strategic plan

CENTER FOR INTEGRATED TRANSPORTATION SYSTEMS MANAGEMENT (CITSM)

A TIER I UNIVERSITY TRANSPORTATION CENTER

University of Maryland
Kim Engineering Building
College Park, MD 20742

Phone: (301) 405-1963
Fax: (301) 405-2585
Email: haghani@umd.edu

Submitted to:
U.S. Department of Transportation
Research and Innovative Technology Administration

November 2007

TABLE OF CONTENTS

I. PROGRAM OVERVIEW

This section has been prepared to set the stage for the strategic plan, by providing an overview of the context within which it has been developed. The theme, scope, processes and anticipated products of the center are described.

I.A. GLOSSARY

The list of acronyms used in this Strategic Plan is as follows:

AASHTO	American Association of State Highway and Transportation Officials
BOA	Board of Advisors
CATT	Center for Advanced Transportation Technology
CEE	Department of Civil and Environmental Engineering
CITE	Consortium for ITS Training and Education
CITSM	Center for Integrated Transportation Systems Management
CUTC	Council of University Transportation Centers
F&A	Facilities and Administrative Costs (formerly indirect)
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FTE	Full time equivalent
GIS	Geographic Information System
GPS	Global Positioning System
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
LTAP	Local Technical Assistance Program

M&O	Management and Operations
MDOT	Maryland Department of Transportation
NCHRP	National Cooperative Highway Research Program
NSF	National Science Foundation
NTIS	National Technical Information Service
PI	Principal Investigator
RFP	Request for Proposals
RITA	Research and Innovative Technology Administration
SPR	State Planning and Research
T2 CENTER	Technology Transfer Center (Maryland LTAP Program)
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
TRC	Transportation Research Center
TRIS	Transportation Research Information Services
TFHRC	Turner-Fairbank Highway Research Center
UMD	University of Maryland
USDOT	United States Department of Transportation
UTC	University Transportation Center

I.B. CENTER THEME

I.B.1 Statement of the Theme

> THE THEME OF THE CENTER IS THE DEVELOPMENT OF ADVANCED TECHNOLOGY, IMPROVED PROCESSES, AND ENHANCED ORGANIZATIONAL STRUCTURES FOR THE INTEGRATED MANAGEMENT AND OPERATION OF TRANSPORTATION FACILITIES AND CORRIDORS.

The theme of the CITSM will be "Integrated Transportation Systems Management". The Center will conduct research and provide education and technology transfer related to this theme. The goal of the Center is to provide improved mobility and reduced congestion for travelers and shippers using the nation's transportation system. The objectives of the Center include the development of advanced technology, improved processes and enhanced organizational structures for the integrated management and operation of existing transportation infrastructure and facilities. Because of the significance of the problems addressed by this theme, parallel research activities are underway within other Universities and their transportation centers. The CITSM activities will be coordinated with these other programs such as the work related to mobility in the northeast corridor being conducted by the Institute for Public Administration at the University of Delaware.

This theme recognizes the likelihood that additions to the capacity of transportation facilities will fail to keep pace with demand, and that the public will increasingly require that existing and planned facilities be managed and operated as efficiently as possible. Current management and operations (M&O) inadequacies reflect inadequate emphasis on this

aspect of the transportation system, as well as a shortage of appropriately trained personnel, technological deficiencies, and incompatibilities with existing administrative and political structures. These problems are further compounded by the stovepiping of management functions such that there is little interaction between planners, engineers and operators, and still less interaction between the organizations responsible for the M&O of various transportation modes. These issues are directly addressed by the CITSM theme which emphasizes a balanced approach to integrated M&O that focuses on education, technology and organizational needs. The Center's activities are further enhanced through the creation of a strong outreach program to ensure that its research successes are implemented by transportation practitioners.

I.B.2 Scope

The CITSM is concerned with the integrated operation of all modes serving the nation's transportation system, including the institutional issues associated with their management and operation. A balanced multi-modal approach will be used that considers freight and passenger mobility, as well as system operation during periods of both recurring and non-recurring congestion, including response to major emergencies. The modes included in this theme include highway, transit, rail, and inter-modal interfaces including ports, terminals and airports. The scope of the center is best described in terms of *eight* overarching topic areas presented below that address both technical and institutional issues. The activities associated with each of the topic areas include research, education and outreach.

1. **Transportation System Data Acquisition and Monitoring** – Integration of currently independent information sources, including electronic forms of system monitoring, monitoring of video images, and manual data inputs, is required for the creation of a fully integrated system in which automated vision processing and data fusion techniques can be applied to acquire a comprehensive picture of existing conditions within the transportation system. Knowledge of such conditions can greatly aid in congestion management, emergency response, private or public sector fleet management and other operations within the transportation system.

2. **Real-time System Management and Operations** – Existing management and operations focus on the independent needs of incident and emergency management, traffic signal operations, tolling and other demand management strategies, transit operations, and terminal (port and airport) operations. Rarely are these independent activities combined and coordinated in a manner that takes advantage of available capacity and the unique ability of these activities to influence demand. The potential of coordinated operation has been demonstrated by a number of research activities, such as a study performed at the University of Maryland under the Vehicle Infrastructure Integration (VII) project funded by the RITA's ITS Joint Programs Office. This study demonstrated that coordinated operation of facilities offers the potential for reducing vehicle delays by more than 50% in the presence of major incidents. CITSM researchers will focus on the development of processes and decision support tools that will facilitate coordinated system management and operations.

3. **Transportation System Safety** – In 2005, there were more than 43,000 transportation system-related fatalities in the US and nearly 1.2 million fatalities worldwide. By most definitions this would be considered a pandemic, with transportation-related accidents ranked as the third leading cause of death, ahead of more highly publicized death causes such as wars (ranked number 8) and HIV (ranked number 10). Victoria, Australia proved that the problem can be effectively addressed, decreasing the fatality rate by 60% in fifteen years, to a rate that is approximately ½ that of the United States. The Victoria success relied on a combination of technology, enforcement and political will. The CITSM research, education and outreach activities are well suited to address this problem by focusing on the political processes that must be energized in order to replicate the Victoria experience. In addition to the obvious benefits of reducing the human cost associated with crashes, improved safety will improve the travel reliability of the system..

4. **Transportation Systems Planning** – Consideration of the transportation system as subsystems of networked infrastructure and of the interactions between these subsystems can greatly affect performance. The Center faculty and staff will develop techniques for planning and operating both single-mode systems (such as transit, rail, highway, air) and multi-mode and inter-modal systems (such as inter-modal freight transport systems involving rail, waterways, roadways, ports and terminals) with special attention to potential efficiencies that can be gained through integration and resulting seamless operation. Research projects undertaken within the CITSM will also focus on the development of modeling and other analysis techniques that will permit the

extension of system planning to emphasize not only construction of new facilities and expansion of existing facilities, but also changes to operations and interactions between supply and demand that can lead to more efficient use of existing facilities.

5. **Management and Operations in Extreme Events** – Human populations are faced with numerous hazards, both natural (e.g. hurricanes, earthquakes, tornados, tsunamis, volcanic eruptions, flooding, mudslides, wildfires) and human-caused, whether accidental (e.g. a hazardous materials release or a nuclear power plant malfunction) or purposeful (e.g. terrorist attack), that have the potential to cause significant devastation. The Center faculty and staff offer a unique range of hands-on knowledge of the issues and procedures associated with emergency preparedness and response. Integrated, coordinated operations are essential in the preparation for such an event and in the decision-making and emergency response that immediately follow.

6. **Information Dissemination to System Users and Operators** (including traveler information) – One of the most significant shortcomings of today's transportation systems is the absence of integrated information regarding system status. This shortcoming reduces the ability of public agencies to manage the system and prevents travelers, carriers, shippers, and others from making informed decisions regarding the best route, departure time, and mode to use for their intended trip. Existing efforts (e.g. the 511 phone number) are only a first step in providing such information, because their geographic scope is limited and the data are rarely integrated in ways that support informed decision-making. In research conducted within CITSM, integration of data sources and presentation of information in ways that facilitate travel decisions will be emphasized.

7. **Performance Measurement** – The Center's activities will focus on development of performance measures to facilitate integration of transportation management and operations. Center faculty and staff have played a lead role in the development of mobility performance measures locally, regionally and nationally. Their work addresses the entire spectrum of performance measurement, from the regular assessment of performance of the State of Maryland's traffic management activities to the development of national standards for measuring mobility. Their activities include the development of measures to support planning, engineering, operations and staff management. Such measures are intended for use in communicating with the public, state legislature and regional Metropolitan Planning Organizations (MPOs) in both the Baltimore and Washington, D.C. regions. The focus of research under the CITSM will be on the development of outcome-oriented and system-wide performance measures as opposed to functions related to performance of facilities that fall within the purview of a particular agency.

8. **Policy and Institutional Issues** – The challenges that the Center's faculty and staff have faced in their ongoing involvement with regional transportation system management and operations (e.g. CapWIN and RITIS) have highlighted the significance of policy and institutional considerations when attempting to establish an integrated transportation system. Existing institutions are intended to serve the local jurisdictions in which they reside. Little credit is given to politicians who think regionally rather than locally. Parochialism is further promoted by required planning (and funding) processes in which projects are initiated by local jurisdictions. This is often done in a manner that discourages region-wide and system-wide support. Activities undertaken within the Center will study deficiencies that exist in the structure of, and coordination between, the various local, regional and federal transportation agencies and the resulting impact of these deficiencies on system performance. The absence of an integrated strategy has led to, for example, significant insufficiencies in intermodal transport as a result of the current structure of modal-based agencies.

