Mountain-Plains Consortium
Strategic Plan for the SAFETEA-LU Period

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

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Table of Contents

I. Program Overview

The Mountain-Plains Consortium (MPC) is comprised of: Colorado State University, North Dakota State University, South Dakota State University, University of Utah, and University of Wyoming (Figure 1). The MPC spans Region 8 through its institutions and strategic partnerships. MPC universities are located in all states of the region, except Montana. The MPC universities are partners with state and local transportation agencies and tribal governments. Four of the MPC universities host a Local Technical Assistance Program (LTAP) or Tribal Technical Assistance Program (TTAP) center. MPC's strategic plan reflects a desire to serve the entire region, while leveraging UTC funds to address critical national issues.

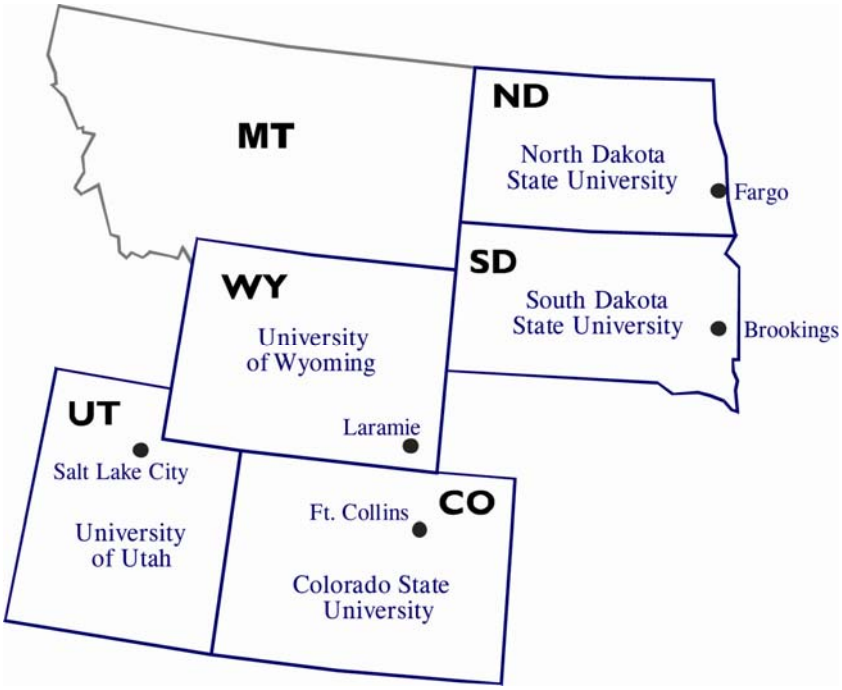

Figure 1. Location of MPC Universities in Region 8

North Dakota State University (NDSU) is the lead university responsible for overall program administration. NDSU is also the recipient of a Title III UTCP grant to the Small Urban & Rural Transit Center. The MPC strategic plan addresses only the regional university transportation center grant for the SAFETEA-LU period.

I.A Glossary

AREMA	American Railway Engineering and Maintenance of Way Association
ARTBA	American Road Transportation Builders Association
ASCE	American Society of Civil Engineers
BIA	Bureau of Indian Affairs
CDOT	Colorado Department of Transportation
CSU	Colorado State University
CSCMP	Council of Supply Chain Management Professionals
CUTC	Council of University Transportation Centers
CVISN	Commercial Vehicle Information Systems and Networks
USDOT	United States Department of Transportation
Executive Committee	The MPC director and one representative from each member university
FMSCA	Federal Motor Carrier Safety Administration
FHWA	Federal Highway Administration
FRP	Fiberglass Reinforcement Plastic
FTA	Federal Transit Administration
GIS	Geographic Information System
GPS	Global Positioning System
HAZMAT	Hazardous Materials
HERS-ST	Highway Economic Requirements System – State Version
HOV	High Occupancy Vehicle
HPMS	Highway Performance Monitoring System
IHSDM	Interactive Highway Safety Design Model
IP	Internet Protocol
IRR	Indian Reservation Roads
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
IVN	Interactive Video Network
LTAP	Local Technical Assistance Program
LTCCS	Large Truck Crash Causation Study
LTPP	Long Term Pavement Performance
MPO	Metropolitan Planning Organization
MPC	Mountain-Plains Consortium
NDDOT	North Dakota Department of Transportation
NDSU	North Dakota State University
NSTC	National Science & Technology Council
NHI	National Highway Institute
QC/QA	Quality Control/Quality Assurance
RITA	Research and Innovative Technology Administration
RTSSC	Rural Transportation Safety and Security Center
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SDSU	South Dakota State University
SDDOT	South Dakota Department of Transportation
SHRP2	Strategic Highway Research Program - 2
SWUTC	Southwest Region University Transportation Center

TEA-21	Transportation Efficiency Act for the 21st Center
TLN	Transportation Learning Network: A Regional Telecommunications Network
TRB	Transportation Research Board
TSSC	Transportation Safety Systems Center
TTAP	Tribal Technical Assistance Program
UDOT	Utah Department of Transportation
UGPTI	Upper Great Plains Transportation Institute
UU	University of Utah
UTCP	University Transportation Centers Program
UW	University of Wyoming
WYDOT	Wyoming Transportation Department

I.B Center Theme

The theme of this center is: *Safe, Mobile, and Sustainable Freight and Passenger Transportation Systems in the Mountain-Plains Region*. This theme reflects USDOT's strategic goals, as well as the unique characteristics of the region.

In the Mountain Plains region, a few large metropolitan areas serve as regional economic and transportation hubs for smaller metropolitan trade centers. These metropolitan centers are surrounded by sparsely populated land—much of which is parkland, Indian reservation, or other federal land. Freight flows are critically important in the region. Farm, forest, and mineral products must be moved from rural to urban areas for processing, consumption, or re-shipment. A reverse flow of inputs and supplies is necessary for rural areas to thrive. Freight corridors through the region are vital to transcontinental flows and national commerce.

With many miles of railroad and rural highway, infrastructure preservation and renewal are critical to mobility and economic development. However, infrastructure planning is complicated by environmental extremes, high winds, and mountainous terrain. Transportation safety and security are major concerns, given the extent of rural two-lane highway travel that occurs under challenging winter conditions and the widespread movement of hazardous materials. Moreover, personal mobility is a priority for rural residents who must have access to the health and professional services concentrated in metropolitan centers.

The Mountain Plains region is also characterized by growing intercity corridors which experience heavy automobile and freight traffic. However, the mobility demands of these corridors must be balanced with the residents' desires to preserve scenic landscape and environmental quality. Growing urban traffic congestion and chokepoints may constrain future economic growth. Peak-hour traffic congestion may soon impede tourism and the unique quality of life associated with national parks and resorts.

I.C Center Director's Summary

The Vision

MPC's vision and theme have been developed in collaboration with our Advisory Committee and strategic partners. The theme and vision reflect our internal strengths and capabilities, as well as opportunities that exist within the region and nation. Our vision is: *To be a leader in transportation by promoting its critical importance to economic viability and quality of life through research, distance learning, and interdisciplinary education, while serving the unique and critical needs of the Mountain-Plains Region*. We envision a center that is a synergistic regional leader, a partner to regional and national stakeholders, a leader in distance learning, a center for the dissemination of information on emerging issues and technologies, and a partner in improving tribal planning and asset management.

During the SAFETEA-LU period, MPC will conduct a mixture of applied, advanced, and basic research. Our annual research program will include input from state transportation departments and industries to address short- to intermediate-run priorities. Through advanced research, MPC

will build future capabilities to improve and develop transportation models and techniques needed to analyze emerging issues. During the SAFETEA-LU period, MPC will expand distance-learning options by increasing the availability of technical short courses, workshops, and seminars throughout the region. In particular, MPC will expand the scope of technical training available via the Transportation Learning Network (TLN)—a regional telecommunication system with sites in all states of the region.[1]

MPC will serve as a regional center for the dissemination of research and information on emerging transportation issues and technologies and, in doing so, will collaborate with other centers in the region, such as the University of Denver and the Western Transportation Institute of Montana State University.[2] Moreover, MPC will continue its tribal transportation outreach initiative. The outreach initiative is a long-term effort designed to improve tribal planning by: (1) making highway planning, safety, and asset management models available to tribal planners (along with training and data development strategies); (2) increasing the technical training available through distance learning media, and (3) facilitating the matriculation of Native American students from tribal and junior colleges to MPC universities. This vision is shared with both of the TTAP Centers in Region 8: The Northern Plains TTAP Center at United Tribes Technical College in Bismarck, ND, and the Colorado TTAP Center at Colorado State University.

Implementing the Vision

The keys to achieving the vision are: (1) the guidance and leveraging opportunities made possible by the MPC Advisory Committee and other strategic partners; (2) the foundation programs and institutional resources of the MPC universities, which provide extensive opportunities for distance learning and communication with partners throughout the region; (3) the high-level of collaboration and interchange among the MPC universities, which is the basis for an integrated region-wide program; and (4) leveraging of resources.

Continuous Guidance. The MPC Advisory Committee is intimately involved in defining the vision, theme, and strategic objectives of the center, as well as in identifying critical research needs. In the future, the Advisory Committee will provide on-going guidance and input to ensure that the center addresses the educational, research, and workforce development needs of the region. Meanwhile, research advisory groups will provide detailed input on project selection (Figure 2). The priorities of state and local transportation agencies, the Federal Highway Administration, and the Federal Motor Carrier Safety Administration will be reflected through the Advisory Committee (Figure 3). Input from the Federal Transit Administration will be provided primarily through the Small Urban & Rural Transit Center, which is located at North

[1] TLN is a dedicated telecommunication network which includes three state transportation departments in Region 8. Such a network is essential to the delivery of a regional program in a vast rural area. TLN provides MPC with an effective mechanism for the exchange of graduate transportation courses among universities, thereby increasing the technical electives available to students on all MPC campuses. Information regarding TLN transportation and training activities can be viewed at http://www.translearning.org/

[2] MPC will expand its cooperative relationship with the University of Denver through new collaborations in intermodal transportation, human factors, and transportation security. Moreover, MPC will work with the Western Transportation Institute of Montana State University to coordinate the delivery of training and technology transfer activities in rural safety.

Dakota State University. Input from Federal Railroad Administration and other USDOT agencies will be obtained through the research selection process. Railroad industry guidance will be provided by the Association of American Railroads. Overall guidance will be provided by USDOT through the liaison, the Advisory Committee, and review of research problem statements.

Foundation Educational and Distance-Learning Programs. All MPC universities have well-established transportation education programs, which provide a strong foundation for multimodal, multidisciplinary educational opportunities. With TLN, distance-learning short courses and training can be delivered to 29 state transportation department district sites in the region. Moreover, the flexible architecture of the network allows MPC to connect with many compatible sites throughout the nation.

Consortium Interchange and Collaboration. The synergies and critical mass of resources generated from the consortium and related partnerships enable the delivery of region-wide services while effectively contributing to the national transportation agenda. Individually, no university can afford the number of transportation faculty necessary to sustain a comprehensive multidisciplinary multimodal program. Collectively, however, the MPC universities can marshal the faculty expertise and institutional resources needed to sustain a region-wide effort.[3]

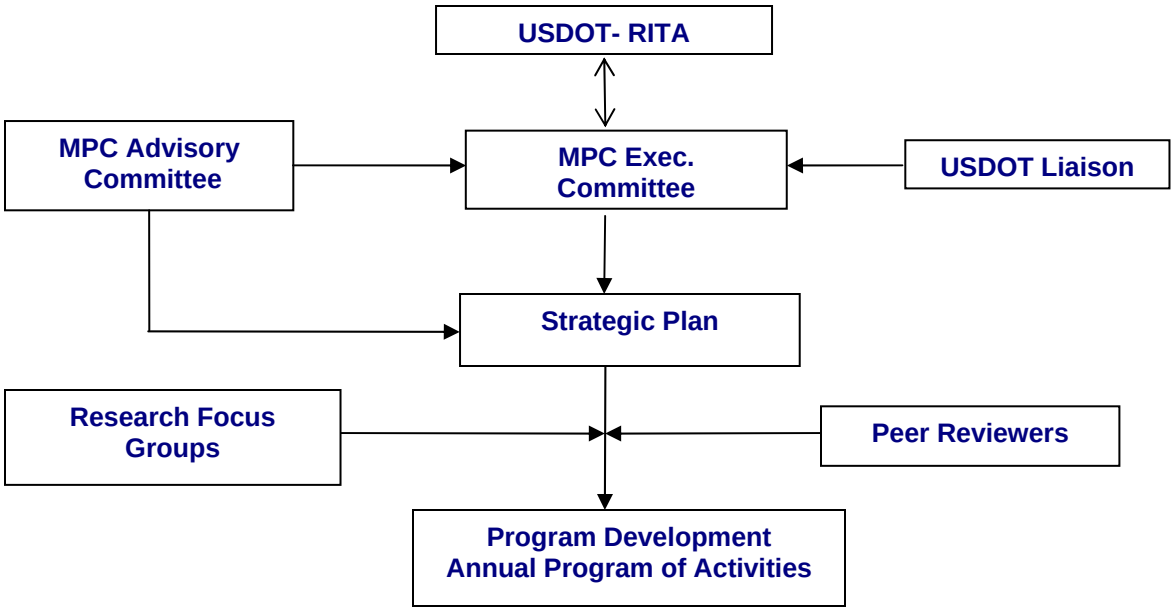

Figure 2. Mountain-Plains Consortium: Organization and Programming Process
Note: The USDOT liaison provides input to the strategic plan as a member of the advisory committee.

