TECHBRIEF

The Concrete Pavement Road Map

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Introduction

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 *Concrete Pavement Road Map Volume II.*

CP Road Map Vision

By 2015, the highway community will have a comprehensive, integrated, fully functional system of concrete pavement technologies that provides innovative solutions for customer-driven performance requirements.

Why is The CP Road Map Needed?

For most of the 20th century, the same materials—portland cement, high-quality aggregate, and water—were used in pavement concrete, with only minor refinements. This fairly forgiving formula allowed some variations in subgrade quality, construction practices, and other variables without sacrificing pavement performance.

In today's environment, however—with new, sometimes incompatible materials, more demanding production schedules, and other pressures—the old system for constructing concrete pavements is not as malleable.

The CP Road Map gives the highway community an opportunity to reinvent itself proactively through research.

What is Unique About The CP Road Map?

Comprehensive and strategic—The CP Road Map combines more than 250 research problem statements into 12 fully integrated, sequential, and cohesive tracks of research.

Innovative—The CP Road Map introduces a new, inclusive, and far-reaching approach to pavement research. It incorporates a comprehensive, flexible research database to track conducted research and revise or adjust as appropriate.

Stakeholder involvement—The CP Road Map was created by and intended for the Federal, State, and private concrete pave-

The Concrete Pavement Technology Program (CPTP) is an integrated, national effort to improve the long-term performance and cost-effectiveness of concrete pavements. Managed by the Federal Highway Administration (FHWA) through partnerships with State highway agencies, industry, and academia, the CPTP's primary goals are to reduce congestion, reduce costs, improve performance, and foster innovation. The program is designed to produce user-friendly software, procedures, methods, guidelines, and other tools for use in materials selection, mix design, pavement design, construction, and rehabilitation of concrete pavements.

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ment community. More than 400 stakeholders helped develop the plan through many brainstorming sessions, which began in 2001.

No cost or time limitations—The CP Road Map is a 7- to 10-year plan with an estimated overall cost of $250 million ($250 M).

Independent of any one agency or pot of money—Stakeholders with funds and expertise will pool their resources, jointly conduct and coordinate the research, and apply the results.

Inextricably linked to technology transfer—Development of innovative technology transfer methods is incorporated into the research tracks.

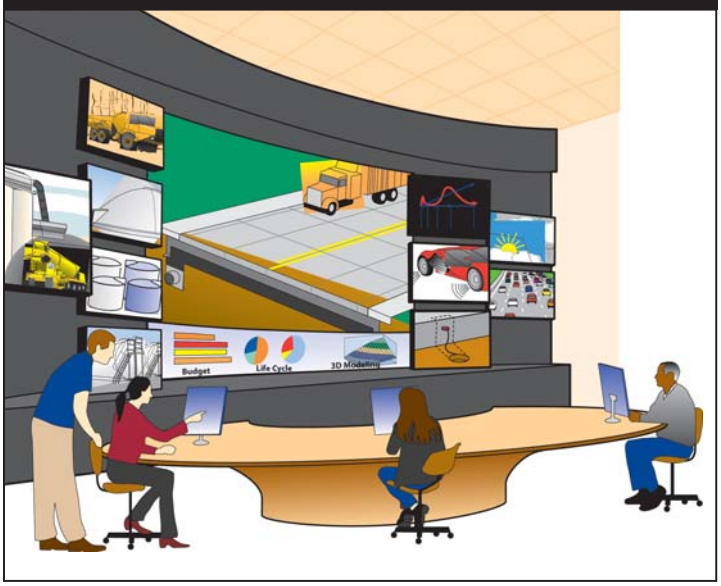
Research Tracks

Each of the CP Road Map tracks is a full research program in itself. Tracks 1 through 9 consist of timed sequences of research leading to products that are essential to reaching overall goals. In every phased track, one subtrack is devoted specifically to developing innovative technology transfer, training tools, and methods.

Research in many tracks is linked to related research in other tracks. Some critical research topics—such as pavement maintenance, foundations and drainage, and environmental advancements—are incorporated throughout the tracks. Making these links and sorting the problem statements through unique queries is possible through the CP Road Map research database.

