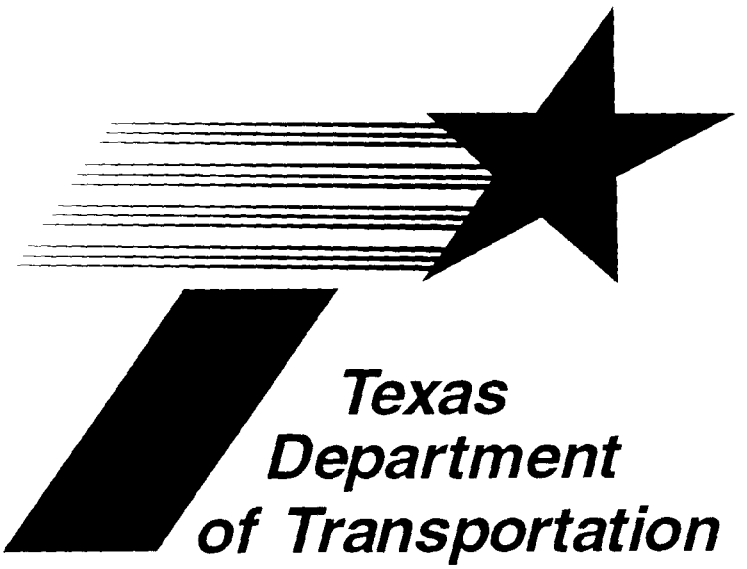
FY '92 – '93 RESEARCH PROGRAM

PROGRESS REPORTS
Fall 1992



PROGRESS REPORTS
Fall 1992

This book includes projects which are terminating in FY 1992 as well as all projects which are active in FY 1993. The projects are divided by subject areas, as follows:

Area 1: Planning, Economics, Environment, Transit and Aviation
Area 2: Materials, Construction, Maintenance, Pavement Design and Aviation
Area 3: Traffic Operations, Geometric Design and Right-of-Way
Area 4: Structural Design

Please note that the budget items reflect charges through June 1992. Reference items are located at the back of the book; including organization charts for the Research and Development and area committees, the Research Section organization and a listing of district and division research liaisons.

AREA I

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 1 **STUDY NO.** TTI 925 **STATUS:** Terminating

TITLE: AN ASSESSMENT OF FREEWAY HIGH-OCCUPANCY VEHICLE PROJECTS

TECHNICAL PANEL	RESEARCHER(S)
Richard Christie, Chairman, D-11	Dennis Christiansen

AREA: 1 **STUDY NO.** TTI 947 **STATUS:** Active

TITLE: TEXAS TRAVEL DEMAND PACKAGE

TECHNICAL PANEL	RESEARCHER(S)
Terry Cearley, Chairman, D-10	George Dresser
Waymon Finch, D-19	

AREA: 1 **STUDY NO.** TTI 968 **STATUS:** Terminating

TITLE: IMPACT OF WIDENING U.S. HIGHWAY 80 IN LONGVIEW, TEXAS

TECHNICAL PANEL	RESEARCHER(S)
Cornell Waggonner, Chairman, DS-10	Jesse Buffington

AREA: 1 **STUDY NO.** CTR 980 **STATUS:** Active

TITLE: DISADVANTAGED BUSINESS ENTERPRISE (DBE) CAPACITY STUDY

TECHNICAL PANEL	RESEARCHER(S)
Efrem Casarez, Chairman, D-14	Ray Marshall
Victor Garcia, D-6	Jorge Anchondo
Wanda Ealey, D-18	Naomi Lede
Cynthia Gonzales, D-14	
Renee Frisinger, D-14	

AREA: 1 **STUDY NO.** TTI 993 **STATUS:** Active

TITLE: HIGHWAY PLANNING AND OPERATIONS FOR DISTRICT 14

TECHNICAL PANEL	RESEARCHER(S)
Glen McVey, Chairman, DS-14	Tim Lomax

AREA: 1 **STUDY NO.** TTI 1099 **STATUS:** Active

TITLE: URBAN TRAVEL IN TEXAS: AN EVALUATION OF TRAVEL SURVEYS

TECHNICAL PANEL	RESEARCHER(S)
Eddie Shafie, Chairman, D-10	David Pearson

AREA: 1 **STUDY NO.** TTI 1108 **STATUS:** Terminating

TITLE: TRAFFIC PATTERN ASSESSMENT AND ROAD USER DELAY COSTS RESULTING FROM ROADWAY CONSTRUCTION OPTIONS

TECHNICAL PANEL	RESEARCHER(S)
Mark Marek, Chairman, D-8	Connie Dudek
Lewis Rhodes, D-18	Ray Krammes
	Steve Levine

AREA: 1 **STUDY NO.** TTI 1131 **STATUS:** Active

TITLE: MEASURING AND MONITORING URBAN MOBILITY IN TEXAS

TECHNICAL PANEL	RESEARCHER(S)
Don Dial, Chairman, D-10	Tim Lomax
Cathy Wood, D-18	

AREA: 1 **STUDY NO.** TTI 1146 **STATUS:** Active

TITLE: A 'BEFORE'-AND-'AFTER' EVALUATION OF THE COMMITTED HIGH OCCUPANCY VEHICLE TRANSITWAY PROJECTS

TECHNICAL PANEL	RESEARCHER(S)
Al Luedecke, Chairman, D-10	Dennis Christiansen

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 1 **STUDY NO.** TTI 1153 **STATUS:** Terminating

TITLE: IMPROVING THE EFFICIENCY, EFFECTIVENESS, AND RESPONSIVENESS OF THE TRAFFIC ASSIGNMENT PROCESS

TECHNICAL PANEL	RESEARCHER(S)
Terry Cearley, Chairman, D-10	George Dresser
	Jimmy Benson

AREA: 1 **STUDY NO.** TTI 1196 **STATUS:** Terminating

TITLE: DEVELOPMENT OF PLANNING AND CAPACITY VALUES FOR URBAN FREEWAYS IN LARGE TEXAS CITIES

TECHNICAL PANEL	RESEARCHER(S)
Bob Cuellar, Chairman, D-10	Carol Walters
Carlos Lopez, D-18	Tom Urbanik
	Dennis Christiansen

AREA: 1 **STUDY NO.** TTI 1206 **STATUS:** Terminating

TITLE: THE FINANCIAL BENEFITS ASSOCIATED WITH JOINT DEVELOPMENT OF HIGHWAY/TRANSIT IMPROVEMENTS IN TEXAS

TECHNICAL PANEL	RESEARCHER(S)
Lewis LeFevre, Chairman, D-7	Katie Turnbull
Ed Collins, D-11	
Khali Persad, D-8	
Bonnie Beck, DS-18	

AREA: 1 **STUDY NO.** TTI 1229 **STATUS:** Terminating

TITLE: THE COSTS AND EFFECTIVENESS OF UPGRADE TO STANDARDS AS PART OF THE SDHPT REHABILITATION PROGRAM

TECHNICAL PANEL	RESEARCHER(S)
Robert Wilson, Chairman, D-8	Jeff Memmott
Tom Word, DS-14	Jim Hanks

AREA: 1 **STUDY NO.** TTI 1235 **STATUS:** Active

TITLE: IMPROVING TRANSPORTATION PLANNING TECHNIQUES

TECHNICAL PANEL	RESEARCHER(S)
Bob Cuellar, Chairman, D-10	George Dresser
Al Luedecke, D-10	Dennis Christiansen
Terry Cearley, D-10	Gordon Shunk
Phil Reeder, D-10	
Don Dial, D-10	
Mark Hodges, D-10	
Fred Marquez, D-10	
Diana Noble, DS-2	
Chris Olavson, DS-12	
John Kight, DS-15	
Mark Marek, D-8	
Bob Kovar, D-8	
Mike Leary, FHWA	
Ted Miller, FHWA	
Phillip Hazen, FHWA	
Mark Young, DS-18	
Zack Graham, D-10	
Michael Morris, COG	
Sally Burke, FDH	
Gary Trietsch, D-18	
Vennie Davis, D-19	

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 1 **STUDY NO.** CTR 1247 **STATUS:** Terminating

TITLE: ECONOMIC IMPACT OF HIGHWAY BYPASSES AND LOOPS

TECHNICAL PANEL	RESEARCHER(S)
Robert Wilson, Chairman, D-8	Mike Walton
	Hani Mahmassani
	Mark Euritt
	Rob Harrison

AREA: 1 **STUDY NO.** TTI 1260 **STATUS:** Active

TITLE: ECONOMIC IMPACT OF HIGHWAY WIDENING PROJECTS

TECHNICAL PANEL	RESEARCHER(S)
Robert Wilson, Chairman, D-8	Jesse Buffington
Eddie Shafie, D-10	William McFarland

AREA: 1 **STUDY NO.** TTI 1262 **STATUS:** Terminating

TITLE: PROCEDURES AND DATA FOR DETERMINING PROJECT COMPLETION TIME

TECHNICAL PANEL	RESEARCHER(S)
Khali Persad, Chairman, D-8	William McFarland
John Finley, D-6	Don Hancher
David Justice, DS-9	
Ed Vernon, DS-23	
Kim Carroll, DS-18	
Vickie Brown, D-19	

AREA: 1 **STUDY NO.** CTR 1270 **STATUS:** Terminating

TITLE: EVALUATION OF TRANSPORTATION CORPORATIONS AND ROAD UTILITY DISTRICTS

TECHNICAL PANEL	RESEARCHER(S)
Jerry Selby, Chairman, D-8	Mike Walton
	Mark Euritt

AREA: 1 **STUDY NO.** TTI 1277 **STATUS:** Terminating

TITLE: FINANCING ALTERNATIVES FOR TEXAS HIGHWAYS

TECHNICAL PANEL	RESEARCHER(S)
Art Elliott, Chairman, D-7	William McFarland
Thomas Doebner, D-3	

AREA: 1 **STUDY NO.** TTI 1278 **STATUS:** Active

TITLE: DEVELOPMENT OF ANALYTICAL TOOLS FOR EVALUATING OPERATIONS OF LIGHT RAIL AT-GRADE WITHIN AN URBAN SIGNAL SYSTEM

TECHNICAL PANEL	RESEARCHER(S)
Ed Collins, Chairman, D-11	Carol Walters
John Kelly, DS-18	Dan Fambro
Ray Derr, D-18	

AREA: 1 **STUDY NO.** TTI 1279 **STATUS:** Active

TITLE: AIR POLLUTION IMPLICATIONS OF URBAN TRANSPORTATION INVESTMENT DECISIONS

TECHNICAL PANEL	RESEARCHER(S)
Wayne Young, Chairman, D-8	Ray Krammes
Zack Graham, D-10	

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 1 **STUDY NO.** CTR 1281 **STATUS:** Active

TITLE: HIGHWAY PRIVATIZATION IN TEXAS

TECHNICAL PANEL	RESEARCHER(S)
John Blain, Chairman, DS-18	Mark Euritt
Robert Wilson, D-8	Rob Harrison
	Randy Machemehl
	Jim Jarrett
	Mike Walton

AREA: 1 **STUDY NO.** CTR 1282 **STATUS:** Active

TITLE: INCREASING MOBILITY AND ECONOMIC DEVELOPMENT THROUGH MULTIMODAL CENTERS

TECHNICAL PANEL	RESEARCHER(S)
Joe Impey, Chairman, D-10	Mark Euritt
Nim Graves, RRC	Rob Harrison
Jim Cotton, D-11	Mike Walton
Jim Randall, D-10	
Linda Howard, D-2	
Les Findeisen, TMTA	

AREA: 1 **STUDY NO.** TTI 1283 **STATUS:** Active

TITLE: CLOSURE OF THE GIWW AND ITS IMPACT TO THE TEXAS HIGHWAY TRANSPORTATION SYSTEM

TECHNICAL PANEL	RESEARCHER(S)
Jim Randall, Chairman, D-10	Steve Roop
	Dock Burke

AREA: 1 **STUDY NO.** TTI 1284 **STATUS:** Terminating

TITLE: EVALUATION AND DEVELOPMENT OF VISUALIZATION TECHNOLOGY FOR HIGHWAY TRANSPORTATION

TECHNICAL PANEL	RESEARCHER(S)
Cooper, Chairman, D-19	Harlow Landphair
Don Garrison, DS-12	

AREA: 1 **STUDY NO.** TTI 1307 **STATUS:** Active

TITLE: AN ASSESSMENT OF THE FISCAL CAPACITY OF TEXAS CITIES AND THEIR ABILITY TO MEET LOCAL STREET CONSTRUCTION AND MAINTENANCE NEEDS THROUGH THE YEAR 2000

TECHNICAL PANEL	RESEARCHER(S)
Lewis LeFevre, Chairman, D-7	Bill Luker
Leon Barba, D-18	
Wayne Dennis, D-8	

AREA: 1 **STUDY NO.** TTI 1310 **STATUS:** Active

TITLE: NEW EVALUATIONS OF LIQUIDATED DAMAGES, MOTORIST LIQUIDATED DAMAGES, AND PERCENT RETAINAGE

TECHNICAL PANEL	RESEARCHER(S)
Howard Johnson, Chairman, D-8	William McFarland
Doug Dillon, DS-18	Ray Krammes
Glen Bohannon, DS-8	
Dawn Vose, D-6	

AREA: 1 **STUDY NO.** CTR 1312 **STATUS:** Active

TITLE: TRUCK TRAFFIC IN LAREDO, TEXAS—A CASE STUDY OF ISSUES AND REMEDIES

TECHNICAL PANEL	RESEARCHER(S)
Jon Underwood, Chairman, D-10	Rob Harrison
	Ronald Hudson
	Frank McCullough

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 1 **STUDY NO.** TTI 1317 **STATUS:** Active

TITLE: THE IMPACT OF A U.S.-MEXICO FREE TRADE AGREEMENT ON THE TEXAS HIGHWAY NETWORK

TECHNICAL PANEL	RESEARCHER(S)
Manny Aguilera, Chairman, DS-24	Bill Luker
John Robey, D-7	Dock Burke
Bob Kovar, D-8	Jeff Memmott
Robert Moreno, IRO	
Joe Impey, D-10	
Bob Briggs, D-18	
Fred Nelle, DS-6	
Mark Tomlinson, DS-7	
Robin Longwell, DS-21	
Judy Ramsey, DS-24	

AREA: 1 **STUDY NO.** TTI 1318 **STATUS:** Active

TITLE: DISPOSAL OF HAZARDOUS WASTE MATERIALS FROM TxDOT ACTIVITIES

TECHNICAL PANEL	RESEARCHER(S)
Otis Jones, Chairman, DS-8	Dallas Little
Royce Rogers, DS-7	Michael Stallard
Carrol Templeton, DS-7	M. Yavuz Corapcioglu
Terry Keener, DS-25	Albert Yeung
Morgan Prince, DS-11	
Stacey Wallis, DS-16	
Dennis Mlcak, DS-12	
Otto Maresh, DS-12	
Roger Barnhart, DS-24	
Gene Adams, DS-10	
Mike Martin, DS-18	
Glen Elliott, DS-2	
Robert Price, D-9	

AREA: 1 **STUDY NO.** CTR 1319 **STATUS:** Active

TITLE: MULTI-MODAL PLANNING AND THE U.S.-MEXICO FREE TRADE AGREEMENT

TECHNICAL PANEL	RESEARCHER(S)
Manny Aguilera, Chairman, DS-24	Rob Harrison
Linda Howard, D-2	Clyde Lee
Lewis LeFevre, D-7	Chandler Stolp
Bob Kovar, D-8	Leigh Boske
Joe Impey, D-10	
Robert Moreno, IRO	
Ed Collins, D-11	
Charles Webb, DS-6	
Gene Hirschfelt, DS-7	
Robin Longwell, DS-21	
Judy Ramsey, DS-24	
Mary May, DS-18	

AREA: 1 **STUDY NO.** TTI 1320 **STATUS:** Active

TITLE: THE ECONOMIC SIGNIFICANCE OF TRANSPORTATION EXPENDITURES IN TEXAS

TECHNICAL PANEL	RESEARCHER(S)
Cornell Waggonner, Chairman, DS-10	William McFarland
Curtis Toews, D-3	
Lewis LeFevre, D-7	
Robert Wilson, D-8	
Ed Collins, D-11	

LIST OF RESEARCH STUDIES

September 1, 1992 — **D-10 RESEARCH & DEVELOPMENT**

AREA: 1 **STUDY NO.** CTR 1321 **STATUS:** Active

TITLE: USE OF CONGESTION PRICING FOR REDUCING URBAN CONGESTION, AS A REVENUE SOURCE, AND COMPLIANCE WITH THE CLEAN AIR ACT

TECHNICAL PANEL	RESEARCHER(S)
Jack Foster, Chairman, D-10	Hani Mahmassani
Randy Keir, D-18	Mike Walton

AREA: 1 **STUDY NO.** CTR 1322 **STATUS:** Active

TITLE: AN EVALUATION OF THE STATUS, EFFECTIVENESS AND FUTURE OF TOLL ROADS IN TEXAS

TECHNICAL PANEL	RESEARCHER(S)
Peggy Thurin, Chairman, D-10	Randy Machemehl
Doug Woodall, D-8	Rob Harrison
Chris Olavson, DS-12	Mark Euritt
Jim Griffin, TTA	Mike Walton

AREA: 1 **STUDY NO.** TTI 1323 **STATUS:** Active

TITLE: EVALUATION OF THE WEIGHT TOLERANCE PERMITS AUTHORIZED IN HOUSE BILL 2060

TECHNICAL PANEL	RESEARCHER(S)
Bert Lundell, Chairman, D-18	Bill Crockford
Jim Bisson, D-7	
Scott Mitchell, DS-8	
Delfino Garcia, DS-16	
Bob Tejada, DS-24	

AREA: 1 **STUDY NO.** CTR/TSU 1324 **STATUS:** Active

TITLE: ENHANCED PUBLIC EDUCATION CAMPAIGN FOR ETHNIC GROUPS AND SPECIAL AUDIENCES

TECHNICAL PANEL	RESEARCHER(S)
Michelle Bibby, Chairman, D-14	Jorge Anchondo, CTR
Cynthia Gonzales, D-14	Patricia Witherspoon
Leslie Pool, D-13	Carol Lewis, TSU
Victor Garcia, D-6	
Efrem Casarez, D-14	

AREA: 1 **STUDY NO.** CTR 1325 **STATUS:** Active

TITLE: VALUE OF ACCESS RIGHTS

TECHNICAL PANEL	RESEARCHER(S)
Jeff Porter, Chairman, D-15	Randy Machemehl
Max Fariss, D-15	Rob Harrison
Jack Foster, D-10	Jim Jarrett

AREA: 1 **STUDY NO.** TTI/TSU 1327 **STATUS:** Active

TITLE: SOCIAL, ECONOMIC AND ENVIRONMENTAL EFFECTS OF ELEVATED AND DEPRESSED FREEWAYS

TECHNICAL PANEL	RESEARCHER(S)
John Kelly, Chairman, DS-18	Jesse Buffington, TTI
Peggy Thurin, D-10	Katie Womack
Roland Gamble, D-14	Wayne McCully
Melissa Neeley, D-8	Jerry Bullin
	Richard Zimmer
	Carol Lewis, TSU

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 1 **STUDY NO.** TTI 1329 **STATUS:** Active

TITLE: LEASING OF TxDOT'S RIGHTS-OF-WAY

TECHNICAL PANEL	RESEARCHER(S)
Robert Bernhard, Chairman, D-15	Steve Roop
Richard Kirby, D-18	
Paul Tucker, DS-4	
James Blackburn, DS-11	
Dwight Allen, DS-12	
Mary May, DS-18	
Lynwood Walters, DS-20	
Suzanne Roach, D-15	

AREA: 1 **STUDY NO.** TTI 1375 **STATUS:** Active

TITLE: DEVELOP AIR QUALITY DATA FOR FEDERAL SUBMISSION

TECHNICAL PANEL	RESEARCHER(S)
Peggy Thurin, Chairman, D-10	George Dresser
Bob Cuellar, D-10	

AREA: 1 **STUDY NO.** TTI 1909 **STATUS:** Active

TITLE: TEXAS REFERENCE MARKER AUTOMATED ROAD INVENTORY RECORD

TECHNICAL PANEL	RESEARCHER(S)
Joel Young, Chairman, D-19	Said Majdi
Larry Kitten, D-10	

AREA: 1 **STUDY NO.** TTI 1910 **STATUS:** Active

TITLE: COST ALLOCATION PROCEDURE ENHANCEMENT

TECHNICAL PANEL	RESEARCHER(S)
Al Luedecke, Chairman, D-10	Dock Burke
	Zane Goff

AREA: 1 **STUDY NO.** CTR 1912 **STATUS:** Active

TITLE: THE ECONOMIC IMPACTS OF GENERAL AVIATION FACILITIES

TECHNICAL PANEL	RESEARCHER(S)
Linda Howard, Chairman, D-2	Jim Jarrett

AREA: 1 **STUDY NO.** TTI 1913 **STATUS:** Active

TITLE: TEXAS AERONAUTICAL FACILITY PLAN

TECHNICAL PANEL	RESEARCHER(S)
Linda Howard, Chairman, D-2	George Dresser

AREA: 1 **STUDY NO.** CTR 1919 **STATUS:** Active

TITLE: COST ALLOCATION PROCEDURE ENHANCEMENT

TECHNICAL PANEL	RESEARCHER(S)
Al Luedecke, Chairman, D-10	Mike Walton

AREA: 1 **STUDY NO.** TTI 1925 **STATUS:** Terminating

TITLE: VIDEO AND DESIGN IMAGERY FOR DISTRICT 12, SDHPT

TECHNICAL PANEL	RESEARCHER(S)
Don Garrison, Chairman, DS-12	Harlow Landphair

AREA: 1 **STUDY NO.** TTI 1933 **STATUS:** Active

TITLE: ENVIRONMENTAL CONCERNS IN MAINTENANCE: A PROACTIVE INITIATIVE

TECHNICAL PANEL	RESEARCHER(S)
Roy Smith, Chairman, D-18	Wayne McCully

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 1 **STUDY NO.** TTI 1940 **STATUS:** Active

TITLE: HIGHWAY PLANNING AND OPERATIONS FOR DISTRICT 18 - PHASE II

TECHNICAL PANEL	**RESEARCHER(S)**
John Blain, Chairman, DS-18	Carol Walters

AREA: 1 **STUDY NO.** TTI 1941 **STATUS:** Active

TITLE: PLANNING, DESIGN AND OPERATION OF TRANSPORTATION FACILITIES IN HOUSTON - PHASE II

TECHNICAL PANEL	**RESEARCHER(S)**
Steve Levine, Chairman, DS-12	Dick McCasland John Mounce

AREA: 1 **STUDY NO.** TxDOT 1942 **STATUS:** Active

TITLE: MONTANA STREET FEASIBILITY STUDY

TECHNICAL PANEL	**RESEARCHER(S)**
Chuck Berry, DS-24	

AREA: 1 **STUDY NO.** CTR 1943 **STATUS:** Active

TITLE: WATER QUANTITY AND QUALITY IMPACTS ASSESSMENT OF HIGHWAY CONSTRUCTION IN AUSTIN, TEXAS AREA

TECHNICAL PANEL	**RESEARCHER(S)**
Tom Word, Chairman, DS-14	Joseph Malina Randall Charbeneau

AREA: 1 **STUDY NO.** CTR 1944 **STATUS:** Active

TITLE: IMPROVED PERFORMANCE AND OPERATION OF THE LOADRATE LOAD ZONE EVALUATION PROCEDURE

TECHNICAL PANEL	**RESEARCHER(S)**
Jeff Jackson, Chairman, D-18	Mike McNerney Dennis Collier

AREA: 1 **STUDY NO.** TTI 1960 **STATUS:** Active

TITLE: ASSISTING TxDOT IN MEETING ISTEA REQUIREMENTS

TECHNICAL PANEL	**RESEARCHER(S)**
Bob Cuellar, Chairman, D-10	Gordon Shunk

AREA: 1 **STUDY NO.** TTI 1962 **STATUS:** Active

TITLE: TRANSPORTATION SYSTEM PERFORMANCE CHANGES I - 1980-1990

TECHNICAL PANEL	**RESEARCHER(S)**
Eddie Shafie, Chairman, D-10	Gordon Shunk

AREA: 1 **STUDY NO.** TTI 1964 **STATUS:** Active

TITLE: FACILITATE DEVELOPMENT OF A STATEWIDE RIDE-SHARE PROGRAM

TECHNICAL PANEL	**RESEARCHER(S)**
Ed Collins, Chairman, D-11	Katie Turnbull

AREA: 1 **STUDY NO.** TTI 1990 **STATUS:** Active

TITLE: SMALL TASK PROJECTS

TECHNICAL PANEL	**RESEARCHER(S)**
Jon Underwood, Chairman, D-10	C.V. Wootan

AREA: 1 **STUDY NO.** TTI 1995 **STATUS:** Active

TITLE: TRANSPORTATION PLANNING ASSISTANCE FOR DISTRICT 2 - PHASE II

TECHNICAL PANEL	**RESEARCHER(S)**
Rondell Fagan, Chairman, DS-2	Carol Walters

LIST OF RESEARCH STUDIES

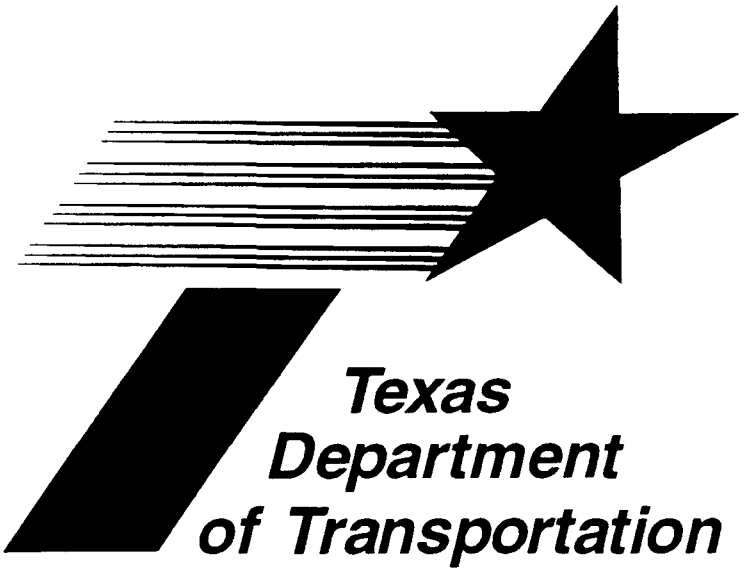
September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 1 **STUDY NO.** TTI 2034 **STATUS:** Terminating

TITLE: MEASUREMENT OF THE IMPACT OF INTERNATIONAL TRUCK TRAFFIC ON THE TEXAS ROADWAY NETWORK

TECHNICAL PANEL
Joe Impey, Chairman, D-10
Diana Noble, DS-24
Emil Seewald, DS-15
Jack Trammell, DS-21
Robert Parker, DS-7

RESEARCHER(S)
Dock Burke
Tim Lomax



PROGRESS REPORTS
Fall 1992

STUDY TITLE: AN ASSESSMENT OF FREEWAY HIGH-OCCUPANCY VEHICLE PROJECTS

STUDY NUMBER:	TTI 925
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	CHRISTIANSEN DL
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	RICHARD CHRISTIE, D-11
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 300,000	TOTAL EXPENDITURES: 293,803
FY 92 BUDGET: 90,000	FY 92 EXPENDITURES: 88,668
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	89-02-15
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

This project attempts to address the recommendations of the 2nd National Conference on HOV Lanes and Transitways which was conducted in Houston, Texas for the purpose of improved implementation of HOV system technology. This project also complements UMTA-funded HOV-related work being performed in Texas and at Harvard.

OBJECTIVE(S):

The objectives of this study are to:

1. Compile information on the effectiveness of transitway projects for use in planning new systems.

2. Review guidelines in the literature concerning warranting conditions for HOV facilities and to assess the usefulness of these guidelines based on current data.

3. Identify the project history and institutional arrangements that have existed in areas that have developed HOV facilities.

IMPLEMENTATION PLAN:

The following will be prepared:

1. State-of-the-Art Assessment of Approaches for Measuring the Effectiveness of HOV facilities

2. Methodology for measuring the effectiveness of HOV facilites

3. Characteristics of operating HOV

4. Case study documentation

5. Final report

STUDY PROGRESS:

Published reports from this study are:

925-1 "A Description of High-Occupancy Vehicle Fatalities in North America," 1990.

925-2 "Suggested Procedures for Evaluating the Effectiveness of Freeway HOV Facilities," 1991.

925-3 "High-Occupancy Vehicle Project Case Studies History and Institutional Arrangements."

STUDY TITLE: TEXAS TRAVEL DEMAND PACKAGE

STUDY NUMBER:	TTI 947
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	DRESSER GB
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	TERRY CEARLEY, D-10
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 320,643
FY 92 BUDGET: 55,000	FY 92 EXPENDITURES: 35,477
FY 93 BUDGET: 80,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	87-09-01
TERMINATION DATE:	CONTINUING

PROBLEM STATEMENT:

OBJECTIVE(S):

The objectives of this study are to:

1. Provide professional and technical staff support for the maintenance and continued development of the Department's travel demand modelling capability.

2. Modify Texas Large Network Assignment Models.

3. Introduction of the TRANPLAN software to D-10P.

4. Prepare a corridor analysis automation annual.

IMPLEMENTATION PLAN:

Seminars will be conducted.

STUDY PROGRESS:

Published reports from this study are:

947-2 "How to Read the Output Tables of the Texas Large Network Assignment Models," 1990.

STUDY TITLE: IMPACT OF WIDENING U.S. HIGHWAY 80 IN LONGVIEW, TEXAS

STUDY NUMBER:	TTI 968
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BUFFINGTON JL
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	CORNELL WAGGONNER, DIST 10
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 184,906	TOTAL EXPENDITURES: 179,689
FY 92 BUDGET: 44,789	FY 92 EXPENDITURES: 40,425
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The Texas Department of Transportation (TxDOT) is continually faced with the responsibility of providing safe and congestion-free highways. One of the principal ways that TxDOT is accomplishing this task is by widening and adding additional travel lanes to existing highways. Widening a highway always impacts the abutting property owners in a positive and/or negative manner. Such impacts either complement or partially offset the increased safety and reduced time and vehicle operating costs of motorists using the improved highway. By documenting the during and after construction effects of a highway widening, the results could be used by the TxDOT to estimate the positive and negative impacts of the same type of improvement on other highways across the state.

OBJECTIVE(S):

The objectives of this study are to:

1. Determine the impact of the construction phase of the U.S. Highway 80 widening on motorists and abutting businesses.

2. Determine the impact of the after construction phase of the Highway 80 widening on motorists and abutting businesses.

3. Determine the effects of the construction expenditures on the Longview area.

IMPLEMENTATION PLAN:

Appropriate data will be collected and analyzed to estimate the during and after construction impacts. The following data shall be collected for analysis:

1. Estimate impact on abutting businesses: collect parking space use, employment, and gross study sales data from abutting businesses. Also, the number of opened/closed businesses and the extent of remodeling, upgrading, and new construction occurring with reasons for making such an investment.

2. Estimate impact on motorists: collect traffic volume, travel time, speed change, stopping, and accident data using traffic recorders, video cameras, and instrumented vehicles.

3. Estimate impact of construction expenditures on the Longview area: (a) collect data on contractor's local expenditures for wages, materials, supplies and services, and (b) apply appropriate multipliers to the results to estimate employment and income impacts of local construction expenditures.

STUDY PROGRESS:

STUDY TITLE: DISADVANTAGED BUSINESS ENTERPRISE (DBE)
CAPACITY STUDY

STUDY NUMBER:	CTR 980
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MARSHALL R,ANCHONDO J,LEDE N
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	EFREM CASAREZ, D-14
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 600,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 385,176	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 214,824	FY 93 EXPENDITURES: 0
DATE BEGUN:	92-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The Texas Department of Transportation (TxDOT) has been directed by the 72nd Texas Legislature to set and meet annual goals for awarding all state funded contracts including construction, maintenance, supply and service contracts to disadvantaged businesses. Senate Bill 352, Article 6669C Section 2b. Contract Goals, requires TxDOT to perform a capacity study to assess the availability of disadvantaged businesses in Texas.

OBJECTIVE(S):

The objectives of this study are to develop a model that will assist TxDOT in assessing the capacity of DBE firms in Texas that have the potential to provide supplies, materials, equipment or services to TxDOT.

IMPLEMENTATION PLAN:

STUDY PROGRESS:

STUDY TITLE: HIGHWAY PLANNING AND OPERATIONS FOR DISTRICT 14

STUDY NUMBER:	TTI 993
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LOMAX T
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	GLEN McVEY, DIST 14
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 63,777
FY 92 BUDGET: 40,000	FY 92 EXPENDITURES: 38,270
FY 93 BUDGET: 40,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	89-12-06
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Innovative approaches to traffic demand are required to deal with growth in the Austin area.

OBJECTIVE(S):

The objectives of this study are to:

1. Provide HOV planning assistance.

2. Collect and analyze freeway and highway traffic operations data.

3. Conduct freeway planning.

4. Conduct thoroughfare planning coordination.

IMPLEMENTATION PLAN:

TTI will prepare 24-28 sets of video-based computer generated images showing before and after conditions of the proposed construction improvements to IH-35 in Austin and District 14 highways and streets. This project will insure that freeway plans in the Austin area are consistent with future high-occupancy vehicle lane requirements. Improvements will be proposed for locations experiencing severe traffic congestion. Freeway management and regional thoroughfare systems for Austin will be developed.

STUDY PROGRESS:

STUDY TITLE: URBAN TRAVEL IN TEXAS: AN EVALUATION OF TRAVEL SURVEYS

STUDY NUMBER:	TTI 1099
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	PEARSON D
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	EDDIE SHAFIE, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 210,000	TOTAL EXPENDITURES: 82,834
FY 92 BUDGET: 135,000	FY 92 EXPENDITURES: 82,834
FY 93 BUDGET: 75,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-02-04
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

During the past decade, travel surveys were conducted in different urban areas in Texas in order to update trip generation models. A need exists to comparatively analyze and compile comprehensive information on all of the travel surveys conducted to gain an understanding of the travel pattern changes that have occurred over time and to develop the most appropriate methods and procedures for optimizing the use and benefit of the data collected.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop a comparative assessment of the travel surveys including differences between urban areas and changes in travel characteristics over time.

2. Determine the most appropriate procedure for estimating trip productions in urban areas in Texas, estimating trip attractions, estimating trips for special generators, estimating truck trips, and conducting external station travel surveys.

3. Measure the changes in travel characteristics that have occurred since the original surveys were done.

4. Determine the need for additional workplace surveys and the appropriate sample sizes for use in those surveys.

5. Measure the ability of the current trip length frequency distribution (TLFD) procedure to estimate the observed distributions from the surveys.

IMPLEMENTATION PLAN:

The findings of this study will allow TxDOT to update the travel demand models being used in many urban areas in Texas. The improvements in travel demand modeling are expected to be substantial.

STUDY PROGRESS:

STUDY TITLE: TRAFFIC PATTERN ASSESSMENT AND ROAD USER DELAY COSTS RESULTING FROM ROADWAY CONSTRUCTION OPTIONS

STUDY NUMBER:	TTI 1108
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	DUDEK CL,KRAMMES RA
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	MARK MAREK, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 383,000	TOTAL EXPENDITURES: 392,529
FY 92 BUDGET: 12,000	FY 92 EXPENDITURES: 7,083
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	86-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Construction and rehabilitation activities on high volume roadways have significant impact on road users. To expedite completion times, the department has introduced incentive/disincentive clauses into their construction contracts. As a result, the department is in need of a comprehensive data base and a sound analytical approach to plan and construct projects in a manner compatible with long-term transportation objectives and to minimize the additional road user costs during construction.

OBJECTIVE(S):

The objectives of this study are to:

1. Review and synthesize previous experience with changes in traffic patterns and road user costs resulting from roadway rehabilitation and construction activities.

2. Evaluate the applicability of existing computer models to analyze and predict traffic patterns and road user costs.

3. Develop a data base to analyze traffic delays, diversions and road user costs.

4. Compare the computer model with actual field conditions.

5. Develop a revised procedure to predict more accurately traffic patterns and road user costs resulting from roadway rehabilitation and construction activities.

6. Assist and train TxDOT personnel with the new procedure.

IMPLEMENTATION PLAN:

The information obtained from this report should assist engineers in planning construction activities and traffic control development to minimize road user delay.

A users' manual for the QUEWZ program to incorporate the modifications made by the researchers is being used by some TxDOT personnel. A training workshop will be conducted to teach department personnel to use the revised version of QUEWZ.

STUDY PROGRESS:

Objectives 1, 2, and 4 were completed previously.

Objective 3 - Data collection is complete and data processing and analysis is almost complete.

Objective 5 - A new diversion algorithm for QUEWZ has been coded and will be tested. New work zone capacity data will be incorporated into QUEWZ.

Objective 6 - The users' manual will be updated, a final report prepared, and a training workshop will be conducted for TxDOT personnel.

Published reports from this study are:

1108-1 "Travel Impacts of Freeway Reconstruction: Synthesis of Previous Research and Experiences," 1987.

1108-2 "Analysis of Accidents at Long-Term Construction Projects in Texas," 1991.

1108-3 "Travel Impacts of Urban Freeway Reconstruction Projects in Texas," 1990.

STUDY TITLE: MEASURING AND MONITORING URBAN MOBILITY IN TEXAS

STUDY NUMBER:	TTI 1131
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LOMAX TJ
RESEARCH AREA:	AREA 1
TxDOT CONTRACT:	DON DIAL, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 340,000	TOTAL EXPENDITURES: 264,611
FY 92 BUDGET: 60,000	FY 92 EXPENDITURES: 46,175
FY 93 BUDGET: 60,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	87-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Previous studies have quantified relative mobility levels on the major roadway systems of several Texas cities. Based on this previous research, it has become apparent that two tasks are needed: (1) monitor urban mobility on an on-going basis in order to identify the impacts of the increased roadway construction and reduced rates of travel growth that have characterized urban areas in Texas since 1983; and (2) develop and apply techniques for measuring the mobility impacts that will result as extensive transit facilities are constructed.

OBJECTIVE(S):

The specific objectives of this study are to:

1. Monitor and update mobility levels in major Texas and other US cities.

2. Develop techniques for measuring the mobility impacts of major mass transportation improvements.

3. Respond to special requests from the Department concerning urban mobility.

IMPLEMENTATION PLAN:

The research will help to determine future highway needs and to assist TxDOT in planning, as it is desirable to measure and monitor the severity of the congestion in large Texas metropolitan areas.

Congestion analysis tools developed were utilized in updating the Houston Regional Mobility Plan. Research results have also been presented to the FHWA to assist in the development of a nationwide policy of measuring and quantifying congestion.

STUDY PROGRESS:

Daily vehicle-miles of travel and general urban characteristics have been finalized. The 1990 congestion indices have been developed and evaluated for the 50 urban areas being monitored. During the next six months, the research team will begin compiling the data for the 1991 congestion indices, as well as preliminary analysis of daily VMT and general urban area characteristics.

Published reports from this study are:

1131-1 "Transportation Corridor Mobility Estimation Methodology," 1988.

1131-2 "Roadway Congestion in Major Urban Areas 1982 to 1987," 1989.

1131-3 "Roadway Congestion in Major Urban Areas 1982 to 1988," 1990.

STUDY TITLE: A "BEFORE AND AFTER" EVALUATION OF THE COMMITTED HIGH-OCCUPANCY VEHICLE TRANSITWAY PROJECTS

STUDY NUMBER:	TTI 1146
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	CHRISTIANSEN DL
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	AL LUEDECKE, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 985,000	TOTAL EXPENDITURES: 676,398
FY 92 BUDGET: 205,000	FY 92 EXPENDITURES: 161,533
FY 93 BUDGET: 205,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

In order to cope with increased traffic congestion, Houston has made a significant commitment to develop high-occupancy vehicle lanes on urban freeway systems. Completed transitway facilities are just beginning to become operational in Texas. The experience gained from the operation of these facilities should help determine the applicability, if any, of high-occupancy vehicle lanes for serving urban travel demands and increasing the person-movement capacities of the freeway system.

OBJECTIVE(S):

The objectives of this study are to:

1. Perform a comprehensive "before-and-after" evaluation of the HOV projects currently being implemented, with emphasis on the development of guidelines for future applications.

2. Monitor the status of all priority treatment projects in Texas (this is a continuation of previous research efforts and is closely related to Objective 1).

3. Provide assistance as requested by TxDOT on matters concerning priority treatment and park-and-ride. This objective was an important element in previous projects and has been continued in this project.

IMPLEMENTATION PLAN:

Implementation of this research is found in the development of future facilities. These results are being used extensively for the HOV planning in Dallas. Data is available on request at any time and is used by the department, the Houston district, and METRO. Project reports act as both manuals and training materials.

STUDY PROGRESS:

Extensive data are collected on a routine basis. Quarterly summaries of data are prepared and a detailed annual report documenting the status and effectiveness of the Houston transitway is prepared.

Published reports from this project are:

1146-1 "The Status and Effectiveness of the Houston Transitway System, 1988," 1989.

1146-2 "The Status and Effectiveness of the Houston Transitway System, 1989," 1990.

1146-3 "The High-Occupancy Vehicle Facility System Houston, Texas," 1990.

1146-4 "An Evaluation of the Houston High-Occupancy Vehicle Lane System," 1991.

STUDY TITLE: IMPROVING THE EFFICIENCY, EFFECTIVENESS, AND RESPONSIVENESS OF THE TRAFFIC ASSIGNMENT PROCESS

STUDY NUMBER:	TTI 1153
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	DRESSER GB,BENSON JD
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	TERRY CEARLEY, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 225,000	TOTAL EXPENDITURES: 194,978
FY 92 BUDGET: 69,000	FY 92 EXPENDITURES: 38,385
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-10-31
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The process of preparing traffic assignments is complex and time consuming, in some cases, a period of several months. There is a strong perception that the traffic assignment process does not respond in a timely manner to the needs of the districts and the department. There is also a perception that the traffic assignment models are not state-of-the-art since there have been no major modifications or improvements to the assignment models for several years.

OBJECTIVE(S):

The objectives of this study are to improve the efficiency, effectiveness, and responsiveness of the traffic assignment process by:

1. Reducing the period of time between the request for a traffic assignment or traffic analysis and the availability of that assignment or analysis for district or department application.

2. Improving the accuracy of the assignment models implemented in the Texas Travel Demand Package.

3. Implement an equilibrium capacity restraint assignment procedure to comply with federal guidelines for air quality analysis.

IMPLEMENTATION PLAN:

Pending the loading and testing of the new procedures on the mainframe computer system, the process developed in this study will enhance results and assist by reducing manual adjustments to corridor traffic volumes. This in turn would result in the department being more responsive in a timely manner in the area of traffic assignment. These results can be utilized in the Tranplan process.

Possible "tools" to be used in the implementation of this project may include manuals or guidelines providing instructions for users of the programs.

STUDY PROGRESS:

Efforts during this reporting period have focused on work programmed under Objective 2. Two significant subtasks have been completed.

1. The development and testing of a nodal capacity restraint assignment technique.

2. A comparative evaluation of the capacity restraint assignment procedures used in the Dallas-Fort Worth Joint Model and the Texas Package.

Published reports from this study are:

1153-1 "Multi-path Traffic Assignment: A Review of Literature," 1990.

1153-2 "An Improved Travel Assignment Process for Project-Level Analysis," 1990.

1153-3 "A Comparison of Traffic Assignment Techniques," 1990.

STUDY TITLE: DEVELOPMENT OF PLANNING AND CAPACITY VALUES FOR URBAN FREEWAYS IN LARGE TEXAS CITIES

STUDY NUMBER:	TTI 1196
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	WALTERS CH,URBANIK T,CHRISTIANSEN D
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	ROBERT CUELLAR, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 333,000	TOTAL EXPENDITURES: 320,356
FY 92 BUDGET: 75,000	FY 92 EXPENDITURES: 57,162
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-03-11
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Although usually reported as daily volume, existing volumes can be examined on an hourly basis, by direction and by classification, and thus can be used for direct capacity analysis. A number of assumptions need to be made in order to estimate the peak period conditions which establish the capacity constraints on a freeway. Failing to estimate future peak hour flow rates creates deleterious effects. This study will refine planning parameters and assess the validity of the hypercapacity flow region for planning purposes.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop trend line analyses over time for the variables.

2. Determine the percentage of heavy vehicles in the peak direction traffic stream and relate to the variables.

3. Test, refine and validate the predictive relationships between Objectives 1 and 2.

4. Identify a representative sample of locations where peak hour average volumes consistently exceed theoretical maximums.

5. Collect and analyze extensive data on flow rates, headways, vehicle types and speed to define the hypercapacity condition and identify the frequency of peak hour incidents.

6. Determine a useful range of hypercapacity flow.

7. Develop and test a predictive model for hypercapacity.

IMPLEMENTATION PLAN:

The preliminary data generated by this study indicate that there have been instances where actual traffic volumes exceed the maximum theoretical capacity. Increases in theoretical capacity values will affect department design practices.

Should the results be determined as being significant variations from existing procedures, appropriate methods will be pursued for modifying the departmental and AASHTO highway design manuals.

STUDY PROGRESS:

The first part of the study dealing with K-factors is complete, and a report was issued. Tasks dealing with the preliminaries for collecting capacity data are also complete. The actual collection and evaluation of data are underway and progressing well.

Published reports from this study are:

1196-1 "Development of Planning Values for Urban Freeways in Large Texas Cities," 1989.

STUDY TITLE: THE FINANCIAL BENEFITS ASSOCIATED WITH JOINT DEVELOPMENT OF HIGHWAY/TRANSIT IMPROVEMENTS IN TEXAS

STUDY NUMBER:	TTI 1206
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	TURNBULL K
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	LEWIS LEFEVRE, D-7
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 50,000	TOTAL EXPENDITURES: 38,087
FY 92 BUDGET: 50,000	FY 92 EXPENDITURES: 38,087
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The transit industry in Texas and throughout the nation faces substantial capital investment requirements. Traditional funding sources have not been able to meet these capital investment requirements. This problem has created a need to investigate innovative financing techniques for transit. One area of interest is the joint development of highway/transit-related projects. However, until recently, much of the information on the financial benefits of joint ventures was projected and not based on actual experience. Now that more projects are underway, research has been able to monitor and evaluate the actual benefits of joint development projects.

OBJECTIVE(S):

The objectives of this study are to:

1. Explore the concept of joint development ventures as related to transportation projects.

2. Identify the forms which this cooperation can take.

3. Assess the financial benefits attributable to joint development projects.

4. Identify legal issues associated with various joint development strategies.

5. Provide policy alternatives which the state may want to consider to encourage such cooperation in the transportation area.

IMPLEMENTATION PLAN:

It is hoped that new knowledge will be discovered and presented in such a manner that it will broaden thinking and perspectives in the department, help to optimize fund attainment and use, and provide impetus for greater roles of the private sector.

Worthwhile results can be used in department-wide plans, for budgeting, and by districts in moving people and goods more efficiently and effectively.

STUDY PROGRESS:

Most of the data has been collected. Additional requests for information on selected projects and telephone surveys are underway. Data analysis is continuing. Work has been initiated on outlining the conditions and circumstances that appear to be needed for successful joint development projects. These will be used to develop the general planning guidelines, which will be included in the final report.

STUDY TITLE: THE COSTS AND EFFECTIVENESS OF UPGRADE TO STANDARDS AS PART OF THE TxDOT REHABILITATION PROGRAM

STUDY NUMBER:	TTI 1229
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	MEMMOTT J,HANKS J
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	ROBERT WILSON, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 210,000	TOTAL EXPENDITURES: 188,901
FY 92 BUDGET: 115,000	FY 92 EXPENDITURES: 90,188
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

A recent annual program calls for rehabilitation of rural highways and has required that a fixed percentage of money must be spent for "Upgrading to Standard." An analysis is needed to document the overall costs of upgrading, exclusive of the actual costs of construction. The analysis should include an analysis, by district, of the cost of ROW and utility adjustments to comply with the mandate to upgrade to standard, as well as the impact to the preventative maintenance budgets of districts in those areas where ROW cannot be purchased by local government agencies.

OBJECTIVE(S):

The objectives of this study are to:

1. Determine the additional costs of upgrade to standard requirements as part of the TxDOT rehabilitation program.

2. Develop alternative strategies and policies to reduce those adverse impacts.

3. Evaluate the cost effectiveness of proposed strategies for upgrading substandard highways.

IMPLEMENTATION PLAN:

The department may choose to use the recommended procedures to determine additional costs of upgrade to standard requirements. These procedures would enhance the department's ability to develop alternative strategies and policies and evaluate their cost effectiveness.

STUDY PROGRESS:

The literature review, survey of districts, selection of candidate sites, and estimation of costs are complete. Detailed cross-section plans have been prepared for each of twelve case study sites.

The development of a life cycle cost procedure for upgrade to standard is complete. The results of the cost estimates for the candidate sites will be used to expand the life-cycle estimates into statewide estimates. Work is being completed on a detailed procedure successfully used by some TxDOT districts to receive approval for design exceptions.

STUDY TITLE: IMPROVING TRANSPORTATION PLANNING TECHNIQUES

STUDY NUMBER:	TTI 1235
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	DRESSER GB,CHRISTIANSEN D,SHUNK G
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	ROBERT CUELLAR, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 1,500,000	TOTAL EXPENDITURES: 748,181
FY 92 BUDGET: 300,000	FY 92 EXPENDITURES: 197,836
FY 93 BUDGET: 300,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	89-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

TxDOT can realize significant benefits through coordination of the research conducted in support of transportation planning. Through a coordinated planning research and implementation program, the quality of transportation planning data and techniques and the time lines of traffic forecasts can be improved. Current practice uses simplifying assumptions that can result in projects being treated similarly when they are different. Also, there is currently a lack of objective criteria to evaluate some system issues.

OBJECTIVE(S):

The objectives of this study are to:

1. Document current transportation planning procedures and develop recommendations for improvement based on review of the practices of other states.

2. Identify traffic forecasting data requirements and develop forecasting procedures appropriate for various types of highway projects that are sensitive to the project's parameters.

3. Evaluate TxDOT traffic data collection and analysis programs and develop recommendations for improving the effectiveness and efficiency of these programs.

4. Refine the methodology used for conducting intercity route studies so they are sensitive to both forecasted traffic and forecasted economic development.

IMPLEMENTATION PLAN:

A large number of department decisions are based on data developed by the Division of Transportation Planning. It is important that the methods used are as state-of-the-art, while still cost-effective, as possible.

The results of this study could change current procedures in the areas of traffic data collection and analysis. Any such changes must have clear indicators that the value gained is greater than the implementation costs.

STUDY PROGRESS:

Interviews have been completed for all districts. Research has continued on estimating and forecasting employment at the zonal level. Work on the Modified Delphi: Estimation Procedures case study is underway. These procedures will be evaluated in Longview concluding in August 1992. Work on trend line forecasting model is complete. An elasticity-based forecasting model is complete. Work is continuing on the Internal/External Trip Attraction Model, the Special Generator Default Model, and the Truck/Taxi Default Model. Work is continuing on a mode share package, a vehicle occupancy model, and the feasibility of conducting a multimodal urban travel and land-use interaction study.