These topics, while varied in nature, are united by the common theme of developing a fully integrated approach to managing and operating available transportation resources. As appropriate, research projects will focus on the development of near-term mitigation strategies for traffic congestion and more basic, exploratory findings whose effects may be experienced further in the future. Examples of potential research projects that could be undertaken by the CITSM faculty and staff are given in Table I.1. Brief descriptions of a select set of potential projects from each research area are presented below.

TABLE I.1. CANDIDATE RESEARCH TOPICS

Data Acquisition & Monitoring	Real-Time Management & Operations	Transportation Systems Planning	Management & Operations of Extreme Events	Information Dissemination	Performance Measurement	Policy & Institutional Issues
Distributed simulation for traffic monitoring/prediction for large urban networks High data-rate directional wireless communications for highway monitoring and surveillance Multimodal travel reliability Modeling and forecasting truck traffic in regional network planning Integrated incident detection/travel-time prediction for multi-corridor travel information system One camera, many users in highway surveillance Network science and infrastructure networks interdependencies	Managed lanes: a dynamic approach for access control and state-dependent pricing operation Integration of real-time traffic systems monitoring and detour operations for non-recurrent congestion in commuting corridors. Optimization for arterial signal progression control Development of optimal location model for deploying limited sensors for a corridor-based traffic systems control	Dynamic fleet management in paratransit service Transfer coordination in public transportation networks Container flow through ports Road space allocation and network evolution GIS-based location of rail transit lines and stations Integrated framework and methodologies for incorporating operational considerations in transportation planning process	Evacuation from urban environments Systematic approach for transportation network vulnerability assessment Modeling driver and tripmaker responses in extreme conditions Corridor-based signal optimization model for evacuation of transit and vehicles Mode split in evacuation Hazardous substance transport under terrorist threat Disaster relief, cleanup and recovery logistics models On-line management of emergency response fleets Joint evacuation and sheltering	True 4D visualization for information dissemination Bursty communications on highways for exchange of highway information	Benchmarking using performance measures Outcome oriented performance measures for traveler information including variable message sign and highway advisory radio messages Outcome oriented performance measures for emergency evacuations and other rare events Measuring customer satisfaction with transportation operations Effectiveness of performance measures and performance goals as incentives for public agency employees	Incentives for infrastructure changes “Disruptive” transportation technologies Safety first (zero tolerance) Institutional changes to optimize intermodal transportation Supporting development of the next generation of (nongas) vehicles Integration tool for recovery management Collaborative decision-making for transportation operations under disruption

1. **Development of a distributed simulation system for real-time traffic monitoring and prediction for large urban networks** (*Area: Transportation System Data Acquisition and Monitoring*)

   The purpose of this project is to develop a tool that can effectively simulate a multi-mode transportation system in a real-time operational environment. Such a tool should be sufficiently efficient and flexible to allow concurrent use by multiple users either at the network or local level. The distributed computing architecture is one of the most promising ways to offer the desirable level of computing efficiency at an acceptable cost to most transportation agencies.

2. **Managed lanes: A dynamic approach for access control and state-dependent pricing operation** (*Area: Real-Time System Management and Operations*)
   Integrated management of transportation systems, particularly in congested corridor networks, entails distributing loads over space and time to maintain the major transportation facilities in the corridor operating at peak efficiencies. Managed lanes, which seek to maintain operational efficiency through a combination of access control, real-time information and pricing, represent an important concept for integrated corridor management. However, achieving the operational and mobility benefits of managed lanes requires continuous monitoring and active control, to make sure that heavy demand levels do not push the system beyond the traffic breakdown point, which would translate into severe loss of operational capacity at a time when it is most needed. Setting prices and more generally controlling access based on prevailing conditions is one mechanism to keep traffic flowing; however, reactive control strategies, which set prices based on prevailing conditions, are often too late. Using state-of-the-art traffic estimation and prediction methods, this research develops a predictive scheme that sets controls and prices in anticipatory fashion, thereby circumventing the limitations of existing approaches and helping attain the promised benefits of managed lanes.

3. **Dynamic fleet management in paratransit service** (*Area: Transportation Systems Planning*)
   Paratransit services are provided in large urban areas generally for disadvantaged populations such as elderly and handicapped. Most of these services require a lead time of one to several days between the time a call for service is placed and the time that the service is actually rendered. Paratransit vehicle routes are designed mainly based on demand information that is received in advance. With the availability of current ITS technologies and real-time traffic information, new paratransit service systems can be designed that take advantage of the available real time traffic information and enable the service providers to accept demand for service while the vehicles are en-route. These systems will be able to provide same day service for the patrons as well as advanced reservation service. Such systems also enable the providers to use the capacity of the vehicles much more efficiently and manage their operation and change the routes in real time to avoid congestion hot spots using the available real time traffic information.

4. **Transfer Coordination in Public Transportation Networks** (*Area: Transportation Systems Planning*)
   Building upon our work in several theses, journal papers and one FTA project, we will develop methods for coordinating the arrivals of transit vehicles (bus, paratransit and rail) at transfer stations. These will include: (1) Real-time dispatching models to determine when vehicles that are ready to leave should leave or wait for incoming vehicles, based on missed-connection delays, delays to on-board and downstream passengers, propagation of system disturbances, and other factors; (2) Methods for predicting and controlling the arrival times of transit vehicles, possibly using traffic signals to assist in transfer coordination; (3) Routing and scheduling methods designed to maximize transfer opportunities and probabilities, with optimized slack times included in schedules. Such methods may also be adapted to coordinate transfers in airline networks and intermodal freight networks.

5. **Evacuation from urban environments** *(Area: Management and Operations in Extreme Events)*
   Significant effort has been expended on the development of evacuation plans for hurricane and naturally caused events, many of which can be predicted with reasonable accuracy. Nearly all of these efforts have focused on evacuation along freeways. In the event of a terrorist incident, little if any notification will be provided and large numbers of people, many of whom will not have access to a personal vehicle, may need to escape an urban environment. This research will consider critical real-life elements that are often missing from no-notice evacuation studies, namely: (1) strategies for signal operations in urban areas to facilitate evacuation; (2) models to describe large-scale pedestrian traffic and competition with vehicular traffic for roadway capacity and methods for addressing the conflicting needs of pedestrian and vehicular traffic; (3) activity and travel

behavior models of pedestrians and vehicles as interacting decision agents at the household, firm and neighborhood levels, recognizing the possibility of moving in the "opposite direction" of the evacuation; (4) role of public transportation in emergency evacuation; and (4) role of information diffusion, both about the threat and the evacuation, in terms of counterproductive rumor spreading, propaganda by the malevolent entities. The research effort will culminate in a critical tool that will be available to response agencies to convey information to evacuees.

6. **True 4D visualization** (*Area: Information Dissemination to System Users and Operators*)
A picture is worth a thousand words, and a 4D picture that jumps out of the screen, you can touch, manipulate, and interact with in real-time, is worth even more. This project would explore 4D holographic projection technologies for use in the interactive evaluation of transportation systems data and real-world modeling systems.

7. **Benchmarking using performance measures** *(Area: Performance Measurement)*
Within the transportation community, the justification for developing a national set of standardized performance measures is based on the understandable need for agencies to establish a benchmark against which they can evaluate the quality of the services they deliver. While the value of benchmarking is intuitively obvious, many questions exist regarding its potential effectiveness. This research addresses the following aspects of benchmarking: (1) Identification of measures that are appropriate for benchmarking. (2) Impact of variations in transportation infrastructure on the ability to benchmark. (3) The value of the benchmarking process as a mechanism to identify innovative techniques that can be adopted by other agencies. (4) Willingness of states to participate in benchmarking given their concern with the release of comparative statistics to the media and the general public. (5) Impacts of benchmarking on the management and operation of the roadway infrastructure. This research will produce a set of guidelines that permits the selection of appropriate performance measures for benchmarking, and the manner in which they can be effectively applied.

8. **Incentives for infrastructure changes and research on disruptive transportation technologies** (*Area: Policy and Institutional Issues*)
Current transportation policy research is focused on "incremental" technologies. Research is needed to investigate the impacts of radical changes in transportation technologies or policies. For example what would be the impact on transportation systems' designs (from air to cars) if the system were to be designed for "zero" tolerance for safety? What incentives need to be created through public policy actions that encourage a new infrastructure to be developed and deployed if we are to move to the next generation of (non-gas) vehicles? Should there be a "DARPA" for DOT, to research the non-traditional approaches that can have a "disruptive" -- and very positive -- impact on the overall transportation system (e.g. dramatic impacts on improved performance at dramatically lower costs)?

I.C. CENTER DIRECTOR'S SUMMARY

IT IS ENVISIONED THAT THE CENTER FOR INTEGRATED TRANSPORTATION SYSTEMS MANAGEMENT WILL EVOLVE TO BECOME A PERMANENT INSTITUTE AT THE UNIVERSITY OF MARYLAND. IN ADDITION, THE CENTER WILL MAKE SIGNIFICANT CONTRIBUTIONS TO THE FIELD OF INTEGRATED TRANSPORTATION MANAGEMENT AND OPERATIONS THROUGH RESEARCH RESULTS, AND THE EDUCATION OF ITS STUDENTS.

The University of Maryland is a State university, and as such, it has both a responsibility and an obligation to ensure the provision of high quality transportation education and research services both to its citizens as well as the traveling public of the nation, overall. High quality transportation services can be defined as services that are reliable, cost-effective and safe for both individuals and shippers. These services are not limited to a single mode, but encompass private passenger vehicles, trucks, mass transit (rail and bus), as well as the aviation and marine communities. In man y respects, Maryland has an advantage in that all transportation modes are housed in a single Department of Transportation that is responsible for roads, mass transit, the Port of Baltimore, and Baltimore Washington International Airport.

