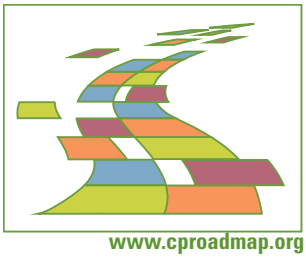
CP ROAD MAP
shaping the future of **concrete pavement**



www.cproadmap.org

"Moving Advancements into Practice"

MAP Brief

Describing promising technologies that can be used now to enhance concrete paving practices

Introducing -- The CP Road Map, 2nd Edition

SEPT-OCT 2011

AUTHORS
David Merritt
The Transtec Group, Inc.

Dale Harrington
Snyder and Associates

Robert Otto Rasmussen
The Transtec Group, Inc.

Jesse Kwilosz
The Transtec Group, Inc.

SPONSOR
FHWA

MORE INFORMATION
Dale Harrington
Snyder and Associates
(515) 964-2020
dharrington@snyder-associates.com

Introduction

The CP Road Map is a comprehensive and strategic plan for concrete pavement research that guides the investment of research dollars. It is a living plan with broad stakeholder involvement. Since 2005, it has tracked research and facilitated the deployment of technologies that have been helping the concrete pavement community meet paving challenges. In short, the CP Road Map is guiding the industry toward a new generation of concrete pavements.

The development of the CP Road Map began in 2001 through an agreement between the Federal Highway Administration and the National Concrete Pavement Technology Center at Iowa State University. The team developed a database of existing research and gathered input from the highway community. They identified gaps in research that became the basis for problem statements, which are organized into a cohesive, strategic research plan.

CP Road Map Update

Today, the CP Road Map is funded through a transportation pooled fund that includes FHWA and several State DOTs. As the CP Road Map has evolved, areas for improvement have been identified. Consequently, the CP Road Map has been updated to reflect progress made to date on various tracks. The track structure has also been revised and updated to better reflect current practices and to emphasize important areas of research. The updated CP Road Map incorporates items originally referenced only in database tables into the formal track structure.

In updating the CP Road Map, one objective was to introduce a variety of new subtracks and problem statements. It was also critical to maintain cohesiveness with problem statements that are cross-referenced between multiple tracks and to reflect current industry practices and research completed to date by removing irrelevant or outdated problem statements. In addition, the "phasing" structure of the original CP Road Map was omitted in order to remove the impression that certain research can occur only after other research has been completed.

The table on the following two pages illustrates key differences between the original and updated CP Road Map tracks and problem statements.

Other than updates to select problem statements, no major changes were made to Tracks 2, 4, 5, and 6. For the remaining tracks, the revisions are outlined below.

Track 1 - Materials and Mixes for Concrete Pavements

- Now covers both concrete materials and mix designs, with an emphasis still placed on performance-based mixture designs.
- Incorporates much of the original Track 12 - Advanced Concrete Pavement Materials.

Track 3 - Intelligent Construction Systems and Quality Assurance for Concrete Pavements

- Track and subtracks have been renamed to reflect current industry practice.
- Emphasis has been placed on quality assurance (QA), an umbrella term that has traditionally been associated with QA/QC.

Track 7 - Concrete Pavement Maintenance and Preservation

- New focus is on maintenance and preservation as these are key areas of research given the current economic climate.
- Incorporates items from Appendix A, Table B (Concrete Pavement Maintenance and Rehabilitation) of the original CP Road Map.

Moving Advancements into Practice (MAP) Briefs describe innovative research and promising technologies that can be used now to enhance concrete paving practices.

The Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map) is a national research plan developed and jointly implemented by the concrete pavement stakeholder community. Publications and other support services are provided by the Operations Support Group and funded by TPF-5(185).

