SAFETEA-LU Sponsored

INTELLIGENT TRANSPORTATION SYSTEMS (ITS) INSTITUTE STRATEGIC PLAN

CENTER FOR TRANSPORTATION STUDIES

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I. PROGRAM OVERVIEW

The Program Overview section of the strategic plan provides a contextual basis for understanding the objectives and activities described in Section II – Program Activities.

Within this section the following subjects are discussed:
• Theme Statement – indicates the nature of the center and communicates the scope of the ITS Institute.
• Director’s Summary – provides a vision of what the Institute will be at the end of the grant.
## Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AC</td>
<td>Asphalt Concrete</td>
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<tr>
<td>CTS</td>
<td>Center for Transportation Studies</td>
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<tr>
<td>DGPS</td>
<td>Differential Global Positioning System</td>
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<td>FDLTCC</td>
<td>Fond du Lac Tribal and Community College</td>
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<tr>
<td>HUD</td>
<td>Head-Up Display</td>
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<tr>
<td>HumanFIRST</td>
<td>Human Factors Interdisciplinary Research in Simulation and Transportation</td>
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<tr>
<td>IGVC</td>
<td>Intelligent Ground Vehicle Competition</td>
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<td>ISTEA</td>
<td>Intermodal Surface Transportation Efficiency Act</td>
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<td>ITS</td>
<td>Intelligent Transportation Systems</td>
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<td>IV</td>
<td>Intelligent Vehicles</td>
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<td>LTAP</td>
<td>Local Technical Assistance Program</td>
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<td>LVR</td>
<td>Low-Volume Road</td>
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<td>Mn/DOT</td>
<td>Minnesota Department of Transportation</td>
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<td>MnROAD</td>
<td>Minnesota Road Research Project</td>
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<td>NATSRL</td>
<td>Northland Advanced Transportation Systems Research Laboratories</td>
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<td>PCC</td>
<td>Portland Cement Concrete</td>
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<tr>
<td>REU</td>
<td>Research Experiences for Undergraduates</td>
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<td>RITA</td>
<td>Research and Innovative Technology Administration</td>
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<tr>
<td>SAFETEA-LU</td>
<td>Safe, Accountable, Flexible, Efficient Transportation Equity Act</td>
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<tr>
<td>TEA-21</td>
<td>Transportation Equity Act for the 21st Century</td>
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<tr>
<td>TRB</td>
<td>Transportation Research Board</td>
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<td>UMD</td>
<td>University of Minnesota, Duluth</td>
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<td>UROP</td>
<td>Undergraduate Research Opportunities Program</td>
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<td>USDOT</td>
<td>United States Department of Transportation</td>
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<td>UTC</td>
<td>University Transportation Center</td>
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<td>VESTR</td>
<td>Virtual Environment for Surface Transportation Research</td>
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<tr>
<td>WIM</td>
<td>Weigh in Motion</td>
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The theme of this center is **Human-Centered Technology to Enhance Safety and Mobility**.  

The University of Minnesota’s SAFETEA-LU-sponsored National University Transportation Center (UTC) is the Intelligent Transportation Systems (ITS) Institute, a program within the Center for Transportation Studies (CTS). The scope of the Institute is to enhance the safety and mobility of road- and transit-based transportation through our focus on human-centered technology.

We will expand on work that began under our ISTEA-authorized center and continued under TEA-21: to pursue research in safety-critical technologies and systems for efficiently moving people and goods. Our efforts bring together the technologists with those who study human behavior. This strategic partnering ensures that Institute-developed technologies become tools to optimize human capabilities. By using a human-centered approach, new developments in our core ITS technologies of computing, sensing, communications, and control systems are used to approach significant safety and mobility problems with a fresh perspective.

With our theme as our common focus, the ITS Institute will pursue research in a) human performance and behavior, b) computing, information, and communication, c) sensing and measurement, d) technologies for modeling, managing, and operating transportation systems, and e) social and economic policy issues related to the above technologies. In addition, our geographical location gives the ITS Institute a unique advantage. In pursuing our theme-related research, we have the opportunity to develop transportation research that is applicable in our northern climate and rural areas.

Minnesota is nationally recognized as a leader in the development and application of intelligent transportation systems and technologies. Part of our success is due to the established and unparalleled partnership of the ITS Institute, CTS, and the Minnesota Department of Transportation (Mn/DOT). We are committed to continuing and improving this partnership in the future.
C. DIRECTOR’S SUMMARY

First, a brief discussion of several important trends:

- For all the talk about safety improvements in vehicles today, the statistics are still daunting. Fatalities on U.S. roads did indeed drop through the 1980s, but from 1991 and on, they have essentially hovered at around 42,000. That is well over 100 fatalities a day. More than 60 percent of the fatalities in the United States occur on rural roads; in Minnesota, rural fatalities represent an even higher fraction of the total (over 70 percent). Driver inattention, fatigue, and distractions are primary causal factors. The fatality rates for rural roads per 100 million vehicle-miles traveled are two and one-half times the urban rate. While interstate highways have proven to be relatively safe, what about the other roads in our network?

- Safety also means keeping our roads open and clear in the winter. Not only do we benefit from the savings in human lives, but we also benefit economically when our rural roads are kept open for the passage of goods and services.

- In the U.S., those 55 years and older make up the largest and fastest growing segment of the population. By 2020, it is estimated there will be 51 million drivers over the age of 65. The ability to drive is a powerful agent of freedom, and aging drivers introduce specific transportation issues. We need to address these issues.

- Over the last decade, approximately 6,000 teenagers have died on our nation’s roads each year. In many states, teen drivers represent the demographic group with the highest fatal crash risk. For example, data from 2004 shows that despite teenagers making up only 4.7 percent of all licensed drivers, they accounted for 11.3 percent of all passenger vehicle driver deaths.

- Traffic congestion is a problem in urban areas around the world. The population in the Twin Cities, for example, is expected to grow by 650,000 by 2020. This will increase the number of daily trips by more than 25 percent, and the number of miles of severe congestion will more than double by 2020. Fifteen billion dollars over the next 20 years would be needed to “build” ourselves out of congestion, and this does not include the social and institutional side of the issue.

- Approximately 25 percent of all traffic congestion is “non-recurring” and can be traced to traffic incidents. Non-recurring congestion continues to increase nationally, exceeding 2.9 million hours annually. On average, every minute during which a freeway crash is not cleared generates five minutes of delay for motorists. Consider then the impact on congestion of the nearly 11,000 crashes that occurred on Twin Cities metro area freeways in 2004.
We all know that current approaches cannot be sustained. We need new solutions. Where are we heading as we move into the next century? There is inadequate room here to describe the overwhelming changes that are taking place.

Although GPS receivers and various forms of location-based services are quickly becoming ubiquitous, today they are mostly limited to cellular phones and expensive navigation systems. The capability of “one meter” correction service for differential GPS, although available across all of Minnesota through the National DGPS Service, is hardly exploited. More than half of Minnesota has centimeter-level DGPS correction services, but these are primarily used by surveyors. Why can’t we exploit this capability to reduce rural lane-departure fatalities that represent more than one third of all fatalities? Our experience with lane-assist technologies developed in previous years on snowplows and buses tells us that a solution is possible.

The crash rate for teens is particularly high during their first 1,000 miles of driving. We believe that in-vehicle smartphones incorporating GPS, digital maps, and a speed limit database can be used to provide better feedback to improve teen driving behavior during this period, especially when coupled with immediate consequences introduced through a Graduated Driving Licensure that takes advantage of such new tools. Such smartphones can disable phone conversations while the vehicle is moving.

Many safety and traffic management applications can be significantly improved by taking advantage of vehicle position sensing with lane-level accuracy. These include rear-end collision avoidance such as emergency electronic brake light systems, lane change and merge assistance, traffic signal priority and violation warning, corridor and incident management, and congestion pricing. New sensor technologies are needed in urban areas, since higher accuracy GPS is not possible where there are limited satellite availability and errors due to multipath. We are working to develop such new sensors and the mechanisms to exploit this capability.

