Technical Publications Catalog

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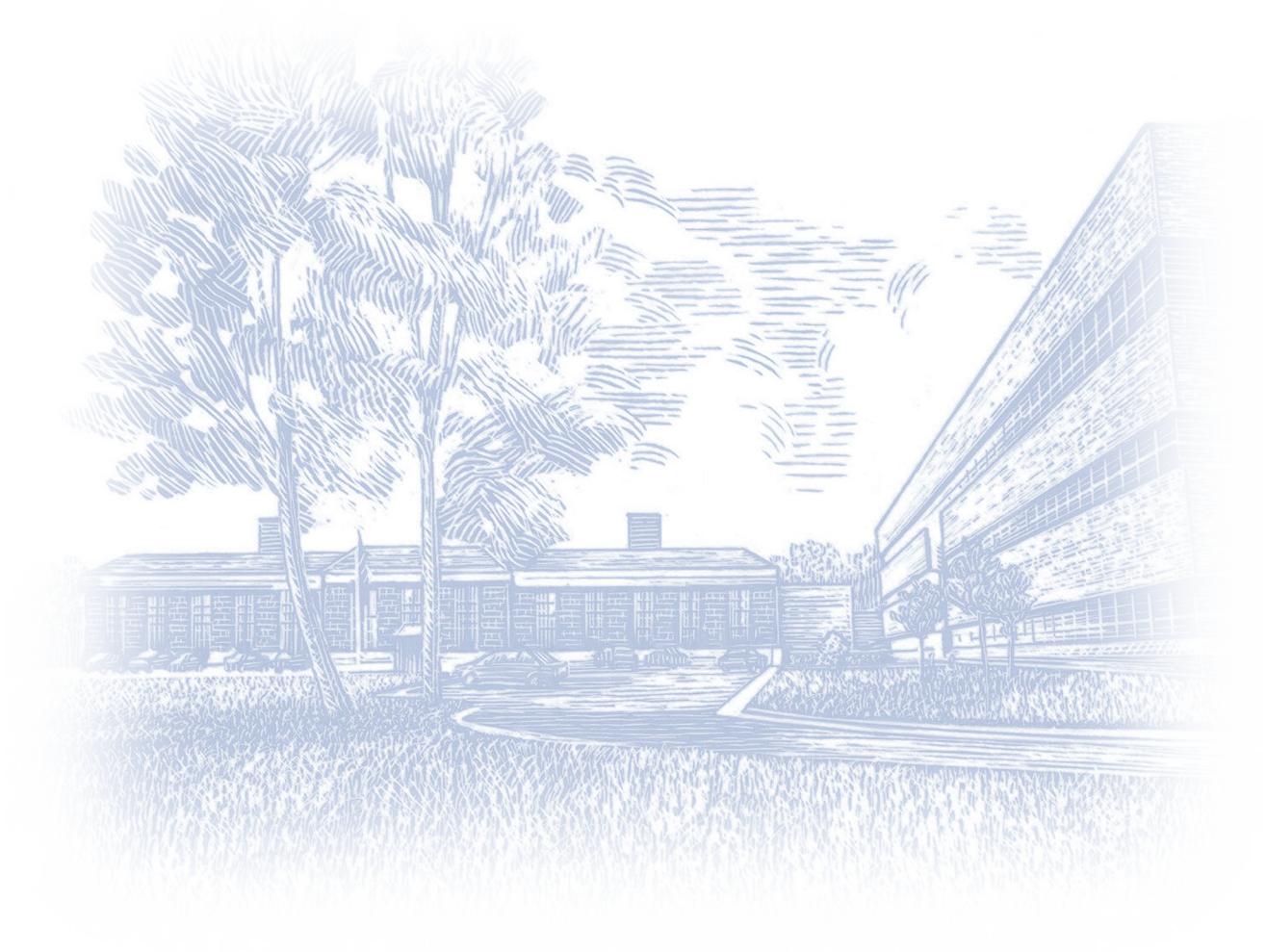

U.S. Department of Transportation
Federal Highway Administration

Federal Highway Administration
Turner-Fairbank Highway Research Center
6300 Georgetown Pike, McLean, VA 22101

Foreword

In 2003, the Turner-Fairbank Highway Research Center (TFHRC) published the first comprehensive listing of our research documents in the *Technical Publications Catalog,* October 1998 – September 2003. It cataloged more than 300 publications generated from research at our facility. The Technical Publications Catalog, October 2003 - September 2005 followed and included the two new categories of Administration and Materials. We are pleased to add to this wealth of information the Technical Publications Catalog, October 2005 – September 2006 – with the additional listings of fact sheets, flyers, product briefs, reports, summaries, and TechBriefs, that are available in print from our Federal Highway Administration Product Distribution Center and online at www.tfhrc.gov/tecpubcat/index.htm.

These three catalogs are indispensable transportation research resources for engineers, transportation specialists, policymakers, information specialists, and other interested groups. Readers can immediately access most publications online or order a copy from the source listed.

I hope you find this a useful addition to your reference library. Questions or comments about this publication can be directed to Martha Soneira at martha.soneira@fhwa.dot.gov or 202-493-3468.

Dennis C. Judycki
Associate Administrator
Research, Development, and Technology

Table of Contents

1 Administration

Administrative Reports

Organizational and Expertise Directory

FHWA-HRT-07-025

The Federal Highway Administration Office of Research, Development, and Technology is organized into 8 offices with 15 teams of experts in more than 30 transportation-related disciplines. This publication lists the Offices and Staff, including contact information.
http://www.tfhrc.gov/about/orgdirectory/index.htm

Fact Sheets

Asset Management Guide

FHWA-HRT-06-055

TAM is not a software or data base system. It is a decision making process for allocating resources. TAM provides agencies with a strategic approach to managing transportation infrastructure and enables agency leadership to view the big picture before deciding how to deploy resources.
https://www.fhwa.dot.gov/resourcecenter/teams/financeservices/guide2a11.cfm
Listing of Priority, Market-Ready Technologies and Innovations
FHWA-HRT-06-070
The Federal Highway Administration's Research & Technology Leadership Team endorses six new priority, market-ready technologies and innovations. This document consists of the 2006 List of Priority, Market-Ready Technologies and Innovations.
https://www.fhwa.dot.gov/crt/marketready/summary.pdf

Performance Plan Fiscal Year 2006-2007

FHWA-HRT-06-037

The Performance Plan covers the strategic framework of the Federal Highway Administration's mission and goals; describes the Turner-Fairbank Highway Research Center, its R&D Office Projects and milestones, program support services, and RD&T performance management. FHWA Research Library and http://www.tfhrc.gov/about/perfplan0607/index.htm

Summaries

FY 2005 Research Project Status Summary
FHWA-HRT-06-084
Over the past 2 years, the Turner-Fairbank Highway Research Center (TFHRC) researchers conducted 170 research projects in support of the Agency's goals. Sixty-six of those projects were completed during the Fiscal Year (FY) 2004/2005 plan timeframe. As a result, 50 ready-to-use products are now available to our customers. A total of 26 projects were completed in support of the Safety goal, and 40 projects were completed in support of the Mobility and Productivity goal. A number of these projects also support agency objectives in the Environment and National Homeland Security goal areas.
http://www.tfhrc.gov/about/06084/index.htm

2 Environment

Fact Sheets

Dispute Resolution Guidance for Environmental Streamlining
FHWA-HRT-06-059
The Federal Highway Administration worked with the U.S Institute for Environmental Conflict Resolution, Federal transportation and resource agencies, and State departments of transportation to develop a guidance document, Collaborative Problem Solving: Better and Streamlined Outcomes for All.
https://www.fhwa.dot.gov/crt/marketready/dispute.pdf

3 Human Factors

Summaries

Driver Attitudes and Behaviors at Intersections and Potential Effectiveness of Engineering Countermeasures
FHWA-HRT-05-158
This document is an executive summary of the report *Driver Attitudes and Behaviors at Intersections and Potential Effectiveness of Engineering Countermeasures,* FHWA-HRT-05-078, published by the Federal Highway Administration in November 2005.
http://www.tfhrc.gov/safety/pubs/05158/index.htm

