FHWA contract NO. DTFH61-06-D-00023

Task Order #04 Report

CONCRETE PAVEMENT ROAD MAP

for the period of
November 1, 2010 – June 30, 2011

Prepare by the Road Map Operations Support Group
National Concrete Pavement Technology Center
Iowa State University
Concrete Pavement Road Map
Task Order #4 Report
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APPENDIX H

CP Road Map Project Team Conference Call Meeting Minutes
Concrete Pavement Road Map  
Task Order #4 Report

This report details the activities involved with Task Order #4 to continue providing administrative support to efficiently execute a coordinated Concrete Pavement Road Map program. The overall form of the report will follow the outline format of the Task Order.

**Task A: Review/Refresh Alignment with Needs**

One of the tasks accomplished under Task Order #4 was to refresh the CP Roadmap to be sure it is addressing the current issues facing DOTs and industry and is in alignment with current needs of the concrete pavement community.

A Technical Advisory Committee was formed to provide input with the refreshing effort and consisted of the following members:

- Ahmad Ardani – FHWA, Turner Fairbanks, CP Road Map Technical Contact
- Brett Trautman – Missouri DOT and chairman of NC2
- Tyson Rupnow – Louisiana DOT
- Roger Schmitt – Florida DOT and TRB representative
- Gordon Smith – President of ICPA
- Jerry Voigt – ACPA
- Rob Rasmussen and Dave Merritt – Transtec

Three committee conference calls were held to receive input and review the track updates. The calls were held on May 2, 2011, June 1, 2011 and June 30, 2011.

Following are the nine tasks that were accomplished for refreshing the Road Map:

1. Convert Tables A, B, C in Appendix A of Volume 2 to three new tracks, similarly named.
2. Populate the three tracks with each of the problem statements identified from the other existing tracks; delete these problem statements from the other tracks. There are cross references throughout the Road Map and these will not be deleted they will be cross referenced.
3. Delete all references to track phasing (timelines) from each of the tracks.
4. Change the tracks so that they are identified by numbers only (no two-letter acronyms). The number track will become the designation and the two-letter code will be dropped.
5. Review Volumes I and II, and change text as needed to properly refer to new tracks/format. This will be a substantial task. All tracks will be reviewed and notes taken so they can be tied into other tracks.
6. Review each problem statement for outdated concepts, and delete or update accordingly. Going through 250 problem statements to go through. Some have become outdated.
7. In Volume I, add text to summarize the work conducted to date under the CP Road Map Pooled Fund project. An additional 5-10 pages of text is anticipated. There are a number of activities that have been done under the Pooled Fund project. They will be referenced and identified in Volume I.
8. Hold 3 conference calls with the review panel. This one is one of the three calls the committee will have for review and comments. The draft will be sent to the committee this month.
9. Revise the documents as a result of 2 review cycles.

The full minutes from each meeting are included in Appendix A.

A copy of the updated track structure is included in Appendix B.

The tracks and track leadership will be reorganized under Task Order #5.

**Task B: Plan/Schedule/Facilitate Meetings**

1. Update the Track Leadership Teams

   Under Task Order #4 (Task A) new and revised tracks where formed and thus some of the track leadership also had to undergo some changes. Some of the revisions being made to the Road Map are a reflection of the priority shifts already present in the tracks and the leadership and teams will continue their involvement. However, some of the tracks may involve avenues that will result in new leadership. These teams will be identified in Task Order #5 in a personnel directory. Depending on the outcome of the reorganized tracks in Task A, the level of support needed for each track under future tasks orders will be evaluated with some support being shifted to new or reorganized tracks.

2. Support Executive Committee

   Under Task Order #3 the CP Road Map Pooled Fund States Committee discussed, at their March 17, 2009 committee meeting, how they wanted to coordinate with the CP Road Map Executive Committee. There was some overlap between the pooled fund contacts and members of the Executive Committee. It was agreed by the committee members that the remaining pooled fund states should participate with the Executive Committee. At the April 2010 Executive Committee meeting it was also agreed that in the future the CP Road Map Executive Committee and the TAC for the ACG pooled fund should be combined and function as one joint committee.

The combined Executive Committee held a face-to-face meeting on January 11, 2011 in Chicago, Illinois and a web meeting on March 29, 2011. Below are some of the details from the meetings.

**Executive Committee Meeting – January 11, 2011**

The administrative support team planned, scheduled and facilitated the Executive Committee meeting held on January 11, 2011 in Chicago, Illinois. The team prepared the agenda and distributed the meeting minutes for the call.

Major items of discussion during the meeting included the following:
- How the Road Map is Making a Difference
- Task Order 3 Accomplishments
o Turner Fairbanks Concrete Pavement Research Program
  • Task Order 4
    o Tasks
    o Business track
  • Future Directions

It was discussed at the Executive Committee meeting that the Road Map will be reviewed and refreshed for alignment with priorities relating to:
  • Pavement preservation/rehabilitation
  • Pavement foundations
  • Research and tech transfer needs

The full minutes are included in Appendix C.

Executive Committee Meeting – March 29, 2011

The March 29, 2011 meeting for the Executive Committee was held via a web conferencing. The administrative support team planned, scheduled and facilitated the conference call. The team prepared the agenda and presentation for the call.

Major items of discussion during the meeting included the following:
  • Update on the SCOR meeting presentation on the CP Road Map
  • Update on TO #4
  • Briefing on TO #5
  • Discussion of TO #5 training topics for the TPF states

The full minutes are included in Appendix C.

3. Summary of National Projects

Past task order annual reports listed out research which was being conducted on PCC pavements. However, they did not capture all of the research the Center was aware of, just the priority tracks. In order to record the known research in this task order report we developed a summary of the current national concrete pavement research projects which are listed in Appendix D. Also, in order to describe and update the entire CP Road Map program to the concrete pavement stakeholders, the project team developed The CP Road Map Pooled Fund – Impacts and Accomplishments. A copy of the eight page document is included in Appendix E.

Task C: Conduct Communications and Outreach Activities

1. Website Update – Continue updating and maintaining the CP Road Map website with emphasis on technology transfer.

As research under the Road Map is being completed, publishing the results, highlighting the implementation of research and promoting the successes have been completed. The website is updated and has an index of E-news and MAP briefs. It will also show the revised tracks
and new track leadership.

2. State DOT Research – Continue outreach to State DOTs, industry, and the research community to identify local opportunities to advance the CP Road Map priorities as well as to provide needed technical resources and products that are being developed.

In this quarter, five state DOTs and FHWA Turner Fairbanks were contacted to determine their concrete research priorities and to obtain their concrete pavement research projects. The research findings for these projects were summarized and placed as research highlights in the E-news. In addition, the information was categorized and inserted into the research database. The current database is in Appendix D.

CP Road Map E-News
News from the Road highlights research around the country that is helping the concrete pavement community meet the research objectives outlined in the CP Road Map.

Updates from the States:

- FHWA's Turner-Fairbank Highway Research Center (May 2011)
- Texas (April 2011)
- Iowa (March 2011)
- Mississippi (February 2011)
- Virginia (January 2011)
- Washington (November 2010)

The E-news and full state updates are included in Appendix F.

3. Continue the CP Road Map e-news on a monthly basis including highlighting research from different state DOTs and MAP briefs.

The following Moving Advancements into Practice (MAP) Briefs - Describing promising technologies that can be used now to enhance concrete paving practices were developed and posted on the CP Road Map website under Task Order #4:

- MAP Brief 7-2: Partial-Depth Repair for Concrete Pavements (Track 7: High-Speed Concrete Pavement Rehabilitation and Construction)
- MAP Brief 6-1: Preventing Joint Deterioration in Concrete Pavements: A Summary of Current Knowledge (Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction)
- MAP Brief 1-3: Fly Ash as a Supplementary Cementitious Material in Concrete Mixtures (Track 1: Performance-Based Concrete Pavement Mix Design System)
- MAP Brief 5-2: Intelligent Compaction for Concrete Pavement Bases and Subbases (Track 5: Concrete Pavement Equipment Automation and Advancements)
- **MAP Brief 3-1: Smart Cure: An Integral Part of an Intelligent Construction System**
  (Track 3: High-Speed Nondestructive Testing and Intelligent Construction Systems)

- **MAP Brief 1-2: Deleterious Chemical Effects of Deicing Solutions on Concrete Pavements**
  (Track 1: Performance-Based Concrete Pavement Mix Design Systems)

A copy of each of the above MAP Briefs is included in Appendix G.

**Staff Communication**

The CP Road Map project team held weekly conference calls during the period of November 1, 2010 through June 30, 2011 and these calls continue. The meeting minutes from the conference calls are included in Appendix H.
CP Road Map Update
Technical Advisory Committee Conference Call
May 2, 2011

Attendees:
- Ahmad Ardani – FHWA, Turner Fairbanks, CP Road Map Technical Contact
- Brett Trautman – Missouri DOT and chairman of NC2
- Tyson Rupnow – Louisiana DOT
- Roger Schmitt – Florida DOT and TRB representative
- Gordon Smith – President of ICPA
- Jerry Voigt – ACPA
- Rob Rasmussen and Dave Merritt – Transtec
- Dale Harrington – Snyder & Associates, Representing the CP Tech Center
- Melisse Leopold – Snyder & Associates, Representing the CP Tech Center (taking notes)

Dale Harrington went through the roll call and opened the meeting. He thanked everyone for agreeing to serve on the committee to refresh the CP Road Map documents. Dale asked if everyone had an opportunity to review the CP Road Map documents. Tyson Rupnow stated he looked at the manuals when they first came out and was familiar with them.

Dale stated the manuals are about 7 years old now. The goal is to look at the documents and refresh them. He stated there are not enough funds or time to go into details of updating the entire Road Map and giving it a strong look. Dale stated the concept is to refresh the problem statements and to populate three new tracks with problem statements that were previously developed under other tracks. The three tracks are Preservation & Rehabilitation; Foundations & Drainage; and Sustainability. He mentioned they have intentionally kept this committee small in order to get more direct and faster discussion. Dale stated that Rob Rasmussen and Dave Merritt of Transtec will do most of the work for refreshing the document. He stated they will look at every track statement to see if all or part of the work has been addressed. If has not been changed it will not be rewritten.

Dale then asked Rob Rasmussen to go over the nine tasks for the refresh. Rob went through each of the following nine tasks:

1. Convert Tables A, B, C in Appendix A of Volume 2 to three new tracks, similarly named.
2. Populate the three tracks with each of the problem statements identified from the other existing tracks; delete these problem statements from the other tracks. There are cross references throughout the Road Map and these will not be deleted they will be cross referenced.
3. Delete all references to track phasing (timelines) from each of the tracks.
4. Change the tracks so that they are identified by numbers only (no two-letter acronyms). The number track will become the designation and the two-letter code will be dropped.
5. Review Volumes I and II, and change text as needed to properly refer to new tracks/format. This will be a substantial task. All tracks will be reviewed and notes taken so they can be tied into other tracks.
6. Review each problem statement for outdated concepts, and delete or update accordingly. Going through 250 problem statements to go through. Some have become outdated.
7. In Volume I, add text to summarize the work conducted to date under the CP Road Map Pooled Fund project. An additional 5-10 pages of text is anticipated. There are a number of activities that have been done under the Pooled Fund project. They will be referenced and identified in Volume I.

8. Hold 3 conference calls with the review panel. This one is one of the three calls the committee will have for review and comments. The draft will be sent to the committee this month.

9. Revise the documents as a result of 2 review cycles.

Dale went through one of the tracks to explain how the refresh would be done. He started on page 105 of the long term plan (Volume II), the beginning of track 3 (High-Speed Nondestructive Testing and Intelligent Construction Systems - ND). This table of content will change and the ND acronym will be dropped as it was confusing. This will be changed to a numbering system. Page 106 will have a list of figures, will talk about the overview and track goals. Dale stated they will not do the phasing portion of the manual. He stated they will continue with the costs and the rest of the section.

Jerry Voigt asked if the CP Road Map was going from 15 tracks to 12 tracks. Dale stated they will see if tracks can be dropped or renamed. It will depend on the review when they go through the tracks. Dale stated they will look to see if the track needs to be modified or dropped. Dale mentioned the revisions will be reviewed by the committee to obtain their opinions. Regarding the problem statements, Jerry Voigt asked when they are revised will new ones be added with the new information. Dale stated the problem statements will be added to tracks if they have not been covered previously.

Ahmad Ardani stated that at the last ACPA meeting it was recommended that some of the tracks could be merged together. Dale agreed this is one of the things they will look at. It is the goal to keep it at 12 tracks or less. Jerry stated it was the CP Road Map Executive Committee meeting in January 2011 that this was discussed. Jerry felt that preservation really incorporates what is in some of the existing tracks and will help with the consolidation. This was agreed by Dale. Jerry felt the team had captured what should be done.

Brett Trautman asked if the costs will be updated and Dale affirmed they would be updated where needed.

Jerry stated that the “phasing” table of each track could be changed to “duration”. Dale stated that in the real world the order of research in a phasing sequence is not done and it is not practical. Jerry stated on Page 113 – if you look approximately phasing is years 1 to 3. Suggested stating the duration reflected is 2 years. Dale felt it was a good idea. Don’t drop the 1 through 3 but state it is the duration. Give an estimated cost and the duration. Everyone thought that would be good.

Roger Schmitt asked if the next committee conference call will be a web-based call so they can review the revisions on screen during the call. It was affirmed that this will be the method for the next conference call.

Jerry asked how the changes would be sent to them so they can see what was changed. Rob stated they would be given a red line version so they can see the changes.

Jerry stated that showing the progress on what has been accomplished is a very important element of the refreshing. This will be helpful in future funding efforts and asked if this would be included in Volume I. Rob stated it would.
Dale stated the National Center, through FHWA, put the CP Road Map book together with input from states through ACPA state chapters. One of the things they really wanted was the Executive Summary. It is 12 pages in color graphics. It was sent to FHWA and they took it and put out their own Executive Summary (12 pages) which was very well done. There are now two very nice Executive Summaries however only one of those will be updated. The National Center will be doing the Executive Summary update. Jerry felt it is very important to be done. Dale stated there aren’t funds for printing the Executive Summary and they will deal with that at a later date. Roger stated it may not need to be printed, if they put it on the state websites it would probably be the fastest way to get the info out. Ahmad stated it could be done as a MAP Brief under TOPR 5. The committee felt Ahmad’s idea would be a good idea.

The next meeting will be held June 1, 2011 at 9:00a.m. CDT. The committee will be sent the review materials prior to the call. A reminder for the call and the instructions will be sent or held as a web conference.
CP Road Map Update
Technical Advisory Committee Conference Call
June 1, 2011

Attendees:
- Ahmad Ardani – FHWA, Turner Fairbanks, CP Road Map Technical Contact
- Brett Trautman – Missouri DOT and chairman of NC2
- Tyson Rupnow – Louisiana DOT
- Roger Schmitt – Florida DOT and TRB representative
- Gordon Smith – President of ICPA
- Jerry Voigt – ACPA
- Tom Cackler, CP Tech Center
- Rob Rasmussen and Dave Merritt – Transtec
- Dale Harrington – Snyder & Associates, Representing the CP Tech Center
- Melisse Leopold – Snyder & Associates, Representing the CP Tech Center (taking notes)

Dale Harrington welcomed everyone and went through roll call. Dale asked for any corrections on the previous meeting minutes. No one had any. Dale stated that Jerry Voigt had two major items at the last meeting. These were changing the phasing tables to duration and include in the update what has been accomplished under the Road Map. They will be included in the update.

Dale stated that he will send the committee the information on the updating of the Sustainability and Mix Tracks for review which are currently in development.

David Merritt went over the spreadsheet comparing the original tracks with the proposed tracks. The goal was to keep 12 tracks. New track 1 combines the original track 1 and track 12. Dale explained that material selection and mix design go hand in hand. Dale felt we should still use “mix” with “materials” in the title. Rob explained what was included in the “mix” for Track 1 Materials for Pavement. Need to ask Peter Taylor about the performance based mixed design element for Track 1. Tyson stated that performance base causes concern and they prefer end result specification. Gordon would like to see it included in the track. It was agreed to include it in subtrack 1-1 title. Jerry suggested revising the title to Track 1 to “Materials and Mixes for Concrete Pavements”. It was agreed.

Track 2 was not changed from the original track.

Track 3 title was changed to “Intelligent Construction Systems and Quality Assurance for Concrete Pavements”. The problem statement stayed the same. Dale explained that quality control is included in quality assurance definition used by FHWA. This terminology was adopted by AASHTO and FHWA is coming out with new guidelines. The quality assurance program is being developed currently through FHWA to bring states up to date. Roger Schmitt stated that some states may not adapt to QA quickly. Dale stated that no one is changing the quality control work only the name is changing. Quality assurance includes contractor quality control and control by the agency. Rob suggested reviewing TRB E Circular-137 (can download off the website) for quality assurance. The committee felt the title was okay as “Intelligent Construction Systems and Quality Assurance for Concrete Pavements”. 
Rob stated the crossovers of the tracks will be addressed in the problem statements with other tracks.

Track 4 was not changed from the original track.
Track 5 was not changed from the original track.
Track 6 was not changed from the original track.

Track 7 title was changed to “Concrete Pavement Maintenance and Preservation”. Track 7 focuses on maintenance and preservation.

Dale explained that preservation and rehabilitation is very important to this country as we are not building a lot of new pavements at this time. Ahmad asked where dowel bar retrofit would fit. Dale stated it is included in preservation system which is Track 7. Roger had issue with restoration in Track 7. Restoration will be changed to preservation in the subtrack 7-1. Jerry explained that IGGA was adopting concrete pavement preservation activities and felt it fit with the term restoration.

Track 8 title was changed to “Concrete Pavement Construction and Rehabilitation”. Track 8 focuses on construction and rehabilitation. Jerry asked when you renamed Track 8 why did you not leave it as 9? Dale felt it was important to maintain the long life pavement terminology. Jerry wasn’t sure where rehabilitation fit today in Track 8. Roger thought resurfacing was a better term.

Track 9 title was changed to “Long-Life Concrete Pavement Performance through Evaluation and Monitoring”. Track 9 was a combination of some of the original 8, 9 and 10.

Track 10 is a new track “Concrete Pavement Foundations and Drainage”. The Executive Committee stated it deserved a standalone track and we are still working on the subtrack problem statements. Roger recommended this being the first track as he would look at the foundation first and everything else would be built upon the foundation. Tom stated this was a good point but it would reshuffle the tracks quite a bit. Dale stated if we put things in order of what we perceived as the important tracks it will cause problems. We would have to rearrange everything and this is the system that the Executive Committee originally wanted. Tom stated we could look at what is the best sequence for the tracks. Dale stated it would require us to redo the entire book to renumber them and put them in a different location and we don’t have the budget to take on that task. Gordon stated he liked how it is now and that this is the concrete research tasks not a design tool. The committee felt the order of the tracks should stay the way the currently are. Intelligent compaction will be included under Track 10.

Track 11 title stayed the same.

Subtrack 11.5 “Concrete Pavement Decisions with Environmental Impact”, Ahmad suggested moving it to Track 12. This will be moved to track 12. The team will also look at the term “Business Systems” to see if this still fits here. Dale stated that warranties are included and accelerated tech transfer and education programs, not just economics.

Track 12 title was changed to “Concrete Pavement Sustainability”. This is in development with the sustainability committee.
Dale stated there are crossovers and we need to be careful to reference the crossovers. Dave stated the crossover referencing will be made very clear in the refreshing of the manual.

The committee felt it was a good job of getting the tracks to 12 tracks. The committee will review the new tracks and let Dale know if they have any other questions or comments.

Dale stated in the next couple of days the team will send the committee the new mix track and the sustainability tracks to review. Dave stated they will be getting two tables. The team took the old problem statements and turned them into problem statements for the new track. These two tracks are still under development.

The next conference call will be held after the draft is complete and the committee has had an opportunity to review it. The committee would like a week to review the materials prior to the next call. The committee should have the materials around the week of June 19th and the call will be held either June 27, 28 or 29. A Doodle calendar will be sent to the committee to set the next call.
CP Road Map Update
Technical Advisory Committee Conference Call
June 30, 2011

Attendees:
- Ahmad Ardani – FHWA TFHRC, CP Road Map Technical Contact
- Brett Trautman – Missouri DOT and chairman of NC2
- Roger Schmitt – Florida DOT and TRB representative
- Gordon Smith – President of ICPA
- John Cunningham – ICPA
- Tommy Nantung – Indiana DOT
- Jerry Voigt – ACPA
- Tom Cackler – CP Tech Center
- Peter Taylor – CP Tech Center
- Rob Rasmussen – Transtec
- David Merritt - Transtec
- Dale Harrington – Snyder & Associates, Representing the CP Tech Center

Dale Harrington went through the roll call and opened the meeting. He stated that we would begin by reviewing the spreadsheet sent out to the committee on June 24. He reminded the committee that the goal of this effort is refreshing the roadmap, not a complete re-write. Dale also stated that we want to focus on major items and revisions during this call. Clerical items can be sent to himself and Transtec separately. Some new tracks have been added, and some merged with each other in order to keep it at 12 tracks.