Published reports from this study are:

1235-1 "Heavy Truck Volume Forecasting," 1990.

1235-2 "TRIPCAL5 Program Specification," 1991.

1235-3 "TRIPCAL5 User's Manual," 1990.

1235-4 "Feasibility of Developing a Statewide Modeling System for Forecasting Intercity Highway Volumes in Texas Informational Report #7," 1991.

1235-6 "TRIPCAL5 Program Documentation Manual," 1992.

1235-9 "Guidelines for Conducting Intercity Highway Route Studies, Informational Report #8," 1991.

STUDY TITLE: ECONOMIC IMPACT OF HIGHWAY BYPASSES AND LOOPS

STUDY NUMBER:	CTR 1247
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	WALTON CM,MAHMASSANI H,EURITT M,HARRISON R
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	ROBERT WILSON, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 125,000	TOTAL EXPENDITURES: 115,116
FY 92 BUDGET: 65,000	FY 92 EXPENDITURES: 55,794
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

During the past two or three years, researchers have had many requests for information on the economic impact of building highway bypasses or loops. These requests have come from highway agencies, councils of government, chambers of commerce, and consulting firms. The only information currently available is based upon old impact studies done on the interstate highway system in the 1960's. There is a need to conduct several new case studies of the economic impact of bypasses located on other highways to broaden the data base. Also, some or all of the nine bypasses studied on the interstate system in Texas should be updated to provide long-term impact data.

OBJECTIVE(S):

The objectives of this study are to:

1. Synthesize previous research on the economic benefits and consequences of bypass and loop projects in Texas.

2. Identify the aggregate economic impact of bypasses and loops for a variety of Texas locations.

3. Identify targeted spatial and economic impacts for different components of the area affected by the bypass or loop.

4. Develop procedures for TxDOT to estimate the economic impact of bypasses and loops throughout Texas based on certain local conditions and factors.

IMPLEMENTATION PLAN:

The information provided from this study will aid in the assessments that will assist the department in estimating the economic impacts of bypasses and loops throughout Texas based on certain local conditions and factors. This study will also provide TxDOT personnel with additional information for discussions with local officials and businessmen which might facilitate the approval of highway improvements.

STUDY PROGRESS:

All work task have been completed and the final report is being prepared.

STUDY TITLE: ECONOMIC IMPACT OF HIGHWAY WIDENING PROJECTS

STUDY NUMBER:	TTI 1260
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BUFFINGTON J,MCFARLAND W
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	ROBERT WILSON, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 350,000	TOTAL EXPENDITURES: 141,156
FY 92 BUDGET: 75,000	FY 92 EXPENDITURES: 60,625
FY 93 BUDGET: 100,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Little data is available indicating the economic impact of highway widening projects on motorists and abutting businesses. The department's experience in District 10 on a widening project of US80 is an indicator of the need for such data. A study was conducted on this particular project which resulted in a small amount of before-and-after data for businesses involved at five intersections. The study of US80 is being continued to provide more thorough before, during, and after conditions on the project. Several more case studies of this type are needed to establish a more reliable data base.

OBJECTIVE(S):

The objectives of this study are to:

1. Determine the impacts on abutting businesses and properties.

2. Determine the impacts on motorists using these highways.

3. Determine the impacts of the local urban areas or cities involved.

IMPLEMENTATION PLAN:

The results of this study can be used by TxDOT planning and design engineers to prepare environmental statements and document the expected economic impact of proposed highway widening projects. This study will also assist the department in writing environmental assessments and making presentations to concerned owners of businesses affected by proposed highway widening projects.

STUDY PROGRESS:

Three study projects have been chosen; they are located in a semi-rural (2/4-lane open ditch to 5 lanes with curbs and gutters), small urban (2 lane to 4/5 lanes), and large urban (freeway with 6 main lanes and 4 service road lanes being widened to 10 main lanes and 6 service lanes) setting. Another study location (a direct access 2/4-lane road being widened to a 4/6-lane limited access freeway) will be added for study.

Collection of the before and during construction data is about on schedule. Data reduction will begin next period.

STUDY TITLE: PROCEDURES AND DATA FOR DETERMINING
PROJECT COMPLETION TIME

STUDY NUMBER:	TTI 1262
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	McFARLAND WF,HANCHER D
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	KHALI PERSAD,D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 185,000	TOTAL EXPENDITURES: 166,244
FY 92 BUDGET: 97,000	FY 92 EXPENDITURES: 74,943
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Graphs and tables have been developed relating working days to project type and cost. There is a need, however, to develop a rational process using more detailed project characteristics, production quantities, and production rates for estimating project completion times. This estimate is made before final plans are completed and is used as an early planning tool.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop a rational procedure for estimating contract completion time based on work quantities and production rates for different types of projects.

2. Test the time estimation procedure using selected case study projects.

3. Develop procedures for updating input data for the procedure.

IMPLEMENTATION PLAN:

The FHWA is requiring TxDOT to establish written procedures for determining contract time. The results of this study will be incorporated in a final policy statement such as an Administrative Circular. PS&E submission will thus include a contract time determination document.

The technical panel chairman will work with the Division of Design to implement the use of the new procedure through changes in the design manuals, etc. A long-term evaluation of the projected contract time vs. actual contract time would be conducted by the department after implementation of the new procedures. Based on this evaluation, the contract time procedures would be adjusted as required.

STUDY PROGRESS:

The literature review, evaluation of different techniques, evaluation of existing programs and project types, and review of production rate data are complete.

Both a manual and a computerized method were developed for project completion time determination. The manual method is being tested in five TxDOT districts.

Multi-stage projects can also be handled using procedures developed. The computerized procedure can be used for most projects and is currently being tested with example projects.

STUDY TITLE: EVALUATION OF TRANSPORTATION CORPORATIONS AND ROAD UTILITY DISTRICTS

STUDY NUMBER:	CTR 1270
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	WALTON CM,EURITT M
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JERRY SELBY, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 125,000	TOTAL EXPENDITURES: 117,134
FY 92 BUDGET: 65,000	FY 92 EXPENDITURES: 57,193
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

In 1984, a law was adopted allowing for the creation of transportation corporations, road utility districts, and county road districts. Since then, several transportation corporations have been created and some interest has been expressed about road utility districts. A number of county road districts are in operation. The impact of this legislation has not been evaluated or documented.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify the financial impact of transportation corporations and road utility districts.

2. Identify problematic, logistical, and legal issues affecting the success of transportation corporations and road utility districts.

3. Present recommendations for improving the utility of transportation corporations and road utility districts in achieving the mission of TxDOT.

4. Compare transportation corporations and road utility districts with other approaches designed to encourage private sector support in the provision of roads.

IMPLEMENTATION PLAN:

Upon completion of this study, the Administration of the Department will be briefed and modification of the rules governing creation of corporations and districts may be modified. An executive report summarizing the study may be useful upon completion.

STUDY PROGRESS:

Objectives 1 and 2 have been completed. Work on Objective 3 will be completed in July. Interviews with appropriate non-TxDOT personnel on road utility districts is the key element remaining. Objective 4 work is nearly completed. All tasks will be completed by August 31, 1992.

STUDY TITLE: FINANCING ALTERNATIVES FOR TEXAS HIGHWAYS

STUDY NUMBER:	TTI 1277
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	McFARLAND W
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	ART ELLIOTT, D-7
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 88,000	TOTAL EXPENDITURES: 57,063
FY 92 BUDGET: 88,000	FY 92 EXPENDITURES: 57,063
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

State budgetary constraints necessitate consideration of alternative revenue sources. Traditional funding sources do not always keep pace with servicing needs of the state highway system. A variety of alternative financing methods have been used successfully throughout the country and the question arises as to the appropriateness and potential effectiveness of these alternatives in Texas. The elements of the different alternatives vary considerably according to the jurisdiction where implemented. Thus, it is necessary to understand the factors that contribute to their successful implementation.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify and classify the alternative financing methods that have been used.

2. Identify the significant factors, issues, and constraints that affect their implementation and relate these issues to procedures and practices in Texas.

3. Analyze the benefit principle as applied to taxation in Texas.

IMPLEMENTATION PLAN:

Current funding for TxDOT relies heavily on fuel tax revenues which are unstable and inadequate to meet the future transportation needs of the state. This research will provide the department with options as to what is the best mix of taxes and fees for Texas. This study will provide the basis for legislative initiatives in the 73rd Texas Legislative session to rectify present problems with funding and provide innovative means of financing highway needs.

STUDY PROGRESS:

A comprehensive listing of alternative revenue sources has been prepared, including variations on different types of highway taxes that are being used by different states. Alternative revenue sources are being compared and evaluated based on the most important criteria garnered from the literature. The benefit principle as used in highway finance has been analyzed and will be discussed in the final report. Several references dealing with the implications of energy policy and the Clean Air Act have been reviewed, and their implications for future revenue sources are continuing to be evaluated.

STUDY TITLE: DEVELOPMENT OF ANALYTICAL TOOLS FOR EVALUATING OPERATIONS OF LIGHT RAIL AT GRADE WITHIN AN URBAN SIGNAL SYSTEM

STUDY NUMBER:	TTI 1278
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	WALTERS C,FAMBRO D
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	ED COLLINS, D-11
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 240,000	TOTAL EXPENDITURES: 35,864
FY 92 BUDGET: 80,000	FY 92 EXPENDITURES: 35,864
FY 93 BUDGET: 80,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Several Texas cities are moving forward with the planning and development of light-rail transit. Since underground or elevated lines are costly, the development of at grade light rail is being considered in many areas. These rail lines must fit into the existing urban street network. There is a need to analyze the effects light rail transit will have on traffic signals and vice versa, so that informed decisions may be made on optimum signal system operation.

OBJECTIVE(S):

The objectives of this study are to:

1. Assemble an advisory panel to guide the study.

2. Evaluate analytical methodologies or models currently in use for the operations of existing light rail within signalized systems and prepare a report.

3. Select a representative sample of study cities, including at least one with a mature, extensive light rail system, and obtain operational data for these systems.

4. Using the models, compare predicted operations for these systems with actual observed operations and assess the reliability of those models. Prepare a report on these findings.

5. Using the most reliable model, refine it to include traffic operations within the signalized network under various types of patterns and control strategies.

6. Test and calibrate the refined model using data from the study cities.

7. Develop a reference guide with operational evaluation procedures for use in planning, design, operation, or review of light rail systems within signalized networks.

IMPLEMENTATION PLAN:

It is planned that analytical tools in the form of a computerized methodology and an accompanying reference manual will allow department

personnel to identify locations where at-grade light rail operations present a high potential for traffic disruption, and to test alternate means of mitigation. Field testing of the analytical tools will be appropriate and available due to the number of light rail systems under consideration in Texas. Input from the professional community will ensure these products are useful to traffic and transit personnel.

STUDY PROGRESS:

The state-of-the-art review has been completed. Assembly of and communication with the Advisory Panel is underway, although some members remain to be appointed. Meetings held with the Advisory Committee have helped identify evaluation methodologies to pursue, identify the assets and the constraints involved in each, and better define what is needed in a preferred evaluation methodology.

Thirteen cities have been contacted in efforts to collect and evaluate existing methodologies. Final selection of candidate cities will be made after July 21, 1992, and these facilities will be observed in operation. Some simulation models are currently being tested for the feasibility of including light rail parameters.

STUDY TITLE: AIR POLLUTION IMPLICATIONS OF URBAN TRANSPORTATION INVESTMENT DECISIONS

STUDY NUMBER:	TTI 1279
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	KRAMMES RA
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	WAYNE YOUNG, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 330,000	TOTAL EXPENDITURES: 74,393
FY 92 BUDGET: 94,000	FY 92 EXPENDITURES: 74,393
FY 93 BUDGET: 145,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

In Texas, Dallas/Fort Worth, Beaumont/Port Arthur, El Paso, and Houston/Galveston are non-attainment areas for one or more pollutants as defined by the Clean Air Act Amendments of 1990. To prepare for compliance with the current legislation, a reassessment of transportation control measures, transportation/air quality planning procedures, and emissions/air quality analysis tools is needed.

OBJECTIVE(S):

The objectives of this study are to:

1. Review the potential impacts of the Clean Air Act Amendments of 1990 on TxDOT.

2. Review and synthesize available transportation measures.

3. Review and synthesize other states' policies and practices on mobile source emissions (MSE).

4. Assess the contribution of MSEs to urban air quality.

5. Assess the role of vehicle and fuel technologies in reducing MSEs.

6. Assess available analysis tools for estimating MSEs and vehicle miles traveled.

7. Develop improved analysis capabilities for estimating MSEs and vehicle miles traveled.

8. Conduct case studies in the Beaumont/Port Arthur and El Paso non-attainment areas.

IMPLEMENTATION PLAN:

The results of the sensitivity analysis will be used to prepare presentations to Metropolitan Planning Organizations (MPO) demonstrating that TxDOT projects will have a positive effect on air quality in non-attainment areas. The results will serve as a basis for judging the air quality merits of various projects, and will be a major asset in gaining MPO approval to construct a project.

STUDY PROGRESS:

Work continues on Objective 1, as the researchers continue to monitor EPA and TRB communications. Objective 2 is complete. Objective 3 is complete. Work on Objective 6 has been directed primarily to updating, testing, and evaluating IMPACT. IMPACT has been upgraded to incorporate Mobile 4.1 to obtain emission rates by vehicle mile and speed, vehicle start-up emissions, vehicle hot-soak emissions, etc. EPA approval of IMPACT has been sought, and problematic issues will attempt to be resolved.

Work will begin on Objective 4 in July 1992, following the Texas Air Control Board's completed emission inventories. Work will begin on Objective 7 during the last quarter of FY 92.

Two interim reports will be submitted by August 31, 1992, covering transportation control measures and other states' policies and practices.

STUDY TITLE: HIGHWAY PRIVATIZATION IN TEXAS

STUDY NUMBER:	CTR 1281
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	EURITT MA,HARRISON R,MACHEMEHL R,JARRETT J,WALTON CM
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JOHN BLAIN, DIST 18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 168,000	TOTAL EXPENDITURES: 77,299
FY 92 BUDGET: 84,000	FY 92 EXPENDITURES: 77,299
FY 93 BUDGET: 84,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

TxDOT, like many state DOTs, is faced with limited resources for addressing a growing number of transportation needs. There is a new federal policy which encourages private sector participation in owning, planning, financing, building, maintaining and managing transportation facilities. A number of states are exploring privatization of highways and facilities. Research is needed to determine the potential impact of these changes for Texas.

OBJECTIVE(S):

The objectives of this study are to:

1. Explore and identify a range of privatization strategies appropriate to the TxDOT mission, including private ownership and operation, public ownership and private operation, public ownership and joint operation.

2. Provide the information and methodology with which TxDOT can identify highway facilities that could be effectively constructed, maintained, or operated by the various privatization strategies, freeing public resources for use in other areas.

3. Describe the potential financial impact of privatization on the Texas State Highway Fund.

4. Develop a data set which characterizes the experiences of Texas and other states with toll facilities and particularly privately constructed and/or operated facilities. A significant portion of this data set will include a comparison of traffic demand forecasts and actually experienced traffic demand for a variety of facilities.

IMPLEMENTATION PLAN:

The research project results could identify alternates for privatization that could affect the current method of constructing, operating and maintaining transportation facilities in Texas utilizing the private sector to a greater extent.

STUDY PROGRESS:

The literature review is complete, but events will be monitored and incorporated. An interim report is being prepared based on the literature review and will be submitted at the end of FY 92. Work has begun on data collection from existing privatized facilities and on the identification of privatization strategies.

STUDY TITLE: INCREASING MOBILITY AND ECONOMIC DEVELOPMENT THROUGH MULTIMODAL CENTERS

STUDY NUMBER:	CTR 1282
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	EURITT MA,HARRISON R,WALTON CM
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JOE IMPEY, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 136,970	TOTAL EXPENDITURES: 61,987
FY 92 BUDGET: 66,970	FY 92 EXPENDITURES: 61,987
FY 93 BUDGET: 70,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Multimodal transportation centers provide a more efficient transfer of passengers from one mode to another and reduce transportation costs through shared facilities. Multimodal centers may also stimulate local economies. By increasing volume in a single area, a common station may attract businesses and services that a single modal facility may not attract because of less volume. More information is needed to determine the potential impact of multimodal centers on Texas mobility and economic development.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify the critical transportation links for the various modes of transportation in Texas.

2. Evaluate the impact of multimodal transportation centers in other areas on mobility and economic development.

3. Identify areas and opportunities for more effective multimodal coordination in Texas, including an analysis of costs and other economic impacts.

IMPLEMENTATION PLAN:

The results of this study would facilitate a policy design, by the department, on further pursuit of the concept of developing such facilities. This information could also serve as an influence on other public and private transportation providers in formulating their decision on this subject.

STUDY PROGRESS:

The principal focus of this first year has been on studying other city, state, and national experiences with multimodal operations. An interim report will be submitted at the end of FY 92. During the next six months work will begin on identifying key issues affecting multimodal centers and on identifying critical intermodal transportation links in Texas.

STUDY TITLE: CLOSURE OF THE GIWW AND ITS IMPACT TO THE TEXAS HIGHWAY TRANSPORTATION SYSTEM

STUDY NUMBER:	TTI 1283
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BURKE D,ROOP S
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JIM RANDALL, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 182,000	TOTAL EXPENDITURES: 88,160
FY 92 BUDGET: 91,000	FY 92 EXPENDITURES: 88,160
FY 93 BUDGET: 91,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The Gulf Intracoastal Waterway System (GIWW) extends 426 miles along the Texas coast and connects with other waterway networks throughout southern and middle America. It is estimated that 20 percent of Texas gross state product is tied to water transportation and that as much as three quarters of Texas' goods are shipped by water. Water transport is energy efficient, less expensive than even railroads in cost per ton shipped. Several studies have investigated the direct and indirect impact of the GIWW on the Texas economy, but no study has developed an assessment of the impact of the GIWW on the Texas Highway System.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify possible and likely events resulting in interruption of services on the GIWW.

2. Develop location "zones" along the canal within which to assess interrupting events.

3. Determine the inventory of existing or expected alternative shipping options to which traffic would shift. Develop a simulation model that distributes freight traffic across alternative routes in accordance with available origin destination and commodity flow data on a zone by zone basis.

4. Perform an impact assessment on the ramifications of identified modal shift scenarios from the GIWW onto Texas highways. The assessment would include estimates of increases in energy use, predicted increased hazardous material transport and resulting safety issues, documentation of expected traffic pattern changes, and predicted increases in maintenance and repair expense to Texas highways.

IMPLEMENTATION PLAN:

The implementation of results is expected to take the form of a contingency plan that enables TxDOT to evaluate interruption of service scenarios for both short and long term interruptions. The contingency plans will be based upon a type of input-output model developed to evaluate service interruption type, location, and to predict likely consequences. The final report will be distributed to the five coastal districts and to Austin

division personnel for contingency planning in the event of a waterway closure.

STUDY PROGRESS:

Work on Objective 1 is complete. Work continues on Objectives 2 and 3. Data has been collected that defines the transportation alternatives to waterborne transport on the GIWW, including rail, ocean, and surface modes. Detailed origin and destination data for predominant commodity types has been obtained and is being used to investigate potential freight shift patterns along the Texas coast. Accident history of the GIWW and related closings has also been investigated.

STUDY TITLE: EVALUATION AND DEVELOPMENT OF VISUALIZATION TECHNOLOGY FOR HIGHWAY TRANSPORTATION

STUDY NUMBER:	TTI 1284
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LANDPHAIR HC
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	DERRELL COOPER, D-19
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 69,867	TOTAL EXPENDITURES: 43,651
FY 92 BUDGET: 69,867	FY 92 EXPENDITURES: 43,651
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Projects to improve and expand the state's highway transportation system are increasingly complex and often slowed or even stopped by adverse public reaction. The increased resistance, particularly in urban/suburban areas, is a function of the need for complex grade separated interchanges, elevated highway sections, increased regulation and concern for the environment. Computer and video visualization technologies offer one means of effectively addressing these problems.

OBJECTIVE(S):

The objectives of this study are to:

1. Work with the TxDOT Division of Automation to determine the department's needs for visualization capabilities.

2. Evaluate current graphic capabilities and their translatability as base material for visualization applications.

3. Develop the most cost efficient means to meet state and district visualization needs as determined in Objective 1.

4. Develop pilot visualization application and make recommendations for further development as required.

IMPLEMENTATION PLAN:

The results of this development could have the specific effect of changing the methods and materials used in design presentations, public hearings, and litigation proceedings. The ability to communicate the details of proposed complicated transportation projects in a more effective manner is absolutely essential in today's environment of increased public involvement and litigation concerns.

STUDY PROGRESS:

Work is complete on summarizing TxDOT's visualization needs and reviewing existing resources. Work in progress includes developing a visual communication component and gathering statistical data for a cost/benefit analysis. No study extension will be required to complete this project.

STUDY TITLE: AN ASSESSMENT OF THE FISCAL CAPACITY OF TEXAS CITIES AND THEIR ABILITY TO MEET LOCAL STREET CONSTRUCTION AND MAINTENANCE NEEDS THROUGH YEAR 2000

STUDY NUMBER:	TTI 1307
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LUKER W
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	LEWIS LEFEVRE, D-7
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 230,000	TOTAL EXPENDITURES: 75,152
FY 92 BUDGET: 95,000	FY 92 EXPENDITURES: 75,152
FY 93 BUDGET: 100,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-01-09
TERMINATION DATE:	T94-02-28

PROBLEM STATEMENT:

Cities in the northeastern and midwestern U.S. are witnessing a decline in their fiscal capacities. As a result, expenditures for services and infrastructure developments have decreased. Some signs indicate that these problems are beginning to occur in Texas cities. A thorough understanding of the causes and consequences is needed if policy makers are to devise appropriate and timely remedies.

OBJECTIVE(S):

The objectives of this study are to answer the following questions.

1. Have Texas cities witnessed a decline in their fiscal capacities, and if so, what caused this decline?

2. What effect has this had on their ability to maintain and improve roads and streets, and what is the actual condition of their streets?

3. What effect has this decline had on shifting services to TxDOT?

4. Can the fiscal capacity of the cities be expected to increase or decrease in the future and how will this affect their ability to maintain or improve their urban transportation systems?

5. What are the spending and planning priorities of local street/transportation departments and how does this impact TxDOT policies and plans?

IMPLEMENTATION PLAN:

Results of this research may be included in department-wide plans and advance policy changes if appropriate. The comprehensiveness of the study has significant implications for planning, policy making and budgeting. It is important that the current and future roles of the department and cities be examined.

STUDY PROGRESS:

Literature searches have been completed and the samples of cities and counties have been selected for study. This sample comprises all of the Metropolitan Statistical Areas (MSA) within Texas, all of the core and fringe metropolitan county governments found within the boundaries of those MSAs, several smaller cities and counties not currently within an MSA, and all rural counties in Texas with an urban population of at least 2,500.

Study staff is collecting the fiscal and socioeconomic data necessary to calculate changes in fiscal capacities over the last three decades. A survey is being prepared for cities and counties, which aims at collecting the extent of local responsibility for streets and roads, as well as the conditions of local roadways.

STUDY TITLE: NEW EVALUATIONS OF LIQUIDATED DAMAGES, MOTORIST LIQUIDATED DAMAGES, AND PERCENT RETAINAGE

STUDY NUMBER:	TTI 1310
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	McFARLAND WF,KRAMMES RA
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	HOWARD JOHNSON, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 194,000	TOTAL EXPENDITURES: 70,830
FY 92 BUDGET: 88,000	FY 92 EXPENDITURES: 70,830
FY 93 BUDGET: 106,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Previous research by TxDOT indicates that project completion times and total project costs can often be reduced by charging the contractors higher liquidated damages. Accurately estimating liquidated damages for project overruns is becoming increasingly important as motorist costs begin to be included in the liquidated damages schedules. There are several contracting strategies that need to be more fully evaluated.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop criteria for evaluating alternative contracting strategies and make comparisons of the advantages and disadvantages of these strategies for different types of projects and situations.

2. Evaluate ongoing and completed projects that use alternative bidding strategies, percent retainage provisions, high liquidated damages based partially on user costs, and other alternatives for reducing project completion times.

3. Evaluate techniques for estimating user costs during construction for different types of projects and situations.

4. Evaluate the state of knowledge of effects of contract completion time on businesses and determine if this should be used as justification of increased liquidated damages or other alternatives on some projects.

IMPLEMENTATION PLAN:

The strategies for determining liquidated damages may change as a result of this study. A policy statement may be needed to set forth a new approach for handling of liquidated damages. Specification changes may need to be initiated.

STUDY PROGRESS:

Several contracting alternatives were identified and information was gathered on each. Criteria for comparing alternative strategies have been identified, and criteria have been identified for selecting case study projects. Several existing computer programs are being reviewed and compared for use in estimating motorist costs.

STUDY TITLE: TRUCK TRAFFIC IN LAREDO, TEXAS - A CASE STUDY OF ISSUES AND REMEDIES

STUDY NUMBER:	CTR 1312
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	HARRISON R,HUDSON WR,MCCULLOUGH BF
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JON UNDERWOOD, D-10
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 88,126	TOTAL EXPENDITURES: 18,750
FY 92 BUDGET: 43,339	FY 92 EXPENDITURES: 18,750
FY 93 BUDGET: 44,787	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-02-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The recent development of industrialized centers in northern Mexico combined with the emerging Free Trade Agreement is greatly increasing the volume of freight crossings at key points on the South Texas-Mexico border. Little is known about the routing, destination, commodity carried, and axle loads of vehicles that cross into Texas border cities. Such data are needed to provide a factual basis for designing, maintaining, operating, and rehabilitating the Texas transportation infrastructure.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify the scale of truck traffic impacts, first at crossing sites along the South Texas border, then in detail at the City of Laredo.

2. Use the data collected on weight and traffic distributions to develop alternative policies to address the problem.

3. Determine a pilot program to be tested at Laredo to handle the routing of truck traffic. This pilot program could also be applied to other key border crossing sites.

IMPLEMENTATION PLAN:

The research findings will be shared during meetings with TxDOT Administration, local officials in Laredo. A single report will be produced which will be suitable for public dissemination. This information will help TxDOT develop alternative programs for dealing efficiently with the increasing supply of loaded trucks.

STUDY PROGRESS:

Secondary data has made apparent the importance of intermodal elements. However, the focus remains on truck traffic. Three trips to Laredo have been made to examine bridge, customs, and border patrol operations. A survey of truck operators, freight consolidators, brokers, TxDOT personnel, etc., has been made to collect essential basic data. TTI researchers have been contacted to coordinate information from study 2034. Data have been collected on flows in Mexican border states, as well as the City of Nuevo Laredo. Data have been obtained on the plan for linking Solidarity Bridge with the industrial centers in the state of Monterrey. In addition,

flow along the Mines Road and along a potential toll road route to I-35 are being considered as part of this evaluation. Bridge data have been collected in terms of movements and revenue and the formation of the city street reconstruction fund. This will be the basis of the revenue source for the cost recovery mechanism. The program RENU has been identified as a possible pavement model to be used to determine deterioration within city networks.

STUDY TITLE: THE IMPACT OF A U.S-MEXICO FREE TRADE AGREEMENT ON THE TEXAS HIGHWAY NETWORK

STUDY NUMBER:	TTI 1317
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LUKER W,BURKE D,MEMMOTT J
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	MANNY AGUILERA, DIST 24
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 210,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 106,800	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

The impact of expanded U.S.-Mexico trade and the growth of the maquiladora manufacturing industry, as well as the proposed North American Free Trade Agreement (NAFTA), on Texas highways and the Texas economy needs to be identified. The continued growth of maquiladora operations, the potential costs and benefits of NAFTA, long term consequences for state transportation revenues, and effects on the Texas highway infrastructure need to be quantified.

OBJECTIVE(S):

The objectives of this study are to:

1. Estimate the impacts to date on the Texas economy and transportation system that have resulted from U.S.-Mexico trade.

2. Forecast the economic impacts on Texas of the proposed NAFTA.

3. Forecast, for the short and long term, the effects of NAFTA on the volume of truck and passenger traffic along the major transportation corridors of Texas, with particular attention on pavement damage, maintenance, and rehabilitation costs, user's costs, etc., as well as forecasts for new location of highways.

IMPLEMENTATION PLAN:

In order to be able to plan for the near and distant future, information on all types of transportation needs and deficiencies will need to be available to TxDOT. Coordination with on-going research studies must be maintained in order to maximize the benefits. Clear and understandable results, presented in the research report, will help TxDOT personnel prepare for the future.

STUDY PROGRESS:

STUDY TITLE: DISPOSAL OF HAZARDOUS WASTE MATERIALS
FROM TxDOT ACTIVITIES

STUDY NUMBER:	TTI 1318
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LITTLE D,STALLARD W,CORAPCIOGLU M,YEUNG A
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	OTIS JONES, DIST 8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 327,266	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 109,266	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

While fulfilling its responsibilities, TxDOT handles a variety of hazardous substances and solid wastes. Public concern and stringent federal and state regulations have a great impact on the current and future operations of TxDOT. This project will develop a set of tools to aid managers at TxDOT in constructing management plans for the variety of waste streams generated by TxDOT.

OBJECTIVE(S):

The principal objective of this project is to develop an overall methodology to assess the environmental implication of construction, operation, and maintenance activities and to develop integrated management plans for waste reduction, handling, and disposal. This methodology will include a database of TxDOT activities, the waste materials and quantities associated with those activities, and appropriate waste management techniques for the various waste streams. A set of planning tools, such as computer software systems, will be provided.

IMPLEMENTATION PLAN:

This study will provide TxDOT with flexible and up-to-date management strategies related to hazardous and toxic substances. In order to be fully implemented, training materials for use in workshops would need to be developed at the conclusion of the project. Production of a field manual that covers management strategies, policies and procedures for handling hazardous substances would be valuable.

STUDY PROGRESS:

STUDY TITLE: MULTI-MODAL PLANNING AND THE U.S.-MEXICO FREE TRADE AGREEMENT

STUDY NUMBER:	CTR 1319
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	HARRISON R,LEE C,STOLP C,BOSKE L
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	MANNY AGUILERA, DIST 24
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 360,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 137,194	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

The growth in U.S.-Mexico trade over the past five years has been dramatic. One strategy to manage the traffic flows more effectively is to develop multi-modal centers where cargo and passengers can be switched to more efficient modes. The key objective of this study is to determine categories of multi-modal centers which can be developed along the border to facilitate trade and protect the transportation infrastructure while offering competitive costs and efficient levels of service.

OBJECTIVE(S):

The objectives of this study are to:

1. Gather infrastructure, demographic, and economic data and prepare a series of infrastructure databases.

2. Develop a series of scenarios covering the most likely configurations of the free trade agreement (FTA) on which to base traffic forecasts.

3. Survey existing facilities of all modes in Mexico and Texas.

4. Predict short and long term impacts of traffic, and identify shortcomings in modal investment levels.

5. Investigate bi-national transportation planning for all modes.

IMPLEMENTATION PLAN:

In order to maximize the benefit of TxDOT, close coordination must be maintained with other on-going research studies such as TTI 1317, CTR 1312, and CTR 1924, etc. In order to adquately plan for the near and distant future, information on all types of transportation needs and deficiencies will need to be identified. Clear and understandable research results presented in the study report will help TxDOT prepare for the future impacts of trade with Mexico.

STUDY PROGRESS:

STUDY TITLE: THE ECONOMIC SIGNIFICANCE OF TRANSPORTATION EXPENDITURES IN TEXAS

STUDY NUMBER:	TTI 1320
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	McFARLAND W
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	CORNELL WAGGONNER, DIST 10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 332,800	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 103,400	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

Past research has shown that highway improvements benefit a locality's economy and quality of life. Legislators and the general public need to be made aware of the economic significance of transportation in the Texas economy. One way to demonstrate the significance of transportation expenditures is to develop updated estimates of the total money spent by motorists and businesses on transportation. Another method is to perform rate of return studies.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop rates of return on highway investments at the state and district levels, using Highway Performance Monitoring System (HPMS) data.

2. Estimate transportation expenditures by transport mode for Texas.

IMPLEMENTATION PLAN:

The economic effect of transportation improvements could be used to influence the selection and prioritization of highway systems. Clear, understandable, and applicable results presented in the study report will help TxDOT inform, influence, and aid the legislature, public, and administrators in decision processes involving levels of financing, location of systems, and prioritization of system development.

STUDY PROGRESS:

STUDY TITLE: USE OF CONGESTION PRICING FOR REDUCING URBAN CONGESTION, AS A REVENUE SOURCE, AND COMPLIANCE WITH THE CLEAN AIR ACT

STUDY NUMBER:	CTR 1321
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MAHMASSANI HS,WALTON CM
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JACK FOSTER, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 150,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 70,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

The general rise of congestion on Texas highway networks has only been slowed, not reversed, by substantial expenditures for increased capacity. A promising method to make a significant change is through the use of congestion pricing, generally tolls, during heavily congested periods. This encourages motorists to use the facility when costs are lower (less congested), make use of other modes, or forgo the trip completely. This strategy could also be used as a revenue source and as a method to comply with Clean Air Act (CAA) provisions.

OBJECTIVE(S):

The objectives of this study are to:

1. Examine the feasibility of road pricing as a measure to reduce congestion and comply with the CAA.

2. Review experience to date with congestion pricing, as well as proposed projects, and assess their applicability to Texas.

3. Examine the technologies and policies that can be most effective in implementing road pricing in Texas.

4. Develop a procedure for the determination of "optimal" prices, considering time-of-day variation in demand and network effects.

5. Identify selected candidate locations for possible implementation of congestion pricing.

IMPLEMENTATION PLAN:

This study is a feasibility study so actual implementation may not occur if it is found that congestion pricing is not feasible in Texas. Should implementation occur, extensive public education would have to be conducted, as well as overcoming any statutory hurdles.

STUDY PROGRESS:

STUDY TITLE: AN EVALUATION OF THE STATUS, EFFECTIVENESS AND FUTURE OF TOLL ROADS IN TEXAS

STUDY NUMBER:	CTR 1322
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MACHEMEHL RB,HARRISON R,EURITT M,WALTON CM
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	PEGGY THURIN, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 198,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 97,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

TxDOT is currently developing policies, based on the new ISTEA provisions, which will examine the feasibility and opportunities for toll road facilities in the state. This is particularly crucial given the projected shortfall in the fiscal base for the funding of the transportation infrastructure. Accordingly, this study will address the status, effectiveness and future of toll roads in Texas.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop an inventory of experiences with toll roads for Texas, and other selected regions.

2. Identify the conditions which are necessary for successful toll road operations.

3. Identify infrastructure linkages where a toll road provision would benefit highway users, including inter-city links and truck-only facilities.

4. Develop concise recommendations regarding the provision of toll road infrastructure in Texas.

IMPLEMENTATION PLAN:

The results of this study can be used by TxDOT personnel who perform policy and planning tasks. It will provide information required to make decisions regarding the state's participation in toll road facilities. The final report will be distributed to TxDOT personnel to be used as a basis for decision making on toll roads.

STUDY PROGRESS:

STUDY TITLE: EVALUATION OF THE WEIGHT TOLERANCE PERMITS AUTHORIZED IN HOUSE BILL 2060

STUDY NUMBER:	TTI 1323
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	CROCKFORD WW
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	BERT LUNDELL, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 112,077	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 112,077	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

In 1989, the Texas legislature authorized the issuance of annual permits allowing commercial motor vehicles to operate nonagricultural vehicles exceeding the mandated axle weight by 10 percent and the gross vehicle weight by 5 percent. The potential impact of this legislation on safety, economics, and infrastructure maintenance must be assessed. The permit regulations and fee structure must be evaluated in light of that assessment.

OBJECTIVE(S):

The objectives of this study are to:

1. Perform a detailed analysis of the text of the legislation to identify both legal and technical issues of concern.

2. Review theoretical and empirical studies to predict impacts on safety, economics, and infrastructure maintenance.

3. Demonstrate the effects of changes in axle loads on pavements.

4. Interact with appropriate agency and industry personnel.

5. Provide recommendations in a form suitable for use in educating the public, legislators, public servants, and administrators on the subject and the impacts of the legislation. Produce technical documentation in support of recommendations.

IMPLEMENTATION PLAN:

The results of this study will provide the basis for corrective legislation; this legislation might allow TxDOT to load zone roads and bridges and prohibit their use under this permit. Another objective would be a permit fee equitably allocated between TxDOT and counties to compensate for the additional deterioration of pavements.

As soon as the project is completed, TxDOT will develop a legislative proposal based on the project findings. A well documented brochure and short video documentary would be ideal in communicating the problem and the desired solution.

STUDY PROGRESS:

STUDY TITLE: ENHANCED PUBLIC EDUCATION CAMPAIGN FOR ETHNIC GROUPS AND SPECIAL AUDIENCES

STUDY NUMBER:	CTR/TSU 1324
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH AND TEXAS SOUTHERN UNIVERSITY
STUDY SUPERVISOR(S):	ANCHONDO JJ,WITHERSPOON P,LEWIS C,LEDE N
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	MICHELLE BIBBY, D-14
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 321,656	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 159,796	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

TxDOT has identified several areas of its operations that will present new challenges in the 1990s. One of these challenges is to increase the effectiveness of TxDOT's internal and external communication, with particular emphasis on racial and ethnic groups, women, and other special audiences with which TxDOT interacts on a regular basis.

OBJECTIVE(S):

The objectives of this study are to:

1. Help improve organizational morale in TxDOT by facilitating awareness of the advantages of diversity within the organization.

2. Help improve organizational productivity by facilitating awareness of the importance of effective communication within an organization in all its forms - oral, written, and electronic.

3. Help improve perceptions of TxDOT among its major internal and external target audiences.

IMPLEMENTATION PLAN:

The specific impact of this study will be to enhance current practices that work to promote a positive agency image and identify additional practices to be implemented to facilitate the world-class image TxDOT deserves. The researchers will develop a Public Education Campaign and an internal communication program. Special products used for these campaigns may include brochures, pamphlets, video tapes, and training course development.

STUDY PROGRESS:

STUDY TITLE: VALUE OF ACCESS RIGHTS

STUDY NUMBER:	CTR 1325
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MACHEMEHL R,HARRISON R,JARRETT J
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JEFF PORTER, D-15
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 184,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 91,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Recent court rulings may require new definitions of the value of property owners' rights of access to public highways. The potential cost to TxDOT and the public of paying for such rights could be very large, as litigation related to condemned property obtained under eminent domain is rapidly increasing. Data and methods should be developed for assessing and defending estimates of the values of these rights.

OBJECTIVE:

The objectives of this study are to:

1. Provide information and methodology with which TxDOT can quantify the economic value of access to typical street and highway functional classes.

2. Develop a methodology for assessing the economic value of modified or reduced property access during construction periods.

3. Provide a compendium and interpretation of judicial findings regarding private property access rights and public compensation.

IMPLEMENTATION PLAN:

Once a methodology for valuating access rights has been developed and confirmed, it should be provided to TxDOT's appraisal staff and recommended for use by contracted appraisers. It should also be provided to TxDOT's negotiators and to the Attorney General's Office for their use in providing complete explanations of the valuation. In time, the methodology could be used for estimating the right-of-way cost of a proposed project.

STUDY PROGRESS:

STUDY TITLE: SOCIAL, ECONOMIC AND ENVIRONMENTAL EFFECTS OF ELEVATED AND DEPRESSED FREEWAYS

STUDY NUMBER:	TTI/TSU 1327
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE AND TEXAS SOUTHERN UNIVERSITY
STUDY SUPERVISOR(S):	BUFFINGTON J,WOMAK J,McCULLY W,BULLIN J, ZIMMER R, LEWIS C
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JOHN KELLY, DIST 18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 427,766	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 169,082	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

TxDOT is continually upgrading the existing highway system in the state, especially in urban and suburban areas. The current trend in design is toward elevated and depressed sections to gain additional lanes. Even though many sections of elevated and depressed freeways have been built over the years in Texas, more questions are being raised by abutting or nearby residents and businesses about the possible impacts of such freeways.

OBJECTIVE(S):

The objectives of this study are to:

1. Determine the appropriate estimating procedures or models and mitigation measures to estimate the social, economic and environmental effects of elevated and depressed freeways.

2. Estimate the social, economic and environmental effects of several existing, contracted and proposed elevated and depressed freeway sections in urban areas and recommend a final set of impact estimating procedures for use by TxDOT.

IMPLEMENTATION PLAN:

It is very important that TxDOT have valid, documented, objective criteria on which to base analysis of the anticipated environmental impacts of freeway configuration alternatives. It is anticipated that this research can result in a reference tool appropriate for use in the preparation of future environmental assessments and environmental impact statements. Intermittent follow-up for a decade or so may be quite useful in refining and verifying the developed methodology.

STUDY PROGRESS:

STUDY TITLE: LEASING OF TxDOT's RIGHTS-OF-WAY

STUDY NUMBER:	TTI 1329
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ROOP S
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	CARLTON BERNHARD, D-15
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 90,000	TOTAL EXPENDITURES:
FY 92 BUDGET:	FY 92 EXPENDITURES:
FY 93 BUDGET:	FY 93 EXPENDITURES:
DATE BEGUN:	92-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

In 1987, TxDOT received authority from the Texas Legislature to lease any part of the highway right-of-way that is not needed for highway purposes. TxDOT may also lease any real property held or controlled by the agency. These actions were taken to generate as much revenue as possible for the state highway fund.

OBJECTIVE(S):

The objectives of this study are to:

1. Document and examine TxDOT right-of-way leasing policies, practices, and guidelines relative to state needs and the practices of other states.

2. Identify and analyze potential users of Texas' rights-of-way by categorizing the active customer base in other states.

3. Examine the cost-to-revenue ratio for existing leases within TxDOT in order to assess the need for a minimum fee for right-of-way leases.

4. Examine staffing levels of other state DOTs relative to the number of leases managed and the dollar amounts generated. This will result in projected staffing needs for TxDOT.

IMPLEMENTATION PLAN:

Several facets of the research will examine policies and practices, marketing strategies, and staffing. The results will specifically create a tangible product to evaluate, revise, or enhance current TxDOT practices based on other states' experiences. This should be especially useful in the development of marketing strategies.

STUDY PROGRESS:

STUDY TITLE: DEVELOP AIR QUALITY DATA FOR FEDERAL SUBMISSION

STUDY NUMBER:	TTI 1375
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	DRESSER G
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	PEGGY THURIN, D-10
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 130,000	TOTAL EXPENDITURES: 26,125
FY 92 BUDGET: 60,000	FY 92 EXPENDITURES: 26,125
FY 93 BUDGET: 75,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-04-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The Federal Clean Air Act Amendments (CAAA) of 1990 require that states and Metropolitan Planning Organizations (MPO) perform a variety of transportation planning activities directed toward improving air quality. The CAAA contains time schedules for activities and sanctions should those activities not be performed. This study shall provide professional and technical staff services to TxDOT D-10 in performing those transportation-air quality planning activities required by the CAAA and EPA.

OBJECTIVE(S):

The objectives of this study are to:

1. Investigate the data required by the CAAA and EPA and evaluate available methodology for developing the required data. Where required, develop new methodologies.

2. Assist TxDOT and non-attainment MPOs in preparing and documenting transportation air-quality data as required.

3. Coordinate activities with staff of TxDOT, FHWA, the Texas Air Control Board (TACB), EPA, and the four non-attainment MPOs in Texas.

4. Assist TxDOT in developing documentation of procedures used to validate urban area travel demand models, as well as the models themselves.

IMPLEMENTATION PLAN:

The results of this research will allow TxDOT and the affected MPOs to meet the deadlines specified by the EPA. The results of this report will be used by TxDOT and the MPOs in their submittal to FHWA and EPA for approval of the transportation improvement programs (TIP).

STUDY PROGRESS:

An evaluation of TxDOT's vehicle miles of travel (VMT) estimates is in progress. Methods have been developed and applied for estimating VMT by functional classification, area type, and vehicle classification. A method was developed and applied for estimating vehicle speed by functional classification and area type for peak and off-peak traffic.

The above procedures were used to prepare data for the El Paso and Beaumont non-attainment areas. The estimates and supporting documentation were provided to the TACB for use in preparing emission inventories for El Paso and Beaumont. Three computer programs have been developed to facilitate the computation of emissions.

STUDY TITLE: TEXAS REFERENCE MARKER PROJECT

STUDY NUMBER:	TTI 1909
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	MAJDI S
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JOEL YOUNG, D-19 and LARRY KITTEN, D-10
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 67,800	TOTAL EXPENDITURES: 35,966
FY 92 BUDGET: 42,300	FY 92 EXPENDITURES: 35,966
FY 93 BUDGET: 25,500	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-03-16
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT: N/A

OBJECTIVE(S):

The objectives of this study are to:

1. Requirements review and planning.
2. Input data processing.
3. Forms generation.
4. Clutter detection.
5. Symbols generation.
6. User interface development.
7. Software integration.
8. Prepare and hold user training.
9. Prepare and hold technical training.
10. Final technical and user documentation.

IMPLEMENTATION PLAN: N/A

STUDY PROGRESS:

STUDY TITLE: COST ALLOCATION PROCEDURE ENHANCEMENT

STUDY NUMBER:	TTI 1910
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BURKE D
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	AL LUEDECKE, D-10
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 17,635
FY 92 BUDGET: 35,000	FY 92 EXPENDITURES: 17,635
FY 93 BUDGET: 50,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	CONTINUING

PROBLEM STATEMENT:

A review of the Texas Highway Cost Allocation study by the Texas Department of Transportation (TxDOT) reveals that the cost allocation procedure can be significantly enhanced by inclusion of the reclassification of pick-up trucks, incorporation of environmental damage in cost allocation and the evaluation of the Trucking Research Institute (TRI) Cost Allocation Methodology Assessment.

OBJECTIVE(S):

The 2D classification includes pick-up trucks, buses, and heavy single-unit trucks. The vehicles are extremely dissimilar in function, gross weight and size. The inclusion of pick-up trucks in the passenger car class would enhance the homogeneity of both classes in terms of the functional and physical attributes.

The American Trucking Association has asserted that pavements undergo environmental damage which should be treated as a common cost in cost allocation studies. A complete examination of environmental damage is proposed.

Evaluate the strong and weak points of the TRI assessment.

IMPLEMENTATION PLAN:

1. Reclassification of pick-up trucks

   (a) recalculation of ESALs for both vehicle classes and
   (b) new computer runs and associated analysis with sensitivity evaluation.

2. Incorporation of environmental damage in cost allocation

   (a) examination and damage assessement of unused Texas pavements,
   (b) inclusion of these findings in the final report,
   (c) inclusion of SHRP study findings, and
   (d) additional computer runs and associated analysis and sensitivity evaluation.

3. Evaluation of the TRI Cost Allocation Methodology Assessment.

STUDY PROGRESS:

STUDY TITLE: THE ECONOMIC IMPACTS OF GENERAL AVIATION FACILITIES

STUDY NUMBER:	CTR 1912
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	JARRETT JE
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	LINDA HOWARD, D-2
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 28,276	TOTAL EXPENDITURES: 3,145
FY 92 BUDGET: 13,483	FY 92 EXPENDITURES: 3,145
FY 93 BUDGET: 14,793	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-02-12
TERMINATION DATE:	T92-12-31

PROBLEM STATEMENT:

A detailed methodology is needed for estimating the economic impact of general aviation facilities in the state of Texas. This methodology would be used to (1) develop objective information; (2) derive general aviation facilities; and (3) prepare a statewide estimate of economic impacts from general aviation throughout the state. During 1991, staff of the Graduate School of Business at The University of Texas at Austin undertook a planning effort to develop and pilot test this methodology. Staff of the Business School, thus, are in an excellent position to carry out the full-scale field tests of the methodology.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify general aviation facilities which represent accurately each of three classes of facilities.

2. Collect detailed information about the economic transactions at each general aviation facility.

3. Determine the economic impacts, both direct and induced, of each airport and for each class of airport.

4. Refine, if necessary, the instruments and methodologies based on the extensive field tests.

5. Prepare statewide estimates of economic impacts for general aviation facilities.

IMPLEMENTATION PLAN:

This project will be the first systematic attempt in Texas to compile objectively economic data on general aviation facilities. In addition to providing Division of Aviation officials with this information, such data can be shared with potential and current sponsors, and TxDOT officials should have more accurate, comprehensive, and useful information as a result.

STUDY PROGRESS:

STUDY TITLE: TEXAS AERONAUTICAL FACILITIES PLAN

STUDY NUMBER:	TTI 1913
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	DRESSER G
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	LINDA HOWARD, D-2
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 65,100	TOTAL EXPENDITURES: 25,720
FY 92 BUDGET: 61,100	FY 92 EXPENDITURES: 25,720
FY 93 BUDGET: 4,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-03-03
TERMINATION DATE:	T92-12-31

PROBLEM STATEMENT: N/A

OBJECTIVE(S):

Update the Texas Aeronautical Facilities Plan.

IMPLEMENTATION PLAN:

1. Operations Counts at Non-towered Airports - The purpose of this task is to monitor operations levels and aircraft mix at non-towered airports to justify and prioritize programmed improvements based on activity levels and to obtain operations and aircraft mix information for selected airports for system planning and master planning purposes.

2. Texas Aeronautical Facilities Plan Update - The purpose of this task is to document aviation and airport facility needs in the state and to prepare and publish general aviation activity forecasts for the state.

3. Management Information Systems Improvements - The purpose of this task to enhance the management information system used in maintaining the 20-year improvement needs at each airport in the TAFP and to automate project cost changes as construction costs vary.

4. Airport Pavement Evaluation and Analysis - The purpose of this task is to continue the program of monitoring pavement conditions at TAFP general aviation airports and to improve the efficient use of airport improvement dollars by identifying deteriorating pavements prior to the need for reconstruction.

5. Regional Planning Meetings - The purpose of this task is to review airport development needs for individual airports with city and county elected officials and staff, airport managers, aviation interest groups, and the general public; to provide information on state and federal programs available to fund airport improvements; and to solicit comments on airport system requirements.

STUDY PROGRESS:

STUDY TITLE: A COST ALLOCATION PROCEDURE ENHANCEMENT

STUDY NUMBER:	CTR 1919
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	WALTON CM
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	AL LUEDECKE, D-10
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 19,539
FY 92 BUDGET: 35,000	FY 92 EXPENDITURES: 19,539
FY 93 BUDGET: 50,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-03-20
TERMINATION DATE:	CONTINUING

PROBLEM STATEMENT:

The Texas Cost Responsibility study provides Texas Deparment of Transportation (TxDOT) with a basis for evaluating the relationship of highway infrastructure costs with the user taxes collected to support the system. Recent legislative enactments require additional improvement and modification to the procedures used in the allocation of costs and revenues.

OBJECTIVE(S):

The cost allocation model developed by the Center for Transportation Research (CTR) and Texas Transportation Institute (TTI) is a tool that can be used to monitor annual changes in this relationship. CTR is responsible, principally, for the user fees and tax analysis and TTI is responsible for the infrastructure cost analysis.

IMPLEMENTATION PLAN:

1. Update Data Base for the Texas Cost Allocation Model - The update will focus on three time periods - the prior year, current year, and the upcoming year. The prior year is the only period where actual data can be collected. The current year will be based on year-to-date estimates and the upcoming year will be a projection. This on-going effort will allow the Department to monitor annual changes in the cost-revenue relationships and be able to respond in a timely manner to legislative or commission inquiries.