[3] Although each university will conduct its own research, faculty from several MPC universities will frequently collaborate on projects that benefit the entire region. By leveraging its resources, MPC will address a wide range of issues that benefit surface transportation agencies, highway users, railroads, and motor carriers and develop innovative transportation programs that meet changing workforce needs. Collectively, the faculty and institutional resources of the MPC universities encompass a wide range of disciplines and topics, and provide a strong platform for multidisciplinary, multimodal education and research.

Leveraging. Our close relationships with state and local transportation agencies in the region, and with railroads and other private industries, create ample opportunities for the leveraging of UTCP funds. Through the strategic planning and research selection process, common areas of research interests with state DOTs will be identified which, in turn, will lead to matching funds for much of the research and technology transfer programs. The potential use of multi-state pooled-funds offers one of the greatest opportunities for leveraging. During the SAFETEA-LU period, we will work through our Advisory Committee to make such projects a reality.

Mr. Grant Levi (Chair) Deputy Director North Dakota Department of Transportation	Dr. Christine Johnson (USDOT liaison) Director of Field Services – West Federal Highway Administration
Ms. Peggy Catlin Deputy Executive Director Colorado Department of Transportation	Mr. Carlos Braceras Deputy Director Utah Department of Transportation
Mr. Loran Frazier Chief Engineer Montana Department of Transportation	Mr. Jeff Loftus Transportation Specialist Federal Motor Carrier Safety Administration
Mr. Anthony R. Giancola Executive Director National Association of County Engineers	Mr. Delbert McOmie Chief Engineer Wyoming Department of Transportation
Mr. David Huft Research Engineer South Dakota Department of Transportation	Mr. Craig Rockey Vice President - Policy & Economics Association of American Railroads

Figure 3. MPC Advisory Committee

Sustaining the Vision

By the end of the grant period, MPC will be a leader in the generation and dissemination of knowledge that will help transportation agencies and industries plan, design, and maintain safe, mobile, and sustainable transportation systems in the Mountain-Plains Region. Furthermore, MPC possesses the institutional resources and partnerships to sustain this vision beyond the end of the SAFETEA-LU period. Colorado State University, North Dakota State University, South Dakota State University, and University of Wyoming have added new tenure-track faculty positions in transportation during the last two years. Moreover, we anticipate adding new faculty positions and expanding our labs and equipment to ensure that we have the resources necessary to sustain and grow our transportation programs.

During the SAFETEA-LU period, MPC will initiate multi-university, multi-state studies of common transportation problems. The universities' research capabilities will be matched with state, local, and industry needs through the Advisory Committee and research advisory panels. These research partnerships will continue beyond the end of the SAFETEA-LU period.

II. Program Activities

II.A Research Selection

The research selection goal is *an objective process for selecting and reviewing research that balances multiple objectives of the program.*

Research Selection Program Outcome

The MPC research selection process is an extension of the process developed and implemented during the TEA-21 period. The outcome is an annual program of peer- and practitioner-reviewed proposals which address the critical needs of the region and USDOT's strategic goals. The selection process entails a sequence of reviews in which each potential project is thoroughly reviewed, internally and externally. The roles of the MPC Advisory Committee and research advisory panels in this process are described in Part III.

Selection Criteria. The research selection criteria are summarized in Table 1. A proposal must score high on criteria 1 and 2 to be selected. The involvement of graduate students and faculty from several disciplines is desirable. Applied research proposals are expected to yield products or results that are usable by transportation practitioners or other researchers (criterion 4). However, this criterion is less applicable to advanced research proposals.

Table 1. MPC Research Selection Criteria

Criterion	Description
1. Contribution to Knowledge	The extent to which the proposed project will expand knowledge in the subject area, including the magnitude of the potential increase in knowledge (e.g. marginal, incremental, large-scale). Contributions to knowledge may include new research or testing methods, new practices or prototypes, and new research findings.
2. Relevance to Strategic Research Issues	The extent to which the proposed project will address critical MPC research issues and USDOT strategic goals.[4]
3. Involvement of Students and Multidisciplinary Faculty	The extent to which graduate students are included in a meaningful and substantive way, and faculty from several disciplines and universities are involved.
4. Outcomes/Tangible Products	The extent to which the proposed project is likely to yield products or results usable by transportation practitioners or other researchers. Outcomes may include: new practices, models, software, testing equipment or procedures, standards, specifications, or manuals.
5. Costs	The project budget should be commensurate with the expected scale of knowledge gains/benefits and scope of effort.
6. Matching Resources	The extent to which UTC funds are leveraged.
7. Congestion Mitigation	The extent to which the proposed project will address USDOT's priority objective of mitigating congestion chokepoints.

[4] Since the MPC critical issues are correlated with USDOT goals, the scoring of this criterion reflects national, as well as regional priorities.

Table 1. MPC Research Selection Criteria	
Criterion	**Description**
8. Advanced Research	The extent to which the proposed project will address USDOT's priority objective of advanced research.

All proposals are not expected to address advanced research needs or congestion mitigation. However, a proposal will receive "extra points" in the scoring process if it does so. To some extent, the mix of applied, advanced, and basic research conducted during the SAFETEA-LU period will be influenced by the research priorities of match providers. In evaluating match contributions, both the level and veracity of potential commitments are important. Projects which generate hard (dollar) matches are preferred.

Relationship of Proposals to USDOT's Strategic Objectives. All proposals must address critical MPC research issues and USDOT strategic objectives (criterion 2). Research emphasis areas are grouped under three main headings: Transportation Safety and Security, Mobility and Global Connectivity, and Infrastructure Management and Environmental Stewardship. The relationships between MPC focus areas and USDOT's goals are illustrated in Figure 4. To be eligible for funding, a proposal must be related to one or more of the focus areas described below; or, the proposal must clearly articulate how the research will contribute to one or more of USDOT's strategic objectives.

1. High-Risk Rural Roads. Rural roads continue to experience a disproportionate number of crashes, resulting in more fatalities and injuries than their urban counterparts. Fatalities on rural roads occur at a rate two-and-a half times greater than on all other routes. Research proposals should address the unique characteristics which contribute to increased risks at particular locations, including: highway geometry, use of alcohol and other substances that impair drivers, monotonous driving conditions, and high crash rates on Indian reservation roads.

2. Rural Transportation Operations. Changes in normal traffic operations that stem from unusual conditions may create or worsen safety problems. Research is needed to better understand: (1) adverse weather and its impacts on traveler safety, including winter weather maintenance decisions, traveler information, and road closures; (2) impacts of incidents and special events, including corresponding response plans; (3) maintenance issues (including snow removal); (4) emergency response to accidents and hazardous material incidents; and (5) communications infrastructure support.

3. Effective Safety Management. Research is needed to identify effective uses of crash and safety data, especially in the development of safety management plans. Some of the expected outcomes of safety-management research include: improvements to crash reporting systems and better utilization of crash data, the development of unique regional variables to be used in safety analysis, and improvements in communication and interaction among different levels of transportation agencies (federal, state, and local). The under reporting of crashes on reservation roads is an important issue that must be addressed before safety options can be fully evaluated.

4. Human Factors. Because rural crashes often involve single-vehicle, run-off-the-road crashes, there is a need to examine unique human factors corresponding to the characteristics of the

Mountain-Plains Region. These critical factors include: driver behavior; driver attitudes to speed, alcohol, and seat belt use; and other regional and cultural factors. These issues are equally applicable to drivers of commercial and passenger vehicles.

5. Low-Cost Safety Improvements. Technology transfer projects are needed to help disseminate available information regarding successful low-cost safety improvements to local and county transportation agencies in the region. Research is needed to identify improvements in roadway inventory data and road safety audit procedures which are necessary to identify cost-effective safety improvements.

6. Work Zone Safety. Research is needed to: (1) develop methods of accurately analyzing the traffic operational and safety impacts of work zones, (2) identify strategies to reduce traffic delay and improve safety, and (3) demonstrate the use of analysis tools and traffic simulation models.

7. Heavy Vehicles and Commercial Trucks. Research into large truck safety issues is needed, especially ways of assessing motor-carrier safety performance data—e.g., evaluating the effectiveness of CVISN partial deployment in terms of its economic and safety impacts—and hazardous material incident planning and response. Researchers are encouraged to access unprecedented details about the events surrounding truck crashes in the Large Truck Crash Causation Study (LTCCS). The Federal Motor Carrier Safety Administration has posted online the LTCCS database, which consists of a nationally representative sample of 967 large-truck fatal and injury crashes with up to 1,000 elements in each crash. These data elements—which are not available elsewhere—will allow researchers across the universities in the MPC to analyze the total spectrum of knowledge about truck crash factors. FMCSA believes that analysis from many sources is the best path for realizing the full potential of the LTCCS.

8. Safety of Unpaved Roads. Most local agencies in the Mountain-Plains Region manage hundreds of miles of gravel roads. For some agencies, the percentage of gravel roads approaches 95 percent of their total networks. Research into the causes of crashes on unpaved roads will help local governments improve the safety of their networks.

9. Hazardous Materials. Substantial quantities of hazardous materials (hazmat) are transported within Region 8. Improved commodity flow data and risk assessment models are needed to reflect safety and security risks. Research priorities include: (1) the incorporation of high-risk rural road segments, railroad grade crossings, and work zones into hazmat routing and risk assessment models, (2) improving the supply-chain security of packaged hazmat and dangerous goods through the use of advanced technologies, and (3) the logistics of emergency response.

10. Freight Security. A national freight planning objective is to provide security while promoting mobility and global connectivity. Preferred security strategies include those which blend with and utilize existing supply-chain and transportation technologies. Research projects should address ways of integrating security, supply-chain, and transportation concepts through the use of advanced technologies and strategic partnerships.

