



Research, Development, and Technology

Fiscal Years 2007 and 2008

Representative Examples of Completed RD&T Projects and Activities

June 2009

FHWA-HRT-09-038

INTRODUCTION

The Federal Highway Administration's (FHWA) mission is to improve mobility on the Nation's highways through national leadership, innovation, and program delivery. This includes developing, testing, and deploying technologies to build longer lasting pavements and more durable bridges, as well as advancing highway safety and traffic management through the creation of advanced traffic models and reflective materials. To advance this mission, FHWA's Office of Research, Development, and Technology (RD&T), located at the Turner-Fairbank Highway Research Center (TFHRC) in McLean, VA, conducts a comprehensive research program in the areas of Infrastructure Research and Development (R&D), Operations R&D, and Safety R&D. The Office of Corporate Research, Technology, and Innovation Management (www.fhwa.dot.gov/crt) and the Office of Resource Management support the RD&T research program. The new Exploratory Advanced Research Program focuses on longer-term, higher-risk research with a high payoff potential. RD&T research initiatives are intended to provide innovative solutions that address current and emerging transportation issues.

The following tables, which correspond to major RD&T offices and initiatives at TFHRC, provide representative examples of the Office of RD&T's activities in fiscal years 2007 and 2008 geared toward conducting research, deploying products and technologies, and providing communications and resource management support. FHWA is publishing this information as part of its commitment to identify, develop, promote, and install new and proven technologies and innovative solutions to improve system performance. This report documents completed research. As new activities innovations are initiated, they will be posted at www.tfhrc.gov.

Each table provides summary information on the individual research projects. For each project, information is included on its projected impact on FHWA's strategic goals, the percentage of the work that has been accomplished, information about whether the project is on schedule and within budget, its anticipated completion date or date when it was completed, and the availability of a resulting product. Contact information for more details on each project is also included.

As the products identified in this document suggest, FHWA continues to be a leader in developing and deploying innovative solutions to national transportation challenges.

LIST OF ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
AVA	Air void analyzer
CICAS	Cooperative Intersection Collision Avoidance Systems
COMPASS	Concrete Mixture Performance Analysis System
CORSIM	Corridor simulator
CP	Concrete pavement
DHMS	Digital Highway Measurement System
FHWA	Federal Highway Administration
GPS	Global Positioning System
HIPERPAV	High PERFORMANCE Concrete PAVING
HSIS	Highway Safety Information System
ICM	Inter-Corridor Management
ICS	Intelligent Construction System
ISAT	Intersection Safety Analysis Tool
LTPP	Long-term pavement performance
LTPPBind	Long-term pavement performance binder
NCAC	National Crash Analysis Center
NDGPS	Nationwide Differential Global Positioning System
R&D	Research and development
RD&T	Research, development, and technology
R&T	Research and technology
REDARS	Risks due to earthquake damage to roadway systems
SHRP	Strategic Highway Research Program
SMP	Seasonal Monitoring Program
SSAM	Surrogate Safety Assessment Model
TFHRC	Turner-Fairbank Highway Research Center
VII	Vehicle infrastructure integration

