



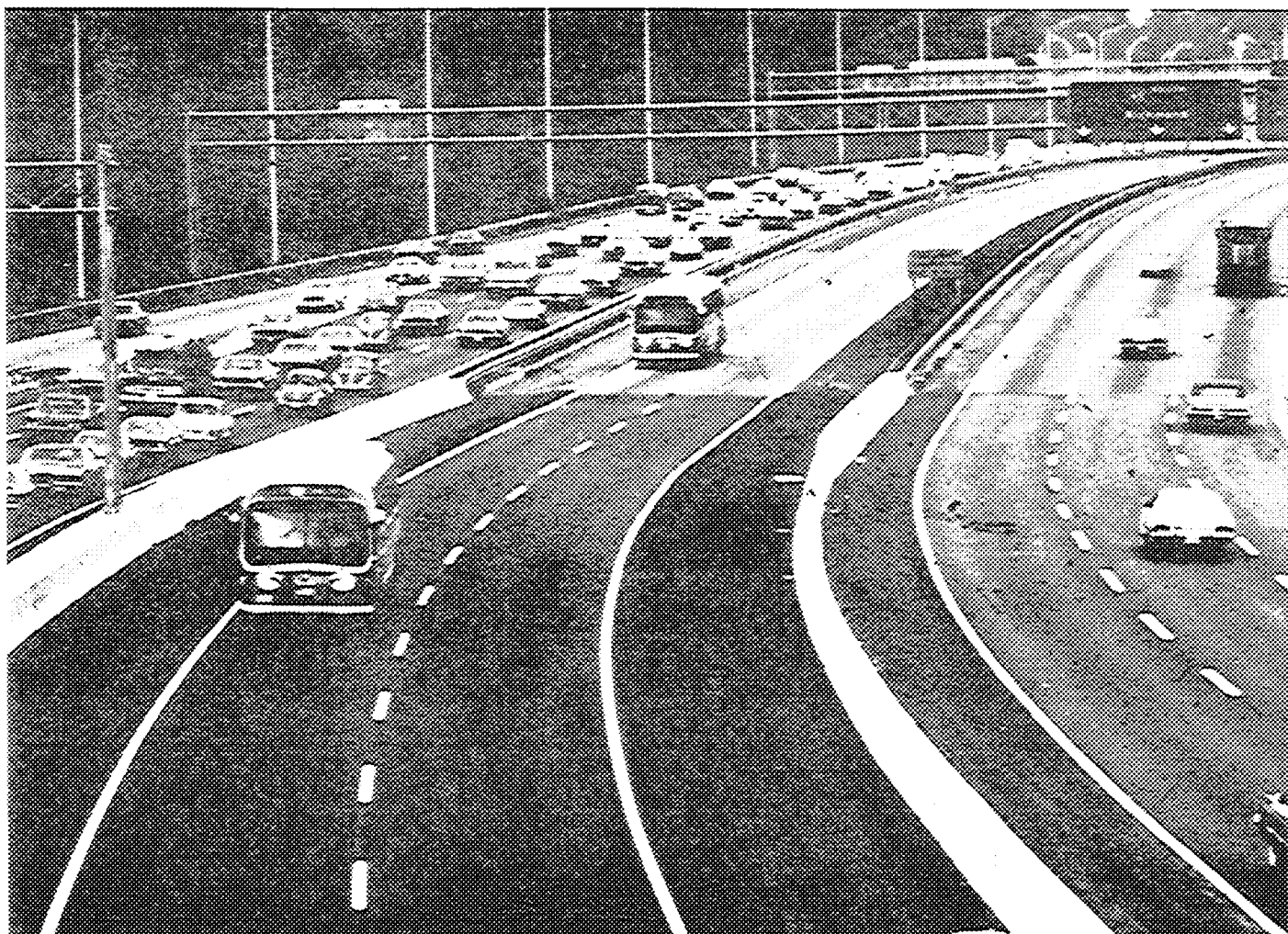
U.S. Department
of Transportation
**Federal Highway
Administration**

University Transportation Centers Program

Published Technical Reports and Project Abstracts

January 1991

Publication No. FHWA-HI-91-005



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Federal Highway Administration

January 1991

U. S. DEPARTMENT OF TRANSPORTATION
UNIVERSITY TRANSPORTATION CENTERS PROGRAM

PUBLISHED TECHNICAL REPORTS
AND
THIRD YEAR PROJECT ABSTRACTS

PROGRAM SUMMARY	1
PUBLISHED TECHNICAL REPORTS: FIRST AND SECOND YEAR RESEARCH PROJECTS	2
THIRD YEAR RESEARCH PROJECT ABSTRACTS	11
APPENDICES	
UTCP KEY PERSONNEL /GRANT REGIONAL REPRESENTATIVES	63
UNIVERSITIES ASSOCIATED WITH THE PROGRAM	64

PROGRAM SUMMARY

LEGISLATIVE HISTORY

Program Funding:

- \$5 million was awarded in FY 1988 and FY 1989 from the Mass Transit Account of the Highway Trust Fund.
- \$9,970,000 was awarded in FY 1990 from the Mass Transit Account and the highway account. Congress appropriated \$30,000 for drug enforcement and reduced the amount for the centers.
- Public Law 100-17 also authorized \$5 million from the highway account; however, it failed to provide the requisite language for authority to use the highway portion of the Highway Trust Fund. The Department of Transportation Appropriations Act for FY 1990 provides \$5 million from the highway account for FY 1990 only.
- Research is open to all modes of surface transportation including landside congestion at airports or marine ports.

Post FY 1991 Legislation

- The Department is supporting extension of the program for the next reauthorization period.

**PUBLISHED TECHNICAL REPORTS
1ST AND 2ND YEAR PROJECTS**

**REGION I	MASSACHUSETTS INST. OF TECHNOLOGY	PRINCIPAL INVESTIGATOR
HU-02	"LAND USE, TRANSPORTATION, AND THE DEVELOPMENT PROCESS"	Jose Gomez-Ibanez
MIT-08	"PREDICTION AND MEASUREMENT OF CORROSION-INDUCED CRACKING IN REINFORCED CONCRETE"	Victor Li
MIT-09	"STRUCTURAL APPLICATIONS OF POLYMER COMPOSITES IN TRANSPORTATION FACILITIES"	Shyam Sunder
MIT-10	"USE OF INFORMATION TECHNOLOGY FOR IMPROVING TRAFFIC FLOWS"	Haris Koutsopoulos
MIT-11	"NETWORK DESIGN AND TRANSPORTATION PLANNING"	Thomas L. Magnanti
MIT-12	"IMPROVING TRANSPORTATION WORKFORCE MANAGEMENT METHODS IN THE TRANSIT INDUSTRY"	Nigel Wilson
MIT-17	"SMART DRIVERS FOR THE 1990s: TRANSPORT APPLICATIONS OF TOPOLOGIC DATABASE TECHNOLOGY"	Richard deNeufville
UCT-7	"HAZARDOUS WASTE TRANSPORT: PERSPECTIVES OF STATE AND LOCAL OFFICIALS"	Seymour Warkov
UMA-19	"APPLICATION OF AN EXPERT SYSTEM IN THE ANALYSIS OF HIGH HAZARD LOCATIONS"	Paul W. Shuldiner
UME-01	"RELIABILITY-BASED DESIGN OF CONCRETE BRIDGE DECKS WITH ISOTROPIC REINFORCEMENT"	H.J. Dagher
UNH-06	"ACOUSTIC EVALUATION OF ENTRAINED AIR BUBBLE SYSTEMS IN PLASTIC CONCRETE"	David L. Gress
URI-04	"UTILIZATION OF A WATERJET CUTTING UNIT ON THE INFRASTRUCTURE MANAGEMENT"	Thomas J. Kim
UVT-05	"HIGHWAY BRIDGE MEMBER INSPECTION"	Jean-Guy Beliveau

**REGION II CITY UNIVERSITY OF NEW YORK		PRINCIPAL INVESTIGATOR
CUNY-51	"AVIONICS MAINTENANCE CERTIFICATION PROGRAM"	Jack Prince
CUNY-90	"MEETING THE TRANSPORTATION NEEDS OF THE U.S. VIRGIN ISLANDS: PROBLEMS AND SOLUTIONS"	Paul Leary
PU-14	"DYNAMIC LAND USE AND TRANSPORTATION MODELS FOR GROWTH MANAGEMENT AND JOB ACCESS"	Julian Wolpert
PU-33	"INFRASTRUCTURE RISK MANAGEMENT PRIORITIZING BRIDGES FOR MAINTENANCE AND REHABILITATION"	E. VanMarcke
RPI-26	"LOGISTICS FOR HAZARDOUS MATERIALS TRANSPORTATION, SCHEDULING, ROUTING, SITING"	George List

**REGION III PENNSYLVANIA STATE UNIVERSITY		PRINCIPAL INVESTIGATOR
MSU-01	"CAREER DEVELOPMENT AND TRAINING"	Moges Ayele
PSU-04	"SEAT TRANSFER FUNCTION"	J.C. Wambold
UVA-02	"INSTITUTE ON RISK MANAGEMENT IN TRANSPORTATION"	Y.Y. Haines
VPI-01	"OPTIMAL DIVERSION STRATEGIES FOR A MODIFIED URBAN NETWORK"	A.G. Hobeika
VPI-02	"APPLICATION OF ARTIFICIAL INTELLIGENCE TO TRANSPORTATION PROBLEMS"	John W. Dickey
VPI-04	"MODELING TRANSPORTATION AND ECONOMIC DEVELOPMENT AT REGIONAL LEVEL"	Donald R. Drew
VPI-05	"USE OF GEOGRAPHIC INFORMATION SYSTEMS BY TRANSPORTATION PROFESSIONALS"	W.A. O'Heill

