Change Is the Only Constant
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Iowa State University (ISU), the country’s first land-grant institution, has a strong core program in engineering and is a preeminent technology-transfer university. The Center for Transportation Research and Education (CTRE, or the center) is the focal point for transportation-related activity at ISU and continues the university’s long and stellar heritage of excellence in transportation programs.

That heritage goes back to at least 1904 when the newly formed Iowa State Highway Commission was housed on ISU’s campus and a productive and lasting partnership between the two organizations was begun. In the early years of the century, engineers from the commission and the university were leading forces in the campaign for a national, integrated transportation research program. In 1920 Anson Marston, ISU’s first dean of engineering and a deciding voice in that campaign, had the satisfaction of chairing the National Research Council’s first Highway Research Board (forerunner of today’s Transportation Research Board). Marston’s student, Roy Crum, was executive director of the board for more than 20 years, and in 1919 another student, Thomas MacDonald, became chief of the Bureau of Public Roads, a position he held for 34 years.

In the ensuing decades, ISU researchers and educators, engineers and technicians have continued to be at the forefront of state and national transportation initiatives and developments. And ISU continues its productive partnership with the successor to the Iowa State Highway Commission: the Iowa Department of Transportation (Iowa DOT).

CTRE was organized in 1983 as Iowa’s Rural Technical Assistance Program (RTAP). It was one of only 10 original Federal Highway Administration (FHWA) RTAP organizations. Then called the Local Transportation Information Center, the center provided training and information to Iowa’s county and city transportation departments and to rural transit agencies.

The center grew, incorporating a rich research element into its program, and the name was changed to the Iowa Transportation Center. In 1988 ISU won a University Transportation Center Program (UTCP) grant for Federal Region VII from the U.S. Department of Transportation. That grant funded the Midwest Transportation Center (MTC), a consortium of ISU and The University of Iowa, with ISU as the lead organization. The Iowa Transportation Center administered the MTC through 1995. The UTCP grant allowed the center to enhance its research and outreach programs and develop a strong educational component.

In 1995 the UTCP grant for Federal Region VII was awarded to another university consortium, but by that time the expanded breadth of the center’s activities had reduced the MTC portion of its budget to a minority share. The MTC funding had helped the center strengthen its core research, education, and outreach programs until they were self-sustaining.

Since the end of the MTC grant, the center has made several changes. It has changed its name to the Center for Transportation Research and Education (CTRE) to reflect a program broadly expanded beyond its original scope. It has continued to diversify funding sources and to broaden the base and expand the numbers of ISU faculty members conducting transportation-related research through CTRE. And through a grant from the University of Nebraska at Lincoln, the new home of the Federal Region VII UTCP grant, CTRE continues to strengthen its educational programming for students in transportation-related fields.

In little more than a decade, CTRE has developed from a $100,000-a-year, technology-transfer unit serving local governments to a program with an annual budget of several million dollars and a national and international reputation for excellence and scope in transportation research, education, and outreach; from an original staff of three to 26 professional and support staff and roughly 30 graduate research assistants; and from an original staff of three to 26 professionals, support staff, and roughly 30 graduate research assistants. Together with its ISU faculty affiliates, the center is working on a large number of projects ranging the entire gamut of transportation issues and involving organizations as far-flung as the Oregon and Florida departments of transportation and the countries of Canada and Mexico. This report reflects the mission, organization, research projects, educational programs, and technology-transfer products of today’s CTRE.

Tom Maze
Director
Mission and vision

CTRE's offices are located in the Iowa State University Research Park.

As part of CTRE's coming of age, in 1997 we authored our first mission statement, objectives, and management plan. The plan will be periodically revised and modified.

CTRE's mission is to develop and implement innovative methods, materials, and technologies for improving transportation efficiency and safety.

CTRE serves:

• local and regional transportation agencies (counties, cities, metropolitan planning organizations, regional planning affiliations, etc.).
• departments of transportation at the federal and state level and other federal and state agencies with transportation-related missions.
• private sector transportation interests including shippers, carriers, manufacturers of transportation vehicles and equipment, and transportation consultants.
• Iowa State University's academic transportation community in all colleges and departments.
• Iowa State University's academic resources with other university-based transportation organizations, transportation agencies, consulting firms, and industry to develop and manage robust research teams. Several center staff members are former employees of CTRE's major sponsors (e.g., the FHWA and the Iowa DOT) or organizations with similar requirements (e.g., former employees of cities, counties, or consultants). This strategy has resulted in flexible and adaptable staff who understand our sponsored needs.