Wireless technology in its many forms will broadly affect transportation. Vehicle-to-vehicle, vehicle-to-infrastructure, and infrastructure-to-vehicle communications and wireless sensor networks will enable new collision-avoidance capabilities, improved traveler information, and better congestion management, especially when coupled with accurate vehicle position sensing.
Congestion mitigation requires better incentives to move drivers from their cars to transit. That will not happen if transit cannot provide a distinct advantage for travelers to get to their destination faster than the automobile stuck in traffic. Sensor-based guidance can provide feedback to bus drivers so that they can use road shoulders (often narrower than standard lanes) to bypass congestion. We have demonstrated such functionality on prototypes and will continue to improve the functionality of the systems.

Clearly, trends in communications, computing, sensing, and control systems will lead us into a radically new world. The questions that we must consider: How will these technologies contribute to a reduction in fatalities? To a reduction in injury? To a reduction in driver stress to reduce congestion? In the past, we have talked about technology leading to automated highways on a national level. The problem is that we are not talking enough about technology leading to safer transportation systems and approaches to congestion mitigation that accommodate many modes of transportation and reduce the stress of the traveler.

Based on the strong foundation developed to date by the ISTEA- and TEA-21-authorized ITS Institute, we now transition to the SAFETEA-LU-sponsored center. The ITS Institute made significant headway in developing a strong research program. Not only will we continue these research efforts, we will move forward to expand our education and outreach activities as well.

The goals and activities outlined in the subsequent sections provide an overview of the Institute’s direction and the processes to carry this program forward. In addition to those goals and activities, the following six goals cut across all our efforts. They will help define the Institute:

- Leverage past research successes
- Develop strategic partnerships
- Pursue rural initiatives
- Pursue research addressing transit needs
- Increase human resources
- Enhance use of technology to improve ITS education

**Leverage Past Research Successes**
We have demonstrated the use of DGPS for lane keeping and other driver-assistive technologies.
We need to get travelers out of their large vehicles and into smaller cars. We believe that it is possible for two vehicles to share a standard lane side-by-side, thus doubling the road capacity. Our researchers have demonstrated a new technology that allows a narrow half-lane-width vehicle to negotiate turns safely without requiring the skills of a motorcyclist. Imagine a safe vehicle half the width of the Daimler Chrysler “Smart” Car.

We have developed technology that allows a police officer to remotely operate a miniature hand-launched airborne vehicle to investigate a traffic incident using synthetic imagery. We are working on using such devices as a high-accuracy sensor platform.

Our researchers have extensively studied the nature of freeway crashes. They have identified specific crash types and causal factors associated with such crashes, using the new ITS Institute Beholder sensor suite deployed at a number of sites along the I-94/I-35W “commons” area. They determined that many drivers exhibit reaction times longer than their following headways. As a result, relatively small individual differences in following distances, reaction times, speeds, and decelerations determine whether or not a stopping shock wave results in a collision. This is exacerbated by driver distraction. Furthermore, drivers often maintain relatively short following distances in order to discourage others from merging in front of them. Because short following headways translate into higher traffic flows, one could argue that short headways make more effective use of limited freeway capacity. Unfortunately, our findings also suggest that short headways often lead to a disproportionate number of crashes for the drivers following upstream. As Professor Gary Davis has indicated, “Reducing the frequency of such collisions— for example, by improving the competency of drivers or deploying in-vehicle collision-avoidance technology—could help reduce travel delays without resorting to expensive additions to highway capacity.”

We will continue to work on such efforts and will expand into other related areas using the knowledge gained from these successes. We believe our research will make a difference.

The Institute will consider issues related to the seven high-priority application areas within the context of the Institute’s theme; it is within these areas that our research, education, and outreach will be focused. The seven categories are:

• Fatality and crash reduction
• Traffic management and congestion mitigation
• In-vehicle and driver-assistance technologies
I. PROGRAM OVERVIEW

The University of Minnesota ITS Institute will be a national resource for education, research, and information in the areas outlined here, and it is this reputation that will allow us to sustain our efforts beyond the end of the grant period.

Strategic Partnerships
Another success of the ISTEA- and TEA-21-sponsored Institute is the formation of several strategic partnerships, most notably with the Minnesota Department of Transportation (Mn/DOT). In addition to our partnership with Mn/DOT, the Institute will pursue partnerships with cities, counties, the Minnesota Department of Public Safety, and other government agencies and industry, along with internal partnerships within the University of Minnesota. Strategic partnerships will provide the mechanism to share information, develop technology, deploy the research results, and conduct field operational tests. We are committed to continuing and expanding these important partnerships.

We have identified other possible partners that relate to our Rural Initiatives and Transit-Based Research goals. These partnerships are described below, in the respective sections.

Rural Initiatives
While the Institute will continue to consider issues related to urban areas, we will also continue our work to develop technologies that meet the needs of rural areas, both in Minnesota and in other parts of the country. For example, we are working with Polk County in northwestern Minnesota, with the Alaska DOT, and with the National Park Service.

Fatalities at rural unsignalized intersections are a major problem, especially of older drivers. We are currently collecting driver gap-acceptance behavior in nine states that will allow us to improve the sensing technologies and methods for communicating to stopped drivers on the minor road when it is safe or unsafe to enter the intersection. With additional support of the USDOT and the Cooperative Intersection Collision Avoidance Systems (CICAS) program, we will expand this research, leading to a field operational test of these new technologies.
For such applications, the Institute will build upon its work in human factors, sensors, lateral guidance, collision warning and avoidance, wireless systems, driver-vehicle interfaces, and infrastructure-based communication interfaces.

As stated in the previous sections on research and partnerships, our vision is that successful demonstration of our research “products” will ensure that our efforts in the rural arena will be sustainable at the end of the grant. However, more importantly, we feel our research will lead to reductions in fatalities and crashes on rural roads.

**Transit-Based Research**

The Institute is committed to multimodal ITS research: our research activities will encompass both road- and transit-based transportation. We have developed successful partnerships with the Twin Cities’ Metro Transit and with the Federal Transit Administration. We will expand these relationships to other transit agencies such as the Minnesota Valley Transit Authority, building on our human factors, driver-assistive technologies, sensors, wireless communications, and traffic management experience. Research will continue to build upon our previous experience in order to exploit the road shoulders as a means to provide high-speed bus rapid transit, and to provide new, more efficient mechanisms that facilitate transit signal priority without overly burdening adjacent traffic.

As we determine the needs of transit-related stakeholders, the Institute will move forward to develop research that addresses such needs. We envision that the Institute’s research, education, and technology transfer efforts will be an important link in not only the Twin Cities’ efforts to reduce congestion, but in other urban areas as well. We will work to find commercial partners with whom to develop “products” that are sustainable after the grant.

**Increased Human Resources**

In order to meet the needs of the Institute’s public partners, address shorter term needs, leverage faculty resources, and fill in the valleys when students graduate, the Institute is committed to maintain its professional staffing level and modestly increase it where necessary. Our new traffic laboratory located in the civil engineering department will shortly hire a new director.

Besides the University’s agreement to provide a one-third match to the UTC funds, the University of Minnesota will continue to increase the faculty size committed to the core science and
technologies of the Institute. This year, the civil engineering department is conducting a search for a new faculty member. This additional faculty member will be involved in the Institute’s education and research efforts. The additional faculty will not be directly tied to the grant funding and thus will be sustained by the University at the end of the grant.