David Merritt began by reviewing the spreadsheet showing the comparison of the original versus new track/subtrack structure.
- The new Track 1 has merged the old track 1 with the old Track 12 (Advanced Materials).
- Roger and Ahmad asked for clarification on what subtrack 1-6 includes.
- David stated that although it is still being populated with problem statements, it will include research related dowel bars, reinforcement, and other materials.
- The committee agreed that the subtrack should be renamed “post construction” instead of “completed pavement.”
- Track 2 – Jerry mentioned that the new version of StreetPave is being reviewed now by the ACPA membership.
- Track 3 – Main change was to titles of track and subtracks to put a new emphasis on “Intelligent Construction Systems”
- Track 3 – Ahmad suggested adding “QA/QC” instead of just QA. Rob mentioned that the narrative includes discussion of QC as part of QA. Dale mentioned how this new language is where the industry is going.
- Track 3 - Tommy asked about PWL and where it fits. Rob suggested that it be added to the narrative.
• Track 4 - Tommy mentioned how concrete pavement smoothness is different for older vs newer pavements. This needs to be a consideration in asset management and decision making.
• Roger says that roughness, faulting, and cracking trigger projects in decision making.
• Rob said that these issues are addressed in Tracks 7, 8, and 11.
• Track 5 – Track/subtracks should not have been highlighted in the spreadsheet – no changes were made to the track other than renumbering the subtracks.
• David and Dale clarified the intent of separating work into Tracks 7 and 8 to separate maintaining and preserving existing pavement from construction and reconstruction, and how “rehabilitation” is intentionally not used based discussions from the last committee conference call.
• Ahmad asked what the title of Subtrack 7-3 (Distress Identification and Preservation Treatment) means. Rob asked if we can discuss this when we get to Volume II.
• Ahmad asked about Track 9 and what it includes. David mentioned how the title was chosen to encompass more than just long-life pavement, and included data collection and accelerated load testing as well.
• Ahmad stated that TFHRC is looking for concrete pavement candidate projects for the ALF at TFHRC.
• Roger mentioned the accelerated loading testing in FL on whitetopping years ago.
• Tommy mentioned that Indiana has an ALF too, and it will be used for testing concrete this fall.
• Jerry stated that precast pavement should be considered for the ALF.
• Roger asked that we revisit the title of Track 9.
• Jerry suggested “Evaluation, Monitoring, and Strategies for Long-Life Concrete Pavements.”
• Tommy asked if “Strategies” might include “Evaluation” and “Monitoring”. Rob asked if we could leave it as is, so that statements could be more readily found by track titles alone.
• Track 10 – Tommy asked if this includes drainage retrofit. Rob said it did – the subtrack titles were intentionally left general so items like retrofit could be included.
• For Track 12, the subtrack titles have come out of the Sustainability task group as part of their ongoing efforts.
• Peter said that the titles for the subtracks were developed by the team and the problem statements are still under development.
• Ahmad asked if we should mention $10M FHWA pavement sustainability program. The first phase underway is $5M, and the second phase will depend on the outcome of the first. Tom Cackler is part of the technical working group for this.
• Dale suggested that once we wrap up with this task, we should see if there is some crossover.
• Peter suggested that we don’t break from the continuity of the rest of the plan by citing a specific ongoing program.
• Dale asked if there should be an appendix in the report that compares the old versus new track structure and problem statements.
• Jerry suggests that we do not add an appendix because once we have a new version, the old becomes irrelevant. The rest of the committee concurs.

David Merritt moved on to Volume I, showing major revisions that had been made, highlighted in blue.
• David began with the Executive Summary, showing what changes had been made.
- Ahmad asked if this is really a “7- to 10-year plan”. Rob suggests that leaving the estimated length of the plan in place helps people stay focused on what is achievable in 7 to 10 years, not necessarily that it has been done. Calling it an open ended plan might give the impression that the Roadmap has no clear direction and plan for completing the research mentioned within.
- Track 6 summary – Ahmad and others suggest that we may want to mention premature joint deterioration.
- Dale asked that if there are any editorial comments, to send them to himself and Transtec rather than discussing them on the call. Ahmad said that he would send documents with tracked changes.
- Jerry asked if a technical editor has looked at this. Dale said it hasn’t been to a technical editor yet and that we should wait on any small changes until after that time.
- David moved to page 99, which provides a synopsis of work completed on various Tracks to date.
- Roger asked if the title could be changed to include the dates covered by the synopsis (i.e., 2006-2011). The committee agreed and dates were added to the title.

David moved on to Volume II to show an example of changes that were made to the track descriptions and problem statements.
- David began by highlighting Track 7 as an example. This was essentially a new Track combining items from two or three of the original tracks. The Track Overview, Goals, Objectives, Gaps, Challenges were shown as an example of how all tracks were structured. The tables with Problem Statements and Estimated Costs were also shown, along with an example of a Problem Statement that had been reviewed and revised as needed.
- David noted that the Track Phasing charts were removed to reflect a change to Project Duration in the problem statements, such that tracks are not seen as so dependent upon each other.
- Jerry asked if we should mention more about track leadership for the roadmap in the individual Tracks. He stated that it has been great to have FHWA and so many other stakeholders involved, and we should highlight this.
- Gordon concurred and stated that it is good to have a connection to the past and the efforts that have been made. This will be important in order to get support and buy-in for work from here on.
- Rob said that the programmatic initiatives can be identified in the Executive Summary (e.g., the $10M sustainability program, ICST, and surface characteristics).
- Jerry said that we should make sure that Chapter 8 of Volume I, and other sections, show that this is an ongoing effort, and not one that is not yet started.
- Jerry said that we don’t need to convince people of the approach proposed by the CP RoadMap - we need to show that there have been successes to date, and celebrate this.

Dale asked each committee member if they had any other thoughts or comments.
- Brett said he did not have any comments, but agrees Jerry’s comments about implying ongoing work.
- Tom did not have any additional comments and felt that we are on the right track.
- Jerry did not have any additional comments.
- Gordon did not have any additional comments.
- John Cunningham wants to make sure we highlight joint deterioration.
• Roger asked how, as a stakeholder, to find in the CP Road Map where to invest his money. Dale explained some of the fundamental concepts of the Road Map.

• Tommy stated that he liked the suggestions of mentioning that we are on the right path.

• Dale said that we’ve had a lot of work done on many of these statements, but we have not eliminated any.

• Dale asked Ahmad and others to send us their comments.

The meeting was adjourned at approximately 11:20 am CDT.
### Track 1. Performance-Based Concrete Pavement Mix Design System (MD)

#### Subtrack MD 1. PCC Mix Design System Development and Integration

- MD 1.0. Framework for PCC Mix Design System Development and Integration (Subtrack MD 1)

- MD 1.1. PCC Pavement Mix Design System Integration Stage 1: Volumes-Based Mix Design (Mix Proportioning)

- MD 1.2. PCC Pavement Mix Design System Integration Stage 2: Property-Related Mix Design

- MD 1.3. PCC Pavement Mix Design System Integration Stage 3: Performance-Based Mix Design

- MD 1.4. PCC Pavement Mix Design System Integration Stage 4: Functionally Based Mix Design

- MD 1.5. Integrating Recycled Materials into PCC Mix Design System

#### Subtrack MD 2. PCC Mix Design Laboratory Testing and Equipment

- MD 2.0. Framework for PCC Mix Design Laboratory Testing and Equipment (Subtrack MD 2)

- MD 2.1. Laboratory Mixer to Replicate PCC Field Blending

- MD 2.2. Laboratory Compactor to Replicate Concrete Paving Practice

- MD 2.3. Aggregate Tests for PCC Mix Characterization

- MD 2.4. Performance-Based Cementitious Materials Specifications

- MD 2.5. PCC Mix Durability Tests

- MD 2.6. PCC Mix Compatibility Tests

- MD 2.7. PCC Mix Property Test Development

- MD 2.8. PCC Mix Thermal Tests

- MD 2.9. PCC Mix Performance Testing Equipment

- MD 2.10. PCC Mix Functional Testing Equipment

- MD 2.11. Expert System for PCC Mixes

#### Subtrack MD 3. PCC Mix Design Modeling

- MD 3.0. Framework for PCC Mix Design Modeling (Subtrack MD 3)

- MD 3.1. Aggregate Models for Optimizing PCC Mixtures

- MD 3.2. Fresh PCC Pavement Behavior Models

- MD 3.3. Hardened PCC Pavement Behavior Models

- MD 3.4. Improved PCC Pavement Performance Models Adaptation

- MD 3.5. Functional PCC Pavement Models Adaptation

- MD 3.6. Characterizing Concrete Materials Variability

- MD 3.7. PCC Mix Model Calibration

- MD 3.8. PCC Mix Model Validation

#### Subtrack MD 4. PCC Mix Design Evaluation and Implementation

- MD 4.0. Framework for PCC Mix Design Evaluation and Implementation (Subtrack MD 4)

- MD 4.1. PCC Pavement Mix Design System Conferences and Workshops

- MD 4.2. Support for FHWA Mobile Concrete Laboratory Demonstrations

- MD 4.3. Standardized Databases and Electronic Communications Protocols for the Concrete Pavement Industry

- MD 4.4. Web-Based Training System for Implementation of PCC Research Products

- MD 4.5. PCC Mix Design Equipment for States

### Track 1. Materials and Mixes for Concrete Pavements

#### Subtrack 1.1. Performance-Based Mix Design and Specifications

- 1.1. Performance-Based Cementitious Materials Specifications

- 1.2. Fresh PCC Pavement Behavior Models

- 1.3. Hardened PCC Pavement Behavior Models

- 1.4. Models to Correlate Ingredient Chemistry and Mix Proportions with Concrete Performance

- 1.5. Standardized Databases and Electronic Communications Protocols for the Concrete Pavement Industry

#### Subtrack 1.2. Materials Selection and Testing

- 1.2.1. Aggregates Tests for PCC Pavement Mix Characterization

- 1.2.2. Characterizing Concrete Materials Variability

- 1.2.3. Increased Percentages of Reclaimed Asphalt Pavement as an Aggregate for Concrete Paving Mixtures

- 1.2.4. Mix Design Considerations with Recycled Concrete Aggregates

- 1.2.5. Acceptance Criteria for Using Recycled Aggregates

- 1.2.6. Waste Materials in Concrete Mixes

- 1.2.7. Test Methods to Assess Concrete Ingredients at Delivery

#### Subtrack 1.3. Innovative Materials

- 1.3.1. High-Performance, Fiber-Reinforced Concrete Pavements

- 1.3.2. Previous Concrete Paving Program

- 1.3.3. Carbon Dioxide-Treated Materials

- 1.3.4. Reactive Powder Concretes as Ductile Materials

- 1.3.5. Localized High-Quality Concrete at the Job Site

- 1.3.6. Alternative Reinforcement Material for Continuously Reinforced Concrete Pavements

- 1.3.7. Application of Self-Consolidating Concrete for Concrete Paving

- 1.3.8. Thermally Modified Concrete

- 1.3.9. Advanced Curing Materials

- 1.3.10. Advancements in Internal Curing of Concrete

- 1.3.11. Self-Curing Concrete

- 1.3.12. Cement Containing Titanium Dioxide

- 1.3.13. Evaluation of Non-Portland Cementitious Materials

#### Subtrack 1.4. Materials Proportioning

- 1.4.1. PCC Pavement Mix Design System Integration Stage 1: Volumes-Based Mix Design (Mix Proportioning)

- 1.4.2. PCC Pavement Mix Design System Integration Stage 2: Property-Related Mix Design

- 1.4.3. PCC Pavement Mix Design System Integration Stage 3: Performance-Based Mix Design

- 1.4.4. PCC Pavement Mix Design System Integration Stage 4: Functionally Based Mix Design

- 1.4.5. Integrating Recycled Materials into PCC Mix Design System

- 1.4.6. Aggregate Models for Optimizing PCC Mixes

#### Subtrack 1.5. Mixtures Evaluation

- 1.5.1. Laboratory Mixer to Replicate PCC Field Blending

- 1.5.2. Laboratory Compactor to Replicate Concrete Paving Practice

- 1.5.3. Test Methods to Assess Concrete Performance at Point of Delivery

- 1.5.4. Statistical Approaches to Mix Evaluation and Acceptance

- 1.5.5. PCC Mix Durability Tests

- 1.5.6. PCC Mix Compatibility Tests

- 1.5.7. PCC Mix Property Test Development

- 1.5.8. PCC Mix Thermal Tests

- 1.5.9. PCC Mix Performance Testing Equipment

- 1.5.10. PCC Mix Functional Testing Equipment

- 1.5.11. Expert System for PCC Mixes

- 1.5.12. Support for FHWA Mobile Concrete Laboratory Demonstrations

- 1.5.13. PCC Mix Design Equipment for States

#### Subtrack 1.6. Completed Pavement Materials Evaluation

- Problem Statements To Be Added
### Track 4. Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements (SC)

#### Subtrack SC 1. Concrete Pavement Texture and Friction
- SC 1.0: Framework for Concrete Pavement Texture and Friction (Subtrack SC 1)
- SC 1.1: High-Speed 3D Microtexture Assessment Equipment
- SC 1.2: In-Situ 3D Microtexture Assessment Equipment
- SC 1.3: High-Speed 3D Microtextures Assessment Equipment
- SC 1.4: Behind-the-Paver Texture Sensing Equipment
- SC 1.5: Multidimensional Concrete Pavement Friction Assessment
- SC 1.6: Unified Concrete Pavement Texture and Friction Model

#### Subtrack SC 2. Concrete Pavement Smoothness
- SC 2.0: Framework for Concrete Pavement Smoothness (Subtrack SC 2)
- SC 2.1: High-Speed, High-Resolution 3D Concrete Pavement Profiling
- SC 2.2: Next Generation Smoothness Index Development and Specifications
- SC 2.3: Behind-the-Paver Smoothness Sensing Equipment
- SC 2.4: Design and Construction Guidelines to Improve Concrete Pavement Smoothness

#### Subtrack SC 3. Tire-Pavement Noise
- SC 3.0: Framework for Tire-Pavement Noise (Subtrack SC 3)
- SC 3.1: Standardized Tire-Pavement Noise Measurement
- SC 3.2: Standardized Vehicle Interior Noise Measurement
- SC 3.3: Tire-Pavement Noise Thresholds
- SC 3.4: Behind-the-Paver Noise Sensing Equipment
- SC 3.5: Unified Tire-Pavement Noise Model that Includes Texture and Absorptivity

#### Subtrack SC 4. Other Concrete Pavement Surface Characteristics
- SC 4.0: Framework for Other Concrete Pavement Surface Characteristics (Subtrack SC 4)
- SC 4.1: Splash and Spray Assessment Equipment
- SC 4.2: Rolling Resistance Assessment Equipment
- SC 4.3: Reflectivity/Illuminance Assessment Equipment
- SC 4.4: Tire and Vehicle Wear Assessment Equipment

#### Subtrack SC 5. Integration of Concrete Pavement Surface Characteristics
- SC 5.0: Framework for Integration of Concrete Pavement Surface Characteristics (Subtrack SC 5)
- SC 5.1: Comprehensive Concrete Pavement Surface Characteristics Field Study
- SC 5.2: Time Stability Evaluations of Concrete Pavement Surface Characteristics
- SC 5.3: Unified Model for Concrete Pavement Texture, Friction, Noise, and Smoothness
- SC 5.4: PCI Pavement Mix Design System Integration Stage 4: Functionally Based Mix Design
- SC 5.5: Relating Pavement Surface Characteristics to Vehicle Accidents

#### Subtrack SC 6. Evaluation of Products for Concrete Pavement Surface Characteristics
- SC 6.0: Framework for Evaluation of Products for Concrete Pavement Surface Characteristics (Subtrack SC 6)
- SC 6.1: Porous Concrete and Related Issues
- SC 6.2: Exposed Aggregate in Two-Course Paving
- SC 6.3: Engineered/Optimized Wet Concrete Texturing
- SC 6.4: Engineered/Optimized Hardened Concrete Grinding and Grooving
- SC 6.5: Precast Pavement Surfaces

#### Subtrack SC 7. Concrete Pavement Surface Characteristics Implementation
- SC 7.0: Framework for Concrete Pavement Surface Characteristics Implementation (Subtrack SC 7)
- SC 7.1: Workshops on Products to Improve Concrete Pavement Characteristics
- SC 7.2: Workshops on Measurement of Concrete Pavement Surface Characteristics
- SC 7.3: Web-Based Training for Implementing Research Products for Concrete Pavement Surface Characteristics

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

#### Subtrack 4-1. Concrete Pavement Texture and Friction
- 4-1.0: High-Speed 3D Microtextures Assessment Equipment
- 4-1.1: In-Situ 3D Microtextures Assessment Equipment
- 4-1.2: High-Speed 3D Microtextures Assessment Equipment
- 4-1.3: Behind-the-Paver Texture Sensing Equipment
- 4-1.4: Multidimensional Concrete Pavement Friction Assessment
- 4-1.5: Unified Concrete Pavement Texture and Friction Model

#### Subtrack 4-2. Concrete Pavement Smoothness
- 4-2.0: High-Speed, High-Resolution 3D Concrete Pavement Profiling
- 4-2.1: Next Generation Concrete Pavement Smoothness Index Development and Specifications
- 4-2.2: Behind-the-Paver Smoothness Sensing Equipment
- 4-2.3: Design and Construction Guidelines to Improve Concrete Pavement Smoothness

#### Subtrack 4-3. Tire-Pavement Noise
- 4-3.0: Standardized Tire-Pavement Noise Measurement
- 4-3.1: Standardized Vehicle Interior Noise Measurement
- 4-3.2: Tire-Pavement Noise Thresholds
- 4-3.3: Behind-the-Paver Noise Sensing Equipment
- 4-3.4: Unified Tire-Pavement Noise Model that Includes Texture and Absorptivity

#### Subtrack 4-4. Other Concrete Pavement Surface Characteristics
- 4-4.0: Splash and Spray Assessment Equipment
- 4-4.1: Rolling Resistance Assessment Equipment
- 4-4.2: Reflectivity/Illuminance Assessment Equipment
- 4-4.3: Tire and Vehicle Wear Assessment Equipment

#### Subtrack 4-5. Integration of Concrete Pavement Surface Characteristics
- 4-5.0: Comprehensive Concrete Pavement Surface Characteristics Field Study
- 4-5.1: Time Stability Evaluations of Concrete Pavement Surface Characteristics
- 4-5.2: Unified Model for Concrete Pavement Texture, Friction, Noise, and Smoothness
- 4-5.3: PCI Pavement Mix Design System Integration Stage 4: Functionally Based Mix Design
- 4-5.4: Relating Pavement Surface Characteristics to Vehicle Accidents

#### Subtrack 4-6. Evaluation of Products for Concrete Pavement Surface Characteristics
- 4-6.0: Porous Concrete and Related Issues
- 4-6.1: Exposed Aggregate Surfaces
- 4-6.2: Engineered/Optimized Wet Concrete Texturing
- 4-6.3: Engineered/Optimized Hardened Concrete Grinding and Grooving
- 4-6.4: Precast Pavement Surfaces

#### Subtrack 4-7. Concrete Pavement Surface Characteristics Implementation
- 4-7.0: Workshops on Products to Improve Concrete Pavement Characteristics
- 4-7.1: Workshops on Measurement of Concrete Pavement Surface Characteristics
- 4-7.2: Web-Based Training for Implementing Research Products for Concrete Pavement Surface Characteristics
Track 5. Concrete Pavement Equipment Automation and Advancements (EA)

Subtrack EA 1. Concrete Batching and Mixing Equipment
EA 1.0. Framework for Concrete Batching and Mixing Equipment (Subtrack EA 1)
EA 1.1. High-Efficiency Concrete Batching
EA 1.2. Automated Aggregate Feed Sensing: Moisture, Gradation, Shape, and Texture

Subtrack EA 2. Concrete Placement Equipment
EA 2.0. Framework for Concrete Placement Equipment (Subtrack EA 2)
EA 2.1. Stringless Concrete Paving
EA 2.2. Roller-Compacted Concrete Paving
EA 2.3. Zero-Clearance Paving
EA 2.4. Two-Course Concrete Paving
EA 2.5. Automated Material Sensing and Equipment Adjustments
EA 2.6. Fully Automated One-Pass Paving

Subtrack EA 3. Concrete Pavement Curing, Texturing, and Jointing Equipment
EA 3.0. Framework for Concrete Pavement Curing, Texturing, and Jointing Equipment (Subtrack EA 3)
EA 3.1. High-Speed, Early, and Efficient Concrete Pavement Jointing
EA 3.2. Advanced Concrete Pavement Surface Texturing Equipment
EA 3.3. Accelerated Concrete Hydration Equipment
EA 3.4. Advanced Concrete Pavement Joint Forming

Subtrack EA 4. Concrete Pavement Foundation Equipment
EA 4.0. Framework for Concrete Pavement Foundation Equipment (Subtrack EA 4)
EA 4.1. Rapid Subgrade/Subbase Stabilization
EA 4.2. Automated Subgrade Installation in Concrete Pavement Construction

Subtrack EA 5. Concrete Pavement Reconstruction Equipment
EA 5.0. Framework for Concrete Pavement Reconstruction Equipment (Subtrack EA 5)
EA 5.1. High-Speed, In Situ PCC Pavement Breakup, Removal, and Processing
EA 5.2. Recycled Concrete Processing/Improvement
EA 5.3. High-Speed, In Situ, One-Pass, Full Concrete Pavement Reconstruction

Subtrack EA 6. Concrete Pavement Restoration Equipment
EA 6.0. Framework for Concrete Pavement Restoration Equipment (Subtrack EA 6)
EA 6.1. Rapid, High-Production Concrete Pavement Grinding
EA 6.2. Automated Concrete Pavement Crack Sensing and Sealing
EA 6.3. Fully Automated Concrete Pavement Restoration Equipment

Subtrack EA 7. Advanced Equipment Evaluation and Implementation
EA 7.0. Framework for Advanced Equipment Evaluation and Implementation (Subtrack EA 7)
EA 7.1. Advanced Concrete Paving Equipment Workshops and Demonstrations
EA 7.2. Concrete Paving Equipment Purchases for States

Track 6. Innovative Concrete Pavement Joint Design, Materials, and Construction (UJ)

Subtrack UJ 1. Joint Design Innovations
UJ 1.0. Framework for Joint Design Innovations (Subtrack UJ 1)
UJ 1.1. Identify, Develop, and Evaluate Innovative Concepts for Concrete Pavement Joint Design, Materials, and Construction
UJ 1.2. Select Promising Innovative Joint Design, Materials, and Construction Concepts and Further Develop to Trial Test Stage
UJ 1.3. Optimization of Mechanical Load Transfer Devices for Load Transfer Efficiency and Deterioration Models
UJ 1.4. Development of an Advanced, High-Speed Joint Analysis Tool
UJ 1.5. Development of Advanced Joint Sealing Procedures

Subtrack UJ 2. Joint Materials, Construction, Evaluation, and Rehabilitation Innovations
UJ 2.0. Framework for Joint Materials, Construction, Evaluation, and Rehabilitation Innovations (Subtrack UJ 2)
UJ 2.1. Construction, Testing, and Evaluation of Promising Concrete Pavement Joint Design Concepts
UJ 2.2. Development of Innovative Ways for Detecting Joint Deterioration in New and Older Pavements
UJ 2.3. Determining the Need and Identifying the Feasibility of Alternative Ways to Provide Pressure Relief and Load Transfer Efficiency for Concrete Pavers