This MAP Brief is available at: http://www.cproadmap.org/publications/ MAPbriefJul-Aug11.pdf

Table 1. Comparison of original CP Road Map tracks and problem statements (left) and updated CP Road Map tracks and problem statements (right, changes highlighted in red)

Original CP Road Map	Updated CP Road Map
Track 1. Performance-Based Concrete Pavement Mix Design System (MD)	**Track 1. Materials and Mixes for Concrete Pavements**
MD 1. PCC Mix Design System Development and Integration	1-1. Performance-Based Mix Design and Specifications
MD 2. PCC Mix Design Laboratory Testing and Equipment	1-2. Materials Selection and Testing
MD 3. PCC Mix Design Modeling	1-3. Innovative Materials
MD 4. PCC Mix Design Evaluation and Implementation	1-4. Materials Proportioning
	1-5. Mixture Evaluation
	1-6. Post-Construction Pavement Materials Evaluation
Track 2. Performance-Based Design Guide for New and Rehabilitated Concrete Pavements (DG)	**Track 2. Performance-Based Design Guide for New and Rehabilitated Concrete Pavements**
DG 1. Design Guide Structural Models	2-1. Design Guide Structural Models
DG 2. Design Guide Inputs, Performance Models, and Reliability	2-2. Design Guide Inputs, Performance Models, and Reliability
DG 3. Special Design and Rehabilitation Issues	2-3. Special Design and Rehabilitation Issues
DG 4. Improved Mechanistic Design Procedures	2-4. Improved Mechanistic Design Procedures
DG 5. Design Guide Implementation	2-5. Design Guide Implementation
Track 3. High-Speed Nondestructive Testing and Intelligent Construction Systems (ND)	**Track 3. Intelligent Construction Systems and Quality Assurance for Concrete Pavements**
ND 1. Field Control	3-1. Quality Assurance
ND 2. Nondestructive Testing Methods	3-2. Intelligent Construction Technologies and Methods
ND 3. Nondestructive Testing and Intelligent Control System Evaluation and Implementation	3-3. Intelligent Construction System Evaluation and Implementation
Track 4. Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements (SC)	**Track 4. Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements**
SC 1. Concrete Pavement Texture and Friction	4-1. Concrete Pavement Texture and Friction
SC 2. Concrete Pavement Smoothness	4-2. Concrete Pavement Smoothness
SC 3. Tire-Pavement Noise	4-3. Tire-Pavement Noise
SC 4. Other Concrete Pavement Surface Characteristics	4-4. Other Concrete Pavement Surface Characteristics
SC 5. Integration of Concrete Pavement Surface Characteristics	4-5. Integration of Concrete Pavement Surface Characteristics
SC 6. Evaluation of Products for Concrete Pavement Surface Characteristics	4-6. Evaluation of Products for Concrete Pavement Surface Characteristics
SC 7. Concrete Pavement Surface Characteristics Implementation	4-7. Concrete Pavement Surface Characteristics Implementation
Track 5. Concrete Pavement Equipment Automation and Advancements (EA)	**Track 5. Concrete Pavement Equipment Automation and Advancements**
EA 1. Concrete Batching and Mixing Equipment	5-1. Concrete Batching and Mixing Equipment
EA 2. Concrete Placement Equipment	5-2. Concrete Placement Equipment
EA 3. Concrete Pavement Curing, Texturing, and Jointing Equipment	5-3. Concrete Pavement Curing, Texturing, and Jointing Equipment
EA 4. Concrete Pavement Foundation Equipment	5-4. Concrete Pavement Foundation Equipment
EA 5. Concrete Pavement Reconstruction Equipment	5-5. Concrete Pavement Reconstruction Equipment
EA 6. Concrete Pavement Restoration Equipment	5-6. Concrete Pavement Restoration Equipment
EA 7. Advanced Equipment Evaluation and Implementation	5-7. Advanced Equipment Evaluation and Implementation
Track 6. Innovative Concrete Pavement Joint Design, Materials, and Construction (IJ)	**Track 6. Innovative Concrete Pavement Joint Design, Materials, and Construction**
IJ 1. Joint Design Innovations	6-1. Joint Design Innovations
IJ 2. Joint Materials, Construction, Evaluation, and Rehabilitation Innovations	6-2. Joint Materials, Construction, Evaluation, and Rehabilitation Innovations
IJ 3. Innovative Joints Implementation	6-3. Innovative Joints Implementation
Track 7. High-Speed Concrete Pavement Rehabilitation and Construction (RC)	**Track 7. Concrete Pavement Maintenance and Preservation**
RC 2. Precast and Modular Concrete Pavements	7-1. Optimization and Automation of Pavement Maintenance
RC 1. Rehabilitation and Construction Planning and Simulation	7-2. Optimized Concrete Pavement Preservation
RC 3. Fast-Track Concrete Pavements	7-3. Distress Identification and Preservation Treatment