Technical Reports

In-Vehicle Display Icons and Other Information Elements Volume I: Guidelines
FHWA-RD-03-065
The key product of this project is a set of clear, concise, and user-centered human factors design guidelines for in-vehicle icon design. The guidelines address issues such as the legibility, recognition, interpretation, and evaluation of graphical and text-based icons and symbols. These guidelines provide IVIS developers with key information regarding the use and integration of existing and new visual symbols. In addition, the Icon IDEA software tool developed in this project has provided a real-time icon development and evaluation tool that, to-date, is receiving consistently positive reviews from the project's working group members. This tool is entirely functional and ready to use, and should prove to be an invaluable aid and resource for icon design.
FHWA Research Library
and **https://www.fhwa.dot.gov/publications/research/safety/03065/index.cfm**
Pedestrian Access to Roundabouts: Assessment of Motorists' Yielding to Visually Impaired Pedestrians and Potential Treatments to Improve Access
FHWA-HRT-05-080
This report describes two related studies intended to address double-lane roundabout accessibility issues for visually impaired pedestrians. The first study was conducted on a closed course to evaluate the feasibility of a pavement treatment to alert blind pedestrians when vehicles have yielded to them. The second study examined drivers; yielding behavior at a two-lane roundabout and the effectiveness of the same roadway treatment in an operational environment.
FHWA Research Library and http://www.tfhrc.gov/safety/pedbike/pubs/05080/index.htm
Human Factors Literature Reviews on Intersections, Speed Management, Pedestrians & Bicyclists, and Visibility
FHWA-HRT-06-034
The Federal Highway Administrations (FHWA) is currently addressing general safety areas, including examining driver behavior at intersections, developing tools and procedures for intersection design, and conducting human factors literature reviews for Safety research and development (R&D) program areas such as Intersections, Speed Management, Pedestrians and Bicyclists, and Visibility.

http://www.tfhrc.gov/humanfac/pubs/06034/index.htm

4 Operations

Brochures

ACS Lite
FHWA-HRT-06-083
A significant portion of traffic delays in metropolitan areas are caused by poor traffic signal timing. ACS Lite, a reduced-scale version of the Federal Highway Administration's (FHWA) Adaptive Control Software (ACS), offers small and medium-size communities a low-cost traffic control system that operates in real time, adjusting signal timing to accommodate changing traffic patterns and ease traffic congestion. ACS Lite can be used with new signals or to retrofit existing traffic signals. It is designed for closed-loop systems, providing cycle-by-cycle control.
https://www.fhwa.dot.gov/publications/research/operations/06083/index.cfm
Coordinated Freeway and Arterial Operations
FHWA-HRT-06-094
Coordinated freeway and arterial (CFA) operations are the implementation of policies, strategies, plans, procedures, and technologies that enable transportation practitioners to manage traffic on freeways and adjacent arterials as a single corridor, rather than as individual transportation facilities. The result of CFA operations is improved mobility and safety and reduced environmental impacts throughout the corridor.
https://www.fhwa.dot.gov/publications/research/operations/its/06094/index.cfm

Fact Sheets

Maintenance Decision Support System (MDSS)
FHWA-HRT-06-039
Maintenance Decision Support System (MDSS) is an enabling technology that integrates weather forecasting (both atmospheric and surface weather conditions) with the state of the practice in winter road maintenance. Managers are better prepared for efficient use of personnel and equipment.
https://www.fhwa.dot.gov/crt/marketready/mdss.pdf
Transportation, Economics and Land Use System (TELUS)
FHWA-HRT-06-049
TELUS is a fully integrated information-management and decision support system to help MPOs and State DOTs develop their transportation improvement programs and carry out other transportation planning responsibilities, particularly, public participation in the transportation planning.
https://www.fhwa.dot.gov/resourcecenter/teams/planningair/plan_8tel.cfm
Improved Decision Making Using Geographic Information Systems
FHWA-HRT-06-050
GIS is a system of computer hardware and software that collects, stores, analyzes, and disseminates information about areas of the earth. While GIS often helps users create maps, the true power of GIS allows the user to maximize the quality and use of spatial data to answer questions of where, how far, how many, what size, and within what area.
https://www.fhwa.dot.gov/resourcecenter/teams/planningair/plan_5gis.cfm
ITS Deployment Analysis System (IDAS)
FHWA-HRT-06-051
IDAS is a sketch-planning software analysis tool that transportation practitioners can use to estimate the benefits and costs of ITS investments. IDAS can predict relative costs and benefits for more than 60 types of ITS investments. IDAS operates as a post-processor to travel demand models, enabling the user to import data from a travel demand model into the IDAS software to recreate the transportation network under evaluation.
http://www/fhwa.dot.gov/crt/marketready/idas.pdf
511 Traveler Information
FHWA-HRT-06-053

USDOT is facilitating national implementation of 511 systems to make real-time traveler information more widely available to motorists. It is working with a 511 Deployment Coalition that includes the American Association of State Highway and Transportation Officials, the Intelligent Transportation Society of America, and the American Public Transportation Association.
https://www.fhwa.dot.gov/resourcecenter/teams/operations/ops_1ti.cfm
DYNASMART-P
FHWA-HRT-06-060
DYNASMART-P is a dynamic traffic assignment analysis tool that operates on recent versions of Microsoft Windows. Transportation engineers and planners can use DYNASMART-P to address complex and dynamic transportation operations and planning issues, particularly in the ITS context.
https://www.fhwa.dot.gov/crt/marketready/dynasmart.pdf
Highway Economics Requirements Systems, State Version (HERS-ST)
FHWA-HRT-06-063
HERS-ST is a user-friendly Microsoft ® Windows ® application that helps transportation agencies plan and schedule highway work and determine future highway system needs. This software uses engineering principles to simulate future highway conditions and performance levels and identify deficiencies. The program then applies economic criteria to select the most cost-effective mix of improvements for system-wide implementation.
https://www.fhwa.dot.gov/resourcecenter/teams/planningair/plan_hers.cfm

Flyers

Intelligent Intersection Traffic Control Laboratory Fact Sheet
FHWA-HRT-06-102
The Intelligent Intersection Traffic Control Laboratory (IITCL) is an outdoor facility that supports the Federal Highway Administration's various research programs and research activities conducted by other U.S. Department of Transportation agencies. The IITCL serves as a testing ground for intersection-related research projects and as a place to integrate and demonstrate advanced technologies.
FHWA Research Library

Technical Reports

Support of the System Test and Analysis Program for the NDGPS Modernization Program
FHWA-HRT-02-110
The Nationwide Differential Global Positioning System (NDGPS) Modernization Program is a multiageny effort to examine the viability of long baseline carrier phase differential correction techniques. Phase I of this program analyzes broadcasting Global Positioning System observables from a single NDGPS site, Hagerstown, MD, to aid in determining the appropriate signal structure and compression techniques to support long range carrier phase operations. Phase II will install a second facility near Hawk Run, PA, enabling multiple baseline carrier and code phase navigation solutions.
https://www.fhwa.dot.gov/publications/research/operations/02110/index.cfm
Coordinated Freeway and Arterial Operations Handbook
FHWA-HRT-06-095
The purpose of this document is to provide direction, guidance, and recommendations for transportation managers, engineers, and planners on how to proactively and comprehensively coordinate freeway and arterial street operations.
FHWA Research Library

5 Pavements

Fact Sheets

Pavement Smoothness Methodologies
FHWA-HRT-06-041

This document lists successful new products that help improve the condition of the Nation's highways, and the National Highway Institute course on pavements smoothness measurement. The Pavement Profile Viewer Analyzer (ProVAL) software is also discussed.
https://www.fhwa.dot.gov/resourcecenter/teams/pavement/pave_5PSM.pdf
Air Void Analyzer
FHWA-HRT-06-057
The presence of closely spaced air voids in concrete is commonly singled out as the primary factor in improving the freeze-thaw resistance of concrete. Researchers believe that as water expands during freezing, the pressure the water develops increases in relation to the distance it must travel to reach the nearest air void. Consequently, the more closely air voids in concrete are spaced, the less likely it is that the pressure of freezing water will damage the concrete.
https://www.fhwa.dot.gov/resourcecenter/teams/pavement/pave_1AVA.pdf