Subtrack UJ 3. Innovative Joints Implementation
UJ 3.1. Implementation of Innovative Concrete Pavement Joint Design, Materials, and Construction

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

Subtrack 6-1. Joint Design Innovations
6-1.1. Identify, Develop, and Evaluate Innovative Concepts for Concrete Pavement Joint Design, Materials, and Construction
6-1.2. Select Promising Innovative Joint Design, Materials, and Construction Concepts and Further Develop to Trial Test Stage
6-1.3. Optimization of Mechanical Load Transfer Devices for Load Transfer Efficiency and Deterioration Models
6-1.4. Development of an Advanced, High-Speed Joint Analysis Tool
6-1.5. Development of Advanced Joint Sealing Procedures

Subtrack 6-2. Joint Materials, Construction, Evaluation, and Rehabilitation Innovations
6-2.1. Construction, Testing, and Evaluation of Promising Concrete Pavement Joint Design Concepts
6-2.2. Development of Innovative Ways for Detecting Joint Deterioration in New and Older Pavements
6-2.3. Determining the Need and Identifying the Feasibility of Alternative Ways to Provide Pressure Relief and Load Transfer Efficiency for Concrete Pavers

Subtrack 6-3. Innovative Joints Implementation
6-3.1. Implementation of Innovative Concrete Pavement Joint Design, Materials, and Construction
Track 7. High-Speed Concrete Pavement Rehabilitation and Construction (RC)

Subtrack RC 1. Rehabilitation and Construction Planning and Simulation
- RC 1.0. Framework for Rehabilitation and Construction Planning and Simulation (Subtrack RC 1)
- RC 1.1. Paving Process Simulations and Constructability Review
- RC 1.2. Traffic Management Simulations

Subtrack RC 2. Precast and Modular Concrete Pavements
- RC 2.0. Framework for Precast and Modular Concrete Pavements (Subtrack RC 2)
- RC 2.1. Refinement of Precast, Posttensioned Concrete Pavilion Technology
- RC 2.2. Precast Concrete Pavements for Slab Replacement
- RC 2.3. Lightweight Precast Concrete Pavements
- RC 2.4. Precast Joints for Joint Replacement
- RC 2.5. Precast Quiet Pavement Surfaces

Subtrack RC 3. Fast-Track Concrete Pavements
- RC 3.0. Framework for Fast-Track Concrete Pavements (Subtrack RC 3)
- RC 3.1. Synthesis of Practice for Accelerated (Fast-Track) Paving
- RC 3.2. Accelerated Paving Techniques
- RC 3.3. Accelerated Hydration Methods
- RC 3.4. Accelerated Concrete Pavement Restoration Techniques

Subtrack RC 4. Rehabilitation and Construction Evaluation and Implementation
- RC 4.0. Framework for Rehabilitation and Construction Evaluation and Implementation (Subtrack RC 4)
- RC 4.1. Workshops on Fast-Track Concrete Paving
- RC 4.2. Workshops on Precast and Modular Concrete Pavement Solutions
- RC 4.3. Workshops on Rehabilitation and Construction Simulation and Modeling
- RC 4.4. Web-Based Training for Implementation of Rehabilitation and Construction Research

Track 8. Long-Life Concrete Pavements (LL)

Subtrack LL 1. Pavement Strategy for Long-Life Concrete Pavements
- LL 1.0. Framework for Pavement Strategy for Long-Life Concrete Pavements (Subtrack LL 1)
- LL 1.1. Identifying Long-Life Concrete Pavement Types, Design Features, Foundations, and Rehabilitation/Maintenance Strategies
- LL 1.2. Design Catalog for Long-Life Concrete Pavements
- LL 1.3. Strategic Application of Preservation Treatments to Preserve Long-Life Concrete Pavement

Subtrack LL 2. Construction and Materials for Long-Life Concrete Pavements and Overlays
- LL 2.0. Framework for Construction and Materials for Long-Life Concrete Pavements (Subtrack LL 2)
- LL 2.1. Development of Quality Control/Quality Assurance Testing Standards to Ensure Long-Life Concrete Pavements
- LL 2.2. Identification of Material Requirements and Tests for Long-Life Concrete Pavements
- LL 2.3. Design, Construct, and Evaluate Experimental Long-Life Concrete Pavements
- LL 2.4. Design, Construct, and Evaluate Concrete Overlays

Subtrack LL 3. Long-Life Concrete Pavement Implementation
- LL 3.1. Implementation of Long-Life Concrete Pavements

Track 7. Concrete Pavement Maintenance and Preservation

Subtrack 7.1. Optimization and Automation of Pavement Maintenance
- 7.1.1. Advancements in Forensic Analysis of Concrete Pavements
- 7.1.2. Optimizing Procedures for New Design and Future Maintenance and Rehabilitation Capable of Managing Total Life Cycle Costs, Lane Closure 1
- 7.1.3. Fully Automated Concrete Pavement Restoration Equipment
- 7.1.4. Accelerated Concrete Pavement Restoration Techniques

Subtrack 7.2. Distress Identification and Preservation Treatment
- 7.2.1. Automated Concrete Pavement Crack Detection and Sealing
- 7.2.2. Development of Innovative Ways for Detecting Joint Deterioration in New and Older Pavements

Subtrack 7.4. Feedback Loop for Concrete Pavement Preservation Effectiveness
- 7.4.1. Strategic Application of Preservation Treatments to Preserve Long-Life Concrete Pavement
- 7.4.2. Guidelines for a Supplemental Pavement Management System and Feedback Loop for Continuous Concrete Pavement Improvements
- 7.4.3. The Economic and Systemic Impacts of Concrete Pavement Mix-of-Fees Strategies

Track 8. Concrete Pavement Construction, Reconstruction, and Overlays

Subtrack 8.1. Construction, Reconstruction, and Overlays Planning and Simulation
- 8.1.1. Characterization of Existing PCC or Hot-Mix Asphalt (HMA) Pavement to Provide a Large Rehabilitation Design
- 8.1.2. Paving Process Simulations and Constructability Review
- 8.1.3. Virtual Construction Simulations

Subtrack 8.2. Precast and Modular Concrete Pavements
- 8.2.1. Refinement of Precast Posttensioned Concrete Pavilion Technology
- 8.2.2. Precast Concrete Pavements for Slab Replacement
- 8.2.3. Lightweight Precast Concrete Pavements
- 8.2.4. Precast Joints for Joint Replacement
- 8.2.5. Precast Quiet Pavement Surfaces

Subtrack 8.3. Concrete Overlays
- 8.3.1. Improvement of Two-Dimensional (2D) and/or Three-Dimensional (3D) Structural Models for Jointed Plain Concrete Pavement and Continuous
- 8.3.2. Structural Models for Special New Types of Concrete Pavements and Overlays
- 8.3.3. Improvements to Concrete Overlay Design Procedures
- 8.3.4. Design, Construct, and Evaluate Concrete Overlays
- 8.3.5. Flexible Cementitious Overlay Materials

Subtrack 8.4. Fast-Track Concrete Pavements
- 8.4.1. Synthesis of Practice for Accelerated (Fast-Track) Paving
- 8.4.2. High-Speed, In Situ PCC Pavement Breakup, Removal, and Processing
- 8.4.3. Recycled Concrete Processing Improvements
- 8.4.4. High-Speed, In Situ, One-Pass, Full Concrete Pavement Reconstruction
- 8.4.5. Accelerated Paving Techniques
- 8.4.6. Accelerated Hydration Methods
- 8.4.7. Accelerated Concrete Pavement Restoration Techniques

Subtrack 8.5. Construction, Reconstruction, and Overlay Evaluation and Implementation
- 8.5.1. Workshops on Fast-Track Concrete Paving
- 8.5.2. Workshops on Precast and Modular Concrete Pavement Solutions
- 8.5.3. Workshops on Rehabilitation and Construction Simulation and Modeling
- 8.5.4. Web-Based Training for Implementation of Rehabilitation and Construction Research
### Track 9. Concrete Pavement Accelerated and Long-Term Data Collection (DC)

**Subtract DC 1. Planning and Design of Accelerated Loading and Long-Term Data Collection**
- DC 1.0. Framework for Planning and Design of Accelerated Loading and Long-Term Data Collection (Subtract DC 1)
- DC 1.1. Identification of Accelerated and Long-term Data Needs
- DC 1.2. Concrete Pavement Data Management and Distribution
- DC 1.3. Master Plan for Conducting Accelerated Testing of Products and Full-Scale Road Experiments
- DC 1.4. Develop Experimental Designs and a Data Collection and Performance Monitoring Plan for Accelerated Loading Facilities and Full-Scale Products

**Subtract DC 2. Preparation of Data Collection/Testing Procedures and Construction of Test Road**
- DC 2.0. Framework for Preparation of Data Collection Testing Procedures and Construction of Test Road (Subtract DC 2)
- DC 2.1. Preparation of Concrete Pavement Data Collection and Testing Procedures
- DC 2.2. Construction of Accelerated Loading Sections and Test Road Sections

**Subtract DC 3. Accelerated Loading and Long-Term Data Collection Implementation**
- DC 3.1. Implementation of Accelerated Loading and Long-Term Data Collection

### Track 9. Long-Life Concrete Pavement Performance through Evaluation and Monitoring

**Subtract 9-1. Technologies for Determining Concrete Pavement Performance**
- 9-1.1. Stress-Sensing Concrete Pavements
- 9-1.2. Self-Inspecting Smart Concrete Pavements
- 9-1.3. Rolling Wheel Deflectometer for Concrete Pavements

**Subtract 9-2. Pavement Strategy for Long-Life Concrete Pavements**
- 9-2.1. Identifying Long Life Concrete Pavement Types, Design Features, Foundations, and Rehabilitation/Maintenance Strategies
- 9-2.2. Design Catalog for Long Life Concrete Pavements
- 9-2.3. Strategic Application of Preservation Treatments to Preserve Long Life Concrete Pavement

**Subtract 9-3. Construction and Materials for Long-Life Concrete Pavements and Overlays**
- 9-3.2. Identification of Material Requirements and Tests for Long Life Concrete Pavements
- 9-3.3. Design, Construct, and Evaluate Experimental Long Life Concrete Pavements
- 9-3.4. Design, Construct, and Evaluate Concrete Overlays

**Subtract 9-4. Planning and Design of Accelerated Loading and Long-Term Data Collection**
- 9-4.1. Identification of Accelerated and Long-Term Data Needs
- 9-4.2. Concrete Pavement Data Management and Distribution
- 9-4.3. Master Plan for Conducting Accelerated Testing of Products and Full-Scale Road Experiments
- 9-4.4. Develop Experimental Designs and a Data Collection and Performance Monitoring Plan for Accelerated Loading Facilities and Full-Scale Products
- 9-4.5. Concrete Pavement Rating System for Highways

**Subtract 9-5. Preparation of Data Collection/Testing Procedures and Construction of Test Road**
- 9-5.1. Preparation of Concrete Pavement Data Collection and Testing Procedures
- 9-5.2. Construction of Accelerated Loading Sections and Test Road Sections

**Subtract 9-6. Long-Life Concrete Pavement Performance Implementation**
- 9-6.1. Implementation of Long Life Concrete Pavements
- 9-6.2. Implementation of Accelerated Loading and Long-Term Data Collection

### Track 10. Concrete Pavement Performance (PP)

**Subtract PP 1. Technologies for Determining Concrete Pavement Performance**
- PP 1.1. Stress-Sensing Concrete Pavements
- PP 1.2. Self-Inspecting Smart Concrete Pavements

**Subtract PP 2. Guidelines and Protocols for Concrete Pavement Performance**
- PP 2.1. Guidelines for a Supplemental Pavement Management System and Feedback Loop for Continuous Concrete Pavement Improvement
- PP 2.2. Advancements in Forensic Analysis of Concrete Pavements
- PP 2.3. Concrete Pavement Rating System for Highways

### Track 10. Concrete Pavement Foundations and Drainage

**Subtract 10-1. Concrete Pavement Foundations**
- 10-1.1. Concrete Pavement Support Sensing
- 10-1.2. Concrete Pavement Smoothness Sensing
- 10-1.3. Rapid Subgrade/Subbase Stabilization

**Subtract 10-2. Concrete Pavement Drainage**
- 10-2.1. Development of Model for Erosion Related to Material Properties under Dynamic Loading
- 10-2.2. Improved Consideration of Foundation and Subdrainage Models
- 10-2.3. Automated Subdrain Installation in Concrete Pavement Construction
- 10-2.4 Concrete Pavement Textures (Wheel Resistance, Splash/Spray Sensing)
Track 11. Concrete Pavement Business Systems and Economics (BE)

Subtrack BE 1. Concrete Pavement Research and Technology Management and Implementation
- BE 1.1. The CP Road Map Research Management Plan Administrative Support Group
- BE 1.2. Accelerated Evaluation and Implementation of Concrete Pavement Research and Technology

Subtrack BE 2. Concrete Pavement Economics and Life Cycle Costs
- BE 2.1. Achieving Sustainability with Concrete Pavements
- BE 2.2. The Economic and Systemic Impacts of Concrete Pavement Mix-of-Fixes Strategies
- BE 2.3. Advanced Concrete Pavement Life Cycle Cost Methods That Include User Costs
- BE 2.4. Optimizing Concrete Pavement Life Cycle Decisions
- BE 2.5. Concrete Pavement Economic Analysis Series

Subtrack BE 3. Contracting and Incentives for Concrete Pavement Work
- BE 3.1. Innovative Contracting Methods That Address Performance-Based Maintenance and Warranties
- BE 3.2. The Next Generation of Incentive-Based Concrete Pavement Construction Specifications

Subtrack BE 4. Technology Transfer and Publications for Concrete Pavement Best Practices
- BE 4.2. Accelerated Technology Transfer and Rapid Education Programs for the Future Concrete Paving Workforce
- BE 4.3. Concrete Pavement Engineering Compendium
- BE 4.4. Concrete Pavement White Paper Series

Subtrack BE 5. Concrete Pavement Decisions with Environmental Impact
- BE 5.1. The Impact of Concrete Pavement Reflectance, Absorption, and Emissivity on the Urban Heat Island Effect
- BE 5.2. Strategic and Technical Issues Related to the Design and Construction of Truck-Only Concrete Pavements
- BE 5.3. Concrete Pavement Restoration Guidelines Specifically for City Streets and Arterials

Track 11. Concrete Pavement Economics and Business Management

Subtrack 11-1. Concrete Pavement Research and Technology Management and Implementation
- 11-1.1. The CP Road Map Research Management Plan Administrative Support Group
- 11-1.2. Accelerated Evaluation and Implementation of Concrete Pavement Research and Technology

Subtrack 11-2. Concrete Pavement Economics and Life Cycle Costs
- 11-2.1. Achieving Sustainability with Concrete Pavements
- 11-2.2. The Economic and Systemic Impacts of Concrete Pavement Mix-of-Fixes Strategies
- 11-2.3. Advanced Concrete Pavement Life Cycle Cost Methods That Include User Costs
- 11-2.4. Optimizing Concrete Pavement Life Cycle Decisions
- 11-2.5. Concrete Pavement Economic Analysis Series

Subtrack 11-3. Contracting and Incentives for Concrete Pavement Work
- 11-3.1. Innovative Contracting Methods That Address Performance-Based Maintenance and Warranties
- 11-3.2. The Next Generation of Incentive-Based Concrete Pavement Construction Specifications

Subtrack 11-4. Technology Transfer and Publications for Concrete Pavement Best Practices
- 11-4.2. Accelerated Technology Transfer and Rapid Education Programs for the Future Concrete Paving Workforce
- 11-4.3. Concrete Pavement Engineering Compendium
- 11-4.4. Concrete Pavement White Paper Series

Track 12. Advanced Concrete Pavement Materials (AM)

Subtrack AM 1. Performance-Enhancing Concrete Pavement Materials
- AM 1.1. Flexible Cementitious Overlay Materials
- AM 1.2. High-Performance, Fiber-Reinforced Concrete Pavements
- AM 1.3. Pervious Concrete Pavement Program
- AM 1.4. Carbon Oxide-Treated Materials
- AM 1.5. Reactive Powder Concretes as Dust Collection Materials
- AM 1.6. Chemically Bonded Ceramic
- AM 1.7. Localized High-Quality Concrete at the Joints
- AM 1.8. Alternative Reinforcement Material for Continuously Reinforced Concrete Pavements

Subtrack AM 2. Construction-Enhancing Concrete Pavement Materials
- AM 2.1. Application of Self-Compacting Concrete for Concrete Paving
- AM 2.2. Applying Very High-Strength Concrete to Pavement Operations
- AM 2.3. Dry-Laid Concrete
- AM 2.4. Energy-Efficient Modified Cement
- AM 2.5. Advanced Curing Materials
- AM 2.6. Cold Weather Concreting Advancements
- AM 2.7. Advancements in Internal Curing of Concrete
- AM 2.8. Self-Curing Concrete

Subtrack AM 3. Environment-Enhancing Concrete Pavement Materials
- AM 3.1. Cement Containing Titanium Dioxide
- AM 3.2. Sulfur Concrete
- AM 3.3. Increased Percentages of Reclaimed Asphalt Pavement as an Aggregate for Concrete Paving Mixtures
- AM 3.4. Mix Design Considerations with Recycled Concrete Aggregate
- AM 3.5. Acceptance Criteria for Using Recycled Aggregate
- AM 3.6. Waste Materials in Concrete Mixes
- AM 3.7. Scourment for Concrete Masses
- AM 3.8. Polymer Concrete Made from Recycled Plastic Bottles

Track 12. Concrete Pavement Sustainability

Subtrack 12-1. Materials and Mixture Design Procedures for Sustainable Concrete Pavement
- 12-1.1. New Generation Concrete Mixtures for Sustainable Pavements
- 12-1.2. Use of Supplementary Cementitious Materials for Sustainable Concrete Pavements
- 12-1.3. Use of Low Impact Local and Recycled Materials in Sustainable Concrete Pavements
- 12-1.4. Reduced Energy and Carbon Footprint for Sustainable Concrete Pavements
- 12-1.5. Carbon Neutral and Closed-Loop Recycling in Sustainable Concrete Pavements
- 12-1.6. Durability Enhancing Admixtures for Sustainable Concrete Pavements

Subtrack 12-2. Design Procedures for Sustainable Concrete Pavements
- 12-2.1. Planning Tools to Enhance Concrete Sustainability from Project Inception
- 12-2.2. Long-Life Design for Sustainable Concrete Pavements
- 12-2.3. Use of Recycled and Industrial Byproducts in Underlying Pavement Layers
- 12-2.4. Two-Lift Sustainable Concrete Pavement Construction
- 12-2.5. Integration of Optimized Surfaces in Sustainable Concrete Pavement Design
- 12-2.6. Precast Sustainable Concrete Pavement Design Systems for the Urban Environment
- 12-2.7. Identifying Local Concrete Pavement Types, Features, and Rehabilitation/Maintenance Strategies

Subtrack 12-3. Construction Practices for Sustainable Concrete Pavements
- 12-3.1. Adoption of Automated and Wireless Control and Quality Monitoring Instruments to Improve Construction Quality
- 12-3.2. Increase Energy Efficiency and Reduce Pollution at the Plant and Construction Site
- 12-3.3. Guidelines to Reduce and Eliminate Construction Waste
- 12-3.4. Guidelines to Minimize the Use of Water During Construction
- 12-3.5. Innovative Curing Methodologies for Sustainable Concrete Pavements

Subtrack 12-4. Preservation, Rehabilitation and Recycling Strategies for Sustainable Concrete Pavements
- 12-4.1. Use of Advanced Sensors to Monitor the Quality and Health of Concrete Pavements
- 12-4.2. Concrete Pavement Performance Modeling for Improved Timing of Preservation and Rehabilitation
- 12-4.3. Innovative Preservation and Restoration Strategies
- 12-4.4. In-Situ Concrete Pavement Recycling Techniques
- 12-4.5. Concrete Overlay Construction through Innovative Technologies and Equipment
- 12-4.6. Recycled Concrete Processing Improvement

Subtrack 12-5. Improved Concrete Life Cycle Cost Analysis for Sustainable Concrete Pavements
- 12-5.1. Establish Key Input Parameters to Conduct an Economic Life Cycle Cost Analysis
- 12-5.2. Development of a User Friendly Life Cycle Cost Analysis Tool
- 12-5.3. Guidelines for Conducting an Economic Life Cycle Cost Analysis

Subtrack 12-6. Adoption and Implementation of Environmental Life Cycle Assessment for Sustainable Concrete Pavements
- 12-6.1. Create and Maintain a Concrete Pavement Specific Environmental Life Cycle Inventory
- 12-6.2. Identify and Rank Environmental Impact Categories that Affect Concrete Pavement Sustainability
- 12-6.3. User-Friendly, Internationally Acceptable Environmental Life Cycle Assessment Toolkit for Sustainable Concrete Pavements

Subtrack 12-7. Identification and Quantification of Additional Environmental and Social Considerations for Sustainable Concrete Pavements
- 12-7.1. Innovative Approaches to Remove Pollutants from Air and Water Using Concrete Pavements
12-7-2. Quantify and Document the Impact of Pavement Reflectivity on the Urban Heat Island.
12-7-4. Quantify and Document Artificial Lighting Needs for Various Pavement Surface Reflectivities and Optimize for Energy Savings.
12-7-5. Establish the Relationship Between Pavement Surface Reflectivity and Nighttime Driver Visibility.
12-7-6. Determine, Quantify, and Optimize Pavement Factors that Contribute to Public Health and Safety.
12-7-7. Tire-Pavement Noise Sensing.
12-7-8. Precast Quiet Pavement Surfaces.

Subtrack 12-8. Concrete Pavement Decisions with Environmental Impact
12-8-1. Strategic and Technical Issues Related to the Design and Construction of Truck-Only Concrete Pavements.
12-8-2. Concrete Pavement Restoration Guidelines Specifically for City Streets and Arterials.