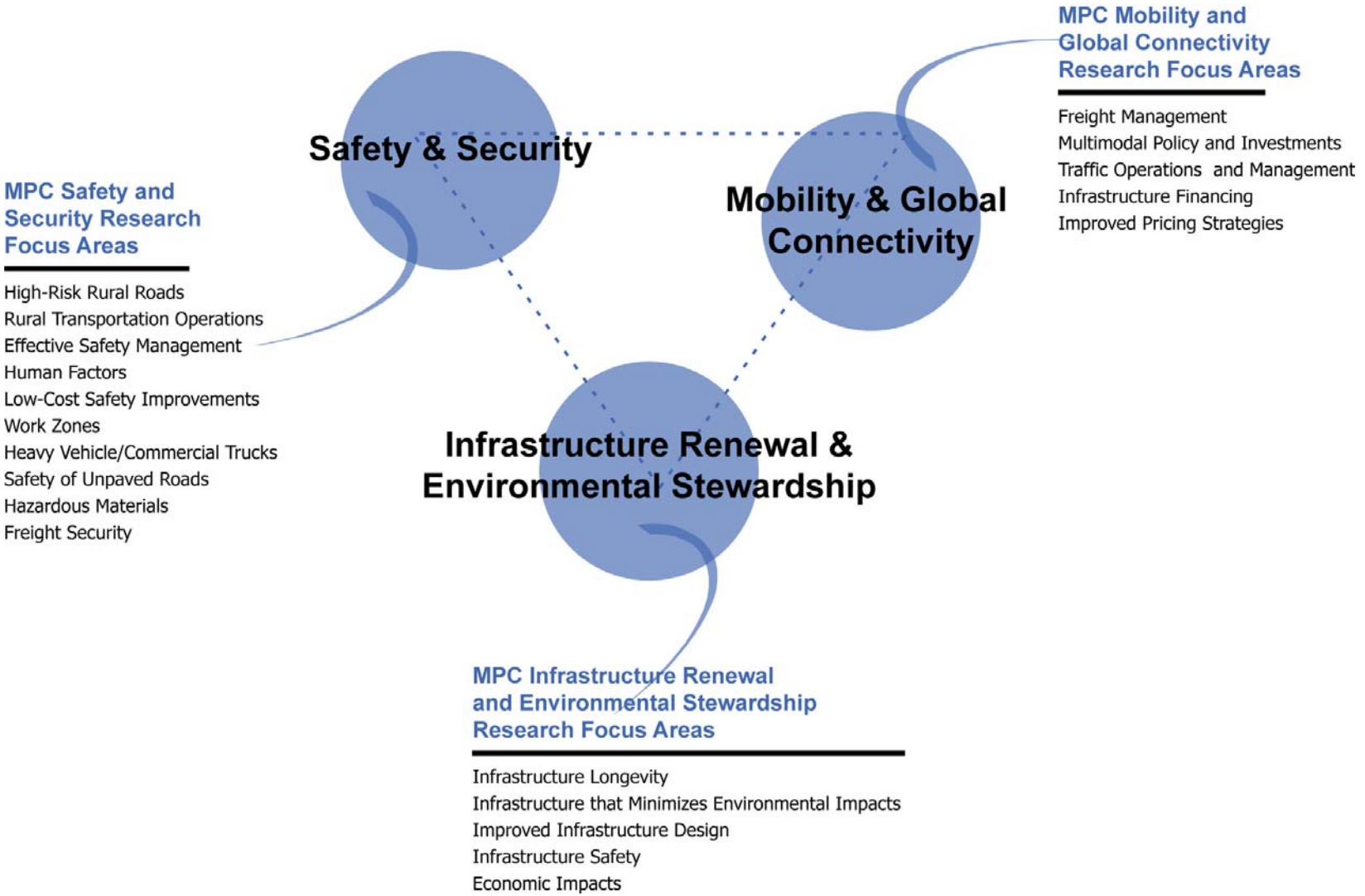

Figure 4. Relationships between MPC Emphasis Areas and USDOT Strategic Objectives

11. Traffic Operations and Management. With increasingly scarce transportation resources and increasing demand on the system, strategic management of short-term traffic issues and longer-term traffic strategies requires a complex of information and management tools. Topics on the forefront include: urban-rural and regional traffic forecasting, driver time value and travel behavior, user pricing incentives, real-time modeling and dynamic traffic assignment, and ITS applications such as intelligent ramp metering, innovative lane utilization, HOV lanes, load restrictions, and traffic adaptive signal control systems.

12. Infrastructure Financing. Many innovative financing ideas have been applied in urban regions of the United States, such as toll lanes, mixed facilities, value pricing, and public-private partnerships. MPC research should capitalize on lessons learned from these deployments regarding the shortcomings of prototype ITS technologies and public responses. Specifically, research is needed to assess managed lane rental opportunities in small-to-medium urban centers such as the Salt Lake City region, which now boasts the longest stretch of continuous HOV lanes in the United States. Other potential research topics include: road pricing mechanisms associated with tourist centers such as national parks, the effects of alternative fuels on state and local revenues, and the challenges of financing passenger railroad infrastructure.

13. Improved Pricing Strategies that reveal perspectives on rural infrastructure financing are important to the region. These strategies must consider the valuation of transportation services by users. Specifically, research is needed regarding the pricing and valuation of freight and personal mobility in small-to-medium sized communities and rural areas.

14. Multimodal Policy and Investment Assessment. Research is needed to improve benefit-cost analysis by adequately addressing parameters such as service cost, reliability, environmental impacts, opportunity costs, and the life-cycle costs of transportation network investments. Other issues include: (1) the effects of rising energy costs on transportation demand, travel choices, and goods movements; (2) the impacts of regional truck size and weight regulations and other multi-jurisdictional truck corridor initiatives; (3) modal interactions and freight planning in capacity-constrained corridors; and (4) the effects of security measures on mobility at borders, airports, ports, and trade zones.

15. Improved Infrastructure Design. Cost-effective infrastructure design is critically important in the region. However, improvements in pavement analysis methods are needed for improved highway design. These improvements depend, in part, upon the effective implementation of the new mechanistic pavement design guidelines. Research is needed to: (1) refine pavement damage estimates based on the new damage models presented in the mechanistic design guide, (2) estimate inputs and identify prototype procedures that can be used by state transportation departments in the region, and (3) quantify the effects of traffic and environmental factors on alternative designs.

16. Infrastructure Longevity. The lifespan of current and future transportation infrastructure can be increased significantly by implementing effective and novel design and maintenance

techniques including: structural health monitoring of transportation infrastructure facilities, determining the capacity of in-place infrastructure versus its design capacity, developing and implementing retrofit techniques, developing and applying advanced technologies and innovative materials, utilizing key databases such as the LTPP pavement data to better understand deterioration factors and rates, and analyzing scour in soil types specific to the region.

17. Environmental Impacts of Infrastructure. Awareness of the impacts that transportation facilities have on the environment leads to environmentally sound decisions in planning, designing, and maintaining the transportation infrastructure. Topics with environmental relevance include: the use of recycled materials, the use of alternative fuels (feasibility, benefits, and highway finance implications), the effects of alternative transportation modes for commuting, and the effects and mitigation of adverse consequences of air pollution, deicers, and other chemicals on the environment and wildlife habitat.

18. Economic Analysis of Investments and Impacts. Factors of regional and national interest include: the impacts of petroleum cost on infrastructure material and construction costs; the impacts of fuel cost on living patterns and transportation demand (which is also addressed in issues 12 and 14); the impact of accommodating larger, heavier vehicles on transportation facilities (e.g., clearances, load capacities, and traffic capacities); and the assessment of retrofit and upgrading costs versus replacement costs for infrastructure improvements based on contemporary and advanced materials. An important regional issue is the impact of seasonal load restrictions and extreme weather conditions on the mobility of people and goods.

19. Integrated Asset Management Systems. The development of integrated GIS and automated data collection systems are essential to the monitoring of infrastructure condition and performance in Region 8, which has vast inventories of signs, pavement markings, culverts, fences, bridges, other roadway structures, sensors, and other assets. Potential research topics include: uses of flexible and cost-effective technologies such as in-motion sensing and RFID for infrastructure monitoring, and methods of analyzing data generated from Asset Management Systems. Research is needed to identify methods to evaluate the performance of transportation assets; develop cost-effective maintenance and rehabilitation strategies; assess the effectiveness of various treatments; and analyze the adaptation of asset management strategies to ITS infrastructure management. These strategies may include technologies and assets such as communications infrastructure, cameras, and Roadway Weather Information Systems.

Relationship to USDOT's Research Needs. On March 19, 2007, Drs. Tolliver and Ksaibati attended the Highway Infrastructure Technology Workshop hosted by Federal Highway Administration at the Turner-Fairbank Highway Research Center. After attending the workshop, the MPC executive committee identified the following ways in which the UTC program can help achieve the nation's highway infrastructure goals:

- MPC infrastructural research will include implementation of SHRP2 findings, since the latest transportation bill allocated funding for research but not for implementation of findings
- MPC will solicit bridge research in the following USDOT emphasis areas:

    - Bridge and tunnel security
    - Bridge upgrading (repair, rehabilitation, and retrofit)
    - Behavior and performance of modular bridge systems
    - Post-disaster assessment and emergency repairs
    - Advanced sensor technologies for inspection and monitoring
    - Advanced fabrication and erection technologies
    - Other materials (FRP, wood, renewable materials, etc.)
- MPC will solicit pavement materials research in the following USDOT emphasis areas:
    - Mechanistic pavement design (e.g., performance-based design thresholds and reliable pavement performance prediction)
    - New and innovative technologies to increase the efficiency of construction (e.g., intelligent compaction and real-time quality control)
    - Improving pavement smoothness
    - Improving and preserving the transportation system through asset management
    - Practicing environmental stewardship by increasing the sustainability of pavements through the use of recycled materials
    - Quality assurance practices that result in quality materials with shared risks to owners and contractors
    - Advanced sensor technologies for inspection and monitoring of pavements and traffic

The overall objective of MPC's infrastructure research is to help the transportation community deliver long-lived assets to meet the public's needs. When selecting problem statements, MPC will relate its research as much as possible to the newly developed "road map" focus areas for asphalt and concrete pavements. Moreover, research projects that analyze LTPP data will be encouraged. MPC will consider FHWA's strategic plan for data analysis when selecting research in this area.

Planned Activities

Solicitation. Approximately 6 months before the start of each fiscal year, a solicitation for research proposals is initiated by the center director. Typically, there is some uncertainty in the process, since the actual amount of funding is unknown. Nevertheless, the director gives his best estimate of available funds and updates this estimate periodically throughout the process. In consultation with state, local, and federal clients and potential users of the research, each university initiates a solicitation process which calls for the submittal of research problem statements.

Research Problem Statements. A research problem statement is a succinct description (usually 3 pages or less) of the proposed project. Although the problem statement is succinct, it must provide sufficient details so that peer reviewers (who may be unfamiliar with the PIs and local contexts) can adequately assess the merits of the proposal. The problem statement must include the following components: (1) a statement of the issues and problems that give rise to the need for the proposed research; (2) a clear statement of the *researchable* issues and objectives, including any hypotheses to be tested; (3) a brief literature review that summarizes the state of

knowledge in the subject area and identifies the knowledge gaps that the proposed research seeks to fill; (4) a brief description of the data and research methods that will be utilized, including a description of any planned experiments or lab tests; (5) the expected outcomes of the research project in terms of the knowledge gained, new analysis and testing methods developed, etc.; (6) tangible products that are expected to result from the project, including any technology transfer benefits, prototype models, software, new practices, etc.; (7) the potential contributions of the research to national and regional objectives, as evidenced by the correlation of the proposal to MPC's critical research issues and USDOT's strategic objectives; and (8) the total cost of the project, the amount of USDOT funds requested, and the amount and source of matching funds. The principal investigator must be named at the time the problem statement is submitted and must continue as the principal investigator if the problem statement is selected.

Problem Statement Review. Each research problem statement is subjected to internal scrutiny and peer review. At least three external reviews are solicited. The external reviewers may be transportation practitioners or other university researchers who are deemed to be technical experts in the subject area.[5] Each university program coordinator (UPC) is asked to provide the names and contact information of potential peer reviewers.[6] In addition to being experts in their fields, the peer reviewers must not have conflicts of interest—financial or otherwise. The proposers are encouraged to identify USDOT reviewers (where practical), so as to increase USDOT input at the project level.[7] If desirable, the center director will independently identify external peer reviewers. In addition, internal reviews are conducted at various stages of the process.

Problem Statement Selection. Initially, the university program coordinators review problem statements and select the most meritorious ones at each university. The problem statements are then submitted to the center director who distributes them for external peer review. After the external reviews are received, the center director provides feedback to the UPC and PIs. If the reviewers' comments can be addressed, the problem statement may be modified and resubmitted (if the proposers elect to do so). Problem statements are rejected if they have flaws that cannot be corrected. The remaining problem statements are reviewed by the MPC Executive Committee. In this process, each university program coordinator critically reviews the problem statements from other universities, and votes to accept or reject (with the majority vote determining the outcome.)[8] The problem statements are usually selected by April 1 of each year.

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[5]It is not necessary for the reviewers to have the same degrees or academic qualifications as researchers. However, it is necessary for peer reviewers to possess recognized expertise in the field or specialization related to the topic. For practitioners, this typically means substantial experience and involvement with an agency's research, engineering, or planning programs. The peer reviewers are not paid for their services.

[6] A university program coordinator is responsible for the implementation of the MPC program on a particular campus.

[7]The USDOT provides direct input through the MPC Advisory Committee (which includes FHWA and FMCSA representatives.) Moreover, the MPC liaison – Dr. Christine Johnson – is the director of Western field services for FHWA. As liaison, she is asked to review problem statements.