Flyer

LTPP 2005 Year in Review
FHWA-HRT-06-086
In 2005, LTPP worked hard to develop a new operational plan for the future under the Safe, Accountable Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). A summary of the plan is described in this publication. In addition, LTPP continued to focus on improving the quality and quantity of data in the LTPP database, and on addressing gaps in the materials and traffic data through the Materials Data Action Plan and Specific Pavement Study (SPS) Traffic Data Collection Pooled Fund Study.
https://www.fhwa.dot.gov/pavement/ltpp/pubs/06086/ltpp2005yir.cfm

Newsletters

Pavement Research Progress Newsletter
FHWA-HRT-06-097
In response to a recent laboratory assessment by our outside partners, FHWA's Office of Research and Development's (R&D's) Pavement Materials and Construction Team has developed this informal, electronic publication to provide updates of ongoing research activities. We hope you find it informative and useful.
https://www.fhwa.dot.gov/pavement/pub_details.cfm?id=379
LTPP Newsletter, May/June 2006
FHWA-HRT-06-120
Passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) required the Long-Term Pavement Performance (LTPP) program to review its operations due to a reduction in funds. This resulted in the LTPP Operational Plan. One of the first orders of business under LTPP Operational Plan was to make pavement performance monitoring adjustments to optimize the use of program resources.
https://www.fhwa.dot.gov/pavement/ltpp/news/06mayjunnews.cfm
LTPP Newsletter, Fall 2006
FHWA-HRT-06-131
To help locate necessary information, users of LTPP data can contact the LTPP Customer Support Service Center to find specific data elements from the hundreds of tables in the LTPP database. This will help prevent researchers from starting a project with all the information they thought was available and then reporting inconclusive results due to insufficient data, only to find out that much more data was available in a different part of the database.
https://www.fhwa.dot.gov/pavement/ltpp/news.cfm

Product Briefs

Long-Term Pavement Performance Program (LTPP) Materials Reference Library (MRL)
FHWA-HRT-06-116
The purpose of this document is to provide information to individuals interested in obtaining materials from the Federal Highway Administration's Long-Term Pavement Performance (LTPP) Materials Reference Library (MRL).
FHWA Research Library
2006 LTPP Product List
FHWA-HRT-06-119
The Federal Highway Administration's (FHWA) Long-Term Pavement Performance (LTPP) program is a 20-year study of in-service pavements designed to provide the data required to understand how and why pavements perform the way they do. This publication briefly describes: (1) Rigid Pavement Design software, (2) Coefficient of Thermal Expansion of Concrete, (3) LTPP Bind 3.1 (4) Guide for Determining Design Resilient Modulus Values for Unbound Materials, (5) Verification of Dynamic Test System—Emphasis on MR, (6) Test Method for Determining the Creep Compliance, MR, and Strength of Asphalt Materials Using the Indirect Tensile Test Device, (7) Pavement Maintenance and Repair Manuals, (8) LTPP Distress Identification Manual, (9) Guidelines for Temperature Adjustment of FWD Results for AC Pavements, (9) ProVAL2.6, (10) Pavement Smoothness Index Relationship, (11) LTPP Seasonal Monitoring Program CD-ROM, (12) Standard Specification for Smoothness of Pavement at the Approaches to Weigh-In-Motion Scales, AASHTO Designation MP 14-05, (13) DataPave Online, and (14) LTPP Standard Data Release.
https://www.fhwa.dot.gov/pavement/ltpp/pubs/06119

TechBriefs

Improving Pavements With Long-Term Pavement Performance: Products for Today and Tomorrow
FHWA-RD-03-049
Improving the productivity and mobility of the National Highway Transportation System are key goals of the Federal Highway Administration (FHWA). During 2005, FHWA's Long-Term Pavement Performance (LTPP) program continued to work toward these goals through its efforts to provide answers to "how" and "why" pavements perform as they do. To better understand pavement performance, the LTPP program gathers and processes data describing the structure, service conditions, and performance of more than 2,400 pavement test sections in North America. Highway engineers can use these data and findings from the analyses conducted to date to help them make decisions leading to more cost-effective and better performing pavements.
FHWA Research Library and **https://www.fhwa.dot.gov/pavement/ltpp/pubs/06086/ltpp2005yir.cfm**
The Concrete Pavement Road Map
FHWA-HRT-05-074
The Concrete Pavement (CP) Road Map is a plan for concrete pavement research that will guide the investment of research dollars for the next several years. This TechBrief is a summary of FHWA-HRT-05-052 Concrete Pavement Road Map Volume I and FHWA-HRT-05-053.
FHWA Research Library and https://www.fhwa.dot.gov/pavement/pccp/pubs/05074/
Quantification of Smoothness Index Differences Related to LTPP Equipment Type
FHWA-HRT-06-064
Researchers in the Long-Term Pavement Performance (LTPP) program are conducting a major data collection effort. They are using an inertial profiler to collect longitudinal profile data at regular intervals on two wheel paths located along the LTPP program test sections. In the LTPP programs, the United States and Canadian Provinces are divided into four regions for the purposes of data collection, and a regional support contractor (RSC) operates an inertial profiler in each region. Recommendations for LTPP Profiler data collection and processing procedures and comparisons are given in this TechBrief.
FHWA Research Library
Selecting Candidate Structures for Lithium Treatment: What To Provide the Petrographer Along With Concrete Specimens
FHWA-HRT-06-069

This TechBrief describes the process of selecting candidate structures for lithium treatment. Sampling components of the structures for laboratory investigations, particularly petrographic examination, and expansion tests is covered.
FHWA Research Library and https://www.fhwa.dot.gov/pavement/pccp/pubs/06069/
Protocol to Identify Incompatible Combinations of Concrete Materials
FHWA-HRT-06-082
This TechBrief summarizes the findings in FHWA-HRT-06-080 Identifying Incompatible Combinations of Concrete Materials, Volume II – Test Protocol.
https://www.fhwa.dot.gov/pavement/concrete/06082/
LTPP Data Analysis: Optimization of Traffic Data Collection for Specific Pavement Design Applications
FHWA-HRT-06-111
The Long-Term Pavement Performance (LTPP) program conducted a study to establish the relationship between the traffic data collection effort, including the combination of traffic data acquisition technologies and length of time coverage, and the variability in predicted pavement life using the M-E PDG. For the study, researchers used extended coverage WIM data from the LTPP Standard Data Release (SDR) 16.0 to simulate a wide range of traffic data collection scenarios. Analysis, conclusions and application is presented in this TechBrief.
FHWA Research Library

Technical Reports

Structural Factors of Jointed Plain Concrete Pavements; SPS-2 – Initial Evaluation and Analysis
FHWA-RD-01-167
The SPS-2 experiment, Strategic Study of Structural Factors for Jointed Plain Concrete Pavements (JPCP), is one of the key components of the LTPP program. The main objective of this experiment is to determine the relative influence and long-term effectiveness of JPCP design features (including slab thickness, PCC flexural strength, base type and drainage, and slab width) and site conditions (traffic, sub-grade type, climate) on performance. This report documents the first comprehensive review and evaluations of the SPS-2 experiment. Thirteen SPS-2 projects have been constructed with one additional site under construction. At each site, there are 12 core sections plus various numbers of supplemental sections.
https://www.fhwa.dot.gov/pavement/ltpp/01167/
Rehabilitation of Asphalt Concrete Pavements – Initial Evaluation of the SPS-5 Experiment Final Report
FHWA-RD-01-168
The SPS-5 experiment, entitled Rehabilitation of Asphalt Concrete Pavements, is one of the key experiments of the LTPP program. The objective of this experiment is to determine the relative influence and long-term effectiveness of different rehabilitation techniques (including overlay thickness, material, and surface preparation) and site conditions (traffic, pre-existing pavement condition, and climatic factors) on performance. This report documents the first comprehensive review and evaluation of data completeness and availability from the SPS-5 experiment. Eighteen SPS-5 projects have been identified. At each site there are nine core test sections. Some SPS-5 projects also have various supplemental sections. 210 test sections are included in the SPS-5 experiment.
https://www.fhwa.dot.gov/pavement/pccp/pubs/01168/
Rehabilitation of Jointed Portland Cement Concrete Pavements: SPS-5 Initial Evaluation and Analysis
FHWA-RD-01-169
The Specific Pavement Studies 6 (SPS-6) experiment, “Rehabilitation of Jointed Portland Cement Concrete Pavements,” was designed as a controlled field experiment that focuses on the study of specific rehabilitation design features of jointed plain concrete pavements (JPCP) and jointed reinforced concrete pavements (JRCP). This experiment examines the effects of climatic regions (wet-freeze, wet-no freeze, or dry-no freeze), type of concrete pavement (plain or reinforced), condition of existing pavement prior to rehabilitation (fair or poor), and traffic rate (as a covariant), incorporating the different methods of rehabilitation with and without asphalt concrete (AC) overlays. This report documents the first comprehensive review and evaluation of the SPS-6 experiment. Fourteen SPS-6 projects have been constructed. At each site, there are eight core sections plus various numbers of supplemental sections.
https://www.fhwa.dot.gov/pavement/ltpp/pubs/01169/