Research Project List

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Within Budget	Research Completion Date	Product Available	Comments
			25	50	75	100					
Office of Infrastructure R&D											
Pavement Design and Analysis											
Integration of Long-Term Pavement Performance (LTPP) Binder (LTPPBind) Version 3.0 with American Association of State Highway and Transportation Officials (AASHTO) M320 Specification	Aramis Lopez HRDI-13 202-493-3145	Mobility and Productivity				X	Yes	Yes	July 2008	Yes	Version 3.1 of the LTPPBind program is now available. For information on the new version, visit the Web site, http://ltp-products.com/OtherProducts.asp .
Pavement Materials and Construction											
Enhancement of High PERformance Concrete PAVing (HIPERPAV) II Software Program	Fred Faridazar HRDI-11 202-493-3076	Mobility and Productivity				X	Yes	Yes	Apr. 2007	Yes	Contact Fred Faridazar for information on this product (202-493-3076).
Future of Full-Scale Accelerated Performance Testing	Nelson Gibson HRDI-11 202-493-3073	Mobility and Productivity				X	Yes	Yes	May 2007	Yes	The established pooled fund forum continues to function. Papers have been prepared for the Third International Conference on Accelerated Pavement Testing.
Procedures for the Detection and Quantification of Lime in Asphalt Pavements	Jack Youtcheff HRDI-11 202-493-3090	Mobility and Productivity				X	Yes	Yes	May 2007	Yes	AASHTO published the procedure as a provisional test method.
LTPP Program Assessment	Aramis Lopez HRDI-13 202-493-3145	Mobility and Productivity				X	No	Yes	June 2007	Yes	See report FHWA-HRT-08-062.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Within Budget	Research Completion Date	Product Available	Comments
			25	50	75	100					
Asphalt Pavement Performance Prediction Symposium	Jack Youtcheff HRDI-11 202-493-3090	Mobility and Productivity				X	Yes	Yes	July 2007	Yes	Contact Jack Youtcheff for further information (202-493-3090).
Concrete Pavement (CP) Road Map: Mix Design and Analysis Track—Phase I Advisory Structure	Rick Meininger HRDI-11 202-493-3191	Mobility and Productivity				X	Yes	Yes	Sept. 2007	No	Contact Rick Meininger for further information (202-493-3191).
Adequate Air Void System, Measured by the Air Void Analyzer (AVA), for Freeze-Thaw Resistance	Rick Meininger HRDI-11 202-493-3191	Mobility and Productivity				X	Yes	Yes	Dec. 2007	Yes	Contact Rick Meininger for further information (202-493-3191).
Concrete Mix Optimization Software	Peter Kopac HRDI-12 202-493-3151	Mobility and Productivity				X	No	Yes	Mar. 2008	Yes	Interested parties received the Concrete Mixture Performance Analysis System (COMPASS).
Intelligent Construction System (ICS)—Computer-Based Field Curing Tool for Concrete Pavement	Fred Faridazar HRDI-11 202-493-3076	Mobility and Productivity				X	Yes	Yes	Mar. 2008	Yes	Researchers are seeking additional funds to make an existing prototype wireless accessible.
Full-Scale Accelerated Performance Testing for Superpave and Structural Validation: Phase II—Loading	Jack Youtcheff HRDI-11 202-493-3090	Mobility and Productivity				X	No	Yes	Mar. 2008	Yes	Completion was delayed due to a better-than-anticipated performance of test pavements. A draft report is available. Contact Jack Youtcheff at 202-493-3090 for information on how to access the draft.
Frost Determination of Seasonal Monitoring Program (SMP) Sites	Aramis Lopez HRDI-13 202-493-3145	Mobility and Productivity				X	No	Yes	Mar. 2008	Yes	The report was delayed due to funding issues; see report FHWA-HRT-08-057.