**Enhance Use of Technology to Improve ITS Education**

Education in intelligent transportation systems requires access to vehicles and to traffic. However, such access is not easy, and given the students’ lack of experience would likely be dangerous to the public. We are committed to develop and expand our capabilities in real-time traffic and vehicle dynamics simulation in order to provide students with the ability to experiment with the latest traffic control, vehicle guidance, and sensor processing methodologies using high-fidelity graphic simulation. This goal will also allow us to expand our ability to provide opportunities for distance learning to professionals who may not be able to come to ITS Institute laboratories.
II. PROGRAM ACTIVITIES

The ITS Institute must plan and conduct activities that further the mission and goals of the United States Department of Transportation’s (USDOT) University Transportation Center (UTC) program.

Mission of the UTC Program:
To advance U.S. technology and expertise in the many disciplines comprising transportation through the mechanisms of education, research, and technology transfer at university-based centers.

The UTC Program’s goal areas are:
• Research Selection
• Research Performance
• Education
• Human Resources
• Diversity
• Technology Transfer

The six goals of the program, along with the Institute’s activities to be undertaken to achieve these goals, are discussed in this section.
A. RESEARCH SELECTION

Goal
An objective process for selecting and reviewing research that balances multiple objectives of the program.

Program Outcomes
The ITS Institute will select research through the use of:

Selection Criteria
Selected research will be consistent with the Institute’s theme and application areas described later in this section. To best meet the needs and goals of the changing transportation environment while setting and attaining goals of unique importance in terms of safety and mobility, our application areas may change over the life of the grant. The selected research will represent the dynamic application areas and support the national strategy for surface transportation research.

Selection Process
The selection process will utilize committees of key stakeholders, professionals, and academic peers to recommend an annual research program.

A phased selection process will include:
• A five-page proposal, with literature review and researcher qualifications
• Selection committees of key stakeholders and external peer reviewers
• A refined research work plan for those proposals selected for funding that incorporates feedback from peer reviewers

Balanced Research Program
A cornerstone of the research selection process is a balanced research program. The balanced program will encompass the following elements:
• Research in several of the Institute’s application areas
• Basic, advanced, and applied research
• Strategic partnerships and new initiatives

Program Activities
The Institute will support the national research, development, and technology priorities of the USDOT. Consistent with these priorities, the ITS Institute will pursue research that:
• focuses on safety and mobility
• considers human-centered technology
• relates to road- and transit-based transportation
II. PROGRAM ACTIVITIES

The Institute will encourage research in the following sciences and technologies that we consider to be ITS components:
- human performance and behavior
- computing, information, and communications
- sensing and measurement
- technologies for modeling, managing, and operating transportation systems
- social and economic policy issues related to the above technologies

The matrix provided in Appendix A shows how the Institute’s research in these science and technology areas relate to the USDOT priorities.

The above list of the Institute’s science and technology areas attempts to address the following seven high-priority transportation application areas of ITS:
- fatality and crash reduction
- traffic management and congestion mitigation
- in-vehicle and driver-assistive technologies
- maintenance and operations
- transit applications
- rural applications
- societal issues – only when they relate to the above

In addition, our geographical location gives the ITS Institute a unique advantage. In pursuing our theme-related research, we have the opportunity to develop transportation research that is applicable in our northern climate.

To achieve our program outcomes for research selection, several major activities will be undertaken.

**Selection Criteria**
The ITS Institute will select multiple types of research that meet the needs of many stakeholders. The different research approaches that will be supported include:
- science that addresses the Institute’s theme
- future-oriented research that expands the frontiers of knowledge
- application-oriented research with advances in theory

For all research approaches, defined selection criteria will be followed. Among other criteria, the research will be selected based on:
- Relevance to the Institute’s theme
- Potential for solution of significant transportation problems
Selection criteria will be developed that outline the salient elements required of each research project. As part of the development of the criteria, a rating system will be determined. The rating system will complement the criteria and will be used by the selection committees during the selection process. The criteria will be reviewed each year to ensure that they align with the Institute and the dynamic transportation environment and meet the objectives of the program, and will be distributed to all individuals who anticipate submitting proposals. The criteria will reflect the Institute’s theme and application areas and support the national strategy for surface transportation research as identified in the report by the National Highway Research and Technology Partnership entitled *Highway Research and Technology: The Need for Greater Investment* ([http://gulliver.trb.org/publications/rtforum/HwyRandT.pdf](http://gulliver.trb.org/publications/rtforum/HwyRandT.pdf)) and the programs of the National Research and Technology Program of the Federal Transit Administration ([http://www.fta.dot.gov/26_ENG_HTML.htm](http://www.fta.dot.gov/26_ENG_HTML.htm)).

**Selection Process**

The selection process will utilize committees of key stakeholders, professionals, and academic peers to recommend an annual research program.

A five-page proposal submittal and a literature review will be required. This submittal will identify the research idea and discuss the anticipated outcome. The proposal should show that the investigator is familiar with the problem area; therefore, communication with relevant professionals in the field is important. The proposed research approach must be unique, and a sound methodology defined to address the problem.

The selection committees will be a critical component of the research selection process. Committee members will be experts in their fields and well-versed in current activities that are germane to the Institute’s theme and application areas. Our goal will be to select committee members who are unbiased and objective, and who understand research. Applicants for funding will not sit on selection committees. At least one USDOT representative will be a member of the committee making final selection recommendations.
The selection committees will comprise local and national stakeholders and external peer reviewers representing the public, private, and academic sectors. The selection committees will review and rate proposals using the prescribed selection criteria. The director of the ITS Institute will use rankings generated by the selection committees to recommend an annual program for research funding to the ITS Institute Board.

After a research program is selected, a refined research work plan will be submitted for each selected project. Comments from the selection committees will be distributed to each principal investigator receiving funding. The principal investigators will address these comments in the refined work plan.

Sustained, specialized programs, such as UMD’s NATSRL program and the ITS Institute’s policy program at the Humphrey Institute of Public Affairs, will utilize similar selection processes; however, the timing of the process may vary by program.

**Balanced Research Program**

As summarized earlier, a cornerstone of the selection process is a balanced research program encompassing several application areas, various types of research approaches, strategic partnerships, and new initiatives.

The balanced research program will encompass the following elements:
- Research in several of the Institute’s application areas
- Basic, advanced, and applied research
- Strategic initiatives and partnerships

Selected research will be consistent with the Institute’s theme and application areas. To best meet the needs and goals of the changing transportation environment, our application areas may change over the life of the grant. Selected research will include several of the Institute’s dynamic application areas.

The Institute recognizes the value of research performed within various stages of knowledge development and innovation. Our research program will strive to include basic, advanced, and applied research approaches. For purposes of categorizing various research approaches, the following definitions will be utilized: Basic research is considered to be the study of phenomena and of observable facts, without specific applications toward processes or products in mind; the primary purpose is to increase knowledge. Advanced research is considered to be research that involves and
draws upon basic research results to provide a better understanding of phenomena and develop innovative solutions--sometimes referred to as exploratory research in order to convey its more fundamental character, its broader objectives, and the great uncertainty in expected outcomes compared to problem-solving research; the primary purpose is to advance the state of knowledge and suggest potential future applications. Applied research is considered to be the study of phenomena to gain knowledge or understanding necessary for determining the means by which a recognized need may be met; the primary purpose is to answer a question or solve a problem.

Strategic partnerships are key to the success and sustainability of the Institute. Proposals displaying strategic initiatives and partnerships (those that bring funds and other resources to the Institute) along with potential for significant innovations in science and technology, will receive a higher consideration for funding.

**Process to Document Performance Indicators**

Upon selection, research projects will be categorized as either basic, advanced, or applied using the definitions provided in this section of the strategic plan, and the total budgeted costs for those projects will be summarized. The baseline information shown in the Appendix was gathered in this manner, and it will be updated for each year of the grant period using this process.
II. PROGRAM ACTIVITIES

Research Performance

B. RESEARCH PERFORMANCE

Goal
An ongoing program of basic and applied research, the products of which are judged by peers or other experts in the field to advance the body of knowledge in transportation.