LTPP Materials Characterization Program: Verification of Dynamic Test Systems with an Emphasis on Resilient Modulus
FHWA-RD-02-034
This document describes a procedure for verifying a dynamic testing system (closed-loop servohydraulic). The procedure is divided into three general phases: (1) electronic system performance verification, (2) calibration check and overall system performance verification, and (3) proficiency testing. This procedure may be used to evaluate a wide range of equipment and has applications to many test procedures. Implementation of this procedure in the Federal Highway Administration contractor laboratories has greatly reduced the within-and between-lab variability associated with the Long-Term Pavement Performance resilient modulus test procedures.
https://www.fhwa.dot.gov/pavement/ltpp/pubs/02034/
Highway Concrete Pavement Technology Development and Testing: Volume I – Field Evaluation of Strategic Highway Research Program (SHRP) C-202 Test Sites (Alkali-Silica Reaction (ASR)
FHWA-RD-02-082
This study consists of continued field evaluations of treatments to four pavements suffering from distress due to alkali-silica reaction (ASR). One set of treatments was evaluated on existing pavements in Delaware, California, and Nevada that already showed ASR-related distress. Two of the existing pavements were located in relatively dry environments, while the third was located in a moderately wet environment. The fourth site, in New Mexico, consisted of treatments on newly constructed pavements built with known reactive aggregates.
FHWA Research Library and https://www.fhwa.dot.gov/pavement/pccp/pubs/02082/
Highway Concrete Pavement Technology Development and Testing: Volume II – Field Evaluation of Strategic Highway Research Program (SHRP) C-203 Test Sites (Freeze-Thaw Resistance)
FHWA-RD-02-083
Field test sections were constructed during 1992 as part of the Strategic Highway Research Program (SHRP) investigation of the frost resistance of concrete. The first freeze-thaw related deterioration expected for pavement concrete exposed to de-icing salt would be salt scaling. The D-cracking mitigation study indicated that in many cases the D-cracking returned after 6 years, independent of the mitigation technique tried.
FHWA Research Library and https://www.fhwa.dot.gov/pavement/pccp/pubs/02083/
Highway Concrete Pavement Technology Development and Testing: Volume III – Field Evaluation of Strategic Highway Research Program (SHRP) C-205 Test Sites (High Performance Concrete)
FHWA-RD-02-084
This Research study, sponsored by the Federal Highway Administration, summarizes the field performance of eight high-early-strength (HES) concrete patches between 1994 and 1998. The patches were constructed mainly with Type III cement, four different types of coarse aggregate, and three different types of fine aggregate. Some of the results of interest include the effect of water reducer type, curing method, and aggregate type on long-term durability. The report also presents comparisons of the rapid chloride permeability and AC impedance test results and the rate of strength gain for the mixes evaluated.
FHWA Research Library and https://www.fhwa.dot.gov/pavement/pccp/pubs/02084/
Highway Concrete Pavement Technology Development and Testing: Volume IV-Field Evaluation of Strategic Highway Research Program (SHRP) C-206 Test Sites (Early Opening of Full-Depth Pavement Repairs)
FHWA-RD-02-085
The objective of this study was to monitor and evaluate the performance of experimental full-depth repairs made with high-early-strength (HES) materials placed under Strategic Highway Research Program (SHRP) project C-206, Optimization of Highway Concrete Technology. The scope of this study included 5-year monitoring of SHRP C-206 full-depth experiment sections, analyzing the data, and revising the guidelines for early opening of full-depth PCC pavement repairs as needed. The monitoring program consisted of annual visual distress surveys to monitor the development of cracking, faulting, and spalling.
FHWA Research Library
Highway Concrete Pavement Technology Development and Testing: Volume V-Field Evaluation of Strategic Highway Research Program (SHRP) C-206 Test Sites (Bridge Deck Overlays)
FHWA-RD-02-086
Two types of concrete overlays and latex-modified Type III Portland cement concrete were installed and tested as part of the Strategic Highway Research Program Project: Optimization of Highway Concrete

Technology--Bridge Deck Overlays. This report summarized the 5-year study to evaluate the long-term performance of the overlays.
FHWA Research Library and https://www.fhwa.dot.gov/pavement/pccp/pubs/02086/
Verification of Long-Term Pavement Performance Virtual Weather Stations: Phase I Report — Accuracy and Reliability of Virtual Weather Stations
FHWA-RD-03-092
This report documents a study undertaken to examine the reliability and accuracy of the LTPP climatic data. The study confirmed that accurate daily, monthly, and yearly estimates of climatic data for a project location can be derived by using the NCDC weather data for several nearby weather stations. The variation in the climatic data was also characterized.
https://www.fhwa.dot.gov/pavement/ltpp/pubs/03092/
Seasonal Variations in the Moduli of Unbound Pavement Layers
FHWA-HRT-04-079
The in situ moduli of unbound pavement materials vary on a seasonal basis as a function of temperature and moisture conditions. Knowledge of these variations is required for accurate prediction of pavement life for pavement design and other pavement management activities. The primary objective of this study is to advance the rational estimation of seasonal variations in back-calculated pavement layer moduli using data collected via the Seasonal Monitoring Program of the Long-Term Pavement Performance Program. Principal components of this endeavor included: evaluation of the moisture predictive capabilities of the Enhanced Integrated Climatic Model (EICM); development of empirical models to predict back-calculated pavement layer moduli as a function of moisture content, stress state, and other explanatory variables; and trial application of the models developed to prediction back-calculated moduli for unbound pavement layers.
https://www.fhwa.dot.gov/pavement/ltpp/pubs/04079/
Computer-Based Guidelines for Concrete Pavements, Volume III: Technical Appendices
FHWA-HRT-04-127
This report documents enhancements incorporated in the (High PERformance PAVing) HIPERPAV II software. Enhancements made within this project include the addition of two major modules: a module to predict the performance of JPCP as affected by early-age factors; and a module to predict the early-age behavior and early life of CRCP. Two additional FHWA studies were also incorporated: one that predicts dowel bearing stresses as a function of environmental loading during the early age; and a module for optimization of concrete paving mixes as a function of 3-day strength, 28-day strength, and cost. Additional functionality to the software was also incorporated by reviewing and prioritizing the feedback provided by users of the first generation of the software, HIPERPAV I.
FHWA Research Library
Long-Term Plan for Concrete Pavement Research and Technology--The Concrete Pavement Road Map: Volume I, Background and Summary
FHWA-HRT-05-052
The Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map) is a holistic, strategic plan for concrete pavement research and technology transfer. The CP Road Map is a 7-10-year plan that includes 12 distinct but integrated research tracks leading to specific products and processes. Volume I describes why the research plan is needed, how it was developed, and generally, what the plan includes.
FHWA Research Library and NTIS and https://www.fhwa.dot.gov/pavement/pccp/pubs/05052/
Long-Term Plan for Concrete Pavement Research and Technology--The Concrete Pavement Road Map: Volume II, Tracks
FHWA-HRT-05-053
The Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map) is a holistic, strategic plan for concrete pavement research and technology transfer. The CP Road Map is a 7-10-year plan that includes 12 distinct but integrated research tracks leading to specific products and processes. Volume II describes in detail the 12 track action items, a list of subtracks, and detailed problem statements within each subtrack.
FHWA Research Library and https://www.fhwa.dot.gov/pavement/pccp/pubs/05053/
Achieving a High Level of Smoothness in Concrete Pavements Without Sacrificing Long-Term Performance
FHWA-HRT-05-068

In a PCC pavement, it is important to achieve both a high level of smoothness during construction, as well as a satisfactory long-term performance. This report: (1) assesses whether high initial smoothness translates into better long-term performance, (2) identifies design features and materials properties in PCC pavements that can cause an initially smooth pavement to exhibit detrimental long-term performance, (3) provides guidance on materials properties, design features, and construction procedures to avoid these detrimental effects, (4) investigates how the smoothness of a PCC pavement measured immediately after construction can change over the short term, and (5) looks at data collection issues related to lightweight inertial profilers.