Project	Technical Contact	Projected Goal Impact	Project Completion Status (Percent)				On Schedule	Within Budget	Research Completion Date	Product Available	Comments
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Moisture Determination of SMP Sites	Aramis Lopez HRDI-13 202-493-3145	Mobility and Productivity				X	No	Yes	Mar. 2008	Yes	The report was delayed due to funding issues; see report FHWA-HRT-08-035.
Bridge Design and Construction											
Bottomless Culvert Scour Study: Phase II Laboratory Report*	Kornel Kerenyi HRDI-07 202-493-3142	Safety, Mobility and Productivity				X	Yes	Yes	Feb. 2007	Yes	For further information, visit www.fhwa.dot.gov/engineering/hydraulics/pubs/07026 .
Junction Loss Experiments: Laboratory Report*	Kornel Kerenyi HRDI-07 202-493-3142	Safety, Mobility and Productivity				X	Yes	Yes	Mar. 2007	Yes	For further information, visit www.fhwa.dot.gov/engineering/hydraulics/pubs/07036/index.cfm .
Seismic Retrofitting Guidelines for Steel Truss Highway Bridges*	W. Phillip Yen HRDI-07 202-493-3056	Safety, Mobility and Productivity				X	Yes	Yes	Apr. 2007	Yes	The report is available through FHWA's Research and Technology (R&T) Szanca Solutions Product Distribution Center, which can be contacted by phone at 814-239-1160 or through email at report.center@dot.gov .
Seismic Isolation of Highway Bridges*	W. Phillip Yen HRDI-07 202-493-3056	Safety, Mobility and Productivity				X	Yes	Yes	Apr. 2007	Yes	The report is available through FHWA's R&T Szanca Solutions Product Distribution Center, which can be contacted by phone at 814-239-1160 or through email at report.center@dot.gov .
Methodology and Software for Seismic Risk Analysis of Highway Systems—Risks Due to Earthquake Damage to Roadway Systems (REDARS) 2*	W. Phillip Yen HRDI-07 202-493-3056	Safety, Mobility and Productivity				X	Yes	Yes	Apr. 2007	Yes	The report is available through FHWA's R&T Szanca Solutions Product Distribution Center, which can be contacted by phone at 814-239-1160 or through email at report.center@dot.gov .
Bridge Coatings: Performance and Selection	Seung-Kyoung HRDI-10 202-493-3077	Mobility and Productivity				X	Yes	Yes	June 2007	Yes	Shuang-Ling Chong and Yuan Yao. (Sept./Oct. 2007). "Selecting Overcoats For Bridges." <i>Public Roads</i> , Vol. 71, No. 2. www.tfhrc.gov/pubrds/07sep/03.htm .

*Additions to FY 2006/2007 Performance Plan.

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Alternative Bridge Deck Reinforcement Materials	Paul Virmani HRDI-10 202-493-3052	Mobility and Productivity				X	No	Yes	Aug. 2007	Yes	Publications: <i>Multiple Corrosion Protection Systems for Reinforced Concrete Bridge Components</i> (TechBrief), FHWA-HRT-07-044, Aug. 2007, www.fhwa.dot.gov/bridge/pubs/07044/07044.pdf . <i>Multiple Corrosion Protection Systems for Reinforced Concrete Bridge Components</i> , FHWA-HRT-07-043, July 2007, www.fhwa.dot.gov/bridge/pubs/07043/07043.pdf . <i>Corrosion Resistant Alloys for Reinforced Concrete</i> , FHWA-HRT-07-039, July 2007, www.fhwa.dot.gov/bridge/pubs/07039/07039.pdf .
Seismic Retrofitting Manual for Highway Structures, Parts 1 and 2*	W. Philip Yen HRDI-07 202-493-3056	Safety, Mobility and Productivity				X	Yes	Yes	Nov. 2007	Yes	The report is available through FHWA's R&T Szanca Solutions Product Distribution Center, which can be contacted by phone at 814-239-1160 or through email at report.center@dot.gov .
*Additions to FY 2006/2007 Performance Plan.											
Office of Operations R&D											
Intelligent Vehicle Initiative (IVI) and Research Related to Human Centered Systems											
Real-Time Linux Operating System for Advanced Traffic Controllers	David Gibson HRDO-04 202-493-3271	Mobility and Productivity				X	No	Yes	Mar. 2008	Yes	The purpose of this project is to connect the Linux real-time operating system to advanced transportation controllers. This will provide the support necessary for faster detector polling and information processing, which is required for Cooperative Intersection Collision Avoidance Systems (CICAS) and vehicle infrastructure integration (VII) research. Phases I and II are complete. A draft final report for Phase II is under review. Phase III will develop a version of the software suitable for on-street use by traffic signal vendors. The software is undergoing lab testing in Los Angeles, CA, after which field testing will begin. An initiative for transfer of the technology to the signal vendors is planned but currently unfunded.
Traffic Control and Operations											
<i>Traffic Detector Handbook</i>	David Gibson HRDO-04 202-493-3271	Safety, Mobility and Productivity				X	No	Yes	Oct. 2006	Yes	The updated handbook is available at www.tfhrc.gov/its/pubs/06108/06108.pdf .