Table 1. (cont.) Comparison of original CP Road Map tracks and problem statements (left) and updated CP Road Map tracks and problem statements (right, changes highlighted in red)

Original CP Road Map	Updated CP Road Map
Track 8. Long-Life Concrete Pavements (LL)	**Track 8. Concrete Pavement Construction, Reconstruction, and Overlays**
LL 1. Pavement Strategy for Long-Life Concrete Pavements	8-1. Construction, Reconstruction, and Overlay Planning and Simulation
LL 2. Construction and Materials for Long-Life Concrete Pavements and Overlays	8-2. Precast and Modular Concrete Pavements
LL 3. Long-Life Concrete Pavement Implementation	8-3. Concrete Overlays
	8-4. Fast-Track Concrete Pavements
Track 9. Concrete Pavement Accelerated and Long-Term Data Collection (DC)	**Track 9. Evaluation, Monitoring, and Strategies for Long Life Concrete Pavement**
DC 1. Planning and Design of Accelerated Loading and Long-Term Data Collection	9-1. Technologies for Measuring Concrete Pavement Performance
DC 2. Preparation of Data Collection/Testing Procedures and Construction of Test Road	9-2. Strategies for Long-Life Concrete Pavements
DC 3. Accelerated Loading and Long-Term Data Collection Implementation	9-3. Construction Techniques and Materials Selection for Long-Life Concrete Pavements and Overlays
	9-4. Planning and Design of Accelerated Loading and Long-Term Data Collection
	9-5. Preparation of Data Collection/Testing Procedures and Construction of Test Road
	9-6. Long-Life Concrete Pavement Performance Implementation
Track 10. Concrete Pavement Performance (PP)	**Track 10. Concrete Pavement Foundations and Drainage**
PP 1. Technologies for Determining Concrete Pavement Performance	10-1. Concrete Pavement Foundations
PP 2. Guidelines and Protocols for Concrete Pavement Performance	10-2. Concrete Pavement Drainage
Track 11. Concrete Pavement Business Systems and Economics (BE)	**Track 11. Concrete Pavement Economics and Business Management**
BE 1. Concrete Pavement Research and Technology Management and Implementation	11-1. Concrete Pavement Research and Technology Management and Implementation
BE 2. Concrete Pavement Economics and Life Cycle Costs	11-2. Concrete Pavement Economics and Life Cycle Costs
BE 3. Contracting and Incentives for Concrete Pavement Work	11-3. Innovative Contracting and Incentives for Concrete Pavement Work
BE 4. Technology Transfer and Publications for Concrete Pavement Best Practices	11-4. Technology Transfer and Publications for Concrete Pavement Best Practices
BE 5. Concrete Pavement Decisions with Environmental Impact	
Track 12. Advanced Concrete Pavement Materials (AM)	**Track 12. Concrete Pavement Sustainability**
AM 1. Performance-Enhancing Concrete Pavement Materials	12-1. Materials and Mixture Design Procedures for Sustainable Concrete Pavement
AM 2. Construction-Enhancing Concrete Pavement Materials	12-2. Design Procedures for Sustainable Concrete Pavements
AM 3. Environment-Enhancing Concrete Pavement Materials	12-3. Construction Practices for Sustainable Concrete Pavements
	12-4. Preservation, Rehabilitation and Recycling Strategies for Sustainable Concrete Pavements
Track 13. Concrete Pavement Sustainability	12-5. Improved Economic Life Cycle Cost Analysis for Sustainable Concrete Pavements
	12-6. Adoption and Implementation of Environmental Life Cycle Assessment for Sustainable Concrete Pavements
Table A: Concrete Pavement Foundations and Drainage	12-7. Identification and Quantification of Additional Environmental and Social Considerations for Sustainable Concrete Pavements
Table B: Concrete Pavement Maintenance and Rehabilitation	12-8. Concrete Pavement Decisions with Positive Environmental Impact
Table C: Environmental Concrete Pavement Advancements	12-9. Sustainable Concrete Pavement Technology Transfer and Implementation