Subtrack 12-9. Sustainable Concrete Pavement Technology Transfer and Implementation
12-9-1. Drafting Document on Implementing Sustainable Solutions for Concrete Pavements.
12-9-3. Organize and Conduct a Conference on Sustainable Concrete Pavements.
CP Road Map Committee Agenda
January 11, 2011

Attending:
Marty Fallon
Gary Frederick
Julie Garbini
Ron Guntert
Steve Kosmatka
Sandra Larson
Rick Sniegowski
John Staton
Jerry Voigt

National CP Tech Center
Tom Cackler
Peter Taylor
Dale Harrington
Sabrina Shields-Cook
Sharon Prochnow
Rob Rasmussen (Transtec)
Sabrina Garber (Transtec)

FHWA Technical Monitor
Ahmad Ardani

I. How the CP Road Map is Making a Difference (PowerPoint slides attached)
The Road Map is not a mandate to funding agencies to direct their research but a philosophy of working
together to solve concrete pavement problems using pooled resources. The Road Map can achieve:

Prioritization:
- Strategic planning: providing funding agencies with a global view, identifying commonalities
  across the country.
- Programmatic thinking: The big issues that can’t be solved with just one project.
- Leverage funding: People/agencies working together to solve issues, not only a local problem

Implementation:
- Identifying who has expertise and pulling them together to do the work

Publicity
- What’s new, and what works. Value of successes dependent on publication of results, training.

II. Examples of CP Road Map Impacts (PowerPoint attached)
The Road Map started with 12 tracks, with Sustainability being added as Track 13. See PowerPoint slides
for specific projects that have had an impact on the priority tracks. All research projects fit within the
Road Map, i.e. 2.3.3 Concrete Overlays (track 2, subtrack 3 problem 3).

Comments:
Ahmad: At a recent ACPT meeting, training on COMPASS was identified as a need.
Sandra: Possible NHI course? SPR funds can be used for NHI courses making them easier for DOTs to
fund. Involving TTCC pooled fund states would be a good way to implement software.
Ahmad: FHWA has a XRF and will soon have a XRD available for use on projects.
Jerry: Proportioning guide (element of track 1) that ACPA and PCA have been working on together will
be finished shortly. ACPA has web applications including a gradation analyzer tool that will be available
as a web application for contractor training.
Track 6: Innovative Concrete Pavement Joint Design, Materials and Construction Joints project: Pooled fund project to investigate why joints have been deteriorating faster than desirable is ongoing. Project is looking at 3 issues: mechanical damage (wrong blade? operator error? time of sawing? Early traffic?) that shows up later in joints, also air void and water issue - poor air void system plus saturation reducing ability to resist freeze thaw cycles.

Track 13: Sustainability.
Everyone is talking about sustainability and the Center is working on how to dovetail all the projects. The Center is developing a manual on best practices that will be the core of a tech transfer initiative.

Track 7: High-speed Concrete Pavement Rehabilitation and Construction.
In addition to projects listed on the slide, NCHRP 10-79: Guidelines for Quality-Related Pay Adjustment Factors is an ongoing project within this track.

Surface Characteristics project has produced a number of products with the final report being written. There are guidelines for contractors on how to make concrete pavements quieter. This project has had input and cooperation from contractors, industry, DOTs, FHWA, and should result in specs and a guide for selecting the right texture for the right situation.

Comments
Rick: The information on quiet concrete needs to be tied to pavement selection. Misconceptions and old information need to be addressed and industry needs to promote the current information.
Tom: This research is resulting in specs and guidance documents that will have the current, up-to-date, correct information and procedures.

**Turner Fairbanks Concrete Pavement Research Program** (PowerPoint attached, Ahmad Ardani)
FHWA’s Pavement Program has Six Focus Areas. All research fits into one of these areas:
- Pavement Design and Analysis
- Materials and Construction Technology
- Pavement Management & Preservation
- Pavement Surface Characteristics
- Construction and Materials Quality Assurance
- Environmental Stewardship

**FHWA has 3 Pavement Research Teams and the Exploratory Advanced Research Program**
- Pavement Design & Construction focusing on:
  - Pavement Design, Management, Performance Modeling, MEPDG Implementation, QA/QC, PBS, NDT, Wireless, Forensic
- LTPP focusing on:
  - 2500 Test Section Covers; GPS, Monitors performance of In-service Pavements; SPS, Examines Effectiveness of Preventive Maintenance, Rehabilitation techniques and Construction Practices; LTPP Database provides support for MEPDG Cal/Valid by State DOTS
- Pavement Materials focusing on:
  - Innovative Solutions to Problems of national significance through In-house & Contract Research; State-of-the-art Equipment; Forensic Investigations; Laboratories include: Concrete, Asphalt, Chemistry, and Aggregate
- Exploratory Advance Research (EAR) focusing on:
  - Advance High-Risk/Payoff Research, Ultimate Goal: Fill the Gap between Basic & Applied Research; Accelerate Adoption of Innovative Technologies, Methods & Materials

**Concrete Pavement Materials Research Strategic Plan**
- Sustainable Concrete Pavement (In-line with track 13 of the CP Road Map)
- Longer-Lasting
- Achieving Balance between the Economic/Environment/Social Impact
III Task Order 3 Accomplishments (see PowerPoint)
There have been many accomplishments of the Road Map, however the Center has not been able to
develop a comprehensive database; it is simply too massive, too expensive, too unwieldy. Instead a
database has been developed from information collected on the priority tracks as each state’s research
director is contacted. In addition, agencies such as ACPA, etc. are also contacted and their research is
included tabulated. This collaborative effort is resulting in a database on JUST concrete pavements.

Comments:
Sandra: The CP Road Map continues to be a model for collaboration and the benchmark for how things
should be done. The Map Briefs continue to be well done and valuable for disseminating information
and training. The Road Map makes FHWA look smart for developing this program.

Recommendations by the group for E-News and the database:
- Need to make the distinction between research and technology development advancements.
- Add a column to the summary table of state’s research to show tech transfer products table.
- Add a tab to the table for industry work.
- It is a good idea to include Tollway projects when appropriate
- Add the graphs and make them website ready.
- Talk about the database in the E-News.

IV Task Order 4 (PowerPoint attached)
Task order 4 has just begun and will continue with the tasks from previous task orders. In addition, the
Road Map will be reviewed/refreshed for alignment with priorities related to:
- Pavement preservation/rehabilitation
- Pavement foundations
- Research and tech transfer needs
Input from TRB, AASHTO and NCC (National Concrete Consortium) will be used in this update.

Comments:
Instead of just adding additional tracks, reevaluating and realigning will keep the tracks focused and
succinct adding to the value of the Road Map by assuring it remains current. Members of the
committee expressed concern whether there was sufficient funding and of time to get this task
completed.

V. Future Directions
1. Looking forward from a state’s perspective, how can the CP Road Map further facilitate
information exchange, efficiency, and effectiveness in addressing needed concrete pavement
research and technology transfer?

John: The quantity and quality of what has been accomplished with the priority tracks and tech transfer
is impressive. Build off of it – continue and take it to next level with electronic newsletters and briefs
and manuals. Take it to the street – develop manuals and training based on them. Continue to seek out
“mega” issues, national issues of which everyone should become aware. Many of the pooled fund
projects are coming to an end. Budget constraints have made projects tougher to sell, increased
scrutiny on value to state for funding, including pooled fund projects. A document is needed on the
impact of the Road Map and other pooled fund projects that aren’t specific to one research issue.

Sandra: Showcase all the research involved in the CP Road Map in one of the next E-News.
Ahmad: Implementation on the research that has been presented is needed. COMPASS implementation is a need.

Jerry: ACPA has COMPASS training in this next year’s program.

Rick: The Road Map was meant to be a 10 year program; it has been active for 7-8 years now and it has been successful in that no one has walked away from it.

Gary: Training is critical and can’t be overdone. Webinars, NHI courses, whatever works. Doesn’t have to be a half day – some information could be disseminated through quick training involving a slide show with time for questions (i.e. dowel bar insertion).

Sandra: Map Briefs, E-news, database information are all even more helpful than anticipated. States need tangible products like these to promote their involvement. Road Map momentum is building; we should be able to attract more members.

John: Need to try and develop more interaction between NCC and CP Road Map. Road Map generates enthusiasm and could be used to keep NCC from getting stale.

Sandra: E-news, MAP Briefs can be used to show what states are getting when justification is needed. Multiple pooled fund projects gives states the leeway to follow their interests and needs.

Ron: In my opinion, the intent should be to move towards some standard specifications for the end product. For example, for gradation of the aggregates, Iowa has incentivized contractor to find “sweet spot” of gradation and get rewarded rather than follow a specific %. Surface Characteristics project shows that if you control the process, control the variability, you can get quietness from any of the textures. Variability is the key. Incentivize the contractor and ensure uniformity and success. Statistical spec with end product clearly defined will keep good contractors highly incentivized and give a new contractor a map of where to go.

2. Where should the CP Road Map’s pooled fund activities be focused to bring the greatest value to the states?

Sandra: Providing a total picture is key, both the research and the tech transfer. The case studies that show the ramifications of different decisions. There is value in pooled funds like this and the NC2 that are not one specific narrow area of study.

Jerry: Dale said we’ve been trying for a few years to shoehorn state’s needs into the Road Map instead of the other way around which is asking states what they need and looking for synergies. That is being done now through personal contact with the research directors at the DOTs and is valuable.

Rick: Keep the national perspective; states and agencies can get buried in seeing only their immediate issues and there is a need to have the bigger picture identified.

Julie: The trend analysis pie chart presented was helpful. When you see another state’s research focus changing, it spurs questions and interest for other states.

Gary: The CP Tech Center through the Road Map identifies the national issue and all the gaps involved in solving the problem. Each state’s specific issues are part of the big picture and each state has the opportunity to work together on the process to solve the issue. A synthesis program to look at complete problem areas is needed.

Sandra: This group could identify research that is needed and look to do the synthesis that is needed to get the project going.
Ahmad: There are so many problem statements in the Road Map; 4-6 high priority problem statements could be identified on a yearly basis and sent submitted to TRB concrete committees for their review and support and eventually submitted to NCHRP.

Sandra: AASHTO SCOR has asked all the AASHTO committees and subcommittees to identify top priorities and rank them.

Gary: The sheer number of problem statements from RAC makes for difficult evaluation, endorsements from the Road Map group might carry weight in the process. The executive committee could endorse several projects needing significant research funding and look for the best mechanism for funding, either NCHRP funding and/or pooled fund.

3. Do you support continuing the TPF beyond June 2011?

Gary: Yes it should continue, but a summary document showing the success, and in particular the advantages to states, is needed. When listing ongoing projects, it’s not clear which projects have originated or are being facilitated due to the Road Map’s involvement in identifying the need and in finding partners to fund the research. This involvement should be noted. Managing the CP Road Map is a pooled fund and that it is a pooled fund should receive more visibility. If more states were involved less money per state would be needed and that would be an easier “sell”.

Julie: Perhaps following the lead from TERRA, projects could show a CP Road Map-initiated and/or CP Road Map-facilitated project designation. The E-News header should credit the pooled fund states.

John: A short document (2 pager) summarizing all of the successes is needed.

Sandra: FHWA has done a good job leading the pooled fund, but we had hoped more states would participate. There is a lot of synergy between this project and the TTCC/NCC pooled fund; approaching the TTCC states would be a good place to start for increased participation. Iowa leads 15-18 pooled funds, including the TTCC, and would be willing to lead this one. Transferring the leadership can be done, and might make the connection for NCC states easier. States are finalizing commitments in March so timing is critical.

Tom: Sandra and Ahmad will meet with Cheryl Richter during TRB. Before we develop supportive documents we have to identify the lead agency and then work to get broader interest from the states.

John: Involvement in the pooled fund should be a discussion item at April’s NCC meeting. If material could be sent out in March, then in April it could be discussed with states that have flexibility; hopefully capture 4-5 more states.

Sandra: If we can meet a March 1 date for determining where the pooled fund wants to go, that would probably help participating states and future participating states to determine if they want to put money in beyond current fiscal year.

Tom: We need to do something at the beginning of February so that we have something out before states completely finalize their plans.

Tom: The present task order ends in June; however, there is some funding remaining that we may be able to budget for June through September 10, 2011.

Jerry: I think an extension and perhaps some of the additional funding should be considered for Task Order 4. Realigning the Road Map is a huge task and needs the time and funding to do it well.
4. What are your ideas on how the OSG (Operating Support Group – the CP Tech Center) can be most effective within the funding provided; i.e., what activities, efforts, products, etc., do you think will bring the most value?

Jerry: Although the database has changed somewhat in how it is being developed, it remains a valuable part of the Road Map.

Julie: The outreach and tech transfer communications.

Sandra: At national meetings, the Road Map is often used as a national model for agencies and organizations.

Gary: RAC managers want to hear not only about the actual Road Map, but also about methodologies that work. Road Map is the poster child for what is working. The OSG should be on agenda as often as possible to leverage interest in methodology and also in the Road Map. Get on RAC meeting for summer to showcase what has all been done.

John: One area of emphasis that is often overshadowed – how do you accept and pay for a pavement that is in the acceptance parameters to assure you are paying for quality. What are the pay factors, acceptance parameters, performance parameters. Process control parameters as opposed to acceptance standards for payment. We need emphasis on good solid acceptance processes.

5. How can this pooled fund work with other existing efforts, i.e., other concrete pavement pooled funds and other related research?

Ahmad: Suggested that TO5 (obligated, remaining funds) or extension of TO4 could be used for implementation activities.

Gary: States need a mechanism for training. Maybe this pooled fund and FHWA could work together for core funding for implementation. Even though money is tight, when experienced people leave, training for new people is not optional.

Tom: The whole issue of national training has been on the CP Tech Center’s radar. We are in the process of working with the NCC states to develop training for the participating states through the TTCC pooled fund. This idea is also on the RMC Foundation agenda for their March board meeting. Organizing industry, states and FHWA funding for a comprehensive training program would really be helpful.

Gary: A national repository of training for concrete pavement would be valuable. There may be states that would get involved in the pooled fund just to facilitate training. It’s often easier to get involved in a pooled fund project and have it pay for specific training and travel. The pooled fund contract needs to be flexible enough to allow for additional money to be added by a state for additional training.

Tom: Task Order contracts allow for the scope to change as needs develop. With the Road Map, Task Order 5 could be written to focus on implementation and training.

Ahmad: If committee wants it, the next scope of work could focus on that direction.

Gary: The database shows successful research but you need funds to facilitate that tech transfer. Build in the flexibility to have states add money for tech transfer, for webinars or hard copies of publications.
Closing remarks:
Marty Fallon: The group has made tremendous progress and it is exciting to see all the successes. Are the newsletters getting to a wide enough audience?

Julie: Excellent meeting, excellent progress. There is good momentum, let’s keep the funding up and continue this task.

Ahmad: The meeting gave a very good overview of all the successes of the program. Extension to Task Order 4 is possible (need to discuss with contract office) and adding a focus for implementation & training may be the way to go.

Unanimous agreement from the members to add implementation and training.

Meeting adjourned.
The Road Map executive committee met on January 11th in Chicago; today's meeting is to update the executive committee on the progress of TO 4, SCOR and discuss Task Order 5.

1. Update on the SCOR meeting

   - SCOR (Standing Committee on Research) is one of the key AASHTO committees with 4 representatives from each AASHTO region. Sandra Larson from the Iowa DOT is vice-chair. She gave the SCOR committee an update on the CP Road Map pooled fund.
     - Informational packet, including the briefing paper on the pooled fund, was shared (copies were included in executive committee email)
     - Impact of the Road Map was communicated
     - Road Map is a partnership that is working was the message

2. Update on TO #4 activities (see attached PowerPoint for details)

   - Dale Harrington and Rob Rasmussen are refreshing the Road Map; reorganizing it for current use and priorities. Committee members to assist and review includes: NCC members (Tommy Nantung, Tyson Rupnow, Bret Trautman), ACPA national/state chapter exec, FHWA. Completion scheduled for June.
   - Foundations, sustainability, rehabilitation are not full tracks in the current document, but current needs indicate consideration should be given to this in the updated document. Sustainability has already been made a track, and this will be reflected in the revised Road Map. Committee will try to revise the document rather than just add material.
   - The 2 newest MAP Briefs (SmartCure: An Integral Part of an Intelligent Construction System and Intelligent Compaction for Concrete Pavement Bases and Subbases) were included in the mailing.
3. Briefing on Task Order #5 (Ahmad Ardani)

- Last committee meeting indicated that a portion of the remaining funds should be used for training/workshops in order to accelerate the adoption of new technologies. The six participating pooled fund states (MI, MS, PA, IA, NY, VA) will be offered their choice from 10 workshops. Webinars will be offered on an ad-hoc basis.
- E-new and MAP Briefs will continue as part of the communications/outreach task
- Support for the executive committee and track teams will continue.

4. Discussion on Training (Tom Cackler)

- The Center has 8 training programs nearly developed, with 2 more in the works. The material in each of the programs will be customized to the needs of the state requesting the training.
- Suggestion: Compile information to compare asphalt and concrete for agencies making a decision on appropriate usage.
  - Response: That type of promotional material is more suited to ACPA or others in the industry than the CP Road Map.
- Suggestion: A module on sustainability, and introducing the concept of Life Cycle Cost Analysis
  - Response: A manual of existing practices for sustainability is presently being written. The manual (~200 pages) will be available in December and training material could be developed.
  - FHWA has a comprehensive sustainability program with Tom Van Dam as lead
  - Life Cycle Cost Analysis
- Suggestion: MIT concrete research will have results that could roll into this
  - Response: Julie Garbini will keep the Center informed of opportunities
- Suggestion: Recast IMCP manual for new employees. Perhaps a back to basics and a bit beyond module; training on the basics are always needed.
  - FHWA wants to build upon IMCP and testing guide that came out. This is the 3rd piece that would tie it all together.
- Suggestion: Webinars might be more cost effective as budgets are still very tight. Perhaps on-demand webinars?
  - The Center has worked with TCCC on modules that are available on-demand through our website and the TCCC website,
  - The Center is open to working with TCCC on more modules if the opportunity presents itself.

5. Future meetings:

- Electronic meetings
  - September 6, 2011 10:00 CDT
  - January 10, 2012 10:00
- Physical meeting
  - April 3, 2012 (Chicago)
APPENDIX D