**REGION IV	UNIVERSITY OF NORTH CAROLINA	PRINCIPAL INVESTIGATOR
UFL-01	"MICROCOMPUTER BASED TRAFFIC CONTROL SYSTEM MONITORING AND ENHANCEMENT"	Kenneth Courage
	<ul style="list-style-type: none">- DEVELOPMENT OF OPTIMAL THRESHOLD PARAMETERS FOR TRAFFIC RESPONSIVE CONTROL IN ARTERIAL SIGNAL SYSTEMS- LATE NIGHT TRAFFIC SIGNAL CONTROL STRATEGIES FOR ARTERIAL SYSTEMS- REMOTE MONITORING OF ARTERIAL TRAFFIC CONTROL SYSTEM OPERATIONS	
UFL-09	"IMPLEMENTATION OF TRAFFIC SIGNAL TIMING PLANS IN COORDINATED ARTERIAL SYSTEMS"	Kenneth Courage
UKY-01	"ANALYSIS OF TRANSPORTATION LOGISTICS AND INDUSTRY COMPETITIVENESS"	Roger Calantone
UKY-02	"LIFELINE DESIGN FOR BRIDGES"	Hans Gesund
UKY-04	"LARGE-STONE MIXTURES TO REDUCE RUTTING IN FLEXIBLE PAVEMENTS"	Kanyar Mahbaub
UTN-01	"DEVELOPMENT OF A PERFORMANCE INFORMATION SYSTEM FOR RURAL TRANSPORTATION SYSTEMS IN TENNESSEE"	Frederick Wegmann
	<ul style="list-style-type: none">- HAMILTON COUNTY WELFARE AND RURAL TRANSPORTATION SERVICES DEPARTMENT- HANCOCK COUNTY- MID-CUMBERLAND HUMAN RESOURCE AGENCY- NORTHWEST TENNESSEE HUMAN RESOURCE AGENCY- SOUTH CENTRAL TENNESSEE DEVELOPMENT DISTRICT- SOUTHEAST TENNESSEE HUMAN RESOURCE AGENCY- SOUTHWEST HUMAN RESOURCE AGENCY- UPPER CUMBERLAND HUMAN RESOURCE AGENCY	

- DEVELOPMENT OF A GENERIC MANAGEMENT INFORMATION SYSTEM FOR TENNESSEE SECTION 18 OPERATORS
 - APPLICATION OF TLD "TENDER LOVIN' CARE FOR YOUR VEHICLE" TO TENNESSEE'S RURAL TRANSPORTATION SYSTEM - USERS' GUIDE
 - IMPLEMENTATION OF RURAL PUBLIC TRANSPORTATION COMPUTERIZED MANAGEMENT INFORMATION SYSTEM
 - USERS' GUIDE FOR TENNESSEE RURAL TRANSIT MANAGEMENT INFORMATION SYSTEM (RTMIS)
 - RURAL PUBLIC TRANSPORTATION IN TENNESSEE
- UTN-03 "GUIDELINES FOR ROADWAY CROSS-SECTIONS IN DEVELOPING URBAN/SUBURBAN AREAS" Steve Richards
- "OPERATIONAL EFFECTS OF NON-TRAVERSABLE MEDIAN AND TWO-WAY LEFT TURN LANES: A COMPARISON" Mohan Venigallia
- VBTU-10 "IMPROVED TRAFFIC NOISE ANALYSIS TECHNIQUES: INTEGRATION WITH CAD" William Bowlby
- VBTU-13 "WARRANTING ADVISOR FOR ROADSIDE SAFETY HARDWARE" Malcolm Ray

****REGION V UNIVERSITY OF MICHIGAN PRINCIPAL INVESTIGATOR**

- UM-01 "HUMAN FACTORS CONSIDERATIONS IN THE DESIGN OF TRUCKS" Michael Sivak
- "HUMAN FACTORS CONSIDERATIONS IN THE DESIGN OF TRUCK LIGHTING, SIGNALLING, AND REARVIEW MIRRORS"
- UM-02 "ECONOMICS OF TRUCK AND BUS REPLACEMENT" James Bean
- "EQUIPMENT REPLACEMENT UNDER TECHNOLOGICAL CHANGE"
- "CONDITIONS FOR THE DISCOVERY OF SOLUTION HORIZONS"

UM-03	"FAULT DIAGNOSIS FOR IMPROVED SAFETY AND RELIABILITY OF HEAVY-DUTY COMMERCIAL VEHICLES"	William Ribbens
	- "APPLICATION OF FAILURE DETECTION AND ISOLATION THEORY TO ELECTRONICALLY CONTROLLED DIESEL ENGINES"	
UM-03a	"PREDICTIVE MAINTENANCE FOR HEAVY-DUTY ELECTRONICALLY CONTROLLED DIESEL ENGINES"	William Ribbens
	- "FAILURE DETECTION IN PERIODIC DISCRETE-TIME SYSTEMS"	
UM-04	"NATIONAL TRUCK TRAVEL BY GROSS COMBINATION WEIGHT AND OTHER FACTORS"	Kenneth Campbell
	- "NATIONAL ESTIMATES OF TRUCK TRAVEL BY CONFIGURATION AND WEIGHT"	
UM-05	"INTELLIGENT SYSTEMS TECHNOLOGY FOR TRUCKS AND BUSES"	Robert Ervin
	- "SURVEY OF THE TRUCKING INDUSTRY'S PREFERENCES FOR IVHS"	
UM-05a	"A METHOD FOR EVALUATING THE POTENTIAL PAYOFF FROM TECHNOLOGIES FOR PREVENTING TRUCK COLLISIONS - AN IVHS FEASIBILITY PROJECT"	Robert Ervin
	- "THE FEASIBILITY OF QUANTITATIVELY CHARACTERIZING THE VEHICLE MOTION ENVIRONMENT"	
UM-07	"PRODUCTIVITY VS. TRACKING AND STABILITY OF MULTI-UNIT HIGHWAY VEHICLES"	Paul Fancher
	- "DIRECTIONAL DYNAMICS CONSIDERATIONS FOR MULTI-ARTICULATED, MULTI-AXLED HEAVY VEHICLES"	
	- "VEHICLE DESIGN IMPLICATIONS OF THE TURNER PROPOSAL"	
UM-08	"PREDICTION OF BRAKE TEMPERATURES ON URBAN BUS ROUTES"	Paul Fancher
UM-09	"A STUDY OF ROAD DAMAGE DUE TO DYNAMIC WHEEL LOADS USING A LOAD MEASURING MAT"	Chris Winkler

UM-10	"JIT SCHEDULING OF INTERMODAL INTERFACE TRANSPORT SYSTEMS"	William Grissom
UM-11	"HIGHWAY SAFETY, THE MOTOR CARRIER INDUSTRY, AND THE COSTS AND BENEFITS OF INCREASED SURVEILLANCE AND INSPECTIONS"	Leon Moses
	- "ECONOMICS OF MOTOR CARRIER SAFETY"	
UM-12	"EFFECT OF TRUCK LOADING ON BRIDGES"	A. Nowak
	- "SIMULATION OF DYNAMIC LOADS FOR BRIDGES"	
	- "SIMULATION OF DYNAMIC LOADS FOR GIRDER BRIDGES"	
UM-15	"URBAN BUS TRANSIT SHARING OF PAVEMENT COSTS"	Robert Carr
	- "URBAN BUS TRANSIT IMPACT ON FLEXIBLE PAVEMENT CONDITION AND LIFE CYCLE COSTS, PRELIMINARY BACKGROUND"	
UM-16	"INVESTIGATION OF SAFETY AND STRUCTURAL IMPLICATIONS OF SEAT BELTS ON TRANSIT BUSES"	Snehamay Khasnabis
	- "SAFETY IMPLICATIONS OF SEAT BELTS ON TRANSIT BUSES"	
	- "IMPACT OF SEAT BELTS ON THE STRUCTURE OF A TYPICAL TRANSIT BUS"	

****REGION VII IOWA STATE UNIVERSITY PRINCIPAL INVESTIGATOR**

ISU-01	"BRIDGE MANAGEMENT SYSTEM FOR THE STATES OF IOWA, NEBRASKA, KANSAS, AND MISSOURI"	Fouad Fanous
ISU-02	"THE NEED FOR TRANSPORTATION ALTERNATIVES FOR THE RURAL ELDERLY"	Mary Kihl
ISU-03	"EMISSION CONTROL IN DIESEL ENGINES BY ALCOHOL FUMIGATION"	Jon Van Gerpen
ISU-04	"ALTERNATIVE INVESTMENTS IN THE RURAL BRANCH RAILROADS AND COUNTY ROAD SYSTEMS"	C.P. Baumel

ISU-05 "THE CHANGING ROLE OF FREIGHT
TRANSPORTATION-MODES AND INTERMODAL
FREIGHT" Tom Maze

UIA-06 "ROAD INVESTMENT TO FOSTER LOCAL
ECONOMIC DEVELOPMENT" David
Forkenbrock

UIA-07 "A COMPUTER-AIDED DECISION SUPPORT
SYSTEM FOR MAKING LOCATIONAL DECISIONS" Gerald
Rushton

UIA-08 "DYNAMIC SIMULATION METHODS FOR EVALUATING
MOTOR VEHICLE AND ROADWAY DESIGN AND
RESOLVING POLICY ISSUES" James
Stoner

UIA-09 "TRANSIT-RELATED JOINT DEVELOPMENT FOR
ECONOMIC GROWTH IN RURAL AND SMALL
URBAN AREAS" David
Forkenbrock

****REGION VIII NORTH DAKOTA STATE UNIVERSITY** **PRINCIPAL
INVESTIGATOR**

NDSU-01 "ECONOMIES OF DENSITY AND SIZE FOR SHORT
LINE RAILROAD" Frank
Dooley

UWY-05 "CORRELATIONS BETWEEN RESILIENT MODULES,
R-VALUES, AND PLATE LOAD TESTS FOR
REGIONAL SUBGRADE SOILS" John P.
Turner