The general range of costs associated with each track represents the time dedicated to the CP Road Map by multiple stakeholders who contributed to its development. The support needed for this effort comes from in-kind services and funding provided by a number of participants including industry organizations, State departments of transportation, and Federal agencies. These estimates are subject to change as the CP Road Map evolves.

1. Performance-Based Concrete Pavement Mix Design System

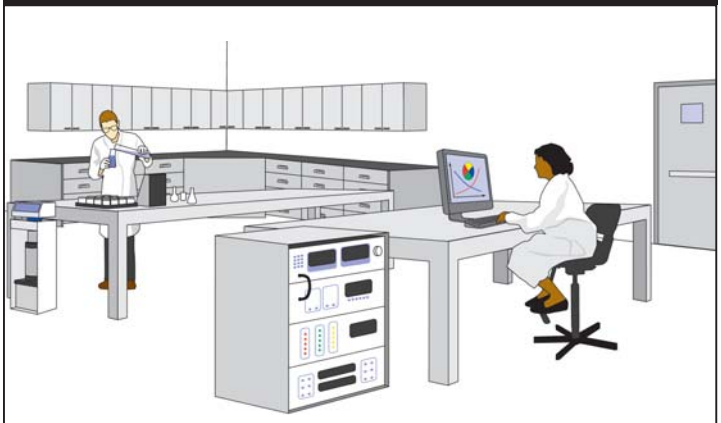


1. Performance-Based Concrete Pavement Mix Design System. ($30-68 M*)

This track will produce a practical yet innovative concrete mix design procedure with new equipment, consensus target values, common laboratory procedures, and full integration with both structural design and field quality control—a lab of the future. It also lays the groundwork for the concrete paving industry to assume more responsibility for mix designs as State highway agencies move from method specifications to more advanced acceptance tools.

*All numbers are rounded.

2. Performance-Based Design Guide for New and Rehabilitated Concrete Pavements



2. Performance-Based Design Guide for New and Rehabilitated Concrete Pavements. ($41-60 M)

Under this track, the concrete pavement research community will expand the mechanistic approach to pavement restoration and preservation strategies. This track builds on the comprehensive work done under the National Cooperative Highway Research Program (NCHRP) 1-37A (creating the *Mechanistic-Empirical Pavement Design Guide*) and continues to develop the models from that key work.

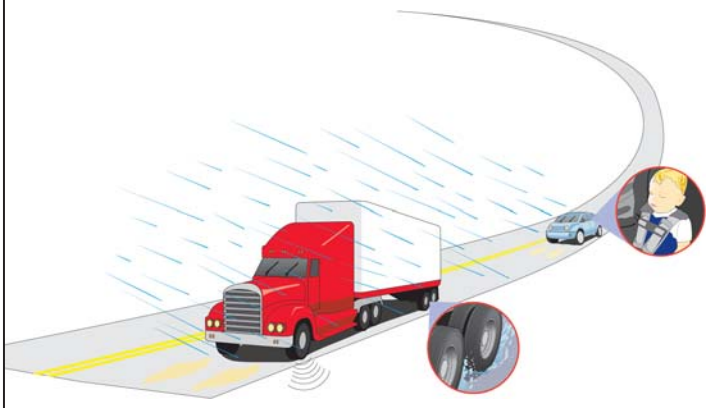
3. High-Speed Nondestructive Testing and Intelligent Construction Systems



3. High-Speed Nondestructive Testing and Intelligent Construction Systems. ($20-41 M)

This track will develop high-speed, nondestructive quality control systems to monitor pavement properties continuously during construction. As a result, instant adjustments can be made to ensure the finished product meets given performance specifications.

