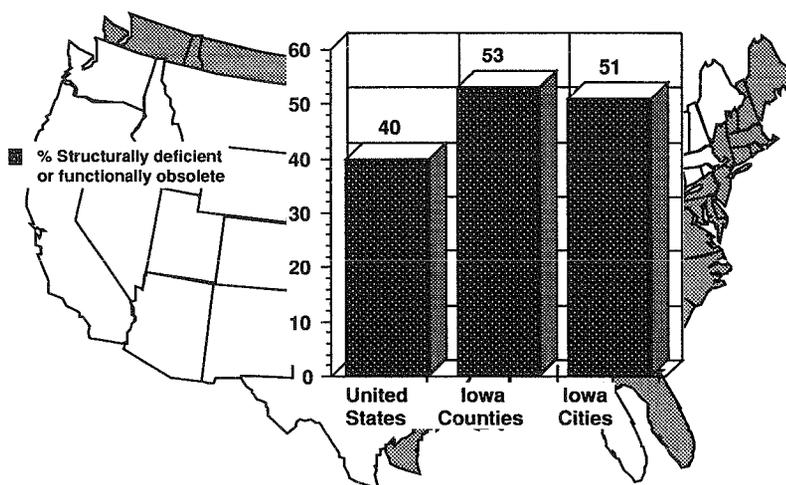
Maintaining a schedule of repair and maintenance for bridges is nothing new for local road and street agencies. As a nation, however, the number of structurally deficient or functionally obsolete bridges indicates that agencies at all levels face a major challenge in keeping their bridges in good condition.

According to research by Iowa State University Associate Professor Fouad Fanous, around 40 percent of the nation's 578,000 bridges are in need of repair. Fixing all those bridges will cost an estimated \$67 billion; however, the current federal bridge fund is approximately \$2.4 billion.

According to the Iowa Department of Transportation, bridges in Iowa are in slightly worse condition. Forty-seven percent of Iowa's 22,170 bridges are in satisfactory condition. Twenty-seven percent of them are functionally obsolete and 26 percent are structurally deficient.

Bridge management systems (BMSs) provide a systematic way for local agencies to allocate limited resources to provide the most positive

Deficient bridges plague Iowa and the U.S.



Source: Iowa Department of Transportation

impact. Carl Kurt, a professor of civil engineering at the University of Kansas who is currently working on a series of projects to develop software for local agencies, said, "Bridge management systems give managers a rational method to decide which bridges are in critical need of repair."

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Inside pages

3. It's time for the annual *Technology News* survey. Please take the time to fill it out and return it to us.
4. Tape drives are a good to back up computer hard disks. Find out about them in "Microtechnology."

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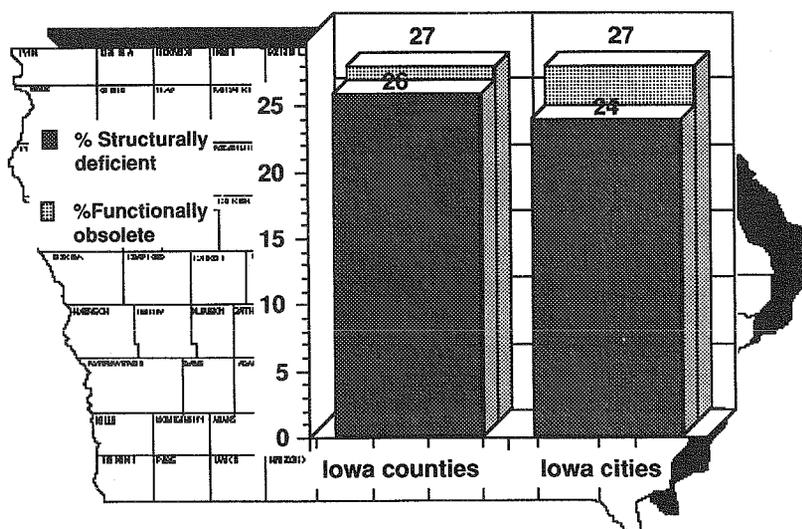
The key to any bridge management system is to have all pertinent data for bridges in one place where it can easily be retrieved. There are computer programs specifically designed for bridge management systems. But according to Kurt, even inputting just the information from the structure inventory and appraisal (SI&A) forms into a database program can greatly enhance bridge management. When a system manager needs specific information, the database can furnish it in minutes. Searching for the information by hand to find the same answer could take weeks. Using the computer speeds up a time-intensive task.