CTRE values:

• research. We focus on applied research in the wide variety of disciplines that affect transportation.
• educational activities. We sponsor undergraduate and graduate students from many transportation-related disciplines, providing them with a rigorous academic program and with significant research opportunities and professional experiences. CTRE's educational programs help build a human infrastructure prepared to address current and future transportation challenges.
• outreach. We act as a conduit between the academic community and transportation practitioners, adapting technology and research results to practitioners' needs and giving practitioners a voice in setting research agendas. These outreach activities are a natural function of Iowa State University's mission as a land-grant institution.
• objectivity. We perform impartial academic research, employing rigorous methods and standards.
• ethics. We provide honest advice and recommendations and strive to meet or exceed our commitments.

As a university center, CTRE reports to ISU’s Vice Provost for Research and Advanced Studies. CTRE and its staff are currently organized around three key competency areas or divisions: Advanced Transportation Technologies, specializing in intelligent transportation systems for commercial vehicle operations (ITS-CVO); Transportation Planning and Information Systems; and Outreach. A fourth key competency area, Transportation Infrastructure Design and Development, is being planned.

Within CTRE’s management structure, each of these divisions is managed by an associate director. Each associate director supervises staff of individuals specializing in the competency area. The staff in each competency area is comprised of a division of CTRE. In actual operation, the distinction between divisions is blurred, as individuals assigned to one division may work on an aspect of the competency domain of another division. Whenever possible, CTRE generates project teams that include faculty members and research scientists from appropriate ISU departments, other universities, and government and industry.

In addition to the three key competency areas or divisions, CTRE manages basic research agreements with the Iowa and other state departments of transportation, as well as active educational programs. Each of these activities supports CTRE's mission areas of transportation research, education, and outreach. The relationship between each competency and mission area is shown in the matrix at right. In the matrix, the amount of a core activity’s emphasis in each mission area is indicated by the degree of shading, the higher the emphasis, the darker the shading. For example, the bottommost cell under the Outreach Division is darkly shaded because this core activity area is heavily involved in outreach. However, Outreach Division staff are commonly involved in applied research and education, as shown by the lighter shading in those focus areas.

Center staff

Critical to the center's success is the expertise of its faculty and staff. CTRE staff members are recognized experts in their areas. We respond to the needs of practitioners with similar requirements (e.g., former employees of cities, counties, or consultants). This strategy has resulted in flexible and adaptable staff who understand our sponsored needs.

Center organization

CTRE's core activities support the center's mission areas of research, education, and outreach.

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Center staff

Critical to the center’s success is the expertise of its faculty and staff. CTRE staff members are recognized experts in transportation engineering, planning, safety, systems management and operations, and policy. These staff excel in combining their knowledge and resources with other university-based organizations, transportation agencies, consulting firms, and industry to develop and manage robust research teams.

Several center staff members are former employees of CTRE's major sponsors (e.g., the FHWA and the Iowa DOT) or organizations with similar requirements (e.g., former employees of cities, counties, or consultants). This strategy has resulted in flexible and adaptable staff who understand our sponsored needs.
With their wide range of expertise, CTRE's ISU faculty affiliates have worked on a variety of transportation-related projects. From human factors studies related to the driving abilities of elderly drivers, to urban growth management research, to a field test evaluation of aluminum bridge members, to applications of statistical models to determine when specific vehicle movements may indicate driver drowsiness, these and other projects broaden and deepen CTRE's scope.

Department of Civil and Construction Engineering, Structural Engineering Division (Bridge Engineering Center), College of Engineering

Dr. Lowery F. Greimann, Professor and Chair of Civil Engineering, PhD, 1968, Colorado State

Dr. Wayne F. Klaiber, Professor of Civil Engineering, PhD, 1968, Purdue

Dr. Kenneth L. Bergman, Associate Professor of Civil Engineering, PhD, 1986, Iowa State

Dr. Michal Crums, Associate Professor of Business, DBA, 1983, Indiana University

Dr. Richard T. Poir, Professor of Business, PhD, 1977, Pennsylvania State

Dr. Theodore Bink, Assistant Professor of Business, PhD, 1994, Georgia

Department of Civil and Construction Engineering, Geotechnical and Materials Engineering Division, College of Engineering

Dr. Richard T. Poir, Professor of Business, PhD, 1977, Pennsylvania State

Dr. Theodore Bink, Assistant Professor of Business, PhD, 1994, Georgia

Department of Transportation and Logistics, College of Business

Dr. Benjamin Allen, Distinguished Professor of Business, PhD, 1974, Illinois

Dr. Michael Crums, Associate Professor of Business, DBA, 1983, Indiana University

Department of Civil and Construction Engineering, Construction Engineering Division, College of Engineering

Dr. Mark O. Fiehler, Assistant Professor of Civil Engineering, PhD, 1990, Michigan

Dr. Charles J. Jahn, Assistant Professor of Civil Engineering, PhD, 1987, Purdue

Dr. Edward J. Jaakko, Associate Professor of Civil Engineering, PhD, 1988, Texas

Department of Civil and Construction Engineering, Construction Engineering, Transportation Division, College of Engineering

Dr. James A. Cribb, Associate Professor of Civil Engineering, PhD, 1990, Illinois

Dr. Edward J. Jaakko, Associate Professor of Civil Engineering, PhD, 1988, Texas

Dr. Michael Crums, Associate Professor of Business, DBA, 1983, Indiana University
Fatigue testing a segment of a full-sized, aluminum, welded-I-shaped, composite bridge girder.