The State's transportation system is a microcosm of the nation's system, in that expansion of infrastructure capacity is not keeping pace with demand. As a result, transportation services are deteriorating with an attendant reduction in both the quality and safety of travel. The public is increasingly demanding that transportation infrastructure M&O ensure that it is being used with maximum efficiency and safety. As a reflection of these demands, the Maryland Department of Transportation (MDOT) is increasingly looking toward the University to provide a broad set of responsive services including such items as system operations, safety, technology applications, information warehousing and dissemination, asset management, staff productivity, project management, training and education. These needs are also applicable to the nation's transportation system. The provision of this support requires the existence of a broad-based organization with the research, education, and development capabilities.

The vision for the CITSM is for the creation of a sustainable organization offering the range of capabilities and services to support the state in its efforts to provide high quality transportation services to its citizens. The following ingredients are needed to achieve this vision:

1. **Long Term Funding Sources –** The approach described by this plan leverages University Transportation Center (UTC) funding received from the USDOT with the intent of developing reliable long-term funding for the CITSM. It is intended that the source of this longer term funding will be a combination of research grants provided by MDOT, funding from nationally oriented research programs (e.g. FHWA, FTA, NCHRP and TCRP), and permanent line-item funding from the State legislature. Past success of other centers housed within the Department of Civil and Environmental Engineering (CEE) demonstrate the University's ability to acquire the needed ongoing funding support.

2. **Cadre of Multidisciplinary Students and Faculty with Relevant Interests –** Many University of Maryland Departments and programs offer relevant specialties that span the needs of the nation's transportation system. A major activity of the CITSM leadership is to attract their faculty and students to the transportation field. This challenge will be addressed through inclusion of a variety of faculty representatives on the Center's Steering Committee (discussed below), as well as direct contacts with these colleges and schools to identify areas of common interest that might be incorporated into their curricula.

3. **University Support –** The University has demonstrated its support for the establishment of an ongoing transportation center, through its past funding of the Maryland Transportation Initiative. Further evidence of the University's commitments to the transportation community can be found in the most recent strategic plan of the College of Engineering which states that it intends to "continue to improve the excellence of our best research programs while increasing the number of programs…" The plan then indicates that this will be accomplished by investing "a significant part of new college resources on strengthening or building up specialty areas of large potential with the aim of making the college a significant force in these areas on the national landscape. Five such areas that have been identified so far are: (i) Information Technology: Computing and Communications, (ii) Smart Small Systems, (iii) Intelligent Transportation Systems, (iv) Bioengineering and (v) Nanotechnology. The vision for the future will be accomplished through continuing contacts and outreach to appropriate University personnel to ensure their ongoing support.

4. **Involved Stakeholders –** Stakeholders with an interest in the success of the CITSM include members of the business community, trucking/delivery community, and public sector officials at the state, county, municipal, and regional levels. Stakeholders will become active participants in the planning and development of the Center. This will be accomplished through the creation of a Board of Advisors that will include high level public and private sector representatives. The responsibilities and membership of the Board of Advisors are discussed below.

5. **Committed Support from Senior Management and Elected Leaders within the State –** In order to make the transition from a university center to a permanent transportation institute, which is the central to the long term vision of the CITSM; budget line order funding must be provided by the State of Maryland. While it is not essential that this funding be of sufficient magnitude to support all the activities of the Institute, it must be adequate to support its administrative activities, and serve as a match to leverage research programs funded from other sources. Achieving this aspect of the vision requires the support of cabinet-level officials and elected representatives within the State of Maryland. Significant progress is being made in the acquisition of the required support, such that the CITSM leadership is optimistic that success will be achieved during the three year funding period of the UTC.

But an organizational vision by itself is not adequate to fully define success. The vision for the CITSM also includes the anticipated outcome that the Center will become a center of excellence for integrated transportation operations. Just as many existing university centers have become known for various transportation specialties – safety, performance measurement, vehicle automation, etc., it is the vision of this plan that, by the end of the initial three year funding period, the CITSM will have established a dynamic research program, and a pool of talented graduate and undergraduate students, along with an evolving track record of successful research (and its associated publications) related to integrated transportation management. Thus the vision for the Center, as an organization that delivers technically excellent research results, is presented with the anticipation that it will make significant contributions to the transportation community at both the State and national levels, both in the form of research results, as well as the education of students with an interest in entering the transportation operations profession.

II. PROGRAM ACTIVITIES

This section describes the CITSM's specific program activities that will occur in each of the areas of research, education, human resources, diversity and technology transfer. It also defines the process by which the program will be defined, and performance will be measured. The emphasis of this section is on continuous performance measurement using criteria established by the steering committee and researchers, to ensure that the objectives of the CITSM and RITA are fully satisfied.

II.A. RESEARCH SELECTION

RESEARCH SELECTION GOAL

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

II.A.1 Baseline Measures

CITSM's baseline measures are presented in Appendix A.

II.A.2 Research Selection Program Outcome

The CITSM will support research projects that: (1) are aligned with its theme of integrated transportation systems management; (2) are responsive to regional public and private sector transportation organization needs; (3) contribute to the transportation community's collective body of knowledge; and (4) advance national research, development and technology priorities of the Department of Transportation and its Operating Administrations as identified by the *Department of Transportation Strategic Plan* (http://www.dot.gov/about_dot.html), the *U.S. Department of Transportation Research, Development, and Technology Plan* (http://www.volpe.dot.gov/infosrc/strtplns/index.html).

II.A.3 Planned Activities

PROCESS FOR RESEARCH PROJECT SELECTION

Research project proposals will be reviewed in multiple stages.

Stage 1: In the first stage, proposals will be examined to ascertain their suitability for funding under the CITSM. The investigators will be asked to provide an executive summary of their proposal for external review.

Stage 2: All proposals deemed relevant to the CITSM's theme will be distributed to a Panel of Experts from academia, regional transport agencies, state agencies, industry and the U.S. Department of Transportation. The Panel of Experts will be asked to rank the proposals based on the following criteria:

i. alignment of proposed effort with Center's theme;
ii. quality and intellectual merit of the research proposal;
iii. potential benefits to society that would result from successful completion of the work;
iv. relevance of proposed effort with regional and national transportation agendas, including Department of Transportation priority areas;
v. qualifications of the investigators;
vi. appropriateness of the proposed budget;
vii. number and role of students involved in the research work;
viii. principal investigator's performance in prior projects;
ix. balance between basic and applied research; and
x. likelihood the proposed work could be completed in proposed timeframe and within proposed budget.

Stage 3: Final selection will be made by the CITSM's Steering Committee (described in Section III). Proposed research project descriptions, budgets, commitment of resources and matching funds, and the Panel of Experts' reviews will be considered in the final selection. The Steering Committee will seek a well-balanced portfolio of basic and applied research that together focus on various aspects of the Center's theme, meet the goals of matching agencies, are aligned with the Department of Transportation research priorities, and consider a host of transportation modes.

Proposals will be considered annually.

II.A.4 Performance Indicators

The CITSM Administrative Director will collect and report information necessary to track necessary data to assess Performance Indicators 1 and 2 as set forth in Appendix A by collecting data directly from the project principal investigators. Proposals are required to specify the proposed research efforts as basic, advanced, or applied. The Panel of Experts will be asked to confirm the categorization based on their reviews.

II.B. RESEARCH PERFORMANCE

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.

The CITSM's research program of basic, advanced and applied research, judged by peers and other experts in the field, will contribute to advancing the state-of-the-art in transportation science and engineering. The CITSM will develop a national and international reputation around its theme of integrated transportation systems management.

II.B.1 Baseline Measures

CITSM's baseline measures 3 and 4 are presented in Appendix A.

II.B.2 Research Performance Program Outcome

The CITSM will seek to develop a cohesive, coordinated research program of basic, advanced and applied research activities that will significantly advance the state-of-the-art in integrated transportation systems management, and more broadly, transportation science and engineering (as measured by the CITSM faculty's publications in archival journals). These activities will further address the transportation needs of the agencies that provide the matching funds for the CITSM activities and the national transportation agenda. Research activities will be designed and selected such that the outcome of the CITSM research program will be greater than the sum of its parts.

II.B.3 Planned Activities

1. **Integrity of Activities** – The integrity of the CITSM's activities will be assured through the oversight of a Board of Advisors, a panel review process contributing to project selection, and a semi-annual and end-of-award reports reviewed by the Center Director and the Steering Committee. Research projects are expected to culminate in one or more articles that will be presented at conferences, in workshops, or other, and published in peer-reviewed journals. This ensures a review by other transportation professionals of the quality and relevance of the research. Additionally, projects receiving matching funds from industry, the state DOT, or other agencies will require review by technical advisors within the sponsor's organization.

2. **Financial Monitoring** – The CITSM Administrative Director will review project expenditures in light of their progress and ensure that projects are on budget and that scheduled deliverables have been submitted. The principle investigators of CITSM sponsored research projects will be required to provide quarterly project progress reports with information pertaining to funds spent to-date and additional information as needed.

3. **Acknowledgments** – To aid in developing a national and international reputation, all journal articles resulting from CITSM funded research will be required to include acknowledgement comparable to the following statement.

   "This effort was sponsored by the Center for Integrated Transportation Systems Management at the University of Maryland that is partially funded by the Research and Innovative Technology Administration of the United States Department of Transportation. This support is gratefully acknowledged, but implies no endorsement of the findings."