   The specific work tasks associated with the update include:

   (a) Collection of vehicle registration data and formatting for model use;
   (b) Collection of transportation descriptor data, i.e., fuel and oil consumption, VMT, vehicle weights, etc.; and
   (c) Gathering state and federal fee schedules and tax rates and incorporate into model.

2. Monitor activities in highway cost allocation.

3. Prepare briefing document for TxDOT.

STUDY PROGRESS:

STUDY TITLE: VIDEO AND DESIGN IMAGERY FOR DISTRICT 12, TxDOT

STUDY NUMBER:	TTI 1925
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LANDPHAIR HC
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	DONALD GARRISON, DIST 12
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 40,704	TOTAL EXPENDITURES: 7,513
FY 92 BUDGET: 40,704	FY 92 EXPENDITURES: 7,513
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

There is an increasing demand to communicate and negotiate public consensus with regard to the location, operation, form, execution and environmental compatibility. Because of this need, more sophisticated and realistic means of communicating design intent will be required. The Houston District 12 is requesting access to the visualization capabilities of TTI and their professional staff to produce imagery, video animation and to assist in the development of in-house capabilities.

OBJECTIVE(S):

The objective of this study is to develop design imagery, produce video presentations and assist in developing design communications capabilities and procedures in response to the specific needs of the district.

IMPLEMENTATION PLAN: N/A

STUDY PROGRESS:

STUDY TITLE: ENVIRONMENTAL CONCERNS IN MAINTENANCE:
A PROACTIVE INITIATIVE

STUDY NUMBER:	TTI 1933
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	McCULLY WG
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	ROY SMITH, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 273,173	TOTAL EXPENDITURES: 126,451
FY 92 BUDGET: 243,269	FY 92 EXPENDITURES: 122,720
FY 93 BUDGET: 50,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-01-08
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

A highway corridor is an extremely visible landscape feature with a high level of exposure to the public. A conflict arises when a highway maintenance practice is considered to conflict (in a real or imaginary way) with an expressed environmental concern. This study will assist TxDOT in developing a proactive approach and procedure to address present and anticipated environmental concerns impacting various highway maintenance operations.

OBJECTIVE(S):

The objectives of this study are to:

1. Prepare an environmental impact statement (EIS) covering the pesticide operations of the Vegetation Management Program.

2. Identify and prioritize, for environmental assessment, all other maintenance practices and materials used by TxDOT.

IMPLEMENTATION PLAN:

The results from this study are expected to enhance TxDOT policies and procedures for systematically incorporating environmental concerns into the planning and operations phases of maintenance. The results from this study presented as an EIS will aid in the development of a proactive posture for dealing with environmental matters affecting maintenance.

STUDY PROGRESS:

Published reports from this study are:

1933-1 "Summary of Scoping Issues for the Environmental Impact Statement on TxDOT's Pest Management Program," 1992.

STUDY TITLE: HIGHWAY PLANNING AND OPERATIONS FOR DISTRICT 18, PHASE 2

STUDY NUMBER:	TTI 1940
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	WALTERS CH
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JOHN BLAIN, DIST 18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 2,950,000	TOTAL EXPENDITURES: 827,550
FY 92 BUDGET: 1,475,000	FY 92 EXPENDITURES: 827,550
FY 93 BUDGET: 1,475,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Innovative approaches are required to accommodate traffic demands in the growing Dallas area.

OBJECTIVE(S):

The objective of this study is to provide support needed to all parts of the Dallas District 18.

IMPLEMENTATION PLAN:

Six major freeway operational studies will be conducted. TTI will assist in the development of freeway High Occupancy Vehicle (HOV) lanes. Technical assistance will be provided for the seven major freeway corridors under design. Assistance will be provided to the North Central Project Office and Regional Planning Office.

STUDY PROGRESS:

STUDY TITLE: PLANNING, DESIGN AND OPERATION OF TRANSPORTATION FACILITIES IN HOUSTON PHASE II

STUDY NUMBER:	TTI 1941
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	McCASLAND WR,MOUNCE JM
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	STEVE LEVINE, DIST 12
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 2,050,000	TOTAL EXPENDITURES: 1,924,830
FY 92 BUDGET: 1,150,000	FY 92 EXPENDITURES: 1,924,830
FY 93 BUDGET: 1,150,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The Houston District 12 is reconstructing the urban freeway system to replace roadways that have reached their effective life, to expand the roadways to accommodate the increasing demand for mobility and to incorporate special use facilities to provide priority operations for high volumes of commuter traffic. TxDOT is utilizing traffic management strategies and techniques to improve the efficiency and safety of existing and new freeways and arterial streets.

OBJECTIVE(S):

The objective of this study is to provide the Houston District Office of TxDOT with staff support to conduct planning, engineering and technical services in the development and management of urban transportation facilities.

IMPLEMENTATION PLAN:

The implementation of the special use facilities, i.e. high occupancy vehicle lanes, will be expedited. Results will be used to adjust approach capacities to traffic demands which will reduce congestion and energy consumption in freeway corridors. The groundwork for the Houston Intelligent Transportation System (HITS) will be laid.

Computer programs will be developed to assist in the operation of a central transportation control center. These programs will allow traffic control personnel to interact with the control system in the performance of their daily operational duties.

STUDY PROGRESS:

STUDY TITLE: MONTANA STREET FEASIBILITY

STUDY NUMBER:	CTR 1942
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	WARD WV,MACHEMEHL RB,LEE CE
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	CHUCK BERRY, DIST 24
STUDY SPONSOR:	TxDOT
TOTAL BUDGET:	TOTAL EXPENDITURES:
FY 92 BUDGET:	FY 92 EXPENDITURES:
FY 93 BUDGET:	FY 93 EXPENDITURES:
DATE BEGUN:	
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Increasing traffic volumes in east El Paso north of IH 10, together with the need for an east-west high volume roadway other than the interstate, create an immediate need for improving Montana Street between Paisano Drive and Loop 375. High density development along the roadway requires that a thorough investigation be utilized to determine the best use of facility types and access locations so that improved service can be balanced with the preservation of land use characteristics.

OBJECTIVE(S):

The objectives of this study are to:

1. Achieve desired Level of Service C or minimum Level of Service D.

2. Maintain compatibility with land use characteristics.

3. Recommend a facility compatible with the "Year 2000 Transportation Plan" and the "2010 Major Thoroughfare Plan."

4. Identify the best facility design and location.

5. Identify preparatory projects within the corridor which will help to reduce congestion during construction of the Montana Street facility.

6. Investigate possible routes between the central business district and Paisano Drive to recommend a facility type for traffic between those points.

IMPLEMENTATION PLAN:

The study will attempt to identify a best possible solution to the area traffic needs and provide rationale for supporting these recommendations.

STUDY PROGRESS:

STUDY TITLE: WATER QUANTITY AND QUALITY IMPACTS ASSESSMENT OF HIGHWAY CONSTRUCTION IN AUSTIN, TEXAS AREA

STUDY NUMBER:	CTR 1943
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MALINA JF,CHARBENEAU RJ
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	TOM WORD, DIST 14
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 1,421,559	TOTAL EXPENDITURES: 76,239
FY 92 BUDGET: 266,677	FY 92 EXPENDITURES: 76,239
FY 93 BUDGET: 397,557	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-03-06
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

The Consent Decree and Judgement issued to TxDOT in January 1990 has halted the proposed construction of MOPAC south of Hannon Lane and the construction of SH45 between Loop 1 and RM1826 due to concern over the impact of the construction on the quality of the water in the creeks and the pollution load of runoff of rainfall from the highway on the Edwards Aquifer. The highway ROW must be established.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop and execute a project that will respond to the "Consent Decree" issued in regards to the construction of the southern extension of MOPAC through the Edwards Aquifer recharge zone.

2. Develop baseline data on quantity and quality of water in creeks upstream and downstream of highway construction sites before construction commenced.

3. Evaluate runoff characteristics of new highway construction and modelling of highway runoff.

4. Evaluate effectiveness of temporary runoff control structures and devices and of the permanent runoff pollution control systems.

5. Evaluate the effectiveness of existing interception and containment methods of silts and pollutants in runoff during rainstorms.

6. Evaluate pollution loads contributed by existing highways in the vicinity of the Barton Springs segment of the Edwards Aquifer recharge zone.

IMPLEMENTATION PLAN:

The findings of this study and resulting data sets will be published in Technical Reports of Center for Research in Water Resources(CRWR) and Center of Transportation Research (CTR). Quality data can be expected because EPA approved procedures are being used. A computer predictive model of highway runoff will be developed which will be compatible with current state-of-the-art watershed models.

STUDY PROGRESS:

STUDY TITLE: IMPROVED PERFORMANCE AND OPERATION OF THE LOADRATE LOAD ZONE EVALUATION PROCEDURE

STUDY NUMBER:	CTR 1944
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	McNERNEY MT,COLLIER DS
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JEFF JACKSON, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 15,000	TOTAL EXPENDITURES: 3,299
FY 92 BUDGET: 15,000	FY 92 EXPENDITURES: 3,299
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-05-28
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The LOADRATE program was intended to provide a standard means of load-zoning roadways. It was written as a method of determining allowable axle loads to ensure a minimum design life of 10 years. A recent evaluation of this program against all of the load-zoned roads in Ellis County of the Dallas District generated surprising results. The recommendation of the LOADRATE program was that all 40 farm-to-market roads analyzed should have the load restriction removed. However, using current evaluations with the Texas Triaxial Load Capacity Method only four of the 40 analyzed had an allowable wheel load of legal limit 10,000 pounds or greater.

OBJECTIVE(S):

The objectives of this study are to:

1. Correct errors and omissions in the coding and execution of the LDATA and LOADRATE microcomputer programs.

2. Validate the operation of the programs to perform their intended function as a reasonable tool for analyzing nondestructive data for farm-to-market roads to permit evaluation of allowable loading.

IMPLEMENTATION PLAN:

The research findings will be documented in a procedural guide for the operational use of this computer program. The procedural guide will document all changes made to the programs and recommend procedures to analyze low volume roads for load capacity. The benefits of this research will allow the implementation of the LOADRATE program for its intended function of evaluating load-zoned low-volume roads for which it is currently unusable. Improvement will make the LOADRATE more accessible and efficient, thereby saving time and money.

STUDY PROGRESS:

STUDY TITLE: ASSISTING TxDOT IN MEETING ISTEA REQUIREMENTS

STUDY NUMBER:	TTI 1960
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SHUNK G
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	BOB CUELLAR, D-10
STUDY SPONSOR:	TxDOT
TOTAL BUDGET:	TOTAL EXPENDITURES:
FY 92 BUDGET:	FY 92 EXPENDITURES:
FY 93 BUDGET:	FY 93 EXPENDITURES:
DATE BEGUN:	92-07-02
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

TTI will provide professional and technical staff services to assist TxDOT to help MPOs and other local agencies in Texas urban areas to develop and improve the functional processes, technical methodologies, and administrative procedures for urban transportation planning; acquire and train transportation planning staff; and prepare the initial transportation plans and programs required under the new ISTEA and Clean Air Act.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify the requirements of ISTEA and the 1990 Clean Air Act Amendments.

2. Prepare strategies to address requirements.

3. Establish processes and procedures.

4. Train staff from MPOs and other local agencies to handle the added transportation planning activities.

5. Develop technical procedures and validate using available data.

6. Provide transitional assistance.

IMPLEMENTATION PLAN:

STUDY PROGRESS:

STUDY TITLE: TRANSPORTATION SYSTEM PERFORMANCE CHANGES I-1980-1990

STUDY NUMBER:	TTI 1962
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SHUNK G
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	EDDIE SHAFIE, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET:	TOTAL EXPENDITURES:
FY 92 BUDGET:	FY 92 EXPENDITURES:
FY 93 BUDGET:	FY 93 EXPENDITURES:
DATE BEGUN:	92-08-03
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

OBJECTIVE(S):

The objectives of this study are to:

1. Identify Texas urban areas using the same geographic identification structure for the 1980 Census Urban Transportation Planning Package (UTPP) as they are using for the 1990 Census Transportation Planning Package (CTPP).

2. Determine which areas have assigned machine readable coordinates for their zone centroids and obtain copies.

3. Determine if the identified areas have sufficient journey-to-work data, travel time data, and travel mode data.

4. Summarize the results for presentation.

5. Determine the feasibility of computing airline distance and over-the-road distance separation between geographic zones or zone centroids.

IMPLEMENTATION PLAN:

STUDY PROGRESS:

STUDY TITLE: FACILITATE DEVELOPMENT OF A STATEWIDE RIDESHARE PROGRAM

STUDY NUMBER:	TTI 1964
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	TURNBULL KF
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	ED COLLINS, D-11
STUDY SPONSOR:	TxDOT
TOTAL BUDGET:	TOTAL EXPENDITURES:
FY 92 BUDGET:	FY 92 EXPENDITURES:
FY 93 BUDGET:	FY 93 EXPENDITURES:
DATE BEGUN:	92-08-06
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Ridesharing, both carpooling and vanpooling, represents one approach to address traffic congestion, air quality, and mobility concerns. Although ridesharing has been an important component in the mix of transportation alternatives, recent federal, state, and local initiatives have placed even more emphasis on the need to improve and expand ridesharing programs and services. The 1990 Clean Air Act Amendments and the 1991 ISTEA place additional emphasis and specific requirements on trip reduction programs and increasing vehicle occupancy rates.

OBJECTIVE(S):

The objectives of this study are to:

1. Review rideshare programs in other states.

2. Survey Texas rideshare programs.

3. Identify potential market research activities.

4. Identify a potential Texas statewide ridesharing program.

IMPLEMENTATION PLAN:

TTI will help TxDOT examine the need for a statewide rideshare program and will facilitate the development of such a program. A final report will document findings and recommendations to help determine the direction and focus of the statewide rideshare program.

STUDY PROGRESS:

STUDY TITLE: SMALL TASK PROJECTS

STUDY NUMBER:	TTI 1990
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	WOOTAN CV
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JON UNDERWOOD, D-10
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES:
FY 92 BUDGET: SEE BELOW	FY 92 EXPENDITURES:
FY 93 BUDGET:	FY 93 EXPENDITURES:
DATE BEGUN:	89-09-01
TERMINATION DATE:	CONTINUING

PROBLEM STATEMENT: N/A

OBJECTIVE(S):

The objectives of this study are:

TERMINATED TASKS:

Task 1. Preparation of still video images for proposed work on Highway 288 ($1,059)

Task 2. Produce computer images for the proposed construction of Highway 71($4,156)

Task 3. Video image proposals for widening of Loop 610 West-Houston, Texas($8,000)

Task 4. Update of PDP plan where a mainframe version of the TRIP program will be developed for calculation of benefit-cost estimates for added capacity and new location bypass projects($2,000)

Task 5. Development of a graphically-based, user-oriented computer program to design bearing pads($8,000)

Task 6. Video and design imagery services for District 17($753)

Task 7. Unassigned.

Task 8. Review of state and federal legislation-transit services and providers($10,000)

Task 9. Unassigned.

Task 10. Database of rural transportation information($7,000)

ACTIVE TASKS:

Task 11. Comparing WASHTO state transportation systems and agencies ($1,420).

Task 12. Proposal development-elimination of hazards at railroad-highway crossings on the San Antonio-Laredo portion of the International Passenger Rail Corridor from Monterrey, Mexico to San Antonio, Texas (10,000).

IMPLEMENTATION PLAN: N/A

STUDY PROGRESS:

STUDY TITLE: TRANSPORTATION PLANNING ASSISTANCE FOR DISTRICT 2 - PHASE II

STUDY NUMBER:	TTI 1995
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	WALTERS CH
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	RONDELL FAGAN, DIST 2
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 300,000	TOTAL EXPENDITURES: 80,553
FY 92 BUDGET: 150,000	FY 92 EXPENDITURES: 80,553
FY 93 BUDGET: 150,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-10-07
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Innovative approaches are required to accommodate increasing traffic demands due to the projected growth in travel in the Fort Worth.

OBJECTIVE(S): N/A

IMPLEMENTATION PLAN:

TTI will collect and analyze freeway and highway traffic operations data. TTI will assist in the development of freeway plans and systems for freeway surveillance control and communication. TTI will help in the planning of HOV lanes on I-30 West. Finally, TTI will assist in development of super streets to augment the existing freeway and arterial system.

STUDY PROGRESS:

STUDY TITLE: MEASUREMENT OF THE IMPACT OF INTERNATIONAL TRUCK TRAFFIC ON THE TEXAS ROADWAY NETWORK

STUDY NUMBER:	TTI 2034
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BURKE D,LOMAX T
RESEARCH AREA:	AREA 1
TxDOT CONTACT:	JOE IMPEY, D-10
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 84,500	TOTAL EXPENDITURES: 120,540
FY 92 BUDGET: 32,500	FY 92 EXPENDITURES: 30,540
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-11-13
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Recent changes in Mexico's foreign trade and foreign investment policies are facilitating exports to Mexico and making the prospect of transferring production operations from the U.S. to plants in Mexico. These changes may greatly stimulate the maquiladora (twin plant) program. As a result, a significant increase in freight traffic is expected to occur, especially in south Texas.

OBJECTIVE:

The objectives of this study are to:

1. Review the maquiladora program and foreign trade and investment policies of the U.S. and Mexico to determine if recent or proposed changes encourage or impede foreign trade.

2. Collect data on traffic volumes, traffic patterns, purpose of trip, etc. at specific Texas border cities.

3. Develop information on the amounts of truck traffic volume attributable to the export, import and maquiladora components.

4. Develop truck volume forecasts.

5. Determine the willingness of the public and/or private sectors of Mexico to invest in infrastructure within the border zone of Mexico.

6. Identify the impact of current and forecasted truck traffic on other travel demands (commercial, shipping, tourist). Determine any changes in non-truck commercial and shipping traffic.

7. Identify current and anticipated bridge and roadway capacity restraints within the Texas border zone.

IMPLEMENTATION PLAN:

The results of this study will help TxDOT plan for future demands on the roadway network.

STUDY PROGRESS:

AREA II

LIST OF RESEARCH STUDIES

September 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 2 **STUDY NO.** TTI 187.01 & .02 **STATUS:** Active

TITLE: MONITORING OF MOISTURE BARRIERS IN EXPANSIVE CLAYS

TECHNICAL PANEL:
Linda Smith, Chairman, D-10
Richard Floyd, DS-1

RESEARCHER(S):
Bob Lytton

AREA: 2 **STUDY NO.** TTI 187.04 **STATUS:** Terminating

TITLE: MONITORING ASPHALT-RUBBER TEST ROAD PERFORMANCE (MONITORING OF STUDY 449)

TECHNICAL PANEL:
Maghsoud Tahmoressi, Chairman, D-9
David Fink, D-18

RESEARCHER(S):
Cindy Estakhri

AREA: 2 **STUDY NO.** TTI 187.05 **STATUS:** Active

TITLE: ASPHALT ADDITIVES FOR INCREASED PAVEMENT FLEXIBILITY

TECHNICAL PANEL:
Paul Krugler, Chairman, D-9

RESEARCHER(S):
Joe Button

AREA: 2 **STUDY NO.** TTI 187.06 **STATUS:** Active

TITLE: TEXAS FLEXIBLE PAVEMENT DATA BASE

TECHNICAL PANEL:
Gary Graham, Chairman, D-8
David Fink, D-18

RESEARCHER(S):
Tom Scullion

AREA: 2 **STUDY NO.** CTR 187.07 **STATUS:** Active

TITLE: UPDATING AND MAINTAINING THE RIGID PAVEMENT CONDITION SURVEY DATA DASE

TECHNICAL PANEL:
Andrew Wimsatt, Chairman, D-8
David Fink, D-18

RESEARCHER(S):
Frank McCullough

AREA: 2 **STUDY NO.** CTR 187.09 **STATUS:** Active

TITLE: CONTINUED MONITORING OF PAVEMENT TEST SECTIONS

TECHNICAL PANEL:
Harold Albers, Chairman, D-9

RESEARCHER(S):
Al Meyer
Dave Fowler

AREA: 2 **STUDY NO.** CTR 187.10 **STATUS:** Active

TITLE: CONTINUED MONITORING OF SEAL COAT TEST SECTIONS

TECHNICAL PANEL:
Caroline Herrera, Chairman, D-9

RESEARCHER(S):
Al Meyer
Dave Fowler

LIST OF RESEARCH STUDIES

September 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 2 **STUDY NO.** TxDOT 187.11 **STATUS:** Terminating

TITLE: EVALUATION OF SAS PAVEMENT ON U.S. 77, KENEDY COUNTY, TEXAS

TECHNICAL PANEL:
Ken Fults, Chairman, D-9

RESEARCHER(S):
Dale Rand, D-9

AREA: 2 **STUDY NO.** TTI 187.13 **STATUS:** Terminating

TITLE: MONITORING OF 1272 ROUTINE MAINTENANCE USES FOR MILLED RECLAIMED ASPHALT PAVEMENT (RAP)

TECHNICAL PANEL:
John Bohuslav, Chairman, D-18

RESEARCHER(S):
Cindy Estakhri

AREA: 2 **STUDY NO.** TTI 900 **STATUS:** Terminating

TITLE: INSTALLATION AND TRAINING FOR THE DISTRICT 21 PAVEMENT MANAGEMENT SYSTEM DATA BASE

TECHNICAL PANEL:
Frederico Pacheco, Chairman, DS-21
Jerry Vinyard, D-19

RESEARCHER(S):
Donald Smith

AREA: 2 **STUDY NO.** TTI 902 **STATUS:** Active

TITLE: ROADSIDE VEGETATION MANAGEMENT RESEARCH PROGRAM

TECHNICAL PANEL:
Dennis Markwardt, Chairman, D-18

RESEARCHER(S):
Wayne McCully

AREA: 2 **STUDY NO.** TTI 910 **STATUS:** Terminating

TITLE: SKID ACCIDENT REDUCTION PROGRAM SAFETY RECOMMENDATIONS

TECHNICAL PANEL:
Christopher Hehr, Chairman, D-18

RESEARCHER(S):
Don Ivey

AREA: 2 **STUDY NO.** CTR 932 **STATUS:** Terminating

TITLE: MONITORING THE PERFORMANCE OF A BEBO ARCH CULVERT

TECHNICAL PANEL:
John Kight, Chairman, DS-15

RESEARCHER(S):
Richard Furlong

AREA: 2 **STUDY NO.** TTI 944 **STATUS:** Active

TITLE: CONSTRUCTION LANDSCAPE PROGRAM

TECHNICAL PANEL:
Herbert Neimann, Chairman, D-18

RESEARCHER(S):
Harlow Landphair

LIST OF RESEARCH STUDIES

September 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 2 **STUDY NO.** TTI 953 **STATUS:** Active

TITLE: EL PASO MOISTURE BARRIER STUDY

TECHNICAL PANEL:	**RESEARCHER(S):**
Roger Barnhart, Chairman, DS-24	Bob Lytton

AREA: 2 **STUDY NO.** CTR 983 **STATUS:** Terminating

TITLE: CONVERSION OF THE SDHPT AUTOMOTIVE FLEET TO ALTERNATIVE FUELS

TECHNICAL PANEL:	**RESEARCHER(S):**
Glen Hagler, Chairman, D-4	Hani Mahmassani
	Mike Walton
	Mark Euritt

AREA: 2 **STUDY NO.** CTR 987 **STATUS:** Active

TITLE: A LONG-RANGE PLAN FOR THE REHABILITATION OF U.S. 59 IN DISTRICT 11

TECHNICAL PANEL:	**RESEARCHER(S):**
Morgan Prince, Chairman, DS-11	Dave Fowler
	Frank McCullough

AREA: 2 **STUDY NO.** TTI/UTEP/TECH 1165 **STATUS:** Terminating

TITLE: MOISTURE MOVEMENT UNDER THE PAVEMENT STRUCTURE

TECHNICAL PANEL:	**RESEARCHER(S):**
Elias Rmeili, Chairman, D-8	Bob Lytton, TTI
Joe Graff, D-18	Miguel Picornell, UTEP
David Fink, D-18	Kent Wray, TECH

AREA: 2 **STUDY NO.** CTR/TTI 1175 **STATUS:** Terminating

TITLE: DEVELOPMENT OF DYNAMIC ANALYSIS TECHNIQUES FOR FALLING WEIGHT DEFLECTOMETER DATA

TECHNICAL PANEL:	**RESEARCHER(S):**
Bob Briggs, Chairman, D-18	Ronald Hudson, CTR
Larry Buttler, D-8	Jose Roesset
	Ken Stokoe
	Bob Lytton, TTI

AREA: 2 **STUDY NO.** TTI 1184 **STATUS:** Terminating

TITLE: USING THE MULTI-DEPTH DEFLECTOMETER TO STUDY TIRE PRESSURE AND DYNAMIC LOAD EFFECTS ON PAVEMENT

TECHNICAL PANEL:	**RESEARCHER(S):**
Bob Briggs, Chairman, D-18	Tom Scullion

LIST OF RESEARCH STUDIES

September 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 2 **STUDY NO.** TTI 1189 **STATUS:** Terminating

TITLE: AUTOMATIC PHOTO INTERPRETATION SYSTEM FOR THE ARAN

TECHNICAL PANEL:
David Fink, Chairman, D-18
Rob Harris, D-18
Al Rubio, D-16

RESEARCHER(S):
Bob Lytton

AREA: 2 **STUDY NO.** CTR 1227 **STATUS:** Terminating

TITLE: MITIGATING THE ADVERSE EFFECTS OF URBAN HIGHWAY CONSTRUCTION

TECHNICAL PANEL:
Jim Nitsch, Chairman, DS-12
Huck Castleberry, DS-25
Tom Whitaker, DS-12
Dick Rawles, DS-18
Andrew Wimsatt, D-8

RESEARCHER(S):
Frank McCullough

AREA: 2 **STUDY NO.** TTI 1233 **STATUS:** Terminating

TITLE: NEW TECHNOLOGIES FOR PAVEMENT EVALUATION

TECHNICAL PANEL:
Rob Harris, Chairman, D-18

RESEARCHER(S):
Bob Lytton

AREA: 2 **STUDY NO.** CTR/UTEP 1243 **STATUS:** Active

TITLE: AUTOMATED EQUIPMENT FOR CHARACTERIZING THE PROPERTIES AND THICKNESSES OF PAVEMENT LAYERS

TECHNICAL PANEL:
Jeff Jackson, Chairman, D-18
Elias Rmeili, D-8

RESEARCHER(S):
Ken Stokoe, CTR
Jose Roesset
Soheil Nazarian, UTEP

AREA: 2 **STUDY NO.** CTR/TTI 1244 **STATUS:** Active

TITLE: EVALUATION OF THE PERFORMANCE OF TEXAS PAVEMENTS MADE WITH DIFFERENT COARSE AGGREGATES

TECHNICAL PANEL:
Jim Nitsch, Chairman, DS-12
Harold Albers, D-9
John Nichols, FHWA
Andrew Wimsatt, D-8

RESEARCHER(S):
Frank McCullough, CTR
Dan Zollinger, TTI

AREA: 2 **STUDY NO.** TTI 1253 **STATUS:** Terminating

TITLE: UPGRADING MARGINAL AGGREGATES FOR USE IN ASPHALT CONCRETE PAVEMENTS

TECHNICAL PANEL:
Paul Krugler, Chairman, D-9

RESEARCHER(S):
Joe Button

LIST OF RESEARCH STUDIES

September 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 2 **STUDY NO.** TTI 1254 **STATUS:** Terminating

TITLE: VARIATIONS OF ENTRAINED AIR CONTENT OF PUMPED CONCRETE

TECHNICAL PANEL:
Charles Stone, Chairman, D-5
Gerry Lankes, D-9
Vernon Harris, D-5

RESEARCHER(S):
Dan Zollinger
Tianxi Tang

AREA: 2 **STUDY NO.** CTR 1269 **STATUS:** Terminating

TITLE: FEASIBILITY OF SAFETY REST AREA COMMERCIALIZATION IN TEXAS

TECHNICAL PANEL:
Richard Kirby, Chairman, D-18
Robert Wilson, D-8
Robert Bernhard, D-15
Milton Meharg, D-16
Ed Shaddock, MLY
Morgan Prince, DS-11

RESEARCHER(S):
Rob Harrison
Mark Euritt

AREA: 2 **STUDY NO.** TTI 1272 **STATUS:** Terminating

TITLE: ROUTINE MAINTENANCE USES FOR MILLED RECLAIMED ASPHALT PAVEMENT (RAP)

TECHNICAL PANEL:
John Bohuslav, Chairman, D-18
Bob Lindley, DS-8
Jim Freeman, DS-25
Richard Derryberry, DS-18
Ken Fults, D-9
Otis Jones, DS-8

RESEARCHER(S):
Joe Button
Cindy Estakhri

AREA: 2 **STUDY NO.** CTR 1286 **STATUS:** Active

TITLE: LONG-TERM EVALUATION OF STRIPPING AND MOISTURE DAMAGE IN ASPHALT PAVEMENTS TREATED WITH LIME AND ANTI-STRIPPING AGENTS

TECHNICAL PANEL:
Darren Hazlett, Chairman, D-9
Bob Lindley, DS-8
Richard Floyd, DS-1
Charlie Little, DS-18
John Betts, DS-19
Nick Turnham, DS-17
Stacy Wallis, DS-16

RESEARCHER(S):
Tom Kennedy
Bill Elmore
Dave Jones

LIST OF RESEARCH STUDIES

September 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 2 **STUDY NO.** TTI 1287 **STATUS:** Active

TITLE: IDENTIFY STRUCTURAL BENEFITS OF STABILIZATION AND UPDATING TFPS TO ACCOMMODATE STABILIZED LAYERS

TECHNICAL PANEL:
Larry Buttler, Chairman, D-8
Bill Minor, DS-16
Joe Carpenter, DS-11
Tommy Ellison, DS-19
Russell Lenz, DS-14
Bill Crumley, DS-23

RESEARCHER(S):
Dallas Little

AREA: 2 **STUDY NO.** TTI 1289 **STATUS:** Active

TITLE: USE OF MICRO-SURFACING IN HIGHWAY PAVEMENTS

TECHNICAL PANEL:
Maghsoud Tahmoressi, Chairman, D-9
Frank James, DS-20
Bob Lindley, DS-8
Terry Keener, DS-25
Tom Bohuslav, DS-23
Jerry Raines, DS-4
Freddy Hilgers, DS-15
J.B. Hutchinson, DS-1
Russell Lenz, DS-14
Mario Garza, DS-16

RESEARCHER(S):
Roger Smith

AREA: 2 **STUDY NO.** UTA 1290 **STATUS:** Active

TITLE: IMPROVED RUT MEASUREMENT METHODS FOR SIOMETERS

TECHNICAL PANEL:
Rob Harris, Chairman, D-18

RESEARCHER(S):
Roger Walker

AREA: 2 **STUDY NO.** CTR 1306 **STATUS:** Active

TITLE: LONG-TERM PERFORMANCE EVALUATION OF POLYMER-MODIFIED ASPHALT CONCRETE PAVEMENTS

TECHNICAL PANEL:
Darren Hazlett, Chairman, D-9
Bob Mikulin, D-8

RESEARCHER(S):
Tom Kennedy
Dave Jones
Bill Elmore

AREA: 2 **STUDY NO.** TTI 1314 **STATUS:** Active

TITLE: VERIFICATION OF AN ASPHALT AGING TEST AND DEVELOPMENT OF SUPERIOR RECYCLING AGENTS AND ASPHALTS

TECHNICAL PANEL:
Bill Neeley, Chairman, D-9

RESEARCHER(S):
Jesse Bullin

LIST OF RESEARCH STUDIES

AREA: 2 **STUDY NO.** CTR 1315 **STATUS:** Active

TITLE: SOLIDIFICATION/STABILIZATION 0F HAZARDOUS BLAST SAND

TECHNICAL PANEL:
Joe Raska, Chairman, D-9
Randy Cox, D-5
Charles Stone, D-5
Clark Titus, D-18
Bill Curra, D-9
Thomas Bell, DS-16

RESEARCHER(S):
Dave Fowler
Ramon Carrasquillo
Ray Loehr

AREA: 2 **STUDY NO.** TTI 1332 **STATUS:** Active

TITLE: SHORT-TERM GUIDELINES TO IMPROVE ASPHALT-RUBBER PAVEMENTS

TECHNICAL PANEL:
Gene Rudd, Chairman, DS-11
Maghsoud Tahmoressi, D-9
Elias Rmeili, D-8
Jonh Betts, DS-19
Dan Dalager, DS-24
Ronnie Vanpelt, DS-20
Gene Adams, DS-10

RESEARCHER(S):
Cindy Estakhri
Dallas Little

AREA: 2 **STUDY NO.** TTI 1333 **STATUS:** Active

TITLE: RECYCLING SECOND GENERATION ASPHALT RUBBER PAVEMENTS

TECHNICAL PANEL:
Bob Lindley, Chairman, DS-8
Andrew Wimsatt, D-8
Paul Krugler, D-9
Dan Dalager, DS-24
Joe Chappel, DS-4
Ronnie Vanpelt, DS-20

RESEARCHER(S):
William Crockford

AREA: 2 **STUDY NO.** TTI 1334 **STATUS:** Active

TITLE: IMPROVED PRIME COAT METHODS

TECHNICAL PANEL:
Will Parks, Chairman, DS-23
Clifton Coward, D-9
Joe Higgins, DS-8

RESEARCHER(S):
Joe Button
Tom Freeman

LIST OF RESEARCH STUDIES

September 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 2 **STUDY NO.** TTI 1335 **STATUS:** Active

TITLE: MOVEMENT OF SUPERHEAVY LOADS OVER THE STATE HIGHWAY SYSTEM

TECHNICAL PANEL:
Bob Briggs, Chairman, D-18
John Moorman, D-18
Andrew Wimsatt, D-8
J.B. Hutchinson, DS-1
Georgette Pillitere, DS-20
Tracey Griffin, DS-24
Bernie Parma, DS-12
Carl O'Neill, DS-13
Bill Pierce, DS-18
Don Mosier, DS-16

RESEARCHER(S):
Emmanuel Fernando

AREA: 2 **STUDY NO.** UTEP 1336 **STATUS:** Active

TITLE: APPLICATION OF M(R) MODULUS TESTS TO TEXAS BASE MATERIAL FOR PAVEMENT DESIGN

TECHNICAL PANEL:
Harold Albers, Chairman, D-9
Bob Mikulin, D-8
Ken Carpenter, DS-11
Michael Ho, DS-12

RESEARCHER(S):
Soheil Nazarian
Rafael Pezo
Miguel Picornell

AREA: 2 **STUDY NO.** TTI 1341 **STATUS:** Active

TITLE: USING GROUND PENETRATING RADAR FOR PAVEMENT EVALUATION

TECHNICAL PANEL:
Rob Harris, Chairman, D-18
Tomas Saenz, D-9

RESEARCHER(S):
Tom Scullion

AREA: 2 **STUDY NO.** TTI 1385 **STATUS:** Active

TITLE: SPECIAL CONCRETE DESIGN AND CONSTRUCTION METHODS FOR INTERSECTIONS

TECHNICAL PANEL:
John Holzwarth, Chairman, DS-12
Will Parks, DS-23
Joe Chappel, DS-4
James Joslin, DS-19
Andrew Wimsatt, D-8
Dick Rawles, DS-18
Maureen Wakeland, DS-14
Billy Davis, COFW
Clinton Bond, DS-20
Carl Utley, DS-2
Frank Cunningham, ACPA

RESEARCHER(S):
Dan Zollinger
Tianxi Tang

AREA: 2 **STUDY NO.** CTR 1900.03 **STATUS:** Active

TITLE: DEVELOP MLS DISPLAY, SLIDE PRESENTATION, AND PMS VISUAL AIDS

TECHNICAL PANEL:
David Fink, Chairman, D-18

RESEARCHER(S):
Frank McCullough

LIST OF RESEARCH STUDIES

September 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 2 **STUDY NO.** TTI 1903 **STATUS:** Terminating

TITLE: AVOIDING ROAD SHOULDER ASPHALT DEGRADATION DUE TO TURFGRASS ENCROACHMENT

TECHNICAL PANEL:
Craig Steffens, Chairman, D-18

RESEARCHER(S):
MC Engelke

AREA: 2 **STUDY NO.** CTR 1908 **STATUS:** Active

TITLE: TEXAS PAVEMENT MANAGEMENT SYSTEM

TECHNICAL PANEL:
Bob Briggs, Chairman, D-18

RESEARCHER(S):
Ronald Hudson

AREA: 2 **STUDY NO.** TTI 1914 **STATUS:** Active

TITLE: ROADSIDE DEVELOPMENT AND MANAGEMENT PROGRAM AND FIELD LABORATORY: EROSION CONTROL MATERIAL TESTING

TECHNICAL PANEL:
Paul Northcutt, Chairman, D-18

RESEARCHER(S):
Harlow Landphair

AREA: 2 **STUDY NO.** UTA 1916 **STATUS:** Active

TITLE: INVESTIGATE PAVEMENT SURFACE MEASUREMENT METHODS APPLICABLE FOR CONSTRUCTION CONTROL

TECHNICAL PANEL:
Rob Harris, Chairman, D-18

RESEARCHER(S):
Roger Walker

AREA: 2 **STUDY NO.** TTI 1918 **STATUS:** Terminating

TITLE: INCORPORATING DISTRICT REQUIREMENTS INTO MICRO-PES (PAVEMENT EVALUATION SYSTEM)

TECHNICAL PANEL:
Bryan Stampley, Chairman, D-18

RESEARCHER(S):
Tom Scullion

AREA: 2 **STUDY NO.** UTEP 1920 **STATUS:** Active

TITLE: EFFECT OF VEHICULAR VIBRATION ON DEBONDING AND DELAMINATION OF CONCRETE OVERLAYS

TECHNICAL PANEL:
Richard Ellison, Chairman, DS-24

RESEARCHER(S):
Soheil Nazarian
David Rozendal

AREA: 2 **STUDY NO.** UTA 1921 **STATUS:** Active

TITLE: AUTOMATED SURFACE INSTRUMENTATION METHODS

TECHNICAL PANEL:
Carl Bertrand, Chairman, D-18

RESEARCHER(S):
Roger Walker

LIST OF RESEARCH STUDIES

September 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 2 **STUDY NO.** TTI 1923 **STATUS:** Active

TITLE: CONTINUED DEVELOPMENT OF THE TEXAS GROUND PENETRATING RADAR SYSTEM

TECHNICAL PANEL:
Rob Harris, Chairman, D-18

RESEARCHER(S):
Tom Scullion

AREA: 2 **STUDY NO.** CTR 1924 **STATUS:** Active

TITLE: MLS PROTOTYPE DESIGN AND MODEL MLS APPLICATION

TECHNICAL PANEL:
Al Luedecke, Chairman, D-10

RESEARCHER(S):
Frank McCullough
Fred Hugo

AREA: 2 **STUDY NO.** CTR 1934 **STATUS:** Active

TITLE: MODEL PAVEMENT TESTING

TECHNICAL PANEL:
Bob Briggs, Chairman, D-18

RESEARCHER(S):
Frank McCullough
Fred Hugo

AREA: 2 **STUDY NO.** TECH 1936 **STATUS:** Terminating

TITLE: CONTROL OF SEDIMENT DEPOSITION PROCESS AT BIG SANDY DRAW BRIDGE AND INTERSTATE 20

TECHNICAL PANEL:
Bob Lindley, Chairman, DS-8

RESEARCHER(S):
Billy Claborn

AREA: 2 **STUDY NO.** TTI 1939 **STATUS:** Active

TITLE: RIGID PAVEMENT EVALUATION SYSTEM

TECHNICAL PANEL:
Mike Murphy, Chairman, D-18

RESEARCHER(S):
Tom Scullion
Jacob Uzan

AREA: 2 **STUDY NO.** UTEP 1947 **STATUS:** Active

TITLE: IMPLEMENTATION OF ABSOLUTE FWD CALIBRATION SYSTEMS DEVELOPED BY UTEP AND SHRP

TECHNICAL PANEL:
Carl Bertrand, Chairman, D-18

RESEARCHER(S):
Soheil Nazarian

AREA: 2 **STUDY NO.** CTR 1948 **STATUS:** Active

TITLE: REPAIR OF FIRE DAMAGED CONCRETE PAVEMENT ON I45

TECHNICAL PANEL:
Joe Nelson, Chairman, DS-18

RESEARCHER(S):
Frank McCullough
Dave Fowler

LIST OF RESEARCH STUDIES

September 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 2 **STUDY NO.** TTI 1949 **STATUS:** Terminating

TITLE: STANDARDS, POLICIES, GUIDELINES AND DESIGNS

TECHNICAL PANEL:
Mark Marek, Chairman, D-8

RESEARCHER(S):
Don Ivey

AREA: 2 **STUDY NO.** CTR 1952 **STATUS:** Active

TITLE: DEVELOPMENT AND IMPLEMENTATION OF GPS SATELLITE POSITIONING APPLICATIONS FOR TxDOT

TECHNICAL PANEL:
Frank Howard, Chairman, D-19

RESEARCHER(S):
Arnold Tucker

AREA: 2 **STUDY NO.** TTI 1956 **STATUS:** Active

TITLE: CONSTRUCTION OF THE FALLING WEIGHT DEFLECTOMETER (FWD) CALIBRATION FACILITY

TECHNICAL PANEL:
Bob Briggs, Chairman, D-18
Carl Bertrand, D-18

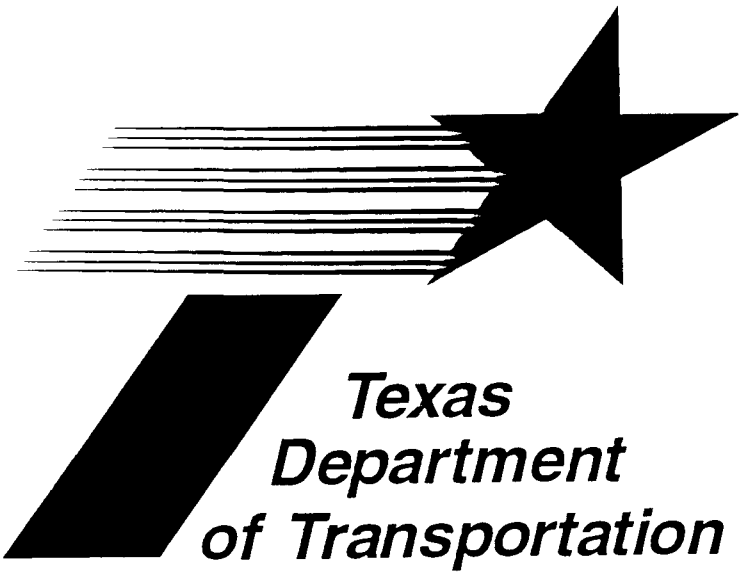
RESEARCHER(S):
Tom Scullion

AREA: 2 **STUDY NO.** CTR 1957 **STATUS:** Terminating

TITLE: FULL-SCALE BONDED CONCRETE OVERLAY ON IH 10 IN EL PASO

TECHNICAL PANEL:
Jose Rodarte, Chairman, DS-24

RESEARCHER(S):
Frank McCullough
Dave Fowler
Eric Moody



PROGRESS REPORTS
Fall 1992

STUDY TITLE: MONITORING OF MOISTURE BARRIERS IN EXPANSIVE CLAYS

STUDY NUMBER:	TTI 187 Tasks 1 & 2
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LYTTON RL
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	LINDA SMITH, D-10R
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 23,932
FY 92 BUDGET: 20,815	FY 92 EXPENDITURES: 7,215
FY 93 BUDGET: 27,890	FY 93 EXPENDITURES: N/A
DATE BEGUN:	76-09-01
TERMINATION DATE:	CONTINUING

PROBLEM STATEMENT:

Expansive clays have been a highway design problem for some time. Moisture barriers are intended to maintain an equilibrium moisture content in order to prevent swelling. This study is a long-term evaluation of several moisture barriers throughout Texas.

OBJECTIVE(S):

The overall objective of this study is to evaluate the effectiveness of moisture barriers. This will be accomplished by:

1. Evaluating the surface profile measurements on test and control sections using the GM profilometer.

2. Analyzing the measurements from Objective 1 in terms of the serviceability index and roughness coefficients.

3. Monitoring moisture sensors and psychrometers installed at certain sites.

4. Developing a computer program to predict changes in roughness (serviceability index, bump height, and IRI) with time as a function of climate and soil conditions.

IMPLEMENTATION PLAN:

This long term study will determine the effectiveness of moisture barriers in expansive clays. This project may be implemented first on a prototype, which will aid in the development of a field manual for site investigation and computer software operation. A training course should also be developed and possibly incorporated into one of the Design Level III courses.

STUDY PROGRESS:

Profilometer measurements at all moisture barrier sites have continued throughout this period of this project. Computer programs have been developed to evaluate measures of pavement roughness including serviceability index, international roughness index, and bump height. A method to predict changes in pavement roughness with time, based upon the climate moisture balance and subgrade soil characteristics at a site, has

been developed and shows a reasonably good ability to predict the observed pavement behavior. Finite element programs have also been developed and calibrated to simulate climatic boundary conditions and unsaturated moisture flow beneath pavements with and without a moisture barrier.

A report developed in conjunction with research study 1165 "Moisture Movement Under the Pavement Structure" is due 92/8.

Published reports from this study are:

187-13 "Detection and Sizing of Surface Cracks in Expansive Soil Deposits," 1987.

187-16 "Monitoring Barrier Effects on Pavement Roughness," 1988.

STUDY TITLE: MONITORING ASPHALT-RUBBER TEST ROAD PERFORMANCE

STUDY NUMBER:	TTI 187 Task 4
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ESTAKHRI CK
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	MAGHSOUD TAHMORESSI, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 24,598
FY 92 BUDGET: 14,000	FY 92 EXPENDITURES: 9,598
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	76-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Asphalt-rubber has demonstrated the ability to reduce reflection cracking in overlay pavements. However, properties of asphalt-rubber that enhance this performance have never been documented. Laboratory properties of asphalt-rubber have never been correlated with field performance. Therefore, a connection between material properties seen in the laboratory and field cracking performance is necessary if reduction of reflection cracking is to be obtained by engineering design of the asphalt-rubber systems.

OBJECTIVE(S):

The objectives of this study are to:

1. Evaluate the field performance of asphalt-rubber test roads constructed under Research Study 347.

2. Correlate field data with existing laboratory data.

3. Determine the optimum asphalt-rubber interlayer combination and application rate.

4. Determine the most suitable conditions for asphalt-rubber systems (i.e., pavement conditions, traffic, and environment).

IMPLEMENTATION PLAN:

As cracking data is collected from each test road, correlation of this data with laboratory properties, will be possible. This correlation will be used to develop a performance-related end result asphalt-rubber specification.

STUDY PROGRESS:

Three test roads have been monitored near El Paso, Buffalo and Brownsville, Texas. The El Paso test road is exhibiting moderate transverse and longitudinal cracking with some alligator cracking and ravelling. The primary type of distress in the Brownsville test road is bleeding. Some cracking is evident but is often obscured due to the flushed surface. The Buffalo test road has

just begun to show signs of distress consisting of transverse and longitudinal cracking. It is anticipated that this test road will provide the most useful information of the three.

The Brownsville test road has been cancelled due to its poor performance and the Buffalo test road is being rehabilitated using hot, in-place recycling. The El Paso test road is scheduled for final evaluation on June 30.

A report documenting research to date is due in November 1992.

Published reports from this study are:

187-15 "Asphalt-Rubber Interlayer Field Performance," 1987.

STUDY TITLE: ASPHALT ADDITIVES FOR INCREASED PAVEMENT FLEXIBILITY

STUDY NUMBER:	TTI 187 Task 5
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BUTTON JW
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	PAUL KRUGLER, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 18,701
FY 92 BUDGET: 16,000	FY 92 EXPENDITURES: 4,420
FY 93 BUDGET: 37,645	FY 93 EXPENDITURES: N/A
DATE BEGUN:	76-09-01
TERMINATION DATE:	CONTINUING

PROBLEM STATEMENT:

Based on laboratory testing, some asphalt additives show promising results from a cost-benefit standpoint. This field study will evaluate asphalt additives in regard to economics, environment, construction, performance, energy requirements, availability, compatibility and recyclability. Several years will be required to fully assess the additive effectiveness, and annual evaluations of the test pavements should be conducted throughout their life cycle.

OBJECTIVE(S):

The objective of this research is to evaluate the performance of asphalt additives as economic alternatives to reduce premature pavement cracking. In reaching this goal it will be necessary to:

1. Determine the types of distress these materials can economically correct.

2. Develop guidelines for TxDOT specifications for the purchase, design and construction of the evaluated additives.

3. Compare the performance of the materials in the laboratory with the field performance to evaluate the different products and/or techniques.

IMPLEMENTATION PLAN:

Implementation of results from this monitoring study will include the elimination of poor performing modifiers and continued or expanded use of superior performing modifiers. This will require the preparation of special provisions to Item 300 and/or new statewide special specifications written by D-9 personnel. Approval of the specification committee will be required for this implementation.

STUDY PROGRESS:

Pavement evaluations were performed at Texarkana, Sherman, and Fort Worth in March 1992.

Texarkana - There is notably more cracking in the Polybilt (EVA) section than any of the other sections. Chemkrete is showing some transverse cracking. Styrelf and latex are showing less cracking than the control sections. All sections are exhibiting slight raveling.

Sherman - Carbon Black and DuPont EVA are showing more longitudinal cracking than any of the other sections. Novophalt, Kraton, and latex are exhibiting less longitudinal cracking than the control sections. All modified pavements are showing less transverse cracking than the control sections. All sections are showing slight raveling.

Fort Worth - None of the pavements are showing significant distress.

San Benito - Test pavements will be visually and/or mechanically evaluated within the next two months.

Published reports from this study are:

187-14 "Asphalt Additives in Highway Contsruction," 1987.

187-18 "Asphalt Additives in Thick Hot-Mixed Asphalt Concrete Pavements," 1991.

STUDY TITLE: TEXAS FLEXIBLE PAVEMENT DATA BASE

STUDY NUMBER:	TTI 187 Task 6
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SCULLION T
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	GARY GRAHAM, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 67,790	TOTAL EXPENDITURES: 64,049
FY 92 BUDGET: 20,000	FY 92 EXPENDITURES: 1,692
FY 93 BUDGET: 15,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-09-01
TERMINATION DATE:	CONTINUING

PROBLEM STATEMENT:

Since 1972, TTI has maintained the Texas Flexible Pavement Data Base comprising detailed information on 350 sections of pavement that were originally selected as a stratified random sample of the state's pavements. This data base has provided invaluable predictive capabilities. With the termination of project 455, there is an urgent need to initiate a data base maintenance project to perform annual updates of the system.

OBJECTIVE(S):

The objectives of this study are to:

1. Preserve, update and improve the Texas Flexible Pavement Data Base.

2. Store all condition and deflection data collected by TxDOT personnel on the pavement sections in the data base.

3. Revise, using the new data, the pavement distress and performance equations for each type of pavement represented in the data base.

IMPLEMENTATION PLAN:

The Texas Flexible Pavement Database has provided the department design methods that are based on performance. Data from this database is also used in the numerous programs for predicting rehabilitation need (funding) and for truck damage studies. By continuing to collect data, maintaining and improving performance equations for flexible pavement design procedure will be possible.