Affiliates’ research tantalizes aluminum industry: An aluminum bridge proves its metal

In 1957 the Iowa State Highway Commission, with financial assistance from the aluminum industry, constructed a 200-ft-long, four-span continuous, composite, welded-I-shaped, aluminum girder bridge to carry traffic on Clive Road (86th Street) over Interstate 80 near Des Moines, Iowa (the Clive Road bridge). One of only seven aluminum girder bridges ever built in the continental United States, the Clive Road bridge was a unique structure. It performed successfully for about 35 years before being removed in 1993 to make way for an interchange at the same location. Except for the possible need for deck resurfacing, the bridge was in very good condition when it was removed.

The Clive Road bridge was constructed during a time when fabricated structural steel was difficult to obtain, therefore aluminum was considered to be a viable alternative material. In recent years there has been increased interest in alternative bridge materials, including aluminum with its light weight and corrosion resistance. The repurposing of the Clive Road bridge provided a unique opportunity to closely examine and test the components of an aluminum structure after many years of use.

In 1993 CTRE faculty affiliates Dr. Robert Abendroth and Dr. Wallace Sanders of ISU’s Bridge Engineering Center led a research project to examine the Clive Road bridge prior to its demolition and to perform a fatigue study of some of the aluminum girders salvaged during the bridge demolition. The goal of the research was to determine behavioral characteristics of the bridge and to provide additional design recommendations for aluminum bridge structures and components. The project was funded by the Iowa DOT and the FHWA.

Two Clive Road bridge girders were fabricated with all welded aluminum girders. The girders were fabricated in pairs with welded diaphragms between the girders and were bolted to girders brackets. A composite, reinforced concrete deck, surfaced as the roadway surface.

The bridge was load tested in 1959 shortly after its construction and again in 1993 just prior to its demolition. The 1993 load tests were conducted by driving an overloaded truck to preselected locations on the bridge deck and then monitoring the induced strains in the bridge. Deflections were also measured in the northern end span. A comparison of the experimental girders strain and deflection test results and these results obtained from an analytical model of the bridge showed that the theoretical model accurately predicted the bridge response to applied wheel loads. The analytical model was used to determine the effect that changes in the magnitude of particular design parameters had on the response of the bridge.

The results of the load tests and theoretical analyses provided basic information on load distribution and confirmed that the new AASHTO LRFD Bridge Design Specifications provide load distribution criteria that are applicable to the Clive Road bridge. Even though the part of the AASHTO LRFD specification that addresses girders-slab bridges currently identifies only prestressed concrete and steel girder bridges, the load distribution criteria also appear to be applicable for I-shaped aluminum girder bridges.

Fatigue testing of the aluminum girders that were removed from the end spans of the Clive Road bridge were conducted by applying constant-amplitude cyclic loads. These tests established the fatigue strength of an existing, welded, flange-splice detail and added, welded, flange cover plate and horizontal web-stiffener plate details. The results of fatigue tests of the aluminum girders confirmed the stress range versus load cycle behavior for the aluminum alloy used in the bridge.

Off-campus partners

CTRE prides itself in working through interinstitutional teams with many partners outside of the ISU campus. CTRE has current projects and program level partnerships with governmental agencies, organizations at other universities, and the private sector.

CTRE works closely with several governmental agencies at the local, regional, and state level in Iowa and in many of the surrounding states, as well as with federal agencies. For example, a CTRE intelligent transportation systems (ITS) project to implement electronic procurement of motor carrier credentials involves Iowa and all the adjacent states plus Kansas, in addition to motor carrier associations and technology suppliers.

CTRE has had project level partnerships with several universities. Current projects include partnerships with the University of Northern Iowa, The University of Iowa, the University of Kentucky, Kentucky State University, the University of Nebraska at Lincoln, and Oregon State University.

CTRE’s most significant industry partners continue to be manufacturers and integrators of intelligent transportation systems (ITS). CTRE has projects and with partners involving proposals with a number of multi-national defense contractors, laboratories, and consultants.