If a local agency has a small bridge inventory, a BMS can be set up manually — on file cards or other paper systems. However, a computer system allows for more varied manipulation of data in less time.

No matter how the system is set up, a BMS is just a tool. Managers can use it to help make good decisions — it doesn't make good decisions on its own.

"While the judgment of the engineer must remain in any BMS, many of the guesses associated with the judgment can be removed by going to a more systematic procedure for making bridge decisions," Kurt said.

Deficient bridges in Iowa for both cities and counties



Source: Iowa Department of Transportation

There are many ways for a system manager to use the information stored in a BMS. That information may be used to determine which bridges are in poor condition; to evaluate the benefits of doing a certain project over another in the system; to determine a bridge rehabilitation program that extends many years into the future; to maintain an historical record for each bridge; to suggest rehabilitation strategies on a project or network basis;

to provide a cost analysis for each of those strategies; to analyze design criteria policies such as load capacity, width, clearances, and others; to use with other databases such inventory records or GIS systems; and to help educate decision makers.

"BMSs can be used in many applications," Kurt said. "For some local agencies, a simple BMS may be all

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The preparation of this newsletter was financed through the Technology Transfer (T²) Program. The T² Program is a nationwide effort financed jointly by the Federal Highway Administration and the Iowa Department of Transportation. Its purpose is to translate into understandable terms the latest state-of-the-art technologies in the areas of roads, bridges, and public transportation.

The opinions, findings, or recommendations expressed here are those of the Iowa Transportation Center and do not necessarily reflect the views of the Federal Highway Administration or the Iowa Department of Transportation.



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Help us serve you better

We want to improve the practical value of our newsletter, services, and workshops. We are very interested in your input. Please take a few minutes to answer the following questions. Then fold and TAPE this page with the return address facing out. (Postal regulations prohibit the use of staples!) The postage is prepaid. Thanks from the Iowa Transportation Center.

1. What type of agency do you work for? Check one.

<input type="checkbox"/> Municipality	<input type="checkbox"/> County	<input type="checkbox"/> State agency
<input type="checkbox"/> Association	<input type="checkbox"/> Consultant	<input type="checkbox"/> Contractor
<input type="checkbox"/> Supplier	<input type="checkbox"/> University/college	
<input type="checkbox"/> Other _____		

2. What is your job title? _____

3. How do you rate Technology News?

<input type="checkbox"/> Very Useful	<input type="checkbox"/> Useful
<input type="checkbox"/> Somewhat useful	<input type="checkbox"/> Not very useful

4. Which subjects are of the most interest to you? Check each that apply.

<input type="checkbox"/> Transit	<input type="checkbox"/> Bridge maintenance, rehabilitation
<input type="checkbox"/> Safety	<input type="checkbox"/> Equipment maintenance
<input type="checkbox"/> Management	<input type="checkbox"/> Highway or bridge design
<input type="checkbox"/> Computers	<input type="checkbox"/> Roadway maintenance
<input type="checkbox"/> Others _____	

5. How often do you attend transportation workshops or conferences at Iowa State University?

<input type="checkbox"/> 5 or more times per year	<input type="checkbox"/> 2-5 times per year
<input type="checkbox"/> 1-2 times per year	<input type="checkbox"/> Occasionally
<input type="checkbox"/> Never	

6. In the past year, have you attended transportation workshops by an organization other than ISU? Yes No Topic was _____

7. Would you attend more workshops or conferences if they were held at a site closer to you? Yes No

8. How would you rate the transportation-related workshops or conferences that you have attended at ISU?

<input type="checkbox"/> Very useful	<input type="checkbox"/> Useful
<input type="checkbox"/> Somewhat useful	<input type="checkbox"/> Not useful
<input type="checkbox"/> Programs by other organizations are more useful	
<input type="checkbox"/> I never go to workshops or conferences	

9. Have you ever requested and received publications, tapes, or audio-visual materials from the ITC library? Yes No

10. Are you interested in having an ISU specialist speak to your board of supervisors or city council on how current transportation issues affect local agencies? Yes No

11. Would you be interested in more programs like the Safety Circuit Rider that bring training programs directly to your city or county? Yes No

T E C H N O L O G Y N E W S

11. On a scale of 1 to 5, with 1 being the best, please rate your interests in the following workshops. We would appreciate your thoughts on our programming. Please feel free to write in comments or suggestions.