REGION IX UNIVERSITY OF CALIFORNIA, BERKELEY **PRINCIPAL
INVESTIGATOR**

UCB-2405 "A FREIGHT NETWORK MODEL FOR MODE AND
ROUTE CHOICE" Edward
Sullivan

****REGION X UNIVERSITY OF WASHINGTON** **PRINCIPAL
INVESTIGATOR**

TNW90-01 "THE EFFECT OF ICE AT INTERSECTIONS ON
OPTIMAL SIGNAL TIMING ON URBAN ARTERIALS" Jan
Botha

TNW90-02 "THE ROLE OF TRANSIT AND PARATRANSIT IN
RURAL COMMUNITIES IN ALASKA" Jan
Botha

TNW90-03	"MOTIVATIONS OF EXTENDED, EXURBAN COMMUTERS WITHIN A REGION"	K.J. Dueker
TNW90-04	"CHALLENGES CONFRONTING METROPOLITAN PORTLAND'S TRANSPORTATION DECISION-MAKING REGIME"	Sheldon Edner
TNW90-05	"ASSESSING OREGON'S CONTINUING TRANSIT FINANCING SYSTEM"	Sheldon Edner
TNW90-06	"IMPROVED DESIGN AND ANALYSIS OF PRESTRESSED CONCRETE GIRDERS"	Verne A. Geidl
TNW90-07	"AN EVALUATION OF THE VARIABLES TO CONSIDER WHEN PERFORMING NIGHTTIME REPAIR AND REHABILITATION PROJECTS ON STREETS AND HIGHWAYS"	James W. Hinze
TNW90-08	"THE NO EXPANSION JOINT BRIDGE FOR NORTHERN REGIONS"	J. Leroy Hulsey
TNW90-09	"RAILROAD RESEARCH NEEDS IN THE PACIFIC NORTHWEST"	C. T. Jahren
TNW90-10	"TRAFFIC OPERATIONS AT ALL-WAY STOP-CONTROLLED INTERSECTIONS"	Michael Kyte
TNW90-11	"PRACTICAL EVALUATION OF MOISTURE DAMAGE CUTOFF SPECIFICATIONS FOR ASPHALT CONCRETE"	Robt. P. Lottman
TNW90-12	"AN ANALYSIS OF BUS RIDERSHIP POTENTIAL TO OREGON HEALTH SCIENCES UNIVERSITY USING A GEOGRAPHIC INFORMATION SYSTEMS APPROACH"	Richard Lycan
TNW90-13	"GENERATION AND ASSESSMENT OF INCIDENT MANAGEMENT STRATEGIES"	Fred L. Mannering
TNW90-14	"DEVELOPMENT OF RAIL RATES AND TRANSPORTATION NETWORK STRUCTURE FOLLOWING DEREGULATION: THE EXPERIENCE IN THE PACIFIC NORTHWEST"	B. Starr McMullen
TNW90-15	"FREEWAY DATABASE STORAGE AND LOOP DETECTOR VALIDITY"	Nancy L. Nihan
TNW90-16	"HOV COMPLIANCE MONITORING AND THE EVALUATION OF THE HERO HOTLINE PROGRAM"	G. Scott Rutherford

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|----------|---|--------------------|
| TNW90-17 | "DEVELOPMENT OF A METHODOLOGY FOR SUBDIVIDING LARGE SUBURBAN TRAFFIC ANALYSIS ZONES TO SUPPORT MICRO-SCALE TRAFFIC IMPACT STUDIES" | Jerry B. Schneider |
| TNW90-18 | "DEVELOPMENT OF AN <u>E</u> LECTRONIC <u>D</u> ATA <u>G</u> ATHERING SYSTEM FOR <u>G</u> EOTECHNICAL <u>E</u> NGINEERING (EDGGE) FOR HIGHWAY SYSTEMS" | Trevor Smith |
| TNW90-19 | "AN EVALUATION OF AUTOMATIC PASSENGER COUNTERS: VALIDATION, SAMPLING, AND STATISTICAL INFERENCE" | James Strathman |

examine two case studies of the most advanced and serious proposals in the United States. If additional funding can be secured for travel (beyond that included in the proposed budget), we hope also to examine briefly the experience of at least one or two of the European countries with extensive private toll road systems and develop its implications for the United States. Throughout, the emphasis would be on the practical institutional and economic considerations that might affect the viability of private toll roads in the United States. What advantages do private toll roads appear to have over their public counterparts, for example, and under what circumstances are state and local officials and the public more likely to accept proposals for private toll roads?

MIT-20* PLANNING STUDY: DESIGN OF A DEMONSTRATION
PROGRAM TO ILLUSTRATE THE BENEFITS OF Thomas F.
HIGHWAY SYSTEM TECHNOLOGICAL INNOVATION Humphrey

This is the second phase of a planned three-phase project designed to develop and implement a demonstration program in the Boston metropolitan area to illustrate the benefits of highway technology. The objectives are to:

- (1) Develop the details of a Demonstration Program design to implement at least one cost-innovative technological improvement to deal with current highway issues in Boston. The selected technique(s) will have a very high probability for successful implementation.
- (2) Develop the funding package and commitments required to implement this demonstration, which will include state, Federal and private sector funds, and the involvement of all those sectors in this demonstration.
- (3) Establish a specific schedule for implementing the Demonstration Project.

MIT-25 INTEGRATING GIS TECHNOLOGIES INTO Joseph
TRANSPORTATION OPERATIONS AND MANAGEMENT Ferreira

The proposed research will identify, compare and demonstrate alternative strategies for integrating geographic information system (GIS) technologies into transportation management and operations. Attention will be focused on transit-related applications in order to make the project manageable, applicable to an important set of problems that have not been addressed elsewhere, and well-matched to our interests and experience and to the current state of emerging GIS technologies. The project has four objectives:

- (1) to improve the ability of transportation management and operations to use spatially referenced data and computer graphics;
- (2) to identify and evaluate particular application areas for spatial decision support systems within transit agencies;
- (3) to identify alternative data structures and system designs that address transit agency applications and to compare and evaluate these alternatives;
- (4) to develop a prototype system for an operating agency in order to test and evaluate recommended data structures and system designs in a realistic context.

MIT-26 IN-VEHICLE NAVIGATION AND ROUTE GUIDANCE
 SYSTEMS: DESIGN PARAMETERS AND TRAFFIC Haris N.
 FLOW CONTROL CONSIDERATIONS Koutsopoulos

Urban traffic flows have increased dramatically in recent years, causing alarmingly high levels of congestion. Sixty-one percent of rush hour traffic on urban interstates was rated as congested in 1985, compared to 40% in 1975. The number of cars owned in the U.S. tripled between 1960 and 1986, and total annual motor vehicle miles increased from 719 billion to 1,861 billion in the same period. Traffic congestion is characterized as recurrent or incident congestion. Recurrent congestion is caused by the fact that the capacity of certain facilities is temporarily reduced by incidents, such as car impairments, that routinely occur in the highway system. It is a widely held belief that the construction of new facilities alone will be unable to alleviate this congestion. Motorist information systems (MIS) based on modern information technology may play an important role in reducing traffic congestion and improving traffic flows and safety. Crucial in this respect is the ability of the systems to provide real time information and facilitate dynamic routing as opposed to static routing decisions.

MIT-27 NATIONAL COST EFFECTIVENESS OF SMARTEST Richard C.
 TRAFFIC LIGHTS Larson

The scientific objective of this research proposal is to develop computer-based model-oriented procedures for calculating a three-tiered performance measure of traffic control systems in use today and applying these to advanced adaptive traffic control systems that could be in use tomorrow. The three performance measures of interest are the time delay to the occupant(s) of the vehicle, fuel consumption and air pollution attributable to stops at signalized intersections. The ultimate objective of this research is to first verify or modify our conjecture based on scientific analysis and then to identify those organizational, political and

- (1) to develop a set of guidelines regarding the service life and costs of pavement maintenance practices typically used in New England by small cities and towns on locally funded highways;
- (2) to offer a workshop and produce a video of the workshop in order to present the overall results of the project and review the guidelines with highway superintendents and public works directors from small cities and towns in the region. A special effort will be made to demonstrate how the guidelines can be integrated into local budgetary, decision making, and pavement management processes. It should also be noted that the project will be carried out in coordination with the Baystate Roads Program (Massachusetts' T₂ Center), and other T₂ centers in the region.

UMA-23 IDENTIFICATION OF MULTIPLE-OBJECTIVE
OPTIMIZATION STRATEGIES FOR ADVANCED
TRAFFIC SIGNAL CONTROL ALGORITHMS

Victor J.
Maslanka

The purpose of this research is the investigation of opportunities for the application of multiple-objective optimization techniques for traffic signal timing. Through a review of past and current efforts in the development of traffic control algorithms and an investigation of state-of-the-art multiple-objective operations research techniques, specific opportunities for further research will be identified which shows promise in the provision of improved traffic signal control algorithms. The areas of application shall include real-time "self-timing" operation of isolated signals, coordinated signal systems, and improved timing plans for existing fixed-time and actuated signal systems.

UME-22 TRANSPORTATION BUS SERVICE NEEDS IN
BUSINESS CENTERS

Basile
Spirakos

The purpose of this research is to:

- (1) Investigate public bus service needs related to business centers that are located in small metropolitan areas.
- (2) Study social, economic, and physical characteristics of future potential bus riders that are workers, and shoppers of business centers.
- (3) Determine the future Metro service characteristics on the Maine Mall Business Center according to potential riders' needs.

be coordinated on the basis of main street green rather than main street yellow, as is currently the standard practice. The advantage of this strategy is that it maximizes the feedback to the motorist regarding the progression speed on the arterial. Platoon organization is heightened and dispersion minimized. Adaptation of PSC should produce major improvements for signalized networks.

RPI-46 TRANSFERABILITY OF TRAVEL SURVEY DATA George List

The transferability of travel survey findings from one urban area to another has long been a goal for the transportation planners. RPI, in cooperation with Cornell University, will explore the transferability of survey data and attempt to determine whether there are indicators that can be developed which determine when such reuse of data is possible.

RU-50 TRANSPORTATION FINANCE IN THE NEW YORK/
NEW JERSEY REGION John Pucher

The financing of transportation has been a growing problem in the United States. The financing problem is particularly critical for New York and New Jersey due to the lack of sufficient funding from dedicated taxes. This research project will examine in detail the current financing arrangements in New York and New Jersey, with emphasis on the greater metropolitan region. Expenditure levels, types of government assistance, sources of tax funds, levels of governmental responsibility and funding formulas will be examined.

SUNY-80 EXPERT SYSTEM FOR STEEL BRIDGE SUPERSTRUCTURE
INSPECTION AND EVALUATION Stuart Chen

The knowledge needed for infrastructure rehabilitation and maintenance is often quite different than that involved in the initial design. Knowledge-based expert systems have had their greatest successes in the tasks of interpretation and diagnosis. The research will apply these most successful areas of expert system development to the pressing needs of interpreting bridge inspection data about corrosion and fatigue cracking and diagnosing cases of the distress. This will provide decision support tools to those responsible for rehabilitation and maintenance decisions.