Cal Grayson
University of Kentucky

Ed Payne
Kentucky State University

Greg Tomasic
Rackewell International Corporation

Plans for the future

In the last decade, CTRE has gone through a number of changes, evolving from a small extension organization to one of only eight Iowa State University centers with an annual cash flow exceeding four million dollars. As part of its coming of age, CTRE must work to become an even more critical part of the fabric of Iowa State University and of the university-based transportation community in the nation. This can be accomplished by expanding and evolving in three key areas:

• facilitating faculty involvement and faculty-based programs
• developing long-term partnerships with other external organizations
• diversifying CTRE’s expertise and sources of sponsorship

Clearly, development in these three areas will require a number of actions that will evolve over the next few years. We expect to see continued growth in CTRE programs by involving more faculty and by developing a larger CTRE staff with more diversified areas of expertise. A key development in the diversification of expertise will be building the Transportation Infrastructure Design and Development Division in 1997–98.

Center for Transportation Research and Education
To collect the data, motor carrier vehicles were equipped with specialized technology. In-vehicle equipment consisted of a GPS receiver and satellite communications transmitter fitted with an integrated single board computer (SBC), keyboard display unit, antenna, anemometer, odometer, sensor cable and power cable, all provided by Rockwell. The SBC provided the computing and memory resources necessary for the jurisdictional boundary database, the jurisdictional border crossing algorithm, and the collected vehicle travel event and mileage data.

The test was based on installing the prototype equipment in 30 commercial vehicles from six motor carriers encompassing various sized fleets and market segments. Two of the carriers were based in each of Iowa, Wisconsin, and Minnesota. As each vehicle traveled during the test, daily trip report (DTR) records were created and recorded by the onboard equipment. Each DTR contained vehicle history of starts, stops, border crossings, and other events and system exceptions.

The AMASCOT succeeded in proving the concept of automated mileage and route data collection and electronic filing for use in complying with commercial vehicle tax requirements. The project did not test electronic filing for registration apportionment, but because mileage reporting requirements are essentially the same as the test system, this project would work equally well for registration apportionment. Data collected and reported by the system were accurate as checked by participating state auditors. Auditors from Iowa, Minnesota, and Wisconsin took a test ride to see how the automatic data collection worked.

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Sampling of current ATTech Division projects

Concept highway maintenance vehicle
Partnering with the Iowa, Minnesota, and Michigan departments of transportation and several private companies, CTRE is incorporating existing and modified advanced technologies on highway maintenance vehicles and studying the effectiveness of these technologies for enhancing the efficiency and safety of winter highway maintenance operations.

Several project partners gathered at the Iowa DOT in May 1997 for a news conference to introduce the concept vehicle to the public. (From left): Wilfrid Nixon (University of Northern Iowa), John Whitnell (O’Halloran International), Greg Tomasic (Rockwell International), Tom Mazze (CTRE), Bob Kayser (O’Halloran International), Craig Cole (Rockwell International), Dave Stone and Duane Fosseen (Fosseen Manufacturing), Jim O’Halloran (O’Halloran International), Leland Smithson (Iowa DOT), Tim Simodynes (CTRE).

Midwest multistate one-stop electronic purchase of motor carrier credentials
CTRE is developing and managing this FHWA-sponsored development and operational test of a simple, low cost, and easily deployable electronic system to allow motor carriers to apply for and receive all necessary credentials or permits. The project also will evaluate the resulting effects on productivity for the motor carriers and eight states involved in the test.

Midwest CVO mainstreaming
The FHWA has initiated a “mainstreaming” program to move ITS/CVO from research, development, and testing to model deployment and then full deployment at the state and regional levels. Of the seven participating regional consortia, CTRE is coordinating the mainstreaming activities for the Midwest consortium led by the Missouri Department of Transportation.

Oregon green light evaluation
CTRE is assessing productivity, user acceptance, and institutional issues in connection with the test of mainline electronic screening of commercial vehicles in Oregon.

Des Moines ITS/early deployment study
Funded by the FHWA and the Iowa DOT, CTRE is identifying ITS functions that will be most beneficial to the safe and efficient movement of people and goods in the Des Moines metropolitan area.

Minnesota mainstreaming for automated roadside screening
As part of the FHWA’s mainstreaming initiative, CTRE is identifying and evaluating issues involved in incorporating ITS/CVO services, especially electronic screening, into a roadside commercial vehicle enforcement facility in Minnesota.

National Governors Association study of public sector costs and benefits of ITS/CVO
Partnering with Apogee Research, Inc. and Castle Rock Consultants, Inc., CTRE is preparing a cost-benefit analysis of state administrative processes for ITS/CVO in all 50 states.

Advantage I-75 evaluation
CTRE is evaluating the effects of electronically screening commercial vehicles at weigh stations on fuel use and weigh station throughput time and is developing a simulation plan for modeling traffic operations at weigh stations.