4. **Project Outcome Oversight** – The CITSM Administrative Director will monitor the progress of the funded projects and ensures that the projects' milestones are met and the promised deliverables are delivered on time and within budget. The principle investigators' project performance in earlier projects will be considered as a criterion in the evaluation of the proposals submitted to the CITSM by those investigators.

II.B.4 Performance Indicators

The principal investigator of each funded research project will provide quarterly progress and end-of-award reports to the CITSM Administrative Director. This report will indicate the type of research (basic, advanced, applied, or combination thereof) that was or is to be conducted; funds spent to-date, number of published articles, disseminated reports, and presentations given at academic/professional meetings; problems encountered; and any additional information necessary to track performance measures 3 and 4 in Appendix A. The budget for each research project will be set at the time the project is awarded.

II.C. EDUCATION

EDUCATION GOAL

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

II.C.1 Baseline Measures

The CITSM's baseline measures are presented in Appendix A.

II.C.2 Education Program Outcome

The CITSM's education program is designed to foster the growth and development of future leaders of the transportation field. The program supports graduate student involvement in all research projects and seeks to attract domestic undergraduates, including women and minorities, to graduate school in transportation through hands-on experience and a fun, enlightening summer experience.

II.C.3 Planned Activities

1. **Support for Graduate Students** – Graduate student support will be a significant portion of the budget of all research projects funded under this center. The involvement of graduate students in basic and applied research is critical to the future of the Transportation field. Such opportunities provide students with real-world experience through which knowledge gained through class work is put into use. In addition, through their involvement in basic research, they will help contribute to the expansion of knowledge in our field.

2. **Summer Research Program for Undergraduate Students** – An eight-week summer program for domestic undergraduate students going into their senior year will be developed and instituted. This program will introduce students from around the nation to transportation and research, more generally. The undergraduate students will be expected to work with graduate students and faculty on research projects, including all CITSM funded research efforts. Weekly seminars will be held. Site visits to local transportation attractions, such as the Turner Fairbank Highway Research Center, Baltimore Washington International and Dulles Airports, Montgomery County Traffic Control Center, Metrorail Greenbelt Yard, Port of Baltimore, and to various Maryland State agencies, including State Highway Administration, Maryland Transportation Authority, and Maryland Department of Transportation will be included in each summer's activities. At the end of the summer experience, students will give presentations related to the research work in which they were involved. An award will be given for the best presentation. In addition to providing research experience to undergraduates, this program is designed to aid in attracting domestic undergraduate students to graduate school. This summer program will be run by the CITSM Administrative Director. It will be open to 8 to 10 students. It will be advertised widely during the Spring semester of each year and will place special emphasis on the inclusion of women and underrepresented minorities.

3. **Fellowship Program** – The Center will provide up to 10 graduate student fellowships each year. These will be prestigious fellowships that would carry a stipend of up to $15,000 per year. The CITSM will use these fellowships to attract the best and the brightest graduate students to enroll in the transportation graduate programs offered by the University of Maryland.

4. **Distance Education** – The University of Maryland is offering a variety of continuing education and academic courses through the Consortium for ITS Training and Education (CITE). CITE is a consortium of more than 100 universities, worldwide, that provide on-line training for university students and practitioners related to ITS and transportation operations. This consortium is led by the University of Maryland which leads course development and delivery through the Center for Advanced Transportation Technology. The CITSM offers an opportunity for the expansion of CITE curriculum into subject areas that are the focus of this new center such as corridor management and congestion pricing as well as the development of a full blown web-based distance education program leading to a Master of Engineering degree in transportation.

5. **Awards and Recognition** – Each year, CITSM will select a single outstanding student to receive the CITSM Outstanding Student of the Year Award. This award will be accompanied by a $1,000 prize and support to attend an award ceremony in Washington, D.C. during the annual meeting of the Transportation Research Board (TRB). Students must be nominated by faculty. The Steering Committee will select a panel of at least three experts, including at least two faculty members, to review the applications and to choose the winning

student. The students will be nominated by their faculty advisors and will be required to furnish statements of their contributions to the field of transportation and one letter of reference in addition to their advisors' nomination letters. Each faculty advisor can nominate one student in a given year. Faculty who advise or financially support any student who has been nominated for the award in a given year may not serve on the

selection panel. Panelists will be asked to rank the students based on the following criteria:

i. Contribution to the field of transportation, with particular emphasis on the CITSM research goals and the national transportation research agenda.
ii. Contribution to the CITSM educational goals.
iii. Technical merit of their work
iv. Originality and creativity of their work
v. Leadership qualities.

II.C.4 Performance Indicators

Undergraduate and graduate courses considered to be part of the transportation curriculum have been identified. New courses offered in future semesters will be added to this list of identified courses. A system for identifying students who participate in transportation research projects has been developed and documented. Data will be gathered annually by Elyse Beaulieu, Assistant Director of Graduate Students Services for the Department of Civil and Environmental Engineering.

II.D. HUMAN RESOURCES

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 Center.

It is expected that at the end of this five-year grant there will be an increasing number of students, faculty, and research staff who are attracted to and actively involved in the undergraduate, graduate, and professional programs of the center. In addition, the center is expected to significantly increase the joint research and implementation activities with transportation professionals from both local public and private agencies.

II.D.1 Baseline Measures

The CITSM's baseline measures are presented in Appendix A.

II.D.2 Human Resources Program Outcome

At the end of this grant we envision having a very successful human resources program that develops excellence in students, faculty, staff members, and professionals involved in our continuing education and technology transfer activities. We expect to recruit very capable individuals and markedly enhance their abilities and performance in their transportation activities. We expect to do this through our undergraduate and graduate education programs, through our research programs in which we train graduate and undergraduate research assistants, through our faculty mentoring and development programs and through our continuing education and technology transfer programs.

II.D.3 Planned Activities

1. **Undergraduate Students** – We will seek to provide undergraduates an excellent education in transportation by increasing the range of courses available to them and by enhancing the quality of those courses with recent developments from transportation research and practice, including our own research activities. We will work to

familiarize undergraduate students with real-world transportation problems and activities through presentations and seminars with experienced professionals, through visits to transportation facilities and construction sites, and also by arranging student internships with private companies and government agencies involved in transportation. We will reserve funds and faculty time for involving undergraduate students in transportation research projects conducted by the center.

2. **Graduate Students** – We will do our utmost to ensure that graduate students receive an excellent education in transportation engineering and planning, comparable to the best available in any nationally known university. We will work very hard to provide good training opportunities as well as necessary funding through our sponsored research projects. Special efforts will be made to help place our graduating students in good jobs in which their training can be advantageously applied. We will also seek to develop a sense of fellowship among our graduate students, which include students from many parts of the world as well as some part-time students.

3. **Faculty** – Our faculty members are expected to be highly skilled professionals by the time they start their faculty jobs. However, they can still greatly benefit from various opportunities to develop their skills and contacts through participation in conferences, short courses, training programs and sabbatical activities. We will especially work to provide helpful mentoring of our junior faculty members by senior faculty.

4. **Staff** – The technical and administrative members of the center, some of whom will be shared with the Department of Civil and Environmental Engineering or the existing Center for Advanced Transportation Technology, will also benefit from opportunities to develop their capabilities through training courses, seminars and participation in conferences.

5. **Professionals** – The CITSM will offer practicing engineers, planners, managers, and other professionals various opportunities to improve their skills and develop new ones through seminars, workshops, short courses, conferences, and participation in regular undergraduate and graduate courses at the University of Maryland. Opportunities will be arranged for professionals from private organizations as well as government agencies to meet students and recruit them for their organizations. Additionally, the suggestions and advice of such professionals will be sought in the development on new courses and research proposals.

II.D.4 Performance Indicators

The information necessary to track performance measures 7 (number of advanced degree programs considered to be transportation-related), 8 (number of students enrolled in those transportation-related advanced degree programs), and 9 (number of students who received degrees through those transportation-related advanced degree programs) will be collected by the CITSM staff from the various departments of the University of Maryland that have academic programs related to transportation. This information will be updated every semester.

II.E. DIVERSITY

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 Center.

II.E.1 Baseline Measures

Because of privacy concerns raised by grantees who received UTC Program grants in prior years, RITA no longer requires the collection of performance measurements regarding diversity.

II.E.2 Diversity Program Outcome

It is envisioned that CITSM will have a diverse group of students, faculty and staff reflecting the future diversity of the U.S. workforce. Furthermore CITSM is expected to attract outstanding students and researchers from around the world, just as the existing transportation programs at the University of Maryland already do. CITSM is expected to achieve this outcome without great difficulties, since there is already great diversity among the students, faculty and staff of its transportation programs. For example, approximately 35% of the graduate students and 40% of the faculty in transportation engineering are women and over 50% of the students in transportation engineering represent various minorities. The transportation programs at the University of Maryland have produced and continue to produce relatively large numbers of degrees and especially M.S. and Ph.D. degrees for women and minority students. Still, the leadership of the CITSM will consciously seek to maximize the diversity of its students, faculty and staff.

II.E.3 Planned Activities

As noted above, CITSM is fortunate since the transportation programs at the University of Maryland already have a very diverse community and continue to attract large fractions of women and minorities among its students, faculty and staff. The CITSM leadership will continue to affirmatively recruit women and minorities, to encourage women and minorities to enter transportation professions through the education, research and technology transfer activities of CITSM, and to make the working and living experiences at College Park as attractive as possible for all members of its community.

II.E.4 Performance Indicators

Because of privacy concerns raised by grantees who received UTC Program grants in prior years, RITA no longer requires the collection of performance measurements regarding diversity.