Track 8 - Concrete Pavement Construction, Reconstruction, and Overlays

- This is effectively Track 7 of the original CP Road Map, but now includes a subtrack devoted exclusively to concrete overlays.
- This track relates to pavements that are beyond maintenance and preservation.
- Although "high-speed" is no longer present in the title, this track still emphasizes rapid construction/reconstruction.

Track 9 - Evaluation, Monitoring, and Strategies for Long-Life Concrete Pavements

- This track has essentially combined Tracks 8, 9, and 10 of the original CP Road Map.
- The focus is still on long-life concrete pavements, but this track also incorporates methods for evaluating and monitoring pavement performance through accelerated loading and advanced data collection techniques.

Track 10 - Concrete Pavement Foundations and Drainage

This is a new track that focuses on foundations and drainage issues previously outlined in the appendix of the original CP Road Map document.

Track 11 - Concrete Pavement Economics and Business Management

The only changes were a modification of the track title and the elimination of the subtrack Concrete Pavement Decisions with Environmental Impact, which is now covered within the updated Track 12.

Track 12 - Concrete Pavement Sustainability

- This is essentially Track 13 from the original track structure, which was not included in the original CP Road Map, but added later.
- This track incorporates items from appendix Table C (Environmental Concrete Pavement Advancements) of the original CP Road Map.

CP Road Map Progress and Products

Shortly after the release of the original CP Road Map in September 2005, an operations support group (OSG) was established to help agencies and industry partners meet their research goals efficiently. The OSG, funded by Transportation Pooled Fund TPF-5(185) and managed by the National CP Tech Center, also tracks national concrete pavement research which, in turn, helps Federal, State, industry, and academic partners work together to leverage resources and avoid costly duplication of research activities.

Work under TPF-5(185) has been conducted under individual task orders. As of June 2011, five task orders have been issued and include the following implementation activities.

Executive Advisory Committee - The committee was established to provide overall guidance and coordination of CP Road Map activities. The committee meets 3-4 times per year, and its responsibilities include fostering research integration within and between the CP Road Map's tracks, suggesting/promoting innovative technology transfer and training activities, and evaluating CP Road Map progress.

Database - The original CP Road Map database was created as a tool to assist in the development of the CP Road Map plan, and the National CP Tech Center has augmented this database with research ongoing or completed since that time. The database includes work conducted under sponsorship of the FHWA, NCHRP, pooled fund studies, and the concrete paving industry, as well as international work.

Track Team Meetings - The OSG has provided planning and facilitation services for various track teams led by track coordinators. These teams are dedicated to establishing track priorities, developing project objective statements for each track's priority projects, and developing funding mechanisms for each priority project.

Website - A website has been developed and maintained to facilitate coordination and communication of CP Road Map activities. Content includes program information and news, status of current work, and links to aid implementation of completed work.

E-News - The E-News is an electronic newsletter distributed via email that highlights research from around the world that is helping the concrete pavement community meet the objectives outlined in the CP Road Map. Each issue includes links to publications of interest and highlights a research agency, including work that the agency has sponsored or conducted.

MAP Briefs - Each E-News issue is accompanied by a Moving Advancements into Practice (MAP) brief. The MAP brief highlights a specific research effort and its products and discusses implementations of the findings from that research.

For more information

For more information about the CP Road Map, including current and past issues of the E-News and a complete listing of the 14 MAP briefs published to date, visit the website at http://www.cproadmap.org or contact Dale Harrington, dharrington@snyder-associates.com, 515-964-2020.