Vendor supplying equipment for the advanced technology maintenance vehicle:
- Bristol Company, Broomfield, Colorado — Material applicator
- Fosseen Manufacturing, Radcliffe, Iowa — Engine power booster
- Global Sensor Systems, Ontario, Canada — Reverse obstacle sensor
- Monroe Truck Equipment, Monroe, Wisconsin — Plows and spreader
- Normet Technology, Rud, Norway — Pavement friction measuring device
- O’Halloran International, Inc., Des Moines, Iowa — Truck vendor
- Roadway Corporation, Ontario, Canada — Pavement friction measuring device
- Rockwell International, Cedar Rapids, Iowa — Global positioning system
- Sprague Company, Canby, Oregon — Air/pavement temperature sensor
- Tri-State Signing, New Hampton, Iowa — High intensity warning lights
CTRE partners with Iowa DOT to develop GIS strategic plan

To promote and guide the development of GIS-T applications in the Iowa DOT, CTRE was enlisted to develop a GIS strategic plan for the department. During development of the strategic plan, a GIS coordinating committee (GIS-CC) was created to coordinate GIS efforts, provide GIS education, monitor GIS development, provide guidance for GIS database development, and make recommendations regarding GIS staffing and resource commitment at the Iowa DOT. CTRE continues to provide support and assistance for the GIS-CC activities as well as for GIS application design, data integration, coordination, implementation and training at the Iowa DOT. CTRE’s primary objectives were to ensure continuity of the Iowa DOT’s GIS program and assist the department in developing and fostering appropriate GIS tools and applications.

After the Iowa DOT’s GIS strategic plan was developed, the GIS-CC recommended a number of GIS pilot projects. The identified projects support ongoing efforts of the Iowa DOT and are conducive to the application of GIS. Four of these pilot project areas are project planning, wetland mitigation, access location identification, and accident and roadway/roadside features analysis.

Project planning
CTRE investigated the use of GIS with publicly available GIS data sets to develop and evaluate proposed highway and location alternatives. In general, it was found that data from public sources (like the National Wetlands Inventory and the Department of Natural Resources) can help the Iowa DOT’s official Project Planning (1) increases knowledge of a particular project at minimal cost and with soil, landscape, and wetland feature data to identify existing wetlands near current projects, identify potential sites for replacement wetlands, and monitor the replacement wetlands.

Access location identification
The Iowa DOT’s Maintenance Division classifies roadways according to level of access. CTRE developed a system, using GIS technology, that efficiently updates the access classification database and creates color-coded maps based on the six access classifications for the entire state, Iowa’s transportation regions, and individual counties and cities. Users can also retrieve attribute data from the access classification database by simply selecting a section of a roadway on one of the electronic maps.

Accident and roadway/roadside features analysis
The Iowa DOT has recently begun accumulating roadway safety features data with accident rates. CTRE developed a GIS database of spatially-based associated roadway safety features data (for the pilot project, guardrail locations) and accident locations in the Scott County, Iowa, area. GIS analysis and display capabilities were beneficial for understanding and evaluating the spatial relationships between different accident types and guardrail locations.

CTRE has developed a GIS database of associated guardrail locations and accident locations in Scott County, Iowa.

Geographic information systems data sets help planners identify roadside features.

Growth in the research and development needs of the Iowa DOT has been dramatic. Some TPS activities also have been sponsored by local and regional governments and the FHWA.

A key resource developed in the last three years is the division's GIS Transportation Laboratory. The GIS-T lab represents a significant resource in terms of computer and peripheral hardware and software.

Developing the Iowa DOT's transportation management systems and, more recently, integrating those systems has lately dominated the division's work. Included in the division's portfolio is the development of the statewide pavement management program. This includes:

- Developing a statewide GIS database to support pavement management and collecting pavement historical data and condition data for 23,000 lane-miles of highways.
- The TPS Division also supports significant outreach activities, both informally through advising and interacting with state, regional, and local governments, and formally through staffing the Iowa Geographic Information Council and the Midwest TRANPLAN Model Users Group.

CTRE’s GIS-Transportation laboratory is a resource for transportation managers and planners in Iowa and the Midwest.

GIS-T laboratory computer hardware and software

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<th>Software</th>
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<td>Intergraph TD-40, TD-200 work stations</td>
<td>Operating Systems</td>
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<tr>
<td>Intergraph Intermap work station</td>
<td>UNIX</td>
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<tr>
<td>Several state-of-the-art PCs</td>
<td>Windows 3.1</td>
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<td>CD-ROM reader and writer</td>
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<td>Hewlett-Packard DesignJet 650C plotter</td>
<td>MGe/MGA</td>
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<td>MGE/MGA</td>
<td>AML/Avenue</td>
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<tr>
<td>MFS-6000CX flatbed scanner</td>
<td>AtlasScript/C</td>
</tr>
<tr>
<td>Novell network with large on-line storage</td>
<td>AtlasScript/VB</td>
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<tr>
<td>Hewlett-Packard PaintJet XL300 plotter</td>
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The Iowa DOT’s primary objectives were to ensure continuity of the Iowa DOT’s GIS program and assist the department in developing and fostering appropriate GIS tools and applications.