FHWA Research Library

Optimization of Traffic Data Collection for Specific Pavement Design Applications
FHWA-HRT-05-079

The objective of this study is to establish the minimum traffic data collection effort required for pavement design applications satisfying a maximum acceptable error under a prescribed confidence level.

FHWA Research Library and https://www.fhwa.dot.gov/pavement/ltpp/pubs/05079/index.cfm

Review of the Long-Term Pavement Performance Backcalculation Results—Final Report
FHWA-HRT-05-150

A new approach to determine layered elastic moduli from in situ load-deflection data was developed. This "forwardcalculation" approach differs from backcalculation in that modulus estimates come directly from the load and deflection data using closed-form formulae rather iteration. The forwardcalculation equations are used for the subgrade and the bound surface course for both flexible and rigid pavement falling weight deflectometer (FWD) data. Intermediate layer moduli are estimated through commonly used modular ratios between adjacent layers.

FHWA Research Library and https://www.fhwa.dot.gov/pavement/ltpp/pubs/05150/

Guidelines for Review and Evaluation of Backcalculation Results
FHWA-HRT-05-152

This document presets a new approach to determining layered elastic moduli from in situ load-deflection data, which was developed under the Federal Highway Administration's project for reviewing Long-Term Pavement Performance (LTPP) Backcalculation data. This approach is called forward calculation, and it differs from Backcalculation in that modulus estimates are calculated directly from the load and deflection data using closed-form formulae rather than through iteration. The closed-form forward calculation equations are used for the subgrade and the bound surface course, respectively, for both flexible and rigid pavement falling weight deflectometer (FWD) data. Intermediate layer moduli are estimated through commonly used modular ratios between adjacent layers.

https://www.fhwa.dot.gov/pavement/ltpp/pubs/05152/

Identifying Incompatible Combinations of Concrete Materials: Volume I--Final Report
FHWA-HRT-06-079

Unexpected interactions between otherwise acceptable ingredients in Portland cement concrete are becoming increasingly common as cementitious systems become more complex and demands on the systems are more rigorous. Such incompatibilities are exhibited as early stiffening or excessive retardation, potential for uncontrolled early-age cracking, and unstable or unacceptable air void systems. A number of test methods have been reviewed to assess their usefulness in detecting incompatibility. A protocol has been developed to allow product manufactures, and concrete producers to monitor their materials and concrete systems. This report is the first of two volumes.

FHWA Research Library

Identifying Incompatible Combinations of Concrete Materials: Volume II--Test Protocol
FHWA-HRT-06-080

Unexpected interactions between otherwise acceptable ingredients in Portland cement concrete are becoming increasingly common as cementitious systems become more complex and demands on the systems are more rigorous. Several test methods have been reviewed to assess their usefulness in early detection of incompatibility, and thus prevent pavement field problems. A protocol has been developed to allow product manufacturers, concrete producers, contractors, and owners to monitor materials and concrete systems. The protocol has two phases: relatively simple field tests to provide early warnings of potential problems and central laboratory tests to support and confirm the field work.

FHWA Research Library

Review of the Long-Term Pavement Performance Backcalculation Results--Final Report
FHWA-HRT-06-150

A new approach to determine layered elastic moduli from in situ load-deflection data was developed. This "forward calculation" approach differs from backcalculation in that modulus estimates come directly from the load and deflection data using closed-formulae rather iteration. The forward calculation equations are used for the subgrade and the bound surface course for both flexible and rigid pavement falling weight deflectometer (FWD) data. Intermediate layer moduli are estimated through commonly used modular ratios between adjacent layers.
FHWA Research Library

6 Safety

Brochures

Safety Analyst Brochure
FHWA-HRT-06-124
SafetyAnalyst is a set of software tools under development to help State and local highway agencies advance their programming of site-specific safety improvements. SafetyAnalyst will incorporate state-of-the-art approaches to safety management to guide the decisionmaking process on safety improvement needs and a system wide program of improvement projects. SafetyAnalyst also will include economic analysis tools to ensure that transportation agencies get the greatest possible benefit from each dollar committed to improving highway safety.
http://www.tfhrc.gov/safety/pubs/06124/index.htm

Fact Sheets

PedSafe
FHWA-HRT-06-042
The tools available in the Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE) are designed to enable practitioners to effectively select and review engineering, education, or enforcement treatments to mitigate a known crash problem or to help change motorist and/or pedestrian behaviors.
https://www.fhwa.dot.gov/crt/marketready/pedsafe.pdf
QuickZone
FHWA-HRT-06-044
QuickZone is a traffic impact analysis tool that can be used to estimate work zone delays. An enhanced second version of QuickZone, known as QuickZone 2.0, was released in February 2005. This new version adds a graphical user interface for network development, an enhanced cost analysis tool, and the capability for modeling two-way, one-lane operations.
https://www.fhwa.dot.gov/crt/marketready/quickzone.pdf
Red Light Cameras
FHWA-HRT-06-045
Red light camera (RLC) technology can make intersections safer. RLCs detect a motor vehicle that passes over sensors in the pavement after a traffic signal has turned red. The sensors are connected to computers in high-speed cameras, which take two photographs of the violation.
https://www.fhwa.dot.gov/crt/marketready/redlight.pdf
Road Safety Audits
FHWA-HRT-06-046
Road safety audits (RSA) are a formal safety performance examination of an existing or future road or intersection by an independent audit team. These step-by-step procedures can be performed during any or all stages of a project, including the planning, preliminary design, detailed design, traffic control, construction planning, or preopening stages.
https://www.fhwa.dot.gov/crt/marketready/roadsafety.pdf
Roundabouts
FHWA-HRT-06-047
A roundabout is a one-way, circular intersection in which traffic flows around a center island. Roundabouts are designed to meet the needs of all road users--drivers, pedestrians, pedestrians with

disabilities, and bicyclists. A roundabout eliminates some of the conflicting traffic, such as left turns, which cause crashes at traditional intersections. Because roundabout traffic enters or exits only through right turns, the occurrence of severe crashes is substantially reduced.
https://www.fhwa.dot.gov/crt/marketready/roundabouts.pdf
Rumble Strips
FHWA-HRT-06-048
Rumble strips are raised or grooved patterns on the roadway shoulder that provide both an audible warning and a physical vibration to alert drivers that they are leaving the driving land. In addition to warning inattentive drivers, rumble strips help drivers stay on the road during inclement weather when visibility is poor.
https://www.fhwa.dot.gov/crt/marketready/rumblestrips.pdf
Cable Median Barriers
FHWA-HRT-06-058
Median crossover crashes often result in fatalities or severe injuries to occupants of the errant vehicle and the motorists in the opposing traffic lanes. State departments of transportation are interested in reducing median crossover crashes through the use of median barriers. As an alternative to concrete and metal beam barriers, some States are turning to cable median barriers in areas where there is sufficient median width and a high potential for crashes.
https://www.fhwa.dot.gov/crt/marketready/cable.pdf
Federal Outdoor Impact Laboratory
FHWA-HRT-06-107
The Federal Outdoor Impact Laboratory (FOIL) is a fully equipped outdoor crash testing laboratory and research facility used to support the Federal Highway Administration's (FHWA) Safety Research and Development (R&D) programs and other federally funded security initiatives. Researchers use the facility to extend their understanding of crash events by staging controlled, high-speed motor vehicle collisions. The facility typically is used to confirm the accuracy of computer-generated crash predictions.
http://www.tfhrc.gov/about/foil.htm
FHWA/NHTSA National Crash Analysis Center Fact Sheet
FHWA-HRT-06-110
The National Crash Analysis Center (NCAC) is a globally unique storehouse of safety expertise and information that focuses on advancing new technologies and tools for crash analysis. NCAC primarily supports the U.S. Department of Transportation's strategic goal to reduce fatalities and injuries on the Nation's roadways, but has served to enhance efforts to improve safety worldwide. The missions, accomplishments, current activities, future activities, partnerships and customers of the NCAC are discussed in this Fact Sheet.
FHWA Research Library