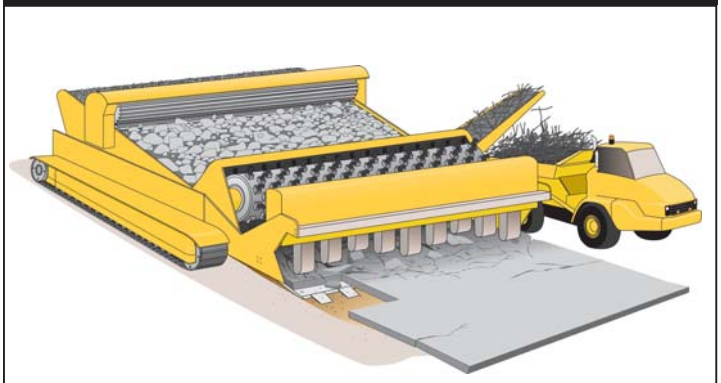
4. Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements



4. Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements. ($25-54 M)

This track will improve understanding of concrete pavement surface characteristics. It will provide tools to help engineers meet or exceed requirements for friction/safety, pavement-tire noise, smoothness, splash and spray, wheel path wear (hydroplaning), light reflection, rolling resistance, and durability (longevity). The challenge is to improve one characteristic without compromising another.

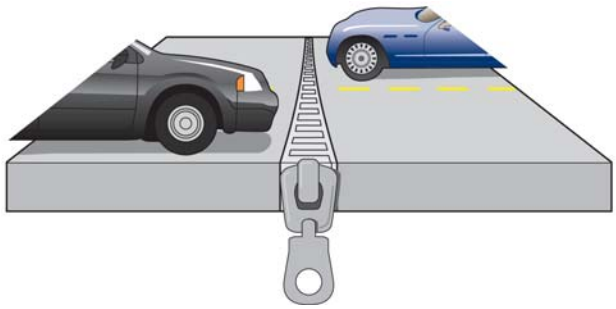
5. Equipment Automation and Advancements



5. Equipment Automation and Advancements. ($26-56 M)

This track will improve process and technology for high-speed, high-quality concrete paving equipment. Examples include the next generation of concrete batching and placement equipment; behind-the-paver equipment to improve curing, surface treatment, and jointing; mechanized ways to place and control subdrains and other foundation elements; one-pass construction equipment; and improved repair processes.

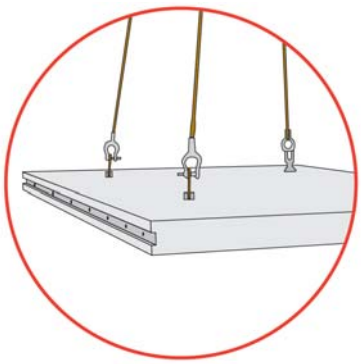
6. Innovative Concrete Pavement Joint Design, Materials, and Construction



6. Innovative Concrete Pavement Joint Design, Materials, and Construction. ($10-15 M)

Potential products for this track include a new joint design, high-speed computer analysis techniques for joint performance, a more accurate installation scheme, and faster rehabilitation strategies. The problem statements in this track address proposed research that will help develop breakthrough technologies and extremely high-speed joint repair techniques.

7. High-Speed Concrete Pavement Rehabilitation and Construction



7. High-Speed Concrete Pavement Rehabilitation and Construction. ($10-20 M)

This track addresses a series of activities. Some involve planning and simulation of high-speed construction and rehabilitation, precast and modular options for concrete pavements, and fast track concrete pavement construction and rehabilitation; others propose evaluation and technology transfer of high-speed construction and rehabilitation products and processes developed through research.

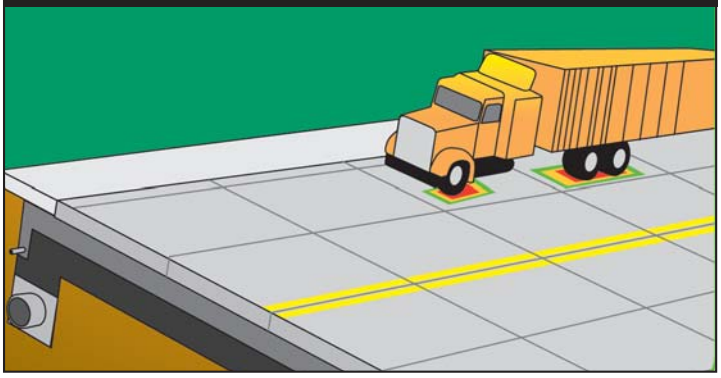
8. Long Life Concrete Pavements



8. Long Life Concrete Pavements. ($11-17 M)

The need for pavements that last longer between maintenance, restoration, or rehabilitation is integrated throughout the CP Road Map. However, this track highlights specific research that may address pavement life approaching 60 years or more.