SUMMARY OF THE CURRENT NATIONAL CONCRETE PAVEMENT RESEARCH PROJECT DATABASE
<p>| Project Title                                                                 | Project Description                                                                                                                                                                                                                                                                                                                                                      | Agency          | Contact         | Progress | Track 1 | Track 2 | Track 3 | Track 4 | Track 5 | Track 6 | Track 7 | Track 8 | Track 9 | Track 10 | Track 11 | Track 12 | Track 13 | Notes                                                                 |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------|-----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------------------------------------------------------------------------|
| FHWA Computer-Based Guidance for Air-Specific Optimization of Pavement Designs | The guidance system was developed for FHWA as an aid in evaluating concrete pavement designs to provide reliable and consistent guidance on long-term performance. The guidance consists of a performance-based design tool for concrete pavement systems. The tool uses input data from long-term pavement performance (LTPP) and pavement performance (Pavement Performance Management System) databases to calculate the expected life of the pavement system. The system outputs the performance of the pavement system for up to 50 years, considering various factors such as traffic volume, climate, and material properties. | FALCON Project  | Fred Fralick     | Active    | 1       |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |
| SmartCure                                                                   | The SmartCure project was developed for FHWA as an aid in evaluating concrete pavement designs to provide reliable and consistent guidance on long-term performance. The guidance system consists of a performance-based design tool for concrete pavement systems. The tool uses input data from long-term pavement performance (LTPP) and pavement performance (Pavement Performance Management System) databases to calculate the expected life of the pavement system. The system outputs the performance of the pavement system for up to 50 years, considering various factors such as traffic volume, climate, and material properties. | FALCON Project  | Fred Fralick     | Active    | 1       |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |
| CP Ms, Lit of the Future - High-Res Concrete &amp; Long-Term Durability &amp; Performance | The CP Ms, Lit of the Future project focuses on high-resolution concrete pavement designs to provide reliable and consistent guidance on long-term performance. The guidance system consists of a performance-based design tool for concrete pavement systems. The tool uses input data from long-term pavement performance (LTPP) and pavement performance (Pavement Performance Management System) databases to calculate the expected life of the pavement system. The system outputs the performance of the pavement system for up to 50 years, considering various factors such as traffic volume, climate, and material properties. | FALCON Project  | Richard Massinger| Active    | 1       |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |
| Technology Transfer Implementation, and Technical Assistance for PCAM METMIA Deployment | This is an ongoing project where FALCON is the following up on gaps and strategies identified in phases 1 and 2 of the project. The primary objective is to implement the M2S in a more comprehensive manner. The system will include various functionalities such as implementation of the new design procedures, including implementation of innovative pavement materials and pavement technologies. | FALCON Project  | Gary Doolitt     | Active    | 1       |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |
| Traffic Data Inputs for WER POC | Develop and collect a vehicle traffic data set that can be used to develop a pavement performance model for the WER. This project will focus on collecting and analyzing traffic data. The project will include the following tasks: a) Collect and analyze traffic data, b) Develop a pavement performance model, and c) Test the performance model using collected data. | FALCON Project  | M. Maloney      | Active    | 1       |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |
| Assessing Traffic Data and Analysis in Demand/Supply Design and Analysis | This project focuses on assessing traffic data and analyzing its impact on demand and supply design. The project will include the following tasks: a) Collect and analyze traffic data, b) Develop a pavement performance model, and c) Test the performance model using collected data. | FALCON Project  | M. Maloney      | Active    | 1       |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |
| Improved Reliability Modeling and Analysis for Pavement/Defensive Driving Model of WER | The project focuses on improving the reliability of the Pavement/Defensive Driving Model of WER. This project will include the following tasks: a) Collect and analyze traffic data, b) Develop a pavement performance model, and c) Test the performance model using collected data. | FALCON Project  | M. Maloney      | Active    | 1       |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |
| Support for Development of WERPS version 3.2 | This project focuses on supporting the development of WERPS version 3.2. The project will include the following tasks: a) Collect and analyze traffic data, b) Develop a pavement performance model, and c) Test the performance model using collected data. | FALCON Project  | Gary Doolitt     | Active    | 1       |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |
| Enhancement of Sensational Requirements for NMI Systems | The project focuses on enhancing the sensational requirements for NMI Systems. This project will include the following tasks: a) Collect and analyze traffic data, b) Develop a pavement performance model, and c) Test the performance model using collected data. | FALCON Project  | Mike Marinos        | Complete  |         |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |
| Evaluation, assessment, and in-situ demonstration of advanced sensing technologies | This project focuses on evaluating, assessing, and demonstrating advanced sensing technologies. The project will include the following tasks: a) Collect and analyze traffic data, b) Develop a pavement performance model, and c) Test the performance model using collected data. | FALCON Project  | Gary Doolitt     | Active    | 1       |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |
| Integration Traffic Noise Model Development Continuation | This project focuses on integrating the Traffic Noise Model into the Pavement Maintenance (Powerful) Noise Model. The project will include the following tasks: a) Collect and analyze traffic data, b) Develop a pavement performance model, and c) Test the performance model using collected data. | FALCON Project  | Larry Water         | Active    | 1       |         |         |         |         |         |         |         |         |         |         |         |         | <a href="http://www.fhwa.dot.gov/pavement/design/guidance.asp">http://www.fhwa.dot.gov/pavement/design/guidance.asp</a>                   |</p>
<table>
<thead>
<tr>
<th>Concrete, Pavement, and Research Projects Title</th>
<th>Project Description</th>
<th>Agency</th>
<th>Contact</th>
<th>Projects</th>
<th>Track 1</th>
<th>Track 2</th>
<th>Track 3</th>
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<th>Note</th>
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<td>ProFlex, Software Development and Support</td>
<td>&quot;Continuing to provide technical support will ensure this software remains an industry standard.&quot;</td>
<td>ROEML</td>
<td>Roland Orthwey</td>
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<td>Speak-Spray Pavement Accelerated</td>
<td>&quot;This project addresses two needs: the need to predict the systematic spray potential of an existing roadway.&quot;</td>
<td>ROEML</td>
<td>Mark Kiesewalter</td>
<td>Complete</td>
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<td>Reservoir and Reservoir Relationship</td>
<td>&quot;This document for pavement structural performance characterization to evaluate observed load-related distresses is associated with collection of pavement surface characteristics related to safety.&quot;</td>
<td>ROEML</td>
<td>Mark Kiesewalter</td>
<td>Complete</td>
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<td>Concrete Reinforcing Bar to Compressive</td>
<td>&quot;Studied balanced beams for determination of material/property amounts and cost to facilitate aero/structural interface to assess effectiveness of these strategies for other pavement structures.&quot;</td>
<td>ROEML</td>
<td>Naderkhan Barkevand</td>
<td>Active</td>
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<td>Achievement of Continuously Reinforced Concrete Pavement (CRCP)</td>
<td>&quot;This project will evaluate the load-bearing capacity of a composite pavement structure for use in current and future applications.&quot;</td>
<td>ROEML</td>
<td>Sue Turner</td>
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<td>Concrete Pavement Management as a Result of Identified Problems in the PAV System</td>
<td>&quot;The project will also further promote pavement management as a result of identified problems in the PAV system.&quot;</td>
<td>ROEML</td>
<td>Nathaniel Colby</td>
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<td>Pavement Performance Data Collection</td>
<td>&quot;This project will aid in the development of a pavement management system that can be used to evaluate CRCP pavement performance data.&quot;</td>
<td>ROEML</td>
<td>Naderkhan Barkevand</td>
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<td>Operations Support for Concrete Pavement Reinforcement</td>
<td>&quot;This is a continuation of the FALCON 3 PO of Roadhead Management Parsons.&quot;</td>
<td>ROEML</td>
<td>Ahmed Askar</td>
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<td>Mortar and Innovative Materials in Concrete Placing Surface : WAP Project (AP-2)</td>
<td>&quot;Concrete paving is an essential advancement for the application of used material quantities to ensure proper placement and compaction of the final product.&quot;</td>
<td>ROEML</td>
<td>Richard Meisinger</td>
<td>Active</td>
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<td>Office of Infrastructure Development</td>
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<td>Deliverable/Year</td>
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<tr>
<td>Infrastructure Development</td>
<td>Pavement Design and Construction</td>
<td>Support for: The California Department of Transportation (Caltrans) Pavement Performance Models</td>
<td>The California Department of Transportation (Caltrans) and the University of California, Berkeley, are collaborating to develop performance models for pavements in California.</td>
<td>2023: Support</td>
<td>2023: Support</td>
<td>University of California: Berkeley</td>
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<td>Infrastructure Development</td>
<td>Pavement Design and Construction</td>
<td>Research and Development</td>
<td>This project is focused on developing a new, user-friendly pavement performance model for Caltrans. The model will incorporate the latest technologies and methodologies to improve the accuracy and efficiency of pavement performance predictions.</td>
<td>2024: Research</td>
<td>2024: Research</td>
<td>University of California: Berkeley</td>
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<td>Infrastructure Development</td>
<td>Bridge Design and Construction</td>
<td>High Performance Concrete (HPC)</td>
<td>This project aims to develop advanced high performance concrete (HPC) materials and technologies for bridge construction. The objective is to enhance the durability and performance of bridges while reducing life cycle costs.</td>
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<td>2025: Design</td>
<td>University of California: Berkeley</td>
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<td>Infrastructure Development</td>
<td>Geotechnical Engineering</td>
<td>Geotechnical Research</td>
<td>This project focuses on geotechnical research to improve the understanding of soil and rock properties and their behavior under various conditions.</td>
<td>2026: Research</td>
<td>2026: Research</td>
<td>University of California: Berkeley</td>
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<td>Infrastructure Development</td>
<td>Geotechnical Engineering</td>
<td>Geotechnical Research</td>
<td>This project focuses on geotechnical research to improve the understanding of soil and rock properties and their behavior under various conditions.</td>
<td>2027: Research</td>
<td>2027: Research</td>
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<tr>
<td>Infrastructure Development</td>
<td>Geotechnical Engineering</td>
<td>Geotechnical Research</td>
<td>This project focuses on geotechnical research to improve the understanding of soil and rock properties and their behavior under various conditions.</td>
<td>2028: Research</td>
<td>2028: Research</td>
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<td>Agency</td>
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<td>Caltrans</td>
<td>Artificial Vision for the Drunk, Dazzled, and Delayed</td>
<td>Artificial Vision for the Drunk, Dazzled, and Delayed</td>
<td>916-278-5850</td>
<td>Palms,小龙虾 (3944)</td>
<td>6/20/2019</td>
<td>515-300-7544 (530-64)</td>
<td>1/20/2019</td>
<td>10/20/2019</td>
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<td>California State University</td>
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<td>Continued Building of the Persistent Research Database</td>
<td>Continued Building of the Persistent Research Database</td>
<td>916-207-1525</td>
<td>Hardy, John (354-8844)</td>
<td>7/1/2009</td>
<td>6/30/2011</td>
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<td>Regents of the University of California</td>
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<td>Caltrans</td>
<td>Contribution of Thin Surface Treatments to the Absence of Traffic Noise Over a Road Construction</td>
<td>Contribution of Thin Surface Treatments to the Absence of Traffic Noise Over a Road Construction</td>
<td>916-287-6805</td>
<td>Hardy, John (354-8844)</td>
<td>7/1/2004</td>
<td>6/30/2011</td>
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<td>Virginia Tech Transportation Systems Center</td>
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<td>Caltrans</td>
<td>Corrosion and Marine Protected Pavement Research Program</td>
<td>Corrosion and Marine Protected Pavement Research Program</td>
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<td>Caltrans</td>
<td>Leading Behavior of Soil-Embedded Precast and Environmental Mitigation in Road Construction: Phase 1</td>
<td>Leading Behavior of Soil-Embedded Precast and Environmental Mitigation in Road Construction: Phase 1</td>
<td>916-410-4646</td>
<td>Palacios, Roy (713-272-2500)</td>
<td>8/1/2010</td>
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<td>Texas DOT</td>
<td>Mitigation of High-Scatter Debris in Texas</td>
<td>Mitigation of High-Scatter Debris in Texas</td>
<td>214-202-3604</td>
<td>Palacios, Roy (713-272-2500)</td>
<td>8/1/2010</td>
<td>9/1/2010</td>
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<td>University of Texas</td>
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<td>University of Colorado</td>
<td>Defining Concrete</td>
<td>Defining Concrete</td>
<td>401-974-2904</td>
<td>Baker, J. D. (512-641-7599)</td>
<td>8/1/2010</td>
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<td>University of Nairobi</td>
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**Note:** The table above is a simplification of the document content. Each row represents a different project with details such as the agency responsible, project description, public contact, sponsor, date awarded, and location/affiliation. The projects are listed under various agencies, including Caltrans and Texas DOT, and cover a range of topics such as artificial vision, transportation infrastructure, environmental mitigation, and definitions of concrete properties.
<table>
<thead>
<tr>
<th>Agency</th>
<th>Concrete Pavement Research Project Title</th>
<th>Project Description</th>
<th>Primary Contact</th>
<th>Secondary Contact</th>
<th>Goal(s) Achieved</th>
<th>University/Other Affiliation</th>
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<tbody>
<tr>
<td>TxDOT</td>
<td>Characterization of Fly Ash</td>
<td>The research team has proposed a comprehensive, methodical approach to characterize fly ash used in high-performance concrete. This project will involve the examination of various fly ashes from different sources and their potential for use in concrete.</td>
<td>Andy (PI)</td>
<td>Norma</td>
<td>512-453-4085</td>
<td>Kathleen J. (915) 223-0102</td>
</tr>
<tr>
<td>TxDOT</td>
<td>Preventing Aggregate Property Depreciation for Portland Cement Concrete</td>
<td>The research team will evaluate various methods to prevent aggregate property depreciation in Portland cement concrete. This project will involve the examination of various Portland cement concrete mixes and their potential for use in high-performance concrete.</td>
<td>Michael (PI)</td>
<td>David (Co-PI)</td>
<td>512-453-4085</td>
<td>Flavio, David R. (915) 223-0102</td>
</tr>
<tr>
<td>TxDOT</td>
<td>Phospholipids in PHPC-CCS for Use in Transportation Applications</td>
<td>The research team will investigate the potential use of phospholipids in PHPC-CCS for use in transportation applications. This project will involve the examination of various phospholipid sources and their potential for use in high-performance concrete.</td>
<td>Pat (PI)</td>
<td>Harry</td>
<td>512-453-4085</td>
<td>Jonner, Harry</td>
</tr>
<tr>
<td>TxDOT</td>
<td>Water Quality Performance of Portland Cement Concrete in Cold Regions</td>
<td>The research team will investigate the water quality performance of Portland cement concrete in cold regions. This project will involve the examination of various Portland cement concrete mixes and their potential for use in cold environments.</td>
<td>Gary (PI)</td>
<td>Harry</td>
<td>512-453-4085</td>
<td>Ramos, Michael</td>
</tr>
<tr>
<td>NIDOT</td>
<td>Effect of C-Aggregate on Concrete Strength</td>
<td>The research team will investigate the effect of C-aggregate on concrete strength. This project will involve the examination of various C-aggregate sources and their potential for use in high-performance concrete.</td>
<td>Jack (PI)</td>
<td>Dave</td>
<td>405-942-9098</td>
<td>Lee, Tanya</td>
</tr>
<tr>
<td>NIDOT</td>
<td>Effect of C-Aggregate on Concrete Performance</td>
<td>The research team will investigate the effect of C-aggregate on concrete performance. This project will involve the examination of various C-aggregate sources and their potential for use in high-performance concrete.</td>
<td>Jack (PI)</td>
<td>Dave</td>
<td>405-942-9098</td>
<td>Lee, Tanya</td>
</tr>
<tr>
<td>NIDOT</td>
<td>Performance of Ultra-Thin Waterproofing Systems in Oklahoma</td>
<td>The research team will investigate the performance of ultra-thin waterproofing systems in Oklahoma. This project will involve the examination of various waterproofing systems and their potential for use in high-performance concrete.</td>
<td>Kory (PI)</td>
<td>David</td>
<td>405-522-0809</td>
<td>Matthew</td>
</tr>
<tr>
<td>TxDOT</td>
<td>Quantifying the Costs and Benefits of Precast Reinforcement Prestress on Concrete Pavement</td>
<td>The research team will investigate the costs and benefits of using precast reinforcement prestress on concrete pavement. This project will involve the examination of various precast reinforcement prestress systems and their potential for use in high-performance concrete.</td>
<td>Cathe (PI)</td>
<td>Oran</td>
<td>405-237-2020</td>
<td>Shriver, David</td>
</tr>
<tr>
<td>PennDOT</td>
<td>Using Clay Fly Ash and Recycled Glass in Developing Low-Cement Granular Materials</td>
<td>The research team will investigate the use of clay fly ash and recycled glass in developing low-cement granular materials. This project will involve the examination of various clay fly ash and recycled glass sources and their potential for use in high-performance concrete.</td>
<td>Mark (PI)</td>
<td>David (Co-PI)</td>
<td>405-942-9098</td>
<td>Daniel</td>
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<tr>
<td>Agency</td>
<td>Concrete Pavement Research Project Title</td>
<td>Project Description</td>
<td>Primary Contacts</td>
<td>Secondary Contacts</td>
<td>Date started</td>
<td>State Contact</td>
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<tr>
<td>TxDOT</td>
<td>Synthesis of Successful Recycled and Innovative Recycled Materials in TxDOT Specified Mixtures</td>
<td>Synthesis of Successful Recycled and Innovative Recycled Materials in TxDOT Specified Mixtures</td>
<td>Dhris Patel</td>
<td>Prof. Hager</td>
<td>12/17/2017</td>
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<tr>
<td>California Department of Transportation</td>
<td>Develop New Knowledge and New Design Methods for Sustainable Rehabilitation Techniques</td>
<td>The University of California Pavement Research Center (UCPRC) recently identified a</td>
<td>John Harvey</td>
<td>Marci Hegyi</td>
<td>10/20/2018</td>
<td>Active</td>
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<td></td>
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<td>new design framework and new design mechanistic models for innovative asphalt mixtures that</td>
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<td></td>
<td></td>
<td>were developed in a 5-year research project conducted at the University of California, Davis.</td>
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<td>Florida DOT</td>
<td>Assessment of Pavement Concerns Associated with the Use of Coarse Grains in FDOT Concrete Mixes</td>
<td>The objective of this project is to assess FDOT's potential for using coarse aggregates in</td>
<td>Harvey Deard</td>
<td>Prof. Schwing</td>
<td>11/20/2011</td>
<td>Active</td>
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<td></td>
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<td>Florida mixtures. The study will evaluate the performance characteristics of coarse aggregate</td>
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<td>Group</td>
<td>Project Description</td>
<td>Project Details</td>
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<td>NCMHP-DP</td>
<td>Installation of the Outfall at Pascagoula Junction on the Atlantic Ocean</td>
<td>Outfall installation in Pascagoula Junction.</td>
<td>Track 1</td>
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<td>NCMHP-DP</td>
<td>Monitoring of Pascagoula Junction for the Model Pascagoula Junction</td>
<td>Monitoring of Pascagoula Junction.</td>
<td>Track 3</td>
<td>In progress</td>
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<td>NCMHP-DP</td>
<td>Development of the Pascagoula Junction</td>
<td>Development of the Pascagoula Junction.</td>
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<td>Development of the Pascagoula Junction.</td>
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<td>NCMHP-DP</td>
<td>Monitoring of the Pascagoula Junction</td>
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<td>NCMHP-DP</td>
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<td>Development of the Pascagoula Junction.</td>
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<td>Track 9</td>
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<td>NCMHP-DP</td>
<td>Development of the Pascagoula Junction</td>
<td>Development of the Pascagoula Junction.</td>
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<td>Track 12</td>
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<td>NCMHP-DP</td>
<td>Development of the Pascagoula Junction</td>
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<td>Research Agency</td>
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<td>NCFP 14 16</td>
<td>Maintenance of Delayed</td>
<td>The objective of this research is to develop a methodology to identify the components of delayed maintenance treatments. The process will be applicable to highway pavements, sidewalks, and other physical assets. Components shall be evaluated in terms of performance, cost, and risk. The life cycle cost analysis of the maintenance of delayed maintenance treatments shall be performed to identify the most cost-effective maintenance strategy.</td>
<td>Cambridge Systematics, Inc.</td>
<td>James A. Mazzochi</td>
<td>J. R. Rice</td>
<td>678079</td>
</tr>
</tbody>
</table>
**Project Description**

The ultimate objective of the IMPRAGE is to reduce the overall cost of regional & sub-regional hazardous waste management options, and to reduce the cost and environmental impacts of DTG projects.

**Indicating Source**

- EPA
- US
- EPA
- DTG
- US
- DTG
- DTG
- DTG
- DTG
- DTG
- DTG

**Contact**

- Jason Chandler
- DTG
- DTG
- DTG
- DTG
- DTG
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- DTG
- DTG
- DTG
- DTG

**Start Date**

- Aug 09
- Mar 08
- Mar 08
- Aug 09
- May 09
- May 09
- May 09
- May 09
- May 09
- May 09
- May 09