Workshop	Rating	Workshop	Rating
Safety features for local roads	1 2 3 4 5	Geotextile engineering	1 2 3 4 5
Manual on Uniform Traffic Control Devices	1 2 3 4 5	Geographic Information Systems	1 2 3 4 5
Tort Law	1 2 3 4 5	Bridge rating	1 2 3 4 5
Barriers and safety features design	1 2 3 4 5	Sign inventory/management	1 2 3 4 5
Traffic signal timing design	1 2 3 4 5	Pavement maintenance techniques	1 2 3 4 5
Traffic signal maintenance management	1 2 3 4 5	Pavement recycling	1 2 3 4 5
Traffic site impact analysis	1 2 3 4 5	Maintaining granular surface roads	1 2 3 4 5
Regional transit service marketing	1 2 3 4 5	Bridge rehabilitation	1 2 3 4 5
Regional transit system management	1 2 3 4 5	Equipment maintenance management	1 2 3 4 5
Work zone safety	1 2 3 4 5	Computer estimation of urban drainage	1 2 3 4 5
Construction inspectors' workshop	1 2 3 4 5	Hazardous waste management	1 2 3 4 5
Soils and foundations workshop	1 2 3 4 5	Geotechnical engineering fundamentals	1 2 3 4 5

Comments _____

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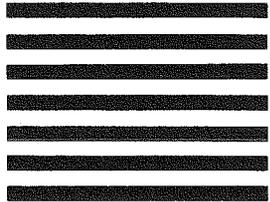


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Tape drives make best backup media

In the last issue of "Microtechnology," I discussed the importance of making backup copies of hard disk data files. Experts even suggest making two backup copies and having enough blank media (e.g., floppy disks, tape cartridges, etc.) available at your workstation to make a third backup. Keep the first backup at your workstation and store the second at another location (probably your home). The third set allows you to rotate a backup copy between your alternate location and work, making sure there is always a current backup in a safe location.

Using floppy disks to back up a hard disk has advantages, but they are unpractical for hard disks over 40 megabytes. Backing up larger capacity hard drives using different media is more efficient. The most popular of these are tape drives that back up data on quarter-inch cassette tapes.

Quarter-inch cassette backup systems use a continuous drive (no stopping and moving back and forth like 9-track tape drives on mini and mainframe computers). Earlier systems used image copying to keep data flowing continuously, but current systems use software to permit both file-by-file copying and image copying. File-by-file and image copying are methods that backup systems use to copy your files.

A file-by-file backup copies each individual file to the back-up medium. Image copying simply copies your hard disk as it is. Because of the way a computer reads data from its hard disk, image copying is faster. However, file-by-file copying speed has improved and doesn't require restoring the entire hard disk — as image copying does — to replace lost data.

Microtechnology

By Tom Maze
Program Manager

An industry standard for cassette cartridges, the DC600 tape was the early focus of attention. The six-by-four inch cartridge contains 600 feet of tape that normally holds about 60 megabytes of data. However, although equipment manufacturers agreed on standards for the cartridge, they did not create a standard for storing data. Therefore, a backup tape made on one company's DC600

No matter what back up system you decide on, remember it doesn't mean anything if it's not used regularly.

machine may not be readable by a DC600 machine made by another company.

Later, the DC2000 cartridge was developed. The cartridge is a 3-1/2 inch by 2-1/2 cartridge with about 205 feet of tape, and can normally hold about 40 megabytes of data. The Quarter-inch Cartridge Drive Standards, Inc. or QIC has established tighter standards for the DC2000 tape systems.

Tape backup devices can be mounted internally in a floppy drive bay, or operate externally. Internal devices use the floppy disk drive controller and therefore, the disk drive controller board needs to be compatible with the tape drive. Exter-

nal drives are more expensive, but they can be used as a portable unit and one back-up external drive can back up several computer hard drives. However, each computer must have the proper interface card. The external unit becomes cheaper than the internal unit when the same back-up unit serves several machines. The least expensive way to perform backups is to network computers in the office. Then only one computer, the network file server, needs a tape drive.