II.F. TECHNOLOGY TRANSFER

TECHNOLOGY TRANSFER GOAL

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

The goal of technology transfer is the availability of research results to potential users in a form that can be directly implemented, utilized or otherwise applied. The faculty and staff of the CITSM are committed to the concept of outreach to the practitioner community as a key focus of the Center. Unless potential users are aware of the Center's research products, investments made in their creation are essentially wasted. For this reason, establishment of a robust technology transfer program is essential to the ongoing success of the program. The dissemination and application of research products will also ensure the continuing support of the public and private sectors needed to ensure Center's longevity.

TECHNOLOGY TRANSFER PHILOSOPHY

> RESEARCH IS OF LITTLE VALUE UNLESS THE RESULTS ARE RELEVANT TO THE NEEDS OF PRACTITIONERS, AND THEY ARE ADOPTED FOR REAL-WORLD APPLICATIONS.

Past experience has shown that the approach used for technology transfer must be based on a plan that includes the ingredients of awareness, demonstration of benefits, support for implementation and continuing information dissemination. The plan presented here recognizes the obstacles that exist to the adoption of new processes and technology, and includes a multi-faceted approach that includes the ingredients of awareness, demonstration of benefits, implementation support and ongoing information dissemination. It is not sufficient to expect that a single short-course describing a particular research product will be successful. All of the ingredients included in the plan are required for successful technology transfer.

TECHNOLOGY TRANSFER INGREDIENTS

Awareness and information dissemination will be accomplished through the creation of a professionally produced quarterly newsletter that will describe ongoing research, research results, and successful applications of completed research. The newsletter will also describe available training and publications developed by the CITSM. The newsletter will be published in both hard copy and electronic form. Distribution of the newsletter will include members of the research community (other UTCs), the national network of LTAP Centers, the students of the Maryland LTAP Center, past students of CITE, and mailing lists provided by operations-oriented organizations such as ITE and ITS America.

Additional information dissemination will be accomplished through the use of training courses developed and delivered by the Maryland T2 Center (Maryland's LTAP center) and the CITE distance learning program. The former emphasizes basic system management and preservation concepts to local practitioners. The latter emphasizes the implementation and operation of advanced technology concepts using either a distance learning or blended format. The blended format includes a mix of on-line (distance learning training) interspersed with instructor led sessions. Through the delivery of these training courses, students will be provided with both introductory-level presentations as well as hands-on experience with the use of research products. For example, new decision support or simulation software will be presented at the concept level, and also in a workshop format that will permit the students to practice the use of these research products.

The final ingredient of the technology transfer will be a program similar to the Federal Highway Administration's Peer-to-Peer program. This program will involve personalized support of individuals and organizations that wish to adopt the research results, by Center staff with expertise in the particular program. This personalized support program will be used to assist in the initial stages of use of the new research, as well as ongoing support and evaluation of its effectiveness. The results of this program will be reported in the quarterly newsletter.

TECHNOLOGY TRANSFER RESOURCES

The outreach activities described in section II.F.2 will be led by members of the University of Maryland's CATT and T2 Centers. Distance learning and blended curriculum will be produced by CITE which is a program that exists within the CATT Center. Classroom courses for practitioners will be provided by the T2 Center.

The CATT/T2 organization along with the Department of Civil and Environmental Engineering both employ staff with the capabilities for developing, publishing and disseminating the hard copy and electronic newsletters. The staffs of the two organizations currently work together to publish a number of newsletters, and it is their intent to publish the CITSM newsletter utilizing these existing staff resources.

Requests for personalized assistance will be coordinated by the Director of the CITSM. It will be the Director's responsibility to identify the appropriate individual to provide the required support and to coordinate their activities with those of the requesting organization.

It must be emphasized that the newsletter and CITE training will be distributed nationally. Budget limitations will preclude the delivery of classroom training and the provision of personalized support outside of the State of Maryland.

II.F.1. Baseline Measures

The CITSM's baseline measures are presented in Appendix A.

II.F.2 Technology Transfer Program Outcome

As proposed, the baseline measures will exceed those required by items 10 and 11 in Appendix A of the UTC Strategic Plan instructions. The CITSM Director will be responsible for measurement of outreach outcome. These outcome measures, which are more difficult to evaluate will be reported anecdotally. They will include:

1) Number of individuals and organizations receiving training (both on-line and classroom)
2) Number of organizations receiving personalized support, and the type of support provided

3) Research results adopted by the practitioner community

4) Reported benefits (if any) realized as a result of the adoption of the research

It is difficult to anticipate the outcome of the technology program prior to the identification of the specific research activities to be conducted. However, specific technology transfer goals will be established once the research program is underway.

II.F.3 Planned Activities

As previously indicated, the following activities are planned for the technology transfer program:

- Professionally produced quarterly newsletter describing ongoing research, research results and successful applications
- Development of training courses delivered either through the Maryland T2 Center for research results applicable to local government
- Development of either on-line or blended training delivered through the CITE distance learning program for more sophisticated technology-based applications
- Personalized support for implementation of research results, similar to the FHWA Peer-to-Peer program.

3a. Required Activities

The following activities required by the Instructions for Preparing a UTC Strategic Plan are included.

3.a.1 Internet Home Page

The CITSM will maintain a website that will include all items identified by the UTC reporting requirements. To the extent that they are not already covered by the reporting requirements, the website will also include:

- A description of the Center and its objectives
- Descriptions of ongoing research and research results
- Calendar of relevant events
- Links to applicable websites
- Profiles of researchers associated with the CITSM
- Names of advisory board members
- Contact information

The website will be professionally maintained by staff members currently responsible for the Civil Engineering Department, Technology Transfer Center and CATT websites. Updates will be on an as-needed basis, but no less often than once per month.

3.a.2 Meeting Participation

Appropriate CITSM personnel will participate in UTC meetings and provide expertise and expert advice to USDOT on technical and education topics. It is anticipated that meeting participation will include presentations, as well as attending roundtables and other sessions discussing topics relevant to the specialties of the CITSM.

II.F.4 Performance Indicators

As indicated in Section II.F.1, a series of measures are proposed that exceed those identified as baseline measures in Appendix A, of the UTC Strategic Plan instructions. These measures will be obtained and reported in the following manner:

- Number of transportation seminars, symposia, distance learning classes, etc. conducted for transportation professionals. Reporting on these measures will be the responsibility of the CITSM research and advisory board

members, as well as members of CITE and the Technology Transfer Center

- Number of transportation professionals participating in these events. These measures will be reported in the same manner as those above.
- Number of organizations receiving personalized support, and the type of support provided. Reporting on these measures will be the responsibility of faculty members receiving awards for CITSM supported research. These reports will be included as a research grant requirement.
- Research results adopted by the practitioner community. This measure will be reported in the same manner as that described above.
- Reported benefits (if any) realized as a result of the adoption of the research. This measure will be derived from interviews with members of the practitioner community who have reported the adoption of research results. Interviews will be the responsibility of the CITSM Director.

III. MANAGEMENT APPROACH

The management philosophy of the CITSM aspires to establish a result-oriented performance-driven organization. The primary mission of the Center will be to create and successfully operate programs for research and development in transportation, and for education and training of future transportation professionals at various supporting private and public organizations.

The location in the Clark School of Engineering will provide full utilization of existing infrastructure, administrative and technical support. In addition the proposed Center will benefit from strong organizational interrelationships with CATT, the ISR, participating Clark School engineering departments, as well as the Robert H. Smith School of Business, School of Architecture, Planning and Preservation, and the Computer Science Department.

The CITSM will have a Steering Committee which will be composed of the Center Director, One faculty representative from Clark School of Engineering Departments other than CEE, Three faculty representatives from other departments at UMD, and the CEE Transportation Group faculty members. All faculty members of the Steering Committee will be tenured associate or full professors. The Steering Committee will oversee the Center Director's activities.

The Steering Committee will meet frequently to review the performance of the Center and set the agenda for the CITSM activities. The Committee will set the general guidelines for the research, education, technology transfer and commercialization programs of the Center. The Steering Committee will oversee the ongoing projects and activities of the Center and conduct project evaluations during and after the completion of each project and activity. The evaluations during the course of the project will focus on ensuring that appropriate progress is made according to the project schedule and deliverables. The evaluations after the completion of the projects will consider concordance with the Center's research and other priorities, as well as technical merit, productive use of resources and degree of success anticipated or achieved. The Center Administrative Director will be in charge of conducting these evaluations with the help of the Steering Committee.

The activities of the Center will require considerable and diverse expertise. The Center will have many industrial and state and local government partners. The Center will have a Board of Advisors composed of the representatives from the state and federal governments as well as private industry. At this time several prominent state government employees have agreed to serve on this Board. These individuals include Honorable John Porcari, Secretary, Maryland Department of Transportation, Mr. Neil Pedersen, Maryland State Highway Administration; Mr. Ronald Freeland, Maryland Transportation Authority; Mr. Paul Wiedefeld, Maryland Transit Administration, Mr. James White, Maryland Port Administration, Ms. Anne Ferro, Maryland Motor Trucking Association and Ms. Elizabeth Baker, MD Division, NHTSA.

Several others have been contacted as well. It is expected that the Board's roster will be completed in the next few weeks. The Board will meet once or twice a year and its main responsibility will be to provide guidance and comments on the Center's research and education programs.

It is envisioned that the CITSM will have an Industrial Affiliates Program modeled on the successful Clark School ISR program. Its goal is to draw upon a rich resource base of the Washington metropolitan area transportation and other high technology companies and involve industry in collaborating with CITSM in research programs, technology transfer, commercialization opportunities, identifying technology needs, and providing funding and in-kind contributions including manpower, software, hardware, facilities, and testbeds. The interaction with the transportation community will also be achieved through cooperation with other transportation research centers, and other major organizations interested in transportation research such as TRB, ITS America, I-95 Corridor Coalition, and National Laboratories.