After the Iowa DOT’s GIS strategic plan was developed, the GIS-CC recommended a number of GIS pilot projects. The identified projects support ongoing efforts of the Iowa DOT and are conducive to the application of GIS. Four of these pilot project areas are project planning, wetland mitigation, access location identification, and accident and roadway/roadside features analysis.

Project planning
CTRE investigated the use of GIS with publicly available GIS data sets to develop and evaluate proposed highway and location alternatives. In general, it was found that data from public sources (like the National Wetlands Inventory and the Department of Natural Resources) can help the Iowa DOT’s official Project Planning (1) increases knowledge of a particular project at minimal cost and with soil, landscape, and wetland feature data to identify existing wetlands near current projects, identify potential sites for replacement wetlands, and monitor the replacement wetlands.

Access location identification
The Iowa DOT’s Maintenance Division classifies roadways according to level of access. CTRE developed a system, using GIS technology, that efficiently updates the access classification database and creates color-coded maps based on the six access classifications for the entire state, Iowa’s transportation regions, and individual counties and cities. Users can also retrieve attribute data from the access classification database by simply selecting a section of a roadway on one of the electronic maps.

Accident and roadway/roadside features analysis
The Iowa DOT has recently begun accumulating roadway safety features data with accident rates. CTRE developed a GIS database of spatially-based associated roadway safety features data (for the pilot project, guardrail locations) and accident locations in the Scott County, Iowa, area. GIS analysis and display capabilities were beneficial for understanding and evaluating the spatial relationships between different accident types and guardrail locations.

CTRE has developed a GIS database of associated guardrail locations and accident locations in Scott County, Iowa.

Geographic information systems data sets help planners identify roadside features.

With soil, landscape, and wetland feature data to identify existing wetlands near current projects, identify potential sites for replacement wetlands, and monitor the replacement wetlands.

CTRE partners with Iowa DOT to develop GIS strategic plan

To promote and guide the development of GIS-T applications in the Iowa DOT, CTRE was enlisted to develop a GIS strategic plan for the department. During development of the strategic plan, a GIS coordinating committee (GIS-CC) was created to coordinate GIS efforts, provide GIS education, monitor GIS development, provide guidance for GIS database development, and make recommendations regarding GIS staffing and resource commitment at the Iowa DOT. CTRE continues to provide support and assistance for the GIS-CC activities as well as for GIS application design, data integration, coordination, implementation and training at the Iowa DOT.

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Improved employment data for transportation planning

CTRE is developing tools and protocols for using an already-collected set of Iowa non-farm employment data, local area labor supply data, and occupational labor demand projections to supplement Census Bureau data for transportation planning in Iowa. The result will be an ongoing, economical source of annual data. These improved employment data will allow transportation planners in Iowa to better model and predict transportation needs from both a commutator and business viewpoint.

Statewide, non-NHS, federal-aid-eligible pavement management program

CTRE is working with the Iowa DOT to develop a program to support the management, planning, and programming needs of Iowa’s transportation agencies, both at the project level and the program level.

Grain flow transportation planning model

CTRE is working with the Iowa DOT to develop a simulation model analyzing the impacts of grain flows within the state of Iowa due to changes in the transportation system, the level of transportation services, or grain market conditions.

Outreach Division

CTRE’s roots reside in outreach. Begun in 1983 as one of the FHWA-funded Rural Technical Assistance Programs (RTAP), the center was to provide transportation technical assistance and training to counties and cities smaller in population than 50,000. In the early 1990s, the RTAP program was broadened to include larger cities (up to 1,000,000 in population) and regional governments as clients, and the name of the program was changed to the Local Technical Assistance Program (LTAP).

In addition to LTAP, CTRE’s outreach functions have broadened to include a number of other activities. These include conferences, newsletters, and training programs that are prepared and presented by CTRE without LTAP support. In addition, because of the traditional link between outreach and traffic safety, all of CTRE’s safety programs are managed through the Outreach Division.

Local Technical Assistance Program (LTAP)

Most of the center’s LTAP activities are planned by a committee of the program’s clients (staff members from local and regional governments and the programs’ sponsors (the Iowa DOT and the FHWA). Often members of the planning committee participate in presenting the program (e.g., a workshop or state-of-the-practice report). The purpose of these committees is to make sure that the programs satisfy client needs. In addition, LTAP has a program-wide advisory committee that reviews the overall program and makes recommendations. An annual survey of clients, along with attendee evaluations at workshops, regularly informs the Outreach Division about the effectiveness of the LTAP program.