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Inter-Corridor Management (ICM) Initiative Phase I: Foundational Research	Dale Thomson HRDO-03 202-493-3420	Safety, Mobility and Productivity				X	Yes	Yes	Aug. 2007	Yes	The foundational research (Phase I) to initiate the ICM program is complete. ICM stakeholder involvement will continue through Phase II (ICM Research and Systems Development). During Phase II, researchers will address integration issues, initiate research projects, develop ICM analysis tools, and establish demonstration sites. More information is available at www.itsa.org/icm.html .
Pedestrian Stereo Imaging Sensor	David Gibson HRDO-04 202-493-3271	Safety, Mobility and Productivity				X	No	Yes	Sept. 2007	No	This project investigated the uses of stereo imaging to detect and trace pedestrians near intersections. Phase I was completed in Sept. 2005. A second phase was completed in Sept. 2007.
Inter-Corridor Management (ICM) Initiative Phase III: Pioneer Site Demonstrations*	Dale Thomson HRDO-03 202-493-3420	Safety, Mobility and Productivity				X	Yes	Yes	Mar. 2008	Yes	Phase III was completed with eight pioneer sites selected to develop ICM concepts of operations and requirements. The pioneer sites were chosen to expand the probability of generating innovative ideas and to demonstrate the broadest advancement of the ICM concepts.
Surface Transportation Security and Reliability Information System Model Deployment (Florida)	James Pol HOTM-01 202-366-4374	Safety, Security, Mobility and Productivity				X	No	Yes	June 2008	No	This project demonstrated and evaluated how security, reliability, and safety can be enhanced through the widespread availability of real-time information.
Inter-Corridor Management (ICM) Initiative Phase II: Technical Integration and Advanced Modeling Systems	Dale Thomson HRDO-03 202-493-3420	Safety, Mobility and Productivity				X	Yes	Yes	Sept. 2008	No	Phase II identified and conducted initial ICM operations and systems development activities to support early development of ICM management schemes, corridor operational strategies, analysis tools development, systems interfaces, limited prototype development, and field testing.

*Additions to FY 2006/2007 Performance Plan.

Traffic Analysis Tools/Simulation and Modeling

Corridor Simulator (CORSIM) Application Guidelines	Raj Ghaman HRDO-03 202-493-3270	Mobility and Productivity				X	No	Yes	June 2007	Yes	These guidelines were released as Volume IV of the FHWA Traffic Analysis Toolbox. Volume IV is available at http://ops.fhwa.dot.gov/trafficanalysis/tools/tat_vol4/index.htm .
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Enabling Technologies											
High-Accuracy Nationwide Differential Global Positioning System (NDGPS)	James Arnold HRDO-04 202-493-3265	Safety, Mobility and Productivity, Environment, and Security				X	Yes	Yes	Dec. 2007	No	This program provides the capability to broadcast corrections to the global positioning system (GPS) over long ranges to achieve a better than 10-cm accuracy throughout the coverage area. The conceptual model is completed. Phase I & II test reports are available on the TFHRC Web site (www.tfhrc.gov).
Precipitable Water Vapor for Weather Forecasting*	James Arnold HRDO-04 202-493-3265	Safety, Mobility and Productivity, Environment, and Security				X	Yes	Yes	Dec. 2007	No	This is a research program designed to develop and evaluate a perceptible water vapor algorithm, which is intended to help improve weather forecasting. The final model has been developed and delivered.
*Additions to FY 2006/2007 Performance Plan.											
Office of Safety R&D											
Run-Off-the-Road Prevention: Design											
Wet Night Visibility of Pavement Markings	Carl Andersen HRDS-05 202-493-3366	Safety				X	Yes	Yes	Mar. 2007	Yes	The Virginia Transportation Research Council published reports VTRC 05-CR3, VTRC 05-CR4, and VTRC 07-CR7.
Updated Minimum Levels for Pavement Marking Retroreflectivity	Carl Andersen HRDS-05 202-493-3366	Safety				X	Yes	Yes	Sept. 2007	No	The final report was accepted in June 2007. The information will be used internally for development of proposed rule making.
Guidelines for Maintaining Night Visibility of Pavement Markings	Carl Andersen HRDS-05 202-493-3366	Safety				X	Yes	Yes	June 2008	No	The final report has been accepted. It will not be published, but it will be used in-house to guide rule-making efforts.
Run-Off-the-Road Mitigation: Severity Reduction											
Cable Median Barrier Development—Phase 1	Ken Opiela HRDS-04 202-493-3371	Safety				X	Yes	Yes	June 2008	Yes	Researchers developed models for cable barriers and demonstrated the usefulness of crash simulation for analyzing their performance. The National Crash Analysis Center (NCAC) posted the report on its Web site (http://www.ncac.gwu.edu/).