The Center director, with assistance from the steering committee will be responsible for monitoring relevant transportation research and developments throughout the world, whether they arise in government, industry, universities, or any other organizations. Our supporting organizations will also assist our director and steering committee in keeping abreast of relevant transportation developments. Activities at other University Transportation Centers are considered especially relevant. We intend to fully meet the USDOT expectations in cooperating with those centers, including frequent exchanges of information, research results and ideas for improving center activities, and peer reviews of technical activities at other centers. We will also collaborate with other centers in planning training and technology transfer programs, in organizing conferences and in promoting implementation of research results.

III.A. INSTITUTIONAL RESOURCES

The CITSM is envisioned as a multidisciplinary Center that will benefit from the organizational and functional support of several key Departments in the Clark School of Engineering as well as other University of Maryland Schools. The Clark School of Engineering is vital to the success of the CITSM and will serve as its administrative hub. The Clark School programs are ranked number 16 in the 2007 US News and World Report ranking of graduate engineering schools. The Clark School units that are the key players in the CITSM are the Department of Civil and Environmental Engineering (CEE) and its three major centers CATT, Technology Transfer Center (T^2), and the Center for Networking of Infrastructure Sensors (CNIS), the Department of Electrical and Computer Engineering (ECE), the Department of Fire Protection Engineering (FPE) and the Institute for Systems Research (ISR).

Other UMD academic units that will play an active role are the Robert H. Smith School of Business, the School of Public Policy and the Department of Computer Science and the School of Architecture, Planning and Preservation. The Robert H. Smith School of Business is among the finest in the nation. Two programs which would be especially active participants in the CITSM are (1) Operations Research and Statistics (ORS) and Transportation, Logistics and Public Policy (TLPP). The ORS program is nationally recognized for its excellence both in graduate education and in research. Much of its research has been transportation related, such as network analyses, system optimization and simulation (particularly for transit systems). Its involvement with the CITSM is a great asset. TLPP also has a very high national reputation in all three elements of the program. Specifically in transportation, the faculty have conducted numerous studies on airline economics and operations, port operations and trucking. Their background and experience will be very useful to the CITSM particularly in transportation management areas. Other UMD departments and schools that are involved in the activities of the Center include the School of Public Policy, School of Architecture, Planning and Preservation, and the Department of Computer Science, all nationally renowned.

The CEE Department's three research centers (CATT, T^2, and CNIS) will collaborate closely with the CITSM. CATT is a major transportation center that provides services to local, state and federal government agencies and conducts applied research as needed. CATT maintains a significant level of activity year round with its cadre of full time staff. It also supports an extensive educational outreach program through CITE and it provides vital communication services to Washington metropolitan area police and fire departments through its CapWIN program. The T^2 Center, established in

August 1984, is physically and functionally within the CEE Department. Its main function is to provide systematic and coordinated information dissemination programs responsive to the needs of local and essentially rural transportation agencies in Maryland and nearby (DE, DC, and Northern VA). The Center's major goal is to assist cities, counties and public transportation operators in providing safe, efficient and effective transportation services. The T² Center will play a major role in the success of the CITSM by facilitating the dissemination of its education and research program results. CNIS is a multidisciplinary research center in the CEE Department with an emphasis on research in broadband, wireless networking of infrastructure sensors. The CNIS provides indoor and outdoor testbeds and other laboratory facilities for cross-disciplinary research in sensors and broadband, hybrid wireless communications networks. CNIS facilitates research collaboration between the CEE and ECE Departments' faculty members.

With the establishment of the CITSM the University of Maryland will have three major centers whose activities are focused on transportation research and education (CITSM, CATT, and T²). It is of utmost importance that the activities of these centers complement each other and not overlap. It is envisioned that CATT will maintain its current focus and activities in providing services to local, state and federal agencies and ITS education and training. CITSM will focus on advanced research and/or congestion chokepoints as high priority areas identified by USDOT and on recruiting and educating undergraduate and graduate students for the future transportation workforce. The T² Center will support both CITSM and CATT in facilitating the dissemination of research results and in technology transfer.

FACILITIES

A wide range of facilities is available at the University of Maryland for research in transportation. The Clark school has a complex computing network that is spread throughout four main engineering buildings that house the units playing key roles in the activities of the CITSM. The CITSM will be housed in the Kim Engineering Building. The Kim Engineering Building is the most advanced engineering building that opened only a year ago and houses all multidisciplinary research activities of the Clark School, including transportation research. The University of Maryland transportation research program benefits from major new facilities in the Kim Engineering, including the following new transportation research laboratories:

- Intelligent Transportation Systems Laboratory focuses on technologies and methodologies to make transportation systems more efficient and safer; e.g. by providing users (travelers) and managers with real-time information from distributed sensors, interconnecting vehicles and the infrastructure wirelessly, and automating systems for optimum performance.

- Advance Traffic Control and Safety Laboratory focuses on technologies and tools for design and simulation of roadway elements, traffic control and display devices. It has demonstrated capabilities to integrate detection systems with control models, traffic operation strategies and websites information systems for implementation and monitoring of real-time transportation projects. Since 2002 this lab has designed, developed and operated real-time demonstration projects exceeding $2.5 million. Examples of such projects can be found at http://oceancity.umd.edu, or http://i70.umd.edu/ or http://attap.umd.edu/.

- Collaborative Decision-Making Laboratory for Large-Scale Distributed Dynamic Systems allows investigation of large scale distributed systems of systems that are managed simultaneously by multiple agents.

- Real-Time Traffic Management Laboratory focuses on improving flow in traffic systems, reducing congestion and managing incidents and emergencies, including evacuations.

In its labs and student offices the transportation engineering program provides modern computers for each of its more than 60 graduate students. It also routinely employs teaching classrooms equipped with computers for each individual student for both its normal academic courses as well as its continuing education specialty courses. In addition to these impressive labs the University of Maryland also employs in its traffic studies instrumented vehicles equipped with video cameras, infrared distance measuring equipment and various other sensors.

CATT's infrastructure and facilities are invaluable assets for the CITSM research activities. CATT operates a computer laboratory that has 44 high-end research PCs. CATT Laboratory also hosts over 19 servers that are used for a wide range of projects from basic web services to database development to video distribution systems. These servers contain over 4 Terabytes of storage and an additional 6 Terabytes of robotic tape storage. CATT Laboratory also hosts a Maryland State Highway Administration CHART Traffic Management Workstation which has access to live transportation management center data and video from the entire state of Maryland, the District of Columbia and Northern Virginia. This system runs off of a dedicated T1 line that is separate from the Lab's copper gigabit LAN connected to two gigabit fiber connections to the University of Maryland's campus network. A VDOT Northern Virginia Traffic Management Center workstation and server are also available for viewing all incidents and traffic data from the NoVA Smart Traffic Center.

The lab has a cache of data acquisition and digital control equipment for measuring analog and digital signals from sensors and devices such as strain gauges, piezo sensors, temperature probes, vibrometers, etc. Additionally, CATT Lab has a six high-end video capture boards, two pan-tilt-zoom traffic cameras, and an Autoscope ® Video Traffic Detection System. Lastly, CATT Lab is the only research facility to house Maryland, Virginia, D.C., Montgomery County, and WMATA Transit data going back as far as 2001 for research and analysis. CATT Lab's 16kVa backup power supplies allow the current servers to run for approximately 2.5 hours in the event of a power outage. The sheer volume of real time and archived data that is available through CATT laboratory is a gold mine for CITSM researchers and is unmatched in any peer institution.

Other departments and schools that are involved in the CITSM research activities also have extensive research laboratories and computing facilities that will be available to the CITSM faculty and staff as needed. Library facilities are also extensive. The University libraries are noted for their excellence and McKeldin Library, the graduate research library, is a regional depository for all federal publications.

III.B. CENTER DIRECTOR

The Center Director will be a University of Maryland employee appointed based upon the recommendation of the Center's Steering Committee for a renewable term to be determined. The Center Director will be responsible for overseeing and coordinating all aspects of the Center operation, including research and development activities, education programs, student, faculty, and research staff support, funds allocation, financial management, administration, initiation of new projects, termination of projects, industrial collaboration and technology transfer efforts, commercialization efforts, new block grants, collaborative efforts with government R&D laboratories, liaison with other cooperating organizations which include other University Research Centers, and liaison with the State and Local governments. The Center Director will seek advice from the Advisory Board, especially regarding longer term developments and strategic issues. The Director will be the primary point of contact with the USDOT program managers and will be responsible for the day-to-day execution and implementation of the policies established by the Steering Committee.

The Center Director will be assisted by an Administrative Director. The Administrative Director will be in charge of all administrative and personnel affairs of the Center and will assist the Center Director in performing his or her duties. The Administrative Director will be responsible for the Center's compliance with all USDOT reporting requirements, the appointments of center faculty, staff, and graduate students, and the Center's accounting and finance.

Mr. Philip Tarnoff will be the Director of the CITSM. Mr. Tarnoff has over 35 years of experience in transportation consulting, research, and education and brings a wealth of management experience to the position. Dr. Ali Haghani, Chairman of the Civil and Environmental Engineering Department, who is the University of Maryland Principle Investigator of the Tier-I Center project will be the key faculty member involved in the administration of the CITSM and will work closely with Mr. Tarnoff in running the day to day operations of the Center.