Flyers

Interactive Highway Safety Design Model
FHWA-HRT-06-100
A suite of evaluation modules offers comprehensive assessment capabilities. There are five evaluation modules in the public release of IHSDM for two-lane rural highways. Research and development efforts are underway to add evaluation capabilities for multilane rural highways and urban and suburban arterials.
FHWA Research Library

TechBriefs

Evaluation of Safety, Design, and Operation of Shared-Use Paths
FHWA-HRT-05-139
This TechBrief is a summary of Evaluation of Safety, Design, and Operation of Shared-Use Paths: Final Report, FHWA-HRT-05-137.
FHWA Research Library and http://www.tfhrc.gov/safety/pubs/05139/index.htm
Federal Highway Administration University Course on Bicycle and Pedestrian Transportation

FHWA-HRT-06-065
The second edition of the Federal Highway Administration (FHWA) University Course on Bicycle and Pedestrian Transportation, a set of resources designed to provide background materials for an undergraduate or graduate university course on bicycling and walking, is now available from the FHWA. The FHWA distributes this teaching resource to stimulate the development of nation-wide university courses on bicycle and pedestrian transportation. This TechBrief lists the teaching materials available.
FHWA Research Library and http://www.tfhrc.gov/safety/pedbike/pubs/06065/index.htm

Technical Reports

Evaluation of LS-DYNA Wood Material Model 143
FHWA-HRT-04-096
Calculations are performed with the finite element code LS-DYNA to evaluate the performance of wood material model 143 and to set default material properties for southern yellow pine and Douglas fir. Correlations with published test data include static bending and compression simulations of dry timbers, static bending of saturated posts, and dynamic simulation of saturated posts impacted by bogie vehicles.
FHWA Research Library and http://www.tfhrc.gov/safety/pubs/04096/index.htm
Safety Effects of Marked VersusUnmarked Crosswalks at Uncontrolled Locations, Final Report and Recommended Guidelines
FHWA-HRT-04-100
The purpose of this study was to determine whether marked crosswalks at uncontrolled locations are safer than unmarked crosswalks under various traffic and roadway conditions. Another objective was to provide recommendations on how to provide safer crossings for pedestrians. This study involved an analysis of 5 years of pedestrian crashes at 1,000 marked crosswalks and 1,000 matched unmarked comparison sites. All sites in this study had no traffic signal or stop sign on the approaches.
FHWA Research Library and http://www.tfhrc.gov/safety/pubs/04100/index.htm
Enhanced Night Visibility Series Executive Summary
FHWA-HRT-04-132
This volume, an executive summary of the Enhanced Night Visibility project, is the first of 18 volumes that report on the project's evaluation of the merit of implementing supplemental ultraviolet headlamps, supplemental infrared systems, and other vision enhancement systems (VESs) to enhance drivers' nighttime roadway safety. The entire project evaluated 18 VESs in terms of their ability to provide object detection and recognition. Objects included scenarios with pedestrians standing or walking in different locations on the roadway. Pedestrians were dressed in black, white, or blue clothing to produce varying levels of contrast with their surroundings. Detection and recognition testing took place in clear weather, rain, snow, and fog conditions. Project research also evaluated a subset of the VESs for their effect on drivers' disability and discomfort glare.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04132/index.cfm
Enhanced Night Visibility Series, Volume III: Phase II—Study 1: Visual Performance During Nighttime Driving in Clear Weather
FHWA-HRT-04-134
Phase II—Study 1 was performed as a stepping stone to expand the knowledge of how different vision enhancement systems can affect detection and recognition of different types of objects. The empirical testing for this study was performed on the Smart Road testing facility during clear weather conditions. A total of 30 participants were involved in the study. A 12 by 9 by 3 mixed-factorial design was used to investigate the effects of different types of vision enhancement systems, types of objects on the roadway, and driver's age on detection and recognition distances; subjective evaluations were obtained for the different systems as well.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04134/index.cfm
Enhanced Night Visibility Series, Volume IV: Phase II—Study 2: Visual Performance During Nighttime Driving in Rain
FHWA-HRT-04-135
Phase II, Study 2 (rainy weather) was performed following the same procedures used for Study 1 (clear weather). Study 2 helped expand the knowledge of how current vision enhancement systems can affect detection and recognition of different types of objects while driving during adverse weather, specifically

during rain conditions. The empirical testing for this study was performed on the Virginia Smart Road; the rain was controlled by weather making equipment. Thirty participants were involved in the study. A 12 by 7 by 3 mixed factorial design was used to investigate the effects of different types of vision enhancement systems, different types of objects on the roadway, and driver's age on detection and recognition distances; subjective evaluations also were obtained for the different vision enhancement systems.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04135/index.cfm

Enhanced Nighttime Visibility Phase II-Study 3: Visual Performance During Nighttime Driving Under Adverse Weather Conditions-Snow, Volume V
FHWA-HRT-04-136
Phase II, Study 3 was part of the Enhanced Night Visibility project, a larger research effort investigating drivers' visual performance during nighttime driving. Study 3 helped expand the knowledge of how current vision enhancement systems can affect detection and recognition of different types of objects during adverse weather, specifically for snow conditions. A total of 20 participants detected and recognized different roadway objects while driving experimental vehicles equipped with various headlamps in a snow condition. A 4 by 3 by 2 mixed factorial design was used to investigate the effects of the different types of vision enhancement systems, the types of objects on the roadway, and driver's age on detection and recognition distances. Subjective evaluations for the different systems were obtained as well.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04136/index.cfm

Enhanced Night Visibility Series, Volume VII: Phase II—Study 5: Evaluation of Discomfort Glare During Nighttime Driving in Clear Weather
FHWA-HRT-04-138
Phase II—Study 5 helped expand the knowledge of how current vision enhancement systems (VESs) affect the discomfort glare experienced by nighttime drivers. The empirical testing for this study was performed on the Smart Road. Sixty participants were involved in the study, which consisted of two data collection efforts. An 11 (VES) by 3 (Age) experimental design was used to investigate the effects of different types of VESs and driver's age on discomfort glare. In addition, an evaluation of the Schmidt-Clausen and Bindels equation was performed to determine its predictive value in driving scenarios with oncoming glare.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04138/index.cfm

Enhanced Night Visibility Series, Volume VIII: Phase II—Study 6: Detection of Pavement Markings During Nighttime Driving in Clear Weather
FHWA-HRT-04-139
Phase II—Study 6 was part of the Enhanced Night Visibility project, a larger research effort investigating drivers' visual performance during nighttime driving. Study 6 evaluated the possibility of improving the detection distances of pavement markings through the use of fluorescent materials, combined with augmentation of vehicle headlamps with UV–A sources. Three different pavement marking materials and 11 headlamp configurations—vision enhancement systems (VESs)—were evaluated. The VESs studied included halogen low beam (HLB), high intensity discharge (HID), halogen high beam (HHB), and high output halogen (HOH) sources. Both the HLB and HID configurations were used in the systems augmented with UV–A sources. The pavement marking materials included fluorescent paint, fluorescent thermoplastic, and a two-component liquid system.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04139/index.cfm

Enhanced Night Visibility Series, Volume IX: Phase II—Characterization of Experimental Objects
FHWA-HRT-04-140
The Enhanced Night Visibility (ENV) project is a series of experiments undertaken to investigate different visual enhancement systems (VES) for the nighttime driving task. The purpose of this portion of the ENV project is to establish the photometric nature of the objects presented to the observer. The photometric measurements of interest are the headlamp illuminance, object luminance, and the background luminance. Other calculated parameters were established such as object contrast with the background, reflectance of the objects, and object visibility level. The measurements were taken and calculated for 11 VESs and 8 object types.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04140/index.cfm

Enhanced Night Visibility Series, Volume XII: Overview of Phase II and Development of Phase III Experimental Plan
FHWA-HRT-04-143