UPR-33 A COMPUTER GRAPHICS DECISION SUPPORT Sergio
SYSTEM TO AID TRAFFIC ENGINEERING Gonzalez

This is a joint research project between UPR and the City University of New York that addresses congestion and information systems for decision making, two of the critical issues in the process, and two of the critical issues in the area of transportation

systems management. Within TSM projects, the geometric and operational design of signalized intersections (GODGSI) is a very cost effective activity with significant potential to relieve congestion and many of its associated negative impacts. The research will develop a computer program to provide information for decision making for the GODGSI problem and will test this program in two operating environments.

****REGION III PENNSYLVANIA STATE UNIVERSITY PRINCIPAL
INVESTIGATOR**

- MSU - Morgan State University
- PSU - Pennsylvania State University
- UPA - University of Pennsylvania
- UVA - University of Virginia
- VPI - Virginia Polytechnic Inst. & State Univ.

MSU-01* CAREER DEVELOPMENT AND TRAINING Moges Ayele

As a part of the Mid-Atlantic Universities Transportation Center's third-year program, Morgan State will continue its highly successful and innovative career in development and training project. This project recruits and places minority students in internships with state and local transportation organizations. In addition, Morgan State conducts workshops and seminars, and prepares promotional materials for other Historically Black Colleges and universities in the eastern United States so that additional minority students can be added to the pool of future transportation professionals.

UPA-04 ADVANCES IN SURFACE FREIGHT TRANSPORTATION
TECHNOLOGY AND OPERATIONS, AND REGIONAL
ECONOMIC DEVELOPMENT W.B. Allen

Prior research indicated very clearly that excessive freight transportation costs negatively affect a region's ability to attract industry and sustain its economy. The intermodal project clearly indicated that there are significant opportunities to both reduce the real costs of freight transport and simultaneously improve the quality of service, particularly through use of recent advances in information technology such as EDI computerized planning procedures.

There will be two main foci of the proposed research. One will specifically address the relationship between transportation and economic development. This will emphasize refinement of a multi-regional input-output model for the Southeastern Pennsylvania area so that it can directly trace the effect of a variety of types of freight transportation service improvements (e.g., reduced rates,

improved transit times, and the creation of integrated transportation and distribution services) on regional economic activity, employment, and development. The second effort will be directed at ways in which freight transportation cost and service quality can be enhanced, addressing issues related to intermodal and single mode services. Much emphasis will continue to be placed on opportunities to use advanced technologies in cost-effective ways, including vehicle monitoring, location, and communication systems, advanced intermodal concepts, and innovative organizational arrangements.

UPA-05 ADVANCED TRANSIT SYSTEMS AND THE CHANGING
 NEEDS FOR METROPOLITAN AREA-WIDE
 TRANSPORTATION

S.H. Putnam

The proposal research will explore possibilities for increased use of transit service for region-wide mobility and travel. The difficulties in making transit service effective for such travel suggest that consideration must be given to innovative types of service and innovative means of service provision. This research is structured to address three major aspects of transit service provision: innovations in design and operations, organizational issues, and demand aspects.

UVA-05 DEVELOPMENT OF A METHODOLOGY FOR BUS
 TRANSIT SECURITY

L.A. Hoel

The provision of a secure environment in public transit is recognized as an essential element if ridership is to be maintained. Choice riders will elect to drive, and captive riders will avoid making certain trips if the perception of danger exists. The purpose of this project is to investigate the extent to which crimes occur against bus patrons and to develop a methodology for improving security at bus stops.

UVA-06 A METHODOLOGY FOR SELECTING APPROPRIATE
 ACCIDENT COUNTERMEASURES THROUGH MULTI-
 OBJECTIVE ANALYSIS

Nicholas
Garber

A major concern in traffic operations is the continuing high accident rates on our nation's highways. For example, fatal accident rates of large trucks in Virginia increased from 3.81 per 100 million vehicle miles of travel in 1982 to 5.88 in 1984. Although several research projects have been undertaken to identify factors that significantly affect accidents, it has been difficult to prioritize countermeasures developed from these studies, because the resulting effects of these countermeasures on accident rates have not been quantified. The main reason for this is that, in general, no accident is due to only one causal factor but rather to two or more, although one of these may be the

primary factor. This study is therefore proposed to develop a methodology for selecting appropriate safety countermeasures through the optimization of multiple objectives.

UVA-07 A RISK MANAGEMENT ADVISORY SYSTEM

M.J.
Demetsky

This study develops an expert advisory system that leads State DOT personnel to make appropriate decisions concerning reaction to a reported hazardous incident that needs repair and possible alteration to avoid liability from future reoccurrences. The knowledge base will consist of a compilation of acceptable practice for dealing with incident management, maintenance of the roadway and safety engineering. Both short- and long-term corrective actions will be addressed.

UVA-08 ESTABLISHING LAND USE LIMITS FOR
TRANSPORTATION SUPPLY LEVELS

M.J.
Demetsky

A new goal for the transportation planning process is to develop preventative and remedial strategies to eliminate saturation conditions on roadway networks. In view of the congested network problem where breakdowns begin as queues at critical intersections, it is timely to investigate a planning process that is sensitive to the congestion problem. The specific objectives of this proposed research are to:

1. Establish desirable uncongested levels of performance for street systems.
2. Develop a concept of "excessive demand" for existing flows on congested highway systems.
3. To examine highway network flows vs. development patterns for selected urbanized areas to macroscopically investigate trends between urban growth, highway development, and traffic congestion.
4. To investigate use of existing transportation planning and operations analysis tools for:
 - (a) maximizing the carrying capacity of the network,
 - (b) defining excessive demands for an existing network,
 - (c) indicating the level of land use that a specified transportation network will support.

UVA-09 DECISION SUPPORT SYSTEM FOR PAVEMENT
MAINTENANCE MANAGEMENT

W.T.
Scherer

This project develops a generic decision support system that will

aid infrastructure decision makers in (1) evaluating the impacts of specific maintenance policies, (2) generating policies that maximize the quality (perhaps as defined as a combination of several measures of effectiveness) of the infrastructure while adhering to budgetary and possibly other constraints, and/or (3) determining the required budget for achieving a given level of service (performance, effectiveness) for the particular infrastructure problem. It is vitally important to note that the purpose of such a system is to assist (aid, support), not replace, experienced decision makers. In fact, the current conceptualization of the Infrastructure Maintenance Decision Support System (IMDECSS) cannot function without active user participation in the decision making process.

UVA-10 OPTIMAL PATH DETERMINATION IN A TRANSIT
 NETWORK IN REAL TIME

C.C. White

The problem of finding shortest paths through a network is well studied; several good algorithms will find the shortest path between a specified pair of nodes. The problem of finding an optimal path through a transit network differs from the general graph-search problem in several ways:

- (1) Certain transfers between transit lines are disallowed.
- (2) The optimal path between two transit stops may be different at different times of day.
- (3) Various transit system users place different subjective values on travel time, walking time, waiting time, and the inconvenience of transferring between transit lines.
- (4) Several deterministic and heuristic algorithms will be investigated to determine which can best be adapted to find, in real time, the optimal path between two given points in a transit network at a specific time of day.

UVA-11 NATIONAL CONFERENCE ON TORT LIABILITY AND
 RISK MANAGEMENT FOR HIGHWAYS AND TRANSIT

L.A. Hoel

Risk management for tort liability is a fast moving area that is highly interdisciplinary involving both the legal profession and engineering. To be effective, both groups must understand the issues involved, recent experiences and the proper role of each, and successful approaches to mitigate the likelihood of liability cases or to bring these to a satisfactory conclusion. This proposal addresses the need for improved communication and dissemination of research findings and experiences in the area of tort liability for surface transportation. A national conference

also a major concern. Guidelines for quality control on night construction projects are needed. Finding the optimum techniques for performance of the work will allow maintenance of safety, quality and productivity. Of course, there are social issues as well--noise, night-lighting, etc. Finally, research is needed to quantify both the benefits and any additional costs of night operation. This data would greatly assist in the planning of urban transportation projects.

UFL-10 DETERMINATION OF AN OPTIMUM ANALYTICAL Kenneth
 INTERSECTION DESIGN PROCEDURE Courage

The objectives of this project include assembling the body of knowledge into a form suitable for expert system use, then selecting an expert system "shell" and developing a fully functional system. A review of recent work in this area will be conducted. The system will be tested and expanded as additional knowledge becomes available. Finally, user training and support will be provided.

UFL-11 TRANSPORTATION CONSTRUCTION MANAGEMENT Ralph
 INSTITUTE Ellis

The Institute is an intensive two-week management development program presented by the University of Florida in order to:

- (1) Provide professional construction management education to experienced managers active in the construction of transportation facilities in order that they may be able to complete projects in a cost effective and competitive manner.
- (2) Provide an opportunity for engineers and technically oriented managers to acquire the management and interpersonal skills demanded by changes in responsibility and authority.
- (3) Provide an opportunity for managers drawn from all sectors of the industry to meet, share experiences and develop a positive team approach to the solution of industry problems.

UNC-29 PEDESTRIAN AND PASSENGER ACCIDENTS RELATED Charles V.
 TO BUS TRANSIT: CHARACTERISTICS AND Zegeer
 SOLUTIONS

The purpose of this study is to (1) determine the magnitude and characteristics of accidents involving pedestrians and passengers related to bus transit systems, (2) develop a list of recommended guidelines to reduce the incidence of specific types of accidents and personal injuries associated with bus transit operations, and (3) develop an informational guide to be used to convey some of the study findings to bus transit officials.

strategy is applicable to one vehicle, whereas the best decision for many vehicles in a fleet may indicate replacement in the same year. The second year objective is to extend the single vehicle model to a fleet scenario constrained by a maximum capital outlay by year. The third year project will be an extension of this work.

UMI-03* ARCHITECTURE OF ONBOARD FAILURE DETECTION
 AND ISOLATION SYSTEM FOR ELECTRONICALLY William
 CONTROLLED HEAVY-DUTY DIESEL ENGINES Ribbens

The objective of this project to design the hardware and software architecture for the real-time on-board implementation of the failure detection and isolation strategies developed during the first two years of this project. It will demonstrate that it is possible to accurately detect incipient failures in the engine/controller using FDI methods by means of relatively inexpensive on-board electronics and existing sensors.