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Effects of Terrain on Vehicle Trajectories	Ken Opiela HRDS-04 202-493-3371	Safety				X	Yes	Yes	Feb. 2009	Yes	The report discusses an analysis of vehicle tracking and the potential for rollovers on all types of roadside slope conditions. Technical activity is complete, and the results are available upon request. The results will be incorporated into future research.
Analysis of the Impacts on Existing Roadside Hardware of Updated Crashworthiness Criteria	Ken Opiela HRDS-04 202-493-3371	Safety				X	Yes	Yes	June 2009	Yes	The technical activity is complete, and the results are available upon request. The results will be incorporated into future research.
Intersections											
Safety Evaluation of the New Jersey Jughandle Intersection	Joe Bared HRDS-05 202-493-3314	Safety				X	Yes	Yes	Jan. 2007	Yes	<i>Transportation Research Record</i> 1953 published the study results.
Novel Intersections—Diverging Diamond Interchanges	Joe Bared HRDS-05 202-493-3314	Safety				X	Yes	Yes	May 2007	Yes	The TechBrief is available at www.tfhrc.gov/safety/pubs/07048/index.htm .
Operational Evaluation of the New Jersey Jughandle Intersection	Joe Bared HRDS-05 202-493-3314	Safety				X	Yes	Yes	June 2007	Yes	The TechBrief is available at www.tfhrc.gov/safety/pubs/07032/index.htm .
Safety Impact of Urban Freeway Interchange Spacing	Joe Bared HRDS-05 202-493-3314	Safety				X	Yes	Yes	June 2007	Yes	The TechBrief is available at www.tfhrc.gov/safety/pubs/07031/index.htm .
Interchange Safety Analysis Tool	Joe Bared HRDS-05 202-493-3314	Safety				X	Yes	Yes	Aug. 2007	Yes	<i>User's Manual for Intersection Safety Analysis Tool (ISAT)</i> is available at www.tfhrc.gov/safety/pubs/07045/index.htm (FHWA-HRT-07-045).
Innovative Speed Reduction Treatment	Joe Bared HRDS-05 202-493-3314	Safety				X	Yes	Yes	May 2008	Yes	See summary report FHWA-HRT-08-063.