III.C. CENTER FACULTY AND STAFF

An outstanding team of faculty from the University of Maryland has been assembled who will be involved in the Center programs. It includes many nationally and internationally known researchers in all areas of engineering and management. These individuals collectively have an impressive record of research accomplishments. The key faculty participants in the work of the Center will initially devote up to 25% of their time to the program. The faculty and staff will be supported by the Center funds only to the extent that they directly participate in the specific work of the Center. A brief description of the qualifications of the Center's key faculty members is given below.

DR. GANG-LEN CHANG is a Professor in the CEE Department and Director of the Traffic Safety and Operations Laboratory. He teaches courses in highway engineering, traffic control, traffic management and travel demand analysis. Over the past 20 years, he has served as the principal investigator for more than 100 research projects related to ITS and traffic operations for various state and federal agencies. His Ph.D. is from the University of Texas at Austin.

DR. CINZIA CIRILLO is an Assistant Professor in the CEE Department, primarily interested in transportation modeling techniques, applications of advanced statistical methods to travel demand forecasting, and survey techniques for determining travelers preferences and behavior. She has a Ph.D. from the Polytechnic School in Torino, Italy, and has worked at several European universities.

DR. CHRISTOPHER C. DAVIS is a Professor of Electrical and Computer Engineering. His research interests are in directional wireless communication systems, communication networks, sensor networks, fiber sensors, biosensors, and characterization of antennas in the near field. He is author of over 400 publications including journal and conference papers, books and book chapters. He holds 8 United States Patents. Dr. Davis is a Fellow of the IEEE, and a Fellow of the Institute of Physics. His Ph.D. degree is in physics from the University of Manchester in 1970.

DR. MARTIN DRESNER is a Professor of Logistics and Transportation in the University of Maryland's Smith School of Business. His research focuses on air transport policy and logistics management. He is co-author of a book on supply chain management, editor of the Transportation Journal, and President of the Transportation and Public Utilities Group of the American Economic Association. He has a Ph.D. in Policy Analysis from the University of British Columbia.

THE HONORABLE DR. JACQUES S. GANSLER is the University's Vice President for Research and holds the Roger C. Lipitz Chair in Public Policy and Private Enterprise (School of Public Policy) and is a Glenn L. Martin Fellow (Clark School of Engineering). He was the Under Secretary of Defense (for Acquisition, Technology and Logistics, 1997-2001), is a member of the National Academy of Engineering and a Fellow of the National Academy of Public Administration. He has served on numerous government and National Academy advisory boards, and is a frequent congressional witness. He was a member of the FAA Blue Ribbon Advisory Board on Acquisition Reform; a member of a National Academy Committee on the Next Generation Vehicle; a member of a National Academy Committee on Intermodal Transportation; and a member of an FAA Blue Ribbon Committee on the Global Positioning System. He holds graduate degrees in Electrical Engineering and in Economics.

DR. ALI HAGHANI is a professor and Chairman of the Department of Civil and Environmental Engineering. He has expertise in large-scale network optimization and fleet management focusing on emergency response management and freight transportation safety and security. He has served as a member of the Editorial Advisory Board for Transportation Research and is currently a member of the Joint Publication Committee for Highway Engineering and Urban Transportation, ASCE, is the Chairman of the Transportation Network Modeling Committee of the Transportation Research Board and an Associate Editor for the Journal of Intelligent Transportation Systems.

DR. ELISE MILLER-HOOKS, associate professor of civil & environmental engineering at the University of Maryland, has expertise in optimization and mathematical modeling of transportation systems, network algorithms, routing and scheduling, emergency response and evacuation, inter-modal goods transport, hazmat transport, and collaborative and multi-objective decision-making. Her research has been sponsored by FHWA, MD SHA & MTA, PennDOT, NSF, European Commission, United Technologies, the Protective Technology Center, and others.

DR. STUART MILNER is a research professor at the Department of Civil and Environmental Engineering and the Director of CNIS with expertise in topology control for optical wireless and RF networks, wireless network scalability, and sensor networks for critical infrastructure surveillance. Dr. Milner has held various positions within the United States Government, most recently as Program Manager at the Defense Advanced Research Projects Agency, where he directed R&D programs in advanced networking technologies, large-scale simulation networks and mobile wireless network technologies.

MR. MICHAEL PACK serves as the Director of the Center for Advanced Transportation Technology Laboratory at the University of Maryland in College Park. Mr. Pack has extensive experience in the areas of Intelligent Transportation Systems, data acquisition systems, database management systems, process control, data visualization methods, and video image processing. Mr. Pack received his M.S. in Systems Engineering from the University of Virginia and B.S. in Integrated Science & Technologies from James Madison University in Harrisonburg, VA.

DR. PAUL SCHONFELD is a Professor in the CEE Department of Civil & Environmental Engineering and Director of its Transportation Engineering Program. For numerous federal and state agencies he has developed methods for transportation system evaluation, simulation, optimization, planning, infrastructure management, and real-time control, focusing especially on public transportation, airports, and waterways. He has a Ph.D. from U. C. Berkeley.

Other University of Maryland faculty members will also participate in the CITSM activities. Due to space limitations, we do not provide biosketches for all but only list the names of some of them as follows:

MICHAEL BALL - Professor of Decision and Information Technologies, R.H. Smith School of Business
GREGORY BAECHER - Professor of Civil and Environmental Engineering
KELLY CLIFTON - Assistant Professor of Urban Studies, School of Architecture and Planning
CHUNG FU - Associate Research Engineer, Civil and Environmental Engineering
STEVEN GABRIEL - Associate Professor of Civil and Environmental Engineering
BRUCE GOLDEN - Professor of Decision and Information Technologies, R.H. Smith School of Business
DIMITRIOS GOULIAS - Associate Professor of Civil and Environmental Engineering
GERRIT-JAN KNAAP - Professor and Director, National Center for Smart Growth
DAVID LOVELL - Associate Professor of Civil and Environmental Engineering
JAMES QUINTIERE - Professor of Fire Protection Engineering
CATHERINE PLAISANT-SCHWENN - Associate Research Scientist, Department of Computer Science

III.D. MULTIPARTY ARRANGEMENTS

The University of Maryland is the sole organization operating the CITSM. Therefore, there are no multiparty arrangements.

III.E. MATCHING FUNDS

While the University of Maryland is the sole organization in the operation of the CITSM, it enjoys the strong support of many federal, state, and local agencies as well as private sector companies which will play strong roles in shaping its research agenda and its educational programs. The CITSM will maintain close interactions and linkages with the transportation community. The University of Maryland has a proven record of cooperation and interaction with a variety of public and private sector transportation organizations and individuals within the transportation community. The CITSM will continue and strengthen this interaction through its Advisory Board. Two state agencies have already committed to be partners with the University of Maryland in establishing the CITSM and have pledged their strong support for the activities of the center

by providing matching funds for the CITSM activities. These are Maryland State Highway Administration and Maryland Transportation Authority, who have pledged to provide $600,000 and $200,000, respectively in matching funds. Their letters of support are shown in Exhibits H.1 and H.2. CITSM faculty and staff are also currently in discussion with several other public and private sector agencies to garner their support for the activities of the CITSM.

EXHIBIT H.I

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*

SHA State Highway Administration — Driven to Excel

Robert L. Flanagan, *Secretary*
Neil J. Pedersen, *Administrator*

Maryland Department of Transportation

August 7, 2006

Ali Haghani, Ph.D., Chairman
Department of Civil and Environmental
Engineering
1173G Martin Hall
University of Maryland
College Park, Maryland 20742

Dear ~~Dr. Haghani~~ Ali:

The Maryland State Highway Administration (SHA) is pleased to express its strong support for the University of Maryland's application for the establishment of a federally funded Tier I Transportation Center, as well as SHA's interest in participating in the activities of the center. The SHA has greatly benefited from the wide range of educational and research activities that are ongoing at the University. This center not only will play a very important role in broadening and strengthening the current partnership between SHA and the University, but will foster education, training, and research in Maryland together with strong partnerships between the University and other state and local government agencies.

Because we are committed to the partnership with the University, should the center become a Tier I Transportation Center, SHA is prepared to provide up to $600,000 per year to match the federal funds to be spent on projects that are of interest to SHA. The funding would come from SHA's research program and other project funds.

My telephone number/toll-free number is 410-545-0400 or 1-800-206-0770
Maryland Relay Service for Impaired Hearing or Speech: 1.800.735.2258 Statewide Toll Free
Street Address: 707 North Calvert Street • Baltimore, Maryland 21202 • *Phone:*410.545.0300 • www.marylandroads.com

EXHIBIT H.1 (CONT'D)

Ali Haghani, Ph.D.
Page Two

Thank you for the current research services and partnership activities that the University provides to SHA. We wish you success with the proposed center and look forward to continuing our close working relationship with the University. If you have any questions or comments, please do not hesitate to contact Dr. Richard Y. Woo, Director of Policy and Research, SHA at 410-545-0340, toll-free 888-204-0157 or via email at rwoo@sha.state.md.us. SHA will be pleased to assist you. Of course, you should never hesitate to contact me directly.

Sincerely,

Neil J. Pedersen
Administrator

cc: Richard Y. Woo, Ph.D., Director of Policy and Research, SHA

EXHIBIT H.2

MARYLAND TRANSPORTATION AUTHORITY

Robert L. Ehrlich, Jr.
Governor

Michael S. Steele
Lt. Governor

Robert L. Flanagan
Chairman

Susan M. Affleck Bauer, Esq.
Louise P. Hoblitzell
John B. Norris, Jr., P.E.
Carolyn Y. Peoples
Carol D. Rieg
Walter E. Woodford, Jr., P.E.