UMI-10* JIT OPERATION AND SCHEDULING OF INTERMODAL William
 TRANSPORT SYSTEMS Grissom

In the first year the transportation supply variables affecting operations of intermodal interfaces under JIT operations were examined. In the second year a stochastic simulation model of interface operations will be developed and validated for use in investigating the applicability of robotic materials handling systems. Third year activities will continue the development and application of the stochastic simulation model as appropriate, based on second year results.

UMI-11* ECONOMICS OF MOTOR CARRIER SAFETY: INDUSTRY
 STRUCTURE AND THE COSTS AND BENEFITS OF Leon
 INCREASED SAFETY STANDARDS AND SURVEILLANCE Moses

This project is a continuation of an earlier project concerned with evaluating the benefits and costs of federal actions to increase safety performance of trucking firms following deregulation of the industry in 1980. These actions included increases in minimum standards for driver qualifications, safety audits and the Motor Carrier Safety Assistance Program. The economic costs of restrictions to the trucking industry, along with direct costs of the increased enforcement activities, and savings that follow from reductions in accident rates will be estimated to present an economic evaluation of the recent programs and initiatives.

UMI-12* EFFECT OF TRUCK LOADING ON BRIDGES Andrzej Nowak

The objective of this project is to improve the evaluation procedures for existing bridges. The study will draw on recent developments in bridge diagnostics, structural tests, material tests, structural analysis, and probabilistic methods to develop models for truck load and bridge evaluation which will serve as a basis for a bridge management system.

UMI-15* URBAN BUS TRANSIT IMPACT ON PAVEMENTS Robert Carr

The objective of the project is to develop methodology and quantify the extent of road damage attributable to transit bus operations on urban streets. The city of Ann Arbor is being used as a test case for the study.

WSU-16* AN INVESTIGATION OF THE SAFETY AND STRUCTURAL S.
IMPLICATIONS OF SEAT BELTS ON TRANSIT BUSES Khasnabis

This project examines the safety implications of seat belts on transit vehicles. In previous work finite-element computer models of the bus frame and associate structure were developed and validated by laboratory testing. The objectives in Phase 3 are to develop and prove modifications for transit buses which can be incorporated in future designs to provide better seat/seatbelt retention in accident situations.

WSU-17* AN INVESTIGATION OF DESIGN, MAINTENANCE, AND
OPERATING PROCEDURES OF WHEELCHAIR LIFTS ON S.
TRANSIT BUSES Khasnabis

This project examines the problems in maintenance and operation of wheelchair lifts on transit buses. Phase 3 leverages from the findings in earlier work with regard to the design and operational shortcomings of lifts, and the analyses to develop better designs and manufacturing standards for such devices. The objectives in this last phase are to develop design procedures and redesigns for key components of wheelchair lifts that meet the more rigorous specifications developed in Phase 2.

MSU-20* ALTERNATIVE FUELS William
Taylor

The objective of the project is to develop test methodologies and/or facilities to evaluate options for commercial vehicles to meet the diesel particulate requirements of the 1992 Clean Air Act. The project will be a cooperative effort between the Center, the Michigan Department of Transportation transit division, the Detroit Diesel Company, and transit authorities in the State of

Michigan. State-of-the-art diesel emissions hardware will be installed on new buses and the emissions performance will be evaluated periodically during the service life of the vehicles.

MSU-23 REDUCTION OF RUTTING

Gilbert
Baladi

Rutting of asphalt pavements represents one of the most visible and costly mechanisms of pavement wear caused by heavy commercial vehicles. This project will examine the rutting experience in Region 5 to establish relationships between pavement materials properties (aggregate angularity, asphalt properties, mix design, etc.) and rutting under exposure to heavy vehicle traffic. Mechanistic and statistical analyses will produce a rutting model that can be used to establish proper mix design procedures, upgrade existing material specifications, and design flexible pavements and bituminous overlays.

UMI-24 DEVELOPMENT OF A LOW-COST TRAFFIC SURVEILLANCE
SYSTEM UTILIZING REAL-TIME PROCESSING OF
VIDEO CAMERA IMAGES

Charles
MacAdam

The intent of this work is to demonstrate the feasibility of using existing off-the-shelf hardware in combination with image processing software, for the development of an operational traffic surveillance system. The proposed system is similar in functionality to others currently being deployed in traffic monitoring systems, but at considerably lower cost. Systems with lower costs and improved performance are vital to the implementation of IVHS.

UMI-25 A SYMPOSIUM TO EXPLORE THE STAKE OF THE
TRUCKING COMMUNITY IN IVHS

Robert
Ervin

In this project the Center will be one of multiple organizations cooperating to sponsor a conference focused on trucking applications of IVHS. The conference will be organized by UMTRI in cooperation with the Motor Vehicle Manufacturers Association, and will be held in Ann Arbor, Michigan, on October 2 and 3, 1990. The intention of the conference is to inform and challenge the leaders of the U.S. trucking community to take notice of the IVHS issue and to acknowledge that they have a fundamental stake in the outcome.

UMI-26* A METHOD FOR EVALUATING THE POTENTIAL PAYOFF
FROM TECHNOLOGIES FOR PREVENTING TRUCK
COLLISIONS -- AN IVHS FEASIBILITY PROJECT

Robert
Ervin

This is a project directed toward sensing and preventing truck collisions. The first objective is to determine the feasibility

TAMU-04* UNIVERSITY TRANSPORTATION CENTERS PROGRAM
INFORMATION EXCHANGE NETWORK Don Maxwell

This project established a computer network linking all ten University Transportation Centers, and all state DOTs. The network will be used to store and distribute mail message and copies of material of interest to project participants.

TAMU-10* FIELD STUDIES OF ROUTE DIVERSION OF
AUTOMOBILES, TRANSIT AND COMMERCIAL
VEHICLES USING REAL-TIME INFORMATION Kevin L.
AND OTHER IVHS TECHNOLOGIES IN TEXAS Balke

This study examines the role of enhanced motorist information in causing diversion to alternate routes in a freeway corridor. Advancements in IVHS technologies will allow operators to systematically obtain real-time information on alternate routes in a freeway corridor. Field studies will be performed to demonstrate the feasibility of using IVHS technology to enhance motorist information and determine motorist responses to this enhanced information.

TAMU-11 AN EVALUATION OF STRATEGIES FOR IMPROVING Vergil G.
URBAN TRANSIT ENERGY EFFICIENCY Stover

This project will evaluate the energy efficiency of auto, local bus service, park and ride, and rail transit under the densities and land use activity patterns prevalent in Texas and the southern and western urban areas. The potential transportation energy requirements and modal efficiency will be projected under a scenario of land use activity patterns and arterial street systems. The potential energy savings that might be achieved by the development of high density transit corridors will also be estimated.

TAMU-12 COMPREHENSIVE STUDY DESIGN FOR THE
"BEFORE" AND "AFTER" ASSESSMENT Katherine F.
OF THE DALLAS RAIL TRANSIT STARTER LINE Turnbull

This project will develop a comprehensive study design for use in conducting a multi-year "before" and "after" assessment of the Dallas light rail transit starter line. The study design will identify the elements to be addressed in the assessment, the evaluation criteria, the data collection techniques, a possible schedule, potential roles and responsibilities of the different agencies, and costs. The results will be used in conducting a multi-year evaluation that will provide an assessment of the

impact of the starter rail line on transit operating costs and passenger levels, land use, economic development, image, energy, air quality, and congestion levels.

TAMU-13 NEW METHOD AND DATA FOR ESTIMATING
 FUEL SAVINGS OF HIGHWAY AND TRANSIT William
 MOBILITY ALTERNATIVES McFarland

New approaches for estimating energy consumption for different types of vehicles have been developed, based partially on automotive engineering models of vehicle fuel consumption as related to vehicle characteristics, speeds, and roadway profiles. The purpose of this research is to adapt this method to typical vehicles in the United States and to develop and implement a computer program for comparing highway and signalization alternatives using this method.

TAMU-14 MODAL ENERGY DATA BASE FOR Dock Burke
 TRANSPORTATION STUDY

The primary purpose of this project is to develop a current and comprehensive energy data base for the transportation sector of the State of Texas. This data base will encompass all transportation modes, including urban public transportation, and will be similar in concept to the national data base developed and maintained by the Oak Ridge National Laboratory. The project activities will include two phases: (1) developing the complete and current data base; and (2) developing methods for maintaining and updating the resulting data base.

TAMU-15 MULTIMODAL TRANSPORTATION CORRIDORS: A Dock
 COMPARATIVE ASSESSMENT Burke

With heightened interest in high-speed rail and its accompanying technologies (including MAGLEV), justifications for intercity mobility improvements will increasingly demand modal (rail, highway, and air) comparisons in the analysis and planning stages. Importantly, transportation energy technology and efficiency must be made an integral part of such a global assessment. The result of this project will be a systematic methodology for use in conducting a comprehensive study of the relevant modal options to be evaluated prior to building major improvements for intercity transportation.

automobile. However, increasing densification of the suburbs and the emergence of major activity nuclei outside the CBD opens opportunities for creative approaches to the supply of transit services. The aim of this project is to develop and test computer-based design procedures for the configuration of bus route networks in areas characterized by suburban spatial patterns, so as to maximize ridership capture and serve mobility needs in a cost-effective and energy efficient manner.

UTA-17 IMPROVED ENERGY EFFICIENCY THROUGH BETTER C. Michael
 URBAN INTERMODAL COORDINATION Walton

Coordinated freight interface at urban port facilities is central to efficient intermodal operations. The success of intermodalism relies on the efficiency of the transfer points. Inefficient port operations combined with limitations on truck and/or rail traffic to and from the terminal can undermine efforts for economic growth. Efforts to improve the efficient operations of port facilities must parallel or precede efforts to coordinate urban transportation flows. This study addresses the major issues affecting the urban intermodal interface for freight transportation. The research will identify and analyze the impact of growing port operations in the southwest region, principally the Port of Houston and the Port of New Orleans, on urban infrastructure. Analytical methods for assessing this impact will be developed, including documentation of the associated energy savings through more efficient intermodal operations.