As Iowa’s LTAP center, CTRE is dedicated to helping Iowa’s local governments keep up with growing demands on local roads, streets, bridges, and public transportation. The center provides technical and management assistance to Iowa’s local transportation officials through a variety of activities:

- Frequent workshops, like this snow management workshop, in local garages, break rooms, or meeting halls.
- Safety Circuit Rider CTRE’s Safety Circuit Rider is a professional engineer who travels throughout the state presenting safety programs for local government employees at convenient facilities (e.g., break rooms, garages, and meeting halls). Initiated in 1990, this program won the Best Overall and Most Efficient Use of Resources award in the FHWA’s biennial safety competition.
Publications
CTRE publishes research reports and executive summaries for all center-sponsored research projects, as well as project newsletters, working papers for research in progress, and special documents like a history of laws involved with the Transportation Research Board. Most of the publications are available in print and on-line.

Safety programs
Accident Location and Analysis System (PC-ALAS)
CTRE's Safety Circuit Rider teaches classes to Iowa cities and counties on the use of PC-ALAS, a database of accident information. Accident data and reports from the database are available on CTRE's electronic bulletin board service.

Collision Diagram Software
CTRE is evaluating for the Iowa DOT several commercial software packages that develop collision diagrams for intersections. The accident data that drives these packages are normally entered manually, but CTRE is investigating ways of interfacing with the PC-ALAS database so that diagrams can be developed directly from this database.

Accident Reduction Factors
CTRE re-evaluated for the Iowa DOT the accident reduction factors used in evaluating safety projects. A database was developed to analyze crash reductions based on proposed safety improvements; the cost savings are used in benefit-cost evaluations.

Safety Management System
CTRE provides support to the Iowa Safety Management System (SMS) by providing short- and long-term solutions, products, and services.

Support of Iowa DOT's technology transfer programs
CTRE performs ongoing operations functions for the Iowa DOT, including training and education, development of databases, and other activities to support Iowa DOT's technology transfer and dissemination of information.

Transportation referral service
CTRE provides advice and assistance in locating funding sources, conducting literature searches, and linking organizations with top intellectual resources and specialized technical facilities and services. The center also provides technical expertise and advice for public and private transportation projects.

Sampling of ongoing Outreach Division projects
BBS
CTRE's electronic bulletin board system (BBS) provides toll-free access to local transportation agencies. Services include batch e-mail, news groups, postings of Iowa DOT job notices and bid information; spreadsheet templates, equipment specifications, electronic copies of data from the Iowa DOT (map databases, accident files, equipment specifications, etc.); AutoCAD files; and Web browser software that gives BBS users limited access to the World Wide Web through the BBS.

Satellite teleconferences
CTRE's annual satellite teleconferences on subjects as diverse as global positioning systems, traffic signal timing, and geographic information system applications attract audiences from Maine to California.

Many of CTRE's print publications are also available on-line.

In 1996 CTRE hosted several research focus groups. Consisting of representatives of Iowa's public, private, and academic transportation interests, the groups helped set the agenda for the Iowa DOT's sponsored research program.

In addition to programs falling under each of CTRE's three divisions, CTRE manages two other long-term activities: basic research agreements with state departments of transportation, and transportation education programs.

Basic agreement with the Iowa Department of Transportation
ISU's long standing partnership with the Iowa DOT goes back to the days of Armon Whitman, ISU's first dean of civil engineering and first chief engineer of the Iowa State Highway Commission. CTRE continues that partnership through CTRE's sponsored students and affiliated ISU faculty. The center also provides techni-cial expertise and advice for public and private transportation projects.

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Interdisciplinary Master of Science Degree in Transportation

The MS in Transportation degree at ISU is one of the few truly interdisciplinary transportation programs in the country. The degree includes three core fields: Civil and Construction Engineering, Transportation and Logistics (through the College of Business), and Community and Regional Planning (through the College of Design). In addition, the degree is supported by excellent ISU programs in economics, political science, industrial engineering, statistics, sociology, and psychology.

The Transportation MS degree is a select program that accepts only the most qualified students. The degree is research oriented, requiring students to write a thesis based on their self-designed program of courses. The number of students is limited to ensure all students have an opportunity to work closely with a faculty member on research.

A committee comprised of one faculty member from each of the participating departments supervises the degree program. Students are admitted through one of the three departments. The director of CTRE serves as the Civil and Construction Engineering faculty member on the supervisory committee, and is the chair of the Transportation MS degree program.