Before buying a system, consider the type of software you will want to use with it. First, you may not need a separate back-up program. Most tape drives come with their own back-up software. In addition, some utility programs have back-up capability.

Before deciding on software, look for some convenient features. Some software has the ability to compress data. Compression increases the amount of data stored on a DC2000 cartridge. Back-up software may have the capability to conduct timed backups (at night when you are gone). Some systems permit incremental backups. This means that they store an additional copy of newly changed data files. Some software will routinely back up only those files that have been changed or created since the last backup.

In general, tape drives are currently the most popular way to back up large hard disks. However, you must make choices about the type of tape used, whether it will be used with more than one computer, and what type of software is needed. But no matter what back up system you decide on, remember, it doesn't mean anything if it's not used regularly.

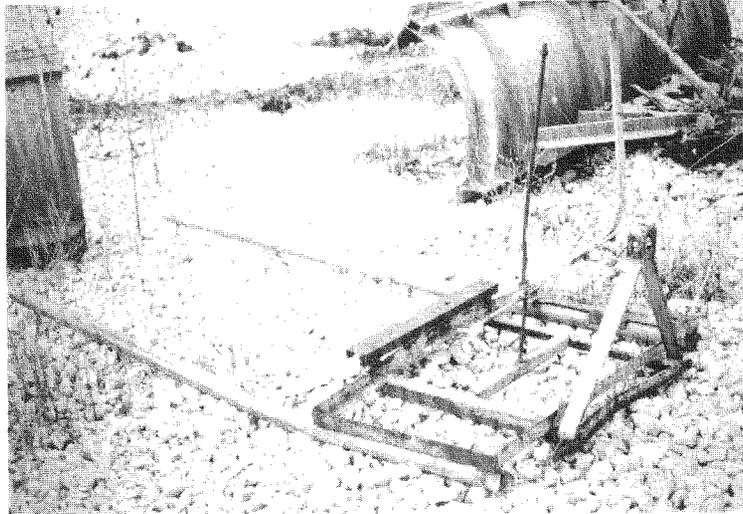
Tips From The Field

Picnic table pick-up relieves backs

A three-point hitch devised by the City of Pleasant Hill allows one man to move picnic tables over a large park system quickly and easily.

The photo shows how the device works. Two long pipes are fitted at the back of the hitch. The pipes easily fit underneath the table. Using the tractor's hydraulic lift makes it easy to move picnic tables around the park.

The modified hitch has two additional benefits. The first is that it reduces the risk of back injuries to workers. The second is that it can be made easily and cheaply out of spare parts.



An inexpensive hitch makes moving picnic tables an easy task.

For more information contact Allen Schoemaker, City of Pleasant Hill

Public Works Director, 4450 Oakwood Dr., Pleasant Hill, IA

50317. The phone number is 515/262-6663.

Bridge management continued from page 2

that is needed. It may only rank each bridge in the network, then the manager and his staff can use their experience to determine the best improvement action."

When compared to setting up pavement management systems, it is easier to start up bridge management systems. Data for bridge management systems should be on file and ready to type in from the biannual bridge inspection reports required by the federal government. Pavement management systems require extensive pavement surveys and data coding prior to inputting things into the system. With a BMS, a temporary employee can inexpensively type in this already collected data.

It is critical that the data input into the system is correct. If incorrect data get into the database, the results based on that data will be equally incorrect. Kurt said.

SI&A information doesn't have to be the only information in the database. Additional information such as deterioration rates, discount rates, unit costs, and analysis options, makes it easier for the system manager to determine life-cycle costs and cost-benefit ratios. Managers can also add data on bridges less than 20 feet.

"We have all our SI&A information in our database," Assistant Marshall County Engineer Wayne Chizek said. "We also have additional information

like plank and beam size to make our maintenance program easier. Having information like this on the database gives us an idea of what maintenance items we need to restock."