UTA-18 TELECOMMUNICATIONS-TRANSPORTATION-ENERGY
 INTERACTIONS: POTENTIAL FOR REDUCING
 TRANSPORTATION ENERGY CONSUMPTION Hani S.
 THROUGH TELECOMMUTING Mahmassani

The substitution of transportation by telecommunications has long been advocated as an approach that might eventually alleviate the demand placed on transportation facilities and thereby reduce fuel consumption and air pollutant emissions. With increasing penetration of telecommunications in individual homes and businesses, coupled with the widespread availability of computing equipment, facsimile capabilities and the like, there is renewed interest in exploring and encouraging telecommuting arrangements. These include work-at-home schemes and workplace decentralization with satellite work centers, as well as many other non-traditional approaches of structuring workplace activities and worker responsibilities. The aim of this project is to address the travel behavior implications of telecommuting, and determine the potential of telecommuting to improve urban mobility and reduce fuel consumption.

UTA-19 DEMONSTRATION OF ENHANCED ARTERIAL
STREET TRAFFIC FLOW, REDUCED FUEL
CONSUMPTION AND USER COSTS THROUGH R.B.
APPLICATION OF SUPER STREET TECHNOLOGY Machemehl

This study is designed to simultaneously accomplish objectives of applying state-of-the-art technology to the solution of a current traffic congestion problem and also advance the state-of-the-art. This will be accomplished by selecting an existing arterial street corridor for design and implementation of a high flow or "super street" improvement program. During and after implementation of the improvement program, a rich data base will be developed. The contents of this data base, including before-after traffic flow and delay information, will be used to evaluate and enhance the current state-of-the-art analysis and design methods.

UTA-20 ENERGY AND SYSTEM COSTS EVALUATION B.F.
OF TRUCK SIZE AND WEIGHT CHANGES McCullough

Currently there are a number of federal proposals to increase the size and weight dimensions of large freight trucks. There is a likelihood that such trucks would be allowed to operate over the highway infrastructure, or selected lengths of the network, without a full technical and economic analysis of the impacts in terms of energy, rates, pavements, costs, or intermodal consequences. The project would evaluate several sources of data on the various components of a full transportation system evaluation and provide a hierarchy of impacts, including those associated with energy, which would follow significant changes in truck size and weight legislation.

UTA-21 FUEL AND TIME SAVINGS THROUGH EXPEDITING Robert
PAVEMENT CONSTRUCTION Harrison

Pavement construction on existing highways creates problems for state agency staff, vehicle owners, and commercial businesses. Motorist, or user, costs during such construction are dominated by increased fuel expenditures and time evaluations, which combine to form substantial financial impacts. If expediting techniques, sometimes known as fast-tracking, can be used to get the pavement back into service quickly, then the benefits from vehicle energy savings alone could be very substantial.

****REGION VII** **IOWA STATE UNIVERSITY** **PRINCIPAL**
INVESTIGATOR

ISU - Iowa State University
KSSU - Kansas State University
UMO - University of Missouri
UNE - University of Nebraska
UIA - University of Iowa

ISU-10* EFFICIENT DISTRIBUTION OF GRAIN TO MEET C. Phillip
 THE QUALITY NEEDS OF END-USERS Baumel

The economic potential of end-user quality marketing to rural communities is substantial, in the order of 10-30 cents per bushel for corn and soybeans. These numbers are in the same magnitude as was created by unit-grain-train shipments. However, as with train-loading, major modifications will need to occur in elevator operations, elevator design, elevator size and location, shipment routing, and carrier design. The project evaluates the logistical changes needed to support quality differentiation of corn and soybeans. Its focus is to be on bulk grain routings, carrier designs, and rate making practices that would enable large shipments of specified quality grain to reach users, domestic and foreign, as efficiently as do current undifferentiated shipments. Handling strategies at interior elevators, export ports, and import ports will be evaluated as well as the impacts on the number, size, and location of elevators.

ISU-13 ANALYSIS OF SELECTED FEDERAL AND Michael R.
 STATE POLICIES AFFECTING RAILROAD Crum
 LABOR

The primary objective of the research is to facilitate sound policy formulation by providing:

- (1) A single-source document that reviews and analyzes key recent developments in rail labor policy and case law and anticipates relevant rail labor issues for the Midwest region; and
- (2) An approach to assessing the potential impacts on railroad operations and service of public policy decisions concerning rail labor issues.

KSSU-16 A STUDY USING MICROCOMPUTER TRANSPORTATION
PLANNING MODELS TO DEVELOP KEY HIGHWAY
COMMODITY FLOWS AND ESTIMATE TRUCK
ESAL VALUES

Eugene R.
Russell, Sr.

The primary objective of this study is to obtain better knowledge of key commodity flows for key industries in Kansas, present and future, particularly as these truck freight flows impact highways, and highway pavements. By determining truck numbers, type, size and estimated weight needed for each commodity, estimates of equivalent single axle loads (ESAL) values can be made. Thus ESALs will be valuable in truck traffic routing and management and estimating projected pavement needs and deficiencies, as well as determining the impact on highways of various economic development scenarios.

UIA-14 TRANSPORTATION AND IOWA'S ECONOMIC
FUTURE

D.J.
Forkenbrock

Iowa's present and future economic success depends on an efficient transportation system to allow people, goods, and information to move into and out of the state. As the state's economy becomes increasingly dependent on links to other parts of the world, an insufficient or inappropriate transportation system may constrain the state's businesses from seizing new opportunities or even make Iowa an unattractive location for businesses to invest.

The purposes of this project are threefold:

- (1) Present a clear, useful summary and assessment of surface transportation service in Iowa at the present time. The various modes and areas of the state will be analyzed for level and cost of service, financing practices (including cross-subsidization), and emerging trends in movements of people and goods. The objective of this summary and assessment is to provide a basis for the analysis to follow.
- (2) Examine the key issues affecting the ability of transportation to support economic growth in Iowa. While the primary issues will be determined interactively, we offer several candidates in this proposal.
- (3) Blend research on future directions of Iowa's economy with our analysis of adequacy of the state's transportation services to identify needed actions. The purpose will be to help identify ways in which today's transportation services can best be adjusted to facilitate growth in Iowa's economy in the next 20 years.

UIA-17 THE ECONOMIC, OPERATING, AND INFRASTRUCTURE
IMPACTS OF CONCENTRATED TRUCK
TRANSPORT SERVICE AND DESIGNATED
COMMERCIAL HIGHWAY NETWORKS

James W.
Stoner

Current proposals for truck weight and length reform focus on the use of Longer-Combination Vehicles (LCV) through state-by-state permits on designated routes. Depending on the specific strategy, LCVs of varying popular configurations, such as Rocky Mountain doubles, turnpike doubles, and Turner vehicles would be allowed on permitted routes, largely consisting of interstate facilities with and without approval to travel on adjacent non-interstate roadways. If a national LCV system is adopted, with the states retaining permitting authority, the diversion of traffic from rail to truck is estimated to be between 40 (American Association of Railroads) and 50 (American Trucking Association) billion ton miles per year. The proposed project is to be accomplished in two phases, each phase corresponding to one year.

The mission of the project is twofold:

- (1) research and develop scenarios for the development of an LCV commercial highway network in the State of Iowa, and
- (2) evaluate the public and private sector impact of the permitting of various LCV combinations and the implementation of an LCV commercial highway network in the state.

The Iowa case study is used as an illustration of the techniques because of the general availability of the required data. The researchers will identify in the final report the analogies that can be drawn given conditions in other states.

UMO-15 A TRANSPORTATION MODELING SYSTEM FOR
HEURISTIC MICRO-COMPUTER TRANSPORTATION
MODEL FORMULATION AND SOLUTION

Lori S.
Franz

This research project will develop generalized formulation tools and heuristic methods which can be used as a foundation to build and implement large scale, easier-to-use transportation modeling systems which may be transferable to or initiated from a microcomputer environment. The objectives of this project are to:

- (1) Develop a prototype transportation routing and assignment model generator with library components to allow easy, nonspecialist formulation and maintenance of transportation problems.
- (2) Determine a rounding heuristic for three categories of well known transportation problems which are difficult to solve.

- (3) Test the model generator and heuristic on a microcomputer for three general transportation problem types to demonstrate applicability.

UNE-12* STRATEGIES FOR IMPROVING THE SAFETY OF
ELDERLY DRIVERS IN RURAL AREAS OF THE
MIDWEST

Patrick T.
McCoy

This is the second year of a project which is a multidisciplinary study of the safety problems of elderly drivers. It is being conducted by a team of researchers from the areas of highway traffic engineering, gerontology, and driver education. The objective of the research is to develop and evaluate ways of improving the safety of elderly drivers in rural areas of the Midwest region.

****REGION VIII NORTH DAKOTA STATE UNIVERSITY**

**PRINCIPAL
INVESTIGATOR**

COSU - Colorado State University
NDSU - North Dakota State University
UCO - University of Colorado, Denver
UMN - University of Minnesota
USU - Utah State University
UWY - University of Wyoming

COSU-08* IMPROVED RURAL BRIDGE TECHNOLOGIES

R.M.
Gutkowski

The overall purpose of the research is to investigate innovative experimental bridge technologies for application to the full range of spans encountered on rural roadways of the type predominant in the region. In the preceding phase of the project an orthotropic grid, all-timber bridge concept was evolved by computer based analytical studies and laboratory experimentation. The next phase of the project includes monitoring behavior in the field and load testing the bridge for comparison with analysis. The continued research will be focused on extending the experimental concepts to intermediate spans, including skewed geometry. Exploratory research on composite concrete/timber concepts conducted in the first year will be expanded. A second full-scale experimental bridge will be erected for field testing and verification of the computer model.

NDSU-16 THE EFFECT OF FEDERAL LAWS ON RAIL LABOR
AND THE RAIL INDUSTRY: A NATIONAL
TRANSPORTATION POLICY CHALLENGE

Frank J.
Dooley

The overall goal of this research is to provide an objective, multidisciplinary analysis of issues related to federal statutes governing rail labor relations. The four specific objectives include:

- (1) legal research to identify the institutional constraints imposed by the unique sets of laws governing rail labor relations;
- (2) economic analysis to estimate the economic effects of the institutional restrictions;
- (3) sociological research to determine rail labor and managements' perceptions on institutional and economic factors affecting job satisfaction; and
- (4) based on the legal, economic, and sociological work, developing alternatives to the current federal rail labor statutes which promote economic efficiency and enhance job satisfaction.