STUDY PROGRESS:

The data base has been fully updated with 89/90 visual, deflection, ride, and traffic data. With support from D-18 and D-8, milepost to reference marker conversions for each section in the flexible and rigid pavement data bases were provided. The system has been fully integrated into the department's annual PES survey.

Sections from this data base will be used to assist in evaluations of the new Texas Flexible Pavement System (TFPS). Deterioration curves for flexible pavements will be developed for PMS efforts.

STUDY TITLE: UPDATING AND MAINTAINING THE RIGID PAVEMENT CONDITION SURVEY DATA BASE

STUDY NUMBER:	CTR 187 Task 7
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MCCULLOUGH BF
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	ANDREW WIMSATT, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 119,000	TOTAL EXPENDITURES: 35,439
FY 92 BUDGET: 21,000	FY 92 EXPENDITURES: 12,206
FY 93 BUDGET: 21,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	89-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

TxDOT has over 7,000 miles of continuously reinforced concrete pavements (CRCP), and plans call for many more miles of CRCP overlays and pavements. One of the most important components of the state-wide Pavement Management System is the information related to the condition of these pavements at various stages of their service life. Development of a suitable rigid pavement database will create an important source of valuable information for planning, design, construction, maintenance, and rehabilitation purposes.

OBJECTIVE(S):

The objectives of this study are to:

1. Update and maintain the existing rigid pavement database.

2. Write the final report(s) summarizing the major findings and their applications.

3. Analyze the data collected in overlaid sections in the 1988 condition survey.

4. Calibrate and improve prediction models for pavement performance, pavement design, traffic predictions, aggregate-type effects predictions, etc.

IMPLEMENTATION PLAN:

This project will directly implement the results of previous research, which resulted in the development of an extensive overlay design procedure in projects 249 and 388. Other possible uses of this database are in analyses performed as part of projects 422 and 1169, where load transfer across joint and cracks, drainage effects and subbase-type effects are investigated.

STUDY PROGRESS:

The database has been reformatted, corrected, and improved to prevent data errors in the future. Frequency distributions were developed to assess the age profile of existing sections. Many existing sections are nearing the end of their design life, so new projects have been identified for possible inclusion in the database.

A modification has been submitted in order to conduct visual surveys, which have not been conducted since 1987.

STUDY TITLE: CONTINUED MONITORING OF PAVEMENT TEST SECTIONS

STUDY NUMBER:	CTR 187 Task 9
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MEYER AH,FOWLER DW
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	HAROLD ALBERS, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 54,000	TOTAL EXPENDITURES: 5,210
FY 92 BUDGET: 25,800	FY 92 EXPENDITURES: 5,210
FY 93 BUDGET: 14,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

Forty pavement sections were established in Research Study 1222 "Establishment of Acceptance Limits for the 4-cycle MSS and Modified Wet Ball Mill for Aggregates in Seal Coats and HMAC Surfaces." This study will add to the two-year data already stored in the database.

OBJECTIVE(S):

The objectives of the project are to:

1. Collect additional performance data for the research pavement sections.

2. Incorporate the data into the existing database.

3. Modify, if necessary, the recommendations of the parent study.

IMPLEMENTATION PLAN:

This is a continuation to gather data from roadway sections. This additional data will refine or reinforce the recommendations from Research Study 1222. This data will help verify and improve soundness requirements in order to achieve better pavement performance.

STUDY PROGRESS:

Thirty-seven test sections in seven districts are still in service and are tested once every year during this monitoring phase. The tests that have been performed include the mini-texture meter, the visual condition survey, the macro-photographs, and frictional resistance measurements obtained with the skid trailer.

The collected data has been added to the project database. No significant changes have occurred during the past twelve months.

STUDY TITLE: CONTINUED MONITORING OF SEAL COAT TEST SECTIONS

STUDY NUMBER:	CTR 187 Task 10
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MEYER AH,FOWLER DW
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	CAROLINE HERRERA, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 67,000	TOTAL EXPENDITURES: 12,185
FY 92 BUDGET: 17,000	FY 92 EXPENDITURES: 12,185
FY 93 BUDGET: 17,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

Fifty-nine pavement sections were established in Research Study 490 "Strategic Plan for Achieving Adequate Pavement Friction." This study will add to the five-year data already stored in a database.

OBJECTIVE(S):

The objectives of the project are to:

1. Collect additional performance data for the research pavement sections.

2. Incorporate the data into the existing database.

3. Modify, if necessary, the recommendations of the parent study.

IMPLEMENTATION PLAN:

Information from the data base is being used to evaluate TxDOT's use of polish value to satisfy the FHWA's pavement skid resistance requirements. The additional data will be used to refine the recommendations and will give a better understanding of the relationship between field performance and laboratory testing.

STUDY PROGRESS:

At this time, thirty-nine of the original test sections remain in service. These sections are tested once every year during this monitoring phase. Tests include mini-texture meter, visual condition survey, macro-photographs, and friction measurements using the skid trailer.

The collected data has been added to the project database. No significant changes have occurred during the past twelve months.

STUDY TITLE: EVALUATION OF SAS PAVEMENT ON US 77
KENEDY COUNTY, TEXAS

STUDY NUMBER:	TxDOT 187 Task 11
RESEARCH AGENCY:	TEXAS DEPARTMENT OF TRANSPORTATION
STUDY SUPERVISOR(S):	RAND D
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	KEN FULTS, D-9
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 7,530	TOTAL EXPENDITURES: 16,701
FY 92 BUDGET: 2,000	FY 92 EXPENDITURES: N/A
FY 93 BUDGET: 0	FY 93 EXPENDITURES:N/A
DATE BEGUN:	91-08-05
TERMINATION DATE:	T92-02-29

PROBLEM STATEMENT:

In 1977, a 3,000-foot sand-asphalt-sulfur test section was placed on US 77 in District 21. This was the first demonstration of SAS on a Federal highway. The experimental section was divided into six subsections of various thicknesses. Two subsections were purposely underdesigned to show distress in two to three years. After 15 years of service, this road will finally have to be reconstructed.

OBJECTIVE(S):

The objectives of the project are to perform and document a 15th year post-construction evaluation of the six SAS subsections constructed under project SDHPT 519. Specifically, the road will be checked for signs of visual distress, cores will be taken and laboratory tested for strength and ductility, and FWD tests will be performed.

IMPLEMENTATION PLAN:

The results of this study will be the final assessment of a 15 year test project. The longer-than-expected life of the pavement should provide valuable information.

STUDY PROGRESS:

All tasks have been completed and the final report is ready for publication. The report, 187-19 "Final Evaluation of a Sand-Asphalt-Sulfur Test Section, US 77, Kenedy County, Texas," contains test results indicating that, with regard to pavement performance alone, SAS mixtures could be used as a suitable base material.

STUDY TITLE: MONITORING OF 1272 ROUTINE MAINTENANCE USES FOR MILLED RECLAIMED ASPHALT PAVEMENT (RAP)

STUDY NUMBER:	TTI 187 Task 13
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ESTAKHRI C
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	JOHN BOHUSLAV, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 26,500	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: N/A
FY 93 BUDGET: 12,500	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

This project will monitor the performance of the various test sections placed for research study 1272.

As of this reporting period, no proposal is available to provide more information.

OBJECTIVE(S): N/A

IMPLEMENTATION PLAN: N/A

STUDY PROGRESS:

STUDY TITLE: INSTALLATION AND TRAINING FOR THE DISTRICT 21 PAVEMENT MANAGEMENT SYSTEM DATA BASE

STUDY NUMBER:	TTI 900
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SMITH DR
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	FEDERICO PACHECO, DIST 21
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 197,420	TOTAL EXPENDITURES: 107,660
FY 92 BUDGET: 32,759	FY 92 EXPENDITURES: 6,542
FY 93 BUDGET: 56,302	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

This project oversees the implementation of a newly designed flexible pavement highway database in Pharr, Texas District 21 Headquarters. This work involves the installation of hardware and software and a series of 2-3 day training sessions for the district personnel to expose them to the workings of the system. Future technical support for the district personnel needs to be provided to further develop the database language and computer systems for changing circumstances.

OBJECTIVE(S):

The objectives of this study are to:

1. Obtain the requisite hardware as per the system specifications required to accommodate the developed system.

2. Install the 10-county database with appropriate backup protocols and physically install in the District Headquarters (Pharr, Texas).

3. Develop and conduct on-site orientation and detailed training sessions for District 21 and other required personnel.

4. Design and install any required extensions/modifications to the base system as identified from the training/orientation sessions.

5. Develop and maintain appropriate documentation manuals regarding all facets of the database.

6. Supervise the maintenance of the system.

7. Supervise the analysis of the 1989-90 data with preparation of exception reports, segment plots and any additional requests for data analysis/summarization.

8. Design and install "interval segment plots" for a selected highway segment.

9. Construct a database graphics module to plot.

10. Modify the District 21 database structure to bring the system into compliance with recently mandated Federal highway reporting standards.

11. Produce journal articles to describe the work completed to-date.

12. Include new reference marking fields within all 0.1, 0.2 and 0.5 mile files for the 1990/91 period.

13. Modify all database files holding milepost reference fields to hold the equivalent reference marking system's coded sequence values.

IMPLEMENTATION PLAN:

Training sessions including onsite orientation courses will be conducted. System documentation and user guides will be prepared.

A final project summary report will be issued and the entire documentation for this project will be updated and released.

STUDY PROGRESS:

The appropriate microcomputer hardware was purchased and installed. Data collection for the 10-county district except for FWD measurements has been completed. Highway segment data and visual and ride data is now in the database. Both a detailed document describing collection and preparation of skid data and a design manual which has information about in-house data entry and analysis will be available. The RIDE file has been expanded from a 0.2-mile to a 0.1-mile file. The 0.1-mile master file now contains ADT and 18-KIP data.

STUDY TITLE: ROADSIDE VEGETATION MANAGEMENT RESEARCH PROGRAM

STUDY NUMBER:	TTI 902		
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE		
STUDY SUPERVISOR(S):	McGULLY WG		
RESEARCH AREA:	AREA 2		
TxDOT CONTACT:	DENNIS MARKWARDT, D-18		
STUDY SPONSOR:	TxDOT		
TOTAL BUDGET:	CONTINUING	TOTAL EXPENDITURES:	754,543
FY 92 BUDGET:	93,000	FY 92 EXPENDITURES:	74,672
FY 93 BUDGET:	93,000	FY 93 EXPENDITURES:	N/A
DATE BEGUN:	82-09-01		
TERMINATION DATE:	CONTINUING		

PROBLEM STATEMENT:

An innovative system of roadside vegetation management is needed for installation of desired roadside vegetation components, for managing the existing matrix of roadside plants and for protecting capital facilities against deterioration resulting from unwanted plants.

OBJECTIVE(S):

The objectives of this study are to:

1. Assess the ecological compatibility of specified grass seed mixtures in various regions of Texas.

2. Determine reproduction parameters for selected plants having a low maintenance requirement and desired for roadside use.

3. Provide a technical resource base to SDHPT for formulating operational and policy guidelines concerning vegetation management.

IMPLEMENTATION PLAN:

Materials under test and test results will be supplied on a continuing basis to D-18L and to the TxDOT Automated Information Service. Data from the test seedlings installed in 1989 will be collated, analyzed and presented as a report. TTI will contribute technical support to D-18L and Districts in selecting reference roadside locations, inspecting operational erosion control and revegetation, advising and assisting in modification of standard specifications, and assembling in-house reports on specific vegetation management topics.

STUDY PROGRESS:

Candidate materials from four herbicide manufacturers have been tested and ten herbicides were selected to control vegetation in pavement surfaces, in cracks and joints, encroaching from open soil, competing with lower-growing vegetative cover, and treatment of thorny woody plants. The test seedings in Districts 5, 6, 11, and 23 will be evaluated at the end of fiscal year 1991/92. Technical support is being supplied to Vegetation Management Program of D-18L and the Districts.

Published reports from this project are:

902-1 "Potential for Using Mycorrhizal Plants to Revegetate Texas Highway Right-of-Ways," 1984.

902-2 "Control of Wild Oat and Jointed Goatgrass on Texas Roadsides," 1986.

902-3 "Enhancement of Texas Highways Vegetation with Mycorrhizal Fungi," 1985.

902-4 "Propagation of Wildflowers for Roadside Use," 1986.

902-5 "Propagation of Some Native Landscaping Plants," 1986.

STUDY TITLE: SKID ACCIDENT REDUCTION PROGRAM SAFETY RECOMMENDATION H-87-2

STUDY NUMBER:	TTI 910
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	IVEY DL
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	CHRISTOPHER HEHR, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 372,163
FY 92 BUDGET: 79,577	FY 92 EXPENDITURES: 39,325
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	89-01-18
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Among all the factors that influence wet weather accidents, only highway geometrics and pavement skid resistance can be controlled. Skid resistance is the much easier approach of the two. There is more potential for improving upon skid resistance despite all the progress to date.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop the methodology necessary to identify accident locations where surface improvements will increase wet weather safety.

2. Develop methods to indicate cost-effectiveness of surface improvement.

3. Assess current methods of determining tire/pavement friction, determine the most effective of these and determine if new methods need to be developed.

4. Develop algorithms for friction consideration in the Pavement Management System.

5. Formulate improved TxDOT statewide skid accident reduction program.

6. Implement improved TxDOT skid accident reduction program.

IMPLEMENTATION PLAN:

A three level approach will be used:

1. Training of maintenance personnel using simple techniques of observation and measurement to identify spots where surface treatment is needed initially involving six volunteer Districts.

2. Continuation and improvement of statewide surface friction monitoring.

3. Continued analysis on an annual basis of all wet weather accidents on the state and federal highway system.

STUDY PROGRESS:

STUDY TITLE: MONITORING THE PERFORMANCE OF A BEBO ARCH CULVERT

STUDY NUMBER:	CTR 932		
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH		
STUDY SUPERVISOR(S):	FURLONG RW		
RESEARCH AREA:	AREA 2		
TxDOT CONTACT:	JOHN KIGHT, DIST 15		
STUDY SPONSOR:	TxDOT		
TOTAL BUDGET:	68,095	TOTAL EXPENDITURES:	75,479
FY 92 BUDGET:	12,035	FY 92 EXPENDITURES:	9,379
FY 93 BUDGET:	0	FY 93 EXPENDITURES:	N/A
DATE BEGUN:	87-07-22		
TERMINATION DATE:	T92-08-31		

PROBLEM STATEMENT: N/A

OBJECTIVE(S):

The objective of this study is to monitor the structural performance of the reinforced concrete segmental arch culvert beneath Highway 1604 in Northeast Bexar County from the time of construction until the year 1992.

IMPLEMENTATION PLAN:

Observations and interpretations of performance measurements will be reported at regular intervals during the monitoring periods. A computer program will be prepared to interpret, average and error-balance all readings in order to produce culvert profile data.

STUDY PROGRESS:

STUDY TITLE: CONSTRUCTION LANDSCAPE PROGRAM

STUDY NUMBER:	TTI 944
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LANDPHAIR HC
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	HERBERT NEIMANN, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 1,346,359
FY 92 BUDGET: 360,792	FY 92 EXPENDITURES: 203,467
FY 93 BUDGET: 368,618	FY 93 EXPENDITURES: N/A
DATE BEGUN:	87-09-01
TERMINATION DATE:	CONTINUING

PROBLEM STATEMENT:

The TxDOT mows rights-of-way along more than 74,000 miles of highways each year. This is not the best measure to deal with the problem of safety concerns or vegetation and is merely a response to public pressure. The most economical approach would be to change the public's perception of the roadside, how it looks and how it should be maintained. To this end, a five-year "Prairie Restoration and Management Pilot Project" is being proposed. There is a great deal of evidence from work done in Kansas, Nebraska and Minnesota that suggests there is very good public acceptance of native grasses when the grass is mature and in good health.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop management strategies that will utilize and enhance the native vegetation associations on the rights-of-way, to the end they become more self-sustaining.

2. Investigate methods that will better unite physical structures with vegetation maintenance techniques in order to increase efficiency and reduce costs related to damage to roadway and drainage structures.

3. Develop a better understanding of management strategies that will allow designers and managers to predict and enhance the aesthetic qualities of the native prairie vegetation associations; grasses, forbs, and wildflowers.

4. Demonstrate the aesthetic quality that can be achieved by "designed management" practices.

IMPLEMENTATION PLAN:

Monitoring of the sites will occur at intervals throughout the year. The primary data will be collected in film records and will document the effects of the management plan throughout the seasons. As data becomes available, the management plan itself will be reviewed at least annually and revised as necessary to take advantage of new knowledge gained. Steps will also be taken to generate public support for the goals of the program. A plan will be developed for appropriate signage at each site to inform the public of the program underway. In addition, papers or articles will be written about different phases as they develop.

STUDY PROGRESS:

STUDY TITLE: EL PASO MOISTURE BARRIER STUDY

STUDY NUMBER:	TTI 953
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LYTTON RL
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	ROGER BARNHART, DIST 24
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 91,460	TOTAL EXPENDITURES: 53,032
FY 92 BUDGET: 26,000	FY 92 EXPENDITURES: 8,535
FY 93 BUDGET: 29,976	FY 93 EXPENDITURES: N/A
DATE BEGUN:	87-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Research and evaluation of vertical moisture barriers is also being conducted in studies 187-1 and 187-2 "Monitoring of Moisture Barriers in Expansive Clays" and in study 1165 "Moisture Movement Under the Pavement Structure."

OBJECTIVE(S):

The objective of this study is to gather data on the performance and effectiveness of a vertical moisture barrier in reducing surface roughness due to moisture changes in the subgrade soil on a 3 mile section of I-10 east of El Paso.

IMPLEMENTATION PLAN:

A report containing evaluations and recommendations on the construction methods of the vertical moisture barrier will be issued.

STUDY PROGRESS:

STUDY TITLE: CONVERSION OF TxDOT AUTOMOTIVE FLEET TO ALTERNATIVE FUELS

STUDY NUMBER:	CTR 983
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MAHMASSANI H, EURRITT MA, WALTON CM
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	GLENN HAGLER, D-4
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 177,500	TOTAL EXPENDITURES: 148,579
FY 92 BUDGET: 100,000	FY 92 EXPENDITURES: 71,276
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-06-19
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The Texas legislature requires that vehicles purchased after September 1, 1991 for all state agencies with a minimum 16 vehicle fleet should be able to operate on compressed natural gas(CNG) or other alternative fuels to reduce emissions. TxDOT will be significantly affected by this legislation. The types of vehicles to be converted need to be determined based on several factors. Fiscal, personnel and operational impacts need to be evaluated.

OBJECTIVE(S):

The objectives of this study are to:

1. Evaluate the immediate and long-term implications of the conversion of its fleet of vehicles from gasoline and diesel to alternative fuels.

2. Formulate a strategy in this regard.

IMPLEMENTATION PLAN:

A model will be evaluated for optimal design and operation of CNG and LPG fueling infrastructure.

STUDY PROGRESS:

STUDY TITLE: A LONG-RANGE PLAN FOR THE REHABILITATION OF U.S. 59 IN DISTRICT 11

STUDY NUMBER:	CTR 987
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	FOWLER DW,MCCULLOUGH BF
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	MORGAN PRINCE, DIST 11
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 1,134,682	TOTAL EXPENDITURES: 642,980
FY 92 BUDGET: 272,900	FY 92 EXPENDITURES: 178,945
FY 93 BUDGET: 203,252	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

U.S.59 is one of the principal arterial highway routes in Texas running from Laredo at the Mexican border to Houston and to Texarkana. This 130 mile long highway consists of a variety of rigid and flexible pavement designs which have been modified by various rehabilitation and maintenance activities. The current pavement structures evolved from designs which emphasized budgetary limitations rather than long-service life and minimum maintenance cost. The economic importance of U.S. 59 and the expected growth in traffic will require improved pavement quality. Several pavement restoration methods could be used.

OBJECTIVE(S):

1. Prepare a plan which will address the needed annual cost for rehabilitating and re-constructing all of U.S.59 within District 11 during a 10 to 15 year planning horizon.

2. Plan, design, construct and monitor the performance of alternate experimental pavement structures deemed promising for subsequent utilization within District 11.

IMPLEMENTATION PLAN:

The framework of the long range plan that will be developed in this study could be used for the cost effective rehabilitation of jointed rigid pavements throughout the State of Texas. A limited number of experimental sections will be placed on U.S.59 to effectively assess various rehabilitation options.

STUDY PROGRESS:

Published reports from this project are:

987-1 "The Development of a Long-Range Rehabilitation Plan for US-59 in District 11 - Preliminary Report," 1991.

STUDY TITLE: MOISTURE MOVEMENT UNDER THE PAVEMENT STRUCTURE

STUDY NUMBER:	TTI/TECH/UTEP 1165
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE TEXAS TECH UNIVERSITY UNIVERSITY OF TEXAS AT EL PASO
STUDY SUPERVISOR(S):	LYTTON RL,WRAY WK,PICORNELL M
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	ELIAS RMEILI, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 837,593	TOTAL EXPENDITURES: 905,241
FY 92 BUDGET: 84,553	FY 92 EXPENDITURES: 57,773
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	87-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Water under pavements on expansive clays causes considerable damage requiring costly maintenance and rehabilitation, which many times provide only a temporary respite. The problem is to find ways to stabilize the moisture under a pavement on expansive clay when water infiltrates through the pavement surface as well as horizontally in the subgrade soil mass. Field measurements, analytical predictions, and installation and monitoring of promising methods are necessary to mitigate water damage to pavements.

OBJECTIVE(S):

The objectives of this study are to:

1. Select critical drainage and infiltration conditions for pavements on expansive clays in the major climatic zones in Texas, install appropriate calibrated moisture measuring devices and monitor them.

2. Develop analytical methods, calibrated against field data, to predict moisture movement under pavements accounting for vertical and horizontal moisture barriers, drainage blankets and subdrains.

IMPLEMENTATION PLAN:

The principle application of the analysis method is to evaluate drainage alternatives for a pavement. This technique will also provide an evaluation of the long-term decrease of subbase soil modulus and the rate at which it takes place. The final result of this project will be the prediction methods, the field data and recommended moisture control installation practices.

STUDY PROGRESS:

Moisture sensor readings are taken monthly at sites around the state. Soil samples are taken every two months to provide additional soil suction information. Soil profiles have been made for each test site. Suction-moisture content relations were made of samples using the filter paper method. The models developed have been exercised over a variety of site conditions and match field observations reasonably well. Profilometer readings have been taken and were analyzed to predict bump height, international roughness index, and serviceability index.

The model developed is being exercised over a wide variety of site conditions including depths of moisture barrier, climatic zones, topography, moisture conditions, depths of root zones, and soil permeability.

Published reports from this study are:

1165-1 Volume 1 "Moisture Movement Under the Pavement Structure," 1989.

1165-1 Volume 2 "Moisture Movement Under the Pavement Structure," 1989.

STUDY TITLE: DEVELOPMENT OF DYNAMIC ANALYSIS TECHNIQUES FOR FALLING WEIGHT DEFLECTOMETER DATA

STUDY NUMBER:	TTI/CTR 1175
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE AND CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	LYTTON RL,HUDSON WR
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	BOB BRIGGS, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 827,500	TOTAL EXPENDITURES: 906,932
FY 92 BUDGET: 177,000	FY 92 EXPENDITURES: 138,033
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	87-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Most software available to analyze Falling Weight Deflectometer (FWD) data is based on static loading conditions. There is evidence that this approach does not accurately model the dynamic loading conditions imparted by the FWD or a moving wheel load. Loads applied by the FWD may result in nonlinear pavement behavior. It is necessary to be able to extrapolate values for different magnitudes and cycles of loading. Because extrapolation of nonlinear values is difficult, a significant understanding of the problem is needed.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop a computer program for linear dynamic analysis of pavements subjected to FWD loads.

2. Extend the program to include nonlinear behavior of the pavement, base and subgrade.

3. Find the most convenient procedure to reduce FWD test data to back figure the elastic moduli (linear or nonlinear).

4. Validate the program by comparing the results with field data for a variety of pavements.

5. Correlate the information obtained from the FWD, Dynaflect and Spectral-Analysis-of-Surface-Waves (SASW) methods.

6. Arrive at recommendations to optimize the performance of the FWD.

IMPLEMENTATION PLAN:

Pavement models and analysis guidelines developed in this project will be evaluated by D-18PM. Test sections on the PMS research data base will be flagged and evaluated using the FWD. These test sections will be used to assess the accuracy and to calibrate the rutting and cracking susceptibility models developed in this study. Should the models prove accurate, the rut and crack parameters can be input directly to TFPS program for pavement design.

STUDY PROGRESS:

Work completed includes:

- develop computer model of pavement dynamic response;
- conduct FWD field tests of selected sites;
- perform dynamic analysis of FWD data;
- perform laboratory tests on pavement samples.

Work nearing completion includes:

- back-calculate pavement layer properties;
- compare FWD field deflection data with computed data,
- compare back-calculated data with laboratory data;
- compare dynamic analysis method with conventional methods.

Published reports from this study are:

1175-1 "Dynamic Analysis of Falling Weight Deflectometer Data," 1988.

STUDY TITLE: USING THE MULTI-DEPTH DEFLECTOMETER TO STUDY TIRE PRESSURE AND DYNAMIC LOAD EFFECTS ON PAVEMENT

STUDY NUMBER:	TTI 1184
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SCULLION T
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	BOB BRIGGS, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 350,525	TOTAL EXPENDITURES: 309,706
FY 92 BUDGET: 71,500	FY 92 EXPENDITURES: 52,260
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

High tire pressure and new axle configurations continue to be a major concern to highway engineers. TTI has recently installed two multidepth deflectometers (MDD) to measure pavement response under load. There is an urgent need to measure the pavement response to increased tire pressures and new wheel configurations. Of particular interest will be measuring the strains induced in base and subgrade layers.

OBJECTIVE(S):

The objectives of this study are to:

1. Build MDD modules for in-pavement sections and continue the software development for data acquisition and analysis.

2. Measure the induced strains in each pavement layer for a variety of truck types and axles loads.

3. Evaluate the feasibility of using the MDD as an integral part of a low-cost pavement instrumentation unit.

4. Conduct special studies to determine the effects of tire pressure, axle loads, tire type and vehicle configurations and compare measured response to theoretical model predictions.

5. Provide TxDOT with an instrumented pavement site.

6. Determine other areas in which the MDD can assist the TxDOT's research effort, such as the ongoing rutting studies.

IMPLEMENTATION PLAN:

This project has two avenues of implementation: the MDD can be used with WIM equipment to monitor pavement response and permanent deformation under actual traffic; and the results can be used to assess the impact of overweight trucks, to validate assumptions regarding pavement damage factors for pavement design, and to improve pavement performance models.

The installation of MDD systems will occur on a special-project basis, as part of the PMS research database and in conjunction with the Mobile Load Simulator under development.

STUDY PROGRESS:

This project will use multidepth deflectometers (MDD) to study the effect of tire pressure and dynamic loads on pavement response. Two in-service pavements (one thick and one thin), have been instrumented. Pavement response was measured for various axle configurations, load tire pressures, speeds and roughness. A low-cost WIM station has been installed, together with instrumentation to log environmental factors such as temperature and moisture. The large volume of data collected on this project is currently being processed.

Data obtained for "super-singles" conflicts with other reports. TTI measured higher deflections and vertical compressive strains under these tires, as well as high shear strains at the edge of the tire.

A tire force transducer will be used to monitor the influence of tire pressure on 3-D contact forces.

STUDY TITLE: AUTOMATIC PHOTO INTERPRETATION SYSTEM FOR THE ARAN

STUDY NUMBER:	TTI 1189		
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE		
STUDY SUPERVISOR(S):	LYTTON RL		
RESEARCH AREA:	AREA 2		
TxDOT CONTACT:	DAVID FINK, D-18		
STUDY SPONSOR:	FHWA & TxDOT		
TOTAL BUDGET: 372,260	TOTAL EXPENDITURES:	366,759	
FY 92 BUDGET: 60,000	FY 92 EXPENDITURES:	61,133	
FY 93 BUDGET: 0	FY 93 EXPENDITURES:	N/A	
DATE BEGUN:	88-09-01		
TERMINATION DATE:	T92-08-31		

PROBLEM STATEMENT:

The Automatic Road Analyzer (ARAN) has the potential to be a tremendous asset for pavement management. It can collect large volumes of pavement condition photographs at high speeds. Automated image processing techniques are now available to assist with the interpretation of the photographs. These techniques need to be evaluated to determine if they can provide cost effective procedures for automatically determining pavement information.

OBJECTIVE(S):

The aim of this research is to develop procedures to automatically process data collected by the ARAN for input into the department's pavement management studies. These three levels of data collection are important:

1. Network Level Evaluations - by recording the distress at regular intervals in the two-mile PES section, it should be possible to process this data in real time.

2. Project Level Evaluations - the rutting statistics can be obtained from the ARAN rut bar, and the cracking statistics can be generated in the office from the detailed video photos.

3. SHRP Experimental Sites - perform detailed distress inspections for 750-foot experimental sections.

4. Hardware and software systems to perform photo interpretation in real time or in the office.

IMPLEMENTATION PLAN:

The development of an automated photo interpretation system will reduce the manpower needed to perform the distress rating process. This will in turn allow for more pavement distress surveys to be conducted. This automated system will also make the results more objective. A one year "900" study will concentrate on lighting and computer controlled VCR implementation.

STUDY PROGRESS:

The current video image processing system can support continuous digitization and processing. The processing time requirement has been reduced from 5 seconds per frame to 0.7 seconds per frame. Preliminary processing of PES sections indicates 70% accuracy in terms of each frame. The score is higher when the result is converted to PES ratings.

Two reports will be submitted at the conclusion of this study.

STUDY TITLE: MITIGATING THE ADVERSE EFFECT OF URBAN HIGHWAY CONSTRUCTION

STUDY NUMBER:	CTR 1227
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	McCULLOUGH BF
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	JIM NITSCH,DIST 12
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 474,750	TOTAL EXPENDITURES: 373,131
FY 92 BUDGET: 156,850	FY 92 EXPENDITURES: 128,913
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	89-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Roadwork on heavily trafficked highways, commercially important frontage roads and urban street intersections is becoming more complicated. There are many costs associated with such work; the department's, the public's inconvenience, and the effects on the business of commercial entities. When these elements are considered as a system, there is a wide range of design and management choices to be made. This project will define when expediting construction would be beneficial and will evaluate the full spectrum of costs.

OBJECTIVE(S):

The original objective of this study was to report on ways and means of expediting urban pavement construction. This has been expanded to address all measures which would contribute to the expeditious completion of the project.

IMPLEMENTATION PLAN:

A manual highlighting the ways and means of mitigation and their significance is proposed to be published and issued to TxDOT planners and managers. This would encourage premeditated consideration for mitigation measures at the inception of a project, as well as during construction.

STUDY PROGRESS:

Numerous meetings, surveys, and questionnaires have been completed to cover a wide variety of expeditious construction techniques and issues. Interpretation of this data is 80% complete.

A method for estimating user's costs for typical temporary traffic handling schemes is 90% complete.

The periodic change in sales tax receipts along U.S. 59 in Houston was compared with taxes received was compared with another freeway not under construction.

STUDY TITLE: NEW TECHNOLOGIES FOR PAVEMENT EVALUATION

STUDY NUMBER:	TTI 1233
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LYTTON RL
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	ROBERT HARRIS, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 300,000	TOTAL EXPENDITURE: 304,583
FY 92 BUDGET: 157,500	FY 92 EXPENDITURE: 151,726
FY 93 BUDGET: 0	FY 93 EXPENDITURE: N/A
DATE BEGUN:	89-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The presence of voids beneath a pavement signals the onset of rapid deterioration. Delamination of bridge decks also precedes rapid deterioration. A number of nondestructive testing (NDT) techniques allow for defects in pavement to be detected, but in order to use this equipment, software for microcomputers is needed to automatically analyze the raw data produced by NDT devices. This crucial information would need to be entered into the TxDOT Pavement Evaluation System.

OBJECTIVE(S):

The objectives of this study are to:

1. Verify and use the computerized method developed at TTI for determining the layer thickness, density and asphalt or water content of each pavement layer.

2. Develop "ground-truth" information on pavement layer thicknesses by coring and testing, and develop expected layer and material dielectric constants using information from a literature review and from laboratory measurements.

3. Develop a method of using the layer thickness and moisture information to modify the structural index in the Pavement Evaluation System.

IMPLEMENTATION PLAN:

This project is developing a ground penetrating radar (GPR) whose applications include determination of layer thicknesses for the PMIS data base and structural analysis routines, investigations for determination of rehabilitation design strategies, and determination of PCC slab thickness without the need for expensive coring activities. Using GPR on a network level will be examined in study 1341 "Using Ground Penetrating Radar for Pavement Evaluation."

D-18 is purchasing a GPR system with specifications developed during this project.

STUDY PROGRESS:

Data acquisition software and data processing software have been developed. Two case studies have been conducted to put the developed software to use. The first case is to investigate various surface treatments in SHRP sites and their effects on layer thickness determination. The second study is void detection under concrete pavement. Field cores have verified that the radar signal predictions are accurate. A forward model has been developed to simulate the radar return waveform based on the pavement layer parameters.

A testing method for pavement material dielectric constants have been established. Extensive testing and sample preparation has started to develop a catalog of dielectric constants and conductivities for Texas pavement materials.

STUDY TITLE: AUTOMATED EQUIPMENT FOR CHARACTERIZING THE PROPERTIES AND THICKNESSES OF PAVEMENT LAYERS

STUDY NUMBER:	CTR/UTEP 1243
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH AND UNIVERSITY OF TEXAS AT EL PASO
STUDY SUPERVISOR(S):	STOKOE K,ROESSET J,NAZARIAN S
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	JEFF JACKSON, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 453,000	TOTAL EXPENDITURES: 271,039
FY 92 BUDGET: 123,000	FY 92 EXPENDITURES: 68,165
FY 93 BUDGET: 110,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	89-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Methodologies used to determine the need for or type of improvements to be applied to a deteriorated pavement section are generally based upon empirical and experience-based procedures. It would be preferable if a well-developed mechanistic procedure could be used to incorporate several important parameters. This procedure could be automated into a system for characterizing the properties and thicknesses of pavement layers from data generated by deflection-based nondestructive tests such as the Spectral Analysis of Surface Waves (SASW).

OBJECTIVE(S):

The objectives of this study are to:

1. Develop an automated, simple-to-use procedure for reducing the field data collected by the SASW method, i.e., incorporate optimization and general inverse theory with a dispersion function to find an economical process to determine real-time modulus depth profiles.

2. Develop a rapid method for determining the modulus and thickness of surface layers by using the simplified SASW and impulse-echo methods.

3. Develop a prototype testing device that can measure continuous profiles of pavement condition.

IMPLEMENTATION PLAN:

D-18 Pavement Management will review the processes and equipment developed in this project. If this research is successful, the previous time-consuming data collection procedures for the SASW will be replaced with more implementable methods. Then, surface layer thicknesses can be made in real time. This method can also be used to assess joint and crack efficiency for rehabilitation design strategies of PCC pavements.

STUDY PROGRESS:

UTEP - The perturbational study and sensitivity analysis is complete. The literature survey is complete. The development of the inversion algorithm is essentially complete and is being evaluated for accuracy and robustness. Field tests have been performed at three sites and the results are being reduced.

CTR - Work has focused on Objective 3 (see above). A second-generation profiling device is under development and work is continuing to improve the new system. A computer program to model the vibratory profiler has been implemented, and progress has been made.

STUDY TITLE: EVALUATION OF THE PERFORMANCE OF TEXAS PAVEMENTS MADE WITH DIFFERENT COARSE AGGREGATES

STUDY NUMBER:	CTR/TTI 1244
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH AND TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	MCCULLOUGH BF,ZOLLINGER D
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	JIM NITSCH, DIST 12
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 887,847	TOTAL EXPENDITURES: 584,443
FY 92 BUDGET: 129,726	FY 92 EXPENDITURES: 146,010
FY 93 BUDGET: 180,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	89-11-17
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Rigid and flexible pavements in Texas are generally made using crushed limestone (LS) and/or siliceous river gravel (SRG) as coarse aggregates. Coarse aggregates comprise over 60 percent of the pavement volume and thus greatly influence the performance of pavement structures. The evaluation of pavements using LS and SRG is necessary to determine the extent of performance difference between the aggregates so that design adjustments can be made.

OBJECTIVE(S):

The main objectives of this study are to:

1. Collect and analyze field and laboratory evaluations of the effects that LS and SRG may have.

2. Identify the major modes of pavement failure and distress manifestations associated with the types of aggregates used.

3. Develop model improvements to account for aggregate related distresses that are not presently accounted for.

4. Propose alternative design and/or construction methods for improving pavement performance using practical solutions.

5. Develop an interaction between research teams, the TXDOT and the materials industry for the purpose of developing a common approach for solutions to problems.

IMPLEMENTATION PLAN:

The results of this study will help identify the exact extent and nature of the difference in long-term performance of pavements made with different coarse aggregates. The findings and recommendations obtained from this study will help in selecting correct design assumptions and construction approaches that need further analysis. Improved pavement design equations and computer programs will be developed based on information obtained from the research work recommended in this study.

STUDY PROGRESS:

Work during this period has concentrated on gathering data on the test sections placed in Houston and Texarkana. Detailed condition information, photographs, and video footage were taken for all the test sections. This survey provides some of the most significant information compiled to date on the long term performance of CRC pavements placed with different coarse aggregates.

A study of spalling on CRC pavement is continuing and has resulted in the development of a mechanistic model for the prediction of spalling. Laboratory work has included investigating the effect of coarse aggregate on rutting in asphalt pavement and how different blends of coarse aggregate affect pavement performance. Correlations between chemical and physical properties of coarse aggregates for concrete has also begun.

A new set of test sections has been designed for placement in the Houston District in the summer of 1992. These will test several new techniques for controlling the formation of cracks.

Published reports from this study are:

1244-1 "Field Evaluation of Coarse Aggregate Types: Criteria for Test Sections," 1991.

STUDY TITLE: UPGRADING MARGINAL AGGREGATES FOR USE IN ASPHALT CONCRETE PAVEMENTS

STUDY NUMBER:	TTI 1253
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BUTTON J
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	PAUL KRUGLER, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 185,016	TOTAL EXPENDITURES: 130,766
FY 92 BUDGET: 97,614	FY 92 EXPENDITURES: 60,628
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Asphalt concrete pavements comprised of gravels and sands typical of those found in Texas usually exhibit some or all of the following shortcomings: plastic deformation (rutting, shoving, corrugations), damage by moisture (stripping, ravelling), polishing (very poor skid resistance in wet weather), and load-induced cracking (poor fatigue resistance). Recent research in Kuwait has shown promising results for a technique of cement-coated gravel/sand type aggregate prior to use in hot mix ACP. Test results have shown that precoating the aggregates yields marked increases in resistance to rutting, stripping and fatigue of asphalt concrete mixtures. Gravel and sand aggregates are much less expensive than similarly graded crushed stone, sometimes less than one-third the cost. The above described technique is reported to add only about 20 percent to the cost of the hot mix. Portland cement concrete could also benefit from this surface treatment with cement-rich mortar.

OBJECTIVE(S):

The objectives of this study are to:

1. Verify the earlier findings, design and implement a laboratory experiment to familiarize the researchers with the procedure, identify potential problems with the coating process, and make adjustments necessary to accommodate Texas aggregates and environmental conditions and conventional equipment.

2. Plan and conduct field operations of the mortar mixing, aggregate coating, and film curing processes at a mixing plant to identify associated problems and develop acceptable procedures.

3. Conduct controlled field trials to evaluate the construction process, performance, and cost-effectiveness of the technique.

4. Prepare guidelines for use in developing specifications.

IMPLEMENTATION PLAN:

Several areas of the state do not have local sources of high quality aggregate. If these lower quality aggregates could be upgraded, shipping costs would be reduced. Should long-term field evaluation of this method show satisfactory performance, a special provision to Item 340 would be necessary to implement use of the process.

STUDY PROGRESS:

A literature search has been completed, and aggregate samples for laboratory analysis and experiments were obtained for areas in Districts 5, 17, and 21. Laboratory tests have been conducted to determine how cement coating of various size aggregates will affect their gradation, and results indicate that, when properly applied, cement coating has a minimal effect on gradation. Preliminary testing indicates that cement coating increases HVEEM stability, tensile strength, resistance to moisture damage and permanent deformation, and decreases resilient modulus at low temperatures.

The construction of two test pavements has been completed in the Bryan District. No problems related to the treated aggregate were experienced during construction. During placement, much of the cement coating had been abraded off the aggregate. Aggregates, asphalts, and pavement cores were collected from the field test sites and are being tested.

The examination of phenolic-coated aggregates has been canceled, as the necessary materials have not been provided by Southwestern Laboratories.

STUDY TITLE: VARIATIONS OF ENTRAINED AIR CONTENT OF PUMPED CONCRETE

STUDY NUMBER:	TTI 1254
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ZOLLINGER DG,TANG T
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	CHARLES STONE, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 118,763	TOTAL EXPENDITURE: 117,376
FY 92 BUDGET: 61,226	FY 92 EXPENDITURE: 63,613
FY 93 BUDGET: 0	FY 93 EXPENDITURE: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Air-entraining admixtures are used to provide frost resistant properties to concrete. Obtaining the desired air content in the hardened concrete is important to meet durability and other design requirements. On some projects in Texas, a loss in entrained air content was experienced at the end of the discharge line, but after the concrete was placed, the air content reverted back to the content near the pump. Further investigation is needed to understand the effects of pumping.

OBJECTIVE(S):

The objectives of this study are to:

1. Review the process of air entrainment in concrete and the test procedures used to determine air content along with the principles upon which the procedures are based.

2. Determine the types of air entrainment admixtures and aggregates used in pumped concrete in TxDOT projects.

3. Detail the pumping and material effects on air entrainment (from delivery to placement) in terms of the aggregate type, admixture type, and the mix requirements for pumpable concrete.

4. Describe the effects in terms of testing specifications and procedures for pumpable concrete with respect to when and where air content testing should be conducted and what the expected range of air content, which may be obtained for a given level of air entrainment, should be.

IMPLEMENTATION PLAN:

This research will provide information about the nature and causes of variations of air content in pumped concrete (including different aggregates, admixtures, and pumping procedures). This information will allow for construction personnel to produce more durable bridge structures. Any specification changes, special provisions, or bulletin supplements will be initiated by D-5.

STUDY PROGRESS:

Work during this period concentrated on the completion of a special factorial of pumping tests and the development of a relevant empirical pumping model. The resulting model is useful in the selection of mix proportioning and admixture (AEA) characteristics to minimize the loss of air due to pumping operations.

Coordination of bridge deck projects under construction using pumped concrete is under way to collect further verification data for the above model.

STUDY TITLE: FEASIBILITY OF SAFETY REST AREA COMMERCIALIZATION IN TEXAS

STUDY NUMBER:	CTR 1269
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	HARRISON R,EURITT M
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	RICHARD KIRBY, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 147,000	TOTAL EXPENDITURES: 142,946
FY 92 BUDGET: 73,000	FY 92 EXPENDITURES: 69,127
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

A number of states successfully initiated projects that involve privatization of numerous roadside maintenance and service functions. The success of these contractual arrangements, the increased level of service provided to the driving public and the fact that the federal government will likely rescind its restrictions on such developments, suggests that similar arrangements should be explored for Texas.

OBJECTIVE(S):

The objectives of this study are to:

1. Compile an inventory of rest area privatization arrangements utilized in the coterminous United States. This would include but not be limited to, all contractual arrangements currently in force that involve public-private agreements for the provision of facilities, services, materials and maintenance operations.

2. Analyze the contracts and facilities being provided.

3. Detail a recommended TxDOT pilot privatization program.

IMPLEMENTATION PLAN:

One or more sites in the pilot program will be selected to build or have built a rest area that is more of a "travel service center," possibly providing food, gas and other motorist services in addition to rest rooms and picnic tables. If the test facilities prove to be successful, the program could be expanded to other highway locations. This program will be a new step for the department in joint public-private endeavors and may save on costs of construction and maintenance.

STUDY PROGRESS:

Completed tasks include the literature review, survey of other states' experiences, review of other Texas agencies' experiences, and the identification of federal and state legal constraints.

Work is underway in conducting a thorough financial analysis of rest area privatization. Efforts focus on compiling accurate ADT counts and capture rates for each rest area on the Texas highway system. Maintenance costs for the last six years are being calculated.

The 1991 Transportation Act did not include a rest area privatization clause. Thus, the pilot study must use a U.S. highway rest area or get special permission from the federal government.

STUDY TITLE: ROUTINE MAINTENANCE USES FOR MILLED RECLAIMED ASPHALT PAVEMENT (RAP)

STUDY NUMBER:	TTI 1272
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BUTTON J,ESTAKHRI C
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	JOHN BOHUSLAV, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 136,000	TOTAL EXPENDITURES: 119,681
FY 92 BUDGET: 65,000	FY 92 EXPENDITURES: 59,037
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Cold milling of asphalt pavements is necessary during many rehabilitation projects. To be suitable for recycling as ACP, milled tailings must exhibit enough uniformity to facilitate design and production of consistency with standard specifications. Often the milled areas are small, yielding limited quantities, or the materials in the pavement are not uniform. Considerable quantity of nonuniform milled ACP is accumulated in stockpiles. Although unsuitable for use as a recycled pavement, this valuable material may have a variety of useful and cost-effective functions.

OBJECTIVE(S):

The objectives of this study are to:

1. Determine existing, effective uses of milled ACP currently used within the districts and in other states and countries.

2. Determine effectiveness of new, untried ideas and improvements on existing uses through field experimentation.

3. Provide the department with a mode of implementation for the research results.

IMPLEMENTATION PLAN:

Upon completion of the study, copies of the final report and video will be distributed to all district design, construction, and maintenance engineers for consideration and implementation of the recommendations. Based on the success of field trials, it is anticipated that field manuals and videos will be distributed to maintenance workers for review and implementation of routine maintenance uses of RAP. Based on the recommendations for use of RAP in base and subbase courses, it is anticipated that new or revised specifications be reviewed and approved by the Specifications Committee for use by the districts in design, construction, and maintenance. Long-term evaluation of the field trials may be necessary to determine long-range effectiveness.

STUDY PROGRESS:

An extensive literature review is complete. The survey results obtained last November were finalized and distributed to interested personnel.

Five additional field tests have been completed since January 1992, covering various applications and additives. Video footage was collected during several of these field tests.

A full laboratory test plan has been completed for a total of eleven different materials, and additional testing is underway.

A new study has been approved to monitor the performance of the test sections for an additional two years. This new study will begin in September 1992 and is entitled 187-13 "Monitoring of 1272 Routine Maintenance Uses for Milled Reclaimed Asphalt Pavement (RAP)."

STUDY TITLE: LONG-TERM EVALUATION OF STRIPPING AND MOISTURE DAMAGE IN ASPHALT PAVEMENTS TREATED WITH LIME AND ANTI-STRIPPING AGENTS

STUDY NUMBER:	CTR 1286
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	KENNEDY TW,JONES DR,ELMORE WE
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	DARREN HAZLETT, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 160,389	TOTAL EXPENDITURES: 46,501
FY 92 BUDGET: 76,383	FY 92 EXPENDITURES: 46,501
FY 93 BUDGET: 84,006	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

There is a need to continue the evaluation of asphalt pavements constructed under previous research studies (253 and 441) in eight districts. This evaluation will provide the necessary data on the long-term performance and cost-effectiveness of lime and anti-stripping agents.

OBJECTIVE(S):

The objectives of this study are to continue the evaluation plan developed in Research Study 441. The test sections will be monitored (condition survey, traffic, environmental, etc.) and cores will be taken. Testing of the samples will continue as set up in Research Study 441.

IMPLEMENTATION PLAN:

The results of this project may indicate that certain antistrip treatments result in no significant improvements in moisture susceptibility over control sections. It may also be determined that one of the two current test methods used for the determination of moisture susceptibility is more effective than the other. This project may require annual extensions until test sections exhibit significant change.

STUDY PROGRESS:

Cores have been taken from all test sections. The Indirect Tensile Test was utilized to determine the tensile strength ratio (TSR). A report will be submitted in September 1992.

STUDY TITLE: IDENTIFY STRUCTURAL BENEFITS OF STABILIZATION AND UPDATING TFPS TO ACCOMMODATE STABILIZED LAYERS

STUDY NUMBER:	TTI 1287
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LITTLE DN
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	LARRY BUTTLER, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 275,000	TOTAL EXPENDITURES: 23,257
FY 92 BUDGET: 75,000	FY 92 EXPENDITURES: 23,257
FY 93 BUDGET: 99,988	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-01-30
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The new Texas Flexible Pavement Design System (TFPS) does not currently permit designing with lime, portland cement or fly ash stabilized bases and/or subgrades. These types of bases and subbases are used extensively in several areas of the state. Thus, this shortcoming should be addressed in FPS.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop a procedure for TFPS which realistically characterizes stabilized layers in structural pavement systems.

2. Determine levels of in situ moduli for stabilized layers as a function of age to account for the effects of cracking due to shrinkage and load-induced fatigue.

3. Determine stiffness or moduli values for lime-treated subgrades.

4. Determine in situ properties for layers with "nonstandard" stabilizers and incorporate these materials into analyses to select optimal pavement design.

5. Develop realistic fatigue and failure structural models for stabilized layers for use in TFPS.

IMPLEMENTATION PLAN:

The TFPS system is currently undergoing trial implementation within D-8. However, the utility of this system is restricted because it does NOT address stabilized layers. Development of a subsystem to address stabilized layers would greatly assist in the TFPS implementation effort.

STUDY PROGRESS:

Test sections have been identified in four districts, with early emphasis being on portland cement treated pavement sections in the Houston District. Many of the test sections have existing FWD data. In addition, FWD data and construction data sheets have been collected for each flexible SHRP test site which has a chemically modified or stabilized subgrade or base.

Several non-standard soil and aggregate stabilizers have been identified for future study, including fly ash, bottom ash, by-product gypsum, sulfonated naphthanene, and silica-based stabilizers.

STUDY TITLE: USE OF MICRO-SURFACING IN HIGHWAY PAVEMENTS

STUDY NUMBER:	TTI 1289
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SMITH RE
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	MAGHSOUD TAHMORESSI, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 200,000	TOTAL EXPENDITURES: 46,082
FY 92 BUDGET: 65,000	FY 92 EXPENDITURES: 46,082
FY 93 BUDGET: 65,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Current specifications for the use of micro-surfacing allow the contractor to provide the mix design. The department often does not have the ability to conduct or interpret tests used in the mix design performed by the contractor. Guidelines for the types of roads, condition level, traffic level and the environment for which micro-surfacing should be used need to be developed for the department's use. Current test methods also need evaluation.

OBJECTIVE(S):

The objectives of this study are to:

1. Verify or develop mix design procedures.

2. Verify or develop quality assurance tests and guidelines.

3. Develop application guidelines for micro-surfacing.

IMPLEMENTATION PLAN:

The use of micro-surfacing is rapidly gaining popularity and the current specifications need to be updated to ensure performance of these materials. In addition, a mixture design procedure, test methods, and job control guidelines are also needed. The research results will be implemented as they are developed. A draft usage guideline has been prepared and can be distributed to residencies upon preparing the final draft.