Program Outcomes
At the end of the grant, we envision the Institute’s research performance program to consist of the following components:

**Peer Review**
The backbone of our research performance outcomes is the Institute’s external, merit-based peer review process. Our process will encompass peer reviews at key project milestones. In addition, research may be guided on an informal basis by local experts and stakeholders.

**Researcher Development**
In order for the researchers to perform quality research, they must have opportunities to exchange information and learn from other experts. The Institute’s researcher development programs will facilitate information exchange and focus on collaborating with researchers around the world.

**Research Products**
In order to advance the body of knowledge in transportation, the Institute’s researchers must produce products that can be shared. The Institute recognizes the importance of peer-reviewed reports, books and research papers, journal publications, peer-reviewed conference proceedings, patents, licenses, demonstrations, and presentations as research products that can be used as a tool to share knowledge.

Program Activities
The Institute is committed to external, merit-based, peer-reviewed research. We want to perform research that will provide results and will advance knowledge in transportation. We want our researchers to inform and to be informed.

The Institute will reach our research performance outcomes by developing the following activities:

**Peer Review**
Every Institute-sponsored research project will be subject to an external peer review. The Institute’s peer review process is multifaceted to provide meaningful and timely input into the research project.
For projects co-funded by the Minnesota Department of Transportation (Mn/DOT) or the Minnesota Local Road Research Board, the peer review includes a technical advisory panel (TAP) that participates in the research review. The principal investigator, sponsoring agency Technical Liaison, and Institute staff determine the TAP members. These TAPs vary in size, depending on the scope and research project topic, but generally consist of at least four transportation professionals from state and local agencies and consulting firms.

For research projects funded only by the Institute, the principal investigator of each research project, in consultation with the director of the Institute, will select external peer reviewer(s) to review research progress and findings throughout the life of the project. Peers will be selected from other research universities and agencies as appropriate and will be reviewed to ensure that no conflict of interest exists. The selected peer reviewer(s) will conduct reviews during, but not limited to, the following project milestones:

• Project start-up, to review and make suggestions on the research work plan
• At least once during the duration of the project, to provide feedback on research progress
• At the end of the project, to provide comments on the final technical report

In some instances, Institute-funded research cannot adequately be peer reviewed by local professionals or by a large number of peers, due to the complex and unique nature of the research. Our process of seeking out highly qualified and engaged reviewers will ensure that even with one key peer reviewer, the research performed will be of the highest standard. In addition, many Institute-funded research projects result in journals, conference proceedings, and similar highly regarded academic publications that incorporate extensive peer reviews. These reviews are in addition to the Institute-coordinated project peer reviews described above.

In addition to external peer reviews, some research projects may also be guided on an informal basis by local agency professionals and other stakeholders. These individuals will play an important advisory role for projects having strong connections to our partners.

**Researcher Development**

Researcher development will center around two core activities: collaborating with other researchers and hosting periodic theme-based meetings.
Collaboration
Institute researchers can benefit from sharing information and knowledge and building relationships with their counterparts both nationally and internationally. In this global society, collaborating with other researchers is critical to addressing the high-priority transportation application areas of ITS previously identified. To this end, the Institute will create a travel award program to encourage researchers to travel to share knowledge and build relationships that will lead to future project collaboration and external funding to support the Institute’s program. Researchers will apply for a travel award and will be selected based on the anticipated benefit to the Institute. Researchers will be required to summarize the results of the trip in a report to the Institute.

Periodic Theme-Based Meetings
While it is important to connect with experts throughout the world, it is also important for the Institute’s researchers to interact with each other. To facilitate multi-departmental interaction, the Institute will coordinate periodic theme-based meetings focusing on high-priority research topics. These meetings will provide a forum for faculty and staff to discuss their research and a mechanism to form strategic partnerships among the various researchers.

Research Products
The Institute will encourage researchers to develop a means to share their research findings through technical research reports, conference presentations and proceedings, archival journals, or other means.

The Institute will play a role in the development of various research products and will aid researchers in sharing their research outcomes.

Another, more specialized method that may be used to share information, is targeted demonstrations of new technologies. Public, private, and academic representatives will be invited to demonstrations at appropriate events to learn about the technologies and future research and deployment opportunities.

Process to Document Performance Indicators
The Institute will collect information on project-specific publications and presentations from our faculty and staff on a quarterly basis, using a Web-based reporting interface to populate a database hosted and maintained by CTS. The Institute will also use a questionnaire, filled out by our faculty and staff on an annual basis, to collect information on all other ITS-related publications.
and presentations. Last, Institute staff will publish final technical research reports for Institute-funded projects. The baseline data shown in the Appendix was gathered in this manner, and it will be updated for each year of the grant period using this process.
C. EDUCATION

Goal
A multidisciplinary program of course work and experiential learning that reinforces the transportation theme of the Institute.

Program Outcomes
The University of Minnesota and the ITS Institute will continue to be a premier source for education, research, and information in our core ITS technologies, with particular emphasis on the human element. This will be achieved through our program outcomes:

Educational Initiatives
The purpose of the educational initiatives is to enhance the educational experience of both undergraduate and graduate students. Our activities will include a graduate-level seminar series, ITS curriculum development, undergraduate research, and support of student participation in competitions. These initiatives will increase the awareness of, and interest in, our core ITS science and technologies.

Master’s- and Ph.D.-Level Graduates with ITS Research Experience
The programs supported by the Institute will provide graduate students with experience using ITS technologies. We will continue to encourage researchers to include master’s- and Ph.D.-level students in ITS research projects in order to train them in our focus and theme areas.

Student Awards
The Institute will continue to honor outstanding students in ITS-related areas of study. An annual outstanding student of the year award will be granted, as well as multiple travel awards for students to attend ITS-related conferences.

Program Activities
To remain a premier source for education, research, and information in our core ITS technologies, we will meet our program outcomes through the deployment of several activities

Educational Initiatives
The purpose of the educational initiatives is to enhance the educational experience of both undergraduate and graduate students. These initiatives will increase the awareness of, and interest in, our core ITS science and technologies.

Several educational initiatives have been identified, and are explained below.
Advanced Transportation Technologies Seminar Series
We will continue the Advanced Transportation Technologies Seminar Series. The semester-long program will be available for University credit for master’s-level students to learn more about research focusing on ITS topics. Practitioners will also be invited to attend the seminars.

The series will highlight ITS-related research underway both at the University and around the country. The series will provide updates on research projects in the ITS Institute's core science and technology areas—human factors, intelligent vehicles, traffic modeling and management, sensing, communications, and controls. Each seminar will be recorded and posted to the Institute’s Web site for worldwide viewing.

Institute leadership will work closely with its faculty and staff and the various academic departments that support the Institute to plan the seminar content each year, and we will utilize both academic and industry representatives to serve as speakers. To ensure that the course remains up-to-date with new technological developments, we will frequently evaluate the seminar series and make enhancements as necessary.

ITS Curriculum Development
The Institute will continue to expand educational tools for ITS-related courses, such as those that have been developed for vehicle guidance and transportation engineering. Potential future development includes computer-based simulation tools to enhance transportation-related education and Web-based access to traffic and vehicle simulations.

Integrate ITS Into Current Courses or Programs
Institute staff will explore the opportunity to integrate ITS-related research topics into current courses or programs to encourage students to pursue a transportation degree, and more specifically, an ITS-related degree.

Staff will explore other opportunities for undergraduate students, such as the Research Experiences for Undergraduates (REU) sponsored through the National Science Foundation, to introduce students from across the nation to the depth of ITS programs available within the Institute and at the University. Not only will students in the programs be introduced to ITS, they will also be encouraged to attend the University of Minnesota for future ITS-related studies.
Undergraduate Research
Another important educational initiative is the use of undergraduate students in ITS research. Funding will be available to supplement ITS-related projects with undergraduate assistants. We will work with faculty to identify undergraduate students interested in working on ITS-related research projects.