NDSU-19 TRANSPORTATION AND RURAL ECONOMIC
DEVELOPMENT

Frank J.
Dooley

Much of rural America did not participate in the economic growth experienced by the rest of the nation during the past decade. A poor understanding of transportation service and pricing alternatives may be a factor hindering economic development in rural areas. To remedy these problems, this project has two primary objectives. First, transportation information needs for all parties involved in economic development in rural regions will be identified. Second, the most effective transportation information delivery system will be determined.

NDSU-20 EVALUATION OF INSTITUTIONAL IMPEDIMENTS TO
INTERSTATE TRUCK COMMERCE

Gene C.
Griffin

The motor carrier industry provides the national and Mountain-Plains Consortium region with transportation service and capacity critical to its economic viability. State laws and regulations which unnecessarily increase the costs of the motor carrier industry inhibit commerce between the states and reduce the economic viability of industry, the states, the MPC region, and the country. A great deal of effort has been made in the past few years to mitigate some of the problems caused by differences in

state laws impacting the motor carrier industry. The objective of this study is to assess the effectiveness of those programs which exist, identify problems with implementation, identify continuing problems not addressed by existing programs and suggest corresponding solutions.

UCO-06* DETERMINATION OF LEAST COST APPROACH TO W.S.
 CONGESTION REDUCTION IN URBAN AREAS Pollard

This research examines the system attributes of roadways to determine methods of improving traffic capacity, reducing congestion and improving air quality for extended periods on a cost effective basis. The most congested urban corridors in the Denver metro region are used as models. This study examines the technical and policy issues of capital intensive methods of making significant increases in capacity, calculates costs, and determines the air pollution impacts on the urban environment. The research measures the cost effectiveness of the advanced technology approaches as compared to more conventional approaches to the problems of congestion, air pollution, and increasing costs. The advanced technology considered in this phase of the investigation is electrification of vehicles with some degree of automation. The results are organized in such a way as to make them particularly appropriate for evaluation by policy makers.

UMN-12* A TEST CASE FOR THE MINNESOTA ROAD David Newcomb
 RESEARCH PROJECT

Minnesota Road Research Project (MnROAD) is a unique facility being built on Interstate 94 near Monticello, Minnesota, at which the effects of climate and traffic on pavement performance will be tested and studied. The construction and operation of MnROAD will produce a significant amount of data which must be captured, processed and stored. This project will begin to identify proper sampling and statistical operations by analyzing data from weather and traffic instrumentation which is already on the MnROAD site and from pilot projects which will be built this summer with similar pavement response instrumentation. This project will also summarize data generated during the construction activities associated with the soil preparation at MnROAD.

UMN-13* ASSESSING THE TRANSPORTATION NEEDS OF Thomas
 NATIVE AMERICANS ON RESERVATIONS Anding

The overall objective of this project is to measure the nature and extent of transportation problems of Native Americans living on reservations. The problems are broadly viewed as economic and having an impact on the related accessibility to life support services. The specific objectives of the project are to design and test survey instruments for both reservation inhabitants and

travel reduction programs. It is a component of a continuing multi-campus effort comparing travel-reduction programs in Los Angeles, San Francisco Bay Area, and metropolitan Arizona. This second year research will evaluate changes in commuter travel behavior and the success of differing sets of employer strategies in achieving program goals. Multivariate statistical analyses drawing on geographic information systems are instrumental to this evaluation. The findings will contribute to understanding the effectiveness of travel-reduction strategies in different urban contexts and different institutional settings.

CSULB-2404* SEAPORT-SURFACE FREIGHT ACCESS AND URBAN CONGESTION CONTROLS P.L. Shaw

Freight tonnage passing through the ports of San Pedro Bay (Long Beach and Los Angeles) is projected to double by 2010, reaching 200,000 million metric tons. With landside freight movements already at congestion levels, the needs for new controls and new modes of freight transshipment have become compelling. This project addresses prospects for peak-hour controls of surface-freight handling that would not seriously constrain port operations, landside shipments, or competitiveness.

UCB-1211 RESPONSES TO THE LOMA PRIETA EARTHQUAKE M.M. Webber

Following the October 1989 earthquake, and at the request of U.S. DOT officials, studies were initiated to detect the effects of major breaks in the regional transportation network. They include telephone interviews of a random sample of East Bay commuters, on-board surveys of BART and ferry riders, interviews with truckers companies, traffic counts, and interviews with small and large business firms. The studies seek to find how employers and employees adapted to breaks in the transport network and to discover effects on the regional economy.

UCB-2409* ADVANCED SIGNAL CONTROL STRATEGIES A. Skabardonis

Ongoing research has already evaluated existing methods for traffic control, and it has proposed and tested improved control strategies for signals operating either as isolated units or grouped in arterial systems. The current project is the continuation of the ongoing work. The objective is to develop and evaluate strategies for timing grid networks and signal systems' operations to cover a wide range of traffic conditions and system configurations. The study will also address issues generated by recent technologic advances in signal equipment and their implications for traffic control and management.

UCB-2412* PORTSIDE/LANDSIDE INTERACTIONS

Carlos Daganzo

This continuing study seeks to expose the functional relations between seaports and their connecting land-transportation systems. It investigates portshed versus warehouse pricing strategies, effects of alternative landside-transportation technologies on port location, and analyzes land-bridge intermodal operations at ports. The study is also directed to exposing the effects of ports on their surroundings (traffic, land use, and economic effects) and to suggest managerial and operational strategies for enhancing desired affects and mitigating undesired ones of massive freight movements inside large metropolitan areas.

UCB-1301*

ADVANCED SUSPENSIONS FOR HEAVY
TRUCKS TO REDUCE PAVEMENT DAMAGE

J.K.
Hedrick

Electronically controlled suspension systems have the potential for dramatically reducing tire loads of heavy trucks, thereby increasing pavement life of our highways. This research employs electronic sensors that feed information about the pavement surface to the truck suspension and that then activate valves within the suspension mechanisms to soften the impact of tire on pavement. The current phase of the study is aimed at developing laboratory and field tests to quantify potential benefits and to address practical implementation concerns.

UCB-1304 TRUCK-PAVEMENT INTERACTIONS

John Lysmer

This project extends the ongoing study into effects of traffic velocities on wheel loads, relations between rigidity of pavements and dynamic loads, and effects of pavement warping and faulting. The next phase of the research will be directed to a method for converting oscillatory moving loads to nearly equivalent systems of pulse-type stationary loads. A major tool in this investigation will be a solution, already attained, for treating a moving transient load on a beam of finite length.

UCB-3703* EMPLOYMENT, SUBURBANIZATION, AND THE
JOURNEY TO WORK

Jonathan Levine

A large location and commuting survey, conducted during the past year, has provided a sample of over 2000 workers at six major Bay Area employment sites. These data are now being analyzed in pursuit of a discrete choice model of the residential location decision. Alternative formulations are now to be tested: joint models, sequential (nested) models, models stratified by location, and models stratified by household income. The models will be

tested against several policy alternatives, including the effectiveness of multifamily housing in the vicinity of suburban employment centers in stemming long-distance commuting by low- to moderate-income households.

UCB-3706* TRANSPORTATION AND EMPLOYMENT OF
DISADVANTAGED WORKERS

J.M. Quigley

This ongoing study is analyzing the link between the spatial concentration of minority workers, the character of the urban transport systems, and the employment opportunities of those workers. It is based on indices of household segregation by race for 50 SMSAs, measure of employment by race and aggregate indices of the transport system. Measures of differential employment by race and class of labor, related to transport accessibility and spatial isolation have been completed. The next phase of the study will analyze the impact of the transportation system at the individual level.

UCB-3707 MANAGING THE SUBURBAN COMMUTE: A CROSS-
NATIONAL COMPARISON

Peter Hall

This is to be a comparative analysis of policies that cater to the suburb-to-suburb commute trip in three major metropolitan areas that exhibit rapid growth and decentralization of population and economic activity: the San Francisco Bay Area, Paris, and Frankfurt-am-Main. Specific policies to be examined are those directed to land-use control, urban-growth control, and investment in highways and public transit. The quality of transit services is of particular interest, especially as it affects settlement patterns and travel behavior in these three metropolises. The underlying aim of the study is to seek out lessons that American metropolitan areas might learn from the recent European experience, especially in overall pattern of suburban commuter travel and in factors affecting modal split.

UCB-3911 TRANSPORTATION STRATEGIES FOR AIR-
QUALITY IMPROVEMENT

E.A. Deakin

This study parallels the studies by Burns and Wachs/Giuliano focusing on ways of reducing air pollution through traffic mitigation. By asking what affects delaying or dropping highway projects might have on urban growth patterns, on travel, and on air-quality, the study seeks to appraise the operational consequences of an important recent law suit in the Bay Area. The project will examine the effects of varying levels of highway accessibility on growth rates and travel patterns, and it will investigate potential impacts of prospective changes in highway technology. It will also examine the potential effects of varying levels of transit accessibility and investigate the effects of high transit accessibility on work and nonwork travel patterns.

UCD-1105

EFFECTS OF TRANSPORT POLICIES ON
LAND USE PATTERNS

A.M. Sullivan

This research will develop simulation models to predict quantified effects of transportation policies on urban land-use patterns, traffic congestion, and air pollution. Policies to be appraised include those affecting investments in infrastructure, pricing of transit services, taxes on automobile use, encouragement of car-pooling and of high-occupancy vehicles, and those seeking to coordinate transportation services and land-use developments. The envisioned models will be capable of simulating outcomes of improvements in public transit, especially as they might affect air quality. Simultaneously, they will expose latent tradeoffs between improved accessibility and environmental quality.

UCD-1202* TELECOMMUTING IMPACT: ACCESSIBILITY
IMPLICATIONS OF WORK AT HOME

Ryuichi
Kitamura

This continuing research focuses on changes in nonwork travel-related behavior owing to telecommuting. "Telecommuting" refers to the performance of work activity through some telecommunications medium, either at home or at a neighborhood satellite center. A panel data set consisting of three-day travel diary information will be geo-coded and used to quantify anticipated changes in nonwork activity engagements, spatial distributions of activity locations, and mode choice. The project is concerned with determining the effects on travel patterns owing to enhanced accessibility associated with commuting to a central city location.