**Final Report**

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<th>Project Title</th>
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<td>Agency</td>
<td>Concrete Pavement Research Project Title</td>
<td>Project Description (Summaries are copied directly)</td>
<td>Status</td>
<td>Date completed (or observed)</td>
<td>Researchers</td>
<td>University(s) involved with this project</td>
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<td>PennDOT</td>
<td>Evaluation Performance of Limestone Pione to Pavement</td>
<td>Recently Completed Dec-09 Zihan Rado Pennsylvania State University</td>
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<tr>
<td>PennDOT</td>
<td>Measured Response of an Instrumented Joint Plan Concrete Pavements to Applied Vehicle Loads</td>
<td>Recently Completed Feb-08 Jennifer McCracken, Ranis Abtahian, and Julia Vandenbussche University of Pittsburgh</td>
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<td>PennDOT</td>
<td>Hardened Air in Concrete: Roadway Pavements in Structures</td>
<td>Recently Completed</td>
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<td>PennDOT</td>
<td>Prestressed Pavement Rehabilitation</td>
<td>The purpose of this project was to develop recommendations for rehabilitation strategies for prestressed concrete pavements on I-95 in Blair County.</td>
<td>Recently Completed Jun-09 Stofles, Schrueller, Yin, Yang, and Lopez de Mury Pennsylvania State University</td>
<td></td>
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<tr>
<td>PennDOT</td>
<td>Research of Current Practices in Pavement Performance Modeling</td>
<td>The goal of this research was to identify devices capable of measuring air void systems in concrete and to investigate their ability to analyzing air void system parameters (e.g., size, spacing, filler, surface characteristics) in both fresh and concrete. The need for such research is to be able to improve quality control in order to maximize long-term durability. The report includes a comprehensive literature review, discussion of the formation of the air void system during pavement hydration, and how it relates to durability, testing procedures with results, and conclusions that identify unclassified and thermography air technologies having the most potential for evaluating concrete air void systems.</td>
<td>Recently Completed Feb-10 Wotans and Zimmerman Applied Technology</td>
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<tr>
<td>PennDOT</td>
<td>Technology Evaluation on Characterization of the Air Void System in Concrete</td>
<td>The report documents field research evaluating the performance of alternative rehabilitation methods for cracked concrete pavements. Doweled bar retrofit (DBR), full-depth patching, steel mesh patching, hot-mix asphalt (HMA) overlays, and combinations thereof were used as rehabilitation methods along a determined section of I-80 in Valley Township, Montour County. The purpose of this research effort was to identify the best alternative for rehabilitation of concrete pavements in PennDOT District 3. The report concludes that DBR is a viable, faster alternative when cracking is at low severity, whereas full-depth patching is the preferred alternative when cracking is of high severity. Steel mesh allows the progression of reflective cracking provided existed pavement is structurally sound and HMA overlays improve long-term performance of DBR.</td>
<td>Recently Completed Aug-09 David Sbero and Alberto Medina none</td>
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<td>PennDOT</td>
<td>Concrete Pavement Cracking Rehabilitation</td>
<td>The objective of this program is to increase the awareness and knowledge of concrete overlay applications. This report discusses the feasibility of an overlay for US-119.</td>
<td>Complete</td>
<td>Nov-10 CP Tech Center FHWA CP Tech Center</td>
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<tr>
<td>Agency</td>
<td>Concrete Pavement Research Project Title</td>
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<td>Universities involved with this project</td>
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<td>PennDOT</td>
<td>Premature Deterioration of Jointed Plain Concrete Pavements</td>
<td>&quot;The purpose of this project is to help identify the cause of premature deterioration so that it can be prevented in future projects and also provide guidance on how to address this deterioration once it has developed. Early-age deterioration can be caused by three primary factors: construction practices, construction materials and/or design deficiencies. Many times, early-age deterioration is the result of a combination of these three factors. Deterioration related primarily to the use of a non-durable concrete will still typically take ten to fifteen years to manifest. The deterioration being observed is occurring within the first five to ten years so the focus of this research effort will be to look at premature deterioration that is not related to concrete durability.&quot;</td>
<td>Current</td>
<td>Nov-10</td>
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<td>Agency</td>
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<td>WSDOT</td>
<td>Concrete Performance Using Low Degradation Aggregate</td>
<td>Evaluating the effect of using low degradation aggregate in concrete to determine the detrimental effects on concrete performance. This information will allow us to produce long-lasting concrete pavements.</td>
<td>Current</td>
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<td>University of Washington</td>
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<td>WSDOT</td>
<td>Basic Practices for the Design and Construction of Portland Cement Concrete Pavements in Washington State</td>
<td>The research will enable WSDOT to make the best choice on the design and construction of concrete pavements for upcoming projects in the Puget Sound urban area. Implementation will be achieved through training and modified standard specifications or specifications.</td>
<td>Current</td>
<td></td>
<td>Washington State University</td>
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<td>WSDOT</td>
<td>Determining Changes in Greenhouse Gas Emissions from Circa 1990 to Present Due to Changes in Pavement Technology</td>
<td>The goal is to understand how the changes we've made over the past 20+ years in pavement technology (e.g., use of recycled materials, etc.) can affect the creation of greenhouse gas emissions.</td>
<td>Future</td>
<td>2011</td>
<td>University of Washington</td>
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<tr>
<td>State Pavement</td>
<td>Greenrnade – A Sustainability Performance Metric for Roadway Design and Construction</td>
<td>Stephan Messmer and Jeralee Anderson recently completed a report titled ‘Greenrnade – A Sustainability Performance Metric for Roadway Design and Construction’. The research was done through the SPTC.</td>
<td>Recently Completed</td>
<td></td>
<td>University of Washington</td>
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<tr>
<td>Technology</td>
<td></td>
<td>The report discusses the importance of sustainability in roadway design and construction.</td>
<td></td>
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<td>Muirhead University</td>
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<td>Consortium</td>
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<td>TransFlow</td>
<td>Evalulating and Optimizing Recycled Concrete Fines in PCC Mixtures Containing Supplementary Materials</td>
<td></td>
<td>Recently Completed</td>
<td>August 2010</td>
<td>Hareon, Connolly, Jackson</td>
<td>Oregon State University</td>
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<td>WSDOT</td>
<td>Effect of Chloride-based Deicers on Reinforced Concrete Structures</td>
<td>Through a lab investigation, it seems that corrosion inhibitors delay the initial onset of corrosion of steel in concrete, but once active corrosion begins, the benefits diminish. Also, the concrete itself did not seem to benefit from the inhibition of steel.</td>
<td>Recently Completed</td>
<td>July 2010</td>
<td>Warring Shi, Yijun Liu, Matthew Kluay, Michael Derry, Samir Khudib, Laura Fay, Andy Phan, Leonard</td>
<td>Washington Transportation Institute</td>
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<td>WSDOT</td>
<td>Evaluation of Portland Cement Concrete Pavement with High slag Content Cement</td>
<td>In June 2008, Keith Anderson, Jeff Uhlmeyer, Kurt Williams, Mark Russell, and Jim West completed the report titled ‘Evaluation of Portland Cement Concrete Pavement with High Slag Content Cement’. The report presents a comparison study of two</td>
<td>Recently Completed</td>
<td>June 2008</td>
<td>Keith Anderson, Jeff Uhlmeyer, Kurt Williams, Mark Russell, and Jim West</td>
<td>Washington State University</td>
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<tr>
<td>WSDOT</td>
<td>Use of Recycled Concrete Aggregate in PCCP: Literature Search</td>
<td>Aggregates used in concrete pavements constructed in Washington is of such great quality that the DOT is very interested in reusing the material. Therefore, in June of 2008, Keith Anderson, Jeff Uhlmeyer, and Mark Russell completed a report for WSDOT that</td>
<td>Recently Completed</td>
<td>June 2008</td>
<td>Keith Anderson, Jeff Uhlmeyer, and Mark Russell</td>
<td>Washington State University</td>
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<td>Project Description/Conceptual Approach</td>
<td>Name</td>
<td>Contact Info</td>
<td>Status</td>
<td>Date completed</td>
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<td>VCTAB</td>
<td>High Performance Compliance Reinforced Concrete Pavements in Richmond and Lynchburg, Virginia</td>
<td>K. C. Oyelakin</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=190">http://mix.virginia.edu/MemberDetail.aspx?ID=190</a></td>
<td>Recently completed</td>
<td>Sep-07</td>
<td>Oyelakin</td>
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<tr>
<td>VCTAB</td>
<td>Investigation of the Effects of Water Cure on Durability Parameters of Portland Cement Concrete</td>
<td>D. Stephen Lane</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=210">http://mix.virginia.edu/MemberDetail.aspx?ID=210</a></td>
<td>Recently completed</td>
<td>Mar-08</td>
<td>Lane</td>
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<td>VCTAB</td>
<td>Use of Nanosilica to Improve the Properties of Concrete</td>
<td>H. C. Oyelakin</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=230">http://mix.virginia.edu/MemberDetail.aspx?ID=230</a></td>
<td>Recently completed</td>
<td>Jun-09</td>
<td>Oyelakin</td>
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<td>VCTAB</td>
<td>Evaluation of Cement-Modified Concrete Pavement Rehab with on-lit in the Richmond and Harrison Roads Corridor of Virginia</td>
<td>Brian K. Defalquerta</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=240">http://mix.virginia.edu/MemberDetail.aspx?ID=240</a></td>
<td>Recently completed</td>
<td>Sep-09</td>
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<td>VCTAB</td>
<td>Independent Measurements of AASHTO C312 Concrete Mix Designs</td>
<td>H. C. Oyelakin</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=260">http://mix.virginia.edu/MemberDetail.aspx?ID=260</a></td>
<td>Current</td>
<td>Apr-08</td>
<td>Sharp</td>
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<td>VCTAB</td>
<td>Permeability, Absorptivity, and Chloride Penetration Measurements in VDOT Concrete Mix Designs and the Correlation of these Design</td>
<td>H. C. Oyelakin</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=270">http://mix.virginia.edu/MemberDetail.aspx?ID=270</a></td>
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<td>Oct-08</td>
<td>Oyelakin</td>
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<td>VCTAB</td>
<td>Evaluation of Ultra-High-Performance Fiber Reinforced Concrete</td>
<td>H. C. Oyelakin</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=280">http://mix.virginia.edu/MemberDetail.aspx?ID=280</a></td>
<td>Recently completed</td>
<td>Apr-09</td>
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<tr>
<td>VCTAB</td>
<td>Strength, Finite Element Analysis, Permeability and Corrosion of Lightweight Concrete</td>
<td>H. C. Oyelakin</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=290">http://mix.virginia.edu/MemberDetail.aspx?ID=290</a></td>
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<td>Dec-08</td>
<td>Oyelakin</td>
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<td>VCTAB</td>
<td>Characterization of Hydraulic Cement, Performance-Based Specifications, and Characteristics of other Mineral Admixtures Used in Concrete</td>
<td>D. Stephen Lane</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=300">http://mix.virginia.edu/MemberDetail.aspx?ID=300</a></td>
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<td>VCTAB</td>
<td>Use of Plant Data for Pavement Rehabilitation and Their Utilization</td>
<td>H. C. Oyelakin</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=330">http://mix.virginia.edu/MemberDetail.aspx?ID=330</a></td>
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<td>Jan-11</td>
<td>Oyelakin and Hossein</td>
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<td>VCTAB</td>
<td>Advanced Pavement Layer Resilient Moduli for WMA</td>
<td>M. Shaker Hossein</td>
<td><a href="http://mix.virginia.edu/MemberDetail.aspx?ID=340">http://mix.virginia.edu/MemberDetail.aspx?ID=340</a></td>
<td>Recently completed</td>
<td>Dec-09</td>
<td>Hossein</td>
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Note: The table represents the projects conducted by VCTAB and their respective contacts, statuses, publications, and links to summaries and reports.
<p>| Agency      | Concrete Pavement Research Project Title                             | Project Description | Research Project Contact                        | Data completed (for planned completion) | Track 1 | Track 2 | Track 3 | Track 4 | Track 5 | Track 6 | Track 7 | Track 8 | Track 9 | Track 10 | Track 11 | Track 12 | Track 13 | Link | Notes                                                                                           |
|------------|-----------------------------------------------------------------------|---------------------|------------------------------------------------|------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MOOT       | R-1976 - Evaluation of Various Concrete Pavement Joint Sealants       | Michael J. Ecker, Andrew R. Bennett                         | May-02                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | evaluate current material Anticipated benefits: identify better alternatives                                                                                                                             |
| MOOT       | Three Year Evaluation of Whitetopping Project on 46                  | Michael Ecker, MOOT                                         | Feb-04                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        | 1     | approaches                                                                                       |
| MOOT       | Concrete Surface Testing Study                                       | Robert Muether and Thomas Miller, MOOT                      | May-01                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | design guide for new and rehabilitated pavements based on mechanistic-empirical (M-E) model                                                                                                 |
| MOOT       | Unbonded Concrete Overlay Demonstration Project on I-75 in Ogemaw County - Construction Report | Michael Ecker and Andrew Bennett, MOOT                       | Jun-05                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | design guide for new and rehabilitated pavements based on mechanistic-empirical (M-E) model                                                                                                 |
| MOOT       | Absorption Capacity of Coarse Aggregates for Portland Cement Concrete | John F. Staton                                               | Sep-06                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | evaluate moisture conditioning for freeze-thaw testing Anticipated Benefits: determine if lab testing using vacuum saturation sufficiently stresses the aggregates                                                                 |
| Michigan State | Analytical investigation of the effects of aligned dowel bars coated with corrosion protective systems on initial dowel concrete bond stresses | Neenj Buch, Amit H. Vyas and Milton L. Prashita, MSU         | Feb-07                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       |                                                                                                  |
| Michigan State | A Laboratory examination of alignment tolerances for dowel bars and their effect on joint opening behavior | Neenj Buch, Amit H. Vyas and Milton L. Prashita, MSU         | Feb-07                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       |                                                                                                  |
| MOOT       | Graphical Analysis of Freeze-Thaw Test Results, R-1495               | Robert W. Maathel                                           | May-07                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | identify a trend of intermediate freeze-thaw expansion measurements                                                                                                                                   |
| MOOT       | Graphical Analysis of Iowa Freeze Index Test Results, R-1494         | Robert W. Maathel                                           | May-07                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | develop correlation curves of absorption values and expansion for dense and absorbent aggregate                                                                                                      |
| U of M - MOOT | Investigation of Early Cracking on Selected PCP Project              | David Skelly, MOOT and Dr. Will Johnson, U of M             | Dec-07                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       |                                                                                                  |
| Michigan State | Quantifying Coefficient of Thermal Expansion Values of Typical Hydraulic Cement Concrete Pavement Mixtures | Neenj Buch, Ph.D. (PS), Steven J. Apple (Michigan State University) | Jan-08                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | evaluate CTE of typical aggregate sources for PCP                                                                                                      |
| Michigan State | Quantifying Coefficient of Thermal Expansion Values of Typical Hydraulic Cement Concrete Pavement Mixtures | Neenj Buch and S. Jahannejad, MSU                           | Jan-08                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       |                                                                                                  |
| MOOT       | Evaluation of Geotextile Mechanical Splices for Prestressed Concrete Construction, R-1512 | Peter O. Jerskove, P.E.                                     | May-08                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | excluded two proprietary geotextile mechanical reinforcement systems, the Alfatex geotextile, and the Precast/CAST geotextile system, for suitability in connecting prestressed concrete structural elements Anticipated Benefits: Both products are recommended for use on decks                                                                 |
| U of M and Stonkard University | Sustainable Pavement Overlays Using Engineered Cementitious Composites | Michael D. Lavelle (Corresponding) and Victor C. U. | May-06                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | To reduce environmental impact and improve the sustainability of pavement overlay systems, a class of materials called Engineered Cementitious Composite (ECC) is introduced to construct more sustainable/bearable rigid pavements overlay                                                                 |
| Michigan State | Evaluation of the 1-3/FHA Design Process for New and Rehabilitated PCP and IBA Pavements | Neenj Buch, Ph.D. (PhD), Hamid Chati, Ph.D. (PS) and Roger Haefer, Ph.D., P.E., S. Anusha-Mark, Ph.D., MSU | Oct-06                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | initiated to develop a pavement                                                                                                                             |
| Michigan State | Absorption Capacity of Coarse Aggregates for Portland Cement Concrete, R-1529 | John F. Staton, P.E. (PE), Joseph O. Anderson               | Feb-02                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | to investigate concerns regarding the feasibility of moisture conditioning methods employed by MOOT's freeze-thaw testing program for coarse aggregates used in Portland cement concrete                                                                 |
| Michigan State | Development of a Simple Diagnostic Tool for Detecting Localized Roughness Features | Kann Chati, Ph.D., Irvin Zobbo, M.S., Anusha Deka, Ph.D., M.S., S. Anusha-Mark, Ph.D., MSU | Feb-09                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | conducted to develop a pavement for evaluation of areas for potential pavement remediation projects                                                                                                        |
| Michigan State | Effect of Mix, Multi-Axe Trucks on Pavement Distress                 | Kishan Chati, Harvard University, MA, Ph.D., M.S., S. Anusha-Mark, Ph.D., M.S., S. Anusha-Mark, Ph.D., M.S., S. Anusha-Mark, Ph.D., M.S. | Feb-09                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | conducted to evaluate the effects of multi-axe trucks on pavement distress                                                                                                         |
| MOOT       | R-1520 - Cement-Based Stabilized Test Sections on 1-1/8Y-75 in Monroe County - Construction Report | Prashanta Bandara and Math Ongel, MOOT                       | May-08                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       |                                                                                                  |
| Michigan State | Value Affected of Construction Incentive Payments on Pavement Performance | Gilbert Balbo, Ph.D., P.E. and Brent Lemon, MSU             | Aug-09                                       |                                          | 1      |        |        |        |        |        |        |        |        |        |        |        |        |       | explanatory study to determine whether or not the available data discriminate in the MOOT data files and processed records could adequately support the analysis of the costs and benefits of the IDC program and in performing preliminary data assessment                                                                 |</p>
<table>
<thead>
<tr>
<th>Institution</th>
<th>Project Title</th>
<th>Lead Contact(s)</th>
<th>Publication Date</th>
<th>Abstract</th>
</tr>
</thead>
</table>
| Li of M + MDOT | Performance Evaluation of JRCP with Stabilized Open-Graded Friction Course | Dr. Will Hansen, Li of M | Aug 09 | The objectives of the joint Li of M-MDOT investigation was to determine whether the improved joint performance of JRCP projects on treated GODC was due to the GODC stabilization, or whether those findings are transferable to current JRCP designs to benefit...
| Michigan Tech | Development of New Test Procedures for Determining the Specific Gravity and Absorption of Fine and Course Aggregates, (PC-1009) | Zheng Ning, Junhui Mi, Bao C., Chua Williams, and Ting-Shi (Michigan Tech University) | Sep 09 | 1 |
| Michigan State | Characterization of Truck Traffic in Michigan For the Next 20 Years | Naeem Siddiqi, Ph.D., Saeed Waqar Hider, Ph.D., F.I., Joel Brezan, and Kevin Shadk, Ph.D., MTC | Dec 09 | 1 |
| MDOT | Fifteen Year Performance Review of Michigan's European Concrete Pavement | David L. Shindel, MDOT | Feb 10 | 1 |
| Michigan Tech | Evaluation of Concrete Pavements with Materials-Related Deterioration | Dr. Lawrence Sutter, Thomas VanDam, Kurt Peterson, MTC | Mar 10 | 1 |
| Li of M | High-Strength RCC for Rapid Durable Repair - Material Properties | Li Li and Victor Li | Almost | To establish an understanding and database of selected HPFCC material properties. Anticipated benefits:
1. faster and more durable repair with reduced environmental impact.
<p>| Li of M | Self-Healing Characterization of Engineered Cementitious Composite (ECC) Materials | (Balakrish + Li University of Michigan + Kim + Sh = Tongji University (Shanghai China)) | Almost | 1 |
| DOT + ARTFH | Sustainable Recycling Material for Recycled Pavement | Tom VanDam | Mar 11 | 1 |
| Michigan Tech | Efficient Use of Recycled Concrete in Transportation Infrastructure | Jake Modis | 1 |
| Michigan Tech | Carbon-Footprint for Hot Mix Asphalt - PCP | Antoni Mucha | May 10 | 1 |
| Michigan Tech | Impact of Hydrated Cement Paste Quality on Air-Entrained Air Void System | Larry Satter | Dec 10 | 1 |
| Michigan State | Recycled Glass as SCM | Rob Ud-Din Nassar | 1 | 1 |</p>
<table>
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<tr>
<th>Project Title</th>
<th>Project Description</th>
<th>Researcher(s)</th>
<th>Start Date</th>
<th>End Date</th>
<th>Contact</th>
<th>Participants Involved in Project</th>
<th>Tasks</th>
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<tr>
<td>Performance Evaluation of Open-Gradated Lime Course and Non-Gradated Transite Mixes on U.S. 49 (I-105) and S.T.R.A. 29</td>
<td>This study is to investigate the 20-year performance of a concrete pavement test sections in Alabama. The test sections will be constructed of multiple combinations of dowelled and non-dowelled plain pavement, granular base pavement, and solid and Crushed Lime Transite.</td>
<td>Robert Schmitt</td>
<td>Oct-88</td>
<td>April-95</td>
<td>DOT</td>
<td>Dept. Civil Engineering, U of W, P, MS</td>
<td>1</td>
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<td>Evaluation of Minimum Required Weight of Coarse Materials in Concrete Mixes</td>
<td>The objective of this research project is to make recommendations on the quality and weight required for minimum CDMC to be used by WDOT for future pavement mixes and to make recommendations to WDOT for future work in this area.</td>
<td>Lawrence Butler</td>
<td>Sep-07</td>
<td>Dec-08</td>
<td>DOT</td>
<td>Macquarie Tech, Transportation Institute, Michigan</td>
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<td>Detrimental Fine Particles in Concrete Aggregates and denim Textile Impact</td>
<td>The objective of this research is to determine the impact on concrete strength development, shrinkage, and porosity.</td>
<td>Steven M. Chesser</td>
<td>Oct-88</td>
<td>Nov-98</td>
<td>DOT</td>
<td>Dept. Civil and Environmental Engineering, U of W, Madison</td>
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<td>Part/Depth Repair of Concrete Pavements</td>
<td>See notes</td>
<td>DOT</td>
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<td>Investigation and Application of Forced-Slab Techniques for CPO Pavements</td>
<td>See notes</td>
<td>DOT</td>
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<td>Laboratory Study of Concrete Properties in Support Implementation of the New AASHTO Mechanistic-Empirical Design Guide</td>
<td>The objective of this research is to determine if the new AASHTO Mechanistic-Empirical Design Guide is realistic.</td>
<td>Steven M. Chesser</td>
<td>Dec-09</td>
<td>Mar-10</td>
<td>DOT</td>
<td>Dept. Civil and Environmental Engineering, U of W, Madison</td>
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<td>Determination of Long Weather Concrete Forms</td>
<td>See notes</td>
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<tr>
<td>Investigation of Testing Methods to Determine Long Term Aggregate Durability of Various Types of Wisconsin Aggregate Sources</td>
<td>See notes</td>
<td>DOT</td>
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Note: This is brief on the Research in Progress website, but there are no details.
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<th>Agency</th>
<th>Concrete Pavement Research Project Title</th>
<th>Project Description (Summaries are listed directly)</th>
<th>RESEARCH PROJECT CONTACT</th>
<th>Date started (or proposal due)</th>
<th>Date completed (or proposal due)</th>
<th>Recently completed or Current?</th>
<th>Case Study, Report, Authors</th>
<th>University/State involved with this project</th>
<th>Delays/changes after project is funded? (if any)</th>
<th>Tracking (1-10)</th>
<th>Links to Summary</th>
<th>Links to Report</th>
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<td>MDOT</td>
<td>Effect of Moisture Content on the Durability of Concrete Pavement</td>
<td>The purpose was to evaluate how aggregate type, moisture content, and temperature affect concrete coefficient of thermal expansion (CTE). Twenty different mix designs were tested in accordance to five test methods in the AASHTO TP-520, Daniel, T11-91, and Brinell-Otto methods. This report summarizes the results of these tests. The test methods, prepare the testing data, and provides conclusions that discuss the results obtained from each of the test methods.</td>
<td>A10682 ARN06</td>
<td>06/09</td>
<td>Sep/07</td>
<td>Recently Completed or Current?</td>
<td>2024</td>
<td>University of Mississippi</td>
<td>MODOT/PHWA</td>
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<td><a href="http://www.portal.dot.gov/Transportation/Research/ProjectSummaryDetail.aspx?prj=10682">http://www.portal.dot.gov/Transportation/Research/ProjectSummaryDetail.aspx?prj=10682</a></td>
<td><a href="http://www_portal.dot.gov/Transportation/Research/ProjectSummaryDetail.aspx?prj=10682">http://www_portal.dot.gov/Transportation/Research/ProjectSummaryDetail.aspx?prj=10682</a></td>
<td>MODOT/PHWA</td>
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<td>Evaluation of the Effectiveness of Damper-Less Layers</td>
<td>The purpose of the research was to evaluate existing pavement drainage systems and to provide recommendations for any revision. The current research work documented in the report included a literature review and pavement evaluations. The literature review focused on pavement drainage design and construction concepts, current state practices, and maintenance procedures. Two parameters were examined using US 50 tests, one was the permeability of the course and the other was the permeability of the subgrade. The permeability class was tested on 10 test sections. The test sections were 40 feet long and 8 feet wide and were constructed in three layers. The test section was evaluated using the permeability class. The report also included a discussion of the results obtained from the test sections.</td>
<td>Wilsie White</td>
<td>07/07</td>
<td>Dec/07</td>
<td>Recently Completed or Current?</td>
<td>2024</td>
<td>Mississippi State University</td>
<td>MODOT/PHWA</td>
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<td><a href="http://www_portal.dot.gov/Transportation/Research/ProjectSummaryDetail.aspx?prj=10683">http://www_portal.dot.gov/Transportation/Research/ProjectSummaryDetail.aspx?prj=10683</a></td>
<td>MODOT/PHWA</td>
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<td>Development of Automated Excavation Measurement Model for PNeEL</td>
<td>The purpose of the research was to develop an automated method for measuring granular and asphalt pavements based on profile data. The tools of this research is an Automated Excavation Measurement (AEM) tool. AEM tool will automate the process of excavating and measuring the pavement. The tool will be used to collect data from the pavement surface and measure the thickness of the pavement at each location. The AEM tool will be used to collect data from the pavement surface and measure the thickness of the pavement at each location. The AEM tool will be used to collect data from the pavement surface and measure the thickness of the pavement at each location.</td>
<td>Chang George</td>
<td>2015</td>
<td>Recently Completed</td>
<td>2015</td>
<td>Georgia</td>
<td>MODOT/PHWA</td>
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<td><a href="http://www_portal.dot.gov/Transportation/Research/ProjectSummaryDetail.aspx?prj=10686">http://www_portal.dot.gov/Transportation/Research/ProjectSummaryDetail.aspx?prj=10686</a></td>
<td><a href="http://www_portal.dot.gov/Transportation/Research/ProjectSummaryDetail.aspx?prj=10686">http://www_portal.dot.gov/Transportation/Research/ProjectSummaryDetail.aspx?prj=10686</a></td>
<td>MODOT/PHWA</td>
<td>Chang Georgia</td>
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<td>Project Description</td>
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<td>University/Other Agency/Industry Involved in Project</td>
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<td>Iowa DOT</td>
<td>Air Content and Permeability of PCC Pavements: 1990 to 2006</td>
<td>The objective of this research is to evaluate various aspects such as permeability and air content in PCC pavements to better understand their effect on durability. Also, the changes in cement chemistry over the last century may have some impact.</td>
<td>Todd Hanson</td>
<td>Iowa State University</td>
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<td>Iowa DOT</td>
<td>Investigation of PCC Pavement Soundness from 1993 to 2000</td>
<td>The objective of this research is to document the early deterioration of PCC pavements due to PCC failure in Iowa.</td>
<td>Todd Hanson</td>
<td>Iowa State University</td>
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<td>Iowa DOT</td>
<td>Improving Portland Cement Concrete Mix Consistency and Production Rate Through Two Stage Mixing</td>
<td>The goal of the study was to find optimal mixing proportions for production of a homogeneous and workable mixture and productivity using a two-stage mixing operation.</td>
<td>Todd Hanson</td>
<td>Iowa State University</td>
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<td>Iowa DOT</td>
<td>Evaluation of Dowl Reinforced Concrete Pavements, February 2008</td>
<td>The project included the application of polyvinyl and sound-vapor dowel in a rehabilitation project. Dowel material types included conventional epoxy-coated steel and fiber-reinforced polymer. This work involved an examination of the ease of installation and the performance of dowels in the field work.</td>
<td>Todd Hanson</td>
<td>Iowa State University</td>
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<td>Iowa DOT</td>
<td>Rehabilitation of Concrete Pavements Using Microporous and Coarse and Stiff Methods</td>
<td>The primary objective of this study was to evaluate the structural condition of existing rehabilitated concrete pavements across Iowa through Field Weight Deflectometer (FWD) tests, Dynamic Cone Penetrometer (DCP) tests, visual pavement distress surveys, etc.</td>
<td>Todd Hanson</td>
<td>Iowa State University</td>
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<tr>
<td>Iowa DOT</td>
<td>Performance Evaluation of Concrete Pavement Subgrade--Pavement Surface Condition Evaluation</td>
<td>This research project covered a wide range of activities that involved the evaluation of the relationship between stability, pavement distress, and required performance pavement conditions (PPCC) and aggregate materials. Detailed laboratory and field tests, including pavement distress surveys, were performed.</td>
<td>Todd Hanson</td>
<td>Iowa State University</td>
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<td>Iowa DOT</td>
<td>Crack Development in Beam Mid-Span of Various Slab Depths</td>
<td>The present study investigated the effects of different paving systems on mid-span cracking in portland cement concrete (PCC) pavements.</td>
<td>Todd Hanson</td>
<td>Iowa State University</td>
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<tr>
<td>Iowa DOT</td>
<td>100 Years of Concrete Pavements in Iowa</td>
<td>The objective of this report is to document various changes in specifications, pavement design, and equipment for PCC paving from the early 1900s to present.</td>
<td>Todd Hanson</td>
<td>Iowa State University</td>
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<tr>
<td>Iowa DOT</td>
<td>Improving Concrete Overlay Construction</td>
<td>Four ongoing construction projects in Iowa were selected to study the repair of concrete overlay construction. Seven research objectives for improving concrete overlay construction were investigated across the four projects.</td>
<td>Todd Hanson</td>
<td>Iowa State University</td>
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<tr>
<td>Iowa DOT</td>
<td>Pavement Thickness Design for Laid Roads in Iowa</td>
<td>The pavement thickness design software packages were compared with regard to how they were different in determining design input parameters and their influence on pavement thickness. Based on the current pavement design procedures and sensitivity analysis results, a practical pavement design and sensitivity analysis (PDBSA) software testing was performed to develop a practical pavement thickness design value for a given condition and to allow a user to perform a pavement design sensitivity analysis.</td>
<td>Todd Hanson</td>
<td>Iowa State University</td>
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[Links to reports and summaries provided by the relevant departments or agencies]
Visual Representation of the Number of Concrete Pavement Research Projects in Iowa