Trent M. Kittleman
Executive Secretary

Engineering Division
300 Authority Drive
Baltimore MD 21222-2200
410-537-7800
410-537-7801 (fax)

410-355-7024 (TTY)
1-888-754-0098

e-mail: mdtaengineer@mdtransportationauthority.com

www.mdtransportationauthority.com

August 8, 2006

Professor Ali Haghani
Chairman
Department of Civil and Environmental Engineering
University of Maryland
College Park, MD 20742

Dear Professor Haghani:

I am writing to express the strong endorsement of Maryland Transportation Authority for the establishment of a Tier I Transportation Center, which is proposed for funding by the US Department of Transportation, and our interest in participating in its activities. We are impressed by the wide range of transportation research, education and training activities that are on-going at the University of Maryland and we strongly believe that this Center will further enhance these activities and will foster an even stronger partnership between our two organizations.

Should the Center be successful, we are prepared to provide up to $200,000 per year to match the federal funds to be spent on projects that are of interest to the Maryland Transportation Authority.

We hope yours is one of the ten new federally funded centers and look forward to continuing our partnership with the University of Maryland.

Sincerely,

Geoffrey V. Kolberg

Geoffrey V. Kolberg, P.E.
Executive Director of Engineering & Construction Management

GVK/cet

IV. BUDGET DETAILS

The proposed allocation of the CITSM funds is given in Exhibit III. The proposed budget includes salaries for the CITSM Director, faculty researchers, an Administrative Director, full time research staff members, technical support staff and graduate students. These salaries are charged to both the federal and the matching funds. Exhibit III contains a budget plan for the first year of CITSM's operation. This budget includes $816,600 of federal funds and $1,373,246 in non-federal matching funds for a total of $2,189,846.

Exhibit III clearly indicates the proportion of the funds in each category that are allocated to the federal funds, matching funds from the University of Maryland partners, and matching funds from the University of Maryland. The CITSM partners will cover $800,000 of the required matching funds. The University's commitment is $451,938. The total matching funds are above and beyond the required matching funds and bring the total first year budget for the CITSM to $2,189,846.

IV.A. FORMAT

The CITSM's budget plan is prepared according to the format presented in Exhibit III and shows the required cost categories. Following the first year project selection, more detail will be provided in each line item category presented in Exhibit III. Until the CITSM selects the specific projects it will fund, except for the Center Director's salary, the costs shown in various categories in Exhibit III are estimated.

IV.B. GRANT YEAR

The proposed CITSM Grant Year 1 is 1 July 2008 through 30 June 2009. The University of Maryland fiscal year starts on July 1 each year. The Fall Semester normally starts in the third week of August and the Spring Semester normally starts in the third week of January. Since the contracting process for the CITSM took an unusually long time, we are proposing the Grant Year to start at the beginning of our next fiscal year. That way the Grant Year will cover the next fiscal year.

IV.C. SALARIES

It is expected that the Center Director will spend 40% of his time on the management of the Center activities. One other key faculty member will spend up to 40% of their time on the Center activities. Others will spend time as required. 10% of the salary of the Center Director and the key faculty member will be charged to the federal funds. The other 30% will be covered by the matching funds.

The Center will have an Administrative Director to assist the director in the Center's day to day operations. This staff position is crucial for the success of the Center. The Administrative Director's responsibilities were discussed in Section III.B. 50% of the Administrative Director's salary will be covered from the federal funds and the other 50% from the matching funds. Salary support is also budgeted for technical support of the activities of the CITSM.

The faculty salaries indicated in Exhibit III are the funds that are allocated for faculty salary expenditures for research projects. These funds along with the Graduate Research Assistant (GRA) salaries will be competitively allocated based on the review of the research proposals that are submitted for funding to the CITSM by the Panel of Experts.

The Center will support up to15 graduate students as GRAs. The GRAs are paid a stipend and they gain tuition and health benefits. In addition, the Center will support 10 Graduate Student Fellowships through funds provided by the Center's partner agencies and the University of Maryland. It is envisioned that as new students enroll in the Center's educational programs, they will start as Graduate Fellows in their first year when they enroll in graduate classes. After one year of education, they will become trained and productive researchers and can advance to the GRA status. In this way, the federal funds are best used for productive research. In addition, the Center will support 10 undergraduate students in a special summer research program in an effort to recruit the best and the brightest to the University of Maryland graduate programs in transportation and eventually to the transportation profession. Undergraduate students are paid an hourly rate and accrue no fringe benefits.

Other important items in the proposed budget are the fringe benefits at a rate of 26%, permanent equipment acquisition for the Center's faculty, staff and students, expendable supplies and services and travel funds for attending conferences and symposia to disseminate the Center's research results.

IV.D. SCHOLARSHIPS

As discussed above Center will support 10 Graduate Student Fellowships through funds provided by the Center's partner agencies and the University of Maryland. It is not envisioned at this time that federal funds will be used for scholarships. If in the future the Center uses federal funds for fellowships or scholarships, it will do so within the limitations set forth in section III.5 of the "General Provisions of Grant Agreements for UTCs."

IV.E. EQUIPMENT

The CITSM does not anticipate acquiring any permanent equipment having a unit acquisition cost of $5,000 or more. The equipment budget shown in Exhibit III is primarily for computing hardware and software for use in research.

IV.F. FOREIGN TRAVEL

The CITSM does not anticipate foreign travel. If, on a rare occasion, foreign travel becomes necessary, written permission will be obtained from RITA, per section III.4 of the General Provisions, prior to the initiation of such travel.

If a principle investigator expects to travel abroad as part of the requirements for completion of a research project, he or she must indicate that requirement in the early proposal stage so that the Panel of Experts reviewing the proposal consider the merits of that travel during their evaluation. If the project is funded, then there will be ample time to secure the necessary authorizations from RITA.

IV.G. OTHER DIRECT COSTS

Other direct costs included in Exhibit III are the fringe benefits for the faculty, staff and graduate students as well as tuition remission costs, domestic travel and expendables. Faculty, staff, and graduate student fringe benefits are calculated at 26% of their salaries. Graduate student tuition remission is calculated at $427 per credit for 24 credits for each graduate student. Domestic travel budget is for the principle investigators' travel to conferences and symposia to disseminate the results of their research.

IV.H. FACILITIES AND ADMINISTRATIVE (INDIRECT) COSTS

The current audited indirect cost for the University of Maryland is 50% that is reflected in Exhibit III. The indirect costs are applied on all budget items except for the tuition remission, fellowship and the equipment costs.

EXHIBIT III

University Transportation Center (UTC) Budget Plan

Name of Grantee: University of Maryland Grant Year: 4/1/2008 thru 6/30/2009

CATEGORIES	Budgeted Amount*	Explanatory Notes
Center Director and Key Faculty Member Salaries	$156,766	See Section IV.C
Faculty Salaries	$339,818	See Section IV.C
Administrative Staff Salaries	$70,000	See Section IV.C
Other Staff Salaries	$25,000	See Section IV.C
Student Salaries	$461,915	See Section IV.C
Staff Benefits	$260,910	See Section IV.G
Total Salaries and Benefits	$1,314,408	
Scholarships/Tuition	$303,720	See Section IV.D
Permanent Equipment	$20,000	See Section IV.E
Expendable Property, Supplies, and Services	$6,000	See Section IV.G
Domestic Travel	$20,000	See Section IV.G
Foreign Travel	$0	None at this time.
Other Direct Costs (Specify)	$0	Included in the above categories
Total Direct Costs	$1,664,128	
F&A (Indirect) Costs	$525,718	See Section IV.H
TOTAL COSTS*	$2,189,846	
Federal Share	$816,600	
Matching Share (if applicable)	$1,373,246	

*Includes Federal and Matching Shares

APPENDIX A

BASELINE MEASURES FOR UNIVERSITY TRANSPORTATION CENTERS (UTCs)

The numbers reported below are for the 2006-2007 academic year. These numbers represent the educational and research activities of the University of Maryland without the CITSM.

RESEARCH SELECTION

1. Number of transportation research projects selected for funding.

_____16_____

1a. Number of those projects that you consider to be: basic research ____3____, advanced research ____5____, and applied research _____8_____. Projects may be included in more than one category if applicable.

2. Total budgeted costs for the projects reported in 1 above.

$__1,200,000__

RESEARCH PERFORMANCE

3. Number of transportation research reports published.

_____16_____

4. Number of transportation research papers presented at academic/professional meetings.

_____16_____

EDUCATION

5. Number of courses offered that you consider to be part of a transportation curriculum. Report courses shown in the university course catalog as being offered, whether or not they were conducted during the academic year being reported.

Undergraduate: _____15_____
Graduate: _____18_____

6. Number of students participating in transportation research projects. Count individual students (one student participating in two research projects counts as one student).

Undergraduate: _____ 5_____
Graduate: _____43_____

HUMAN RESOURCES

7. Number of advanced degree programs offered that you consider to be transportation-related.

Master's Level:	6
Doctoral Level:	3

8. Number of students enrolled in those transportation-related advanced degree programs.

Master's Level:	11
Doctoral Level:	45

9. Number of students who received degrees through those transportation-related advanced degree programs.

Master's Level:	6
Doctoral Level:	10

TECHNOLOGY TRANSFER

10. Number of transportation seminars, symposia, distance learning classes, etc. conducted for transportation professionals.

Distance learning short courses	42
Instructor lead distance learning courses	2
Classroom courses (LTAP)	23

11. Number of transportation professionals participating in those events.

Distance learning including students attending both online and instructor lead courses	200
Students attending classroom courses (LTAP)	246