[8] Each university representative reviews the research problem statements from other universities. Voting is conducted via secret ballot. Although the Executive Committee review is internal, it is credible because the university program coordinators are peers from different universities and there are no conflicts of interest. Research

Research Proposal and Work Plan. After the problem statements have been selected by the executive committee, full proposals are submitted. In addition to the information contained in the problem statement, each proposal includes a work plan, which details the major steps or tasks to be completed. Certain tasks are identified as *milestones*, which are essential to the successful completion of the project. Each milestone has an expected completion date. The center director and university program coordinators use the milestones to assess whether a project is progressing as planned. In the proposal, where applicable, each PI is asked to identify external contacts. These contacts may include one or more of the initial peer reviewers. Alternatively, the external contacts may be transportation professionals from state, local, or private agencies that are providing matching resources.

Proposal Review and Selection. Each full proposal is reviewed by the center director, the appropriate university program coordinator, and external contacts, where applicable. Each proposal must include work and evaluation plans. The evaluation plan describes how the project will be evaluated during and after completion. Evaluation methods are described in part II.B. If the proposal is acceptable, a project number is assigned and the PI is authorized to commence the project on the start date or the first date thereafter when funding becomes available.

Performance Indicators

The two primary performance indicators for research selection are: (1) the number of transportation research projects selected for funding, and (2) the total budgeted costs of the projects. These indicators are automatically generated each year, because each project is given a unique number and a budget is required for each.

Performance measure 1(a) calls for the classification of projects among basic, applied, and advanced research. The classification of each project will be decided upon by the MPC Executive Committee. In doing so, RITA's definition of *advanced research* will be used: "research that involves and draws upon basic research results to provide a better understanding of phenomena and develop innovative solutions—sometimes referred to as exploratory research in order to convey its more fundamental character, its broader objectives, and the great uncertainty in expected outcomes compared to problem-solving research." The following definitions from NCHRP Report 20-45 will be used to distinguish between basic and applied research:[9]

- *Applied research* is original work undertaken to acquire new knowledge with a specific practical application in view. It is undertaken to determine possible uses for the findings of basic research, or to determine new methods or ways of achieving some specific and pre-determined objective.

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funds are allocated among universities by formula. Therefore, the rejection or approval of a research proposal from any university does not increase or decrease the research funds available to other universities in the consortium.

[9] Transportation Research Board. National Cooperative Highway Research Program (NCHRP) Report 20-45, *Scientific Approaches to Transportation Research*. Volume I, page 4.

- *Basic research* is undertaken to extend knowledge and gain understanding without immediate concerns for the utility of the research.

In addition to collecting and analyzing these performance measures, we will continue to refine our expectations for success. This effort will focus on expected outcomes and targeted levels of success within the research program.

At this time, it is difficult to forecast how much research will be conducted in each of the 19 focus areas. For one thing, we must secure matching funds for our projects. Thus, we must adjust to changing priorities throughout the period. Nevertheless, in conjunction with our Advisory Committee (which has detailed knowledge of the availability of matching funds), we will refine our end-of-period expectations for the amount of work to be conducted in each focus area, based on projections of matching funds. In addition, we will consider implementing the recommendations of NCHRP Project 20-63 *Performance Measurement Tool Box and Reporting System for Research Programs and Projects*. After beta testing and revision, the final report is expected to be released in November. At that time, we will assess how the tool box can be used to help us with our evaluations, at both the program and project levels.

II.B Research Performance

The research performance goal is *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*.

Research Performance Program Outcome

MPC's research program will generate new research findings and methods each year that will advance the body of knowledge in transportation. This outcome will be realized through: (1) a thorough and rigorous research selection process which features ample peer and expert review; (2) a project research evaluation process; (3) peer review of research reports; (4) publication of articles derived from research reports; and (5) presentation of results to a broad audience of practitioners, faculty, and students. The UTCP performance indicators will be used to evaluate the research program as a whole. In addition, each project will be monitored and evaluated using the following criteria: (1) achievement of stated objectives; (2) timeliness; (3) cost-effectiveness; (4) satisfaction of research partners and funding agencies; (5) peer-reviewed publications; and (6) presentations at conferences or proceedings. Because presentations or articles may lag a project by several months, a project evaluation is a work-in-progress that may not be finalized until a year or so after the conclusion of the project. Nevertheless, much useful information can be derived from these evaluations.

Planned Activities

At mid-year, each PI (in conjunction with the appropriate UPC) will submit a progress report stating the approximate percentage of the project completed and whether the milestone tasks scheduled for completion during the first six months have been completed. The center director

will follow-up with a visit to the campus of each university in the consortium to meet with PIs and graduate students and further assess the status of projects. Through mid-year progress reports and site visits, potential problems with projects may be identified early enough so that corrective measures can be taken. The timeline of the project monitoring process is summarized in Table 2.

Table 2. Research Project Monitoring Timeline

Step/Task	Month
Project Initiation	0
90-day Report by PI to UPC	3
Mid-year Report by PI/UPC to Center Director	6
Site Visits by Center Director	6-9
Final Status Report	11
Project Conclusion	12

In addition to on-going monitoring, each MPC project will be evaluated using the criteria described below. Moreover, the overall research program will be evaluated using the performance measures described later.

Cost-Benefit Analysis. In some cases, it may be possible to estimate the benefits of a research project in dollars. Benefit/cost analysis is possible when benefits flow from the conclusion of a project and continue at a predictable rate into the future. Examples are: (1) a project which results in a new design procedure that reduces the quantity or cost of materials or results in longer component lives, and (2) a congestion mitigation study which results in quantifiable travel cost savings.

Cost-Effectiveness Analysis. Often, a research project will result in incremental benefits that cannot be readily translated into dollars. In cost-effectiveness analysis, an improvement in a level or condition is quantified and compared to the cost of the project. For example, the implementation of a new travel demand management system (made possible by a research or technology transfer project) may reduce mobile-source emissions by 5 percent in a non-attainment area. Similarly, new quality control/assurance procedures resulting from a research project may increase the percentage of highway projects meeting post-construction specifications by 10 percent.

Case Studies. The benefits of many projects are best represented through case studies, which often take the form of success stories. For example, an industry is able to utilize waste products (as the result of a research project) to produce more environmentally-friendly products. However, the future dollar benefits and output levels cannot be precisely estimated. In another example, research findings may lead to the adoption of new contract management practices by state and local transportation agencies.

Expert Review. The acceptance of journal articles and papers for presentation at conferences and workshops are key performance measures, because they provide de facto evidence of peer review. In addition, the comments of clients and other experts can be used to gauge the contributions of a research project to its field.

Timeliness. Most MPC projects start on July 1. However, students may not be fully engaged until late August or September. The stated objective is to complete all research projects within a year. At a minimum, draft reports should be submitted by then. An additional 90 days may be authorized for revising the draft report and fulfilling the technology transfer requirement (a seminar or presentation of findings via the Transportation Learning Network.) However, 10 percent of the project funds will be withheld until the draft report is revised and a TLN seminar is scheduled. Additional time extensions are discouraged. A detailed justification must be provided by the PI or UPC, which must be approved by the center director. In no case will the budget for a project be increased in conjunction with a time extension.

Performance Indicators

The performance indicators for research performance are: the number of transportation research reports published (No. 3) and the number of transportation research papers presented at academic/professional meetings (No. 4). These indicators are part of the current MPC performance reporting system and, therefore, will not require new data collection procedures. As noted earlier, MPC will consider implementing the recommendations of NCHRP Project 20-63 *Performance Measurement Tool Box and Reporting System for Research Programs and Projects*.

II.C Education

The education goal is *a multidisciplinary program of course work and experiential learning that reinforces the transportation theme of the Center*.

Education Program Outcome

The desired educational outcomes for the center are: (1) multidisciplinary graduate transportation degree programs at each university; (2) a multi-university educational program which features the exchange of courses and the interaction of faculty and students across campuses; (3) a distance-learning program for transportation professionals in the region; (4) a national distance-learning certificate program; and (5) internship and experiential learning programs which prepare students for careers in the highway, transit, and railroad industries. Information regarding the educational needs of state transportation departments and industries in the region will be obtained from the Advisory Committee and industry panels.

Planned Activities

Deliver Multidisciplinary Graduate Programs. All MPC universities have existing educational programs in transportation. All of these programs involve faculty or students from disciplines, in addition to civil engineering. While continuing and expanding the baseline programs, new programs will be developed. For example, NDSU will develop a proposal for a new interdisciplinary Master of Science degree in Transportation & Urban Planning, which will involve participation from the Architecture, Geosciences, Civil Engineering, Emergency Management, and Political Science departments. With this new degree, NDSU will have the

following suite of interdisciplinary graduate programs: (1) Doctorate in Transportation & Logistics, (2) Master of Military Logistics, (3) Master of Transportation & Urban Planning, and (4) Transportation Options in Civil Engineering and Agribusiness & Applied Economics. We will encourage our faculty to contribute to our multi-school graduate program by offering stipends. In this way, we will be able to expand our range of courses through incentives.

Deliver Multidisciplinary Transportation Courses. The baseline courses that we consider to be part of our transportation-related curricula are shown in the appendix. We plan to continue to offer these courses and add new courses during the period. Since new courses must pass through several curricula and university committees, only the general titles of potential courses can be listed at this time. Figure 5 lists a series of courses that may be implemented when the new master's degree in Transportation and Urban Planning is approved.

Principles of Urban Planning and Design, Urban Transportation Planning, Context Sensitive Solutions, Public Sector Policy and Investment Decisions, Freight Systems and Transportation Geography, Introduction to Public Transportation, Public Transportation II, Environmental Planning & Assessment

Figure 5. New Transportation-Related Courses Planned for SAFETEA-LU Period

Develop Transportation Safety Courses. In conjunction with USDOT, AAR, and state transportation departments, MPC will develop new courses in transportation safety and security. These courses will encompass the surface transportation modes and will include modules on hazardous materials and security risks.

Deliver Multi-University Education Programs. MPC instituted a graduate course exchange program in 1994. Since then, the universities have exchanged graduate courses via the TLN (formerly TEL8) videoconferencing network. This effort will continue in the future. Some of these courses will simultaneously serve state transportation departments. MPC has adopted an open access policy which allows state transportation department employees with baccalaureate degrees to receive course lectures on a non-credit basis at their locations via TLN without applying to graduate school or registering at one of the MPC universities. During the next three years, the MPC universities expect to offer the following courses via TLN: Airport Planning and Design, Transportation Economics, ITS, Public Transportation, Pavement Materials, Advanced Technical Communication, Transportation Modeling, and Transportation Safety.

Deliver Region 8 Technical Training/Distance-Learning Program. MPC will continue and expand its technical training program for state transportation department employees via the Transportation Learning Network. This program includes the following types of offerings: (1) seminars and technical presentations, (2) short courses and workshops, and (3) course modules. Seminars and technical presentations describe research findings or research in progress, as well as emerging technologies and issues. They typically last less than 2 hours. The technical training program also includes short courses which range from ½ to 2 days in length. We have already begun the process of adapting NHI course material developed for traditional seminars and workshops. Our "NHI" conversions will be similar in content and yet modified substantially so

that they are effective in a synchronous distance-learning format. Course modules extend over longer time periods and encompass components of university courses. A more detailed discussion of the distance-learning program is provided in part F.

Enrich Graduate Student Experiences Through Interuniversity Exchange. MPC's distance-learning capabilities will be applied to encourage graduate students in all five universities to present their research as it evolves. We plan to do this by frequently teleconferencing Masters and Ph.D. program proposal and thesis seminars. In this way, our students will be exposed to more faculty critique and peer assessment. Perhaps most importantly, our students will have a sense of belonging to a much larger graduate program. Their exposure to other faculty and graduate students will give them an experience that is closer to that of students at larger schools with numerous transportation faculty.

Expand Internship/Experiential Learning Programs. All MPC universities have internship and cooperative educational programs. In the SAFETEA-LU period, MPC will continue and expand its experiential learning programs, including the highlighted activities described below.

- **North Front Range Transportation Research Internship Program.** Colorado State University works with the North Front Range Metropolitan Planning Organization to offer a joint university-government-industry internship program. Interns work on prominent transportation projects throughout northern Colorado. Transportation students gain real work experience in transportation planning and air quality analysis. At the same time, the transportation agency benefits from the technical expertise of the interns and their faculty advisors.