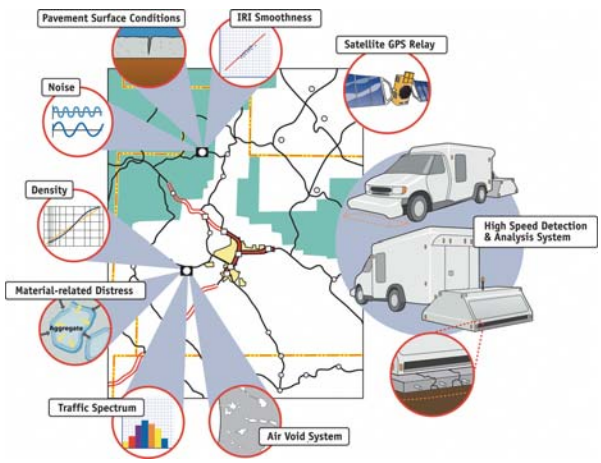
9. Concrete Pavement Accelerated Loading and Long-Term Data Collection



9. Concrete Pavement Accelerated Loading and Long-Term Data Collection. ($10-16 M)

This track provides the infrastructure—such as testing methods and data collection and reporting tools—for a future national program that will plan accelerated loading and long-term data needs, construct test sections, and collect and share data.

10. Concrete Pavement Performance



10. Concrete Pavement Performance. ($3-4 M)

This track addresses key elements of pavement management and asset management systems that determine whether or not and in what manner pavements meet performance characteristics. Research will address the functional aspects of concrete pavement performance, particularly surface characteristics. Research also will provide rapid performance feedback and examine ways to schedule surface characteristics and condition improvements.

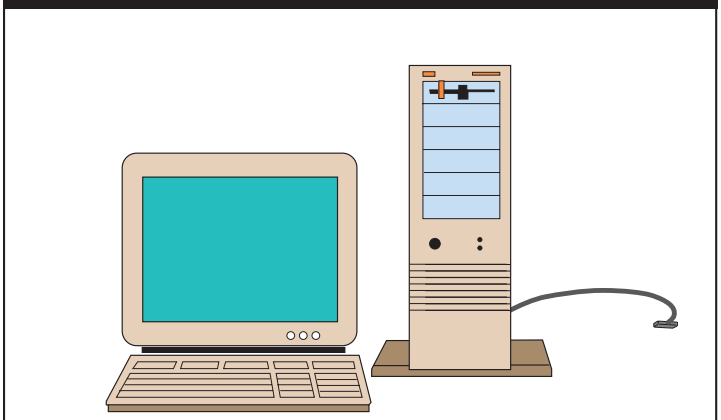
11. Concrete Pavement Business Systems and Economics



11. Concrete Pavement Business Systems and Economics. ($21-31 M)

Roles and responsibilities are changing in the highway industry, affecting the way in which paving projects are designed, bid, built, and maintained. Contractors are being asked to assume more control of the operation and quality control inspections. This track captures some important research regarding topics such as contracting options, new technology transfer systems, public-private partnerships, and economic models.

12. Advanced Concrete Pavement Materials



12. Advanced Concrete Pavement Materials. ($11-23 M)

The problem statements in this track aim to develop new materials and refine or reintroduce existing advanced materials to enhance performance, improve construction, and reduce waste. Many existing materials studied in this track have been used only on a small scale or in laboratory evaluations. Many of them have not been used in the United States but show promise based on work done in other countries.

MANAGING THE RESEARCH

A unique research plan warrants an innovative system for managing and conducting the research. The research management plan that accompanies the CP Road Map:

- Relies on a cooperative, tri-party executive advisory committee (Federal, State, and industry) for general oversight.
- Is decentralized, recruiting research track team leaders to bring stakeholders together voluntarily to pool their resources in win-win partnerships.
- Requires a full-time administrative support group dedicated to supporting research coordination, conduct, and implementation. A primary function of this group is maintaining and updating the CP Road Map research database.