STUDY PROGRESS:

Draft recommendations for changes to the current specifications, lab testing plans, field testing plans and draft usage guidelines were prepared. Samples of materials will be taken from six sites during this reporting period. Work will be substantially completed on different distillation methods for emulsions.

Lab equipment for testing has not been acquired yet. This has delayed the testing portion of this project.

STUDY TITLE: IMPROVED RUT MEASUREMENT METHODS FOR SIOMETERS

STUDY NUMBER:	UTA 1290
RESEARCH AGENCY:	UNIVERSITY OF TEXAS - ARLINGTON
STUDY SUPERVISOR(S):	WALKER RS
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	ROBERT HARRIS, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 168,156	TOTAL EXPENDITURES: 43,537
FY 92 BUDGET: 95,504	FY 92 EXPENDITURES: 43,537
FY 93 BUDGET: 72,652	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

With the increase in rutting in Texas, a reliable rut-measuring system must be evaluated and implemented. Current rut measurements in Texas are made manually. D-18 has started development of a low-cost rut bar which uses the SIometer's microcomputer. However, in order to collect accurate data, extensions outside the vehicle body are needed. These extensions can be hazardous in high traffic locations. Thus, different measurement instrumentation (such as LEDs or lasers) needs to be developed.

OBJECTIVE(S):

The objectives of this study are to:

1. Investigate the feasibility of using low-cost lasers, better acoustic methods, or focused LED light sources.

2. Develop a methodology for estimating rut depth from such measurements.

3. Determine the optimum design (i.e., number and spacing of sensors).

IMPLEMENTATION PLAN:

After testing, D-18 will design and manufacture the improved rut bar. One will be installed on each SIometer vehicle. This will allow for continuous rut measurements in conjunction with PES data collection efforts. In addition to PES, this data could be used as inputs for the Flexible Pavement System design program.

STUDY PROGRESS:

The best low-cost sensor worked well under static condition but failed under dynamic measurements. The best system to date is still the Selcom Laser, which at $12,000 is too expensive for use in rutting detection. A general interface has been developed for future testing.

STUDY TITLE: LONG-TERM PERFORMANCE EVALUATION OF POLYMER-MODIFIED ASPHALT CONCRETE PAVEMENTS

STUDY NUMBER:	CTR 1306
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	KENNEDY TW,JONES DR,ELMORE WE
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	DARREN HAZLETT, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 157,489	TOTAL EXPENDITURES: 45,173
FY 92 BUDGET: 75,313	FY 92 EXPENDITURES: 45,173
FY 93 BUDGET: 82,176	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Improving asphalt cement binders in order to improve engineering properties has become increasingly important due to changes in load applications. Polymer additives are currently dominating this field. It is important to provide a means of determining the long-term performance characteristics of polymer-modified asphalt concrete pavements, including hot mix and seal coat applications.

OBJECTIVE(S):

The objectives of this study are to:

1. Establish a long-term monitoring program to follow the performance of polymer-modified asphalt concrete pavement test sections (established in Research Study 492).

2. Determine the critical engineering properties which will predict long-term pavement performance.

3. Evaluate and document the long-term field performance of polymer-modified mixtures placed in field test sections under a variety of loading and environmental conditions.

4. Produce guidelines and proposed specifications to enable polymer-modified asphalt pavements to be more cost-effective.

IMPLEMENTATION PLAN:

The results of this study may indicate that the use of certain polymer modifiers do not result in significant improvements in long-term performance. This study may also be able to determine that certain engineering properties may contribute more than others to the long-term performance of a pavement. The most useful result of this project may be the implementation of procedures to determine the cost-effectiveness of specific polymers for specific applications.

STUDY PROGRESS:

Cores were taken from test sections located in Districts 10, 11, 15, and 25. Laboratory testing (indirect tensile strength, resilient modulus, fatigue, and creep) was performed on all cores.

STUDY TITLE: VERIFICATION OF AN ASPHALT AGING TEST AND DEVELOPMENT OF SUPERIOR RECYCLING AGENTS AND ASPHALTS

STUDY NUMBER:	TTI 1314
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BULLIN JA
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	DARREN HAZLETT, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 270,000	TOTAL EXPENDITURES: 30,493
FY 92 BUDGET: 90,000	FY 92 EXPENDITURES: 30,493
FY 93 BUDGET: 90,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-05-21
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

With the increasingly heavy loads of major highways and the particularly severe restraints on asphalt recycling, asphalt quality must be improved. Refineries have little incentive to produce superior products as long as what they produce with minimum processing meets specifications. As a result, the science of producing superior asphalts is not well developed.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop superior recycling agents and asphalts.

2. Perfect the pressure oxygen vessel (POV) aging test so that the asphalts and recycling agents can be realistically evaluated.

3. Validate the POV test with road aged materials, for which we have the original asphalt.

IMPLEMENTATION PLAN:

This project could result in analysis of aged asphalts to determine the best recycling agent to chemically restore the asphalt to original properties. The POV test may also be able to tell us which asphalts are better from an aging standpoint. Thus, TxDOT would receive better asphalts and better recycled asphaltic material. This could result in changes to test procedures, investigation, and possibly inclusion in asphalt specifications.

STUDY PROGRESS:

Two more POV aging apparatuses have been constructed. A number of asphalts have been hardened to different viscosities in the POV. A number of fractions have been separated into aromatics, oils, and waxes. Rheological properties of these and the aged asphalts have been determined. Some aging data have been obtained for various oil-aromatic blends.

STUDY TITLE: SOLIDIFICATION/STABILIZATION OF HAZARDOUS BLAST SAND

STUDY NUMBER:	CTR 1315
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	FOWLER DW,LOEHR RC,CARRASQUILLO RL
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	JOE RASKA, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 246,000	TOTAL EXPENDITURES: 63,356
FY 92 BUDGET: 110,000	FY 92 EXPENDITURES: 63,356
FY 93 BUDGET: 136,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-12-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The use of sandblasting to remove paint containing lead, chromium and cadmium results in contaminated sand which is sometimes classified as a hazardous waste. With even more stringent disposal requirements predicted for the future, the problem is likely to become even more difficult and expensive. This study has the objective of developing cost-effective means of solidification and stabilization of hazardous blast sand which would allow it to be recycled and disposed of as a nonhazardous waste.

OBJECTIVE(S):

The objectives of this study are to:

1. Define the state-of-the-art, particularly for this application.

2. Conduct a laboratory program to develop solidification/stabilization methods which will render the blast sand nonhazardous thus allowing for its use in construction and reconstruction.

3. Conduct a field testing program to verify the results of the laboratory tests.

4. Prepare a user's manual.

5. Conduct a training workshop.

IMPLEMENTATION PLAN:

Results from this project will take TxDOT from a generator of hazardous waste to a recycler, thus saving virgin materials. The Water Commission, Health Department, and the Air Control Board will be involved in this project to ensure thoroughness.

In order to test the project findings, two cleaning and painting projects will be set up to use the results from this project to produce an environmentally safe fill for dolphins (protection systems for bridge piers) or for use in rip-rap. It is quite possible that other projects will be needed to show how this material can be used for products such as curbs, sidewalks, median barriers, concrete pavement, etc.

The results from this project will enable the writing of clear and precise specifications for recycling that will be included in each bridge

repainting project.

STUDY PROGRESS:

The literature search, survey of current practices, and an evaluation of related state and federal regulations have been reviewed.

Collection and analysis of two types of spent blasting media have been completed from two different bridge sites. Laboratory work has included testing over 80 experimental mixes. These mixes have been tested for leaching (as per the Toxicity Characteristic Leaching Procedure), strength, and permeability. The most promising will be refined further.

The Rainbow Bridge in the Beaumont Bridge will be the first project where these results will be used.

STUDY TITLE: SHORT-TERM GUIDELINES TO IMPROVE ASPHALT-RUBBER PAVEMENTS

STUDY NUMBER:	TTI 1332
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ESTAKHRI C,LITTLE DN
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	GENE RUDD, DIST 11
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 240,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 119,891	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Asphalt rubber has been used in Texas for many years as a binder for chip seals and interlayers. Only recently has TxDOT used asphalt-rubber binder in hot-mixed asphalt concrete (HMAC). Guidelines and specifications for proper application, mix design, and testing are needed so that quality assurance and control can be sustained in asphalt-rubber pavements. This is especially important with the new federal legislation that requires the use of tire rubber beginning in 1994.

OBJECTIVE(S):

The objective of this study is to optimize performance of asphalt-rubber concrete pavements through the development of materials and construction specifications, mixture design and testing procedures, binder testing procedures, and quality control and construction guidelines.

IMPLEMENTATION PLAN:

Mix design procedures will be developed for different applications, such as heavy freeze-thaw cycles, flushing, overlays, etc. Specifications will be developed in close coordination with TxDOT advisors. TxDOT involvement in the mix design and testing procedure development will help ensure an implementable product.

Design procedures, working specification, and testing techniques should be incorporated into a manual for use as a ready reference.

STUDY PROGRESS:

STUDY TITLE: RECYCLING SECOND GENERATION ASPHALT RUBBER PAVEMENTS

STUDY NUMBER:	TTI 1333
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	CROCKFORD W
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	BOB LINDLEY, DIST 8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 200,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 100,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

As more waste tire rubber is incorporated into virgin pavement materials, it becomes more important to look forward to the eventual need to recycle these materials. This will help maximize the potential economic, environmental, and natural resource conservation benefits. This project will explore the options available for recycling these pavements (made with waste tire rubber) and the potential construction, environmental, and structural problems associated with the recycled materials.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify potential problems with current mix design and construction techniques that might preclude the possibility of successfully recycling pavements containing rubber.

2. Develop recommendations to resolve any problems identified.

3. Develop recycling guidelines for TxDOT use.

4. Evaluate alternative uses for rubber in transportation applications.

IMPLEMENTATION PLAN:

The results of this research can help TxDOT establish goals for the use of asphalt-rubber. If asphalt-rubber cannot be recycled, other uses for waste tire rubber need to be found. Actual field tests are needed to verify the results of this research. Material needs to be milled from the roadway, a design established, actually run through a plant, and put back on the roadway before we will truly know all the problems and results of recycling asphalt-rubber.

STUDY PROGRESS:

STUDY TITLE: IMPROVED PRIME COAT METHODS

STUDY NUMBER:	TTI 1334
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BUTTON J,FREEMAN T
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	WILL PARKS, DIST 23
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 85,331	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 85,331	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

A prime coat is an application of low viscosity asphalt to a granular base in preparation for an asphalt surface course. The prime coat should coat and bond loose mineral particles, waterproof the surface of the base, provide adhesion between the base and the next course, strengthen the surface by binding the finer aggregate particles, and plug capillary voids. Currently, cutback asphalts provide the best prime coat, but cutbacks may be disallowed by future regulations because of environmental concerns. Thus, alternatives need to be found.

OBJECTIVE(S):

The objectives of this project are to:

1. Examine the importance of the bond between the base and various types of surface courses.

2. Explore materials and construction techniques to improve prime coat performance.

3. Field test and evaluate the various alternatives identified.

4. Develop appropriate construction specifications and test procedures with criteria for quality assurance and control.

5. Suggest material specifications for products which may be developed.

IMPLEMENTATION PLAN:

This research will produce material and construction specifications for one or more products. TxDOT will need to contract several test sections across the state to evaluate short- and long-term performance. These sections will also help to evaluate the costs associated with the product(s) and to develop a training manual and/or videos for statewide implementation if the desired results are achieved.

STUDY PROGRESS:

STUDY TITLE: MOVEMENT OF SUPERHEAVY LOADS OVER THE STATE HIGHWAY SYSTEM

STUDY NUMBER:	TTI 1335
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	FERNANDO E
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	BOB BRIGGS, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 376,022	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 116,022	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

TxDOT is issuing permits for movement of superheavy loads (>250,000 lbs.) over the state highway system on an ever increasing basis. Occasionally these loads exceed 1,000,000 pounds, and in some instances over 2,000,000 pounds. The effects of these loads on pavement structures is not well understood and cannot be analyzed with conventional procedures.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop a preliminary procedure to be implemented on subsequent movements of superheavy loads.

2. Formulate a field testing plan, addressing data collection with Ground Penetrating Radar, Falling Weight Deflectometer, and video camera.

3. Use Texas Triaxial Data to provide ultimate strength values.

4. Correct deficiencies within the preliminary procedure.

5. Develop an instrumentation plan to monitor damage induced by actual superheavy loads.

6. Provide TxDOT with reports documenting results and findings.

IMPLEMENTATION PLAN:

The results of this study will provide a systematic method for determining probability and location of pavement damage so that measures can be taken to avoid it. Furthermore, TxDOT will have a defensible method for recouping costs associated with damage caused by superheavy loads.

The Pavement Management Section will implement the results of this research by performing structural analyses of pavements prior to movement of superheavy loads and reporting the results to the Central Permit Office. As each district becomes more familiar with the procedures, they can perform the analysis for heavy load movement within their own district. Videotapes and field manuals will need to be developed for the districts. A short training course could also speed up district implementation.

STUDY PROGRESS:

STUDY TITLE: APPLICATION OF M(R) MODULUS TESTS TO TEXAS BASE MATERIAL FOR PAVEMENT DESIGN

STUDY NUMBER:	UTEP 1336
RESEARCH AGENCY:	UNIVERSITY OF TEXAS AT EL PASO
STUDY SUPERVISOR(S):	NAZARIAN S,PEZO RF,PICORNELL M
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	HAROLD ALBERS, D-9
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 177,975	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES:
FY 93 BUDGET: 111,523	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

For several practical reasons, little has been done to characterize granular base and subbase materials in the laboratory. The main goal of this research is to develop a reliable and efficient procedure for testing granular base materials by improving the existing methodology and by minimal equipment development and modification. This study will build on work performed in previous studies 1123 "Non-Destructive Test Procedures for Analyzing Structural Conditions of Pavements" and 1177 "Development of Routine Resilient Modulus Testing for Use with the New AASHTO Pavement Design Guide."

OBJECTIVE(S):

The objectives of this study are to:

1. Develop an easy-to-use laboratory testing procedure for use by TxDOT staff.

2. Develop a simple database of main sources of base course materials used by each district and corresponding volume of use.

3. Develop a factorial experiment for laboratory testing of representative base materials, conduct tests on identified materials, and derive models to describe test results.

4. Verify model by comparing in situ moduli with laboratory moduli at one site.

5. Install new M(R) testing system for TxDOT use and assist TxDOT personnel in using the developed procedures.

IMPLEMENTATION PLAN:

The results of this study can be implemented several ways. This project will provide confidence in resilient modulus values for a number of Texas base materials for the new Texas Flexible Pavement Design System (TFPS). The D-8 Operations and Procedures Manual and the Pavement Design training courses will be updated to include this new information.

Additionally, having a second resilient modulus testing system within TxDOT will enable more asphalt and soil mateials to be tested.

STUDY PROGRESS:

STUDY TITLE: USING GROUND PENETRATING RADAR FOR PAVEMENT EVALUATION

STUDY NUMBER:	TTI 1341
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SCULLION T
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	ROBERT HARRIS, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 342,923	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 172,923	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

Ground Penetrating Radar (GPR) has been shown to measure the thickness of asphalt surfacings to +/- 0.1 inch. Since GPR is a non-destructive technology, developing it for other applications would be very useful. This research will build on the work conducted in studies 1233 "New Technologies for Pavement Evaluation" and 1923 "Continued Development of the Texas Ground Penetrating Radar System."

OBJECTIVE(S):

The objectives of this study are to:

1. Evaluate GPR's potential for locating voids beneath rigid pavement, measuring the thickness of rigid pavement, and identifying areas of stripping in hot-mixed asphalt.

2. Implement a field GPR system and demonstrate its ability in a series of pilot and in-service tests.

3. Assist TxDOT in implementing GPR technology.

4. Construct a series of test slabs at TTI for GPR evaluation and calibration purposes.

IMPLEMENTATION PLAN:

Should this project prove successful, the Pavement Management Section will pursue the purchase of several GPR units. Data collection and analysis procedures will be developed for both network and project level evaluations.

Full implementation will take several years to complete and will most likely require training and continuing education, preparation of field manuals, and long term testing, to be coordinated by the Pavement Management Section.

STUDY PROGRESS:

STUDY TITLE: SPECIAL CONCRETE DESIGN AND CONSTRUCTION METHODS FOR INTERSECTIONS

STUDY NUMBER:	TTI 1385
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ZOLLINGER DG,TANG T
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	JOHN HOLZWARTH, DIST 12
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 198,000	TOTAL EXPENDITURES: 101,588
FY 92 BUDGET: 160,000	FY 92 EXPENDITURES: 101,588
FY 93 BUDGET: 88,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Intersection construction in urban and commercial areas must be particularly sensitive to the increased congestion which may occur because of reconstruction. This problem is multiplied by the fact that traffic may be delayed in four directions. Consequently, there is a great need to expedite the construction process at intersections to minimize traffic delays and user costs.

OBJECTIVE(S):

The overall objective of this research is to develop guidelines for the design and construction of concrete intersections to minimize traffic delay. Specific objectives are to:

1. Identify and evaluate the existing design and construction methods for intersections and develop a draft guideline incorporating this information.

2. Develop mix design and construction methods to insure proper results.

3. Develop an understanding of the balance between strength gain and the development of stress to provide insight into sawcutting and other jointing requirements.

4. Establish a framework for the modeling of stress as a function of various causes for different materials and environmental conditions.

5. Construct a test section to verify study findings.

6. Finalize guidelines for intersection design and layout details, construction details, procedures, and material specifications.

IMPLEMENTATION PLAN:

This research study will document (and develop where necessary) the concrete mix design, pavement design, construction methods and material specifications to reach adequate concrete strengths to allow early pavement opening to traffic, and provide a durable pavement structure.

The favorable results of the research study, when implemented, will improve traffic handling at the intersections, the inconvenience to the traveling public will be lessened, and the department will benefit by having a shorter construction time.

To fully implement the use of Fast Track concrete pavement, a special specification and standard detail sheet need to be approved for general use. The durability of Fast Track concrete pavement will be evaluated at the district level.

STUDY PROGRESS:

Work during this period has concentrated on the development of preliminary construction guidelines which address the state's needs with respect to construction of accelerated concrete pavements. The guidelines contain information on concrete materials, workability, durability, placement, jointing, and curing. Other important factors such as subgrade support, pavement performance, steel reinforcement, and concrete temperature/strength management are also addressed.

Coordination is also underway to instrument actual fast-track paving construction to collect temperature and maturity data to provide input for stress analysis and prediction of pavement cracking.

STUDY TITLE: DEVELOP MLS DISPLAY, SLIDE PRESENTATION, AND PMS VISUAL AIDS

STUDY NUMBER:	CTR 1900 Task 3
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MCCULLOUGH BF
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	DAVID FINK, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 10,000	TOTAL EXPENDITURES: 4,711
FY 92 BUDGET: 5,000	FY 92 EXPENDITURES: 4,711
FY 93 BUDGET: 5,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-10-19
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT: N/A

OBJECTIVE(S):

The objectives of this study are to:

1. Develop a display for both the Mobile Load Simulator (MLS) and the Pavement Management System(PMS).

2. Prepare slides for a joint CTR/D-18PM presentation to the TxDOT Administration.

3. Assist in the development of PMS graphics and visual aids.

IMPLEMENTATION PLAN:

The graphics will assist in identifying the key points of a PMS. The slides will demonstrate the need for ongoing research and development that a PMS requires. The display will be used at events such as the short course, the Transportation Research Board Meeting, etc.

STUDY PROGRESS:

STUDY TITLE: AVOIDING ROAD SHOULDER ASPHALT DEGRADATION DUE TO TURFGRASS ENCROACHMENT

STUDY NUMBER:	TTI 1903
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ENGELKE MC
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	CRAIG STEFFENS, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 45,000	TOTAL EXPENDITURES: 77,796
FY 92 BUDGET: 45,000	FY 92 EXPENDITURES: 4,996
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-03-18
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Common bermudagrass, well adapted to Texas conditions, dominates most roadside plantings along Texas roads. However, bermudagrass has very invasive rhizomes, which are capable of penetrating asphalt. This can cause the need for shoulders to be replaced every 2 to 3 years. Herbicides can extend the life to 8 to 10 years, but this is an expensive practice, costing 4 to 5 million dollars annually in Texas.

OBJECTIVE(S):

The objectives of this research are to:

1. Find an alternative grass which can stabilize roadside banks as effectively as bermudagrass.

2. Find an alternative grass which is as competitive as bermudagrass under low maintenance, water deficit conditions.

3. Find an alternative grass which does not have aggressive rhizome growth.

IMPLEMENTATION PLAN: N/A

STUDY PROGRESS:

STUDY TITLE: TEXAS PAVEMENT MANAGEMENT SYSTEM

STUDY NUMBER:	CTR 1908
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	HUDSON WR
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	BOB BRIGGS, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 239,180	TOTAL EXPENDITURES: 38,984
FY 92 BUDGET: 113,640	FY 92 EXPENDITURES: 38,984
FY 93 BUDGET: 125,190	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-01-29
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

A need exists to develop inputs and models related to rigid pavements for TxDOT's Pavement Management System (PMS). The formal PMS is scheduled to be implemented in two stages. Stage I will address the statewide system and has a target implementation date of February 1993. Stage II will address the district level and has a target date of August 1995.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop appropriate models for rigid pavements for use in the Texas PMS concerning pavement performance, preventative maintenance, rehabilitation, and heavy rehabilitation and reconstruction treatments.

2. Study the feasibility of expanding the SHRP database to include additional pavement test sections to give Texas a self-contained database for future PMS efforts.

3. Evaluate and analyze structural data to produce structural peroformance models for rigid pavements for use in PMS.

4. Develop information related to environmental and weather factors and their impact on rigid pavement performance in Texas.

IMPLEMENTATION PLAN:

The models and results developed herein will be directly integrated into the Texas PMS. The Pavement Management Section of TxDOT will use these models to help meet their target implementation dates.

STUDY PROGRESS:

STUDY TITLE: ROADSIDE DEVELOPMENT AND MANAGEMENT FIELD LABORATORY: EROSION CONTROL MATERIAL TESTING

STUDY NUMBER:	TTI 1914
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	LANDPHAIR HC
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	PAUL NORTHCUTT, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 665,244
FY 92 BUDGET: 230,000	FY 92 EXPENDITURES: 175,125
FY 93 BUDGET: 171,173	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-05-11
TERMINATION DATE:	CONTINUING

PROBLEM STATEMENT:

There is a need for a coordinated research program to evaluate retention blankets and cellulose fiber mulches. Data needs to be collected relative to its performance in order to develop and maintain an approved material list for the Department.

OBJECTIVE(S):

The objective of this study is to provide the manufacturers of erosion control and revegetation materials a timely and fair program through which their individual products may be evaluated for use within the Department's construction and maintenance personnel.

IMPLEMENTATION PLAN:

This project will produce a list of approved erosion control materials and methods of erosion control, channel lining and vegetation establishment for maintenance, construction and repair which will be of immediate value to design and construction specifiers, construction supervisors and maintenance personnel.

STUDY PROGRESS:

STUDY TITLE: INVESTIGATE PAVEMENT SURFACE MEASUREMENT METHODS APPLICABLE FOR CONSTRUCTION CONTROL

STUDY NUMBER:	UTA 1916
RESEARCH AGENCY:	UNIVERSITY OF TEXAS AT ARLINGTON
STUDY SUPERVISOR(S):	WALKER RW
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	ROBERT HARRIS, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 25,860	TOTAL EXPENDITURES: 33,589
FY 92 BUDGET: 25,247	FY 92 EXPENDITURES: 17,506
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-06-11
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The profilograph does not provide a uniform response to the various surface profile frequencies and it may over or under estimate the amplitudes of important surface profile frequencies.

Another limitation of the profilograph is the requirement of manual interpretation of the data. A new instrument is needed which provides a flat response in the range necessary for adequate construction control purposes and which would be in the same price range as the profilograph.

OBJECTIVE(S):

The objective of this study is to test and evaluate several methods of using the current SIometer in both the self calibrating and South Dakota processes.

IMPLEMENTATION PLAN:

Data will be provided to TxDOT, TTI and CTR for concurrence on its possible use for construction control specifications.

STUDY PROGRESS:

STUDY TITLE: INCORPORATING DISTRICT REQUIREMENTS INTO MICRO-PES (PAVEMENT EVALUATION SYSTEM)

STUDY NUMBER:	TTI 1918
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SCULLION T
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	BRYAN STAMPLEY, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 100,000	TOTAL EXPENDITURES: 78,628
FY 92 BUDGET: 15,000	FY 92 EXPENDITURES: 3,072
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-06-18
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

MICRO-PES system was developed to provide district personnel with easy access to PES data together with a series of analysis programs to generate output reports. However, several organizational and technical issues need to be addressed prior to statewide implementation. The two organizational issues that cause problems are unavailability of adequate microcomputers at the District Level and computer training for the district staff. The technical issues involved are improved segmentation, increasing the number of sections, simple sorted listings, district modifiable decision trees, graphical displays of pavement condition and access to deflection data.

OBJECTIVE(S):

The objectives of this study are to:

1. Improve MICRO-PES.

2. Assist the Department in planning its statewide implementation.

IMPLEMENTATION PLAN:

TTI will coordinate with D-18PM to conduct training schools for Departmental and District personnel. User and instructional guides will be produced. The modified PES system will be used within the existing Pavement Management System.

STUDY PROGRESS:

STUDY TITLE: EFFECT OF VEHICULAR VIBRATION ON DEBONDING AND DELAMINATION OF CONCRETE OVERLAYS

STUDY NUMBER:	UTEP 1920
RESEARCH AGENCY:	UNIVERSITY OF TEXAS AT EL PASO
STUDY SUPERVISOR(S):	NAZARIAN S;ROZENDAL D
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	RICHARD ELLISON, DIST 24
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 119,264	TOTAL EXPENDITURES: 74,025
FY 92 BUDGET: 28,824	FY 92 EXPENDITURES: 17,096
FY 93 BUDGET: 33,511	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Delamination and debonding of concrete layers overlying bridge decks and in thin bond overlays occur frequently and these problems significantly accelerate the rate of deterioration of concrete. The vibration of the member due to traffic in the vicinity of the freshly-poured concrete has not been considered as a factor and it could propagate the debonding once started.

OBJECTIVE(S):

The objective of this study is to study and evaluate the effect of vibration on the initiation and propagation of debonding and delamination of concrete overlays.

IMPLEMENTATION PLAN:

The results of this study can be implemented upon completion of study and tremendous economic benefits could be realized by minimizing the amount of maintenance and repair of debonded and delaminated pavements.

STUDY PROGRESS:

Published reports from this project are:

1920-1 Volume 1 "Laboratory Investigation of Delamination and Debonding of Thin-Bonded Overlays Due to Vehicular Vibration," 1991.

1920-1 Volume 2 "Laboratory Investigation of Delamination and Debonding of Thin-Bonded Overlays Due to Vehicular Vibration (Appendices and Supporting Data)," 1991.

STUDY TITLE: AUTOMATED SURFACE INSTRUMENTATION METHODS

STUDY NUMBER:	UTA 1921
RESEARCH AGENCY:	UNIVERSITY OF TEXAS AT ARLINGTON
STUDY SUPERVISOR(S):	WALKER RW
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	CARL BERTRAND, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 189,434	TOTAL EXPENDITURES: 74,734
FY 92 BUDGET: 61,704	FY 92 EXPENDITURES: 38,959
FY 93 BUDGET: 38,144	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The various methods employed by Texas to collect pavement distress related data have been improved e.g. upgrade of the Surface Dynamics Profilometer, implementation of SIometer, the development of an automated crack identification and measurement system, the use of acoustic units with the SIometer for rut depth measurements. A project has been initiated to investigate using the SIometer with acoustic displacement units for a better method for aiding in determining the acceptance of new pavement construction. It was decided that Texas should have similar capabilities as the successful South Dakota profilometer. Due to availability of Global Positioning Systems (GPS), all measuring systems need to be automated to the point of determining and recording their respective measurement locations from satellite data.

OBJECTIVE(S):

The objectives of this study are to:

1. Compare the profile and rut capability of the SIometer to that of the various South Dakota systems.

2. Monitor technological advancements in profile and rutting capability.

3. Continue investigation of new laser technology for surface identification.

4. Provide operational, hardware and software support of the automated crack identification system as it is used in PES and other various field applications.

5. Obtain one or more units which will allow interface to Satellite Global Referencing System.

6. Develop a fault detection system for concrete pavements.

IMPLEMENTATION PLAN:

An operational rut bar has been designed and is being installed on five of the SIometer vans. Procedures have been developed to produce ride data and rutting.

STUDY PROGRESS:

STUDY TITLE: CONTINUED DEVELOPMENT OF THE TEXAS GROUND PENETRATING RADAR SYSTEM

STUDY NUMBER:	TTI 1923
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SCULLION T
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	ROBERT HARRIS, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 90,854	TOTAL EXPENDITURES: 73,171
FY 92 BUDGET: 15,000	FY 92 EXPENDITURES: 12,796
FY 93 BUDGET: 15,401	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Currently, a TxDOT vehicle is fitted with a Ground Penetrating Radar (GPR) antenna and other relevant equipment for experimentation with a GPR system. Funding is required for maintenance, expansion and demonstration of the Texas GPR system.

OBJECTIVE(S):

The objectives of this study are to:

1. Maintain the vehicle.

2. Implement enhancements to the antenna mounting and data collection systems.

3. Provide services to other research projects.

4. Demonstrate the equipment to interested division and district personnel.

IMPLEMENTATION PLAN:

Potential applications which will be of interest to division and district personnel include:

1. Layer thickness determination of both asphalt and concrete pavements.

2. Void detection.

3. Detection of stripping in asphalt.

STUDY PROGRESS:

STUDY TITLE: MOBILE LOAD SIMULATOR (MLS) PROTOTYPE DESIGN AND MODEL MLS APPLICATION

STUDY NUMBER:	CTR 1924
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MCCULLOUGH BF,HUGO F
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	AL LUEDECKE, D-10
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 947,351	TOTAL EXPENDITURES: 405,316
FY 92 BUDGET: 654,481	FY 92 EXPENDITURES: 185,633
FY 93 BUDGET: 798,165	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-10-22
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The technical brochure of the MLS has only general information on the testing ability of the machine. It is expected that the specific details of the MLS may differ from the information in the brochure. These changes should be performed in conjunction with the needs of the Department and in consultation with the technical coordinators.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop and manage the construction of the Texas Mobile Load Simulator.

2. Execute pre-commissioning testing and evaluation to enable delivery by termination date.

IMPLEMENTATION PLAN:

It is planned that at the end of the first year of the project, the MLS structural frame with at least one bogie and the connecting chain of links will be in place with the installation of some form of power drive. The model MLS will be used to enhance the development of the protoype and used to test model pavements.

STUDY PROGRESS:

STUDY TITLE: MODEL PAVEMENT TESTING

STUDY NUMBER:	CTR 1934
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MCCULLOUGH BF,HUGO F
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	BOB BRIGGS, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 165,941	TOTAL EXPENDITURES: 53,813
FY 92 BUDGET: 76,658	FY 92 EXPENDITURES: 33,835
FY 93 BUDGET: 69,283	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-01-17
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

A mechanical evaluation of the model Mobile Load Simulator was completed in August 1990. The most important features for long term testing were improved upon; however, productivity improvements were not addressed. Ongoing improvements on the mechanical aspects of the model were conducted during the development of the full-scale facility. Findings during the developmental phases of the testing have necessitated changes of the study periodically.

OBJECTIVE(S):

The objectives of this study are to:

1. Study the mechanical behavior of a machine resembling the full-scale prototype.

2. Serve as a basis for future modeled pavement materials research in a situation resembling real loading conditions.

IMPLEMENTATION PLAN:

Improved knowledge of the mechanical behavior of the model could be obtained for designing the prototype. The feasibility of future modeled pavement materials research could be evaluated.

STUDY PROGRESS:

STUDY TITLE: CONTROL OF SEDIMENT DEPOSITION PROCESS AT BIG SANDY DRAW BRIDGE AND INTERSTATE 20

STUDY NUMBER:		TECH 1936	
RESEARCH AGENCY:		TEXAS TECH UNIVERSITY	
STUDY SUPERVISOR(S):		CLABORN BJ	
RESEARCH AREA:		AREA 2	
TxDOT CONTACT:		BOB LINDLEY, DIST 8	
STUDY SPONSOR:		TxDOT	
TOTAL BUDGET:	33,626	TOTAL EXPENDITURES:	27,795
FY 92 BUDGET:	21,796	FY 92 EXPENDITURES:	15,965
FY 93 BUDGET:	0	FY 93 EXPENDITURES:	N/A
DATE BEGUN:		91-03-12	
TERMINATION DATE:		T92-08-31	

PROBLEM STATEMENT:

Big Sandy Draw in Howard County has deposited sediment to a depth sufficient to impede the flow of storm water through the bridge openings on both access roads and both lanes of Interstate 20. The sediment has been removed twice in the last three years by mechanical means but it is again approaching the point where flooding of the interstate roadway could occur.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop an understanding of the causes of sediment deposition.

2. Evaluate the possible means to alleviate the deposition of sediment at the Big Sandy Draw crossing of Interstate 20.

IMPLEMENTATION PLAN:

The results of this study will help the Abilene District formulate a plan to alleviate the sediment deposition problem. It could also be used to combat similar problems elsewhere.

STUDY PROGRESS:

STUDY TITLE: RIGID PAVEMENT EVALUATION SYSTEM

STUDY NUMBER:	TTI 1939
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SCULLION T,UZAN J
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	MICHAEL MURPHY, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 86,100	TOTAL EXPENDITURES: 3,668
FY 92 BUDGET: 50,000	FY 92 EXPENDITURES: 2,610
FY 93 BUDGET: 20,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-03-20
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

TTI developed a flexible pavement structural evaluation system called MODULUS which uses Falling Weight Deflectometer deflection data and calculates the modulus of each of the layers in the pavement system. It has been proposed that a similar system be developed for rigid pavements but there are several distinct differences between rigid and flexible pavement analysis. Currently, there are no analytically based procedures for interpreting deflection data collected on pavement edges or joints. The existing system only collects data at the center of the slab.

OBJECTIVE(S):

The objective of this study is to develop a MODULUS type framework for rigid pavements.

IMPLEMENTATION PLAN:

TxDOT should have the capability of analyzing center slab and unsupported edge deflections and load transfer along a project.

A general purpose system will also be developed to analyze several loading positions at the center and edges.

STUDY PROGRESS:

STUDY TITLE: IMPLEMENTATION OF ABSOLUTE FWD CALIBRATION SYSTEMS DEVELOPED BY UTEP AND SHRP

STUDY NUMBER:	UTEP 1947
RESEARCH AGENCY:	UNIVERSITY OF TEXAS AT EL PASO
STUDY SUPERVISOR(S):	NAZARIAN S
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	CARL BERTRAND, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 10,991	TOTAL EXPENDITURES: 10,996
FY 92 BUDGET: 7,732	FY 92 EXPENDITURES: 1,017
FY 93 BUDGET: 2,836	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-05-28
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The primary function of the Falling Weight Deflectometer (FWD) is to measure a deflection basin due to a load imparted to the pavement which is then used to backcalculate modulus profiles of pavement sections. UTEP and SHRP developed calibration systems for geophones and load cells used in the accurate determination of these deflection basins. TxDOT will require assistance in evaluating and implementing these systems.

OBJECTIVE(S):

The objective of this study is to assist TxDOT personnel in the evaluation of both the SHRP and UTEP calibration systems.

IMPLEMENTATION PLAN:

By implementing the most appropriate system, TxDOT can ensure standardized and uniform data collection with all TxDOT FWD devices.

STUDY PROGRESS:

STUDY TITLE: REPAIR OF FIRE-DAMAGED CONCRETE PAVEMENT ON I-45

STUDY NUMBER:	CTR 1948
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MCCULLOUGH BF,FOWLER DW
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	JOE NELSON, DIST 18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 26,714	TOTAL EXPENDITURES: 8,671
FY 92 BUDGET: 16,452	FY 92 EXPENDITURES: 4,454
FY 93 BUDGET: 10,262	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-06-21
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Fire damage occurred in a jointed concrete pavement in the southbound lanes of I-45 approximately two miles north of the Freestone County line in Navarro County near Corsicana two years ago when drums of flammable chemicals hit the pavement. The resulting spalling of the pavement was intermittent over a distance of 660 feet.

OBJECTIVE(S):

The objectives of this study are to:

1. Repair the spalled concrete using relatively new, fast-setting concretes and several application methods.

2. Develop techniques and specifications that may be used in urban conditions with high traffic volumes to minimize closure times.

IMPLEMENTATION PLAN:

CTR will provide all repair materials and personnel for the repair effort and conduct all testing and evaluation. The District will provide equipment and personnel for preparation of repair and traffic control for repair and later evaluation.

STUDY PROGRESS:

STUDY TITLE: STANDARDS, POLICIES, GUIDELINES AND DESIGNS

STUDY NUMBER:	TTI 1949
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	IVEY DL
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	MARK MAREK, D-8
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 175,000	TOTAL EXPENDITURES: 59,517
FY 92 BUDGET: 175,000	FY 92 EXPENDITURES: 59,517
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

TTI possesses a uniquely qualified staff in the area of design policies, procedures and guidelines. TxDOT desires investigation and analysis into design issues using various computer programs, benefit-cost analyses, accident data analyses and full scale vehicle handling and crash testing.

OBJECTIVE(S):

The objective of this study is to develop design policies, procedures and guidelines under the guidance of TxDOT engineers and in response to their needs.

IMPLEMENTATION PLAN: N/A

STUDY PROGRESS:

STUDY TITLE: DEVELOPMENT AND IMPLEMENTATION OF GPS SATELLITE POSITIONING APPLICATIONS FOR TxDOT

STUDY NUMBER:	CTR 1952		
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH		
STUDY SUPERVISOR(S):	TUCKER A		
RESEARCH AREA:	AREA 2		
TxDOT CONTACT:	FRANK HOWARD, D-19		
STUDY SPONSOR:	TxDOT		
TOTAL BUDGET: 704,869	TOTAL EXPENDITURES:	171,737	
FY 92 BUDGET: 339,869	FY 92 EXPENDITURES:	171,737	
FY 93 BUDGET: 365,000	FY 93 EXPENDITURES:	N/A	
DATE BEGUN:	91-11-05		
TERMINATION DATE:	T93-08-31		

PROBLEM STATEMENT:

Global Positioning System(GPS) technology has revolutionized the the field of surveying and navigation. GPS can be utilized to augment Geographic Information Systems(GIS) and in turn the Executive Information Systems. The downward trend in GPS receiver costs and increased awareness of the utility of GPS have revealed other needs and potential applications. Applied Research Laboratories(ARL) has provided TxDOT with technical expertise and the benefits of applications oriented research in the development, implementation and refinement of a number of GPS programs.

OBJECTIVE(S):

The objective of this study is to continue TxDOT's development of GPS technology in several existing and new applications.

IMPLEMENTATION PLAN:

ARL will assist TxDOT in GPS photogrammetry, software enhancements to the RPP station software, realtime positioning/navigation, GPS receiver technology, construction applications; development of GPS bridge motion monitoring capability and development of the TxDOT dynamic positioning system.

STUDY PROGRESS:

STUDY TITLE: CONSTRUCTION OF THE FWD CALIBRATION FACILITY

STUDY NUMBER:	TTI 1956		
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE		
STUDY SUPERVISOR(S):	SCULLION T		
RESEARCH AREA:	AREA 2		
TxDOT CONTACT:	BOB BRIGGS, D-18		
STUDY SPONSOR:	TxDOT		
TOTAL BUDGET: 100,000	TOTAL EXPENDITURES:	18,357	
FY 92 BUDGET: 60,230	FY 92 EXPENDITURES:	18,357	
FY 93 BUDGET: 65,000	FY 93 EXPENDITURES:	N/A	
DATE BEGUN:	91-12-23		
TERMINATION DATE:	T93-08-31		

PROBLEM STATEMENT:

OBJECTIVE(S):

The objective of this study is to locate and construct a permanent indoor facility for the calibration of the TxDOT Falling Weight Deflectometer (FWD).

IMPLEMENTATION PLAN:

This calibration center will serve as the Southeast Regional Falling Weight Deflectometer Calibration Center (FWDCC). Regional SHRP contractors and other participating state highway agencies will be able to utilize the FWDCC for the calibration of their equipment. TTI with the assistance of TxDOT and the SHRP personnel will acquire the necessary FWD calibration equipment. TTI personnel will operate the FWDCC and assist the TxDOT Maintenance and Operations D-18PM personnel to compare the SHRP calibration system with the FWD calibration developed for Texas.

STUDY PROGRESS:

STUDY TITLE: FULL SCALE BONDED CONCRETE OVERLAY ON IH-10 IN EL PASO

STUDY NUMBER:	CTR 1957
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	McCULLOUGH BF,FOWLER D,MOODY E
RESEARCH AREA:	AREA 2
TxDOT CONTACT:	JOSE RODARTE, DIST 24
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 27,392	TOTAL EXPENDITURES: N/A
FY 92 BUDGET: 27,392	FY 92 EXPENDITURES: N/A
FY 93 BUDGET: N/A	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-06-08
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

To determine the feasibility of placing a bonded concrete overlay on the continuously reinforced concrete pavement on Interstate 10 running through El Paso, Texas.

OBJECTIVE(S):

The objectives of this study are to:

1. Collect background information:
   -annual traffic, ADT, ESAL's
   -environmental information
   -determine District 24's long term objectives; design life
   -are preliminary deflections necessary?

2. Develop preliminary BCO designs to assess feasibility
   -recommend initial pavement repairs
   -consider construction cost, user cost, maintenance cost
   -use life cycle cost analysis
   -determine detailed data collection needs
   -determine need for pilot sections
   -recommend rehabilitation approach, verify design life

3. Prepare and present proposal to TxDOT administration.

IMPLEMENTATION PLAN:

Perform detailed data collection activities as required. Finalize designs for pilot test sections if they are at all necessary. Finalize full scale BCO designs and recommend experimental sections. Also, a recommendation of construction controls and specifications would be made to the district. Next, preliminary cost estimates would be made for the district. The research would also develop a short and long term monitoring plan of BCO (14 days and 2 years). And finanally an interim report would be submitted followed by a final report to the TxDOT.

STUDY PROGRESS:

AREA III

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 3 **STUDY NO.** TECH 187.12 **STATUS:** Active

TITLE: MONITORING OF PREVENTION OF SINGLE VEHICLE RUN-OFF-THE-ROAD ACCIDENTS

TECHNICAL PANEL	**RESEARCHER(S)**
Chris Hehr, Chairman, D-18	Kent Wray
Charles Webb, DS-6	
John Mills, DS-7	
Mark Tomlinson, DS-7	
Joe Lane, DS-7	
Gary Humes, DS-7	

AREA: 3 **STUDY NO.** TTI 945 **STATUS:** Terminating

TITLE: TRANSPORTATION COMMUNICATIONS TEAM

TECHNICAL PANEL	**RESEARCHER(S)**
Al Kosik, Chairman, D-18	Gene Ritch

AREA: 3 **STUDY NO.** TTI 949 **STATUS:** Terminating

TITLE: HIGH-LEVEL ILLUMINATION LUMINAIRES

TECHNICAL PANEL	**RESEARCHER(S)**
William Ezzell, Chairman, DS-12	R.A. Zimmer
John Hemme, DS-12	

AREA: 3 **STUDY NO.** TTI 958 **STATUS:** Terminating

TITLE: EVALUATION OF A MOTORIST INFORMATION SYSTEM USING COMPUTER DISPLAY TERMINALS

TECHNICAL PANEL	**RESEARCHER(S)**
Steve Levine, Chairman, DS-12	Dick McCasland

AREA: 3 **STUDY NO.** CTR 1216 **STATUS:** Terminating

TITLE: DRIVER RESPONSES TO TRAFFIC DISTURBANCES AND CONTROL STRATEGIES

TECHNICAL PANEL	**RESEARCHER(S)**
Ray Derr, Chairman, D-18	Hani Mahmassani
Peggy Thurin, D-10	

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 3 **STUDY NO.** TTI 1232 **STATUS:** Active

TITLE: URBAN HIGHWAY OPERATIONS RESEARCH AND IMPLEMENTATION PROGRAM

TECHNICAL PANEL	**RESEARCHER(S)**
Gary Trietsch, Chairman, D-18	Tom Urbanik
Carlos Lopez, D-18	Dick McCasland
J.R. Stone, DS-2	
Pat Irwin, DS-15	
Tom Watters, DS-18	
Tommy Howell, D-19	
Bob Hodge, D-10	
Al Luedecke, D-10	
Steve Levine, DS-12	
Mel Partee, D-18	
Bob Cuellar, D-10	
Bob Kovar, D-8	
Mark Marek, D-8	
Wallace Ewell, DS-2	
James Huffman, DS-18	
Milton Dietert, DS-12	
Dick Lockhart, DS-15	
Charles Riou, D-18	
John Mack, FHWA	
Bill Lancaster, D-8	
Randy Keir, D-18	
Bob Musselman, FHWA	
Carol Rawson, D-18	
Karen Glynn, D-18	

AREA: 3 **STUDY NO.** TTI 1255 **STATUS:** Active

TITLE: EFFICIENT UTILIZATION OF ACTUATED CONTROLLERS IN COORDINATED TRAFFIC CONTROL SYSTEMS

TECHNICAL PANEL	**RESEARCHER(S)**
Stan Swinton, Chairman, D-18	Edmund Chang
Henry Wickes, D-18	
Curtis Herrick, D-18	

AREA: 3 **STUDY NO.** UTA 1256 **STATUS:** Terminating

TITLE: SELECTION CRITERIA FOR LEFT-TURN PHASING, INDICATION SEQUENCE, AND AUXILIARY SIGNS

TECHNICAL PANEL	**RESEARCHER(S)**
Ray Derr, Chairman, D-18	Sia Ardekani
	Jim Williams

AREA: 3 **STUDY NO.** TECH 1257 **STATUS:** Completed

TITLE: PREVENTION OF SINGLE VEHICLE RUN-OFF-ROAD ACCIDENTS

TECHNICAL PANEL	**RESEARCHER(S)**
Chris Hehr, Chairman, D-18	Kent Wray
Klaus Alkier, D-10R	

AREA: 3 **STUDY NO.** CTR 1258 **STATUS:** Terminating

TITLE: TEXAS MODEL FOR INTERSECTION TRAFFIC - ADDITIONAL FEATURES

TECHNICAL PANEL	**RESEARCHER(S)**
Rick Collins, Chairman, D-18	Clyde Lee
	Randy Machemehl

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 3 **STUDY NO.** TTI 1261 **STATUS:** Active

TITLE: ASSESSMENT AND IMPROVEMENT OF MOTORIST UNDERSTANDING OF TRAFFIC CONTROL DEVICES

TECHNICAL PANEL	**RESEARCHER(S)**
Lewis Rhodes, Chairman, D-18	John Mounce
Franklin Cox, DPS	Katie Womack
Jim Copeland, D-10	
John Hall, DPS	

AREA: 3 **STUDY NO.** TTI 1271 **STATUS:** Active

TITLE: FREEWAY CORRIDOR SIGNAL TIMING DEVELOPMENT AND APPLICATION

TECHNICAL PANEL	**RESEARCHER(S)**
Ray Derr, Chairman, D-18	Nadeem Chaudhary

AREA: 3 **STUDY NO.** TTI 1273 **STATUS:** Terminating

TITLE: METHODS TO ENHANCE SAFETY OF PASSIVE WARNING DEVICES AT RAILROAD-HIGHWAY GRADE CROSSINGS

TECHNICAL PANEL	**RESEARCHER(S)**
Ken Willis, Chairman, D-5	Dan Fambro
Gary Trietsch, D-18	

AREA: 3 **STUDY NO.** TTI 1292 **STATUS:** Active

TITLE: COMMUNICATING LANE DROPS TO MOTORISTS

TECHNICAL PANEL	**RESEARCHER(S)**
Henry Wickes, Chairman, D-18	Kay Fitzpatrick
Tom Newbern, DS-23	Tom Urbanik
Steve Hill, DS-8	
Pat Irwin, DS-15	
Jerry Keisler, DS-1	
Paul Frerich, DS-13	
Dennis Beckham, DS-19	

AREA: 3 **STUDY NO.** TTI 1293 **STATUS:** Active

TITLE: THE USE OF CONTINUOUS TWO-WAY LEFT-TURN LANES ON HIGH-SPEED RURAL AND SUBURBAN HIGHWAYS

TECHNICAL PANEL	**RESEARCHER(S)**
Jerry Selby, Chairman, D-8	Kevin Balke
Pat Irwin, DS-15	Kay Fitzpatrick
John Kight, DS-15	
Lonnie Gregorcyk, DS-13	
Gary Trietsch, D-18	

AREA: 3 **STUDY NO.** CTR 1296 **STATUS:** Active

TITLE: PEDESTRIAN SIGNALS: WARRANTS AND EFFECTIVENESS

TECHNICAL PANEL	**RESEARCHER(S)**
Cathy Wood, Chairman, D-18	Randy Machemehl
Steve Hill, DS-8	Hani Mahmassani
Pat Irwin, DS-15	
Paul Frerich, DS-13	
Wallace Ewell, DS-2	
Curtis Herrick, D-18	

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 3 **STUDY NO.** TTI 1297 **STATUS:** Active

TITLE: WARRANTS FOR FLASHING TRAFFIC SIGNAL OPERATION

TECHNICAL PANEL	**RESEARCHER(S)**
Curtis Herrick, Chairman, D-18	Gene Hawkins
Steve Hill, DS-8	
Jerry Keisler, DS-1	
Paul Frerich, DS-13	

AREA: 3 **STUDY NO.** TTI 1298 **STATUS:** Active

TITLE: DESIGN, INSTALLATION, AND OPERATIONS OF FREEWAY LANE CONTROL SIGNALS

TECHNICAL PANEL	**RESEARCHER(S)**
Ray Derr, Chairman, D-18	Jerry Ullman
	Poonam Wiles

AREA: 3 **STUDY NO.** CTR 1308 **STATUS:** Active

TITLE: INTERACTIVE GRAPHICS INTERSECTION DESIGN SYSTEM

TECHNICAL PANEL	**RESEARCHER(S)**
Henry Wickes, Chairman, D-18	Randy Machemehl
Ray Derr, D-18	Clyde Lee
Gary Humes, D-8	Tom Rioux
Billy Hardie, DS-2	
Rob Haley, DS-16	
Clarence Pampell, DS-12	
Judy Skeen, D-19	
Chuck Berry, DS-24	

AREA: 3 **STUDY NO.** TTI 1345 **STATUS:** Active

TITLE: DEVELOPMENT OF GUIDELINES FOR TRAFFIC MANAGEMENT IN RESPONSE TO MAJOR FREEWAY INCIDENTS

TECHNICAL PANEL	**RESEARCHER(S)**
Ray Derr, Chairman, D-18	Dick McCasland
James Maytum, DS-15	Mike Ogden
Steve Levine, DS-12	
Ray Mims, DS-16	
Carlos Chavez, DS-24	

AREA: 3 **STUDY NO.** TxDOT 1346 **STATUS:** Active

TITLE: A COMPREHENSIVE IVHS PLAN FOR TEXAS

TECHNICAL PANEL	**RESEARCHER(S)**
Al Kosik, Chairman, D-18	Not selected at publication
Gary Humes, D-8	
Dorn Smith, D-11	
Steve Levine, DS-12	
Patrick McGowan, DS-15	

AREA: 3 **STUDY NO.** TTI 1347 **STATUS:** Active

TITLE: DESIGN CRITERIA FOR SUBURBAN HIGH SPEED CURB AND GUTTER SECTIONS

TECHNICAL PANEL	**RESEARCHER(S)**
Bill Crumley, Chairman, DS-23	Dan Fambro
Rick Collins, D-19	Hayes Ross, Jr
Tom Beeman, D-8	
John Kight, DS-15	
Mark Read, DS-4	
Richard Skopik, DS-10	
Bill Minor, DS-16	
Don Garrison, DS-12	
Craig Warren, DS-24	

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 3 **STUDY NO.** UTA 1350 **STATUS:** Active

TITLE: IMPACTS OF TRAFFIC SIGNAL INSTALLATION AT MARGINALLY WARRANTED INTERSECTIONS

TECHNICAL PANEL	**RESEARCHER(S)**
Tom Newbern, Chairman, DS-23	Jim Williams
Eddie Gutierrez, D-18	Sia Ardekani
Bill Stebbins, DS-6	
Angie Ortegon, DS-7	
Steve Hill, DS-8	
Ray Mims, DS-16	
William Ezzell, DS-12	
Carlos Chavez, DS-24	

AREA: 3 **STUDY NO.** UTA 1372 **STATUS:** Terminating

TITLE: INVESTIGATE REQUIREMENTS FOR AN INTELLIGENT ROUTING SYSTEM WITH FAULT TOLERANT CONSIDERATION

TECHNICAL PANEL	**RESEARCHER(S)**
Bert Lundell, Chairman, D-18	Roger Walker

AREA: 3 **STUDY NO.** TTI 1373 **STATUS:** Active

TITLE: EVALUATION OF RURAL GUIDE SIGNING

TECHNICAL PANEL	**RESEARCHER(S)**
Lewis Rhodes, Chairman, D-18	Gene Hawkins, Jr.