- **Utah Traffic Operations Internship and Training Program.** The University of Utah has an on-going internship program with the Utah Department of Transportation (UDOT) and the Salt Lake City Transportation Division. UDOT provides two internships for graduate research assistant engineers for approximately 20 hours per week during academic terms, and for approximately 40 hours per week in summer. Each intern is supervised by a principal investigator in academic matters and by a professional transportation engineer while engaged in his/her work experience. The intern's thesis or dissertation likely will be closely associated with his or her work experience. In addition to this on-going program, the University of Utah is negotiating a contract with UDOT to establish a formal training program for its Traffic Operations Center Operators at the University of Utah. These operators are the technicians who monitor the cameras and traffic control systems in order to manage traffic when needed. These people will come to the Utah Traffic Lab for a period of six weeks where they'll get a basic training in traffic engineering principles and how to operate the traffic monitoring and management software. Graduate students will be the trainers.

- **Railroad Engineering Internship Program.** A railroad engineering internship program will be established at NDSU in response to the critical shortage of engineers in the railroad industry. Much of the focus of manpower/human resource development has been

on state transportation departments and highway-related industries. However, the railroad industry is facing an equally serious problem. A large portion of the railroad engineering workforce is scheduled for retirement in the next 5 to 10 years. An advisory group (which includes representation from the Association of American Railroads and BNSF Railway) is being established to guide the program.

- **Cooperative Education Programs.** All MPC universities offer cooperative education programs which give undergraduate and graduate students opportunities to integrate classroom study with paid professional work experiences related to their field of study. These programs provide students, who have decided on a career, an opportunity to obtain pre-graduation experience in their chosen careers, and those who have not, an opportunity to explore several career possibilities. During the SAFETEA-LU period, MPC will continue to work with the cooperative education offices on each campus to develop partnerships with public and private sector entities that will enrich the academic experiences of transportation and logistics students and provide them with enhanced understanding of the transportation profession and employment opportunities.

Initiate National Distance-Learning Certificate Program. In conjunction with other regional centers, MPC will lead an effort to establish a transportation certificate program which will be available nationally. A consortium of Regional University Transportation Centers has been formed to establish a Distance Learning Graduate Education Certificate Program. The purpose of the certificate program is to educate the "Transportation Leaders of the 21st Century." A curriculum of graduate level courses will be offered by the participating universities, consistent with the certificate theme of *Transportation Policy, Management, and Operations*. All courses will be delivered via distance-learning media and can be accessed nationwide.

Continue Outstanding Student Award. MPC will continue to select the top student within the consortium as the Student of the Year in Region 8. The Student of the Year will receive a $1,000 award, plus travel costs to attend the award ceremony in Washington, DC, during the annual winter meeting of the Transportation Research Board. In addition, each university will continue to provide undergraduate and graduate awards, as exemplified by the four undergraduate scholarships awarded each year at NDSU by MPC (two in Transportation Engineering and two in Transportation Logistics/Economics).

Performance Indicators. The two performance indicators for this goal are: the number of courses offered that are part of our transportation curricula (No. 5), and the number of students participating in transportation research projects (No. 6). We already have data reporting systems in place to collect these performance measures.

II.D Human Resources

The human resources goal *is 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*.

Human Resources Program Outcome

The expected program outcomes are greater numbers of faculty, students, and staff involved in transportation programs at the MPC universities and throughout the region. The first part of the outcome is directly under the Center's control. However, the second part concerns the broader region over which the Center has some influence, but limited control.

One of MPC's goals is to have a multi-university educational and research program in which transportation is viewed as a cross-cutting, high-priority area of emphasis at each institution. Logically, the realization of this goal will attract more faculty and students to transportation, since people tend to gravitate towards high-profile programs. A related goal is to maximize the use of scarce faculty time through course sharing, collaborative projects among universities, and the use of distance-learning media to increase access to faculty throughout the region.

Planned Activities

Increase Faculty Involvement in Transportation. The Center will increase transportation faculty in several ways. (1) The MPC universities will hire new transportation faculty to fill strategic roles. Colorado State University, North Dakota State University, South Dakota State University, and University of Wyoming have added new tenure-track faculty positions in transportation during the last two years. We anticipate adding additional faculty in the future. (2) A parallel strategy is to attract existing faculty to transportation through recruiting and the use of incentives. For example, it may be possible to attract a faculty member previously interested only in geotechnical engineering to transportation by offering developmental funding or other incentives. (3) A third strategy is to recognize young faculty through newsletters and other means, and periodically offer them incentives to specialize in transportation research and education.

Increase Student Participation in Transportation Programs. More students will be attracted to transportation programs during the SAFETEA-LU period as a result of recruitment efforts, funding, and an emphasis on transportation and logistics at the MPC universities. The recruitment strategies may differ somewhat at the undergraduate and graduate levels. Typically, freshmen are recruited and attracted to disciplines such as engineering, business, geography, etc. The main strategy at this level is to successfully market transportation as a concentration within a major and as an attractive career outcome of a discipline. To this end, MPC faculty members provide information to academic advisors in various departments regarding transportation graduate programs and potential careers. This practice will continue at a heightened level during the SAFETEA-LU period. We will pursue multiple marketing and student recruitment strategies including:

- Disseminating information about transportation topics, programs, and careers to college freshmen and sophomores and to high schools and community colleges
- Working with student organizations and chapters of national organizations such as the American Society of Civil Engineers (ASCE), the Institute of Transportation Engineers (ITE), the American Railway Engineering and Maintenance of Way Association

(AREMA), and the Council of Supply Chain Management Professionals (CSCMP) to raise awareness of transportation issues and careers
- Promoting cooperative ventures such as internships and mentoring programs with business and governmental agencies
- Leading and participating in general transportation awareness campaigns

Utilize Science and Engineering Fairs to Promote Transportation. The MPC universities will continue to utilize science and engineering events to promote greater awareness of transportation. For example, the annual Science and Engineering Fair sponsored by the College of Engineering & Architecture at NDSU arranges for campus learning tours for high school students. This year, two groups of students are scheduled to tour traffic control and simulation labs at the Advanced Traffic Analysis Center and interact with undergraduate and graduate transportation students to learn about their research.

Outreach to High Schools. All MPC universities have outreach efforts targeted at high schools. For example, Colorado State University and the Colorado Department of Transportation have a partnership for K-12 schools. This initiative disseminates information about civil engineering careers and informs students and teachers about transportation issues through the use of computer-based illustrations of transportation problems. NDSU and the Northern Plains TTAP Center are initiating a long-term effort to reach out to students (especially Native American students) in grade and high schools in North Dakota and the region. This effort is described more fully under the diversity goal.

Enhance Opportunities for Participation. MPC will work with the Fargo School District to develop a grant proposal under the Garrett A. Morgan Technology and Transportation Education Program to attract K-12 students to transportation, with special emphasis on female students and students from non-traditional ethnic backgrounds.

Use National Transportation Week Events to Raise Awareness. National Transportation Week presents an opportunity for a consortium-wide focus on transportation careers and student recruitment. Unfortunately, the timing of Transportation Week is not compatible with university academic schedules. Nevertheless, MPC will continue to plan programs of activities to promote transportation awareness in the spring. The awareness campaign will use the TLN system and involve state transportation departments. All five campuses will be linked electronically. Faculty and staff will conduct a series of coordinated transportation awareness and recruiting activities.

Performance Indicators

The performance indicators for this goal are: the number of transportation-related advanced degree programs offered (No. 7), the number of students enrolled in these programs (No. 8), and the number of students who received degrees through these programs (No. 9). All of the MPC universities have information systems in place to collect these measures while distinguishing among master's level and doctoral level students.

II.E Diversity

The diversity goal is: *students, faculty, and staff who reflect the growing diversity of the US workforce and are substantively involved in the undergraduate, graduate, and professional programs of the Center*.

Diversity Program Outcome

The MPC universities are committed to attracting talented people to transportation and ensuring that no one is excluded. One of our goals is: *increased opportunities for the meaningful involvement of Native Americans in transportation careers and programs*. Several key partnerships will be utilized for this purpose.

MPC is linked with 2 of the 7 Tribal Technical Assistance Centers in the United States. CSU houses the Colorado TTAP Center, which serves the states of Arizona, Colorado, New Mexico and Utah. Another Native American center—the Northern Plains Tribal Technical Assistance Center—is located at the United Tribes Technical College in Bismarck, ND. The Northern Plains Center serves Montana, North Dakota, Nebraska, South Dakota, and Wyoming. NDSU has a strong partnership with the Northern Plains Center. Both TTAP Centers are well-positioned to help MPC conduct outreach activities and disseminate career and educational information to Native Americans in the region.

Enabling Tribal Planners. In the SAFETEA-LU era, MPC will enable tribal planners by providing them with greater access to highway planning tools and training. These tools will allow them to: (1) improve local transportation planning efforts; (2) illustrate the importance of transportation engineering and planning to Native Americans, and thereby attract more of them to transportation careers; and (3) more effectively participate in coordinated planning efforts with state and local transportation agencies.

Enhancing Communications and Access to Knowledge. By linking the TTAP Centers with TLN, MPC will increase the opportunities for Native Americans to access training and interact with other tribal planners and state transportation departments through video conferencing. This will greatly expand the number of events that Native Americans can participate in by overcoming barriers of distance and travel costs. Moreover, joint events with LTAP and TTAP Centers will increase communication among tribes and local and state transportation practitioners.

Improving the Mobility of Native Americans. In partnership with SURTC and the TTAP Centers, MPC will continue to provide guidance on mobility issues on reservations, as well as access to jobs and opportunities off reservations.

Attracting Native Americans to Transportation Careers. By partnering with the TTAP Centers, MPC will raise awareness of transportation career opportunities in grade and high schools in the region. Greater opportunities will be created for internships and summer experiential learning.

Enhancing Opportunities for Everyone. MPC will continue its efforts to attract more women and minorities to transportation careers. Female faculty at the MPC universities will act as mentors and sources of information for undergraduate students and conduct various outreach activities each year. To the extent possible, they will participate in student-related chapters and educational organizations that can channel women into the field of transportation. For example, Colorado State University has a model diversity plan which includes university-wide and community initiatives to bring more women and minority students and faculty to the university. Significant increases in grants and scholarships are being planned—building upon a National Science Foundation grant.

Planned Activities

Improve Planning Capabilities for Native Americans. In an important early step, MPC will partner with FHWA, Federal Lands Highway, BIA, and the TTAP Centers to convert the Indian Reservation Roads (IRR) Inventory to a format that is compatible with federal and state highway databases. The conversion of the IRR Inventory to an HPMS-like format will allow federal, state, and tribal planners to work with consistent databases. Moreover, it will allow tribal planners to use software (such as HERS-ST) that utilize data in HPMS format. MPC will also provide improved safety analysis tools including: (1) proven methods for roadway safety audits, (2) low-cost safety improvements, and (3) applied highway safety models. In particular, MPC will examine the potential for using IHSDM to analyze safety alternatives for reservation roads; in doing so, we will assist in the deployment and utilization of IHSDM at state, local, and tribal levels. Through these efforts, MPC will: (1) increase the meaningful participation of Native Americans in transportation planning in the region by providing them with some of the same tools that state DOTs have available to them; (2) increase coordination among state and local entities; and (3) elevate awareness of the critical importance of transportation planning on reservations while promoting career opportunities for Native Americans.

Improve Communications and Training. In 2007, we will experimentally link the Northern Plains TTAP Center to our videoconference system, allowing Native Americans access to MPC and TLN training events. Furthermore, we will assess the feasibility of linking to other telecommunication sites at other tribal colleges and universities. We will repeat the very successful tribal transportation videoconference series that was initiated during National Transportation Week of 2005. Periodically, TLN videoconferences will be planned that focus on tribal issues. Annual events will be planned in conjunction with LTAP and TTAP Centers to increase communication among tribes and local and state transportation agencies.

Recruit Native Americans. In partnership with the TTAP Centers and state transportation departments, MPC will raise awareness of transportation careers and recruit Native Americans into the transportation programs of the universities. (1) We will start by meeting with school counselors and providing them with information including the Careers in Transportation book. (2) Afterward, we will work with tribal colleges and TTAP Centers to plan “career day” events for Native American high school students. (3) At NDSU, we will create an undergraduate work-study program that provides opportunities for Native American students transferring from

community colleges or applying directly to NDSU from high schools. The program will involve mentoring and support capabilities. In their junior and senior years, the students will work on real or example highway projects on reservations. (4) We will work with state transportation departments to provide summer work experience for Native Americans students. (5) We will ask state transportation departments and the highway industries to help us establish summer experiential learning events (e.g., camps) where potential students can meet with and learn from transportation industry professionals.