TPF Participation
Currently Ongoing Research
Recently Completed Research
<table>
<thead>
<tr>
<th>Agency</th>
<th>Concrete Pavement Research Project/Project Title</th>
<th>Project Description</th>
<th>Principal Investigator(s)</th>
<th>Date Started (or planned start)</th>
<th>Date Completed on (project completion)</th>
<th>Summary of Results Complete/Incomplete</th>
<th>Link to Report</th>
<th>Researchers, Report Authors</th>
<th>University of Colorado Boulder/Other Agency (if applicable) (if project)</th>
<th>Database where project is located (e.g., CRIP) (if applicable)</th>
<th>Track 1</th>
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<th>Track 11</th>
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<th>Track 13</th>
<th>Notes</th>
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<tr>
<td>Texas DOT</td>
<td>Improving Portland Cement Concrete Pavement Performance (5-1725-1)</td>
<td>The primary objective of this study was to develop procedures to improve the long-term performance of Portland cement concrete. In order to achieve the primary objective, several task directions were executed during the study.</td>
<td>Moon Won</td>
<td>Mar-07</td>
<td>completed</td>
<td><a href="http://www.txdot.texas.gov/transportation/research/1725-1.pdf">http://www.txdot.texas.gov/transportation/research/1725-1.pdf</a></td>
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<td>Texas DOT</td>
<td>Development of a Concrete Pavement Rehabilitation Training SC/MD (5-1734-01)</td>
<td>The primary objective of this study was to develop a training program to provide concrete rehabilitation engineers with the knowledge and skills needed to effectively repair concrete pavements.</td>
<td>Tom Scoular</td>
<td>Aug-08</td>
<td>completed</td>
<td><a href="http://www.txdot.texas.gov/transportation/research/1734-01.pdf">http://www.txdot.texas.gov/transportation/research/1734-01.pdf</a></td>
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<td>Texas DOT</td>
<td>Construction and Evaluation of Push-Permeated Prestressed Concrete Pavement (4-4239-01)</td>
<td>The primary objective of this research project was to investigate the use of push-permeated prestressed concrete pavement (Push-Pave) for pavement rehabilitation.</td>
<td>Seongheon Choil</td>
<td>Jan-10</td>
<td>completed</td>
<td><a href="http://www.txdot.texas.gov/transportation/research/4239-01.pdf">http://www.txdot.texas.gov/transportation/research/4239-01.pdf</a></td>
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<td>Texas DOT</td>
<td>Pilot Implementation of Bump Detection Modules for CHIPS Construction (5-4343-01)</td>
<td>The primary objective of this research project was to develop and implement a bump detection system for concrete pavement construction.</td>
<td>Roger Walker</td>
<td>Aug-06</td>
<td>completed</td>
<td><a href="http://www.txdot.texas.gov/transportation/research/4343-01.pdf">http://www.txdot.texas.gov/transportation/research/4343-01.pdf</a></td>
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<tr>
<td>Texas DOT</td>
<td>Flow in Continuously Reinforced Concrete Pavement (4-4020-01)</td>
<td>The primary objective of this research project was to investigate the flow behavior of continuously reinforced concrete pavement.</td>
<td>Kevin Folkard</td>
<td>Dec-06</td>
<td>completed</td>
<td><a href="http://www.txdot.texas.gov/transportation/research/4020-01.pdf">http://www.txdot.texas.gov/transportation/research/4020-01.pdf</a></td>
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<td>Texas DOT</td>
<td>Use of Graded Crushed Concrete in Concrete Pavement (5-4062)</td>
<td>The primary objective of this research project was to investigate the use of graded crushed concrete in concrete pavement.</td>
<td>Kenal Zollinger</td>
<td>Aug-06</td>
<td>completed</td>
<td><a href="http://www.txdot.texas.gov/transportation/research/4062.pdf">http://www.txdot.texas.gov/transportation/research/4062.pdf</a></td>
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<td>Texas DOT</td>
<td>Best Practices for the Use of Crushed Rock Base in Concrete Pavement (5-4064)</td>
<td>The primary objective of this research project was to develop best practices for the use of crushed rock base in concrete pavement.</td>
<td>Kenal Zollinger</td>
<td>Dec-06</td>
<td>completed</td>
<td><a href="http://www.txdot.texas.gov/transportation/research/4064.pdf">http://www.txdot.texas.gov/transportation/research/4064.pdf</a></td>
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<td>Texas DOT</td>
<td>Performance of Old Concrete Under Thin Overlays (5-4092)</td>
<td>The primary objective of this research project was to investigate the performance of old concrete under thin concrete overlays.</td>
<td>Moon Won</td>
<td>Aug-07</td>
<td>completed</td>
<td><a href="http://www.txdot.texas.gov/transportation/research/4092.pdf">http://www.txdot.texas.gov/transportation/research/4092.pdf</a></td>
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<td>Agency</td>
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<td>Project Description</td>
<td>Research Project Code (DB#)</td>
<td>Principal Investigator</td>
<td>Lead Author</td>
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<td>Date Completed</td>
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|----------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------|------------------------|-------------|--------------|---------------|------------------------|------------------------|-----------------------|--------------------|}
<p>| TxDOT          | Concrete Pavement Development and Pavement Mechanics (3-4486-3)              | The main objective of this project was to present the findings of the assessment of various asphalt concrete overlays (ACO) projects built in the Bryan, Fort Worth, and Dallas districts. Likewise, it shows the results of this evaluation in terms of concrete pavement performance. The project is located in Houston, Texas. Where durability aspects of the project were measured and discussed. Finally, the evaluation of a life cycle cost analysis (LCCA) for the different pavement layers are performed. | 3-4486-3                    | Moon White             | June 08      | completed    | <a href="http://www.txdot.state.tx.us/actpordreport/3-4486_3.pdf">http://www.txdot.state.tx.us/actpordreport/3-4486_3.pdf</a> | CTR CTR                 | CTR CTR                | 1                  |
| TxDOT          | Defending in Bonded Concrete Overlays Over Continuously Reinforced Concrete Pavement (3-4486-4) | This study is focused on investigating the performance of bonded overlays under environmental conditions and highway usage scenarios. The objective of the study is to provide guidance on the design and use of these overlays, as well as develop a model capable of determining the extent of deflection for a variety of materials, structural and environmental conditions. | 3-4486-4                    | Moon White             | June 08      | completed    | <a href="http://www.txdot.state.tx.us/actpordreport/3-4486_4.pdf">http://www.txdot.state.tx.us/actpordreport/3-4486_4.pdf</a> | CTR CTR                 | CTR CTR                | 1                  |
| TxDOT          | Best Design and Construction Practices for Concrete Pavement Transition Areas (3-4484-2)   | The principal objectives of the Texas Department of Transportation (TxDOT) and industry are: improving the design of concrete pavement transitions that are constructed at locations where the design of a project is critical to the overall performance of the pavement. | 3-4484-2                   | Dan Zehring             | August 06  | completed    | <a href="http://www.txdot.state.tx.us/actpordreport/3-4484_2.pdf">http://www.txdot.state.tx.us/actpordreport/3-4484_2.pdf</a> | CTR CTR                 | CTR CTR                | 1                  |
| TxDOT          | Rehabilitation Procedures for Longitudinal Cracks and Joint Separation in Concrete Pavement (3-4444-7) | Researchers surveyed cracking in the U.S. in several publications in the last few years where effective means for repairing and rehabilitating pavements with longitudinal cracking on temporary structures. These mechanisms included the limitations of the methods and procedures for the repair of concrete pavements. The methods were evaluated for ease of application, cost-effectiveness, and durability. | 3-4444-7                   | David Foster             | August 06  | completed    | <a href="http://www.txdot.state.tx.us/actpordreport/3-4444_7.pdf">http://www.txdot.state.tx.us/actpordreport/3-4444_7.pdf</a> | CTR CTR                 | CTR CTR                | 1                  |
| TxDOT          | Mechanistic-empirical Data Collection Approach for Rigid Pavements (3-4493-1) | A database structure has been proposed and data collection efforts followed. This technology will ensue the quality of the data. To address the M-C component, researchers were given a computerized analysis of concrete pavement (COPC) design logic and use the mechanistic-empirical pavement design guide (MEPDG) and the mechanistic-empirical pavement design guide (MEPDG). | 3-4493-1                   | Moon White               | October 06 | completed    | <a href="http://www.txdot.state.tx.us/actpordreport/3-4493_1.pdf">http://www.txdot.state.tx.us/actpordreport/3-4493_1.pdf</a> | CTR CTR                 | CTR CTR                | 1                  |
| TxDOT          | Analysis of Continuously Reinforced Concrete Pavement Behavior Using Information in the Rigid Pavement Database (3-4445-2) | Researchers developed a methodology to analyze and evaluate the behavior of concrete pavements. The database contained information on the performance of continuous reinforced concrete pavements (CPCP) and the behavior of concrete pavements. | 3-4445-2                   | Moon White               | July 08     | completed    | <a href="http://www.txdot.state.tx.us/actpordreport/3-4445_2.pdf">http://www.txdot.state.tx.us/actpordreport/3-4445_2.pdf</a> | CTR CTR                 | CTR CTR                | 1                  |
| TxDOT          | Concrete Pavement Oversight over Existing Asphalt Pavement Structures (3-4483-6) | The primary objective of this research program is to develop guidelines and design procedures for rehabilitating Pavements. The key outcomes of this research program (1) Perform an analysis of the rehabilitation of existing asphalt pavements (EAP) with consideration of the performance of EAP at locations and design procedures (2) Develop the design of EAP at locations and design procedures (3) Develop a procedure to determine the required thickness of EAP at locations and design procedures (4) Conduct a study to determine the required thickness of EAP at locations and design procedures. | 3-4483-6                   | Moon White               | August 07  | completed    | <a href="http://www.txdot.state.tx.us/actpordreport/3-4483_6.pdf">http://www.txdot.state.tx.us/actpordreport/3-4483_6.pdf</a> | CTR CTR                 | CTR CTR                | 1                  |
| TxDOT          | Development of the Thickness Design for Concrete Pavement Oversight over Existing Asphalt Pavement Structures (3-4482-6) | The primary objective of this research program is to develop guidelines and design procedures for rehabilitating Pavements. The key outcomes of this research program (1) Perform an analysis of the rehabilitation of existing asphalt pavements (EAP) with consideration of the performance of EAP at locations and design procedures (2) Develop the design of EAP at locations and design procedures (3) Develop a procedure to determine the required thickness of EAP at locations and design procedures (4) Conduct a study to determine the required thickness of EAP at locations and design procedures. | 3-4482-6                   | Moon White               | September 09 | completed   | <a href="http://www.txdot.state.tx.us/actpordreport/3-4482_6.pdf">http://www.txdot.state.tx.us/actpordreport/3-4482_6.pdf</a> | CTR CTR                 | CTR CTR                | 1                  |</p>
<table>
<thead>
<tr>
<th>Agency</th>
<th>Concrete Pavement Research Project/Report Title</th>
<th>Project Description (Harmonize contents)</th>
<th>Project Report</th>
<th>Project Contact</th>
<th>Data shared on paper copy</th>
<th>Data shared as an Excel</th>
<th>Revised/Completed</th>
<th>Link to Report</th>
<th>Researcher/Report Author</th>
<th>University/Other Agency involved to date in this project</th>
<th>Remaining/Contributions</th>
<th>Deadline/Where project proposed to be presented (if any)</th>
<th>Track 1</th>
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<th>Track 13</th>
<th>Notes</th>
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<tr>
<td>T4DOT</td>
<td>Horizontal Cracking Mechanism in CGCP (5-0549)</td>
<td>This project is to identify the mechanism of longitudinal cracking in continuously reinforced concrete pavement (CGCP). It is a need to develop a new model to predict the rate of horizontal cracking in CGCP was developed. Material properties and stress analysis were considered in the numerical analysis and their effects on the rate of horizontal cracking were investigated. Based on numerical analysis results, laboratory testing was conducted in order to simulate the horizontal cracking in transverse cracks interface in CGCP. A horizontal cracking frame was developed and the mechanism of horizontal cracking was experimentally verifiable.</td>
<td>Moon Won</td>
<td>Jun-09</td>
<td>completed</td>
<td><a href="http://www.ksce.or.kr/portal/web/0549_2.pdf">http://www.ksce.or.kr/portal/web/0549_2.pdf</a></td>
<td>Sanghoil Choi, Seok Ho Kwon, Hyung Jin Park</td>
<td>T4DOT</td>
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<td>T4DOT</td>
<td>Effects of Supplementary Geotechnical Materials on the Settling Time and Early Stages of Concrete (5-050)-1</td>
<td>This study evaluated the setting time, early strength gain, durability, healing, and plastic shrinkage cracking of various concrete mixes. The study also evaluated the influence of different types of materials on the setting time and early stage cracking of concrete.</td>
<td>Marie Juenger</td>
<td>May-08</td>
<td>completed</td>
<td><a href="http://www.ksce.or.kr/portal/web/5000_2.pdf">http://www.ksce.or.kr/portal/web/5000_2.pdf</a></td>
<td>Ando Eiko, Sh NEOK, Chul-Min Lee, Won Moon</td>
<td>T4DOT</td>
<td>CTR</td>
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<td>T4DOT</td>
<td>Development of Application Guide and Specifications for Geosynthetics in Clast and Base (5-0441)</td>
<td>This research is expected to provide T4DOT with the tool for correct selection of geotextiles, but also with opportunities for education on the benefits of using guidelines in pavement design.</td>
<td>Jingsong Zhenjiang</td>
<td>Aug-09</td>
<td>completed</td>
<td><a href="http://www.ksce.or.kr/portal/web/5000_2.pdf">http://www.ksce.or.kr/portal/web/5000_2.pdf</a></td>
<td>Jorge Piozzi, Nathan Thompson</td>
<td>T4DOT</td>
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<td>T4DOT</td>
<td>Develop Guidelines for Routine Maintenance of Concrete Pavement (5-0500)</td>
<td>This research is to develop guidelines for routine maintenance of concrete pavement using field investigation, laboratory testing, and numerical modeling.</td>
<td>Dan Zilinger</td>
<td>Feb-08</td>
<td>completed</td>
<td><a href="http://www.ksce.or.kr/portal/web/5000_2.pdf">http://www.ksce.or.kr/portal/web/5000_2.pdf</a></td>
<td>Thomas Freeman, Youn Goo Jung</td>
<td>T4DOT</td>
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<td>T4DOT</td>
<td>Development of Composite Design Specifications for CGCP (5-060)</td>
<td>This project is to develop a new design specification for CGCP, which incorporates cracking and deformation using field-testing, numerical modeling, and laboratory tests.</td>
<td>Moon Won</td>
<td>Aug-10</td>
<td>completed</td>
<td><a href="http://www.ksce.or.kr/portal/web/0600_2.pdf">http://www.ksce.or.kr/portal/web/0600_2.pdf</a></td>
<td>Byungkoo Cho, Shigehisa Yasuda, Young Min Youn, Kyoung Min Park, Daniel Zilinger</td>
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<td>T4DOT</td>
<td>Alternatives of Asphalt Concrete Pavement Sub-base for Concrete Pavement (5-0607)</td>
<td>This project is to evaluate the design recommendations for long-lasting sub-base mixes based on new methods and design guidelines.</td>
<td>Andrew Worswick</td>
<td>Aug-09</td>
<td>completed</td>
<td><a href="http://www.ksce.or.kr/portal/web/0607_2.pdf">http://www.ksce.or.kr/portal/web/0607_2.pdf</a></td>
<td>Yoon Hwa Jung, Dong Seok Jung, Moon Hoon Cho</td>
<td>T4DOT</td>
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<td>T4DOT</td>
<td>Surface and Subgrade Performance Investigation for Concrete Pavement (5-0279)-1</td>
<td>This project is to investigate the performance of concrete pavements and subgrades using new methods and design guidelines.</td>
<td>Andrew Worswick</td>
<td>Jan-09</td>
<td>completed</td>
<td><a href="http://www.ksce.or.kr/portal/web/0279_2.pdf">http://www.ksce.or.kr/portal/web/0279_2.pdf</a></td>
<td>Yoon Hwa Jung, Dong Seok Jung, Moon Hoon Cho</td>
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<tr>
<td>T4DOT</td>
<td>Consideration for Rigidity Pavement Design When Alternative Solid (5-0606)</td>
<td>This project is to develop a new design specification for rigid pavement using field-testing, numerical modeling, and laboratory tests.</td>
<td>Andrew Worswick</td>
<td>Dec-09</td>
<td>completed</td>
<td><a href="http://www.ksce.or.kr/portal/web/0606_2.pdf">http://www.ksce.or.kr/portal/web/0606_2.pdf</a></td>
<td>Tom Freeman, Paul Cooper, Tom Basdon, Mark Kravitz, Darce Orme-Aldred</td>
<td>T4DOT</td>
<td>UTEP</td>
<td>CTR</td>
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<tr>
<td>Agency</td>
<td>Concrete Paving Research/Project Title</td>
<td>Project Description (A basic overview of the project)</td>
<td>Researcher(s)</td>
<td>Researcher(s) Contact</td>
<td>University(ies) + Other Agency(s) involved with this project</td>
<td>Deliverables, where applicable (Aims, etc.)</td>
<td>Notes</td>
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<td>TxDOT</td>
<td>Performance of Continuously Reinforced Concrete Pavement Containing Recycled Concrete Aggregate (3-1706)</td>
<td>The primary objective of this study was to evaluate (1) the material properties of recycled concrete and (2) the effect of the recycling process, and (3) in situ concrete properties to identify the reasons for good pavement performance.</td>
<td>Moon Won</td>
<td>Jan-Oct completed</td>
<td><a href="http://library.tri-atea.edu/pdf/113a-1.pdf">http://library.tri-atea.edu/pdf/113a-1.pdf</a></td>
<td>Texas Tech CTR</td>
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<td>TxDOT</td>
<td>Identification of Compliance Testing Methods for Curing Efficacy of Hot Mix Concrete (3-1092)</td>
<td>The purpose of this research was to identify common curing procedures that can be implemented to verify compliance with specification requirements on curing. To this end, various test methods that appear to have potential for compliance testing for curing were evaluated in the field. The test methods evaluated include concrete permeability, initial curing assessment, concrete temperature, concrete density, surface hardness, relative humidity, and deflection. A factorial experiment was set up for field testing, and the test methods were evaluated in the field. Sampling rate of curing compound applications as well as application time was included as variables in the factorial experiment. Advantages and limitations of each method were identified and discussed.</td>
<td>Moon Won</td>
<td>Jun-Oct completed</td>
<td><a href="http://library.tri-atea.edu/pdf/113a-1.pdf">http://library.tri-atea.edu/pdf/113a-1.pdf</a></td>
<td>Seongheon Cho</td>
<td>CTR CTR</td>
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<td>TxDOT</td>
<td>Laboratory and Field Evaluation of Concrete Paving Curing Efficacy (3-1096-2)</td>
<td>The research utilized several techniques to evaluate curing effectiveness from both a material strength and physical properties standpoint to develop a laboratory-based curing evaluation protocol that has application to the field. A series of tests were carried out to identify factors controlling curing quality under field conditions.</td>
<td>Dan Ye</td>
<td>Nov-Oct completed</td>
<td><a href="http://library.tri-atea.edu/pdf/113a-1.pdf">http://library.tri-atea.edu/pdf/113a-1.pdf</a></td>
<td>Anil Mukhopadhyay Dan Zlotnik</td>
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<td>TxDOT</td>
<td>Use of Dowel Bar at Longitudinal Construction Joint (3-10968)</td>
<td>The primary objective of this research project is to develop rational guidelines on the use of dowels in LCC. To achieve the primary objective of this study, it was divided into two research tasks, one for dowel testing needs to be performed and the other to thoroughly investigate concrete stress characteristics.</td>
<td>Moon Won</td>
<td>Oct-Dec completed</td>
<td><a href="http://library.tri-atea.edu/pdf/113a-1.pdf">http://library.tri-atea.edu/pdf/113a-1.pdf</a></td>
<td>Dar Ha Chen Abbas Mahdavi BM Nezhat Hae Chen Tonya (Suz) Zhang (Merryl Li)</td>
<td>TechMRT CTR</td>
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<td>TxDOT</td>
<td>Use of Manufactured Sand in Concrete Paving (3-10995)</td>
<td>This research will find solutions for using manufactured fine aggregates (MAFA) to produce good quality paving concrete that has adequate surface friction.</td>
<td>David Fowler</td>
<td>Sep-Oct ongoing</td>
<td><a href="http://library.tri-atea.edu/pdf/113a-1.pdf">http://library.tri-atea.edu/pdf/113a-1.pdf</a></td>
<td>Anir Azhan</td>
<td>CTR</td>
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<td>TxDOT</td>
<td>Material Selection for Concrete Overlay (3-10995)</td>
<td>The purpose of this study was to evaluate the suitability of various materials and their effectiveness in terms of cost effectiveness and durability.</td>
<td>David Fowler</td>
<td>Sep-Oct ongoing</td>
<td><a href="http://library.tri-atea.edu/pdf/113a-1.pdf">http://library.tri-atea.edu/pdf/113a-1.pdf</a></td>
<td>Cliff Pinsonen Hae Chen Jeffrey Harmon Mike Alford</td>
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<td>TxDOT</td>
<td>Improvement of Portland and Fine Depth Repair Materials for Concrete Pavement (3-19611)</td>
<td>This project will develop and evaluate the effectiveness of field-depth repair (FDR) and fine-depth repair (FDR).</td>
<td>More Wov</td>
<td>Sep-Oct ongoing</td>
<td><a href="http://library.tri-atea.edu/pdf/113a-1.pdf">http://library.tri-atea.edu/pdf/113a-1.pdf</a></td>
<td>Spike Bernardo-Ferrer Chris Peck Hae Chen Tim Chen</td>
<td>TechMRT USF</td>
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<td>TxDOT</td>
<td>Continuously Reinforced Decorated Concrete Overlay for Disseminated Damage Repair (3-1806)</td>
<td>Building on findings from TxDOT research project (3-1806), this implementation project is the first step in applying CRCP overlays in a section of highway that has experienced repeated pressure cycles. The project aims to repair and maintain it. The CRCP overlay will be monitored and its early age behavior and long-term performance will be documented.</td>
<td>More Wov</td>
<td>Sep-Oct ongoing</td>
<td><a href="http://library.tri-atea.edu/pdf/113a-1.pdf">http://library.tri-atea.edu/pdf/113a-1.pdf</a></td>
<td>Hae Chen</td>
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Total: 6 6 3 5 0 1 0 2 1 2 0 3
Visual Representation of the Number of Concrete Pavement Research Projects in Texas