AREA: 3 **STUDY NO.** TTI 1922 **STATUS:** Active

TITLE: EVALUATION OF A MOTORIST ASSISTANCE PROGRAM USING FREEWAY PATROL VEHICLES

TECHNICAL PANEL	**RESEARCHER(S)**
Steve Levine, Chairman, DS-12	Dick McCasland

AREA: 3 **STUDY NO.** TTI 1928 **STATUS:** Active

TITLE: FEASIBILITY OF DEVELOPING AN AUTOMATED INCIDENT MANAGEMENT (AIM) PLAN

TECHNICAL PANEL	**RESEARCHER(S)**
Steve Levine, Chairman, DS-12	Robert Siegfried

AREA: 3 **STUDY NO.** TTI 1946 **STATUS:** Active

TITLE: RAISED PAVEMENT MARKER FIELD TESTING

TECHNICAL PANEL	**RESEARCHER(S)**
Lewis Rhodes, Chairman, D-18	Jerry Ullman

AREA: 3 **STUDY NO.** TTI 1950 **STATUS:** Active

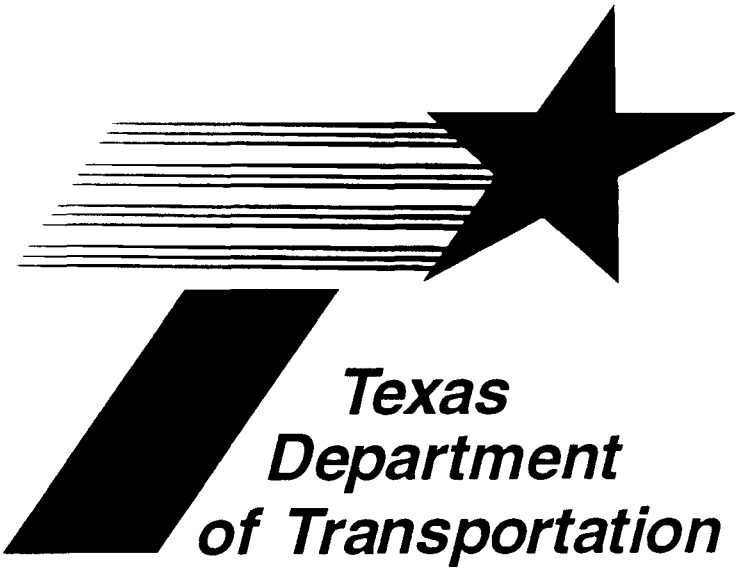
TITLE: DESIGN OF SURVEILLANCE AND COMMUNICATION SYSTEMS FOR DISTRICT 2

TECHNICAL PANEL	**RESEARCHER(S)**
Wallace Ewell, Chairman, DS-2	Charles Blumentritt

AREA: 3 **STUDY NO.** TTI 1953 **STATUS:** Active

TITLE: ANALYSIS OF IH-35 DESIGN ALTERNATIVE FOR DISTRICT 14

TECHNICAL PANEL	**RESEARCHER(S)**
Glen McVey, Chairman, DS-14	Jim Benson



PROGRESS REPORTS
Fall 1992

STUDY TITLE: MONITORING OF PREVENTION OF SINGLE VEHICLE RUN-OFF-THE-ROAD ACCIDENTS

STUDY NUMBER:	TECH 187 TASK 12
RESEARCH AGENCY:	TEXAS TECH UNIVERSITY
STUDY SUPERVISOR(S):	WRAY WK
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	CHRIS HEHR, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 49,160	TOTAL EXPENDITURES:
FY 92 BUDGET: N/A	FY 92 EXPENDITURES: N/A
FY 93 BUDGET: 17,446	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

Single vehicle run-off-the-road accidents are a problem on rural highways. This type of accident is often related to driver fatigue, which includes drivers becoming hypnotized by long stretches of highway. As a result, shoulder treatments are being installed in areas where a significant number of this type of accident have occurred.

OBJECTIVE(S):

This research project will be evaluating the effectiveness of these shoulder treatments installed in Texas. The project will include data collection on existing shoulder treatment installations, comparing before and after accident data and making recommendations on the types of shoulder treatments based on the information collected.

IMPLEMENTATION PLAN:

Upon completion of the three year study, a final report will recommend optimum shoulder treatments for different highways and geographical areas in Texas.

These recommendations will be included in design procedures of the Department.

STUDY PROGRESS:

STUDY TITLE: TRANSPORTATION COMMUNICATIONS TEAM

STUDY NUMBER:	TTI 945
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	RITCH G
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	AL KOSIK, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 40,555
FY 92 BUDGET: 9,000	FY 92 EXPENDITURES: 8,879
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	87-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Information is needed on current state-of-the-art communications equipment and techniques for traffic monitoring and control, CCTV surveillance and motorist aid systems.

OBJECTIVE(S):

The objectives of this study are to:

1. Obtain, evaluate and provide information on current state-of-the-art communications equipment, materials and techniques for traffic control, surveillance and motorist aid systems.

2. Participate with TxDOT on a Transportation Communications Team for determining the optimum methods of communications on traffic control, surveillance and motorist aid projects.

IMPLEMENTATION PLAN:

Results of this interagency study agreement are intended to be incorporated into the Houston Traffic Management System.

STUDY PROGRESS:

This study will terminate 8-31-92, having achieved the above study objectives. A final report will be submitted at that time.

STUDY TITLE: HIGH-LEVEL ILLUMINATION LUMINAIRES

STUDY NUMBER:	TTI 949
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ZIMMER RA
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	WILLIAM EZZELL,JOHN HEMME, DIST 12
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 53,374
FY 92 BUDGET: 20,000	FY 92 EXPENDITURES: 2,581
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	87-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

OBJECTIVE(S):

The objectives of this study are to:

1. Conduct various performance tests on high level illumination luminaires.

2. Assist in the determination of photometric characteristics of luminaires as specified.

IMPLEMENTATION PLAN:

Official test reports will be issued by Division of Materials and Tests.

STUDY PROGRESS:

Photometric performance testing of 1000 watt luminaires is completed. Only 400 watt luminaires are currently in use. Project will terminate August 31, 1992.

STUDY TITLE: EVALUATION OF MOTORIST INFORMATION SYSTEM USING COMPUTER DISPLAY TERMINALS

STUDY NUMBER:	TTI 958
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	McCASLAND WR
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	STEVEN LEVINE, DIST 12
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 252,500	TOTAL EXPENDITURES: 94,536
FY 92 BUDGET: 38,300	FY 92 EXPENDITURES: 37,093
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The probability of serious disruption and large delays due to traffic occurrences or events have increased because of the major reconstruction which is going on now. Any procedure, technique or traffic control that diverts traffic from congested freeway sections should be evaluated since the impact on traffic demand on delay varies exponentially. There is a need for a cost-effective procedure to provide effective, accurate and timely information to the public.

OBJECTIVE(S):

The objectives of this study are to:

1. Determine the accessibility of traffic advisory information presented on ten computer display terminals in a major office center.

2. Determine the user rates of the ten computer display terminals.

3. Conduct written surveys to estimate the effectiveness of the computer display terminals in altering the driving patterns of the users of the Motorist Information System.

4. Determine the costs and benefits for operating the ten computer display terminals providing motorist information.

IMPLEMENTATION PLAN:

The study will involve ten operating computer display terminals at the Greenway Plaza Office Center on U.S. 59 in Houston and another one in the TxDOT Public Information Office for the Southwest Freeway. TTI will evaluate the results.

STUDY PROGRESS:

STUDY TITLE: DRIVER RESPONSES TO TRAFFIC DISTURBANCES AND CONTROL STRATEGIES

STUDY NUMBER:	CTR 1216
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MAHMASSANI H
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	RAY DERR, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 205,000	TOTAL EXPENDITURES: 220,251
FY 92 BUDGET: 15,000	FY 92 EXPENDITURES: 14,997
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-12-14
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

This project is studying drivers' reactions to short term changes in traffic conditions when equilibrium has not been reached. The ability to predict these reactions will be helpful in developing traffic management strategies which depend on influencing the drivers.

OBJECTIVE(S):

The primary objectives of this study are to:

1. Develop guidelines for corridor management planning for urban freeway reconstruction projects.

2. Develop a computer expert system for urban freeway corridor incident management.

3. Develop a methodology to capture daily driver response.

4. Refine and adapt models of users' daily responses to perceived service quality.

5. Incorporate user response models into operational procedures to evaluate alternative traffic control schemes.

6. Characterize the effectiveness of various traffic control and management plans.

7. Field test the methodology in a selected Texas corridor.

IMPLEMENTATION PLAN:

The results of this study will be disseminated through research reports and presentations at technical meetings.

After the project is completed, the methodology developed will be evaluated for use in traffic management systems. The methodology will probably require some modification and adaption before it can be used directly.

The preliminary findings of the survey are likely to be of benefit to the North Central Expressway Reconstruction project, as it contains information on present commuting patterns in the region, and can thus be used to plan and evaluate traffic mitigation measures during the reconstruction period.

In addition, the characteristics of commuters' present use of the traffic system is likely to be of importance to the TxDOT in the present efforts to evaluate and implement information-related IVHS concepts. Furthermore, the real-time control aspects of the work are directly relevant to the ATMS (Advanced Traffic Management Systems) concepts contemplated by D-18 and TxDOT.

STUDY PROGRESS:

A two-stage survey was conducted in the North Central Expressway corridor in Dallas-Plano-Richardson. These surveys resulted in a unique and rich data set for the study of commuter behavior and the development of commuter response models. User response models, as well as general characterizations of commuter patterns, have been developed using the first wave of surveys conducted in Spring 1990. In addition, the second wave of surveys, conducted in late Spring 1991, has been completely processed and entered for analysis. This very time consuming processing, coding and data entry is now complete, allowing for analysis of information.

Results of traffic control aspects are of great interest and relevance to the traffic operations specialists at TxDOT. In particular, novel approaches to real-time control of freeway corridors are being developed and investigated, taking user responses into account.

To date, work on this project is proceeding according to schedule. Most of the research effort in this reporting period has continued to focus on the user behavior model development. Models have been developed to relate observed trip changing, route, and departure time switching patterns to the user and network performance characteristics. Results from exploratory analyses have provided valuable insights into user behavior. Comparisons have also been performed with the data obtained from a similar survey conducted in Austin, to understand issues in user behavior transferability.

Work on the control aspects has proceeded beyond the requirements of the study. Extensive experimentation has been undertaken with the developed framework, consisting of the traffic simulation model and the incorporated user behavior models. Effective entrance control and information strategies are being developed and performance being evaluated based on short and long term system conditions.

The final report on this terminating project will be submitted as scheduled. No contract changes or extensions in time are anticipated at this time.

STUDY TITLE: URBAN HIGHWAY OPERATIONS RESEARCH
AND IMPLEMENTATION PROGRAM

STUDY NUMBER:	TTI 1232
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	URBANIK T,McCASLAND WR
RESEARCH AREA:	AREA 3
TECHNICAL COORDINATOR:	GARY TRIETSCH, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 2,500,000	TOTAL EXPENDITURES: 1,404,786
FY 92 BUDGET: 500,000	FY 92 EXPENDITURES: 406,379
FY 93 BUDGET: 500,000	FY 93 EXPENDITURES:N/A
DATE BEGUN:	89-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

A need exists for a coordinated program of highway operations research in order to assist the department in implementing operational improvements. Many highway operational problems have not been thoroughly evaluated or are being addressed on a crisis decision basis at the district level. Improved coordination and implementation are required. The development of a Texas Highway Operations Manual would provide the necessary documentation to allow department engineers to plan, design and operate state highway facilities.

OBJECTIVE(S):

The objectives of this project are to:

1. Develop a highway operations manual.
2. Evaluate the traffic operations of various roadway geometrics.
3. Evaluate information and data needs for surveillance systems.
4. Evaluate improved incident and special events management strategies.
5. Evaluate improved and/or new traffic control systems.
6. Evaluate improvements to motorist information systems.
7. Evaluate the various components required for an integrated system.
8. Evaluate various analytical tools available for operational evaluation.

IMPLEMENTATION PLAN:

This project will provide the department with a better understanding of traffic operations and the effects that various roadway geometrics, traffic control devices and traffic control strategies have on traffic operations. Specifically, this project will ultimately determine where and what type of traffic control devices and traffic control strategies will be employed.

Implementation will include incorporating the results of the various studies into the Highway Operations Manual.

STUDY PROGRESS:

Task 1.1: All parts of the Manual have been submitted. TTI is expecting that Parts I & II will be approved for publication this reporting period. Some additional work is anticipated to bring Part III into final form.

Task 2.2: Work on a draft report on effectiveness of express lanes through freeway-to-freeway interchanges will be completed during this reporting period.

Task 2.3: Preliminary data collection on weaving areas is complete and analysis of data is underway.

Task 2.5: Work is underway on a draft report on express lane and collector distribution designs which will be completed during this reporting period.

Task 3.3: Considerable activity in evaluating alternative detector technologies including loops, photoelectric, ultrasonic, microwave, microloop, piezoelectric, and image processing. A draft report has been delayed due to the desire to conduct some additional analysis. A draft report should be completed this reporting period.

Task 4.2: A review of the incident management and incident detection literature was completed. Several incident management agencies throughout the nation were contacted to provide raw data needed to complete the assessment of incident detection strategies. A methodology for conducting the assessment of alternative incident detection strategies was devised. The results of the assessment are currently being summarized in a report expected to be submitted this reporting period.

Task 4.4: A literature review identifying the state of the art in incident management in the United States has been completed. This review will provide a solid base of knowledge for the comparison of various incident response and clearance strategies currently used by urban Districts in the state of Texas. The primary focus of these comparisons will be to assess and review the various strategies with respect to their suitability for managing assorted levels and types of incidents.

Task 5.4: Design of signs for dynamic lane assignment has been finalized and construction of the field test on IH10 at Bingle is underway. The necessary preimplementation studies have been completed.

Task 5.7: There are two approaches presently used for the synthesis of freeway O-D tables: One is an entropy-maximizing proportional model and the other is a gravity-type model. The SYNOD series in FREQ family models are based on this entropy-maximizing approach. Messer's and Nihan's models fall into gravity-type category. The newly developed FRESIM model also embodies a gravity-based Destimation model. Attention is focused on two models in this task. One is the FREQ model that has been obtained a wide acceptance and the other is the so-called S971 model that has been recently formulated at TTI based on Messer's dissertation work. The performances of the two models were examined with two historical data sets, 1981 I-10 Katy Freeway in Houston and 1968 I-80 Eastshore Freeway in California. S971 model significantly outperformed the SYNPD2 in FREQ model with I-10 data while both models showed similar results with I-80 data. Frontage roads are a special feature of Texas freeways and provide good alternative routes to the freeway. The sensitivity analysis of the S971

model to alternative route conditions was performed and showed that the S971 model is able to satisfactorily reflect the effect of the alternative route condition. This capability of S971 model implies good potential for real-time corridor-wide modeling. Handling the dynamic nature of real-time volume counts and generating a O-D table on-line using the real-time data timely and efficiently are considered the critical problems to deal with.

Task 6.1: Work continued on the preparation of two draft reports concerning the use and operations of changeable message signs and the design of messages for use on changeable message signs. These two reports will be completed this reporting period. In addition, a questionnaire concerning the purchasing, operation, and maintenance of changeable message signs was developed. The questionnaire will be administered to the Districts during the next 6-month period.

Task 6.2: During this fiscal year, a synthesis of the existing literature pertaining to existing and emerging technologies for communicating with motorists was prepared. The synthesis identifies and discusses a number of human factors, safety, and traffic management issues associated with available and emerging technologies for communicating with motorists in their vehicle. The advantages and limitations of each of these technologies are also discussed. The intent of the synthesis is to provide the Department with insight into the current human factors, safety and traffic management issues that may influence the design, implementation, and operation of ADIS in Texas.

Task 6.3: Laboratory studies have been performed on commuters traveling the North Central Expressway corridor in Dallas, TX to assess the influence that corridor characteristics may play upon motorist potential responses to real-time travel time information. Three corporations in the Dallas CBD (MOBIL, Nations Bank, and ARCO) have assisted in the identification of employees to participate as subjects, and allowed telephone surveys to be performed once the subjects arrived at work. Analysis of this is approximately 75 percent complete.

Task 8.5: Work is underway on this task and a draft report will be completed this reporting period.

Task 8.6: The main effort has been to calibrate and further develop analytical methodologies to identify and analyze potential bottleneck improvements and to assess potential benefits. An effort is being made to identify the appropriate minimum data collection necessary in order to calculate benefits attained by a bottleneck improvement. It is believed that adequate documentation of benefits actually derived, and refinement of methodologies to predict benefits to be expected from similar projects, will be of paramount importance in justifying this type of improvement and allowing prioritization among competing projects. A draft report will be completed this reporting period.

Published reports from this project are:

1232-1 Brochure ("VISION")

1232-2:

- "Operational Evaluation of a Two-Exit Directional Freeway Interchange"

- "Screenline Analysis of the Southwest Freeway Reconstruction Project"

- "Merge Behavior at a Congested Entrance Ramp Junction"

- "Applications of Fuzzy Logic to Urban Traffic Management"

1232-4 "Operational Evaluation of Effects Resulting from Freeway-Freeway Interchange Geometrics"

STUDY TITLE: EFFICIENT UTILIZATION OF ACTUATED CONTROLLERS IN COORDINATED TRAFFIC CONTROL SYSTEMS

STUDY NUMBER:	TTI 1255
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	CHANG E
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	STAN SWINTON, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 300,000	TOTAL EXPENDITURES: 205,895
FY 92 BUDGET: 100,000	FY 92 EXPENDITURES: 101,006
FY 93 BUDGET: 100,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

While a large body of knowledge, including excellent computer programs is available to assist with coordinating pre-timed traffic control systems, there are no operational models available for optimizing coordinated systems utilizing actuated controllers. A potential exists to improve efficiency beyond that of a pretimed system. If improvements can be accomplished the total time a street system is saturated may be reduced. Since small changes in efficiency must be measured, a methodology of measuring these changes must be developed.

OBJECTIVE(S):

The objectives of the study are to:

1. Analyze the state-of-the-art study methodology and operational experience for operations of actuated traffic control signal systems.

2. Examine the operational sensitivity of the various signal controller settings, develop recommended settings, and investigate feasible ranges for coordination of signal systems.

3. Develop implementation guidelines and document the recommended practice in the "Operational Handbook" for providing traffic adaptive, coordinated operations, and field implementation supports.

4. Provide computer software and related user's documentation to facilitate the field implementation of signal timing parameters for coordinated system operations with Texas standard NEMA actuated controllers and Type 170 controllers.

IMPLEMENTATION PLAN:

The handbook developed in this study should be applicable regardless of the coordination method used, and will be made available to Department personnel and others for evaluation. Computer software that is user friendly and designed for use by traffic engineers and technicians will be developed, thereby enhancing field implementation. The professional community will be informed of the computer software developed through distribution of reports and presentations by the researchers and users. Once proven, classes should be developed so users may efficiently utilize the new tools.

STUDY PROGRESS:

A performance index, has been developed to represent total costs to the public with respect to the evaluation of traffic control strategy. The performance index, using a combination of travel time delay, vehicular stops, fuel consumption, and air pollution, has been used in the simulation evaluation (Objective 2).

Simulation analyses were made to evaluate the control schemes, intersection geometric layouts, left-turn signal phasings, and phase timing variables on the arterial system operations. Confirmation techniques have been developed to allow the verification of simulation results with actual traffic data through limited field observations (Objective 2).

Various arterial signal coordination treatments and feasible ranges of the common decision variables have been quantified for demonstrating the improved coordinated arterial operations. The study found that the semi-actuated, using Pretimed Coordination offsets consistently provides a potential 11 percent savings in average system delay (Objective 2).

Software development and documentation have been designed to enhance existing software usage, allow implementation simulation, and signal timing interpretation (Objective 4).

Time schedule and contents of the documentation were established for the Technical Memorandum on the operational analysis and operational benefits assessed (Objectives 3 and 4).

The project continues to be slightly behind schedule according to the original objectives and work plan. No contract changes or requests for extension are anticipated at this time, as the project is expected to be completed satisfactorily on time and within the allowed budget.

STUDY TITLE: SELECTION CRITERIA FOR LEFT-TURN PHASING, INDICATION SEQUENCE, AND AUXILIARY SIGNS

STUDY NUMBER:	UTA 1256
RESEARCH AGENCY:	UNIVERSITY OF TEXAS - ARLINGTON
STUDY SUPERVISOR(S):	ARDEKANI SA, WILLIAMS JC
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	RAY DERR, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 95,687	TOTAL EXPENDITURES: 88,736
FY 92 BUDGET: 18,000	FY 92 EXPENDITURES: 15,572
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The application of the signal sequence change for left turn signals has greatly improved the number of vehicles which can move through a series of interconnected traffic signals. The combination of circular green with left turn arrow for protected-permissive movement permits more left turn vehicles to complete their movement during a signal cycle. There is a need to analyze the combination of these two improved operations with regard to motorist communications and traffic safety.

OBJECTIVE(S):

The objectives of this study are to:

1. Develop guidelines for selection of the most appropriate phasing treatments among the following: (a) protected/permissive; (b) permissive/protected; (c) protected only; and (d) permissive only.

2. Analyze and make recommendations for the use of the various signal sequence indications under each of the above phasing conditions.

3. Make recommendations for the use of auxiliary signs with the left-turn phasing and signal indications including recommendations regarding improvements in design of signs.

IMPLEMENTATION PLAN:

The guidelines developed in this study will be included in the Maintenance and Operations Division Traffic Engineering Procedures Manual and the Texas Manual on Uniform Traffic Control Devices (TMUTCD). When implemented, uniformity will be gained throughout Texas. This information will impact the design and operation of traffic signals and will increase intersection efficiency, safety, and motorist understanding and compliance.

STUDY PROGRESS:

Two groups of tasks were developed to address this problem. First, extensive field studies, along with accident and conflict studies, were conducted to study stopped delay incurred as well as safety and motorists' observance of left-turning rules. City traffic engineers in ten urban areas in Texas were asked to list candidate intersections for this study. Each intersection approach was then observed for at least one peak hour.

Accident data were also obtained from TxDOT and city departments. From these observations and data, the approach and overall stopped delay per vehicle, accident and conflict rates, as well as the fraction of drivers turning when not permitted, or not turning when permitted, were measured.

Second, a survey was formulated and mailed to about 6,000 drivers in the same ten urban areas. These surveys were intended to ascertain drivers' understanding of signal indications and their associated auxiliary signs. The guidelines mentioned above were generated from the results of both field studies and the survey responses.

The final report for this terminating study is currently being revised to include FHWA comments and suggestions and will be submitted by August 7, 1992.

STUDY TITLE: PREVENTION OF SINGLE VEHICLE RUN-OFF-ROAD ACCIDENTS

STUDY NUMBER:	TECH 1257
RESEARCH AGENCY:	TEXAS TECH UNIVERSITY
STUDY SUPERVISOR(S):	WRAY WK
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	CHRIS HEHR, D-18 and KLAUS ALKIER, D-10R
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 99,202	TOTAL EXPENDITURES: 86,745
FY 92 BUDGET:	FY 92 EXPENDITURES:
FY 93 BUDGET:	FY 93 EXPENDITURES:
DATE BEGUN:	90-09-01
TERMINATION DATE:	T91-08-31

PROBLEM STATEMENT:

Many formal studies have been conducted regarding run-off-road (ROR) accidents and various methods have been tried as a prevention mechanism (e.g., raised treatments, depressed treatments, asphalt surface treatments, etc). Although these various means have been tried throughout Texas, there appears to be no guidance in determining locations where special treatments are feasible and effective. A comparison of effectiveness of the various methods and evaluations of the success of treated sections is not available. Additionally, little formal guidance is available regarding cost and/or difficulty of maintaining treated sections.

OBJECTIVE(S):

The objectives of this study are to:

1. Determine the extent of ROR prevention efforts in Texas.

2. Evaluate the success of ROR mitigation techniques, methods or procedures that have been employed.

3. Develop a method of assessing the need for ROR mitigation techniques.

4. Provide recommendations to the TxDOT.

IMPLEMENTATION PLAN:

This study will provide information to the Maintenance and Operations Division to be distributed to the Districts as guidelines in shoulder treatments. Development of field manuals or videos as aids to that distribution will depend upon the results of the monitoring study.

STUDY PROGRESS:

A survey was conducted to determine the extent of the ROR accident preventation efforts in Texas employed by the 24 District offices. The survey was also used to help locate rural highway sections warranting ROR mitigation attention. Two trips were made to analyze the implementation of several mitigation techniques, and to get the District's evaluation of the mitigation techniques implemented in that district.

Use of highway accident data was used to examine where most of the rural ROR accidents were occurring over an eight year period (1983-1990).

A final report will be submitted August 31, 1992.

Research study 187.12 was approved to continue monitoring statistics of ROR accidents in Texas. The final results of this study will determine implementation strategies for the 1257 research results.

STUDY TITLE: TEXAS MODEL FOR INTERSECTION TRAFFIC - ADDITIONAL FEATURES

STUDY NUMBER:	CTR 1258
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	LEE CE,MACHEMEHL R
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	RICK COLLINS, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 159,500	TOTAL EXPENDITURES: 134,102
FY 92 BUDGET: 75,000	FY 92 EXPENDITURES: 55,537
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The TEXAS Model for Intersection Traffic is a powerful engineering and planning tool which is now being used routinely to evaluate designs and traffic operations at intersections and at diamond interchanges through highly-detailed computer simulation and animated graphics. In a series of workshops, more than 120 TxDOT personnel have been trained in its use for solving complex design and traffic control problems. The model currently handles most common intersection situations very well, but the users have requested that several additional features be developed.

OBJECTIVE(S):

Nine features will be incorporated into the program and include the following:

1. U-turn lanes at diamond interchanges.

2. Generate exact percentage of desired driver-vehicle units.

3. Implement sight-distance checking (user-friendly).

4. Simulate NEMA dual-ring traffic signal controllers.

5. Simulate volume-density traffic signal controllers.

6. Provide user choice (a) City of Dallas and (b) TxDOT numbering scheme for traffic phases at diamond interchanges.

7. Present output summary statistics in graphical form.

8. Develop generic plotter-driver output routines and interface capabilities to selected types of plotters.

9. Automate the required number of replicate runs to achieve stability in selected measures of effectiveness.

IMPLEMENTATION PLAN:

Current department practices and policies will not be significantly affected by the results of this research. However, the design and traffic operations at isolated intersections and at diamond interchanges should improve as the flexibility, quality and speed of the model is enhanced.

Implementation will be pursued as follows:

1. Notify the Districts when the additional features have been added to the model and made available for use.

2. Work with The University of Texas to incorporate the use of the new features into the ongoing TEXAS Model classes.

3. Provide assistance to the Districts as needed.

STUDY PROGRESS:

Five of the nine objectives have been accomplished as of 1 June 1992. The remaining four are in progress or will be completed by 31 August 1992. Tasks dealing with U-turn lanes, generation of exact driver-vehicle percentages, choices between phase numbering schemes, plotter-driver routines, and automated replicate runs are completed. The NEMA controller task is virtually complete except for user input processing.

The study is scheduled for completion 31 August 1992. All planned tasks should be completed by that time.

No contract changes or extensions are anticipated at this time.

Project Final Report will be submitted 30 November 1992.

STUDY TITLE: ASSESSMENT AND IMPROVEMENT OF MOTORIST UNDERSTANDING OF TRAFFIC CONTROL DEVICES

STUDY NUMBER:	TTI 1261
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	MOUNCE J,WOMACK K
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	LEWIS RHODES, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 259,180	TOTAL EXPENDITURES: 165,414
FY 92 BUDGET: 88,990	FY 92 EXPENDITURES: 62,559
FY 93 BUDGET: 67,180	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Limited national studies, as well as the Transportation Research Board Committee on Traffic Control Devices, have identified and highlighted driver difficulty in understanding a high proportion of possibly critical TCD's. Confusion, misunderstanding, and lack of familiarity with TCD's may be attributed to: (1) increasing complexity of the driving task in urban areas; (2) increasing age of the driving population; (3) specialized TCD's utilized with priority transportation facilities; (4) increased proportion of Hispanic drivers in Texas; and (5) limited explanation of TCD's given in the driver eduction and licensing process.

OBJECTIVE(S):

This study will identify motorist needs when driving the highway system. A survey will be conducted to determine the understanding of traffic control devices and areas on the highway system that may be confusing. An analysis will be made of the survey data and the researchers will make recommendations on ways to make improvements.

IMPLEMENTATION PLAN:

The results of this study may affect Department design standards and criteria for placement of traffic control devices. Recommendations to alter the Texas Manual on Uniform Traffic Control Devices (TMUTCD) will require coordination with FHWA and the National Committee for the National MUTCD, as the Texas manual must comply with the national standards.

Close coordination with the Department of Public Safety is being maintained during the study, as they are the agency responsible for driver education. Full implementation will depend upon the extended field evaluation, and training courses, if new design standards are recommended and approved.

STUDY PROGRESS:

The first year interim report TTI 1261-1, "Assessment and Improvement of Motorist Understanding of Traffic Control Devices," has been published. The motorist survey data analysis is complete. Preliminary results from this survey were reported in November 1991. The second interim report was submitted in draft form. A final report will be submitted in August 1993. No contract changes are anticipated at this time.

STUDY TITLE: FREEWAY CORRIDOR SIGNAL TIMING DEVELOPMENT AND APPLICATION

STUDY NUMBER:	TTI 1271
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	CHAUDHARY N
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	RAY DERR, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 250,000	TOTAL EXPENDITURES: 144,214
FY 92 BUDGET: 90,000	FY 92 EXPENDITURES: 83,294
FY 93 BUDGET: 100,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The average ratio within the seven largest cities in Texas is 42/18 for freeway/principal arterial travel, considerably larger than the average 34/26 in 22 cities outside of Texas. Increased utilization of the principal arterials could be encouraged by providing improved traffic signal timing along freeway corridors in urban cities, and thus improve mobility.

OBJECTIVE(S):

The overall objective is to draw together the best proven applications of signal timing (PASSER II, III, and IV, MAXBAND, NETSIM) to provide improved methods of application for all types of freeway corridor traffic signal systems. Specific objectives include the following:

1. Improve the PASSER II program to include circular phasing sequence optimization capability.

2. Improve the PASSER IV program to optimize signal timing for a single two-way arterial, progressive diamond interchange, and closed loop arterial networks with both two- and one-way arterials as subcomponents.

3. Incorporate cross street progression using PASSER II and IV to include travel across a signalized freeway interchange.
travel across a signalized freeway interchange.

4. Provide a means of advance implementation of the advanced technology.

IMPLEMENTATION PLAN:

The software developed in this project will primarily be used by cities. Primary implementation efforts will be to demonstrate the usefulness and capabilities of the program, make it available to the cities, and provide training in Texas. The software will be tested in field locations in Houston or Fort Worth to prove the effectiveness of the methods prior to implementation. The Department would sponsor training courses for the software so that the maximum benefits may be realized.

STUDY PROGRESS:

The following tasks, as outlined in the master proposal, were successfully completed:

Task 1: Review of the current state-of-the-art traffic signal timing optimization methods.

Task 2: Study of applications technology including TxDOT's ATM (previously FAC TS) system and FHWA's UTCS system.

Task 3: An assessment of TxDOT's corridor signal timing needs.

Task 4: Conceptual design/specifications of methodologies to be developed in this study.

Task 5: Other promising applications including variable width progression bands, and over-saturated conditions.

Task 6: Formulation of applications software specifications.

The following tasks are currently underway according to the schedule given in the master proposal.

Task 7: Development of PASSER IV software.

Task 8: In-house testing of PASSER IV.

In general, the project is on schedule and no changes in the current objectives, tasks, or completion dates are anticipated at this time.

STUDY TITLE: METHODS TO ENHANCE SAFETY OF PASSIVE WARNING DEVICES AT RAILROAD-HIGHWAY GRADE CROSSINGS

STUDY NUMBER:	TTI 1273
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	FAMBRO DB
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	KEN WILLIS, D-5
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 120,000	TOTAL EXPENDITURES: 102,408
FY 92 BUDGET: 80,000	FY 92 EXPENDITURES: 60,708
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-02-26
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Although significant progress has been made towards improving safety at railroad highway grade crossings, the number of serious injuries and fatalities at these locations continue to be a major concern. Last year alone, 798 people were killed and 2,588 hurt in 5,776 crashes at U.S. grade crossings. Approximately 10 percent of these fatalities, injuries, and crashes occurred at Texas grade crossings. One proven method of improving safety at passive crossings has been the installation of active warning devices; however, based on the current funding level of $12 million dollars per year for installation of these devices in Texas, it would take approximately 70 years to signalize the 9,153 passive crossings in the state.

As an intermediate step in the safety improvement process, two states and at least one railroad are testing experimental passive warning devices at railroad-highway grade crossings. It would appear that these or other devices offer low cost enhancements to the safety performance of existing passive warning devices. The potential for improving safety at Texas grade crossings of these enhancements to existing passive warning devices should be evaluated.

OBJECTIVE(S):

The objectives of this research are to develop more effective passive warning devices than the current MUTCD standard crossbuck and advanced warning sign. The improved passive warning(s) will enhance the safety and effectiveness of current passive warning devices, but will be less expensive than installing active warning devices (i.e., flashing light signals or flashing light signals with automatic gates).

IMPLEMENTATION PLAN:

Upon completion of the field evaluation, one signing system will be recommended for implementation. The sign system recognized as optimal for crossing safety may be the current sign system standard, or it may be one of the experimental sign systems previously identified.

STUDY PROGRESS:

Candidate devices were developed based on the recommendations of an expert panel, and have been fabricated for testing. A survey of motorists in Midland was conducted to evaluate motorist comprehension of the existing and proposed passive warning devices.

Based on the results of the motorist survey, candidate sign systems were developed. Controlled testing of the existing and proposed sign systems was then conducted. Results indicate that the proposed alternatives are generally well understood and would improve the level of safety at passive crossings. Results of the controlled testing identified the alternative sign systems which should be further tested in the field.

The field testing of candidate sign systems will be conducted in six counties throughout Texas. Several crossings in each county will be selected as test sites. The various experimental sign systems and the existing current sign system will be evaluated.

At present, it is planned to apply for a contract extension in time and additional funds to complete the study.

STUDY TITLE: COMMUNICATING LANE DROPS TO MOTORISTS

STUDY NUMBER:	TTI 1292
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	FITZPATRICK K,URBANIK T
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	HENRY WICKES, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 150,000	TOTAL EXPENDITURES: 59,552
FY 92 BUDGET: 72,000	FY 92 EXPENDITURES: 59,552
FY 93 BUDGET: 78,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The Texas Manual of Uniform Traffic Control Devices (TMUTCD) provides limited guidance on communicating lane drops to motorists. Several methods are in use or are being considered. Standardized treatments need to be developed to improve driver expectancy concerning lane drops.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify current Texas lane drop communication methods.

2. Identify and test alternative signing and marking plans.

3. Determine effective changes in lane drop signs and pavement markings.

IMPLEMENTATION PLAN:

Initiate use of standardized effective marking and signing treatments at lane drops.

STUDY PROGRESS:

The literature review is completed. Video analysis of several freeways in Houston, Dallas/Ft. Worth, and San Antonio is yielding geometric information and signing and marking detail for "exit only" ramps. Eight marking techniques have been identified.

Motorists interviews were conducted at the Houston Auto Show (January 25 to February 2). Over 500 individuals participated in the survey. Preliminary results indicate that drivers understand the exit-only situation and the alternative pavement markings tested. The highest understanding of the impending exit were achieved with the solid markings (either the solid, double-wide white line or the parrallel white lines) rather than the broken line (commonly known as "elephant tracks").

The survey to Texas driving instructors located in urban areas (approximately 175) was mailed on June 17, 1992.

STUDY TITLE: THE USE OF CONTINUOUS TWO-WAY LEFT-TURN LANES ON HIGH-SPEED RURAL AND SUBURBAN HIGHWAYS

STUDY NUMBER:	TTI 1293
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BALKE KN,FITZPATRICK K
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	JERRY SELBY, D-8
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 160,000	TOTAL EXPENDITURES: 58,341
FY 92 BUDGET: 80,000	FY 92 EXPENDITURES: 58,341
FY 93 BUDGET: 80,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

There is a need to determine how various traffic, geometric, and development levels influence the operations and safety of seven-lane cross sections. From this analysis, criteria for the application of seven-lane cross sections can be developed. Flush medians are frequently used in rural areas to provide increased separation between opposing traffic streams or to reserve right-of-way for future roadway expansion. Frequently, flush medians are marked with double yellow lines with left turn storage lanes provided only at major intersections and driveways. Recent geometric design policies recommend against the use of two-way left-turn lanes in rural areas. Therefore, there is a need to evaluate the operations and safety of flush medians and to develop alternate signing and delineating strategies for improving the operations and safety of flush medians on four-lane rural highways.

OBJECTIVE(S):

The objectives of this study are to:

1. Evaluate the factors influencing the operations and safety of seven-lane cross sections on urban and suburban arterials.

   -Identify parameters
   -Develop experimental design for field studies
   -Identify study sites
   -Conduct field studies
   -Data processing and analysis
   -Evaluate findings
   -Prepare guidelines

2. Evaluate the operations and safety of flush medians on four-lane rural highways

   -Conduct survey of districts
   -Conduct field observations
   -Review accident statistics
   -Identify candidate treatments
   -Select candidate treatment(s)
   -Conduct field evaluation
   -Evaluate findings
   -Prepare final report

IMPLEMENTATION PLAN:

The department does not have research data on a six-lane urban section with a two-way left-turn lane. Neither do we have data on rural four-lane highways with flush median or two-way left-turn lanes. The results of the study could change our signing and striping or design of the above facilities.

STUDY PROGRESS:

Objective 1:

Task 1.1 Identify Potential Parameters - Through a detailed review of the literature on two-way, left-turn lanes and through field observations, roadway and roadside parameters that may affect the operations and safety of seven-lane roadways were identified. These parameters can be grouped into four categories: Level of Development, Traffic Volumes, Signalization, and Speed Limit. Field studies will be performed to measure the effects of these parameters on the operations and safety of seven-lane cross sections.

Task 1.2 Develop Experimental Design for Field Studies - A two-phase plan for conducting field studies to measure the effects of the identified parameters on the operations and safety of seven-lane roadways was developed. Phase I of the plan focuses on measuring the effects of various parameters on the operations and safety of through traffic. As part of Phase I, a detailed inventory of the characteristics and conditions of each study site will be performed. The purposeof the inventory is to classify the level of development and type of signalization associated with each site. In addition to the inventory data, speed profile and delay data will be collected and correlated with the parameters present at each study site. Accident, conflict, and erratic maneuver data from each site will also be used to evaluate the effects of the parameters on safety.

Phase II of the experimental plan focuses specifically on turning movements at driveways and intersections. From the inventory sites, at least three candidate driveways or intersections will be identified. Gap distribution/gap acceptance and delay data for vehicle turning from the two-way left-turn lane and vehicle turning left from the driveway/intersection will be collected to meausre the impacts of seven-lane cross sections on turning traffic. Conflict and accident analyses will also be conducted along with the operational field studies to examine safety issues associated with turning movements on seven-lane cross sections. Particular attention of the conflict analysis will be the effect of two-stage turning movements on operations and safety of seven-lane cross sections.

Task 1.3 Identify Study Sites - Using the Roadway Inventory Database, a list of roadways in urban areas with a pavement width of greater than 70 feet was developed for each District. Through a survey, the Districts were asked to indicate the type of median that exists on the identified roadway. As of June 1, 1992, thirteen of the Districts have responded. From the survey, a total of 35 potential study sites have been identified.

Objective 2:

Task 2.1 Conduct Survey of Districts - Four-lane roadways that contain flush medians were identified from the Roadway Inventory Database. Four-lane roads with pavement widths between 50 and 70 feet were identified

as potential location (see 1.3 above). A list of potential sites for a district was mailed in January with a request that the type of median treatment for each road be indicated. As of June 1, thriteen of the 21 districts who received the request have responded. The survey revealed only seven sites in the state of Texas with flush median markings.

Task 2.2 Conduct Field Observations - Preliminary field observations at a flush median site and a two-way left-turn lane site were made during a visit to the Lufkin District on April 1.

Task 2.3 Review Accident Statistics - Accident data for the flush median sites are being obtained through the LANSER computer program. One-page "case study" accident data have been reviewed for four of the seven flush median sites. Collision diagrams have also been drawn. Data for the remaining flush median sites are being obtained along with data for the rural two-way left-turn lane sites.

Tasks 2.4 and 2.5 Identify Candidate Treatments and Select Candidate Treatment(s) - Based on the discussions at the Technical Panel Meeting (May 29, 1992), before-and-after studies at two sites in Lufkin will be conducted. Before-and-after accident data will be gathered for a segment of US 69 that was converted from a flush median to a two-way left-turn lane in late 1990. Anther section of US 69 that will be converted from a flush median to a two-way left-turn lane in late summer/early fall 1992 is the location of the before-and-after operational study.

STUDY TITLE: PEDESTRIAN SIGNALS WARRANTS AND EFFECTIVENESS

STUDY NUMBER:	CTR 1296
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MACHEMEHL R,MAHMASSANI H
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	CATHY WOOD, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 153,000	TOTAL EXPENDITURES: 48,836
FY 92 BUDGET: 75,000	FY 92 EXPENDITURES: 48,836
FY 93 BUDGET: 78,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The lack of a pedestrian phase in a signal cycle may result in pedestrian accidents due to the pedestrian's unwillingness to wait until he has the right-of-way. Therefore, an attempt should be made to research and document the effectiveness of a pedestrian phase. The need may also exist to compare vehicular delay and operating cost.

OBJECTIVE(S):

The objectives of this study are to:

1. Summarize and evaluate existing guidelines or warrants for pedestrian signals.

   -Identify, analyze, and evaluate existing pedestrian signal installation guidelines.

2. Evaluate the ability of pedestrians to understand pedestrian signal indications and their willingness to comply.

   -Characterize pedestrian behavioral response to signalization.

3. Evaluate the benefits of pedestrian signalization and the costs due to hardware, operation, and vehicular delay.

   -Evaluate methodologies for estimating pedestrian phase durations.
   -Assess safety benefits of pedestrian signalization.
   -Examine impacts to vehicular delay.
   -Compare benefits and costs.

4. Develop guidelines reflecting the above benefits and costs.

IMPLEMENTATION PLAN:

The guidelines developed in this project will provide traffic engineers with a tool to examine the following:

1. Pedestrian perception of the pedestrian signal indications and behavioral response to indications.

2. Signal timing phasing issues pertaining to pedestrian movement including minimum green time and pedestrian, intervals, phasing.

3. The relationship of benefits and costs of pedestrian signalization.

The resulting guidelines can be used to make decisions regarding the signalization equipment and signal timing that meet the pedestrian's needs. These guidelines can be included in the Maintenance and Operations Division's Traffic Engineering Procedures Manual. This information will result in a more effective and safer pedestrian signalization with reduced costs to our Department as well as the vehicle driver.

STUDY PROGRESS:

Work continued on Tasks 1 and 2, which include existing guidelines and characterization of pedestrian behavior. Work began on Tasks 3, 4, 5, and 6 which encompass pedestrian phase durations, safety benefits, vehicular delay and benefits and costs.

A methodology for estimating effects of pedestrian signal phases on vehicular delay was adopted and tested. A field data collection plan was implemented. Extensive field data collection activities will be on-going during the fourth quarter.

During the next six months, work will continue on Tasks 1 and 2, additionally Tasks 3, 4, and 5 will be underway. Data collection will be about 60 percent complete by the end of the period. Preliminary work will also have begun on Tasks 6 and 7.

No contract changes or modifications are anticipated at this time.

STUDY TITLE: WARRANTS FOR FLASHING TRAFFIC SIGNAL OPERATION

STUDY NUMBER:	TTI 1297
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	HAWKINS HG
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	CURTIS HERRICK, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 216,124	TOTAL EXPENDITURES: 83,691
FY 92 BUDGET: 100,561	FY 92 EXPENDITURES: 83,691
FY 93 BUDGET: 115,563	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:
There are no current guidelines which adequately describe when flashing operation will produce benefits. Instead, the decision to use flashing signal operation is based primarily on engineering judgement. As a result, there is inconsistent use and application of flashing signal operation.

OBJECTIVE(S):

The primary objective of the proposed study will be to develop warrants for the use of flashing traffic signal operation. These warrants will be developed to answer two fundamental questions:

1. Under what circumstances should traffic signals be placed in flashing operations?

2. When flashing operation is used, what flashing mode (color indications) should be displayed to the various approaches and turning movements?

The resulting warrants are likely to be based on traffic volumes, accident experience, time of day, and type of signal control. In developing the warrants, the following issues will be evaluated:

1. The traffic volume level at which flashing operation produces a reduction in travel delay.

2. The impacts of accidents on the implementation of flashing operation.

3. Selection between red/yellow or red/red flashing modes.

4. The influence of pretimed versus actuated control on the effectiveness of flashing operation.

5. The relationship between normal flashing operation and emergency flashing operation.

6. Driver understanding and violation of flashing signal operation.

7. The potential for tort claims over flashing signal operation.

8. The potential fuel and electrical energy savings which can be realized from flashing operation.

9. The interaction of alcohol consumption and flashing signal accidents (number of accidents at flashing signal intersections immediately following the closing of bars).

IMPLEMENTATION PLAN:

At present, use of flashing operation is an engineering judgement left up to the traffic engineer. If the results of this project are fully implemented, the use of flashing operation at intersections will be determined by application of the warrants. There is the possibility of incorporating the warrants into the Texas MUTCD.

Because the implementation of the project results would affect the Department's exposure to tort liability, the proposed warrants must be presented to the Department (which may include the Commission) for acceptance or rejection. The technical panel chairman plans to coordinate the presentation of the project results at the conclusion of the project.

STUDY PROGRESS:

The literature review and flashing survey have been completed and the findings of each will be described in the interim report. The operational analysis is underway and will be completed during the summer so that the results will be described in the interim report. Portions of the interim report are written. The interim report will be completed at the end of the fiscal year and submitted to TxDOT. Data collection has begun. A number of potential study sites have been identified. The data being collected at these sites include video of late-night signal operation, traffic volumes, signal control, and accident history.

The first year interim report will be submitted at the end of the fiscal year. It will include a general description of the study, a summary of the literature review, a summary of the survey findings, results of a computer simulation of flashing signal operation, and preliminary guidelines for flashing signal operation.

This study should be completed on time and within budget.

STUDY TITLE: DESIGN, INSTALLATION, AND OPERATION OF FREEWAY LANE CONTROL SIGNALS

STUDY NUMBER:	TTI 1298
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ULLMAN GL,WILES P
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	RAY DERR, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 190,000	TOTAL EXPENDITURES: 64,864
FY 92 BUDGET: 95,000	FY 92 EXPENDITURES: 64,864
FY 93 BUDGET: 95,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Overhead freeway lane control signals (LCS) have been or are being installed in several major metropolitan areas in Texas. Over 100 of these signals have already been installed or are in the design stage in the Ft. Worth area alone. Another 500 signals are envisioned for the Ft. Worth metropolitan area as part of its computerized freeway traffic management system. The purpose of these signals is to serve as one component of the freeway driver information system, symbolically portraying in real-time the status of the freeway on a lane-by-lane basis. At the present time, very little information is available to the Department to assist with the design, installation, and operation of freeway LCS. A variety of different LCS hardware technologies, symbol displays, light intensities, and color combinations are available, but little objective data has been collected to determine which are most appropriate for freeway conditions in Texas and which will be most readily recognized, understood, and responded to by drivers. Furthermore, the interrelationships between roadway geometrics, traffic conditions, LCS installations, and driver responses have also not been examined to any degree. What is needed is a comprehensive evaluation of these and other factors so that improved design, installation, and operation guidelines for freeway LCS can be developed.

OBJECTIVE(S):

The objectives of this study are as follows:

1. Determine the current state-of-the-practice regarding the design, operation, and effectiveness of freeway LCS systems.

   -Conduct literature review
   -Survey existing and planned LCS systems in Texas
   -Survey other cities-nationwide and Canada
   -Survey equipment manufacturers and suppliers

2. Conduct laboratory studies to determine the effect of selected LCS design elements (hardware, brightness, symbol, color) upon motorist comprehension and legibility.

   -Identify LCS design elements to be evaluated
   -Develop an experimental plan for laboratory and field studies of LCS
   -Conduct laboratory studies
   -Evaluate results of the laboratory studies

3. Conduct operational studies to assess the effectiveness of LCS systems and roadway and traffic characteristics upon LCS effectiveness.

   -Perform field studies of freeway LCS
   -Evaluate field data

4. Develop guidelines and recommendations regarding the design, installation, and operation of freeway LCS systems in Texas.

   -Develop LCS design recommendations
   -Develop design, installation, and operations guidelines

IMPLEMENTATION PLAN:

The results of this study will be implemented as they are found in the design and operation of traffic management systems across the state. Lane control signals are used on both freeways and HOV Lanes and the results will be applicable to both.

The recommendations will be incorporated into the Texas Manual on Uniform Traffic Control Devices and possibly the Texas Motor Vehicle Laws. A proposed revision to the National Manual on Uniform Traffic Control Devices will be submitted. The public will be educated on the meanings of the lane control signal indications. Possible routes include the DPS Driver's Handbook and the Texas Travel Map.