Until the number of deficient bridges is reduced, bridge rehabilitation will be a major concern for system managers at all levels. System managers using computerized BMSs can develop rational rehabilitation strategies to improve bridge sufficiency ratings. BMSs can also determine the cost effectiveness of each rehabilitation project, allowing the manager to spend his or her limited funds to the maximum benefit and plan a long-range rehabilitation program.

For More Information

The videotapes and publications listed in this column are available on a loan basis by contacting John Moody, Iowa State University, Iowa Transportation Center, 194 Town Engineering, Ames, Iowa 50011 515/294-9481.

Note to all holders of the 1988 edition of the Manual On Uniform Traffic Control Devices (MUTCD) — An errata to update your manual is available by writing the Iowa Transportation Center at Iowa State University, 194 Town, Ames, Iowa 50011 or by calling 515/294-9481.

Maintenance of Aggregate and Earth Roads — This 71-page manual is a state-of-the-art document covering all aspects of road maintenance on aggregate and earth surfaced roads. Emphasis is on travelways, shoulders, and roadside ditch maintenance. Within the scope of recurrent and deferred maintenance activities, opportunities are identified to improve cost effectiveness of surfacing and ditch maintenance and reducing future capital improvements. **Request index #691**

Timber Bridges — Design, Construction, Inspection and Maintenance — This 963-page manual, published in 1990 and prepared by Michael A. Ritter, Structural Engineer for the Forest Service, contains many interesting and informative details concerning the history, design, construction, inspection, and maintenance of timber bridges. It is divided into 18 chapters which range from "Timber as a Bridge Material" to "Design of Longitudinal Stress-Laminated Deck Superstructures" to "Maintenance and Rehabilitation of Timber Bridges" and others. **Request index#692 Note: For loan only**

Estimating Highway Maintenance Work — This 40-page manual, prepared by the Bureau of Maintenance of the Ohio Department of Transportation in March of 1990, contains a number of typical problems encountered in everyday maintenance activities along with solutions. These problems involve straight line mileage, seal coating, mowing, material volumes, and many others. A 15-page appendix contains abbreviations, liquid and dry measures, solutions to surface

measures, areas, volumes, and percentages. **Request index #693**

Development of an Economic Dust Palliative for Limestone Surfaced Secondary Roads — This is a final report on Highway Research Project #HR-297 where a series of tests were performed using various materials in a search for a dust palliative that would satisfy the standard on "fugitive dust" defined by the Department of Environmental Quality. **Request index #685**

Our Nation's Highways — Selected Facts and Figures — This 35-page booklet contains a condensed overview of the facts and figures about our nation's highways. It is considered to be of interest to the average citizen. Except where noted, the Federal Highway Administration is the source of data provided by the states. The information provided is updated, for the most part, through 1988 and includes figures relating to the highway systems, condition and performance, vehicle fleet, motor fuel use, number of licensed drivers, and other interesting facts. **Request index #13**

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Please send a complete listing of all audio visual materials available.

Conference Calendar

Vehicle Fleet Management: Equipment Technology and Mechanic Training, Emmetsburg October 24, Council Bluffs October 25, Ankeny October 29, Ottumwa November 7, Waterloo November 8 This course covers aspects of new technology and training requirements. Highlighted are antilock brake systems, inflatable passenger restraints, and electronic engine controls. Contact Deb Schmidt 515-294-5961.

Legal Aspects of the Public Lands, ASCE/ICEA Surveying Conference, October 25-26, Scheman Building, ISU, Ames Contact Connie Middleton 515-295-6229

Better Concrete Conference, November 1, Scheman Building, ISU, Ames Contact Connie Middleton 515-294-6229.

ASCE Annual Convention and Exposition, November 4-7, San Francisco Contact Anthony Baez, 212-705-7496.

ASCE Transportation Conference, November 9, University Inn, Ames Contact Jo Sedore 515-294-5817.

Portland Cement Concrete and Asphalt Cement Pavement Maintenance Workshop, Atlantic November 14, Sheldon November 15 This workshop covers pavement maintenance techniques and practices. The course is suitable for individuals from all size jurisdictions. Contact Carole Seifert 515-294-5642.

Annual Iowa County Engineers Conference, December 4-6, Scheman Building, ISU, Ames Contact Connie Middleton 515-294-6229.

Annual Transportation Research Board Meeting, January 13-17, Washington, D.C. Contact TRB 202-334-2934.

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