Continue the CO-AMP Program. At CSU, faculty will work to incorporate transportation engineering into activities of the Colorado Alliance for Minority Participation (CO-AMP). CO-AMP is an alliance of 11 colleges, universities and tribal affiliates funded by the National Science Foundation to assist minority students in science, math and engineering. It conducts many outreach activities throughout Colorado and the Four Corners area of Utah, New Mexico, Colorado and Arizona, including high school and transfer bridge programs, outreach middle-school summer camps, minority conferences and an outreach shadow day.

II.F Technology Transfer

The technology transfer goal is: *availability of research results to potential users in a form that can be directly implemented, utilized or otherwise applied.*

Technology Transfer Program Outcome

Technology transfer is a priority for MPC. This goal is integrated with our distance education and training programs. Historically, MPC has been a pioneer in the use of telecommunications to exchange courses and provide distance-learning opportunities for state transportation professionals. Through TLN, MPC researchers and instructors can simultaneously reach graduate students and state transportation department professionals throughout the region. TLN operates over an IP network, but maintains the ability to connect to ISDN sites. Each TLN site is capable of participating in individual point-to-point or system-wide videoconferencing. TLN also operates its own videoconferencing bridge, providing connections to multi-site conferences. Moreover, MPC has strong ties with state and local transportation agencies and with LTAP and Tribal Technical Assistance Centers in the region. Three LTAP Centers are co-located at MPC universities and two of the universities have ties to Tribal Technical Assistance Centers.

MPC's primary outcome goals are:

- A library of transportation research materials that is valued and used by practitioners, researchers, and students
- Awareness among transportation researchers and practitioners of multidisciplinary problem-solving techniques and models
- Access to educational programs and research findings for graduate students and transportation practitioners throughout the region, regardless of location
- More technical training for state transportation departments
- Dissemination of information on emerging technologies and issues

Planned Activities

Dissemination of Research. As a condition for receiving MPC research funds, each principal investigator must agree to present the results in a TLN seminar. All reports will be peer-reviewed and then published on the MPC web page. Moreover, each researcher is strongly encouraged to draft journal articles from the MPC reports and present findings at conferences and workshops. Summaries of research findings will be included in MPC newsletters—which will be published at least twice a year and circulated to other centers, partners, and clients. Research results may also be disseminated through LTAP and TTAP newsletters.

Region-Wide Technical Training Program. In conjunction with TLN, MPC is developing a comprehensive program of technical training for state transportation department employees and consultants. In addition to updating and expanding the skills of these transportation practitioners, the program will help satisfy the demands for professional development hours needed by transportation engineers. During the TEA-21 period, a variety of technical short courses and training seminars were offered to state transportation departments via TLN, including a Professional Engineers Exam Review course. Table 3 shows a partial list of technical training seminars and short courses that have been recently delivered (or are planned for delivery) to state transportation departments via TLN. This partial list illustrates the scope of MPC's faculty expertise, which encompasses: materials, pavements, and structures; traffic control, operations, and transit; construction and maintenance; freight transportation and logistics; planning and environmental analysis; safety; and mathematical sciences.

Table 3 Partial List of Planned MPC Technical Training

Area	Seminar/Course Topics
Mathematical Sciences	Scientific Methods Applied to Transportation Research; Applications of Mathematical Programming Techniques to Commodity Distribution Networks; Statistical Methods in Transportation
Materials, Pavements, & Structures	Pavement Preservation: Preserving the Investment in Streets and Highways; Pavement Structural Capacity and Preservation; Ride Quality: Issues and Measurement; Increased Highway Load Capacity and Spring Restrictions; Development of Ride Preservation Programs; Pavement Preservation: Integrating Pavement Preservation Practices and Pavement Management; Pavement Preservation: The Preventive Maintenance Concept; Pavement Preservation: Selecting Pavements for Preventive Maintenance; Pavement Preservation: Design and Construction of Quality Preventive Maintenance Treatments; Temperature Prediction in Asphalt Pavement: Implications for Selection of Asphalt Grades; Optimizing Asphalt-Rubber Binders for Maintenance and Rehabilitation Activities; Superpave Mixes for Low Volume Roads; Effectiveness of Superpave Mixes as Maintenance and Rehabilitation Alternatives; Composite Spike Reinforcement for Bridges; Timber Bridges (Various Topics); Testing Methods for Self-Consolidating Concrete
Traffic Control, Operations, & Transit	Manual on Uniform Traffic Control; Adaptive Signal Control Systems; Traffic Detection Technologies; Analysis of HOV Lanes; Real-Time Measures of Effectiveness; Impact of Cell Phone Conversations on Car Following Behavior; Optimization of Pre-Timed Signal Timing Plans Using a Genetic Algorithm; Travel Demand Modeling; Transportation Operations in Small Urban and Rural Areas; Transit Planning (Various Subjects—e.g., Projecting Changes in Mobility-Challenged Populations in North Dakota); Light Rail

Table 3 Partial List of Planned MPC Technical Training	
Area	**Seminar/Course Topics**
	Procurement Procedures; Telecommunication in Transportation; Work Zone Traffic Management; Use of Radar for Traffic Data Collection; School Transportation Safety; User Cost Estimates Related to Construction and Work Zones.
Construction & Maintenance	Concrete Pavement Repairs; Surveying; Cost Effectiveness of Design-Build; Evaluating the Impact of QC/QA Programs on Asphalt Mixture Variability
Freight Transportation & Logistics	Introduction to Truck Operations and Economics; Total Logistics Costs: Implications for Freight Demand; Consideration of Supply-Chain Planning in Traffic Forecasting & Mode Choice Analysis; Locating Intermodal Facilities in Rural Areas; Truck Size & Weight Regulations in ND; Overview of State & Provincial Truck Regulations and Permitting—Commonalities & Differences
Planning & Environmental Analysis	Statewide Transportation Planning Models; State Highway Planning with HERS-ST; Estimating the Benefits of Highway Investments with HERS-ST and REMI Models; Freight Railroad & Multimodal Capacity; Cross-Modal Impact Analysis; Road Dust Suppressants; Environmental Impact Statements and Analysis Procedures; Travel Demand Models for Sub-Area Analysis and User Construction Cost Impacts; Traffic Data Collection in Urban Areas; County Road Planning and Asset Management
Safety	Motor Carrier Safety Inspection and Selection Program; Low-Cost Safety Improvement Programs; Road Safety Audits; Transportation of Hazardous Materials; Preliminary Impact Testing of Safety/Security Barriers
Other	PE Exam Review; Technical Writing; Transportation Demands of the Military

Avenues of Technology Transfer. Our dissemination plan includes many forms of technology transfer. Each university has proven outreach channels which are used for MPC dissemination such as LTAP centers, extension services, and a variety of internet-based media. The Upper Great Plains Transportation Institute has its own communications coordinator, web communications manager, and technical writers. These people serve MPC, as well as other centers at NDSU. They provide dedicated resources for information dissemination. Our annual programs include workshops, conferences, and video conferences via TLN. After our research reports have been peer-reviewed, they are available from our web page. We also provide free printed copies upon request.

Information Sharing Via Videoconference. Representatives of three state transportation departments and the five MPC universities will plan a joint program of distance training and technology transfer each year. The annual program will include information sharing and training activities collectively referred to as the InfoX series, as well as short courses and related events. This type of cooperative planning with the TLN Programming Committee is one of the ways in which MPC will address mid-career and continuing education needs in the region.

Annual Mix of Events. Our annual activities will include a mix of seminars, conferences, workshops, and internet outreach events. The conferences will feature MPC peer-reviewed research as well as research in progress and student research and thesis topics. Throughout the year, MPC principal investigators will deliver seminars over the TLN network, which describe

results of recently-completed research projects. In this way, research conducted by the Center will be made available in a timely manner to state transportation practitioners, graduate students, and faculty at other MPC universities. Many of our conferences will be jointly planned with LTAP and TTAP Centers to more effectively utilize technology transfer resources. Some examples are discussed below.

Deployment of Asset Management Techniques to Local and Tribal Roads. One of the critical issues in the region is providing asset management and geospatial database capabilities for local and tribal roads. Many local roadway inventories do not identify road segments through linear referencing (e.g., route and mileposts indicators) or geospatial coordinates. Thus, it is difficult to integrate local and tribal roadway databases with state and federal systems. A major MPC initiative seeks to transfer some of the capabilities and techniques resident in state transportation departments to local and tribal road managers. In 2007, pilot projects will be initiated with several counties and tribes to develop and test roadway referencing systems and implement roadway (and pavement) management systems that can be geospatially analyzed. Moreover, methods of potentially improving the quality of data in the IRR will be explored.

Emerging Issues and Technologies. As requested by the Advisory Committee, MPC will serve as a center for the dissemination of information on emerging technologies and issues. Several strategies will be pursued. (1) Webinars will be used (in conjunction with TLN videoconferences) to deliver seminars on critical issues and technologies. (2) A dedicated section of the MPC web page will be used to establish discussion forums for important issues. (3) Private-sector participation will be solicited. Technology specialists from various companies will be asked to describe their technologies and potential transportation applications. Potential contributors include: NAVTEQ (maker of GPS data, digital maps, navigation systems), Traffic Control Corporation (maker of signal controllers and power management technologies), and Alien Technology (manufacturer of RFID tags). (4) MPC faculty will present a series of seminars on technology applications, in which each faculty member focuses on his or her area of expertise. (5) In addition, doctoral students and post-doctoral researchers will present the technology implications of their research.

Deployment of Traffic Detection Technologies. One example of the dissemination of information on emerging technologies is a planned event by the Utah Traffic Lab (at the University of Utah). The Utah Traffic Lab is developing state-of-the-art applications in traffic detection technology. In 2008, a two-hour seminar will be delivered by a manufacturer/developer and University of Utah researchers. The seminar will cover: the state-of-the-art in traffic detection technology, development plans, and research objectives for sophisticated traffic detection systems.

Performance Measures

The performance measures for technology transfer are: the number of transportation seminars, symposia, distance learning classes, etc. conducted for transportation professionals (No. 10), and the number of transportation professionals participating in those events (No. 11).

The MPC universities have data collection systems in place to generate these measures. However, the cost and effectiveness of the data collection systems are currently being reviewed. Improvements will be implemented in the upcoming fiscal year.

III. Management Approach

MPC has an established management system in place that worked effectively during the TEA-21 period. This system has been improved by the creation of a formal Advisory Committee and the allocation of more administrative resources to the Center. One of the keys to MPC's management success is that we are truly a consortium rather than a collection of research centers. Our annual programs of events are selected jointly. Through the Executive Committee, the director provides effective leadership that is effectively disseminated within each university. The USDOT liaison—Dr. Christine Johnson—provides input as the western field services director for FHWA and helps the director coordinate efforts with FHWA divisions.

The management approach is described by first providing an inventory of the institutional resources at the MPC universities. A key to realizing the management vision is to effectively and synergistically utilize these resources to implement the Center's vision while leveraging matching resources from state transportation departments and other partners. Afterward, the roles of the center director and key staff are discussed.

III.A Institutional Resources

MPC has a substantial set of institutional resources available to the UTC program. The *Upper Great Plains Transportation Institute* has well-established research programs in agricultural transportation, logistics, statewide transportation planning, and motor carrier economics and safety. The *MPC Advisory Committee* (described in Part B) is a resource for guidance, administration, and communication within the region. The *Transportation Learning Network* is another great resource that offers dissemination capabilities. Moreover, TLN greatly increases communication between universities and state transportation departments in the region. Three *LTAP centers* are located at the MPC universities. In addition, each university has *pre-existing centers* which provide baseline resources that can be leveraged by MPC. In particular, NDSU has six centers that create a synergy of resources and provide complementary programs that benefit MPC.[10] These and other resources are described next.

Colorado State University (CSU) is governed by the Board of Governors of the Colorado State University System as a public land grant institution and a Carnegie Doctoral/Research

[10] Although the NDSU centers provide baseline institutional resources and opportunities for leveraging and partnering, they are distinct from MPC. Each of these centers focuses on one specialized aspect of transportation. No single center can provide comprehensive region-wide educational, research, and technology transfer services like MPC. Financially, their budgets are completely separate from MPC's budget. Although individual researchers from these centers may apply for MPC funds, the research reports and technology transfer activities that result are clearly labeled as UTC-funded activities.