We will also explore the possibility of bringing ITS-related opportunities to undergraduate students utilizing the current University of Minnesota Undergraduate Research Opportunities Program (UROP).

Student Competitions
The Institute will support experiential learning by providing funding for student teams to participate in various ITS-related competitions. The competitions give students the chance to apply ITS applications to various situations while participating in a team environment. One such competition is the International Intelligent Ground Vehicle Competition (IGVC). Support of teams will depend on student interest and ability to meet competition requirements.

Master’s- and Ph.D.-Level Graduates with ITS Research Experience
Research is an excellent tool for educating our future professionals about today’s technical boundaries and where we might stretch the envelope tomorrow. A typical four-year undergraduate program is not sufficient for the increasingly complex technologies currently being developed. By providing and supporting research opportunities for graduate students, we are strengthening their ITS foundation and contributing to a trained ITS workforce.

The programs supported by the Institute will provide graduate students with experience using ITS technologies. We will continue to encourage researchers to include master’s- and Ph.D.-level students in ITS research projects in order to train them in our focus and theme areas.

Student Awards
The Institute will continue to honor outstanding students in ITS-related areas of study. We will grant an annual Student of the Year award, as well as multiple travel awards for students to attend ITS-related conferences.
Outstanding Students
The ITS Institute will participate in CTS’s annual awards event and the CUTC annual dinner scheduled each year at the TRB Annual Meeting, where the Student of the Year award will be presented. The event will be an opportunity to recognize those who have excelled in ITS academics, research, and leadership.

Student Travel Awards
The Institute will annually fund student travel to various ITS-related conferences, such as the Transportation Research Board (TRB) Annual Meeting, ITS America, and the National Rural ITS Conference.

Process to Document Performance Indicators
The Institute will use a questionnaire, filled out by our faculty and staff on an annual basis, to collect student data and information about new ITS-related courses. We will utilize the University course catalog to track course offerings. The baseline data shown in the Appendix was gathered in this manner, and it will be updated for each year of the grant period using this process.
D. HUMAN RESOURCES

Goal
An increased number of students, faculty, and staff who are attracted to and substantively involved in the undergraduate, graduate, and professional programs of the Institute.

Program Outcomes
By creating an environment where we perform quality research, employ the best faculty and staff, and maintain high-caliber programs and facilities, we are creating a place that attracts faculty, staff, and students. Our program outcomes have direct correlation to the program goal. During the life of the grant, the Institute’s outcomes will be:

**Increased Number of Faculty**
The Institute will work with many ITS-related academic departments to increase the number of faculty who are involved in ITS-related research and committed to the Institute’s theme, application areas, and goals.

**Increased Number of Staff**
Staff will be hired, as needed, to support ITS research and education.

**Increased Number of Students**
K-12 educators will be utilized for outreach and education for pre-college students. A program will be developed to inform K-12 students about ITS technology and future opportunities in ITS.

Program Activities
The Institute will achieve our program outcomes through the following program activities.

**Increased Number of Faculty**
Research in intelligent transportation systems requires expertise in a wide range of areas. At the University of Minnesota, many highly regarded researchers have expertise in our core areas but have not applied it to transportation. The Institute will work with various academic departments to identify potential faculty who might be interested in studying ITS issues. The director will meet with these faculty to explain the ITS issues related to their expertise, identify potential partners, and assist in the development of research ideas.

The Institute will continue its philosophy of providing seed funding to new faculty to the ITS area, in order to facilitate a long-term interest in transportation research.
**Increased Number of Staff**

As described in the management section of our strategic plan, the Institute has access to a large number of staff who can support the Institute’s activities. These staff are a vital resource that enable us to maintain our research, education, and outreach activities. We are committed to maintaining this staffing level, provided funding levels remain stable.

In addition, the Institute has had a successful history of providing research seed funding that has led to additional funding from other sources. As these additional funds were attracted to the programs, we were able to expand our staff. This strategy will continue.

**Increased Number of Students**

As described in other sections of this strategic plan, educational and outreach programs will be developed for K-12, undergraduate, and graduate students.

For K-12 students, various resources and partnerships will be utilized to provide outreach support, develop programs, develop distance learning programs, and organize tours and/or demonstrations. This information educates students of the opportunities in ITS with the goal of attracting these students into our programs. The programs will be developed so volunteers can present information to students, and teachers can incorporate ITS into their standard curriculum.

For undergraduate and graduate students, our education and outreach initiatives described within this plan will help us attract students into our ITS-related degree programs.

**Process to Document Performance Indicators**

The Institute will use a questionnaire, filled out by our faculty and staff on an annual basis, to collect student data and information about new ITS-related degree programs. The baseline data shown in the Appendix was gathered in this manner, and it will be updated for each year of the grant period using this process.
E. DIVERSITY

Goal Students, faculty, and staff who reflect the growing diversity of the U.S. workforce and are substantively involved in the undergraduate, graduate, and professional programs of the Institute.

Program Outcome Consistent with the University of Minnesota’s diversity program, the Institute is committed to achieving excellence through diversity. Our primary diversity outcome is:

**Increased Diversity Among Institute Participants**
We will develop partnerships with minority organizations, existing University of Minnesota diversity programs, and minority schools in order to increase the number of minorities involved in the Institute. Our outcome will produce Institute participants that better reflect the diversity of the Minnesota population.

Program Activities While we encourage the inclusion of minorities in all of our program activities, we will make a concerted effort to create specific activities that provide outreach and education to those sectors of the population that are currently underrepresented in the ITS industry. These activities will help us increase the diversity of our students, faculty, and staff.

**Increased Diversity Among Institute Participants**
We have initially identified three program activities to help us reach our diversity goal:
- Heighten awareness of ITS within minority groups.
- Develop partnerships with schools and organizations that are predominately composed of minorities.
- Collaborate with existing University of Minnesota programs to increase the diversity of Institute participants.

**ITS Awareness**
The Institute will develop education and outreach programs for minority schools and youth organizations to heighten awareness of ITS. Our goal is to provide programs that may spark an interest in students that will lead them to further their education in an ITS-related degree.

Currently, the University of Minnesota works with the Fond du Lac Tribal and Community College (FDLTCC) in northern Minnesota on its Summer Transportation Institute program. The program provides educational opportunities to middle- and high-school-aged Native American students in various modes of transportation. The Institute will continue to offer tours and demonstrations of ITS.
research and careers and will work with FDLTCC to explore future enhancements and expansion of the program to other minority groups.

**Partnerships with Professional Societies**

The Institute will explore opportunities to create strategic partnerships with professional societies serving minorities, increasing the diversity of students, faculty, and staff participating in the Institute. These groups could be an instrumental part of our outreach programs to help us deliver ITS information to minority groups with whom they currently work. It is envisioned that these groups could help as volunteers in the K-12 education and outreach programs. We will explore partnerships with these groups at both the student and professional levels of the societies.

**Collaborate with Existing University of Minnesota Programs**

The Institute will follow the University of Minnesota Board of Regents policy on Diversity, Equal Employment Opportunity, and Affirmative Action, which states:

“As a community of faculty, staff, and students engaged in research, scholarship, artistic activity, teaching and learning, or activities which support them, the University fosters an environment that is diverse, humane, and hospitable.”

The Institute will collaborate with existing University programs that can help identify, recruit, and retain minority students. We will investigate opportunities to provide education and outreach activities to these students through this collaboration.

**Process to Document Performance Indicators**

Performance Indicators are not required for this category.
F. TECHNOLOGY TRANSFER

Goal
Availability of research results to potential users in a form that can be directly implemented, utilized, or otherwise applied.

Program Outcomes
Technology transfer is an inherent component of the ITS Institute. It is through our technology transfer activities that we will strive to become the premier resource of information in our core ITS technologies, with particular emphasis on the human element.