The study's results will be distributed through the reports and presentations at various technical conferences.

STUDY PROGRESS:

Literature regarding LCS's is being summarized for inclusion in the interim report.

The survey of urban Districts in Texas is complete. The survey of cities outside of Texas with freeway LCS systems is currently underway.

A laboratory study to determine motorist understanding of existing LCS symbols was completed and submitted as a Technical Memorandum to the Department. The survey indicated that drivers have trouble comprehending the meaning and proper response to a yellow X used as a transition to the red X in a freeway driving environment.

Phase I laboratory studies are underway in Houston, Dallas-Ft. Worth, and San Antonio investigating motorist comprehension of yellow downward arrows and downward diagonal arrows in simulated freeway driving scenes. The effect of a flashing symbol upon comprehension is also being examined.

STUDY TITLE: INTERACTIVE GRAPHICS INTERSECTION DESIGN SYSTEM

STUDY NUMBER:	CTR 1308
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	MACHEMEHL R,LEE C,RIOUX T
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	HENRY WICKES, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 186,000	TOTAL EXPENDITURES: 62,840
FY 92 BUDGET: 93,000	FY 92 EXPENDITURES: 62,840
FY 93 BUDGET: 93,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The basic ICIDS system currently operates and is configured to permit addition of capabilities that will ultimately make it an extremely efficient and valuable engineering tool. It is thought feasible to develop computer software which permits interactive graphical presentation of all important aspects of at-grade intersection design on a variety of computer hardware configurations. Interchangeability of software components and design files among these hardware systems will provide a very flexible and efficient working environment for design engineers involved in intersection design and modification.

OBJECTIVE(S):

The general objective of the research effort is the development of an Interactive Graphics Intersection Design System (IGIDS), which will conveniently aid engineers in the analysis, design and modification of at-grade intersections. The specific objectives of this study are to develop several important additional features which augment the basic IGIDS. These objectives are:

1. Develop a fully functional IGIDS capability for designing intersection traffic control. This IGIDS function will provide selection, design, and placement of all intersection traffic control features, including official traffic control devices and signal timing.

2. Develop, in close cooperation with D-19 personnel, the IGIDS function of plan preparation through the Automated Plan Preparation (APP) system.

3. Complete the implementation of previously selected IGIDS functions and select and implement additional functional components of the IGIDS system as identified by department contact personnel within available resources.

IMPLEMENTATION PLAN:

IGIDS and training for its use will be made available to District and Division personnel for use in design. IGIDS could eventually be integrated into one of the Level III training courses.

It is anticipated that a training course will need to be developed in order

for IGIDS to be fully implemented.

STUDY PROGRESS:

The development of the IGIDS system continues essentially on schedule. Implementation of the TXTOM turning radius template routines within IGIDS was coordinated with TxDOT personnel. The current state and plans for the Automated Plan Preparation (APP) system were reviewed with D-19 personnel. Plans for interfacing the IGIDS software with APP are continuing. Development of documentation for IGIDS software continues as planned.

No contract changes or requests for modification are anticipated at this time.

STUDY TITLE: DEVELOPMENT OF RESPONSE PLAN FOR TRAFFIC MANAGEMENT IN RESPONSE TO MAJOR URBAN AND RURAL FREEWAY INCIDENTS

STUDY NUMBER:	TTI 1345
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	McCASLAND W,OGDEN M
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	R. DERR, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 260,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: N/A
FY 93 BUDGET: 131,500	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Incident management, especially when large trucks with potentially hazardous cargoes are involved, refers to a coordinated and preplanned approach to restore traffic to normal operation by using all available human and electronic/mechanical resources. This involves a systematic process for detection of incident, identifying the extent and response requirements, and providing appropriate response to aid the motorists involved. Proper guidelines for handling traffic are critical to minimize congestion, delay, fuel consumption and other adverse impacts. A statewide, uniform response plan is needed to assist local jurisdictions in developing optimum incident management strategies on urban and rural freeways.

OBJECTIVE(S):

The objectives of this study are to prepare detailed response plans for:

1. Establishing cooperation between the jurisdictions and agencies involved.

2. Rapid vehicle removal.

3. Determining when a major rerouting of traffic is required.

4. Establishing detour routes and strategies.

5. General and specific equipment needs.

6. Proper use of equipment, material and personnel, with special emphasis on large, heavy truck incidents, involving potentially hazardous cargoes.

IMPLEMENTATION PLAN:

This response plan will provide the framework for the development of uniform strategies for major incidents by traffic management teams statewide.

STUDY PROGRESS:

STUDY TITLE: A COMPREHENSIVE IVHS PLAN FOR TEXAS

STUDY NUMBER:	TxDOT 1346
RESEARCH AGENCY:	TEXAS DEPARTMENT OF TRANSPORTATION
STUDY SUPERVISOR(S):	
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	AL KOSIK, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 150,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	

PROBLEM STATEMENT:

IVHS has caught the attention of many in the transportation field. Texas has devoted considerable resources to this effort and has developed many ideas. It is now becoming evident that, to pursue IVHS most effectively, a comprehensive plan needs to be developed. Such a plan should include all projects being pursued by TxDOT, as well as how that work complements what is being done by other agencies.

In addition, specific IVHS technologies may be available for integration into city and state traffic management systems. Preliminary research has also identified a number of productivity, safety, and regulatory improvements for commercial vehicle operations. Advanced vehicle control technologies can also make our highways safer, and IVHS can have a tremendous impact on the regulation of commerce.

OBJECTIVE(S):

Much work has already been done in this area. The objective of this project is to take what has been done and work with the various agencies to document this material in a comprehensive planning document.

In addition, this project will determine which IVHS technologies may be available in the near future (3 to 5 years) and the feasibility of applying these technologies to better manage and operate traffic management systems in Texas.

Also, IVHS technologies for commercial vehicle operations will be studied to determine their potential application to TxDOT operations and planning.

IMPLEMENTATION PLAN:

A need exists to assure that the IVHS activities being pursued by the different agencies complement each other. Also, Texas needs to be in a position where it can compete effectively for federal IVHS funding. Other states are developing IVHS plans that are proving useful in justifying projects to the U. S. Department of Transportation. This project will help in pursuing the development of IVHS ideas in Texas.

STUDY PROGRESS:

STUDY TITLE: DESIGN CRITERIA FOR SUBURBAN HIGH SPEED CURB AND GUTTER SECTIONS

STUDY NUMBER:	TTI 1347
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	FAMBRO D,ROSS H
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	BILL CRUMLEY, DIST 23
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 180,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 90,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Highways requiring capacity expansion often are located in suburban areas. These highways usually have restrictive existing right-of-way with adjoining commercial and residential development. Depending on the extent of adjoining development, right-of-way for a rural multilane facility may be severely limited. To reduce the right-of-way requirements and associated costs, a curbed section with inlets and storm drains is often proposed. This eliminates the need for parallel drainage ditches and as such, reduces the right-of-way requirements. Design elements, such as clear zone, design speed, shoulder requirements, curb type, etc. need to be clearly defined for projects of this type.

OBJECTIVE(S):

Study various facilities of this type throughout the state and determine optimum design criteria. Develop specific guidelines for high speed urban curb and gutter facilities in suburban areas.

IMPLEMENTATION PLAN:

Uniform design throughout the state. Cost effective and safe highway system. Capacity increase.

STUDY PROGRESS:

STUDY TITLE: IMPACTS OF TRAFFIC SIGNAL INSTALLATION AT MARGINALLY WARRANTED INTERSECTIONS

STUDY NUMBER:	UTA 1350
RESEARCH AGENCY:	UNIVERSITY OF TEXAS AT ARLINGTON
STUDY SUPERVISOR(S):	WILLIAMS JC,ARDEKANI SA
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	TOM NEWBERN, DIST 23
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 61,315	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 61,315	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The Texas Manual on Uniform Traffic Control Devices provides a series of twelve warrants to assist traffic engineers in determining whether traffic flow and safety would be improved at an intersection by installing a traffic signal. These warrants define the minimum conditions under which installing a traffic signal may be justified. Engineering judgement must be used to ensure that a traffic signal will improve traffic flow and safety, particularly at intersections that just barely meet the warrant conditions. Uniform statewide guidelines for analyzing marginally warranted traffic signal locations are needed.

OBJECTIVE(S):

The objectives of this study are to:

1. Review current Department procedures and guidelines for evaluating marginally warranted traffic signal locations.

2. Identify criteria for determining impacts of signal installation at marginally warranted locations.

3. Prepare detailed procedures for evaluating marginally warranted locations.

4. Include brochure covering safety aspects of this issue for local elected officials.

IMPLEMENTATION PLAN:

Without careful evaluation, the installation of a traffic signal at a marginally warranted intersection could have a detrimental effect on traffic flow and safety. The procedures developed in this study will assist Department personnel evaluating impacts and in determining whether to install a marginally warranted traffic signal.

STUDY PROGRESS:

STUDY TITLE: INVESTIGATE REQUIREMENTS FOR AN INTELLIGENT RATING SYSTEM WITH FAULT TOLERANT CONSIDERATION

STUDY NUMBER:	UTA 1372
RESEARCH AGENCY:	UNIVERSITY OF TEXAS AT ARLINGTON
STUDY SUPERVISOR(S):	WALKER R
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	BERT LUNDELL, D-18
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 9,751	TOTAL EXPENDITURES: 4,117
FY 92 BUDGET: 9,751	FY 92 EXPENDITURES: 4,117
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-02-13
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Automated procedures should be used for aiding permit officers in obtaining optimal routes. In addition to safety considerations, such optimal routes will reduce the time required to issue permits, reduce highway maintenance and improve traffic flow at considerable cost savings. Because of these requirements, an appropriate system is needed which not only addresses the above considerations, but also provides a means of insuring continuous operations of the system in the event of failure of one or more components.

OBJECTIVE(S):

The objectives of this study are to:

1. Examine the current manual and automated methods used for obtaining permits. In particular, investigate the everyday operations of the process, noting requirements and other needs used in the permit process.

2. Determine and classify necessary data used for determining routes.

3. Investigate where this data is obtained and how it is maintained.

4. Determine any planned or future DOT methods for obtaining and maintaining or updating this data.

5. Investigate current and future equipment planned for permit operations.

6. Determine current and planned format of the data base for the permit operation needs.

7. Research current applicable routing and expected system algorithms for implementing an automated routing process. Investigate the use of artificial intelligence for aiding in the routing process.

8. Develop an information flow diagram which can be used for programming an automated routing system.

9. Recommend necessary equipment for implementing the automated routing system, including methods of insuring continuous operations.

10. Provide a report recommending the appropriate procedures to be used so that an automated routing system can be developed and implemented.

IMPLEMENTATION PLAN:

Implementation of the project will begin with an anlaysis of current methods used for issuing permits. Data required for routing will be identified and classified. Methods for maintaining the currency and updating the data will be determined. The format of data base will be determined. Existing routing, expert system algorithms and the use of artificial intelligence will be researched for developing the system. A flow diagram will be determined for programming the system. The necessary equipment will be determined and recommended for implementation of the system. A report outlining the recommeded procedures for development and implementation of an automated routing system will be provided.

The results of this study will outline the direction to be taken in developing an automated routing system and will be the basis for determining whether the programming will be done in-house or by contract. Due to the anticipated cost of the programming effort, approval by the Department of Information Resources will be required. A presentation of the study and the proposed project will be required.

STUDY PROGRESS:

System feasibility has been studied and verified.

A data base of District 14 is currently being compiled and a demo routing system will be completed in August 1992.

The original objectives of the program are being pursued and progress to date is satisfactory and in accordance with the planned schedule.

The project is scheduled to terminate on August 31, 1992. It is planned by D-18 to try and continue via a 900 type project, if funds can be located.

A final report will be submitted at project termination.

STUDY TITLE: EVALUATION OF RURAL GUIDE SIGNING

STUDY NUMBER:	TTI 1373
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	HAWKINS, JR. H
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	LEWIS RHODES, D-18
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 289,569	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 92,065	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

The Texas Manual on Uniform Traffic Control Devices (MUTCD) contains descriptions of how guide signing and directions should be provided to drivers on rural highways. However, these guide signing standards are not fully based on results of a recent comprehensive study of rural guide signing. There is a need to conduct research on rural guide signing to provide a more effective system of communicating directions and guidance to rural drivers.

OBJECTIVE(S):

The proposed study will develop and conduct a motorist survey to determine what elements of our standard sign sequences confuse drivers. Sites will be selected to revise existing sign sequences. Additional surveys will be conducted to determine if alternate sign sequences reduce driver confusion.

IMPLEMENTATION PLAN:

Guide signing standards for conventional roads contained in the MUTCD seemingly are based more on engineering judgement and previous experience than on research evaluating their effectiveness. The evaluation of the effectiveness of the current rural guide signing standards proposed in this study will identify how rural guide signs can be improved and provide the opportunity to develop better standards for rural guide signing. These improved standards may eventually become a part of the Texas MUTCD.

STUDY PROGRESS:

STUDY TITLE: EVALUATION OF A MOTORIST ASSISTANCE PROGRAM USING FREEWAY PATROL VEHICLES

STUDY NUMBER:	TTI 1922
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	McCASLAND WR
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	STEVE LEVINE, DIST 12
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 103,700	TOTAL EXPENDITURES: 52,219
FY 92 BUDGET: 53,000	FY 92 EXPENDITURES: 45,420
FY 93 BUDGET: 43,900	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Random incidents such as accidents and vehicle breakdowns cause fifty percent of the traffic congestion on streets and freeways. Traffic control procedures or techniques which reduce the influence of capacity-reducing events should be evaluated. Freeway patrol is a good method that directly affects the removal of incidents. In November 1986, the Harris County Sheriff's Department and the Houston Automobile Dealers Association initiated a motorist assistance program(MAP) to provide assistance to stranded motorists on freeways in Harris County. Although these patrol services have proven to be beneficial and are well received by the public, the limited use of patrols and the curtailment of services when budget constraints are imposed on agencies indicate that the benefit cost relationships for these services are either too low, not well documented or not understood by the service managers.

OBJECTIVE(S):

The objectives of this study are to:

1. Reduce the time that disabled vehicles or accident vehicles disrupt traffic flow on the freeway main lanes.

2. Determine the benefits of MAP for the Southwest Freeway during the reconstruction of the main lanes of the freeway.

IMPLEMENTATION PLAN:

The Southwest Freeway Public Information Office will supervise the operation of two mini-van vehicles equipped with MAP and establish a patrol strategy for minimizing the response times to incidents. Travel logs and reports will be prepared by the MAP operators and submitted to the TxDOT through this office.

STUDY PROGRESS:

STUDY TITLE: FEASIBILITY OF DEVELOPING AN AUTOMATED INCIDENT MANAGEMENT PLAN (AIM)

STUDY NUMBER:	TTI 1928
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	SIEGFRIED RH
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	STEVE LEVINE, DIST 12
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 100,000	TOTAL EXPENDITURES: 29,433
FY 92 BUDGET: 100,000	FY 92 EXPENDITURES: 29,433
FY 93 BUDGET: 61,826	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-04-13
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

The Automated Incident Management (AIM) Plan is one of the techniques being considered by the Houston District of TxDOT in the development of a Freeway Incident Response and Management Program to reduce the time required to clear an incident and to reduce the impacts on motorists while the incident is being removed. The AIM plan will enable the operator to calculate the impact of the incident, to develop alternate routes and to evaluate predetermined reactions and responses.

OBJECTIVE:

The objectives of this study are to:

1. Identify and develop a database from which an incident response plan will be determined.

2. Develop an operating system that will determine alternate routing based on the aforementioned database.

IMPLEMENTATION PLAN:

Three major applications of the AIM plan that are expected to be implemented are:

1. Alternate Routing - determination of alternate routes on freeways and arterial streets to bypass hazardous locations and incidents that will cause traffic delays and subject the motorists to unsafe conditions.

2. Travel Pattern Reassignment - adjustment of traffic volume patterns to permit other computer programs.

3. Resource Document Implementation - an operator's manual that lists the agencies and personnel to be contacted and the location and type of emergency equipment required.

STUDY PROGRESS:

STUDY TITLE: RAISED PAVEMENT MARKER FIELD TESTING

STUDY NUMBER:		TTI 1946	
RESEARCH AGENCY:		TEXAS TRANSPORTATION INSTITUTE	
STUDY SUPERVISOR(S):		ULLMAN GL	
RESEARCH AREA:		AREA 3	
TxDOT CONTACT:		LEWIS RHODES, D-18	
STUDY SPONSOR:		TxDOT	
TOTAL BUDGET:	40,000	TOTAL EXPENDITURES:	1,182
FY 92 BUDGET:	18,000	FY 92 EXPENDITURES:	1,182
FY 93 BUDGET:	11,000	FY 93 EXPENDITURES:	N/A
DATE BEGUN:		92-06-01	
TERMINATION DATE:		T94-06-01	

PROBLEM STATEMENT:

This research will attempt to solve the on-going problem of being able to draw concrete conclusions regarding the performance of different types of reflective raised pavement markers (RRPMs). The plan calls for installation of RRPMs from qualified manufacturers at four Interstate locations in District 15 (San Antonio). The sites represent a wide range of traffic volumes. TxDOT will obtain samples of the RRPMs from the sites at varying times after installation. The Materials and Testing Division (D-9) of TxDOT will perform the actual photometric measurements. The Texas Transportation Institute will also provide selected technical assistance to this effort.

OBJECTIVE(S):

The objectives of this study are to:

1. Evaluate roadway and traffic conditions at four RRPM study sites defined by the Department and document them in an initial report.

2. Monitor RRPM performance data collected periodically by the Department throughout the evaluation process; and

3. Prepare a final report of RRPM performance at the end of the evaluation.

IMPLEMENTATION PLAN:

This research will provide performance data regarding RRPMs, which will be of immediate use in the product procurement and in establishing replacement guidelines. This research will also enable TxDOT to purchase and maintain RRPMs in the most cost-efficient manner while still providing a safe environment for motorists.

STUDY PROGRESS:

Fifteen different types of RRPMs from five different manufacturers will be installed for reflectivity evaluation at four different selected sites in San Antonio for a two year study the week of August 4, 1992. TTI will document existing traffic and reflectivity readings.

A final report will be submitted in August 1994.

STUDY TITLE: DESIGN OF SURVEILANCE AND COMMUNICATION SYSTEM FOR DISTRICTS

STUDY NUMBER:	TTI 1950
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BLUMENTRITT CW
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	WALLACE EWELL, DIST 2
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 2,327
FY 92 BUDGET: 22,000	FY 92 EXPENDITURES: 2,327
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-20
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

A number of Surveillance, Communications, and Control(SC&C) systems are in planning, design, or implementation stages in the State of Texas. To support this system, it is necessary to systematically combine the many components of the control environment ranging from vehicle detection to public information dissemination.

OBJECTIVE(S):

The objectives of this study are to:

1. Analyze the existing I-35W video surveillance system.

2. Develop a design for a video communications system to transmit images from the satellite control center to the City of Fort Worth downtown traffic control center.

3. Prepare specifications for any specialized equipment, secure FCC licensing on behalf of TxDOT and prepare a report on findings.

IMPLEMENTATION PLAN:

The implementation process will require further study. This study will lay the groundwork for later phases of the project.

STUDY PROGRESS:

1. Not much was accomplished on this project, so far.

2. On-going review of plans and specifications for surveillance system (called short-haul microwave system).

3. Provided on-going support for technical equipment evaluation.

STUDY TITLE: ANALYSIS OF IH-35 DESIGN ALTERNATIVES FOR DISTRICT 14

STUDY NUMBER:	TTI 1953
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	BENSON J
RESEARCH AREA:	AREA 3
TxDOT CONTACT:	GLEN McVEY, DIST 14
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 150,000	TOTAL EXPENDITURES: 78,060
FY 92 BUDGET: 120,000	FY 92 EXPENDITURES: 78,060
FY 93 BUDGET: 75,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-11-03
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

OBJECTIVE(S):

Investigate design alternatives of IH-35 for Austin District 14.

IMPLEMENTATION PLAN:

1. Model review and scope refinement.

2. Preliminary analysis of conceptual design alternatives

   (a) review of conceptual design alternatives
   (b) cost effectiveness analysis of conceptual design alternatives

3. Regional travel demand forecasts for alternatives

   (a) estimation of peak hour models and other model preparations
   (b) application of the regional travel demand models for each alternative

4. Operational analysis for selected alternatives

   (a) detailed network development and assignments
   (b) operational considerations of selected alternatives

5. Corridor analysis.

STUDY PROGRESS:

AREA IV

LIST OF RESEARCH STUDIES

September 1, 1992 **D-10 RESEARCH & DEVELOPMENT**

AREA: 4 **STUDY NO.** TTI 187.08 **STATUS:** Active

TITLE: MONITORING OF CEMENT STABILIZED SOIL RETAINING WALLS

TECHNICAL PANEL	**RESEARCHER(S)**
Mark McClelland, Chairman, D-5	Derek Morris

AREA: 4 **STUDY NO.** TECH 500 **STATUS:** Terminating

TITLE: CATHODIC PROTECTION FOR REINFORCED CONCRETE BRIDGE DECK-BIG SPRING

TECHNICAL PANEL	**RESEARCHER(S)**
Bill Burnett, Chairman, DS-24	Phil Nash
Mike Chetty, DS-8	
Dana Honganen, D-5	
Richard Buchen, DS-21	
Joe Canfield, D-9	
Lisa Lukefahr, D-10	

AREA: 4 **STUDY NO.** CTR 576 **STATUS:** Terminating

TITLE: PERFORMANCE OF STEEL DECK FORMS

TECHNICAL PANEL	**RESEARCHER(S)**
Jon Underwood, Chairman, D-10	Karl Frank
Mike Lynch, D-5	
Klaus Alkier, D-10	

AREA: 4 **STUDY NO.** TxDOT 578 **STATUS:** Active

TITLE: CATHODIC PROTECTION OF QUEEN ISABELLA PR 100

TECHNICAL PANEL	**RESEARCHER(S)**
Lloyd Wolf, Chairman, D-5	
Klaus Alkier, D-10	

AREA: 4 **STUDY NO.** CTR 932 **STATUS:** Terminating

TITLE: MONITORING OF CEMENT STABILIZED SOIL RETAINING WALLS

TECHNICAL PANEL	**RESEARCHER(S)**
John Kight, Chairman, DS-15	Richard Furlong

AREA: 4 **STUDY NO.** CTR 1210 **STATUS:** Terminating

TITLE: INFLUENCE OF DEBONDING OF STRANDS ON BEHAVIOR OF COMPOSITE PRESTRESSED CONCRETE BRIDGE GIRDERS

TECHNICAL PANEL	**RESEARCHER(S)**
David Hohmann, Chairman, D-5	Ned Burns

AREA: 4 **STUDY NO.** CTR 1211 **STATUS:** Terminating

TITLE: FRETTING FATIGUE IN EXTERNAL POST-TENSIONED TENDONS

TECHNICAL PANEL	**RESEARCHER(S)**
Brian Merrill, Chairman, D-5	John Breen
	Mike Kreger

AREA: 4 **STUDY NO.** CTR 1234 **STATUS:** Active

TITLE: INSTRUMENTATION OF SEGMENTAL BOX GIRDER BRIDGES AND MULTIPIECE WINGED BOXES

TECHNICAL PANEL	**RESEARCHER(S)**
Pat Bachman, Chairman, D-19	John Breen
	Mike Kreger

AREA: 4 **STUDY NO.** TTI 1259 **STATUS:** Terminating

TITLE: DEVELOPMENT OF ENGINEERING PROCESSES FOR A COMPREHENSIVE BRIDGE MANAGEMENT SYSTEM FOR TEXAS

TECHNICAL PANEL	RESEARCHER(S)
Ralph Banks, Chairman, D-5	George Stukhart
	Ray James

AREA: 4 **STUDY NO.** TTI 1263 **STATUS:** Terminating

TITLE: BRIDGE RAILING AND TREATMENT AT INTERSECTING STREETS AND DRIVES

TECHNICAL PANEL	RESEARCHER(S)
Bob Cochrane, Chairman, D-5	Hayes Ross, Jr.

AREA: 4 **STUDY NO.** CTR 1264 **STATUS:** Active

TITLE: CORROSION PROTECTION FOR POST-TENSION TENDONS AND CABLE STAY SYSTEMS

TECHNICAL PANEL	RESEARCHER(S)
Lisa Powell, Chairman, D-5	John Breen
	Karl Frank

AREA: 4 **STUDY NO.** CTR 1265 **STATUS:** Active

TITLE: STRUCTURAL INTEGRITY OF EPOXY COATED BARS

TECHNICAL PANEL	RESEARCHER(S)
Lloyd Wolf, Chairman, D-5	Jim Jirsa
Robert Sarcinella, D-9	Ramon Carrasquillo
	Harovel Wheat

AREA: 4 **STUDY NO.** TTI/UTEP 1266 **STATUS:** Terminating

TITLE: OVERWEIGHT PERMIT RULES BASED ON BRIDGE STRESSES

TECHNICAL PANEL	RESEARCHER(S)
John Holt, Chairman, D-5	Jim Noel, TTI
Duval Jarl, D-19	Dan Middleton
John Moorman, D-18	Roberto Osegueda, UTEP
	Carlos Ferregut

AREA: 4 **STUDY NO.** CTR 1267 **STATUS:** Terminating

TITLE: HYDRAULIC CHARACTERISTICS OF RECESSED CURB INLETS AND BRIDGE DRAINS

TECHNICAL PANEL	RESEARCHER(S)
Peter Smith, Chairman, D-5	Ed Holley
	George Ward

AREA: 4 **STUDY NO.** TTI 1268 **STATUS:** Terminating

TITLE: NON-DESTRUCTIVE TECHNIQUES FOR DETECTING GROUT DEFECTS IN CABLE STAYS

TECHNICAL PANEL	RESEARCHER(S)
Jeff Cotham, Chairman, D-5	Ray James
	Don Bray

AREA: 4 **STUDY NO.** CTR 1300 **STATUS:** Active

TITLE: EVALUATIONS OF CURRENT CORROSION PROTECTION MEASURES FOR BRIDGE DECKS

TECHNICAL PANEL	RESEARCHER(S)
Duane McPherson, Chairman, D-5	Dave Fowler
Otis Jones, DS-8	Ramon Carrasquillo
Martin Rodin, DS-4	Jim Jirsa
Roger Clements, DS-3	
Tom Bell, DS-16	
Van McElroy, DS-18	
Charles Stone, D-5	
Bill Curra, D-9	

AREA: 4 **STUDY NO.** USGS 1301 **STATUS:** Active

TITLE: UPDATED HYDROLOGIC TECHNIQUES FOR TEXAS

TECHNICAL PANEL	RESEARCHER(S)
Peter Smith, Chairman, D-5	Marshall Jennings
Cheryl Flood, DS-11	
James Grider, DS-1	
Jerry Yates, DS-19	

AREA: 4 **STUDY NO.** CTR 1302 **STATUS:** Active

TITLE: CONNECTIONS BETWEEN STEEL BENT CAPS AND CONCRETE PIERS

TECHNICAL PANEL	RESEARCHER(S)
Mike Lynch, Chairman, D-5	Joe Yura
David McDonnold, D-5	Mike Englehardt
Clifford Clottey, DS-1	Karl Frank

AREA: 4 **STUDY NO.** TECH 1303 **STATUS:** Active

TITLE: WIND LOAD EFFECTS ON SIGNS, LUMINAIRES AND TRAFFIC SIGNAL STRUCTURES

TECHNICAL PANEL	RESEARCHER(S)
Tim Bradberry, Chairman, D-5	Kishor Mehta
Steve Hill, DS-8	Fred Wagner

AREA: 4 **STUDY NO.** CTR 1304 **STATUS:** Active

TITLE: ELASTOMERIC BEARINGS

TECHNICAL PANEL	RESEARCHER(S)
Bryan Wood, Chairman, D-5	Joe Yura
Van McElroy, DS-18	Richard Klingner
Robert Price, D-9	John Tossoulas
Martin Rodin, DS-4	Eric Becker

AREA: 4 **STUDY NO.** CTR 1305 **STATUS:** Active

TITLE: FACTORS AFFECTING DESIGN THICKNESS OF BRIDGE SLABS

TECHNICAL PANEL	RESEARCHER(S)
Carlos Dominguez, Chairman, DS-24	Richard Klingner
Clifford Clottey, DS-1	Ned Burns
Dacio Marin, D-5	

AREA: 4 **STUDY NO.** TTI 1313 **STATUS:** Terminating

TITLE: BRIDGE REPAIR OF EASTBOUND AND WESTBOUND IH-20 STRUCTURES, MIDLAND COUNTY

TECHNICAL PANEL	RESEARCHER(S)
Mark Bloschock, Chairman, D-5	Paul Keating

AREA: 4 **STUDY NO.** TTI 1359 **STATUS:** Active

TITLE: CORROSION EFFECTS OF CEMENT STABILIZED BACKFILL ON GALVANIZED STEEL EARTH REINFORCEMENT

TECHNICAL PANEL	RESEARCHER(S)
Mark McClelland, Chairman, D-5	Derek Morris
Lennie Bobrowski, DS-14	
Carlos Dominguez, DS-24	
Dallas Comuzzie, DS-16	
Michael Ho, DS-12	

LIST OF RESEARCH STUDIES

September 1, 1992 — **D-10 RESEARCH & DEVELOPMENT**

AREA: 4 **STUDY NO.** TTI 1360 **STATUS:** Active

TITLE: REPAIR PROCEDURES FOR FATIGUE DAMAGE IN STEEL HIGHWAY BRIDGES

TECHNICAL PANEL	RESEARCHER(S)
Gregg Freeby, Chairman, D-5	Peter Keating
Jeff Seiders, D-9	
David McDonnold, D-5	
Gene Day, DS-12	

AREA: 4 **STUDY NO.** CTR 1363 **STATUS:** Active

TITLE: ANCHORAGE AND DEVELOPMENT OF GROUPS OF REINFORCING BARS

TECHNICAL PANEL	RESEARCHER(S)
Dacio Marin, Chairman, D-5	Jim Jirsa
Leo Saenz, D-9	

AREA: 4 **STUDY NO.** CTR 1364 **STATUS:** Active

TITLE: DESIGN OF LARGE STRUCTURAL MEMBERS UTILIZING PARTIAL PRESTRESSING

TECHNICAL PANEL	RESEARCHER(S)
Gus Morales-Valentin, Chairman, D-5	Mike Kreger
Dean Van Landuyt, D-5	Ned Burns
	John Breen

AREA: 4 **STUDY NO.** CTR 1370 **STATUS:** Active

TITLE: REPAIR OF IMPACT DAMAGED PRESTRESSED CONCRETE BEAMS

TECHNICAL PANEL	RESEARCHER(S)
Bob Cochrane, Chairman, D-5	Jim Jirsa
Clark Titus, D-18	Dave Fowler
John Chase, DS-2	Ramon Carrasquillo
Martin Rodin, DS-4	
Brian Lawrence, D-9	

AREA: 4 **STUDY NO.** TTI 1945 **STATUS:** Active

TITLE: MAILBOX BRACKET CRASH TESTS

TECHNICAL PANEL	RESEARCHER(S)
Ken Boehme, Chairman, D-18	Hayes Ross, Jr.

AREA: 4 **STUDY NO.** TTI 1949 **STATUS:** Terminating

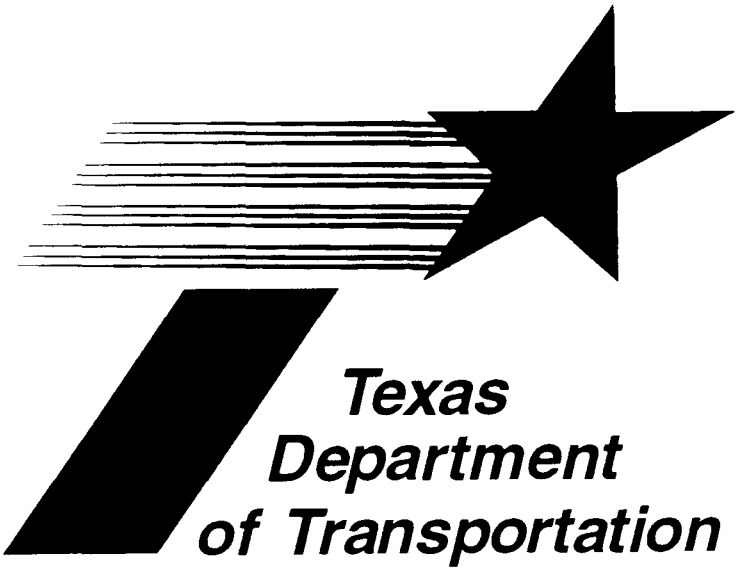
TITLE: REVIEW OF LENGTH-OF-NEED CRITERIA FOR MBGF

TECHNICAL PANEL	RESEARCHER(S)
Mark Marek, Chairman, D-8	Don Ivey

AREA: 4 **STUDY NO.** TTI 1963 **STATUS:** Terminating

TITLE: STRUCTURAL BEHAVIOR OF TRANSFORMER BASES - ENGINEERING EVALUATION

TECHNICAL PANEL	RESEARCHER(S)
Karl Burkett, Chairman, D-18	James Morgan



PROGRESS REPORTS
Fall 1992

STUDY TITLE: MONITORING OF CEMENT STABILIZED SOIL RETAINING WALLS

STUDY NUMBER:	TTI 187 Task 8
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	MORRIS D
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	MARK McCLELLAND, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: CONTINUING	TOTAL EXPENDITURES: 18,180
FY 92 BUDGET: 22,000	FY 92 EXPENDITURES: 18,180
FY 93 BUDGET: 10,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	CONTINUING

PROBLEM STATEMENT:

Experimental retaining walls on the Cypress-Fairbanks bypass of Highway 290 in District 12 were constructed and instrumented by August 31, 1991. It is expected that deformations of the walls and foundations may take place over an extended period of time, at least until full operation of the bypass. Soil stresses and panel anchor forces may also redistribute with time, possibly with the application of working loads.

OBJECTIVE(S):

This study will provide continuity of data and a full record of performance both before and after construction of the experimental design. This design may enable the TxDOT to utilize a low-cost retaining wall. The design should be suitable for general non-specialized use, and should therefore be non-proprietary in nature. The project will verify the performance of the retaining wall, and provide suitable design guidelines.

IMPLEMENTATION PLAN:

As the monitoring progresses, the technical panel chairman will work with the researchers and district personnel to determine if more test walls are necessary, if TxDOT can proceed with inclusion of this wall design in plans or if the wall design should be abandoned. Full implementation may require additional field evaluation of test walls, but the walls would not need the extensive instrumentation used in this test case.

STUDY PROGRESS:

Field measurements on the referenced retaining walls and adjacent conventional reinforced earth walls are in progress. Site access was difficult in December due to flooding. Adjacent piling and bridge decks on the construction project have been completed. Extended measurements of horizontal and vertical inclinometer deflections, earth pressures behind the wall, facing unit anchor forces, and survey settlement data will be collected in the next six months. The first annual report will be submitted by August 31, 1992.

A limited budget one year extension has been approved for FY 93, after which the project is scheduled to terminate.

Approximately a full season's worth of data is now available, and is showing acceptable movements, slowly decreasing with time. Overall behavior is stable. The adjacent frontage road has also been completed, ready for

traffic at the site.

Continuation of the monitoring measurements is planned - in accordance with the comments for next year, the frequency of measurements will be gradually reduced, as the rate of movement is decreasing. Opening up of the bypass will be considered also.

The annual report is estimated to be due as scheduled on or around August 31, 1992, and will report on the data collected and tasks for FY 92.

Some of the site experiences from this project have already been instructive, especially in District 12. On-going evaluation of this design, and of cement stabilization in general, is being carried out in conjunction with the Bridge Division.

STUDY TITLE: CATHODIC PROTECTION FOR REINFORCED CONCRETE BRIDGE DECK - BIG SPRING

STUDY NUMBER:	TECH 500/554
RESEARCH AGENCY:	TEXAS TECH UNIVERSITY
STUDY SUPERVISOR(S):	NASH P
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	BILL BURNETT, DIST 24
STUDY SPONSOR:	FHWA
TOTAL BUDGET: 78,630	TOTAL EXPENDITURES: 13,387
FY 92 BUDGET: 58,972	FY 92 EXPENDITURES: 13,387
FY 93 BUDGET: 19,658	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-03-12
TERMINATION DATE:	T92-11-30

PROBLEM STATEMENT:

The premature deterioration of bridge decks, largely due to the corrosion of steel reinforcement by de-icing salts, has been a major problem facing the highway industry. Cathodic protection has been used for many years to protect underwater and buried metal structures from corrosion. Cathodic protection systems, designed specifically for bridge decks with active corrosion and little delamination, offer an economic, long-term method to provide bridge deck steel protection.

OBJECTIVE(S):

The objective of this study is to evaluate the comparative effectiveness of major cathodic protection systems in controlling the premature corrosion of steel reinforcement in bridge decks.

IMPLEMENTATION PLAN:

TxDOT will be responsible for observing the experimental aspects of the construction and operation of the cathodic protection system. The District will coordinate the performance monitoring and analysis, as well as any required testing and both laboratory and field evaluations. A final report with data summary, conclusions and recommendations will be issued within 3 months of the termination of the field study.

STUDY PROGRESS:

A 12 month contract extension was approved to continue monitoring the performance of the corrosion protection systems.

The project is on schedule with data analysis. Several protection systems failed, or are about to fail, during the monitoring period. Possibly, if proven feasible, a remote monitoring system will be included in the project.

Published reports from this project are:

TECH 500/554-1 "Cathodic Bridge Deck Protection."

STUDY TITLE: PERFORMANCE OF STEEL DECK FORMS

STUDY NUMBER:	CTR 576
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	FRANK KH
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	JON UNDERWOOD, D-10
STUDY SPONSOR:	FHWA
TOTAL BUDGET: 65,000	TOTAL EXPENDITURES: 12,521
FY 92 BUDGET: 65,000	FY 92 EXPENDITURES: 12,521
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-02-06
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The critical construction stage of a composite plate girder bridge occurs during the placement of the concrete deck. The load must be carried by the steel section alone and is limited by either yielding or lateral torsional buckling between the cross frames. Lateral torsional buckling controls the capacity of the girder because the stay in place forms are not allowed to be utilized as a bracing element to stabilize the top compression flange in the positive bending regions of the girder. This buckling has to be resisted by a bigger top flange. The flanges also have to resist tension and compression components from the moment created by the overhanging deck form.

OBJECTIVE(S):

The objectives of this study are to:

1. Investigate the use of the stay in place forms as a tension element to resist the tension component.

2. Study the ability of the stay in place forms to provide lateral torsional stability.

3. Address the influence of the lateral compressive force upon the lower portion of the girder on the lateral torsional buckling behavior of the girder, lateral deflection of the lower flange and the lateral movement of the web.

IMPLEMENTATION PLAN:

The final report will document the results of the experimental and analytical studies. The results will be condensed into design and specification recommendations.

STUDY PROGRESS:

The testing program of closed box and semi-box type forms employed for large girder spacing (spacings greater than 12 feet) have been completed. The open deck forms from two manufacturers have been ordered and one set of forms has arrived. The tests to date indicate that the connection detail employed to connect the form to the girder flange dominates the overall stiffness of the form system. Alternate details are being investigated which allow the full stiffness of the deck to be developed. The strength of

the deck is controlled by the shear and bearing strength of the screw connections of the deck to the connection angle.

The analytical work has progressed significantly. A three dimensional model of a two girder system tied together with a form has been developed. Eigenvalue solutions for the buckling load have been obtained. A super element (substructure) idealization of the form is being implemented to reduce the size of the problem.

STUDY TITLE: CATHODIC PROTECTION OF QUEEN ISABELLA PR 100

STUDY NUMBER:	TxDOT 578		
RESEARCH AGENCY:	TEXAS DEPARTMENT OF TRANSPORTATION		
STUDY SUPERVISOR(S):	N/A		
RESEARCH AREA:	AREA 4		
TxDOT CONTACT:	LLOYD WOLF, D-5		
STUDY SPONSOR:	FHWA		
TOTAL BUDGET:	75,000	TOTAL EXPENDITURES:	23,934
FY 92 BUDGET:	0	FY 92 EXPENDITURES:	0
FY 93 BUDGET:	0	FY 93 EXPENDITURES:	N/A
DATE BEGUN:	87-09-01		
TERMINATION DATE:	T92-12-31		

PROBLEM STATEMENT:

The 12,510 ft. long Queen Isabella Causeway in Cameron County carries Texas Park Road 100 over Laguna Madre between Port Isabel and South Padre Island. It consists of 147 eighty feet prestressed concrete beam spans and one 750 feet continuous plate girder unit. The cast-in-place concrete footings on prestressed concrete piles are subjected to spray and splash induced corrosion.

OBJECTIVE(S):

The objective of this study is to design, install and evaluate four cathodic protection systems on the footings and tie-beams of two interior bents.

IMPLEMENTATION PLAN:

TxDOT will be responsible for designing, installing, operating and evaluating the performance of the cathodic protection systems. A final report regarding all aspects of design, construction and evaluation of the cathodic protection systems will be prepared at the conclusion of the performance period.

STUDY PROGRESS:

As of July 1992 FHWA appropriated a total of $150,000. Recent project cost estimates total $168,000. District agreed to fund the balance. Currently awaiting FHWA confirmation of funding.

STUDY TITLE: MONITORING THE PERFORMANCE OF A BEBO ARCH CULVERT

STUDY NUMBER:	CTR 932		
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH		
STUDY SUPERVISOR(S):	FURLONG RW		
RESEARCH AREA:	AREA 4		
TxDOT CONTACT:	JOHN KIGHT, DIST 15		
STUDY SPONSOR:	TxDOT		
TOTAL BUDGET:	68,095	TOTAL EXPENDITURES:	75,479
FY 92 BUDGET:	12,035	FY 92 EXPENDITURES:	9,379
FY 93 BUDGET:	0	FY 93 EXPENDITURES:	N/A
DATE BEGUN:	87-07-22		
TERMINATION DATE:	T92-08-31		

PROBLEM STATEMENT: N/A

OBJECTIVE(S):

The objective of this study is to monitor the structural performance of the reinforced concrete segmental arch culvert beneath Highway 1604 in Northeast Bexar County from the time of construction until the year 1992.

IMPLEMENTATION PLAN:

Observations and interpretations of performance measurements will be reported at regular intervals during the monitoring periods. A computer program will be prepared to interpret, average and error-balance all readings in order to produce culvert profile data.

STUDY PROGRESS:

STUDY TITLE: INFLUENCE OF DEBONDING OF STRANDS ON BEHAVIOR OF COMPOSITE PRESTRESSED CONCRETE BRIDGE GIRDERS

STUDY NUMBER:	CTR 1210
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	BURNS NH
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	DAVID HOHMANN, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 485,500	TOTAL EXPENDITURES: 474,491
FY 92 BUDGET: 94,700	FY 92 EXPENDITURES: 85,801
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

The use of debonding for some of the pretensioned strands in the construction of standard prestressed concrete bridge girders has been an alternative to draping strands. However, little research has been done to explore the influence of the specified stress limitations on the actual behavior of the girders.

OBJECTIVE(S):

The objective of this research is to develop sound guidelines for the design of pretensioned prestressed concrete bridge girders with debonded strands. Tests will be performed to check the validity of composite action and the appropriate transformed section which might be used in the design of I-shaped and box-shaped girders. The goal of this project is to establish procedures for debonding of straight pretensioned strands which assure the designer that selection of this option, rather than draping some strands, does not reduce ultimate load capacity or ductility of girders designed for highway bridges.

IMPLEMENTATION PLAN:

Results of this study will include greater uniformity in design and the elimination of unconservative design in prestressed concrete girders. Implementation of guidelines growing out of this research has potential economic benefits, while avoiding reduced factors of safety in bridges. Detailed recommendations for implementation will be submitted in the final report of the study.

STUDY PROGRESS:

The past six-month period brought about the successful conclusion of the project. Laboratory testing of the remaining full-sized composite bridge girders was completed, which marks the completion of all currently planned experimental tests. Much of the time and manpower throughout the past period was devoted to completing the final reports for the project.

Currently, the project is on schedule, and no contract changes or modifications are anticipated at this time, as the project is scheduled to terminate on August 31, 1992.

STUDY TITLE: FRETTING FATIGUE IN EXTERNAL POST-TENSIONED TENDONS

STUDY NUMBER:	CTR 1211
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	BREEN J,KREGER M
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	BRIAN MERRILL, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 300,000	TOTAL EXPENDITURES: 264,252
FY 92 BUDGET: 75,000	FY 92 EXPENDITURES: 43,065
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	88-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Texas is currently making substantial use of post-tensioned bridge construction utilizing external tendons. Investigation is needed to develop design and detailing criteria to minimize the risk of fretting fatigue at the deviator regions. The severity of the fretting potential must first be understood and documented. Then, solutions to this problem, such as control of deviator radius, use of flared pipes in the saddles, and the use of liners or other lubricating surfaces at deviators can be explored.

OBJECTIVE(S):

The objectives of this study are to:

1. Examine the potential for fretting fatigue in externally post-tensioned concrete box girder bridges.

2. Explore the effects of various deviator details on the fretting fatigue of external tendons.

3. Explore the effects of various tendon parameters (such as local contact loads, strand coating and type of grouting) on the fretting fatigue of external tendons.

4. Develop design and construction recommendations for external tendon deviators and tendons suitable for inclusion within the general AASHTO fatigue design framework.

IMPLEMENTATION PLAN:

The expected results of this program will provide relatively simple criteria concerning deviator-tendon interaction, which can be immediately implemented by modification of deviator details and, if necessary, by injection of lubricants on critical existing applications. Specific implementation benefits are increased safety and decreased maintenance costs for external tendon applications.

STUDY PROGRESS:

During this reporting period, the second and third series of tests were successfully completed, including the post mortem inspection of the specimens for evidence of fretting fatigue. The ducts and strands did show evidence of fretting with deep abrasions at the contact points and some

brownish corrosion products. Most of the wire fractures did occur within the deviator duct and were caused by strand-to-strand fretting as opposed to strand-to-duct. This is presumably due to the softer base metal of the deviator duct.

Data reduction has been completed and the findings are that even with extreme misalignment of deviator ducts, the fatigue life of a segmental box-girder should not be appreciably decreased by fretting fatigue of the strands at the deviators. Misalignment of the deviator duct will shorten the life but, even so, the fatigue life of an externally post-tensioned box-girder should be comparable to the fatigue life of what might be expected in conventional post-tensioning strand applications when data from Project 465 is compared. In view of this no further variables need investigation with single strand specimens.

Currently, the final design recommendations are being developed and preparation of the final report is underway. Progress is satisfactory and no contract modifications or extensions are anticipated at this time. The study will terminate August 31, 1992.

STUDY TITLE: INSTRUMENTATION OF SEGMENTAL BOX GIRDER BRIDGES AND MULTIPIECE WINGED BOXES

STUDY NUMBER:	CTR 1234
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	BREEN J,KREGER M
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	PAT BACHMAN, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 459,900	TOTAL EXPENDITURES: 269,665
FY 92 BUDGET: 115,000	FY 92 EXPENDITURES: 49,913
FY 93 BUDGET: 120,100	FY 93 EXPENDITURES: N/A
DATE BEGUN:	89-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Texas is currently making use of precast concrete box girder bridges erected using span-by-span methods on urban freeways. A multipiece winged box design using an assemblage of precast pretensioned delta and I-girders has also been considered. In such relatively new forms of construction, additional studies are warranted to develop cost efficient, long-life details and to amplify design criteria.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify major design uncertainties and areas where field verification of assumptions is necessary for segmental box girders, including multipiece winged boxes.

2. Study available instrumentation devices and systems to prepare instrumentation plans for ongoing box girder projects.

3. Instrument selected segments of box girder construction to obtain construction and environmental behavior information.

4. Develop proposed changes to the AASHTO Interim Design and Construction Provisions for Segmental Box Girder Construction.

IMPLEMENTATION PLAN:

The results of this program will improve criteria for predicting post-tension losses and force distribution in segmental bridges as well as improve criteria for long-term stress redistribution and thermal effects. Implementation benefits will be rational design, material economies and improved performance, leading to decreased maintenance costs.

STUDY PROGRESS:

Tasks 1 through 9 of the original work plan have been accomplished as follows:

1. The preliminary literature review is complete.

2. Interviews and discussions have occurred with both designers and contractors who have experience with segmental bridges.

3. The initial instrumentation plan has been developed and detailed instrumentation layouts were formulated for four spans.

4. Special provisions were written and included as part of the contract specifications for Project II-C of the San Antonio Downtown "Y" project.

5. Candidate systems for the instrumentation needs were identified and several systems were chosen for further evaluation in the lab and field.

6. Many instrumentation systems were not investigated in the lab due to their excellent performance in previous experimental programs. Other systems, such as those for tendon forces, deflections and concrete strains required refinements and laboratory testing. The permanent data acquisition system was also tested in the laboratory.

7. The systems for measuring tendon forces, concrete strains, deflections and solar radiation were each field tested in San Antonio. The data acquisition system was also tested in the field.

8. Based on the lab and field investigation, several instrumentation systems have been selected. During the last twelve months all items have been procured and fabricated. All systems have been installed.

9. All four instrumented spans have been precast. Thermocouples and electrical resistance strain gages were cast into many segments. Locating discs were installed in selected segments. All four instrumented spans have been erected.

10. Data is currently being analyzed. After approval of a one year extension, the study progress is as scheduled and no further extensions are anticipated at this time.

STUDY TITLE: DEVELOPMENT OF ENGINEERING PROCESSES FOR A COMPREHENSIVE BRIDGE MANAGEMENT SYSTEM FOR TEXAS

STUDY NUMBER:	TTI 1259
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	STUKHART G,JAMES R
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	RALPH BANKS, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 163,000	TOTAL EXPENDITURES: 148,608
FY 92 BUDGET: 27,000	FY 92 EXPENDITURES: 26,876
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-02-06
TERMINATION DATE:	T92-02-29

PROBLEM STATEMENT:

Bridge management has become one of the most difficult problems facing state highway agencies. Due to lack of adequate funding for bridge replacement and rehabilitation, states must evaluate more cost-effective means of managing their bridge inventories. Texas has a larger bridge inventory than any other state, and a BMS for Texas must work within the existing decentralized management structure. These unique problems for bridge management must be accounted for in a comprehensive BMS.

OBJECTIVE(S):

The objective of this study is to develop and implement, for at least one district, a computerized BMS that meets the needs and resources of TxDOT. The BMS will have the following general characteristics:

1. Ability to utilize existing databases.

2. Ability to utilize existing models of bridge deterioration, user costs and benefits, and costs of management alternatives.

3. Allowance to adjust default variables in the model used.

4. Use of engineering economic analysis to optimally select bridge management alternatives.

5. Consideration of hardware compatibility.

IMPLEMENTATION PLAN:

As a result of this project, TxDOT will possess a comprehensive state-of-the-art bridge management system. The BMS will be fully implemented on the department's mainframe and will be fully validated using data from at least one district. A detailed user's manual will be developed.

STUDY PROGRESS:

The study was scheduled for completion on October 31, 1991. A no-cost time extension was granted for an additional two-month period terminating December 31, 1991. An additional no-cost extension until February 29, 1992, was granted to complete the project's final report.