University-Extensive. Enrollment is nearly 25,000 students. Baccalaureate degrees are offered in 64 fields in eight colleges, including agricultural sciences, applied human sciences, business, engineering, liberal arts, natural resources, natural sciences and veterinary medicine and biomedical sciences. CSU offers 39 doctoral and 62 master's degree programs. Primary transportation graduate educational and outreach activities occur in the College of Engineering, with related activities in business, applied human sciences, and natural resources. Transportation-related graduate courses are available in civil engineering, mechanical engineering, earth resources, business, remote sensing and construction management. The College of Engineering houses the Engineering Research Center (ERC) including world-class facilities for river mechanics and hydraulics, especially as related to major bridge construction; and for wind tunnel testing. The Structural Engineering Laboratory is also housed at the ERC, including an outdoor ramp facility for vehicle crash testing of safety and security barriers. A contemporary spatio-temporal test frame for simulating hurricane loadings and vehicle and train loadings is to be constructed in Fall 2006. CSU also operates the Engines and Energy Conversion Laboratory; the Motorsport program in Mechanical Engineering includes topics such as racecar vehicle dynamics, advanced engines technology, fluid dynamics, and advanced materials.

North Dakota State University (NDSU) is a land grant institution with an annual enrollment of approximately 12,000 students and more than 650 faculty at the central campus in Fargo. The university offers 41 doctorate and professional degree programs, 51 master's degree programs, and 103 baccalaureate degree programs. NDSU is also part of a tri-college system which includes Minnesota State University-Moorhead and Concordia College in Minnesota. In addition, there are six related transportation research centers at North Dakota State University which enhance the institutional resources accessible to MPC and create opportunities for synergy and leveraging of resources. The Advanced Traffic Analysis Lab focuses on traffic simulation, traffic signal control, Intelligent Transportation Systems (ITS), and travel demand modeling. The DOT Support Center contains a highway design lab and provides experiential learning for junior and senior engineering students. These students work on North Dakota Department of Transportation design projects under the supervision of a NDDOT engineer. The Rural Transportation Safety and Security Center (RTSSC)[11] is a designated recipient of FHWA funds, while the Small Urban and Rural Transit Center (SURTC) is a designated recipient of Federal Transit Administration funds.[12] The LTAP center is housed in the Upper Great Plains Transportation Institute. The Transportation Safety Systems Center (TSSC)—which is based in Lakewood, CO—develops and maintains software used by state and federal safety specialists nationwide at truck weigh stations and ports-of-entry for inspecting commercial vehicles. Moreover, NDSU is home to the Center of High Performance Computing and the Center for Nanoscale Science and Engineering (CNSE), which is located in NDSU's Research and Technology Park. CNSE's research facilities include RFID production and testing facilities.

[11] The primary goals of the RTSSC are to: improve communication and coordination within North Dakota and the region for addressing rural transportation safety and security concerns, improve the rural safety and security information available to clients and stakeholders, and improve analysis tools to aid clients and stakeholders in implementing projects or programs for enhancing rural transportation safety and security.

[12] Administratively, the Advanced Traffic Analysis Center, the DOT Support Center, the RTSSC, TSSC and the SURTC are part of the Upper Great Plains Transportation Institute. The MPC director is also the associate director of UGPTI—which allows for coordination of these centers.

CNSE focuses on defense, transportation, agricultural, and security applications of RFID and has strong linkages to private RFID production and research companies.

South Dakota State University (SDSU) is a land grant institution with an annual enrollment of approximately 11,000 students. The university has eight colleges and offers 104 baccalaureate degree and post-baccalaureate certificate programs, 23 master's degree and post-master's certificate programs, eight Ph.D. degree programs, and one first professional program (PharmD). Recently, two additional Ph.D. degree programs in the College of Engineering have been approved for offering. The College of Engineering is comprised of seven departments: Civil and Environmental Engineering, Electrical Engineering and Computer Science, Mechanical Engineering, Agricultural and Biosystems Engineering, Engineering Technology and Management, Mathematics and Statistics, and Physics. The Department of Civil and Environmental Engineering has 10 tenure/tenure-track faculty and many support faculty. There are approximately 230 undergraduate students and 35 graduate students enrolled in the civil engineering program. Supporting programs include the newly developed Geographic Information Science Center of Excellence (GIScCE) which is a joint collaboration between SDSU and the U. S. Geological Survey's National Center for Earth Resources Observation and Sciences (EROS). SDSU houses the South Dakota Local Transportation Assistance Program (SDLTAP)—one of five technology transfer and outreach programs provided by the Engineering Resource Center (ERC). Moreover, the Civil and Environmental Engineering Department at SDSU houses state-of-the-art laboratory facilities. The Lohr Structures Laboratory (LSL) is a 4,500 square foot high-bay structural testing facility fitted with a strong floor, modular loading frame, and a 15-ton traveling bridge crane. The asphalt laboratory is equipped to perform a broad range of tests related to performance and mix design of flexible and rigid pavement. The equipment in the asphalt laboratory includes gyratory compactor, rotational viscometer, and pressure aging vessel.

The University of Utah (UU) has an annual enrollment of about 29,000 students and offers 77 undergraduate degree programs, over 80 minors and certificates, more than 45 teaching majors and minors, and 95 graduate majors. Students are enrolled from all 29 Utah counties and all 50 states. The College of Engineering is the third largest of 18 colleges on campus. It has seven academic departments – Civil and Environmental, Mechanical, Chemical and Fuels, Electrical and Computer, Bioengineering, Materials Science, and the School of Computing. There are nearly 200 regular faculty and 200 adjunct, clinical, and research faculty. Collectively, these departments receive $30 million in external research funding annually. The department of Civil and Environmental Engineering has well-equipped laboratories specializing in transportation, structural, geotechnical, hydraulic, environmental, and materials engineering. The Utah Traffic Laboratory is connected by fiber optic cable to the Utah DOT Traffic Operations Center. The Lab has a state-of-the-art multimedia video conferencing studio with delivery, recording, and hosting capabilities for teaching, training, and research collaboration. The lab boasts the first North American installation of VISUM Online which is an intelligent platform for traffic management. It excels at modeling current and expected traffic conditions accurately and dynamically from real-time data. It links current and historical information intelligently.

The University of Wyoming (UW) has an annual enrollment of about 12,400 students and offers 85 undergraduate degree programs including eight teaching majors. The university offers

58 master degree programs and 32 Ph.D. programs. There are a total of 704 faculty members, with 651 being full-time and 53 being part-time. Students are enrolled from all 23 Wyoming counties, all 50 states and 67 foreign countries. There are seven colleges in the university with the College of Engineering being the fourth largest. It is divided into six academic departments: Civil & Architectural, Mechanical, Electrical, Computer Science, Chemical and Petroleum and Atmospheric Science. There are just over 80 full-time faculty members. The Department of Civil and Architectural Engineering trains its students for those challenges by providing a core of basic engineering courses for its undergraduates and allowing them to specialize in any one or a combination of the following technical areas: Structures, Water Resources, Environmental Engineering, Geotechnical Engineering, and Transportation. The transportation program at the University of Wyoming provides learning opportunities for students in paving materials, traffic, safety, and planning. In addition, the WYDOT Materials Certification Program and the Wyoming LTAP program are hosted at UW. A significant number of funded research projects are regularly conducted by the transportation faculty members at the University of Wyoming.

III.B Center Director

The Center director is Denver Tolliver. Including educational activities, Dr. Tolliver will spend 50 to 70 percent of his time on MPC objectives. He will effectively administer the program at five universities through an executive committee and a series of annual site visits to each campus.

Role of the Executive Committee. The MPC Executive Committee will include five MPC program coordinators who will coordinate activities and oversee the annual program of events at each campus. The program coordinators are: Dr. Richard Gutkowski, Colorado State University; Dr. Kimberly Vachal, North Dakota State University; Dr. Peter Martin, University of Utah; Dr. Nadim Wehbe, South Dakota State University; and Dr. Khaled Ksaibati, University of Wyoming. In addition to biannual meetings, the executive committee will hold videoconferences via TLN throughout the year to monitor the progress of research and technology transfer. The USDOT liaison and chair of the Advisory Committee are invited members, who will participate in executive committee meetings as their time permits.

Role of the Advisory Committee. The Advisory Committee will play a key role in the implementation of the vision which they jointly created with the MPC universities. The Advisory Committee will meet annually to discuss program implementation and opportunities for MPC. The chair will communicate with the committee periodically throughout the year, and the center director and the chair will communicate on a regular basis. In conjunction with the chair, the center director will prepare an annual briefing for the committee and identify any administrative changes or improvements that need to be made. The relationship between the executive committee and Advisory Committee was shown earlier in Figure 2.

Research Advisory Panels. The MPC executive and Advisory Committees will identify research advisory panels to provide specific direction in MPC emphasis areas of safety and security research, mobility and global connectivity, and infrastructure renewal and environmental stewardship (Figure 4). USDOT research managers will be asked to participate in these panels.

For example, an infrastructure research panel is being planned. The panel will meet immediately after the strategic plan is approved. It will include MPC research faculty, research engineers designated by the Advisory Committee, and USDOT research leaders. The panel will develop a detailed infrastructure research plan for the remainder of the SAFETEA-LU era, including: (1) applied research projects that can be matched by state transportation departments, (2) advanced research projects that identify emerging issues and needs, and (3) technology transfer strategies to quickly and effectively implement the results. Advisory Committee members may participate in these panels or designate research engineers from their respective organizations to participate. Through these panels, the director and Advisory Committee can effectively manage the research program even though it encompasses a wide range of focus areas and topics.

Coordination and Outreach. Dr. Ayman Smadi of North Dakota State University will help coordinate MPC's activities with those of other centers and programs at the universities, as well as with external organizations. As director of the Upper Great Plains Transportation Institute, Mr. Gene Griffin will function as a liaison to the Council of University Transportation Centers (CUTC) and promote MPC with national organizations.[13] Mr. John MacGowan will work with the director as needed to ensure that MPC is addressing emerging USDOT priorities. Mr. Doug Benson will lead MPC outreach activities with Native Americans and help implement MPC's midcontinent partnerships with the University of Manitoba and other centers.

Site Visits and Research Progress Updates. The director will visit each campus at least once per year to conduct on-site evaluations. The USDOT liaison will be invited to participate in these annual site visits. The director will maintain control over research performance through required reports and visits. At mid-year, each PI must submit a progress report stating the approximate percentage of the project completed and whether the milestone tasks scheduled for completion during the first six months have been completed. The center director will follow-up with a visit to the campus of each university in the consortium to meet with PIs and graduate students and further assess the status of projects.

Coordination with TLN and LTAP Centers. Administratively, the TLN and North Dakota LTAP directors report to the center director, which allows him to effectively coordinate MPC's distance learning, communications, and technology transfer activities. In addition, two of the MPC program coordinators oversee LTAP Centers at SDSU and University of Wyoming. All MPC program coordinators are members of the TLN board, which allows for integrated planning and administration of the technology transfer and distance-learning activities of the center.

III.C Center Faculty and Staff

The center director spends most of his time (more than 50 percent) on MPC activities as a result of his administrative, coordinative, and educational responsibilities. The program coordinators at the other four universities spend much of their time on MPC activities. However, the administrative portions of their times amount to less than 50 percent. Although they make great

[13] Of these individuals, only the center director will devote at least half of his time to MPC.

administrative contributions, the program coordinators are funded mostly on MPC research and educational projects.

Ms. Kathy McCarthy serves as administrative assistant and information coordinator; but, spends less than 50 percent of her time on MPC matters. Mr. Doug Benson functions as outreach leader and helps the director with key partnerships, research, and technology transfer projects. By drawing from and utilizing many contributors, the director is able to provide cost-effective administration, while devoting the lion's share of UTC funds to research, education, and technology transfer—including the support of graduate students and faculty.