EXECUTIVE ADVISORY COMMITTEE

Responsible for guidance and oversight of the CP Road Map including:

- **Strategic Road Map updates, integration of research tracks**
- **Research database management**
- **Integration of new software products**
- **Communications and technology transfer**
- **Partnering and fund management**
- **Innovative research**

Members of executive advisory committee are representatives from Federal, State, and industry organizations.

Potential Sustaining Organizations

Federal Highway Administration (FHWA)
National Cooperative Highway Research Program (NCHRP)
American Association of State Highway and Transportation Officials (AASHTO)
National Ready Mixed Concrete Association (NRMCA)
American Concrete Paving Association (ACPA)
National Stone, Sand & Gravel Association (NSSGA)
Transportation Research Board (TRB)
Portland Cement Association (PCA)
Individual State departments of transportation
Midwest Concrete Consortium

ADMINISTRATIVE SUPPORT GROUP

Provides support to executive advisory committee and research track team leaders by:

- **Providing lists of potential track leaders**
- **Suggesting and facilitating partnering arrangements**
- **Helping integrate research across tracks**
- **Updating and maintaining the research database**
- **Obtaining information from State and Federal agencies on current research**
- **Developing recommendations for improving, adjusting, or adding new research**
- **Soliciting new and innovative ideas and concepts**
- **Organizing continuous expert review and advice on conduct of research**
- **Recommending strategies to ensure software compatibility**
- **Addressing intellectual property rights issues**
- **Identifying and recommending technology transfer activities**
- **Identifying and facilitating the development of specific, track-related training efforts**
- **Developing and implementing a communications effort**

RESEARCH TRACK TEAM LEADERS

Oversee work within each track—schedules, budgets, integration, plan updates.

Track 1 Leaders
Mix design

Track 2 Leaders
Design guide

Track 3 Leaders
Nondestructive testing

Track 4 Leaders
Surface characteristics

Track 5 Leaders
Equipment advancements

Track 6 Leaders
Innovative joints

Track 7 Leaders
Rehabilitation and construction

Track 8 Leaders
Long life

Track 9 Leaders
Data collection

Track 10 Leaders
Pavement performance

Track 11 Leaders (Executive Committee)
Business systems and economics

Track 12 Leaders
Advanced materials

HOW CAN YOU PARTICIPATE?

Beginning a long-term research program is a long, slow process. In this case, the CP Road Map provides a framework for moving forward.

Stakeholders in the concrete pavement community are invited to participate:

- To receive a printed copy of the full two-volume CP Road Map, with complete problem statements (available mid-2005), contact Peter Kopac, FHWA, 202-493-3151, peter.kopac@fhwa.dot.gov.
- An electronic version of the CP Road Map and the two-volume report also will be available on the FHWA Web site in mid-2005. Visit **www.tfhrc.gov/**.
- For additional information, visit www.tfhrc.gov and search for CP Road Map.

Researchers—This study was performed by D.S. Harrington of Iowa State University's Center for Portland Cement Concrete Pavement Technology, Ames, IA; T. Ferragut of TDC Partners, Ltd., Alexandria, VA; R. Rasmussen of The Transtec Group, Inc., Austin, TX; and M.I. Darter of Applied Research Associates, Inc., ERES Consultants Division, Champaign, IL.

Distribution—This TechBrief is being distributed according to a standard distribution. Direct distribution is being made to the Divisions and Resource Centers.

Availability—FHWA-HRT-05-052 Concrete Pavement Road Map Volume I and FHWA-HRT-05-053 Concrete Pavement Road Map Volume II will be available in fall 2005. The reports, this TechBrief, and FHWA-HRT-05-047 *CP Road Map Executive Summary* may be obtained from the FHWA Product Distribution Center by e-mail to report.center@fhwa.dot.gov, by fax to 301–577–1421, or by phone to 301–577–0818.

Key Words—Concrete pavement, concrete mix design, pavement construction, pavement design, pavement performance, pavement smoothness, equipment automation, accelerated loading, longterm data collection, nondestructive testing, intelligent construction systems, concrete pavement joint design.

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