UCD-1212

LONG-TERM FORECASTING WITH DYNAMIC
MICROSIMULATION

K.G.Goulias

This investigation seeks to further the development of methods that explicitly account for dynamic determinants of changes in travel demand over time. It is unique in its attempt to combine dynamic models with microsimulation. The approach to the study calls for (1) completion of the design for the dynamic microsimulation, (2) design of a comparable static procedure, (3) identification of methods that account for panel specific problems, (4) scenario building based on alternative policy strategies, and (5) comparison of static with dynamic forecasts. If successful, the simulation method should sensitize travel-demand forecasts to changing pricing policies, income distributions, labor-force participation rates, education levels, and levels of service by public transit and highways.

UCD-3805 DISAGGREGATE MODELING OF MOTOR CARRIER
ACCIDENT RISK

P.J. Jovanis

During the past 12 months, a disaggregate method has been developed and tested to capture the contribution of truck driver service hours, over seven or more days, to accident risk. Cluster analysis is used to identify drivers (both accident-involved and nonaccident-involved) with similar patterns of duty hours. Binary logic is then used to estimate the probability of an accident for a driver with a specified driving pattern, age, experience, and current driving time. The methodology will now be extended as part of the current research to include vehicle and roadway characteristics and to include accident-risk estimation using survival theory.

UCD-3908* CONSUMER CHOICE IN MARKETS FOR
ALTERNATIVE TRANSPORTATION FUELS

Kenneth
Kurani

Markets for alternative fuels are not constrained solely by technologic factors. They're limited by what consumers will buy and manufacturers will supply. This study examines the role of consumer preferences in affecting success or failure of alternative transport fuels in New Zealand, Canada, and California. The analysis draws on surveys of owners of vehicles using compressed natural gas (CNG) and gasoline; on interviews with CNG equipment and fuel suppliers; and (3) on analysis of consumer experience allow testing of hypotheses about the relative influences of governments, industrialists, and markets.

UCD-3913 MARKET-BASED INCENTIVES FOR
CONTROLLING VEHICLE EMISSIONS

Quanlu Wang

Current motor vehicle emission controls command unnecessarily high costs. This study is directed to designing market-based incentives through which vehicle manufacturers will be offered lower cost and more flexible means of meeting emission standards. Average-emission standards will be designed to replace current uniform standards. Manufacturers producing low-emission vehicles can earn emission-reduction credits that can then be traded among manufacturers, making for lower overall costs. The study will seek to assess costs and savings relative to those experienced under the current regulatory system, and it will identify latent institutional and political inhibitors to the implementation of the suggested approach.

UCI-1103* TRAVEL FLOWS AND SUBCENTER DEVELOPMENT

Kenneth A.
Small

This study will further analyze demographic and commuting data for the 1285 zones comprising the Los Angeles region, building on work

already completed. The goal is to understand how employment subcenters organize economic activity in a fast-growing metropolis and how travel patterns are shaped. The next phase of the study is to analyze the emergence and growth (or decline) of subcenters between 1970 and 1980, especially as influenced by accessibility to other centers and to the labor force.

UCI-1204* ROTATING TRANSIT-USER PANEL: ASSESSING Thomas F.
DYNAMICS OF TRANSIT DEMAND Golob

The objective of this research is to develop and demonstrate dynamic analyses as transit planning tools for a growing society. A panel of approximately 1,800 commuters has been established, and methods have been developed for modeling discrete choice dynamics with autocorrelated error structures, individual-specific effects, and compensations for survey biases. During the third year, the project will focus on planning applications, including assessing the effectiveness of rideshare incentives, and infrastructure changes, such as carpool lanes.

UCI-1210 ACTIVITY-BASED MODELS OF ACCESSIBILITY: W.W.
PLANNING IMPLICATIONS FOR URBAN SUBCENTERS Recker

This project unites the efforts of researchers on three UC campuses, each of whom has made substantial contributions to developing activity-based approaches to travel-demand modeling. The objective is to test an activity-based planning procedure for improving accessibility in low-density urban subcenters. A primary focus of the research is to develop a consistent method for evaluating impacts of transportation policies, such as flextime and ridesharing, that inherently affect the accessibility and activity scheduling of an entire household, rather than just the tripmaker or the specific trip. A specific test of the method will involve its application to panel data derived from an ongoing UCTC project.

UCI-2410* REAL-TIME SUPPORT FOR TRAFFIC S.G. Ritchie
SURVEILLANCE AND CONTROL

A major concern in developing smart roads is providing decision support for personnel in traffic-management centers, particularly for dealing with nonrecurrent congestion. Decision support for control room staff is necessary if they are effectively to detect, verify, and respond strategically to traffic incidents. These are events that disrupt orderly flows of traffic and cause nonrecurrent congestion and delay. Events can be caused by accidents, spilled loads, stalled or disabled vehicles, maintenance and construction activities, signal and detector malfunctions, or other unusual occurrences. This research will

from detector sites to a control center and to return control instructions to motorist information or control equipment. A communications subsystem that is effective, reliable, and cost-effective is necessary for the freeway surveillance and control system to perform properly. Its flexibility, reliability, adaptability, and expansion capability limit the level of performance and operational effectiveness of the entire freeway-control system. The level of performance and effectiveness vary with media of differing costs. Many communications technologies exist that can be used in this subsystem and selection of the appropriate communication subsystem requires consideration of the performance characteristics and the cost trade-offs of the various communication media options. The primary goal of this research is to evaluate the cost-effectiveness, flexibility, adaptability, and suitability of various communications media for collecting and transmitting information from and to detection and control sites.

UWA-15 USE OF AUTOMATIC VEHICLE IDENTIFICATION
 TECHNIQUES FOR MEASURING TRAFFIC
 PERFORMANCE AND PERFORMING INCIDENT
 DETECTION

G. Scott
Rutherford

Detection of incidents is a major part of an incident response system. The faster the presence of an incident can be detected, the more quickly a response can be implemented and traffic flow can be returned to normal. Automated incident detection relies heavily on the monitoring of traffic performance. Detection systems (using magnetic loop detectors) monitor traffic flow and report deviations from routine traffic conditions and unexpected decreases in traffic performance as indications of potential incidents. Unfortunately, the existing WSDOT loop detector system has its limitations when used by itself (e.g., it is slow to recognize incidents that occur away from the loop sites).

UWA-16 DEVELOPMENT OF METHODS OF ANALYSIS FOR
 PLANNING TRANSIT SYSTEM COMPONENTS IN J.
 AND AROUND MAJOR DIVERSIFIED CENTERS (MDC's) Schneider

Major diversified centers (MDC's), located outside of the traditional central business districts (CBD's) of cities, have become principal areas of growth in many urban areas in recent years. These MDC's have typically grown up around a regional shopping center or suburban office/industrial park and have become fairly dense areas that include a diverse set of businesses and offices. As the MDC land use pattern had become more mixed, their traffic impacts have increased sharply and become more complex. Most are now having the same problems that are traditionally associated with CBD's, such as access, parking, internal circulation, pedestrian mobility and safety, and land use conflicts.

The objective of this research is to develop some methods of analysis that can be used to plan and design transit circulation system components for use in solving the access/circulation/parking problems of major diversified centers. Special attention is to be given to the problems associated with the provision of "feeder" (i.e., collection/distribution) service to high capacity transit stations located within or adjacent to a major diversified center.

UWA-14 PUGET SOUND TELECOMMUTING
 DEMONSTRATION PROJECT

Cy Ulberg

Due to the unlikely alternative of expanding Puget Sound's freeway system, emphasis must be placed upon managing the use of the existing transportation system. Recent focus has been on the use of Transportation Demand Management (TDM) strategies to help improve traffic flow. Such TDM strategies currently in use include high occupancy vehicle lanes, park and ride lots, car pools and van pools, flex-time scheduling, and freeway on-ramp access control. The focus of this study is on another promising TDM alternative--telecommuting, which replaces the transportation of people with the transmission of information through the use of computer and telecommunications technologies. By allowing workers to do some or all of their work at home or at a regional office, telecommuting has the potential to cut work-related travel.

Due to the relative lack of empirical information available, a Puget Sound telecommuting demonstration project would be the most efficient way to evaluate the potential for telecommuting as a viable TDM strategy for the region. Thus the objectives of this research are to demonstrate telecommuting to a diverse group of organizations in the Puget Sound Region by designing, organizing, managing, and documenting a telecommuting research project; to research and evaluate the impacts of telecommuting on employees and their families; and to research and evaluate the impacts of telecommuting on organizations.

* Continued Projects

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Theme: Transportation Management, Policy and Operations

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Theme: Regional Mobility: Urban/Suburban Accessibility

Consortium Schools: Cornell University (NY)
New Jersey Institute of Technology
New York University
Polytechnic University (NY)
Princeton University (NJ)
Rensselaer Polytechnic University (NY)
Rutgers State University of New Jersey
State University of New York, Albany
Stevens Institute of Technology (NJ)
University of Puerto Rico*
University of Virgin Islands*

* Historically Black Colleges and Universities or Minority Institutions

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Theme: Transportation Operations and Management

Consortium Schools: Morgan State University*
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State University
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REGION IV

Lead University: The University of North Carolina, Chapel Hill

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Theme: Mobility 21: Managing Mobility in a High Growth Region

Consortium Schools: Duke University
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North Carolina Central University*
North Carolina State University, Raleigh
University of Florida, Gainesville
University of Kentucky, Lexington
University of North Carolina, Charlotte
University of North Florida, Jacksonville
University of Tennessee, Knoxville
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REGION V

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Theme: Truck and Bus Transportation

Consortium Schools: Central State University (OH)*
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Michigan Technological University
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REGION VI

Lead University: Texas A&M University

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Themes: Transportation Operations Management
Transportation Engineering

Consortium Schools: Texas Southern University*
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Theme: Developing Transportation Actions and Strategies
in a Region Undergoing a Major Transition

Consortium School: University of Iowa

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Lead University: North Dakota State University

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Theme: Strategic Planning for Metropolitan Accessibility

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Theme: Operations Management and Planning

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