This volume provides an overview of the six studies that compose Phase II of the Enhanced Night Visibility project and the experimental plan for its third and final portion, Phase III. The Phase II studies evaluated up to 12 vision enhancement systems in terms of drivers' ability to detect and recognize objects, visibility of pavement markings, and discomfort caused by glare from oncoming headlamps. Drivers' ability to detect and recognize objects was assessed in clear, rain, fog, and snow conditions. The results indicated that supplemental ultraviolet headlamps do not provide sufficient benefit to justify further testing. The performance of supplemental infrared (IR) vision enhancement systems, on the other hand, was robust enough to suggest further investigation. As a result, additional IR testing, disability glare testing, and off-axis object detection on the Virginia Smart Road were proposed as a replacement for public road Phase III testing with UV–A. The details of the experimental plan for each of these testing areas are provided in the Phase III portion of this report.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04143/index.cfm
Enhanced Night Visibility Series, Volume XIII: Phase III—Study 1: Comparison of Near Infrared, Far Infrared, High Intensity Discharge, and Halogen Headlamps on Object Detection in Nighttime Clear Weather
FHWA-HRT-04-144
Phase III—Study 1 was performed to further explore findings on far infrared (FIR) systems from Phase II, to investigate near infrared (NIR) and high intensity discharge (HID) technologies, and to investigate detection and recognition of retroreflective infrastructure components. The empirical testing for this study was performed at the Virginia Smart Road testing facility during clear weather conditions. A total of 18 participants were involved in the study. A 6 by 3 by 17 mixed-factorial design was used to investigate the effects of 6 different types of vision enhancement systems, 3 age groups, and 17 object presentations on detection and recognition distances; subjective evaluations were obtained for the different systems as well. The results of the empirical testing suggest that infrared (IR) systems, when designed correctly, can provide pedestrian detection benefit in clear weather, particularly for pedestrians in dark clothing and veiled in the glare of oncoming headlamps. A wider field of view display appears to facilitate detection in curves of 1,250-m radius. Retroreflective objects may be detected earlier in an NIR display, but require direct visual observation to recognize the object or read signage. HID systems did not provide detection benefit over the baseline halogen headlamps tested.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04144/index.cfm
Enhanced Night Visibility Series, Volume XIV: Phase III—Study 2: Comparison of Near Infrared, Far Infrared, and Halogen Headlamps on Object Detection in Nighttime Rain
FHWA-HRT-04-145
Enhanced Night Visibility Series Phase III, Study 2 (rainy weather) was performed following the same procedures used for Phase III, Study 1 (clear weather). Study 2 served to expand the knowledge of how current vision enhancement systems can affect detection and recognition of different types of objects while driving during adverse weather, specifically during rainy conditions. The empirical testing for this study was performed on the Virginia Smart Road; the rain was controlled by weather-making equipment. Fifteen participants were involved in the study. A 4 by 8 by 3 mixed factorial design was used to investigate the effects of different types of vision enhancement systems, different types of objects on the roadway, and driver's age on detection and recognition distances; subjective evaluations also were obtained for the different vision enhancement systems.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04145/index.cfm
Enhanced Night Visibility Series, Volume XVI: Phase III—Characterization of Experimental Objects
FHWA-HRT-04-147
The Enhanced Night Visibility (ENV) project is a series of experiments undertaken to investigate different visual enhancement systems (VES) for the nighttime driving task. The purpose of this characterization activity is to establish the photometric nature of the objects presented to the observer during the ENV Phase III studies, which assessed headlamp beam patterns as well as the influence of infrared (IR) technology on object detection. The photometric measurements of interest are the object luminance and the background luminance. Other calculated parameters were established such as object contrast with the background and object visibility level. The measurements were taken at the threshold of detection and calculated for three visible-light VESs and three IR VESs.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04147/index.cfm
Enhanced Night Visibility Series, Volume XVII: Phases II and III—Characterization of Experimental Vision Enhancement Systems

FHWA-HRT-04-148
This report is a summary of the photometric characterization of the headlamps that were included in the vision enhancement systems used for the Enhanced Night Visibility (ENV) project. Each of the visible light and ultraviolet sources used for the visibility studies have been photometrically characterized and documented in this report. The report also contains a discussion of the headlamp aiming method.
https://www.fhwa.dot.gov/publications/research/safety/humanfac/04148/index.cfm
Enhanced Night Visibility Series Volume XVIII: Overview of Phase III
FHWA-HRT-04-149
This volume provides an overview of the three studies that compose Phase III of the Enhanced Night Visibility project. The first study compared two prototype near infrared (NIR) vision enhancement systems (VESs), an infrared thermal imaging system (IR–TIS), and three headlamp-only systems in terms of drivers' nighttime detection and recognition of 17 objects. The objects included pedestrians on both sides of straight and curved sections of the road, roadway signs, and obstacles. A subset of the VESs and objects also were tested in rain conditions. The results indicated that both NIR and IR–TIS, if correctly implemented, provided additional detection benefit over headlamps alone for pedestrians in clear conditions. In rain conditions, the NIR also benefited object detection. A disability and discomfort glare study was also conducted with four high intensity discharge lamps and one halogen low-beam lamp. The results indicated that maximum illumination was the best predictor of driver discomfort and disability.
https://www.fhwa.dot.gov/publications/research/safety/04149/index.cfm
Safety Effects of Differential Speed Limits on Rural Interstate Highways
FHWA-HRT-05-042
For the visible-light VESs, the photometric data showed the influence of the headlamp distribution and the suitability of the various metrics to predict object visibility. For the IR systems, the data gave an indication of the usage of the in-vehicle systems and their distraction level for the driver.
http://www.tfhrc.gov/safety/pubs/05042/index.htm
Crash Cost Estimates by Maximum Police-Reported Injury Severity Within Selected Crash Geometries
FHWA-HRT-05-051
This paper presents estimates for the economic (human capital) and comprehensive costs per crash for six KABCO groupings within 22 selected crash types and within two speed limit categories (<=72 kilometers per hour (km/h) (<=45 miles per hour (mi/h)) and >=80 km/h (>= 80 / 50 mi/h)). The comprehensive costs include nonmonetary losses. To produce these cost estimates, previously developed costs per victim keyed on the AIS injury severity scale were merged into U.S. traffic crash data files that scored injuries in both AIS and KABCO scales to produce per crash estimates. The detailed estimates of this study make it possible to include crash severity comparisons in the analysis of different types of crashes by attaching costs to them, and to do so in 2001 dollars.
http://www.tfhrc.gov/safety/pubs/05051/index.htm
Roadway Safety Hardware Asset Management Systems Case Studies
FHWA-HRT-05-073
This study provides information to State DOTs on roadway safety hardware management systems that could help increase their use of state-of-the-practice techniques. This report was developed for State DOT personnel, particularly chief engineers and other top management, involved with the planning, funding, and execution of roadway safety hardware management systems.
FHWA Research Library and http://www.tfhrc.gov/safety/pubs/05073/index.htm
Why Your Agency Should Consider Asset Management Systems for Roadway Safety
FHWA-HRT-05-077
This primer provides a general overview of asset management systems for roadway safety elements, and initial guidance for agencies beginning to consider them. Asset Management is a strategic approach to managing transportation infrastructure elements. It provides a systematic process for maintaining, upgrading and operating physical assets cost effectively. Information in the primer can help State departments of transportation (DOT) increase their use of state-of-the practice techniques on roadway safety hardware management systems. The primer was developed for State DOT personnel, particularly chief engineers and other top management, involved with the planning, funding, and execution of roadway safety hardware management systems.
http://www.tfhrc.gov/safety/pubs/05077/index.htm
Evaluation of Safety, Design, and Operation of Shared-Use Paths Final Report
FHWA-HRT-05-137

Shared-use paths are becoming increasingly busy in may places in the United States. Path designers and operators need guidance on how wide to make new or rebuilt paths, and whether to separate the different types of users. The current guidance is not very specific. The purpose of this project was to develop a level of service estimation method for shared-use paths that overcome limitations. This report documents the research conducted during the project.