Our technology transfer program outcomes will be focused in the following areas:

**Outreach**
Institute project information and research results will be shared with our stakeholders in a timely manner and the Institute will serve as a valued reference on ITS technologies. This will be accomplished using the ITS Institute Web site, a variety of hard copy and electronic publications, and customized outreach programs for pre-college students, the general public, policymakers, and private industry.

**Training**
The ITS Institute will be a national center that focuses on issues related to our theme, application areas, and geographic region. The Institute will be an educational resource for practicing professionals to learn about new ITS technological developments, enabling them to make knowledgeable decisions about ITS technology and implementation.

Program Activities
The Institute will reach its program outcomes through the following activities.

**Outreach**
*Institute Web Site*
The Institute’s Web site will include information for all ages and levels of expertise and will be updated in a timely manner. The information contained within our Web site will reinforce our standing as a reputable and identifiable resource.

We will provide information on the Institute’s key personnel, including faculty, staff, and graduate students; research groups and laboratories; current research project descriptions; and final research reports.
The Institute will also implement Web-based learning and outreach. Practitioners will have opportunities for remote participation in ITS-related training and technology transfer activities. Institute-sponsored seminars will be available live on the Web as well as available for download long after a seminar has been completed.

We will also investigate enhancing our Web site to include virtual tours of the Institute’s affiliated labs, including the Minnesota Traffic Observatory, the Intelligent Vehicles (IV) Laboratory, and the Human Factors Interdisciplinary Research in Simulation and Transportation (HumanFIRST) Program. These tours will offer potential sponsors and research collaborators a virtual view of the capabilities of our labs and researchers and provide students, the general public, and policymakers with a look inside how research is conducted within the labs.

**Institute Publications**
The Institute will develop several publications for use as outreach and education tools.

The Institute will maintain a database of individuals who have identified an interest in our core ITS technologies. Our publications will be mailed to those on the database to keep them informed of our research developments and to educate them about our work.

The Institute will continue to publish its newsletter, the *Sensor*, and will modify its current format to include updates on the Institute’s education and outreach activities. Other publications will include the corporate-style annual report and brochures featuring the Institute and its labs and programs. In addition, Institute research is featured in the monthly electronic newsletter, *CTS Research E-news*, that reaches an audience of more than 4,000 subscribers. The Institute will also explore publishing specialized electronic newsletters for specific topics or projects, based on stakeholder interest.

**Outreach Programs for Pre-College Students, General Public and Policymakers**
Technology transfer is a means to educate the public about ITS issues, research, and solutions. In addition to the outreach opportunities available on our Web site, the Institute will develop outreach activities for pre-college students, the general public, and policymakers to encourage interest in transportation and ITS. Our goal is to inform these audiences, in addition to college students
and ITS professionals, about theme-related activities and the importance of research and education in these areas.

For outreach to pre-college students, the Institute will review methods for reaching such a diverse audience. Initial ideas include articles in publications for young readers, partnering with the Children’s Museum or Science Museum, and/or developing a separate Web page for our K-12 audience.

The Institute will create opportunities to inform the public about ITS core technologies. We will create opportunities to be more visible to the public – either through various open houses, displays at the Minnesota State Fair, relevant rural meetings, newspaper articles, or Web-based games and interactive learning.

Other outreach activities will be developed that specifically target policymakers. We will design a mechanism to inform these officials on the impacts and benefits of our research activities. Institute staff and researchers will lead or participate in ITS-related sessions that are part of a transportation seminar series developed by CTS for state and local elected officials.

**Business Outreach**

The Institute will investigate mechanisms to develop partnerships with private industry that might deploy our technologies.

**Training**

The Institute will work with our partners, including the Minnesota Local Technical Assistance Program (LTAP), Mn/DOT, and other transportation stakeholders, to develop ITS-related short courses. We will utilize a variety of resources including the Institute’s laboratories, faculty, and research staff, and ITS professionals to identify needs, develop, and deliver the courses to practicing professionals. Course development will consider the use of technologies to enable both on-site and remote participation.

**Process to Document Performance Indicators**

The Institute will use a questionnaire, filled out by our faculty and staff on an annual basis, to collect technology transfer data. The baseline data shown in the Appendix was gathered in this manner, and it will be updated for each year of the grant period using this process.
This section of the plan describes the Institute director’s management plan for meeting all the requirements of the Grant and managing the personnel and activities of the Institute. The following subjects are addressed:

- Institutional Resources, including research and training facilities, human resources, physical facilities, and institutional support capabilities.
- Institute Director – how the director plans to effectively direct and oversee the Institute’s funds, personnel, and programs.
- Faculty and staff who will spend 50 percent or more of their time on Institute activities.
- Multi-Party Arrangements
- Matching Funds – prospective amounts and sources of the Institute’s matching funds.
A. INSTITUTIONAL RESOURCES

The institutional resources available to the Institute are described below. The resources are divided by research and training facilities, human resources, physical facilities, and institutional support capabilities.

The institutional resources available to the Institute are all located within Minnesota. The partnership of the ITS Institute, CTS, and the Minnesota Department of Transportation (Mn/DOT) has resulted in numerous resources that are shared among the partners.

Due to the multidisciplinary nature of ITS, the Institute is affiliated with several departments within the University of Minnesota; the resources available to these departments are available to the Institute as well.

Although the Institute is part of an existing center, the Center for Transportation Studies, it will be a distinguishable entity through the use of its own logo, print materials, and Web site.

Research And Training Facilities

The Institute supports four core laboratories/programs that are available to support all researchers. These labs are briefly described below.

Minnesota Traffic Observatory

Formerly the ITS Laboratory, the lab is entering a new phase of operations with a new name, new capabilities, and a new location in the University’s Civil Engineering Building. The new traffic observatory will focus on the specific requirements of traffic flow research, including the development of advanced data-gathering and signal-processing systems and support of the infrastructure needed for signal processing and traffic-flow modeling.

Supporting education in traffic modeling and management will be one of the observatory’s core missions. Staff will continue to develop and support the online simulation systems that have become a key element of the lab’s operations in recent years. Lab staff work closely with faculty to create learning tools that help advanced students experiment and understand traffic patterns in complex road networks.

In conjunction with its move to new facilities, the observatory is exploring a range of potential enhancements to its capabilities in order to meet the changing needs of transportation researchers. As more ITS projects are implemented nationwide, the new
observatory will offer researchers and students a cutting-edge environment for experimentation and learning.

**Intelligent Vehicles Laboratory**
The Institute’s Intelligent Vehicles (IV) Laboratory focuses on developing and testing innovative, human-centered technologies that improve the operational safety, mobility, and productivity of vehicles. These human-centered technologies integrate sensors, actuators, computer processors, and human interfaces to provide drivers with needed information under difficult driving conditions, including low visibility, severe weather, and narrow and congested roadways. Initially, these driver-assisted systems have been tested in specialty vehicles, including snowplows, patrol cars, ambulances, heavy vehicles, and transit vehicles. Ultimately, these systems will also be used on passenger vehicles, providing drivers with warnings and assistance with collision-avoidance and lane-keeping tasks. New efforts are underway to reduce fatalities and injuries among teens and older drivers.

The IV Laboratory research seeks to increase driver safety in difficult driving conditions through the use of improved sensing and driver feedback vehicle-guidance and collision-avoidance technologies. Several vehicles serve as experimental testbeds, including the SAFETRUCK (an International 9400 tractor-trailer), the SAFEPLOW (an International 2540 crew cab snowplow), a state highway patrol car, and a new public transit bus research platform. Using these vehicles, the IV Laboratory researchers are developing, testing, and integrating advanced technologies including centimeter-level differential global positioning systems (DGPS); high accuracy digital-mapping systems; range sensors, including radar and laser-based sensors; a windshield head-up display (HUD), a virtual mirror, and other graphical displays; wireless communications; as well as haptic and tactile feedback.