The Transportation MS degree integrates research portfolios sponsored through CTRE, and almost all the students enrolled in the degree program also hold graduate research assistantships with the center. Working on CTRE research projects enhances students' educational experiences and the interdisciplinary backgrounds of the students enrich the pool of graduate students available to work on CTRE research.

Graduate students in transportation have had backgrounds as varied as the degree itself, including bachelor degrees in business administration, engineering science, mechanical engineering, sociology, political science, industrial engineering, urban planning, and civil engineering. The diversity of students and faculty participating in the Transportation MS degree enriches the academic experience and allows students to see the strength of interdisciplinary approaches to planning, operating, managing, and maintaining the next generation of transportation systems.

MATC-sponsored Transportation Scholars program

The purpose of the Transportation Scholars program is to provide an enhanced educational experience for students accepted into the program, thereby attracting additional high-quality students into transportation-related disciplines. It is sponsored by the U.S. Department of Transportation’s University Transportation Center at the University of Nebraska at Lincoln (the Mid-America Transportation Center [MATC]).

This program preserves the core elements of the original program administered by the Midwest Transportation Center at ISU and continues to provide financial assistance for several ISU students. These students are required to work on research projects, take a semester seminar course to broaden their perspective of transportation, and participate in CTRE-sponsored student activities.

Transportation Seminar

One special feature of the Transportation Scholars program is the Transportation Seminar, presented weekly during the spring semester and featuring speakers with national and international reputations. Typically several transportation professionals from central Iowa attend the seminars along with the students.

The seminar is broadcast to remote locations via the Iowa Communications Network.

Transportation Scholars Conference

Another important feature of the Transportation Scholars program at ISU is a fall semester Transportation Scholars Conference involving only student presenters. During the conference, students present research papers written for the previous spring semester Transportation Seminar series, and the best paper is awarded a cash prize. Beginning with the fall 1996 semester, Transportation Scholars from other MATC consortium universities also participated in the conference and competed for the award.

The Transportation Scholars Conference provides scholars the opportunity to present their research to students from many disciplines as well as to professionals from the local transportation community.

The quality of students involved in CTRE’s educational programs is demonstrated by three research assistants who received prestigious Dwight David Eisenhower Fellowships in 1996 and 1997: Michael Anderson, Christopher Monsere, and David Preissig. Each year about 25 students nationwide receive Eisenhower Fellowships to pursue graduate studies in transportation-related fields.

Anderson (BSC ‘94, University of Denver-Marcy), received a two-year master’s fellowship to study the application of intelligent transportation systems (ITS) to expedite movement of selected commercial vehicles at border crossings. Preissig (BSC ‘96, Iowa State University) received a two-year master’s fellowship to develop a statewide freight model simulation using GIS.

The Eisenhower Fellowship program is administered by the U.S. Department of Transportation.
**Getting the word out**

CTRE uses a variety of avenues to disseminate research results and other information collected or developed through the center's activities. In addition to sponsoring regular training workshops and technical conferences, the center publishes a biannual newsletter, project reports and working papers, and journal articles. Many center staff regularly present at national conferences, and their papers are published in proceedings. Together with the Iowa DOT, the center sponsors a biennial research conference for which it publishes proceedings. Many of these documents are published on-line.

### CTRE en route

The center's new newsletter offers a comprehensive overview of the center's projects and new developments, which often parallel changes and developing needs in the transportation world.

### Biennial conference

In 1996 CTRE, along with the Iowa DOT, sponsored a national research conference that attracted more than 300 researchers and practitioners and featured national figures like Robert E. Skinner, Jr., executive director of the Transportation Research Board; Dr. Thomas Larson, former administrator of the Federal Highway Administration and former chair of the Strategic Highway Research Program Executive Committee; Damin Kulash, president and CEO of the Eno Transportation Foundation, Inc.; and former executive director of the Strategic Highway Research Program and Francis Francois, executive director of the American Association of State Highway and Transportation Officials. The conference will become a biennial event.

### World Wide Web publishing

On-line publishing is fast improving our clients' and sponsors' access to information available from CTRE, including project reports, conference proceedings, project and center newsletters, downloadable data and software, special pages for specific projects, and many other resources. See [http://www.ctre.iastate.edu/](http://www.ctre.iastate.edu/)

### Reports, papers, and conference presentations

Every CTRE project has a final report, and many have separate executive summaries. These reports are reviewed by other researchers in the appropriate field and professionally edited and published for a uniformly quality product. New CTRE project reports are also being published on-line as they are completed.

### From its roots as Iowa's local transportation technology transfer center, CTRE has developed expertise in research areas that didn't exist even a few years ago—intelligent transportation systems, geographic information systems, transportation systems management, etc.—and has positioned itself to help identify and respond to the transportation challenges of the future. Undoubtedly CTRE will continue to grow, and its growth will be based on serving the ever-evolving needs of the transportation community.