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Surrogate Safety Assessment Model (SSAM)	Joe Bared HRDS-05 202-493-3314	Safety				X	Yes	Yes	July 2008	Yes	See final report FHWA-HRT-08-051.
Pedestrians and Bicyclists											
Pedestrian and Bicyclist Intersections Safety Indices	Ann Do HRDS-06 202-493-3319	Safety				X	Yes	Yes	Apr. 2007	Yes	The project was retitled; originally, it was titled "Hazard Index for Assessing Pedestrian and Bicyclist Safety at Intersections." Reports are available at www.tfrc.gov/safety/pedbike/pubs/06125/index.htm and www.tfrc.gov/safety/pedbike/pubs/06130/index.htm .
Development of Design Guidelines for Crosswalk Lighting	Carl Andersen HRDS-05 202-493-3366	Safety				X	Yes	Yes	Dec. 2007	Yes	Report FHWA-HRT-08-053 is available at www.tfrc.gov/safety/pubs/08053/index.htm .
Speed Management											
Effect of Urban Street Environment on Operating Speeds	Carl Andersen HRDS-05 202-493-3366	Safety				X	Yes	Yes	Jan. 2008	Yes	Report FHWA-HRT-08-040 is available (also available as NTIS-FB-2008-105181).
Demonstration and Evaluation of Speed Management on Main Roads in Rural Communities	Carl Andersen HRDS-05 202-493-3366	Safety				X	Yes	Yes	Feb. 2008	Yes	The final report is posted at www.ctre.iastate.edu/reports/traffic-calming-rural.pdf .
Safety Management Systems											
SafetyAnalyst Software	Ray Krammes HRDS-02 202-493-3312	Safety				X	Yes	Yes	Nov. 2006	No	An interim version of the software was distributed to participating pooled fund States for testing on Dec. 8, 2006.
Evaluation of Low-Cost Safety Improvements Pooled-Fund Study, Phase I	Roya Amjadi HRDS-06 202-493-3383	Safety				X	Yes	Yes	Feb. 2008	Yes	Four reports are available online: FHWA-HRT-08-041, FHWA-HRT-08-042, FHWA-HRT-08-043, and FHWA-HRT-08-044. Visit www.tfrc.gov/safety/evaluations/pubs.htm (three were published in Dec. 2007 and the fourth in Feb. 2008).

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Highway Safety Information System (HSIS) Evaluations	Carol Tan HRDS-06 202-493-3315	Safety				X	Yes	Yes	June 2008	Yes	See (a) <i>Evaluation of Factors Contributing to Pedestrian and Bicycle Crashes on Rural Highways</i> , final report available at www.hsisinfo.org/pdf/HSIS-Rural-PedBike-Final-Report.pdf (Report summary under revision, expected Dec. 2008) and (b) "Estimating Safety Benefits of Shoulder Rumble Strips on Two-Lane Rural Highways in Minnesota: Empirical Bayes Observational Before-and-After Study," <i>Transportation Research Record: Journal of the Transportation Research Board No. 2019</i> . Note: The pavement edge dropoff study was reported as a separate project in this section.
Safety and Intelligent Transportation Systems (ITS)											
Advanced Research—Digital Highway Measurement System (DHMS) Vehicle—Phase I	Kunik Lee HRDS-04 202-493-3491	Safety				X	Yes	Yes	Sept. 2008	No	The first phase of the overall DHMS program is complete with the participation of DHMS in North Carolina Asset Management Rodeo and Strategic Highway Research Program (SHRP) 2 S-03 Rodeo, held in Sept. 2008.
Office of Corporate Research, Technology, and Innovation Management											
Office of the Chief Scientist											
Researchers conducted fiscal year 2007 laboratory assessments for Geotechnical Laboratory, Highway Safety Information Systems and the Geometric Design Laboratory, Bridge Management Information Systems Laboratory, and Nondestructive Evaluation and Pavement Surface Analysis Laboratory	Joe Moyer HRTM-01 202-493-3370	Organizational Excellence				X	Yes	Yes	Sept. 2007	Yes	Summary reports are available on the Turner-Fairbank Highway Research Center (TFHRC) Web site (www.tfhrc.gov). Geotechnical and Pavement Surface Analysis Laboratories were not assessed due to limited activity. Resulting action items from assessments are being addressed. Progress is reviewed biannually by TFHRC senior leadership.
Communications and Outreach Team											
Developed and marketed the integrated FHWA R&T Web site	Dawn VanLandingham HRTM-03 202-493-3198	Organizational Excellence				X	Yes	Yes	May 2007	Yes	Visit www.fhwa.dot.gov/crt for more information.