**Human Factors Interdisciplinary Research in Simulation and Transportation (HumanFIRST)**
The mission of the Human Factors Interdisciplinary Research in Simulation and Transportation (HumanFIRST) Program is to apply human factors principles in order to understand driver behavior and support the design and evaluation of usable intelligent transportation systems. As implied by its name, the program’s research strategy is based on a driver-centered approach, considering the “human first” within the transportation system.

The facility includes equipment for basic research on driver psychological functioning including a vision tester, DOT-certified
alcohol Breathalyzer, mobile psychophysiology recording system, video editing and behavioral analysis suite, and a comprehensive psychometric test battery validated for traffic psychology. Much of the research of the HumanFIRST Program uses a state-of-the-art driving simulator engineered specifically for human factors research in surface transportation. This Virtual Environment for Surface Transportation Research (VESTR) is a versatile and realistic simulation environment linked to a full-cab SC2 vehicle donated by Saturn using software that can create virtual environments that precisely reproduce any geospecific location. This visual environment is generated with high-resolution images over a wide field of view. This immersive driving experience is enhanced by realistic motion generated by a three-axis motion base and both high- and low-frequency vibration units, including a surround sound system. With multiple sound systems, integrated touch panel displays (including head-up displays), haptic feedback through the seat and accelerator pedal, and a head free eye-tracker that can detect in real time what a driver is looking at, this simulator supports the investigation of a wide range of interface options for ITS development, design, and assessment. These features make VESTR one of the premier driving simulators in North America and Europe.

To support the validity of the HumanFIRST research, the program has access to a variety of closed test tracks and road network field sites for on-road studies with instrumented vehicles.

Northland Advanced Transportation Systems Research Laboratories

The Northland Advanced Transportation Systems Research Laboratories (NATSRL) is located at the University of Minnesota’s Duluth campus. Its mission is to study comprehensive winter transportation systems and the transportation needs of cities in small urban areas. To accomplish this, NATSRL collaborates with the Minnesota Department of Transportation, city and county engineers, and other agencies on research that covers a wide variety of topics, including optical and electronic traffic and road sensors, transportation data management, and benchmarking of transportation infrastructures.

NATSRL’s current laboratories are the Advanced Sensor Research Laboratory, the Transportation Research Data Laboratory, and the Transportation Engineering Research Laboratory. The Advanced Sensor Research Laboratory tests advanced sensing technologies for pavement and road conditions (speed, weather impact, and traffic density), researches the development of new techniques to
detect incidents and abnormal traffic conditions, and analyzes real-world and real-time measurements of road, weather, and traffic information. The Transportation Data Research Laboratory has developed a statewide traffic data archival and analysis system that is used by Mn/DOT for long-range planning and the development of strategic traffic management plans, and continues to research improvement of data integrity received from road sensors. The Transportation Engineering Research Laboratory is developing, in conjunction with Mn/DOT, an automated inventory management system for transportation infrastructure and the design of efficient management practices through benchmarking state DOT procedures.

In addition to the Institute-supported facilities, several other offsite field-testing facilities are available to the Institute, including:

- University Transitway
  The transitway links the University’s two city campuses and is equipped with detectors and warning devices at five intersections.

- MnROAD High- and Low-Volume Road Test Facility
  The Minnesota Road Research Project (MnROAD) includes a freeway and Low-Volume Road (LVR) pavement test track with 40 Portland Cement Concrete (PCC), Asphalt Concrete (AC), and unsurfaced test sections, 4500 electronic sensors, Weigh in Motion (WIM), weather station, and DGPS correction signals. The facility is used to monitor pavement performance, develop pavement design methods, evaluate paint stripe durability, and serve as a test track for vehicles performing a range of experiments e.g., collision avoidance, augment displays, etc.

- Minnesota Highway Safety and Research Center (MHSRC)
  MHSRC is a 160-acre facility, utilized for research and driver training, that allows drivers the opportunity to experience real-life scenarios in a controlled environment.

**Human Resources**
The Institute’s human resources include faculty and staff associated with the Institute, CTS, and the academic departments associated with the Institute.

The academic units that are currently involved with the Institute are:

- Aerospace Engineering and Mechanics
- Architecture / Landscape Architecture
- Civil Engineering
The Institute is part of the University of Minnesota’s Center for Transportation Studies (CTS). As such, many of the human resources available to the Institute are CTS staff.

**Physical Facilities**
The ITS Institute resides within the Center for Transportation Studies at the University of Minnesota. CTS is located at:

Center for Transportation Studies  
University of Minnesota  
200 Transportation and Safety Building  
511 Washington Avenue S.E.  
Minneapolis, MN  55455-0375

Due to the multidisciplinary nature of the Institute, the faculty and staff are not co-located in this facility. Rather, only CTS personnel and the Institute director have office space at the above location. Other faculty, staff, and laboratories are located in spaces designated by their respective academic departments.

**Institutional Support Capabilities**
CTS supports the Institute’s mission by helping create and disseminate knowledge related to ITS, using research, education, and outreach activities and expertise. Staff teams, drawing from various areas of expertise, accomplish this work. This organizational structure allows the Institute and CTS to leverage resources. In addition, leadership of CTS, through its group of directors, provides connections and access to an extensive transportation network. In addition to the Director of the ITS Institute, CTS directors are:

- Robert Johns, Director  
- Laurie McGinnis, Associate Director  
- Cheri Marti, Associate Director  
- Dawn Spanhake, Director of Finance and Agreements  
- Gina Baas, Director of Communications and Outreach  
- Jim Grothaus, Minnesota LTAP Director
CTS is organized as a matrix structure. Staff are grouped with other staff of similar expertise and responsibilities in functional groups that rarely change, while they perform projects and operations on multiple program teams that change depending on the requirements of the funded program. Staff from other University departments may be members of the CTS teams as a result of partnership agreements.

In addition to CTS resources, the University of Minnesota's resources offer institutional support to the ITS Institute. The office of Sponsored Projects Administration will help manage the grant and its associated restrictions and requirements for spending. The office of Sponsored Financial Reporting will assist in monitoring, tracking, and reporting on grant and match account spending. And the office for Patents and Technology Marketing will be a resource for the development and marketing of technologies with the potential for private sector collaboration.
B. INSTITUTE DIRECTOR

The Director of the ITS Institute is responsible for implementing the Institute’s strategic plan, and ensuring compliance with all other UTC Program requirements, and has overall responsibility for the Institute’s success. The Director directs and oversees the Institute’s programs, personnel, and funds through the use of all the institutional resources described in section A, above, in addition to the human resources provided by the ITS Institute Board, as described below.

The purpose of the Board is to oversee the implementation of the ITS Institute activities. The Board’s responsibilities include:

- Work with the Director of the ITS Institute to make sure RITA requirements are met.
- Approve annual plans and budgets.
- Meet at least twice each year to provide direction to, and approval of, the Institute’s activities.

A current list of Board members is provided below.

- Bob Johns, Chair, CTS
- Rick Arnebeck, Minnesota Department of Transportation
- Mike Asleson, Minnesota State Patrol
- Randy Halvorson, Minnesota Department of Transportation
- Mark Hoisser, Dakota Area Resources and Transportation for Seniors
- Ron Hynes, Federal Transit Administration
- Anthony Kane, American Association of State Highway and Transportation Officials
- Mos Kaveh, University Of Minnesota
- Sue Lodahl, Minnesota Department of Transportation
- James Riehl, University of Minnesota Duluth
- Richard Rovang, Metro Transit
- Dan Murray, American Transportation Research Institute
- Marthand Nookala, Hennepin County
- Richard Sanders, Polk County
- Tom Sorel, Federal Highway Administration
- Kathy Swanson, Minnesota Department of Public Safety
- Don Theisen, Washington County
- Toni Wilbur, Federal Highway Administration
C. FACULTY AND STAFF

The faculty and staff who will spend 50 percent or more of their time on Institute activities are described below.