III.D Multiparty Arrangements

Through the executive committee, the director exercises administrative and financial control within the consortium. Each year, North Dakota State University expends at least 50 percent of the funds. The remaining funds are allocated among the other universities in a manner that provides for a minimal funding base for each university. The key personnel involved in Center management at the five institutions were described in part III.B

IV. Budget Details

Mountain-Plains Consortium

Grant Year: July 1, 2007 - June 30, 2008

Categories	Budgeted Amount	Explanatory Notes
	$0.00	
Center Director Salary	$103,820.00	
Faculty Salaries	$694,962.00	
Administrative Staff Salaries	$175,009.00	
Other Staff Salaries	$169,430.00	
Student Salaries	$753,058.00	
Staff Benefits	$403,266.00	
TOTAL Salaries & Benefits	**$2,299,545.00**	
Scholarships	$6,000.00	
Permanent Equipment	$56,900.00	
Expendable Property & Supplies	$438,044.00	
Domestic Travel	$152,809.24	
Foreign Travel	$0.00	
Other Direct Costs (Specify)	$169,227.00	
TOTAL Direct Costs	**$3,122,525.24**	
F&A (Indirect) Costs	$1,048,038.76	
TOTAL COSTS	**$4,170,564.00**	
Federal Share	$2,000,000.00	
Matching Share	$2,170,564.00	

Colorado State University

Grant Year: July 1, 2007 - June 30, 2008

Categories	Budgeted Amount	Explanatory Notes
Center Director Salary	$0.00	
Faculty Salaries	$116,876.00	8 9-month faculty
Administrative Staff Salaries	$0.00	
Other Staff Salaries	$0.00	
Student Salaries	$133,254.00	8 Graduate + 6 Undergraduate Students
Staff Benefits	$26,800.00	
TOTAL Salaries & Benefits	**$276,930.00**	
Scholarships	$0.00	
Permanent Equipment	$0.00	
Expendable Property, Supplies & Services	$91,290.00	Research + lab mat's, shop services
Domestic Travel	$4,000.00	3 conferences; MPC-TLN Board meeting
Foreign Travel	$0.00	
Other Direct Costs (Specify)	$0.00	
TOTAL Direct Costs	**$372,220.00**	
F&A (Indirect) Costs	$158,192.00	
TOTAL COSTS	**$530,412.00**	
Federal Share	$264,976.00	
Matching Share	$265,436.00	

North Dakota State University

Grant Year: July 1, 2007 - June 30, 2008

Categories	Budgeted Amount	Explanatory Notes
Center Director Salary	$103,820.00	
Faculty Salaries	$369,492.00	
Administrative Staff Salaries	$103,820.00	
Other Staff Salaries	$78,930.00	
Student Salaries	$239,167.00	
Staff Benefits	$239,650.00	
TOTAL Salaries & Benefits	**$1,134,879.00**	
Scholarships	$6,000.00	
Permanent Equipment	$19,500.00	TLN Equipment
Expendable Property & Supplies	$294,954.00	Includes TLN transmission costs
Domestic Travel	$80,000.00	
Foreign Travel	$0.00	
Other Direct Costs (Specify)	$120,000.00	
TOTAL Direct Costs	**$1,655,333.00**	
F&A (Indirect) Costs	$703,517.00	
TOTAL COSTS	**$2,358,850.00**	
Federal Share	$1,108,946.00	
Matching Share	$1,249,904.00	

South Dakota State University

Grant Year: July 1, 2007 - June 30, 2008

Categories	Budgeted Amount	Explanatory Notes
Center Director Salary	$0.00	
Faculty Salaries	$35,631.00	4 PI and Co-PI
Administrative Staff Salaries	$20,689.00	1 Program Director (21% time); 1 Admin Asst (14% time)
Other Staff Salaries	$0.00	
Student Salaries	$40,557.00	
Staff Benefits	$4,434.00	
TOTAL Salaries & Benefits	**$101,311.00**	
Scholarships	$0.00	
Permanent Equipment	$6,000.00	
Expendable Property & Supplies	$32,300.00	Research + lab supplies
Domestic Travel	$22,589.00	Research and attending conferences
Foreign Travel	$0.00	
Other Direct Costs (Specify)	$2,000.00	Tuition Remission
TOTAL Direct Costs	**$164,200.00**	
F&A (Indirect) Costs	$30,212.00	
TOTAL COSTS	**$194,412.00**	
Federal Share	$96,976.00	
Matching Share	$97,436.00	

University of Utah

Grant Year: July 1, 2007 - June 30, 2008

Categories	Budgeted Amount	Explanatory Notes
	$0	
Center Director Salary	$0	
Faculty Salaries	$55,000	
Administrative Staff Salaries	$38,000	
Other Staff Salaries	$42,500	
Student Salaries	$240,000	
Staff Benefits	$80,715	
TOTAL Salaries & Benefits	**$456,215**	
Scholarships	$0	
Permanent Equipment	$25,000	
Expendable Property & Supplies	$10,000	
Domestic Travel	$12,320	
Foreign Travel	$0	
Other Direct Costs (Specify)	$0	
TOTAL Direct Costs	**$503,535**	
F&A (Indirect) Costs	$25,177	
TOTAL COSTS	**$528,712**	
Federal Share	$264,126	
Matching Share	$264,586	

University of Wyoming

Grant Year: July 1, 2007 - June 30, 2008

Categories	Budgeted Amount	Explanatory Notes
Center Director Salary	$0.00	
Faculty Salaries	$117,963.00	3 faculty members + civil engineers
Administrative Staff Salaries	$12,500.00	
Other Staff Salaries	$48,000.00	
Student Salaries	$100,080.00	4 Graduate & 2 Undergraduate Students
Staff Benefits	$51,667.00	
TOTAL Salaries & Benefits	**$330,210.00**	
Scholarships	$0.00	
Permanent Equipment	$6,400.00	Computer
Expendable Property, Supplies & Services	$9,500.00	
Domestic Travel	$33,900.00	
Foreign Travel	$0.00	
Other Direct Costs (Specify)	$47,227.00	
TOTAL Direct Costs	**$427,237.00**	
F&A (Indirect) Costs	$130,941.00	
TOTAL COSTS	**$558,178.00**	
Federal Share	$264,976.00	
Matching Share	$293,202.00	

APPENDIX A – Baseline Performance Measures

Research Selection

1. Number of Transportation research projects selected for funding using your UTC grant funding (Federal and/or match).

Utah - 3
Colorado - 3
North Dakota – 2
South Dakota - 0
Wyoming - 3

1.a Number of those projects that you consider to be:

Basic Research

Utah - 0
Colorado - 0
North Dakota – 0
South Dakota - 0
Wyoming - 0

Advanced Research

Utah - 0
Colorado - 0
North Dakota – 0
South Dakota - 0
Wyoming - 0

Applied Research

Utah - 3
Colorado - 3
North Dakota – 2
South Dakota - 0
Wyoming - 3

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

$205,000 - Utah
$136,786 - Colorado
$118,218 - North Dakota
$0 – South Dakota
$172,192 - Wyoming

Research Performance

3. Number of transportation research reports published.

Utah - 3
Colorado – 2
North Dakota – 2
South Dakota - 0
Wyoming - 4

4. Number of transportation research papers presented at academic/professional meetings that resulted from projects funded by the UTC grant.

Utah - 3
Colorado - 6
North Dakota – 0
South Dakota - 0
Wyoming - 2

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

Colorado – 0
North Dakota – 0
South Dakota - 17
Utah - 0
Wyoming – 14

Graduate

Colorado - 0
North Dakota - 19
South Dakota - 17
Utah – 11
Wyoming - 9

MPC Baseline Courses

The courses shown below are ones that each of the universities consider to be transportation-related courses. There is not a consistent definition among universities because a different set of prerequisite and technical elective courses may be required for transportation-related majors at

each of the universities. Colorado State University considers its entire civil engineering curriculum as prerequisite courses for a specialization in transportation engineering. Therefore, CSU has made no distinction with respect to transportation-related courses. Consequently, we have listed 0 courses in the baseline. However, this does not suggest that CSU does not have a transportation-related curriculum, but that they consider the entire civil engineering curriculum to be transportation related.

NDSU Baseline Courses

Graduate

TL

AGEC 771	Economics of Transportation Systems
ENGR 770	Quantitative Modeling
ENGR 771	Probabilistic and Deterministic Methods
TL782	Transportation Systems I
TL783	Transportation Systems II
TL784	Intermodal Freight Transportation
TL785	Spatial Analysis of Transportation Systems
TL786	Public Transportation
TL788	Research in Transportation and Logistics

MML

TL711	Logistics Systems
TL713	Global Value Chain Management
TL717	Transportation and Logistics
TL719	Crisis Analysis and Homeland Security
TL721	International Logistics Management
TL723	Advanced Supply Chain Planning
TL725	Technology Advances and Logistics
TL729	Adaptive Planning in Logistics
TL731	Logistics Research Methods
TL733	Military Case Studies in Logistics

CE

CE618	Transportation Engineering
CE619	Pavement Design
CE654	Geometric Highway Design
CE655	Airport Planning and Design
CE656	Railroad Planning and Design
CE657	Pavement Management Systems
CE781	Traffic Engineering

SDSU Baseline Courses

Undergraduate

CEE106	Elementary Surveying
CEE208	Engineering Surveys

CEE216/216L Materials and Lab
CEE340 Engineering Geology
CEE346 Geotechnical Engineering and Lab
CEE363 Highway and Traffic Engineering
CEE467 Transportation Engineering
Geog488 Geographic Information Systems
CEE455 Steel Design
CEE456 Reinforced Concrete Theory and Design

Graduate/Undergraduate

CEE411/511 Bituminous Materials and Lab
CEE472/572 Geosynthetics
CEE446/556 Advanced Geotechnical Engineering
CEE447/547 Foundation Engineering and Lab
CEE452/552 Prestressed Concrete Structures
CEE458/558 Design of Timber Structures
CEE443/553 Matrix Structural Analysis

Graduate

CEE765 Pavement Design
CEE664 Highway Capacity Analysis
CEE769 Pavement Management and Rehabilitation
CEE632 Advanced Foundation Engineering and Lab
CEE639 Geotechnical Testing and Lab
CEE654 Advanced Design of Steel Structures
CEE656 Advanced Reinforced Concrete
CEE749 Structural Dynamics
CEE769 Design of Steel and Concrete Bridges
EM641 Finite Elements

UofU Baseline Courses

Undergraduate

CvEEN3520 Transportation I

Graduate

CvEEN5/6510 Highway Design
CvEEN5/6530 Quantitative Methods in Transportation
CvEEN5/6560 Transportation II
CvEEN7520 Transportation Safety
CvEEN7540 Iintelligent Transportation Systems
CvEEN7545 Transportation Modeling
CvEEN7580 Advanced Technical Communication
CvEEN 7590 Public Transportation Systems
CvEEN7920 Scientific Methods in Transportation Research
CvEEN7920 Advanced Traffic Signal Systems

UWY Baseline Courses

Undergraduate

2070	Engineering Surveying
2074	Ethics for the Professional Surveyor
2080	Public Land Surveys I
2082	Public Land Surveys II
2084	Public Land Surveys III
2086	Advanced Public Land Surveys
2088	Writing Land Descriptions
2090	GPS for Surveyors
3500/4500	Transportation Engineering
3600/4600	Soil Mechanics I
3710/4710	Route Surveying
3720/4720	Advanced Surveying
3740	Survey Boundary Control and Legal Principles
3750	Surveying Evidence and Procedures for Boundary Location

Graduate

CE5520	Traffic Engineering
CE5535	Engineering Decision making
CE5540	Traffic Control
CE5550	Geometric Design of Highways
CE5555	Geometric Design
CE5560	Traffic Safety
CE5570	Transportation Planning
CE5585	Pavement Management Systems
CE5590	Pavement Materials

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

Undergraduate

Utah - 2
Colorado - 10
North Dakota – 0
South Dakota - 0
Wyoming - 6

Graduate

Utah - 12
Colorado - 10
North Dakota – 4
South Dakota - 0
Wyoming - 6

Human Resources

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

Master=s Level

Utah - 1
Colorado - 0
North Dakota – 0
South Dakota - 0
Wyoming - 0

Doctoral Level

Utah - 1
Colorado - 0
North Dakota – 1
South Dakota - 0
Wyoming - 0

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

Master=s Level

Utah - 10
Colorado - 0
North Dakota – 7
South Dakota - 0
Wyoming - 8

Doctoral Level

Utah - 2
Colorado - 0
North Dakota – 15
South Dakota - 0
Wyoming - 1

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

Master=s Level

Utah - 2
Colorado - 0
North Dakota – 3
South Dakota - 0
Wyoming -0

Doctoral Level

Utah - 1
Colorado - 0
North Dakota – 1
South Dakota - 0
Wyoming - 0

Technology Transfer

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

Utah - 7
Colorado - 3
North Dakota – 13
South Dakota - 0
Wyoming - 36

11. Number of transportation professionals participating in those events.

Utah - 163
Colorado - 30
North Dakota – 350
South Dakota - 0
Wyoming - 1,138