FHWA Research Library

Shared-Use Path Level of Service Calculator A User's Guide
FHWA-HRT-05-138
The purpose of this project was to develop a level of service (LOD) estimation method for shared use paths that overcomes these limitations. The research included the development of the theory of traffic flow on a path. This report provides step-by-step instructions on how to use the LOS procedure and spreadsheet calculation tool, which can be downloaded from the Turner-Fairbank Highway Research Center Web site at www.tfhrc.gov.
FHWA Research Library and http://www.tfhrc.gov/safety/pedbike/pubs/05138/index.htm
Multiyear Plan for Bridge and Tunnel Security Research, Development, and Deployment
FHWA-HRT-06-072
Although the Federal Highway Administration (FHWA) has always been active in conducting research and development to mitigate natural hazards such as flooding and scour, earthquakes, wind, and wind-induced events, designing for security is a new task. Because the challenge is tremendous, FHWA has led multiple outreach sessions to identify needs and gaps. This input provided by experts in the field of bridge engineering and others has been evaluated and a program has been proposed to design highway bridges and tunnels for security.
FHWA Research Library and http://www.tfhrc.gov/structur/pubs/06072/index.htm
Traffic Safety Information Systems International Scan: Strategy Implementation White Paper
FHWA-HRT-06-099
Safety data provide the key to making sound decisions on the design and operation of roadways, but deficiencies in many States' safety databases do not allow for good decisionmaking. The Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the National Cooperative Highway Research Program (NCHRP) sponsored a scanning study of how agencies in the Netherlands, Germany, and Australia develop and use traffic safety information systems. That scan produced a report that included recommendations for advancing safety themes in the areas of strategy, efficiency, and utility. This current report is the result of a follow-on effort to build on the scan team's final report and draft implementation plan by reviewing in detail the strategies suggested, providing action-related details to some of the critical strategies, and adding new strategies to help reach the team's goals.
http://www.tfhrc.gov/safety/pubs/06099/index.htm

7 Structures

Fact Sheets

Prefabricated Bridge Elements
FHWA-HRT-06-043
Prefabricated bridge construction can help minimize traffic delays and community disruptions by reducing onsite construction time and improving quality, traffic control, and safety. Using prefabricated bridge elements and systems means that time-consuming formwork construction, curing, and other tasks associated with fabrication can be done off site in a controlled environment without affecting traffic.
https://www.fhwa.dot.gov/resourcecenter/teams/structures/str_7pbe.cfm
Accelerated Construction Technology Transfer
FHWA-HRT-06-054
ACTT is a strategic process that uses various innovative techniques, strategies, and technologies to minimize actual construction time, while enhancing quality and safety on today's large, complex multiphase projects. Sponsored by the American Association of State Highway and Transportation Officials' (AASHTO) Technology Implementation Group (TIG) and the Federal Highway Administration (FHWA), the ACTT process begins with a 2-day workshop in which a multidisciplinary team of 20 to 30 national transportation experts works with an equal number of their local counterparts to evaluate all

aspects of a project and develop recommendations for reducing construction time and enhancing safety and quality.
https://www.fhwa.dot.gov/resourcecenter/teams/construction/cpm_1ac.cfm
Continuous Flight Auger Piles
FHWA-HRT-06-056
Continuous flight augered piles can be installed quickly and inexpensively and are a viable foundation alternative to driven piles or drilled shafts for certain applications. CFA piles can support lateral earth and critical and noncritical structures and can be used in ground improvement applications. Typical highway project applications for CFA piles include structure support for new bridges, bridge widening, sound wall foundations, column support for embankment construction, and secant walls for lateral earth support. CFA piles are a good deep-foundation solution in areas that are environmentally sensitive or require minimal disturbance to human activity.
https://www.fhwa.dot.gov/resourcecenter/teams/geohydraulics/geo_1ap.cfm
Fiber-Reinforced Polymer
FHWA-HRT-06-062
Fiber-reinforced polymer (FRP) composite materials have the potential to revolutionize the repair of sign structures with cracked secondary support members. The Federal Highway Administration (FHWA) has researched the use of FRP for more than 20 years, and FRP has been used on a variety of bridges and other highway structures.
https://www.fhwa.dot.gov/resourcecenter/teams/structures/str_2frp.cfm
Geometric Design Laboratory Fact Sheet
FHWA-HRT-06-101
The mission of the Geometric Design Laboratory (GDL) is to provide technical support to the Office of Safety Research and Development to develop the Interactive Highway Safety Design Model (IHSDM, a suite of software tools for the safety evaluation of highway geometric design alternatives. GDL helps establish the standards and procedures for IHSDM software development, prepares the software system and functional specifications, performs verification and validation of the models that are core IHSDM components, performs Alpha testing of IHSDM software, coordinates the Beta testing of IHSDM software by potential end-users, and provides technical support to users of the IHSDM software.
FHWA Research Library

TechBriefs

Protocol for Selecting ASR-Affected Structures for Lithium Treatment
FHWA-HRT-06-071
This TechBrief describes a protocol for evaluating damaged concrete structures to determine whether they are suitable candidates for lithium treatment to address alkali-silica reaction (ASR). A major part of the TechBrief's source document, Protocol for Selecting Alkali-Silica Reaction (ASR)-Affected Structures for Lithium Treatment, deals with the approach/tools that can be used to determine whether ASP is the principal cause, or only a contributing factor to, the observed deterioration (diagnosis); determine the extend of deterioration due to ASR in the structure; and evaluate the potential for future expansion due to ASR (prognosis).
FHWA Research Library

Technical Reports

A Laboratory and Field Study of Composite Piles for Bridge Substructures
FHWA-HRT-04-043
The most commonly used pile materials are steel, concrete, and wood. These materials can degrade, and the degradation rate can be relatively rapid in harsh marine environments, and is financially costly. Because only minimal performance data have been collected for composite piles, a research project was undertaken to investigate (1) soil-pile interface behavior of composite piles, (2) the long-term durability of concrete filled fiber-reinforce polymers (FRP) shell composite piles, and (3) the driveability and axial and lateral load response of concrete-filled FRP composite piles and steel-reinforced recycled plastic piles by means of field tests and analyses.

FHWA Research Library and http://www.tfhrc.gov/structur/pubs/04043/index.htm
Guide for Curing of Portland Cement Concrete Pavements, Volume II
FHWA-HRT-05-038
Information on the current state of knowledge of curing hydraulic-cement concrete and on current curing practice was gathered by means of a literature review and a review of current standard guidance. The result of the investigation was a set of guidelines that focused particularly on attention to details of moisture retention and temperature immediately after placing and on details of selection of materials for final curing and determining when to apply final curing. Test methods for evaluating application rate of curing compound and effectiveness of curing were also reported.
FHWA Research Library and NTIS
Assessing Stream Channel Stability at Bridges in Physiographic Regions
FHWA-HRT-05-072
The objective of this study was to expand and improve a rapid channel stability assessment method developed previously by Johnson eta al. to include additional factors, such as major physiographic units across the United States, a greater range of bank materials and complexities, critical bank heights, stream types and processes, sand bed streams, and in-channel bars or lack of bars. Another goal of this study was to tailor Thorne's reconnaissance method for bridge inspection and stability assessment needs.
FHWA Research Library
Design of Continuously Reinforced Concrete Pavements Using Glass Fiber Reinforced Polymer Rebars
FHWA-HRT-05-081
This is Task 3: Continuously Reinforced Concrete Pavement. The corrosion resistance characteristics of glass fiber reinforced polymer (GFRP) rebars make them a promising substitute for conventional steel reinforcing rebars in continuously reinforced concrete pavements (CRCPs). Studies are conducted on the effect of using GFRP rebars as reinforcement in CRCP on concrete stress development, which is directly related to the concrete crack formation that is inevitable in CRCP.
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Interim Recommendations for the Use of Lithium to Mitigate or Prevent Alkali-Silica Reaction (ASR)
FHWA-HRT-06-073
This report provides a basic overview of ASR, including information on mechanisms, symptoms of ASR damage in field structures, mitigation approaches, test methods, and specifications. A comprehensive summary of lithium compounds is provided, including information their production, availability, and use in laboratory concrete studies and field applications.
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Job Site Evaluation of Corrosion-Resistant Alloys for Use as Reinforcement in Concrete
FHWA-HRT-06-078
Premature deterioration of the Nation's concrete highway and bridge structures as a consequence of chloride exposure and resultant corrosion reinforcing steel has evolved during the past four decades to become a formidable technological and economic problem. This study evaluated epoxy-coated reinforcing steel (ECR), and alternative corrosion-resistant reinforcement.
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