Leadership

Max Donath
Director, ITS Institute
As stated above, the Director of the ITS Institute is responsible for implementing the Institute’s strategic plan and has overall responsibility for the Institute’s success. The director will direct and oversee the Institute’s programs, personnel, and funds.

Finance and Agreements

Dawn Spanhake
Director of Finance and Agreements
Ms. Spanhake is responsible for the Institute’s financial management and reporting, documenting and tracking matching funds, serving as the liaison to RITA, and developing and monitoring agreements with internal and external partners.

Program Development and Delivery

Linda Preisen
Research Program Manager
As Research Program Manager, Ms. Preisen is responsible for the Institute’s research selection and research performance activities and is the primary contact and resource for Institute-funded researchers. In addition, Ms. Preisen will assist the director in monitoring the implementation of various strategic plan activities and aid the Institute’s faculty and staff in forming strategic partnerships.

Jan Lucke
Program Coordinator
Ms. Lucke will assist Ms. Preisen in managing the Institute’s research program, including assisting researchers in workplan and budget development, tracking matching funds, coordinating research activities, and compiling annual performance measures.

Education and Outreach Coordination

Several staff from the Program Development and Delivery group will be available to work on the Institute’s education and outreach activities as appropriate. At this time it is not anticipated that any one staff person will spend 50 percent of more of his or her time on Institute activities.
ITS Institute Communications
The communications personnel – which currently include a
librarian/information manager, publications manager, editors, Web
coordinator, and graphic designer – will be responsible for ITS
Institute communications. This will include maintaining and
updating the Institute’s Web site and creating and managing the
production of publications such as the newsletter and annual
reports. It is not anticipated that any one communications staff
member will spend 50 percent or more of his or her time on
Institute activities.
D. MULTIPARTY ARRANGEMENTS

This section does not apply, as the Institute is independent and does not involve any consortium or partnership arrangements.
E. MATCHING FUNDS

Each Federal dollar contributed to the Institute will be matched with a 100 percent non-Federal match. Committed sources include: Minnesota Department of Transportation, University of Minnesota Central Administration, University of Minnesota Graduate School, and various University of Minnesota academic departments and colleges. Prospective sources of additional matching funds for this year and future years include various pooled-fund research projects, the Minnesota Local Road Research Board, foundations, associations, and private industries.
## Select RD&T Programs

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<th>SAFETY:</th>
<th>ITS Institute Sciences and Technologies</th>
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<td>human performance and behavior</td>
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<td>computing, information, and communications</td>
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<td>technologies for modeling, managing, and operating transportation systems</td>
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<td>social and economic policy issues related to the above technologies</td>
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<td>Crossmodal Human Factors Research (DOT-wide)</td>
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<td>Driver Behavior/Simulation Research (FMCSA/NHTSA)</td>
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</tr>
<tr>
<td>Highway Safety Research (NHTSA)</td>
<td>X X X X</td>
</tr>
<tr>
<td>Human-Centered Systems (FHWA)</td>
<td>X</td>
</tr>
<tr>
<td>Infrastructure Safety (ITS JPO)</td>
<td>X X X</td>
</tr>
<tr>
<td>Intelligent Vehicle Initiative [IVI] (FHWA/FMCSA/FTA/ITS JPO/NHTSA)</td>
<td>X X X</td>
</tr>
<tr>
<td>Intersection Safety (FHWA)</td>
<td>X X X</td>
</tr>
<tr>
<td>Nationwide Differential Global Positioning System [NDGPS] (FHWA/FRA)</td>
<td>X X X</td>
</tr>
<tr>
<td>Planning and Decision Making Research—Safety-Conscious Planning (FHWA)</td>
<td>X X X</td>
</tr>
<tr>
<td>Public Safety Program (ITS JPO)</td>
<td>X X X X X</td>
</tr>
<tr>
<td>Roadway Departure (FHWA)</td>
<td>X X X</td>
</tr>
<tr>
<td>Safety Management Program (FHWA)</td>
<td>X X X</td>
</tr>
<tr>
<td>Speed Management (FHWA)</td>
<td>X X X X</td>
</tr>
<tr>
<td>Visibility Research (FHWA)</td>
<td>X X X</td>
</tr>
</tbody>
</table>

*Continued on the following page.*
## Research Matrix

### ITS Institute Sciences and Technologies

<table>
<thead>
<tr>
<th>Human Performance and Behavior</th>
<th>Computing, Information, and Communications</th>
<th>Sensing and Measurement</th>
<th>Technologies for modeling, managing, and operating transportation systems</th>
<th>Social and Economic Policy Issues related to the above technologies</th>
</tr>
</thead>
</table>

### Select RD&T Programs

#### MOBILITY:

- Advanced Control Systems (FHWA) | X | X |
- Dynamic Traffic Assignment (FHWA) | X | X |
- Fleet Operations (FTA) | X | X | X |
- ITS (FHWA/FMCSA/FTA/ITS JPO) | X | X | X | X | X |
- Metropolitan and Rural Policy Development (FTA) | X |
- Policy Research (FHWA) | X | X |
- Systems Management Information (ITS JPO) | X | X |
- University Transportation Centers Program (FHWA, FTA, RSPA) | X | X | X | X | X |
- Weather Responsive Travel Management (FHWA) | X | X | X | X | X |

#### GLOBAL CONNECTIVITY:

- ITS (FHWA/FMCSA/FTA/ITS JPO) | X | X | X | X | X | X |

#### SECURITY:

- Safety and Security (FTA) | X | X | X |
- Weather Responsive Travel Management (FHWA) | X | X | X | X |
APPENDIX B – Baseline Measures for the ITS Institute
DRAFT BASELINE MEASURES

Report for the most recently completed academic year (2005 – 2006) and for the institutions(s) comprising the Institute.

RESEARCH SELECTION

1. Number of ITS-related research projects selected for funding
   
   1a. Number of those projects you consider to be:
       
       | Research Type          | Number |
       |------------------------|--------|
       | Basic Research         | 0      |
       | Advanced Research      | 6      |
       | Applied Research       | 3      |

2. Total budgeted costs for the projects reported in 1 above
   $948,000

RESEARCH PERFORMANCE

3. Number of ITS-related research reports published*
   58

4. Number of ITS-related research papers presented at academic/professional meetings
   80

*In addition to technical research reports, our baseline data also includes articles and proceedings.
**EDUCATION**

<table>
<thead>
<tr>
<th>ITS Education</th>
<th>Undergraduate</th>
<th>Graduate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of courses offered that are part of an ITS-related curriculum*</td>
<td>26</td>
<td>36</td>
<td>62</td>
</tr>
<tr>
<td>Number of students participating in ITS-related research projects**</td>
<td>9</td>
<td>65</td>
<td>75</td>
</tr>
</tbody>
</table>

*Report courses shown in the University course catalog as being offered, whether or not they were conducted during the academic year being reported.

**Count individual students (one student participating in two research projects counts as one student).

**HUMAN RESOURCES**

<table>
<thead>
<tr>
<th>Category</th>
<th>Master’s</th>
<th>Doctorate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of advanced degree programs offered that are ITS-related</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Number of students enrolled in these advanced degree programs*</td>
<td>32</td>
<td>21</td>
</tr>
<tr>
<td>Number of students who received degrees through these advanced degree programs*</td>
<td>13</td>
<td>3</td>
</tr>
</tbody>
</table>

*Data shown is provided only for those students focusing on ITS.

**TECHNOLOGY TRANSFER**

<table>
<thead>
<tr>
<th>Number of ITS-related seminars, symposia, distance learning classes, etc., conducted for practicing professionals</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of practicing professionals participating in those events</td>
<td>1,405</td>
</tr>
</tbody>
</table>