As of 6 August 1992, the project's final report will be submitted at end of August 1992. The detailed user's manual will be developed and submitted after FHWA comments are addressed, possibly resulting in developing a new study program.

STUDY TITLE: BRIDGE RAILING END TREATMENT
AT INTERSECTING STREETS AND DRIVES

STUDY NUMBER:	TTI 1263
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ROSS HE
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	ROBERT COCHRANE, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 115,000	TOTAL EXPENDITURES: 71,212
FY 92 BUDGET: 60,000	FY 92 EXPENDITURES: 19,148
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Current bridge railing end treatments are inadequate when there is an immediate crossing street or necessary driveway entrance at the bridge end. Methods exist for design speeds of 40 MPH and less using various curved treatments, but an economical method is needed for design speeds of greater than 40 MPH. Impact attenuation systems are not economical in most situations.

OBJECTIVE(S):

The objective of this study is to develop guidelines, through the application of benefit/cost analyses, for the safety treatment of bridge railing ends near intersecting streets or roads and for the safety treatment of other features such as traffic signal supports and utility poles. The study will also develop and crash test new and innovative designs for treating the above hazards if current designs are not adequate and are not cost effective for the intended applications.

The work plan is to be accomplished in the tasks listed below:

1. Meet with TxDOT to discuss alternative designs.
2. Identify impact performance characteristics and costs of candidate treatments.
3. Conduct B/C analyses of alternate treatments.
4. Conceptualize new and/or modified designs.
5. Meet with TxDOT to select most promising design(s).
6. Develop most promising design(s).
7. Construct prototype of most promising design(s).
8. Conduct full-scale crash test program.
9. Update B/C analyses and develop guidelines.
10. Prepare final report.

IMPLEMENTATION PLAN:

The results of this study will be published as guidelines for district design personnel and will be considered for design conference topics.

STUDY PROGRESS:

Tasks 1 through 6 have been completed.

Task 7, construction of prototype of most promising design, is currently underway. Initial crash testing of the first prototype was not successful and the second prototype is being constructed at present.

A request for a contract modification in time and funding is anticipated, as the project is scheduled to terminate August 31, 1992.

STUDY TITLE: CORROSION PROTECTION FOR POST-TENSION TENDONS AND CABLE STAY SYSTEMS

STUDY NUMBER:	CTR 1264
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	BREEN J,FRANK K
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	LISA POWELL, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 635,645	TOTAL EXPENDITURES: 257,463
FY 92 BUDGET: 178,800	FY 92 EXPENDITURES: 84,168
FY 93 BUDGET: 157,600	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

In addition to traditional use in cast-in-situ bridge girders, Texas has used post-tensioning in both internal and external tendon applications in precast segmental bridges and in a wide variety of both cast-in-situ and precast segmental substructure elements which present severe exposure conditioning, ranging from high sulfate soils to salt water exposure. Several studies have documented the need for additional research in segmental construction, anchorage region protection, and improved grouting techniques.

OBJECTIVE(S):

The objectives of this study are to:

1. Examine the potential for corrosion in currently used systems, critically examining segmental jointing techniques, as well as tendon and stay grouting materials and procedures.

2. Recommend improved procedures for use of lubricated tendons, including efficient degreasing methods and friction loss measurements in typical large tendon stressing equipment and ducts.

3. Recommend improved methods for corrosion protection of post-tensioning systems for segmental construction.

4. Recommend improved methods for corrosion protection of cable stay systems.

IMPLEMENTATION PLAN:

Results of this study will be reflected in revised design, detailing and construction procedures for post-tensioned tendons and cable stays. Improving the life of cable stays and reducing initial costs will also result from this study.

STUDY PROGRESS:

A global literature review has been completed and is being continuously updated.

Detailed planning and testing of Task 6 is near completion and planning for Tasks 4 and 5 is underway.

Small-scale corrosion, friction and pull-out tests which were developed to evaluate the performance of oils have been completed. Four oils, which performed the best in the small scale tests, were used in the large-scale friction tests.

The data gathered during the bench tests were reduced and assembled into a matrix priority rating system. This system incorporated several subjective criteria of different relative importance to evaluate and rank the candidate lubricants. The four top-ranked lubricants were then selected for use in the large-scale friction tests.

Significant progress has been made on the large-scale friction tests. The testing for the first monolithic specimen has been completed.

The second specimen is currently under construction and will be studying friction losses in segmental construction. This specimen will be constructed from ten 8-ft. segments with tendon ducts aligned at various tolerance levels. Dimensions and ductwork will be consistent with the first specimen.

Currently, the project is on schedule and no requests for modification or extensions are anticipated at this time.

STUDY TITLE: STRUCTURAL INTEGRITY OF EPOXY COATED BARS

STUDY NUMBER:	CTR 1265
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	JIRSA J,CARRASQUILLO R,WHEAT H
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	LLOYD WOLF, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 347,900	TOTAL EXPENDITURES: 178,361
FY 92 BUDGET: 116,400	FY 92 EXPENDITURES: 69,715
FY 93 BUDGET: 121,700	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Epoxy coatings have been used successfully in many applications to deter deterioration of the reinforcement in concrete structures in highly corrosive environments. However, significant premature deterioration has been noted on fabricated and straight bars as well. The purpose of this study is to evaluate the performance of coated reinforcement under conditions which simulate the corrosive environment and under structural conditions in which coated bars are typically used.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify problems associated with deterioration of coated and uncoated bars in transportation structures in Texas.

2. Sample coated bars issued in the construction of structures in Texas, examining the coating, fabrication, handling, storage and placement procedures in the field.

3. Establish an experimental program to determine the rate at which fabricated reinforcement under load will deteriorate in a corrosive environment.

4. Provide guidance for improving the performance of epoxy coated reinforcement in bridge and other transportation structures.

IMPLEMENTATION PLAN:

The purpose of this project is to indicate the conditions which influence coated reinforcement deterioration so that proper precautions can be taken in design, fabrication, construction and maintenance to maximize the service life of structures in corrosive environments. Guidelines for improved performance (durability) of coated bars will be developed and published.

STUDY PROGRESS:

Three series of tests are currently in progress or completed:

Series 1: Coated fabricated bars with various degrees of damage are being subjected to alternate cycles of immersion and drying to examine the rate of corrosion of damaged bars in air.

Series 2: A group of 68 macro-cell tests is underway to determine rate of corrosion of bars embedded in concrete.

Series 3: Thirty-four beam exposure tests are underway in which the following conditions are being studied.

1. Level of cracking - none, cracking to serviceability limits with the load removed (crack closed), and with load maintained (crack open).

2. Amount of damage and repair to coating in the exposure zone of the beams.

3. Coating damage to ties only, or to longitudinal steel only, or to both.

Work on Series 1 tests is nearly completed and a report is being prepared. Immersion cycles are continuing. Series 2 and 3 tests will continue to be exposed and monitored.

STUDY TITLE: OVERWEIGHT PERMIT RULES BASED ON BRIDGE STRESSES

STUDY NUMBER:	TTI/UTEP 1266
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE UNIVERSITY OF TEXAS AT EL PASO
STUDY SUPERVISOR(S):	NOEL J,MIDDLETON D,OSEGUEDA RA,FERREGUT CM
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	JOHN HOLT, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 197,000	TOTAL EXPENDITURES: 130,360
FY 92 BUDGET: 70,000	FY 92 EXPENDITURES: 66,300
FY 93 BUDGET: 48,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Currently, permits for nondivisible overweight loads are issued which exceed statutory limits. At times super-heavy loads with short wheel bases, such as mobile cranes, may be compromising certain structures. In addition, each overweight permit request involves costly and time-consuming scrutiny by the Division of Bridges and Structures.

OBJECTIVE(S):

The primary objective is to define a bridge permit formula that will assure that permitted overweight vehicles will not cause operating stress levels to be exceeded in bridges where the design loading is known. While this objective includes all design loading, the emphasis of the study is to be given to H15 bridges common on Texas roads.

Specific parameters to be addressed when defining the maximum loading envelope must include:

1. Maximum expected speed (how much allowance should be made for impact); whether or not the permit vehicle will be escorted (will the permit vehicle always be the only vehicle on the bridge).

2. Number of wheels per axle, or a maximum load per inch of tread width.

3. Total gauge.

Of particular interest to the study are some short, continuous slab bridges built in the late fifties and sixties that have very low dead-to-live load ratios.

IMPLEMENTATION PLAN:

Implementation of the research will save time and cost in issuing permits, especially in performing analyses to assure that specified permit loads will not damage bridges.

STUDY PROGRESS:

Previously, weight restrictions had been determined only as a function of the wheelbase of a vehicle. This has been extended for simply supported bridges to include the span length of the bridge. By using the vehicle

wheelbase and bridge span length more liberal weight restrictions may be determined.

Further analysis has been done on continuous slab bridges. A finite element analysis software package, SAFE, has been used to better approximate the effective width and to study the effects of lateral axle position. Several permitted overloads have also been analyzed. These loads produced severe slab overstresses at the first interior supports of H15 bridges.

Also, during the reporting period the UTEP group had completed the demonstration program for all highways and bridges of District 12.

STUDY TITLE: HYDRAULIC CHARACTERISTICS OF RECESSED CURB INLETS AND BRIDGE DRAINS

STUDY NUMBER:	CTR 1267
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	HOLLEY E,WARD G
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	PETER SMITH, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 193,425	TOTAL EXPENDITURES: 152,923
FY 92 BUDGET: 104,950	FY 92 EXPENDITURES: 64,356
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Three types of drainage facilities are presently being designed by TxDOT engineers without adequate hydraulic data: recessed curb inlets, bridge deck drains, and trough and other similar underdrains for finger joints on bridge decks. The recessed curb inlets should be tested for all possible flow conditions, especially to ensure that the higher velocity flow enters the storm sewer. The design of bridge deck drains has the potential of underdesigned drains, leaving excess water on the deck. The underdrains for finger joints have sometimes failed hydraulically as evidenced by accumulated sediment.

OBJECTIVE(S):

The objectives of this study are to:

1. Conduct full-scale laboratory experiments and field tests to determine the hydraulic characteristics of the three types of facilities.

2. Develop design criteria and procedures based upon the testing.

3. Evaluate designs of installed bridge deck drains and finger joint drains.

4. Prepare final reports detailing experiments and design methods.

5. Prepare a separate report for the evaluation of the finger-joint drains.

IMPLEMENTATION PLAN:

The results of the research will enable the Division of Bridges and Structures to develop formal procedures for design and analysis of the three facilities. These formal procedures will be appended to the Hydraulic Manual. Each district will be informed by memorandum of the new procedures, and the curriculum for Level II and III hydraulic design seminars will be revised to include the new information. Video tapes of the testing models and in-place inlets under rainfall conditions will be helpful in demonstrating the new procedures.

STUDY PROGRESS:

All project objectives will have been achieved by the end of August 1992. The laboratory experiments previously described for recessed curb inlets have been extended to include testing with linear transition sections instead of the reverse curve transitions. Different series of tests have also been done with a different slope between the curb line and the inlet opening and with a different hydraulic roughness on the pavement surface. Eight field tests have been done to verify the laboratory results.

Tests have been conducted with three bridge deck drains. The testing program addressed not only the relationship between the water depth in the gutter and the flow captured by the drains, but also whether the inlet opening or the conduit below the drain exerted the controlling influence on the flow captured by the drain.

A survey has been made of FHWA and state personnel to obtain information on design of underdrains for finger joints and on operating experience with the underdrains. Based on this information, recommendations are being formulated relative to these underdrains.

STUDY TITLE: NON-DESTRUCTIVE TECHNIQUES FOR DETECTING GROUT DEFECTS IN CABLE STAYS

STUDY NUMBER:	TTI 1268
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	JAMES R,BRAY D
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	JEFF COTHAM, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 285,600	TOTAL EXPENDITURES: 121,050
FY 92 BUDGET: 90,000	FY 92 EXPENDITURES: 54,549
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	90-09-01
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Fatigue specimens for the grouted cable stays of the Baytown bridge have exhibited a significantly reduced fatigue life, possibly caused by fretting or stress corrosion. Inspection techniques which will allow detection of grouting defects, including bleed water pockets, and corrosion would be beneficial in assuring the integrity of the cable stays. Present techniques are designed for detecting broken strands only.

OBJECTIVE(S):

The objective of the study is to evaluate the most promising NDE technologies for detecting voids and other defects in the grout.

The work plan is divided into the following tasks:

1. Literature survey.

2. Identification of promising NDE methods, including ultrasonics and radiography technology.

3. Evaluation of promising NDE methods.

4. Laboratory evaluation of selection methods.

5. Development of prototype hardware.

6. Field testing of prototype(s).

7. Preparation of final report.

IMPLEMENTATION PLAN:

Once the research has determined the most effective means of nondestructive detection of flaws in cable stays and has constructed a prototype instrument capable of efficiently accomplishing that task in the field, the department will eventually employ the device for scheduled maintenance. There is an anticipated need for training aids, such as video tape and field manual operational instructions.

STUDY PROGRESS:

Work on Tasks 1, 2, 3, and 4 has been completed.

Work on Task 5, "Development of Prototype Hardware," will continue throughout the reporting period. A prototype ultrasonic probe assembly is currently being developed. The prototype system will employ two rolling contact transducers operating in through transmission mode and inspecting in the circumferential direction as they roll along the axis of the cable. Performance specifications for radiographic CT inspection are also being developed. This includes determination of a suitable source, resolution requirements, scan times, and data storage requirements.

Upon completion of the prototype ultrasonic unit, its operation will be demonstrated in the lab on actual cable-stay samples. In addition, field testing of the device on the recently completed Neches River bridge is planned under Task 6. Development of this prototype device will result in design specifications for a fully operational probe inspection system.

Field inspection of several cables on the Neches River bridge using a portable CT inspection unit is also planned under Task 6 during this reporting period. International Digital Modeling Corporation, based in Austin, Texas, is being contracted to perform the inspection. This inspection should provide much needed information regarding the size and distribution of defects in the cables.

STUDY TITLE: EVALUATIONS OF CURRENT CORROSION PROTECTION MEASURES FOR BRIDGE DECKS

STUDY NUMBER:	CTR 1300
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	FOWLER DW,CARRASQUILLO R,JIRSA J
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	DUANE McPHERSON, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 412,000	TOTAL EXPENDITURES: 99,877
FY 92 BUDGET: 147,000	FY 92 EXPENDITURES: 99,877
FY 93 BUDGET: 140,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Recent investigations and studies indicate that some current methods of corrosion protection can be ineffective and even harmful. For example, asphalt overlays, when cracked or damaged, may act as a sponge - trapping moisture and chemicals, or the practice of epoxy coating only the top mat of reinforcing steel may set up a battery effect, thus accelerating the corrosion process in some cases. Likewise, decreasing the volume and chemical strength of deicing salts at times proved ineffective.

OBJECTIVE(S):

The objectives of this study are to:

1. Identify methods for providing corrosion protection of reinforcing steel in bridges, including decks and support structure.

2. Evaluate current TxDOT methods through site visits, field surveys, and evaluations of material properties.

3. Perform an accelerated laboratory exposure test program to investigate the most important material properties, design parameters, and corrosion protection methods.

4. Conduct a field test program on existing bridges to evaluate the different corrosion protection measures.

5. Prepare implementation guidelines and recommendations which will include design provisions, materials specifications, and construction procedures to ensure adequate corrosion protection.

6. Conduct seminars and training sessions to familiarize TxDOT personnel on the proper materials and procedures to be used.

IMPLEMENTATION PLAN:

The results of this project are expected to benefit the department as to which of the current strategies, if any, are ineffective or potentially harmful, and to identify the optimal corrosion protection strategies for bridge structures.

Implementation will be pursued by notification of District/resident engineers, bridge maintenance personnel, Division of Bridges and Structures

design, construction, and BRINSAP sections of the recommendation to specifications, design, construction, and maintenance procedures. As part of the research agreement, the researcher will provide technology transfer to the department in the form of manuals, visual aids, and formal training programs.

STUDY PROGRESS:

A comprehensive work plan has been developed consisting of the following tasks:

Task 1: Literature Search
Task 2: Survey of Current Practices
Task 3: Field Survey of Corrosion Activity
Task 4: Evaluation of Materials Properties in Existing Bridges
Task 5: Accelerated Laboratory Exposure Test Program
Task 6: Field Testing Program Using Identified Methods - New Bridge Construction
Task 7: Field Testing Program
Task 8: Guidelines and Technology Transfer

Work to date has progressed at or slightly ahead of schedule as follows:

Task 1: The literature search is essentially completed, with new information being added as it is published or becomes otherwise available.

Task 2: A questionnaire was developed through the Technical Panel Chairman and was distributed to all TxDOT districts. The responses are being summarized and catalogued at this time.

Task 3: Seven specific bridges representative of different corrosion protection systems have been selected for investigation this summer. Additional sites will be visited as they become available and as the preliminary results direct further study. Test methods are also being evaluated and refined at a test bridge in Austin.

Task 4: Material evaluations will be conducted concurrently with the Field Survey of Corrosion Acitivity (Task 3).

Task 5: Preliminary planning and material selection for the accelerated laboratory testing program has been performed, with further refinements based on the preliminary results of Tasks 3 and 4 anticipated.

Task 6: The field testing program using new construction has begun in an advisory capacity. Preliminary specifications and installation requirements for calcium nitrite corrosion inhibiting admixtures, as well as silane and siloxane sealers, have been developed and used in pre-existing district projects. These bridges will be built with the necessary connections for the non-destructive testing equipment used in this project, facilitating long-term monitoring of the installations.

STUDY TITLE: UPDATED HYDROLOGIC TECHNIQUES FOR TEXAS

STUDY NUMBER:	USGS 1301
RESEARCH AGENCY:	U.S. GEOLOGICAL SURVEY
STUDY SUPERVISOR(S):	JENNINGS ME
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	PETER SMITH, D-5
STUDY SPONSOR:	FHWA, TxDOT, USGS AND OTHERS
TOTAL BUDGET: 945,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 240,000	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 305,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-10-31
TERMINATION DATE:	T96-08-31

PROBLEM STATEMENT:

The TxDOT/USGS Regional Regression Equations are currently utilized to size approximately 90% of culvert and bridge structures on the highway system. It is becoming increasingly apparent that the order of error in runoff estimates can be 300% or even higher which could result (and has) in either severely undersized or uneconomically oversized structures. The regression equations utilized stream gage records collected up to 1974. Significant new data are available for retrieval and manipulation. In addition, several large areas of Texas, especially the Panhandle, are undefined due to a lack of recording stations.

OBJECTIVE(S):

The objectives of this study are to:

1. Collect flood-peak data at gages that can be used to define the regional flood characteristics for the two undefined regions in the state.

2. Update USGS files of available flood data and related basin and climatic characteristics, and perform flood-peak and flood-volume frequency analyses at all qualified gages using best available statistical techniques. Use the same data files to update general flood-peak skew values statewide.

3. Use the flood-peak and flood-volume frequency data along with the most pertinent basin and climatic characteristics in order to determine flood-peak and flood-volume frequency prediction equations for regions in the state.

4. Perform a statewide analysis to regionalize average flood-hydrograph ordinates, and prepare predictive relations for basin lag time.

IMPLEMENTATION PLAN:

The results of the research will immediately affect current department procedures in that the old regression equations will be obsolete and the new methodologies will be invoked. The Division of Bridges and Structures Hydraulics Engineer will test the results of the study by applying the new methodologies to several sites throughout Texas, with cooperation of personnel from several Districts. With favorable results, the Division of Bridges and Structures Hydraulic Manual will be updated to reflect the new

procedures. The new procedures would also be incorporated into Levels II and III training courses.

STUDY PROGRESS:

The literature search was completed in November 1991. A computer file, containing the abstract of each of the several hundred identified reports was created.

The workshop was conducted and suggestions for specific approaches and tasks were documented.

Flood records were selected for study and comparison to existing data.

Skew coefficients were calculated for most long-term stream flow gaging stations in Texas. A preliminary study comparing these coefficients to those currently in use was prepared and given as an oral presentation and published abstract at the semi-annual meeting of the Texas Chapter of the American Water Resources Association.

STUDY TITLE: CONNECTIONS BETWEEN STEEL BENT CAPS AND CONCRETE PIERS

STUDY NUMBER:	CTR 1302
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	YURA J,ENGELHARDT M,FRANK K
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	MICHAEL LYNCH, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 348,050	TOTAL EXPENDITURES: 68,624
FY 92 BUDGET: 126,980	FY 92 EXPENDITURES: 68,624
FY 93 BUDGET: 133,500	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

On structures within congested interchanges, a steel bent cap is frequently used with a small reinforced concrete pier to support steel bridge girders. The structural analysis of the bridge system assumes that the rotation of the continuous bridge girder at the piers does not induce bending in the concrete pier to minimize its size. In the transverse direction, a moment connection must be developed between the steel bent cap and the pier to handle unbalanced lane loading. Current conflicting restraint requirements in the two perpendicular directions cause difficult structural detailing problems. Fatigue problems can develop when the lane loading is sufficient to produce a tension on the anchorage system. Current connection details utilize an expensive disc bearing available from sole source suppliers.

OBJECTIVE(S):

The objectives of this study are to:

1. Determine the stiffness, the fatigue strength, and the ultimate strength of the two typical steel bent cap-concrete pier connections.

2. Develop at least two cost-effective alternative designs which provide at least the same level of performance as current designs. Any significant performance deficiencies in current designs discovered during the experiments will need to be addressed also. Fatigue strength, transverse and longitudinal stiffness, and ultimate strength at the connection will be considered. The use of nonproprietary and multisource hardware will be emphasized.

IMPLEMENTATION PLAN:

The results of this research will provide an improved, simpler, less expensive connection for the above described situations. Benefits of the new design will aid in design and provide increased safety, and cost savings.

STUDY PROGRESS:

Background and current design reviews have been completed. Testing of existing connection details is currently underway. During this period the prototype design was completed. Full size test girders were designed, fabricated and tested in the laboratory. By the end of August, the existing detail tests should be completed. Separate failure tests will be conducted on the compression side of the concrete pier on some smaller size specimens. In the full-size test, the failure is expected to be in the anchor bolts on the tension side.

STUDY TITLE: WIND LOAD EFFECTS ON SIGNS, LUMINAIRES, AND TRAFFIC SIGNAL STRUCTURES

STUDY NUMBER:	TECH 1303
RESEARCH AGENCY:	TEXAS TECH UNIVERSITY
STUDY SUPERVISOR(S):	MEHTA KC,WAGNER F
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	TIM BRADBERRY, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 280,000	TOTAL EXPENDITURES: 19,182
FY 92 BUDGET: 55,789	FY 92 EXPENDITURES: 19,182
FY 93 BUDGET: 124,947	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Current design procedures for determining wind load effects on highway signs, luminaires and traffic signal installations are based for the most part on outdated information and guidelines. In recent times, some traffic signal mast arms have failed, or had to be taken down, because of excessive vibrations when excited at or near resonance by light and steady winds.

OBJECTIVE(S):

The objectives of this study are to:

1. Update and revise wind load criteria which includes revising design wind speeds for Texas and incorporating current state-of-knowledge.

2. Develop procedures to predict and mitigate vibrations of traffic signal structures that can cause fatigue failures. This requires understanding the phenomena through field and laboratory studies and development of strategies to reduce vibrations. This could involve stiffening the structures, modifying the shape of traffic signal heads, or increasing the damping of structures.

IMPLEMENTATION PLAN:

Updated wind loading data for highway sign, luminaire and traffic signal structures will be included in revised design standards. This will accomplish further standardization of designs, reducing the volume of shop drawing checks by design engineers. Material savings may be experienced from lower design wind pressures.

Training courses, design guides or a video which describes the vibration problem, with footage of real cases, and which demonstrates vibration mitigation strategies for retrofitting problematic traffic signal structures would be useful for communicating the study findings to district personnel.

STUDY PROGRESS:

Literature search has been completed.

Wind speed data analysis is currently underway.

Results of the Texas wind data analysis are being compared with wind

analysis being performed at Colorado State University for the entire United States. Any differences will be resolved so the Texas wind speeds will be consistent with the rest of the U.S. Results of the CSU study will be used to develop a new 50-year wind speed map for the 1995 revsion of ASCE 7.

Full-scale field experiments will be designed based on results from the water table and tow tank tests. The goal of the field experiments is to first create the vibration problem and then show how the vibrations can be mitigated or eliminated.

The complete experimental plan will be submitted to the technical panel chairman in August for review and approval. Scale-model water table experiments will be conducted in August. Other testing will begin in September 1992.

An outline of the specifications update has been submitted to the project coordinator for comment. A draft of the specification update will be ready by August 31, 1992.

STUDY TITLE: ELASTOMERIC BEARINGS

STUDY NUMBER:	CTR 1304
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	YURA J,KLINGNER R,TASSOULAS J,BECKER E
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	BRYAN WOOD, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 433,800	TOTAL EXPENDITURES: 56,364
FY 92 BUDGET: 118,800	FY 92 EXPENDITURES: 56,364
FY 93 BUDGET: 161,400	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

One recommendation of the NCHRP Project 10-20 was to conduct a field survey of existing bearing installations to document actual performance. The other recommendations from the research precipitated changes in AASHTO design specifications which disallow bearing designs for prestressed concrete beams. Strict compliance with the revised specifications will be expensive.

This research will study bridge movement, which may be complex due to the interaction of camber, temperature change, grade, and substructure flexibility. There is a need to measure and monitor the movement of selected prestressed concrete beam units to realistically determine the design requirements for elastomeric bearings.

OBJECTIVE(S):

The objectives of this study are to:

1. Recommend practical design procedures for elastomeric bearings used by TxDOT. The research will concentrate on the effect of beam end rotations on bearing design.

2. Recommend practical inspection guidelines and procedures for future and existing elastomeric designs.

IMPLEMENTATION PLAN:

Benefits of the research should include the following:

1. Evaluation of elastomeric bearings in existing bridges for the possible need for replacement.

2. Improved and more efficient design with probable cost savings from less expensive bearings (as compared to AASHTO's new design) and shorter design time.

3. Improved inspection procedures.

STUDY PROGRESS:

The Slaughter Creek overpass bridge has been monitored for bridge and bearing movement. Five of the six pads showed significant movement during

the period February-June. In June this bridge was lifted, after a failed attempt in May, and the pads repositioned. One pad moved almost two inches in just four days. Another bridge in Amarillo will be instrumented by mid-July. Task 1 will be completed by the end of the summer. Bridges with bearing problems were visited in Beaumont, Paris and Amarillo. Bearings from these bridges have been procured.

Available literature, dealing with analytical work and finite element analysis on elastomeric bearings, has been reviewed and a detailed procedure has been implemented on SiliconGraphics workstations. This program allows for modelling of laminated, flat and tapered bearings in two, as well as three, dimensions. In addition, frictional contact of the bearing-pier and bearing-beam interfaces is accounted for. Graphical output of deformed configurations and stress distributions facilitates interpretation of the analytical results.

A review has been conducted of constitutive equations available for the description of rubber behavior. In the absence of specific information, "reasonably typical" rubber properties were assumed. With a friction coefficient as low as 0.1, no appreciable slip accumulation was noted after several cycles of large beam movement.

STUDY TITLE: FACTORS AFFECTING DESIGN THICKNESS OF BRIDGE SLABS

STUDY NUMBER:	CTR 1305
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	KLINGNER R,BURNS N
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	CARLOS DOMINGUEZ, DIST 24
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 261,837	TOTAL EXPENDITURES: 80,766
FY 92 BUDGET: 109,819	FY 92 EXPENDITURES: 80,766
FY 93 BUDGET: 87,527	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

1. The effects of fatigue deterioration on the punching shear resistance of bridge slabs need to be investigated.

2. Flexural strength of bridge decks is significantly increased by compressive membrane action. However, that compressive membrane action is much less effective when slabs are loaded by a series of closely spaced heavy axles. Multiple heavy axles at 4-ft. spacing may create a yield line leading to potential fatigue failure in the reinforcement.

OBJECTIVE(S):

Major objectives are to recommend guidelines for specifying the required thickness of bridge deck slabs as a function of traffic characteristics. This will be pursued as follows:

1. Review design procedures, standard loading patterns, and effects of arching action.

2. Review nonstandard loadings, estimate corresponding flexural stress ranges for standard and nonstandard loadings.

3. Establish S-N fatigue curve for punching shear, pulsating load at constant location, no arching action.

4. Same as No. 3, except with arching action.

5. Establish S-N fatigue curve for punching shear, constant rolling load at varying location, no arching action.

6. Same as No. 5, except with arching action.

7. Determine effects of rolling versus fixed load application and of arching action.

IMPLEMENTATION PLAN:

The results and findings of this research could modify the design procedure currently used for bridge decks.

STUDY PROGRESS:

Design procedures of bridge decks by AASHTO and Ontario have been reviewed in general terms. Using microcomputers, preliminary analytical models have been developed, capable of reflecting the effects of bridge deck cracking and arching action. Work continues on specimen design for S-N fatigue tests, as shown in Item 3 of research objectives. Items 1 and 2 have been completed.

STUDY TITLE: BRIDGE REPAIR OF EASTBOUND AND WESTBOUND IH 20 STRUCTURES, MIDLAND COUNTY

STUDY NUMBER:	TTI 1313
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	KEATING P
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	MARK BLOSCHOCK, D-5
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 14,856	TOTAL EXPENDITURES: 14,328
FY 92 BUDGET: 5,318	FY 92 EXPENDITURES: 4,786
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-07-10
TERMINATION DATE:	T92-03-31

PROBLEM STATEMENT:

Distortion-induced fatigue cracking is due to the interaction between longitudinal and transverse members resulting in stresses not anticipated in the initial design. Generally, the effects of these stresses are seen at connections where a web gap exists due to the reluctance to weld to the tension flange. Types of bridges that see this type of fatigue cracking include highly skewed bridges and continuous span bridges. Typical repair or retrofit of distortion-induced fatigue cracking has not always been successful. Fatigue cracks usually reinitiate in welded retrofits. Bolted retrofits must be properly designed and implemented in order to prevent further damage. Without a clear understanding of the problem of distortion-induced fatigue, a successful solution is rarely achieved.

OBJECTIVE(S):

The objectives of this study are to:

1. Assist the Division of Bridges and Structures with a retrofit procedure urgently needed to repair the subject structures.

2. Establish guidelines for future retrofit of similar structures. Division of Bridges and Structures inspection engineers have recorded similar distress on structures of this type and geometry.

3. Establish additional guidelines for the design of a new diaphragm stiffener detail that would eliminate this design flaw in future structures.

IMPLEMENTATION PLAN:

The results of this study will provide competent recommendations to the Odessa District for the repair of this structure. Future monitoring of the performance, combined with sound engineering judgment, will result in an acceptable repair procedure for this frequently occurring problem.

STUDY PROGRESS:

The initial test plan for the as-built bridge has been developed and was performed July 10-11, 1991. All field measurement data were reduced and analyzed.

The finite element model of the bridge was developed and calibrated with the measured response of the bridge. Various diaphragm removal schemes were studied with the finite element model and compared with the as-built condition. This included removal of approximately half of the diaphragms, removal of all diaphragms, and a staggered diaphragm pattern. The finite element analysis was more extensive than originally proposed, since their removal is a preferred repair procedure.

Based on the analysis and observed behavior of the bridge, various repair options have been developed for consideration by TxDOT.

The study, including all proposed tasks, was completed prior to the termination date for the project. No significant problems were encountered. No extension of the study is required.

The results of the study indicated that a partial removal of diaphragms results in a structural behavior similar to the as-built condition. Remaining diaphragms required replacement with a new design. Diaphragm connection plate ends, where diaphragms remain, require rigid attachment to the flange.

Repair procedures developed from this study are tentatively scheduled for completion in September 1992. It has been recommended that, during the repairs, additional stress measurements be taken. It is proposed that bottom flange stresses be measured when all diaphragms are removed from one bridge structure prior to their replacement with the new diaphragms. This will allow for a more accurate understanding of the behavior of the bridge without diaphragms. Removing all diaphragms from the bridge respresents the most ideal and least costly repair procedure. This work can be performed under a new project, Study No. 1360, "Repair Procedures for Fatigue Damage in Steel Highway Bridges."

STUDY TITLE: CORROSION EFFECTS OF CEMENT STABILIZED BACKFILL ON GALVANIZED STEEL EARTH REINFORCEMENTS

STUDY NUMBER:	TTI 1359
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	MORRIS D
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	MARK McCLELLAND, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 213,921	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 118,921	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

Cement stabilization of select backfill for mechanically stabilized earth type retaining walls has been used both as an aid to construction and to reduce the reinforcement lengths when necessary. In the past it has been assumed that the addition of cement does not adversely affect galvanized steel reinforcements in these walls. However, recently excavated reinforcing strips showed signs of advanced corrosion, including total loss of galvanization.

OBJECTIVE(S):

The proposed research will investigate the effects of cement stabilization on galvanized steel. Apparently the high pH generated by the cement can remove the zinc coating, but not protect the steel as would be the case for concrete. The research will investigate alternative stabilization rates and different coating systems. Most research will be performed in the laboratory, but some field installations might also be monitored.

IMPLEMENTATION PLAN:

Implementation will involve all walls built with cement stabilized backfill. The potential benefit to the Department is immense since large projects, such as the entire North Central Expressway project in Dallas, are currently being built entirely with cement stabilized backfill.

STUDY PROGRESS:

STUDY TITLE: REPAIR PROCEDURES FOR FATIGUE DAMAGE IN STEEL HIGHWAY BRIDGES

STUDY NUMBER:	TTI 1360
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	KEATING PB
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	GREGG FREEBY, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 196,733	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 101,733	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T94-08-31

PROBLEM STATEMENT:

The detection and repair of fatigue damaged connection details in steel bridges will become increasingly important as the state highway system continues to age and accumulate load cycles. Details likely to experience fatigue cracking include: coverplate terminations, lateral gusset plates welded to tension flanges, and diaphragm connection plates. While many techniques are available to repair fatigue damage, not all are applicable to steel highway bridge details. Efforts to retrofit fatigue damage have not always been successful. Fatigue cracks often reinitiate in welded retrofits. In order for a repair procedure to be successful, the source of the cracking must be determined, the extent of the cracking identified, and a retrofit scheme developed that is consistent with the detail type and load condition.

OBJECTIVE(S):

Develop guidelines for identification and repair of fatigue damage in steel highway bridges. A review of the connection details that have typically been used in steel highway bridges throughout the state will be conducted. Details in use that are traditionally susceptible to fatigue cracking will be catalogued. Suitable crack detection methods for each connection detail will be identified. Repair procedures will be developed for various connection details and bridge configurations. Field testing of various repair schemes will be included to verify their adequacy.

IMPLEMENTATION PLAN:

The results of the study will provide a rational and efficient means of detecting and repairing fatigue damage in steel highway bridges. Comprehensive and consistent repair procedures can be implemented on a statewide basis rather than the current case by case basis. This will result in a more efficient use of available resources, while maintaining the integrity and safety of the highway system.

STUDY PROGRESS:

STUDY TITLE: ANCHORAGE AND DEVELOPMENT OF GROUPS OF REINFORCEMENT BARS

STUDY NUMBER:	CTR 1363
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	JIRSA JO
RESEARCH AREA:	AREA 4
TECHNICAL COORDINATOR:	DACIO MARIN, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 279,783	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 84,783	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

A great deal of work has been done on bar anchorage and development. One area that has not been studied in detail is the capacity of bar groups, such as at the base of columns anchored into footings with several layers of multiple bars for the main reinforcement in beams or bent caps. Recently proposed changes for anchorage and development in TxDOT design procedures for bridge structures, and in ACI 318 procedures for building structures, are significant. However, none of the work sponsored by the Department included bar groups where the entire group (several layers in a beam or a circular or square pattern in a column) may be stressed to high uniform stresses and may fail as a group. There appears to be no information in the literature regarding group effects.

OBJECTIVE(S):

It is proposed that bond characteristics of bar groups be studied by testing beam specimens with several layers of closely spaced bars, meeting minimum requirements of TxDOT and columns or piers framing into drilled shafts or footings where an entire group may fail as a unit if lateral forces are applied to the pier. Several bar sizes, bar spacings, concrete strengths, and confinement conditions will be studied.

IMPLEMENTATION PLAN:

The benefit to TxDOT is an improved understanding of the mechanics of stress transfer from steel to concrete in complex structural configurations. The results can be used to modify existing design procedures to provide consistent margins against failure. Construction operations can be adjusted to alleviate potential congestion problems in reinforcement cages.

STUDY PROGRESS:

STUDY TITLE: DESIGN OF LARGE STRUCTURAL MEMBERS UTILIZING PARTIAL PRESTRESSING

STUDY NUMBER:	CTR 1364
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	KREGER MG
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	GUSTAVO MORALES-VALENTIN, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 385,000	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 140,000	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

Construction of new elevated roadways over the existing highway system in Texas has necessitated the use of large structural members, such as the large straddle bents and large cantilever bents being used in San Antonio. The large size and proportions of these members has led to difficulties during design. To satisfy both strength and serviceability requirements, and because current design specifications compartmentalize the design of "structural concrete" by separating prestressed concrete member design from reinforced concrete member design, large structural members are often designed to satisfy both the reinforced and prestressed concrete specifications, resulting in over-designed, extremely congested reinforcing cages. Application of what many researchers currently refer to as "partial prestressing," or a combination of prestressed and non-prestressed reinforcement, could alleviate this design problem. By exploiting the attributes of reinforced and prestressed concrete design, it is likely that much more efficient structural members with greatly enhanced durability (and reduced maintenance) will be produced.

OBJECTIVE(S):

The objective of this study is to develop a better understanding of the influence that post-tensioning has on non-prestressed reinforcement in large structural concrete members.

IMPLEMENTATION PLAN:

The results of this study will give the needed background to develop improved design specifications and detailing practice to cover this increasingly frequent design problem.

It is envisioned that this study will consider several intermediate combinations to facilitate a better understanding of structural concrete with both types of reinforcement working together.

STUDY PROGRESS:

STUDY TITLE: REPAIR OF IMPACT DAMAGED PRESTRESSED CONCRETE BEAMS

STUDY NUMBER:	CTR 1370
RESEARCH AGENCY:	CENTER FOR TRANSPORTATION RESEARCH
STUDY SUPERVISOR(S):	JIRSA JO, FOWLER DW,CARRASQUILLO R
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	ROBERT COCHRANE, D-5
STUDY SPONSOR:	FHWA & TxDOT
TOTAL BUDGET: 298,800	TOTAL EXPENDITURES: 0
FY 92 BUDGET: 0	FY 92 EXPENDITURES: 0
FY 93 BUDGET: 118,800	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-09-01
TERMINATION DATE:	T95-08-31

PROBLEM STATEMENT:

Several districts have experienced prestressed concrete beams being struck by oversized loads. On numerous occasions, the strands are not frayed or severed but lose the pretension force due to loss of the compression section.

OBJECTIVE(S):

Develop a procedure to determine amount of pretensioning loss in a beam from impact. Develop a method to retension strands and restore load carrying ability of damaged beams.

IMPLEMENTATION PLAN:

Significant savings in time and cost can be realized when beam replacement can be avoided.

STUDY PROGRESS:

STUDY TITLE: MAILBOX BRACKET CRASH TESTS

STUDY NUMBER:	TTI 1945
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	ROSS HE
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	KEN BOEHME, D-5
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 123,000	TOTAL EXPENDITURES:
FY 92 BUDGET: 58,000	FY 92 EXPENDITURES:
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-05-01
TERMINATION DATE:	T93-08-31

PROBLEM STATEMENT:

Texas DOT (TxDOT) has been a leader in the design and use of traffic safe mailbox installations. TTI has worked with TxDOT in the development and testing of these designs. These innovative safety improvements have greatly reduced the hazard of mailbox installations.

Since implementation of these designs, the Division of Maintenance and Operations (D-18) of TxDOT has developed a prototype universal mailbox mounting bracket that will adjust to any size mailbox. It requires fewer parts and is easier to install than the current design. Before implementing the new brackets, crash tests are needed to verify their crashworthiness. It is necessary to demonstrate that the brackets have adequate strength to prevent unacceptable post-impact behavior of the mailbox(s)/support subsequent to vehicular impact.

OBJECTIVE(S):

The objective of this study is to demonstrate the crashworthiness of the newly developed universal mailbox mounting bracket through crash testing according to nationally recognized test and evaluation procedures, as contained in NCHRP Report 230.

IMPLEMENTATION PLAN:

Upon completion of crash tests and verification of traffic safety and crashworthiness, new standards and guidelines will be developed for field use. Direct cost savings are expected from reduced labor and fewer parts.

STUDY PROGRESS:

No report available at publication.

STUDY TITLE: REVIEW OF LENGTH-OF-NEED CRITERIA FOR MBGF

STUDY NUMBER:	TTI 1949 Task 1
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	IVEY DL
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	MARK MAREK, D-8
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 30,005	TOTAL EXPENDITURES:
FY 92 BUDTET: 30,005	FY 92 EXPENDITURES:
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	91-10-15
TERMINATION DATE:	T92-02-25

PROBLEM STATEMENT:

Metal beam guard fence (MBGF) is to be used as a last resort to shield hazards located in a highway zone only if efforts to eliminate, treat or relocate the hazard have failed. The Operations and Procedures Manual possesses empirical relationships between MBGF length of need, Average Daily Traffic, clearzone width and other relevant factors. These relationships should be reexamined despite having worked well for so many years.

OBJECTIVE(S):

The objective of this study is to review and revise current TxDOT length of need crteria for MBGF.

IMPLEMENTATION PLAN:

A possible outcome of the reexamination would be the generation of new relationships hopefully in a simpler form. However, the present relationships could be reaffirmed.

STUDY PROGRESS:

No report available at time of publication.

STUDY TITLE: STRUCTURAL BEHAVIOR OF TRANSFORMER BASES - ENGINEERING EVALUATION

STUDY NUMBER:	TTI 1963
RESEARCH AGENCY:	TEXAS TRANSPORTATION INSTITUTE
STUDY SUPERVISOR(S):	MORGAN J
RESEARCH AREA:	AREA 4
TxDOT CONTACT:	KARL BURKETT, D-3
STUDY SPONSOR:	TxDOT
TOTAL BUDGET: 25,000	TOTAL EXPENDITURES:
FY 92 BUDGET: 25,000	FY 92 EXPENDITURES:
FY 93 BUDGET: 0	FY 93 EXPENDITURES: N/A
DATE BEGUN:	92-07-06
TERMINATION DATE:	T92-08-31

PROBLEM STATEMENT:

Breakaway transformer bases (t-bases) are widely used to support the different types of luminaire poles. Some of these luminaire poles can be classified as follows:

1. Common light standard (balanced or unbalanced).
2. Post (top luminaire).

A variety of the t-bases are being produced with a range of load capacities. Therefore, it is necessary to establish guidelines to select an appropriate type of t-base for a specific pole at a specific site. In other words, the required capacity of the t-bases should be determined for supporting each kind of pole by satisfying all of the strength and safety requirements recommended in AASHTO 1985.

OBJECTIVE(S):

The aim of the first phase of this study is to collect and evaluate all existing information useful for making an engineering evaluation of t-bases, based on the current state-of-the-art design and AASHTO 1985 design requirements. As a result, an appropriate test will be designed so that stress and strain can be analyzed and predicted under different loading conditions. Testing the recommended test model will be conducted in a second phase of this study.

IMPLEMENTATION PLAN:

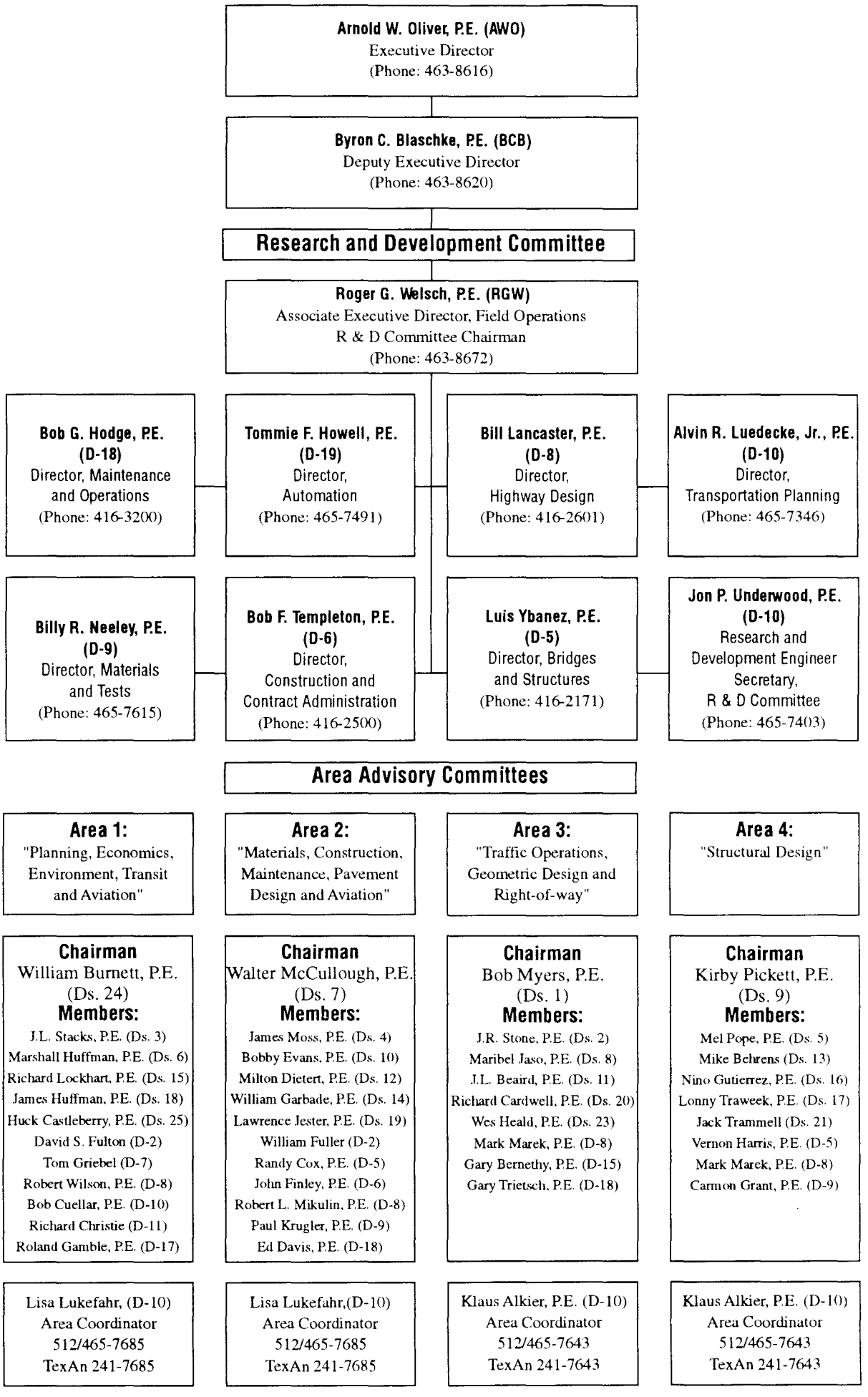
Recommendations and design guidelines will assist TxDOT engineers to select proper types of breakaway transformer bases for different types of luminaire poles.

STUDY PROGRESS:

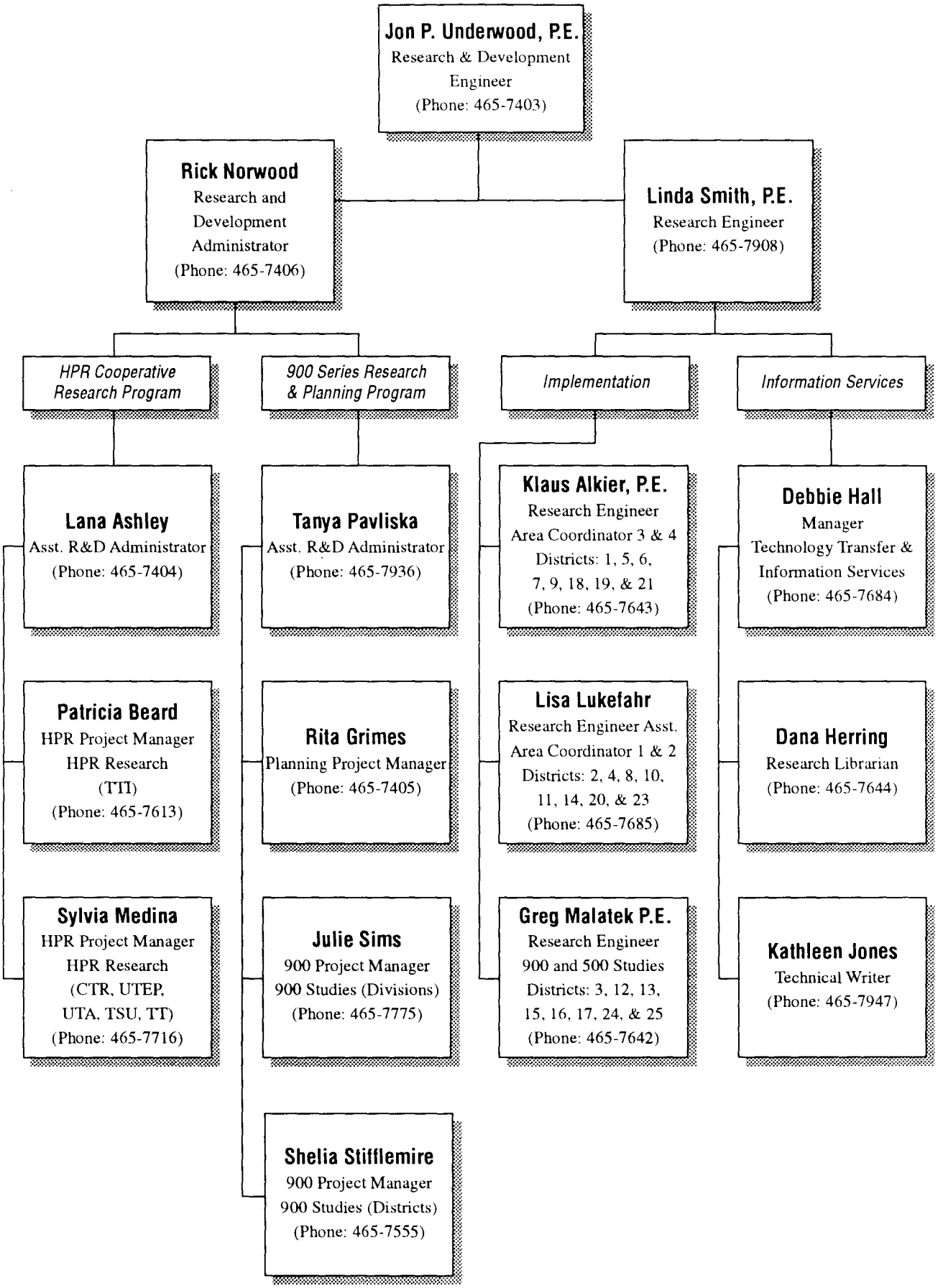
No report available at time of publication.

REFERENCE ITEMS

Texas Department of Transportation Cooperative Research Program



Texas Department of Transportation
Division of Transportation Planning Research Section (D-10R)



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Revised 7•13•92