National Cooperative Highway Research Program (NCHRP)

Advancing Pavement Management and Design Through Research

June 2005
NCHRP- National Cooperative Highway Research Program

- An AASHTO program sponsored by state DOTs
- Started in 1962
- Annual funding ~ $35 million/year
- Contributes to advancements in all aspects of highways
- 8 fields of research (Administration, Planning, Design, Materials and Construction, Soils and Geology, Maintenance, Traffic, and Special Projects)
- 25 Subject areas (e.g., economics, forecasting, pavements, bituminous materials, mechanics and foundations, snow and ice control, illumination and visibility, and special projects)
NCHRP: Goal Oriented Research

- Responds to state DOT needs: DOTs and AASHTO committees propose research topics; SCOR selects projects.
- Ensures applicability of the results: state DOTs and other sectors of the highway industry participate in monitoring the research.
- Results are published by NCHRP (reports, digests, synthesis, CD-ROMs, and Web documents) or by AASHTO (guides/manuals, specifications, and test methods), and often adopted by state DOTs and other organizations.
NCHRP and Pavements

NCHRP pavement-related projects deal with

• Pavement Design/Performance Prediction
• Pavement Materials and Test Methods
• Pavement Construction/Rehabilitation
• Pavement Management and Evaluation
• Special Projects (strategic planning, research needs)
Pavement Design/Performance Prediction - Examples

- Mechanistic-Empirical Design Guide
- Reflection Cracking Models
- Top-Down Cracking Models
- Traffic Data Collection and Forecasting
Recognizing the limitations of the current AASHTO Guide for Design of Pavement Structures (1993) and the need for projections far beyond the original data, NCHRP sponsored a $7 million project to develop an improved guide. The Mechanistic Empirical Pavement Design Guide (MEPDG) and software are available:

http://www.trb.org/mepdg
Reflection Cracking Models

*NCHRP Project 1-41 will develop* mechanistic-based models for predicting reflection cracking in HMA overlays of flexible and rigid pavements and associated computational software for use in mechanistic-empirical procedures for overlay design and analysis.

(completion: mid 2007)
NCHRP Project 1-42A will develop mechanistic-based models for predicting top-down cracking in HMA layers for use in mechanistic-empirical procedures for design and analysis of new and rehabilitated flexible pavements. (contract pending)
Traffic Data Collection and Forecasting

NCHRP Project 1-39 developed

• Guidelines for Collecting Traffic Data and Software for Traffic Forecasting (NCHRP Report 538)

• Guidance on Equipment for Collecting Traffic Data (NCHRP Report 509)
Pavement Materials and Test Methods - Examples

- Evaluating Fracture and Rutting of HMA Mixtures
- Procedures for Evaluating Air-Entraining Admixtures for Highway Concrete
- Improved Cement Specifications and Test Methods
- Performance-Related Aggregate Tests
Simple Performance Tester for Superpave Mix Design

ShedWorks/IPC First-Article SPT
Simple Performance Test

*NCHRP Project 9-19 developed*

- A test that allows a determination of a mixture’s ability to resist fracture and permanent deformation under defined conditions.
- Test is recommended as a final stage in the Superpave volumetric mix design method (to confirm expected performance).

*(NCHRP Report 465)*
Accelerated Laboratory Rutting Tests: Asphalt Pavement Analyzer

*NCHRP Project 9-17 evaluated use of APA*

- Concluded that APA does not predict performance, but is useful as “pass/fail” type proof test for rutting-prone mix design.
- Developed a test procedure for using APA in determining rutting susceptibility of asphalt paving mixtures.

*(NCHRP Report 508)*
Cement and Concrete Test Methods

• *NCHRP Project 18-10* will develop procedures for evaluating and qualifying air-entraining admixtures for hydraulic cement concrete for highway applications (completion late 2005).

• *NCHRP Project 18-11* will recommend potential improvements to specifications and test protocols to determine the acceptability of cements with processing additions (completion early 2006).
Performance-Related Aggregate Tests

- *NCHRP Project 4-19 identified* a set of tests for screening aggregates used in HMA (predictors of performance) – NCHRP Report 405.
- *NCHRP Project 4-20C identified* tests for screening aggregates used PCC pavement (predictors of performance) – NCHRP RRD 281.
- *NCHRP Project 4-23 identified* a set of tests for screening unbound materials used in base and subbase layers of pavements (predictors of performance) – NCHRP Report 453.
- *NCHRP Project 4-31 will identify* tests for screening recycled HMA and PCC used in unbound pavement layers (completion early 2006).
Pavement Construction/Rehabilitation - Examples

- HMA Performance Related Specifications (PRS)
- PCC Early-Opening-to-Traffic (EOT) Concrete
- Pavement Texturing
- Dowel Alignment in Jointed Concrete Pavements
PRS (HMA) and EOT (PCC)

NCHRP Project 9-27 developed
• Performance-related specifications for hot-mix asphalt (NCHRP Report 455).

NCHRP Project 18-04B developed
• Guidelines for the proportioning, testing, and constructing “early-opening-to-traffic” concrete for pavement rehabilitation (6-8 and 20-24 hours) NCHRP Report 540 (in press).
Texturing and Dowel Alignment

NCHRP Project 10-67 will recommend
• A process for identifying and selecting appropriate texturing methods for defined conditions (completion early 2007).

NCHRP Project 10-69 will develop
• Guidelines for dowel alignment in concrete pavements (contract pending).
Pavement Management and Evaluation - Examples

• AASHTO Pavement Management Guide
• Guide for Pavement Friction
• Noise measurement/modeling
Pavement Management Guide
Pavement Management Guide

• Completed under NCHRP Project 1-35A; published by AASHTO in 2001 (replaced the 1990 AASHTO “Guidelines for Pavement Management Systems”)

• Addresses state-of-practice processes and technologies relevant to the development, implementation, and operation of pavement management systems.
NCHRP Project 1-43 will develop

- A Guide for Pavement Friction
- Focus on frictional characteristics with recognition of effects on noise generation and other considerations.
- Expected to replace the 1976 AASHTO “Guidelines for Skid Resistant Pavement Design"
- Completion: late October 2005.
Highway Noise Measurement & Modeling

*NCHRP Project 1-44 will develop*

- rational procedures for measuring tire-pavement noise applicable to both light and heavy vehicles operating at highway speeds and for all paved surfaces.

*NCHRP Project 8-56 will*

- *identify, locate, and quantify* the noise sources on typical commercial truck and tractor-semitrailer combinations for use in computer analysis of traffic noise impacts.
Special Projects - Examples

• Strategic Planning/Business Needs

• Data Analysis in Support of LTPP

• Product Development in Support of LTPP

• Synthesis of Highway Practice
Strategic Planning/Business Needs for Pavement Engineering

*NCHRP Project 20-7(127) identified* four business needs:

- Achieving desired performance level and life.
- Supporting effective management of pavement assets.
- Minimizing adverse impacts on users.
- Enhancing practitioners knowledge and user understanding of pavements.

- Adopted by the AASHTO Technical Committee on Pavements.
- Summarized in NCHRP RRD 276.
Data Analysis and Product Development in Support of LTPP

- *NCHRP Project Series 20-50 analyzed* LTPP data to determine trends and draw preliminary conclusions on the effects of site, design, and construction features and other factors on pavement response and performance.

- *NCHRP Project Series 20-51 supported* the development of products resulting from the LTPP studies.

- Final reports are available as NCHRP web documents.
NCHRP Synthesis of Highway Practice - Examples

• Measuring In-Situ Mechanical Properties of Pavement Subgrade Soils (NCHRP Synthesis 278)
• Evaluation of Pavement Friction Characteristics (NCHRP Synthesis 291)
• Significant Findings from Full-Scale/Accelerated Pavement Testing (NCHRP Synthesis 325)
• Automated Pavement Distress Collection Techniques (NCHRP Synthesis 334)
• Thin and Ultra-Thin Topping (NCHRP Synthesis 338)
More Information on NCHRP Pavement Research

• A list of “Current and Recently Completed Projects Related to Pavements” is available:
  - It identifies status of projects (completed, in progress, or anticipated).
  - It identifies available publications (reports, digests, web documents, etc.)

• Specific information or questions, contact Amir N. Hanna (ahanna@nas.edu/202/334-1892).
Programmed for FY 2006:
• 22 Continuation projects ($10.275 million)
• 38 New projects ($17.340 million)
• 13 Contingent projects ($4.900 million)
• Total 73 projects ($32.515 million) in 17 problem areas (safety, planning, environment, hydrology/hydraulics, administration/policy, operations, security, bridges, maintenance, materials, pavements, etc.)
• Includes materials (4), pavements (2)
Problem Statements for FY 2007 are due by September 15, 2005.
More Information/NCHRP Contact

• www.trb.org → NCHRP

• *NCHRP Contact*
  
  Dr. Amir N. Hanna
  
  ahanna@nas.edu
  
  202/334-1892/202/334-2006 (Fax)