Currently Ongoing Research

Recent Completed Research

TPF Participation

- Track 1
- Track 2
- Track 3
- Track 4
- Track 5
- Track 6
- Track 7
- Track 8
- Track 9
- Track 10
The CP Road Map Pooled Fund—Impacts and Accomplishments

The Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map) is a holistic, strategic plan for concrete research and technology transfer and serves as a framework for stakeholders committed to innovation and implementation of new knowledge and approaches. It is more than just a listing of 250 project statements that outline research needs.

The mission of the CP Road Map is to bring together Federal, State, and industry partners to solve concrete pavement problems using pooled resources. The objective is to provide timely pavement solutions and accelerate the adoption of new, proven emerging technologies.

The goals of the CP Road Map are straightforward and direct:

- **Prioritization**
  - Identify research gaps
  - Address research gaps
  - Leverage funds for research

- **Implementation**
  - Connect people and groups
  - Facilitate collaboration and coordination
  - Demonstrate funding

- **Publications**
  - Develop training documents
  - Disseminate concrete pavement research news

This document gives brief information on how the CP Road Map works; how it benefits Federal, State, and industry partners; what has been accomplished; and what activities are currently in progress.

**How does the CP Road Map work?**

Funded initially by FHWA, national concrete pavement stakeholders consisting of State DOTs, FHWA, and industry collaborated in developing the CP Road Map. This strategic plan has provided significant benefits for agencies needing cost-effective, sustainable, adaptable, 21st century pavement solutions.

The CP Road Map is a living research and technology document that needs administrative people to keep it moving forward. These people make up the operations support group.

The CP Road Map’s operations support group is implementing a system to help agencies and industry partners meet their research goals efficiently. It tracks national concrete pavement research and helps Federal, State, industry, and academic partners work together to leverage resources and avoid costly duplication of research activities.

Pooled Fund TPF-5(185)—with sponsorship from FHWA and the States of New York, Virginia, Iowa, Michigan, Mississippi, and Pennsylvania—currently provides funding for the operations support group. These partners are committed to the vision and opportunities afforded by the CP Road Map and are seeking additional States to join the partnership. Increasing the number of States participating in the Pooled Fund could decrease the amount of money each State needs to contribute.

**How does the CP Road Map benefit State DOTs?**

Why should you dedicate some of your limited funds to financing the operational work needed to manage the CP Road Map?

**Here's how the CP Road Map could work for you:** As a manager at a State DOT, you have a concrete pavement-related issue that needs to be researched. Before you begin, you need answers to questions like, What's been done on this topic recently? Is there research on this topic going on now, in another State, TRB committee, or at AASHTO? Is the research a good idea and can the objective be met? Does other research need to precede it? Is anyone else interested in this topic who might want to collaborate or leverage funds? Who are the researchers best able to answer the need?

“The CP Road Map is a good avenue for information and a sounding board when information outside of the realm of each individual DOT’s jurisdiction is needed in efforts to optimize the value of research.” — John Staton, Michigan DOT
This document will help answer these questions. It provides an overview of the CP Road Map program, examples of priority research (organized by research track), and a detailed database of research (in the appendix).

You can also review the CP Road Map website (www.cproadmap.org) or consult directly with a track research coordinator (contact information on the website). The main thing is, you don’t have to start from scratch.

**Benefit now from training and technology transfer.** The operations support group is helping agencies implement technical advances and innovations that will improve their concrete pavements today. The group is identifying key technology transfer needs, then identifying unique training resources across the country on topics like the state-of-the-art of concrete pavement overlays, concrete mixture quality control, pavement surface texturing to reduce tire-pavement noise, and concrete pavement maintenance practices. The current Pooled Fund States would like to expand the emphasis on education and technology transfer in the future.

**Leverage your research dollars.** A major element of the CP Road Map is identifying intersecting needs, then helping organizations collaborate even when they have different institutional approaches to funding, scheduling, contracting, etc.

**Influence the direction of concrete pavement research.** States and industry who contribute to the Pooled Fund also have the opportunity to participate in committee meetings and influence the direction of national concrete pavement research and technology transfer. The operations support group helps TRB committees, AASHTO committees, State DOTs, and industry funders of research and technology transfer find opportunities to address CP Road Map priorities.

**Participate in the development of new training opportunities.** Participation in the Pooled Fund provides participants with the opportunity to influence the Road Map’s direction in terms of the training opportunities that result from national concrete pavement research. Beginning in 2011, the CP Road Map will begin to develop and implement national training programs on topics identified by the Pooled Fund participants.

**What has the CP Road Map produced?**

The CP Road Map tracks national research activities on a monthly basis. Focusing on one State each month, the operations support group contacts DOT, industry, and university representatives from that State to gather information about recently completed, ongoing, and upcoming research.

Based on these visits, the operations support group develops and distributes the following products:

- CP Road Map E-News
- Moving Advancements into Practice (MAP) Briefs
- National Concrete Pavement Research Database

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**CP Road Map E-News**

This monthly electronic newsletter provides updates on concrete pavement research around the country and the world. Each issue contains links to four to six research projects, training opportunities, or new technology transfer pieces of interest to the concrete pavement community. One State is also featured in the "Updates from the States" section of the E-News each month. These updates provide an in-depth look at each State’s concrete pavement research program.

View the CP Road Map E-News at www.cproadmap.org/publications/e-news.cfm

**Accomplishments**

- 12 E-News issues published, each with links to a minimum of four research efforts of interest
- 12 State highlights
  - Indiana
  - Michigan
  - Wisconsin
  - Minnesota
  - Pennsylvania
  - Washington
  - Virginia
  - Mississippi
  - Iowa
  - Texas
  - New York
  - FHWA Turner-Fairbank Highway Research Center

**Topics covered in each issue**

- August 2010 Special Issue: Updates from the International Technology Scanning Tour on Long-Life Concrete Pavements
  - Two lift concrete paving
  - Concrete pavement design catalogues
  - High-quality concrete pavement foundations
  - Improved concrete mixture designs
  - Geotextile interlayers for cement-bound layers
  - Exposed aggregate concrete pavement surfacing

- September 2010
  - Indiana evaluates in situ subgrade stiffness
  - Wisconsin DOT evaluates dowel bar retrofit performance
  - Iowa investigates improved concrete overlay construction
  - Ontario quantifies highway pavement sustainability
  - Ready Mixed Concrete Foundation investigates effect of pavement type on fuel consumption and emissions
  - Update from Minnesota

- October 2010
  - CPTP publishes tech brief on performance of sealed and unsealed concrete joints
  - Iowa investigates F-T durability of low-permeability concrete
  - Louisiana evaluates titanium dioxide photocatalyst coating
  - Quebec documents continuously reinforced concrete with glass fiber reinforced polymer bars
  - Update from Pennsylvania
November 2010
- Wisconsin investigates test procedures for deicing chemicals
- FHWA conducts interlaboratory study on measuring the coefficient of thermal expansion of concrete
- Wisconsin research evaluates open-graded base course with doweled and non-doweled transverse joints
- Malaysia research investigates roller-compact concrete
- Toronto evaluates permeable pavements in cold climates
- Update from Washington

Moving Advancements into Practice (MAP) Briefs

These four-page technical briefs highlight new technologies that can be used now to improve concrete paving practices. As of June 2011, MAP briefs have been developed on twelve concrete paving-related topics, with a thirteenth MAP brief currently in progress. The following is a list of the MAP brief topics.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Track assignment</th>
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<tbody>
<tr>
<td>Avoiding Incompatibilities in Concrete mixes (June 2011, in progress)</td>
<td>Track 1: Mix design</td>
</tr>
<tr>
<td>Partial-depth repair</td>
<td>Track 7: High-speed rehabilitation and construction</td>
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<tr>
<td>Preventing joint deterioration</td>
<td>Track 6: Joint innovation</td>
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<td>Fly ash as an SCM</td>
<td>Track 1: Mix design</td>
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<tr>
<td>Intelligent compaction for concrete pavements</td>
<td>Track 5: Equipment advancements</td>
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<tr>
<td>SmartCure (Smart Pavements)</td>
<td>Track 3: Intelligent construction</td>
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<tr>
<td>Effects of chemical deleterants on concrete pavements</td>
<td>Track 1: Mix design</td>
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<tr>
<td>Stringless concrete paving</td>
<td>Track 5: Equipment advancements</td>
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<tr>
<td>Roller-compact concrete</td>
<td>Track 8: Long-life pavements</td>
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<tr>
<td>Two-lift concrete paving</td>
<td>Track 13: Sustainability</td>
</tr>
<tr>
<td>COMPASS mix design tool</td>
<td>Track 1: Mix design</td>
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<tr>
<td>Diamond grinding</td>
<td>Track 4: Surface characteristics</td>
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<tr>
<td>Nonwoven geotextile interlayers</td>
<td>Track 7: High-speed rehabilitation and construction</td>
</tr>
</tbody>
</table>

Examples of two MAP briefs

View the MAP briefs online at www.cproadmap.org/publications/index.cfm#MAP.

National concrete pavement research database

The operations support group is compiling a national database of concrete pavement research. The database contains information collected from individual States as well as information from FHWA's Turner-Fairbank Highway Research Program, the American Association of State Highway Transportation Officials (AASHTO), Pooled Fund Research, and the Transportation Research Board (TRB). See Appendix A for the database sheets.

What is the future direction of the CP Road Map?

In addition to continuing to produce the products mentioned above, in 2011 the operations support group will focus on developing national training programs on concrete paving-related topics. These topics will be selected with guidance from the Pooled Fund States and other stakeholders. The training programs will be a combination of in-person and online training. States that participate in the Pooled Fund will have first access to these training opportunities.

What are the research tracks in the CP Road Map?

There are 13 research tracks in the CP Road Map. Each track has a leadership team consisting of industry, State, Federal, and university representatives. More than 100 people from 22 states serve on track leadership teams for the 13 tracks listed below.

1. Performance-Based Concrete Pavement Mix Design System
2. Performance-Based Design Guide for New and Rehabilitated Concrete Pavements
3. High-Speed Nondestructive Testing and Intelligent Construction Systems
4. Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements
5. Equipment Automation and Advancements
7. High-Speed Rehabilitation and Construction
8. Long-Life Concrete Pavements
9. Accelerated and Long-Term Data Collection
10. Concrete Pavement Performance
11. Concrete Pavement Business Systems and Economics
12. Advanced Concrete Pavement Materials
13. Concrete Pavement Sustainability

How can you get involved?

To become a partner in Pooled Fund TPF-5(185), contact CP Road Map Program Manager Dale Harrington, 515-965-0200, dharrington@snyder-associates.com.

For more information, visit www.cproadmap.org.
Examples of CP Road Map research

The following section contains brief information about recent and ongoing research that impact the concrete paving industry. Research is categorized by CP Road Map track.

Track 1: Performance-Based Concrete Pavement Mix Design

The following research projects are categorized under Track 1.
- TPF-5(205) Implementation of Concrete Pavement Mixture Design and Analysis (MDA) Track of Concrete Pavement Road Map (ongoing)
- TPF-5(179) Evaluation of Test Methods for Permeability (Transport) and Development of Performance Guidelines for Durability (ongoing)
- FHWA Computer-Based Guidelines for Job-Specific Optimization of Paving Concrete (COMPASS) (complete)

TPF-5(205) Implementation of Concrete Pavement Mixture Design and Analysis (MDA) Track of Concrete Pavement Road Map

Partners: IA (lead State), KS, MI, MO, NY, OK, TX, WI

Progress (per latest quarterly report):
- Ongoing work:
  - Investigations into the development of alternate methods for calculating mix proportions
  - Investigations of on-site analysis tools
  - Assessing requirements for the air void system
  - Preparation of Guide Specification
- Completed work
  - Investigation of acoustical methods to determine set time

FHWA Computer-Based Guidelines for Job-Specific Optimization of Paving Concrete (COMPASS)
- Deliverables: final report and software program
- Provides guidance for:
  - Choosing materials
  - Optimizing gradations
  - Proportioning mix designs
  - Optimizing mix designs for job-specific needs

TPF-5(179) Evaluation of Test Methods for Permeability (Transport) and Development of Performance Guidelines for Durability

- Objective: develop a test procedure that directly evaluates the permeability (transport properties) of concrete and relates these to anticipated performance with the use of exposure conditions.
- Research team: Tommy Nantung (Indiana DOT), Kartik Obia (National Ready-Mixed Concrete Association), Jan Olek and Jason Weiss (Purdue University)

TPF-5(179)—Permeability: Mechanism of Electrical Conduction in Concrete

Concrete is a composite:
- Solid phase (unhydrated cement, CSH, CH, etc.): \( \sigma_{\text{sol}} = 10^9 \) S/m
- Liquid phase (pore solution): \( \sigma_{\text{liq}} = 1 \) S/m to 20 S/m
- Vapor phase (air voids, emptied pores): \( \sigma_{\text{vap}} = 10^{13} \) S/m

Flow of electricity is essentially ionic and through material’s liquid phase.

TPF-5(179)—Permeability: Using Transport Properties to Understand Joint Behavior

Understanding the fluid transport in saw-cut geometries
- X-ray absorption
- Numerical simulations
- Fluid properties

Joint damage is often observed in transverse and longitudinal joints in concrete pavements.

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

The following research projects are categorized under Track 2.
- CP Tech Center Guidance for the Design of Concrete Overlays using Existing Methodologies (ongoing)
- NCHRP 01-47 Sensitivity Evaluation of MEPDG Performance Prediction (ongoing)
- NCHRP 01-48 Incorporating Pavement Preservation into the MEPDG (ongoing)

Guidance for the Design of Concrete Overlays Using Existing Methodologies

- Does not detail a new design procedure but instead provides background on recommended overlay design techniques currently used by State DOTs and industry
- Provides detailed examples of how to use the existing design techniques
- Learn by example – then apply for your situation!
Track 3: High-Speed Nondestructive Testing and Intelligent Construction Systems

The following research projects are categorized under Track 3.

- SHRP 2 R06(E) Real-Time Smoothness Measurements on Portland Cement Concrete Pavements During Construction (ongoing)
- FHWA SmartCure Practical Enhancements for Field Application (ongoing)

**FHWA SmartCure Practical Enhancements for Field Application**

The SmartCure System uses measuring devices and computer software to provide continuous, real-time, and site-specific recommendations for concrete pavement curing.

![Schematic of SmartCure system devices in the field](image)

![Screen shot of SmartCure readings of ambient conditions](image)

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

The following research projects are categorized under Track 4.

- TPF-5(063) Improving the Quality of Pavement Profiler Measurement (ongoing)
- NCHRP 01-43 Guide for Pavement Friction (complete)

**Measuring Noise Using On-Board Sound Intensity (OBSI) — Track 4**

![Measuring noise with OBSI (Track 4)](image)

**OBSI Testing**

**CP Tech Center OBSI Noise Catalog**

![CP Tech Center OBSI Noise Catalog](image)
Monitor Real-Time Surface Texture and Relate to Noise (Track 4)

Surface Characteristics Publications

How to Reduce Tire-Pavement Noise: Better Practices for Constructing and Texturing Concrete Pavement Surfaces

Surface Characteristics Publications (cont.)

Technical Briefs

- Diamond Grinding to Reduce Tire-Pavement Noise in Concrete Pavements
- What Makes a Quieter Concrete Pavement?
- The Language of Noise and Quieter Pavements
- Measuring and Analyzing Pavement Texture
- Tire-Pavement Noise Test Protocols
- Variability of Pavements and Noise
- Advanced Pavement Texture and Noise Specifications

Track 5: Concrete Pavement Equipment Automation and Advancements

The following research projects are categorized under Track 5.
- Iowa State University 2009 research and publication of Stringless Portland cement concrete paving (complete)
- Final Report on National Open House Two-Lift Concrete Paving for Interstate 70 in Kansas (complete)

Stringless Portland Cement Concrete Paving

Guide Specifications for Texture and Noise (Diamond Grinding, Turf Drag, Longitudinal Tining, and Transverse Tining)

Guide for Selecting the Right Texture for the Right Situation

Stringless paving technology

The prisms on the machine tells the total station where the machine is at for x,y,z. This information is related to the computer model on the machine from the total stations through radios on the machine. The model then knows where the machine is at and tells the machine what elevation in needs to be on each of the four corners of the pan.

Measuring "attitude"
Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction

The following research projects are categorized under Track 6.

**Innovative Concrete Pavement Joint Design, Materials, and Construction Pooled Fund**

Objectives:
- Identify the failure mechanisms occurring in the joints of concrete pavements in various northern States
- Develop strategies to prevent the deterioration of new pavements in the future

[Image of a man working on a concrete pavement]

**Joint Deterioration: Types**

1. Air void/water
2. Mechanical

[Images of joint deterioration]

Top left and right: Joint deterioration related to the air void system or water (freeze-thaw related). Shadowing (top right) indicates water saturation.

Bottom left: Joint deterioration possibly related to mechanical failure.

Track 7: High-Speed Concrete Pavement Rehabilitation and Construction

The following research projects are categorized under Track 7.

- National CP Tech Center / FHWA Concrete Overlays Field Application Program (ongoing)
- TPF-5(165) Development of Design Guide for Thin and Ultrathin Concrete Overlays of Existing Asphalt Pavements (ongoing)
- Illinois Center for Transportation research and publication of Design and Concrete Requirements for Ultrathin White-topping (complete)

**Concrete Overlay Research Program**

[Diagram of research program]

**Overlay Field Application Program**

As part of this project, an expert team makes project field visits to assist State DOTs with design and construction of concrete overlays.

[Map indicating states covered by the program]

**TPF-5(165) Improving Concrete Overlay Construction**

Track 11: Concrete Pavement Business Systems and Economics

The following research projects are categorized under Track 11.
- NCHRP 10-75 Guide for Pavement-Type Selection (ongoing)
- TPF-5(159) Technology Transfer Concrete Consortium (ongoing)

Transportation Curriculum Coordination Council (TTCC)

The TTCC is a Federal/State/industry partnership that supports the training of highway construction personnel.

The goals of the TTCC are to:
- Develop and maintain a national curriculum for various transportation disciplines
- Identify training and certification requirements
- Coordinate/facilitate training efforts

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Track 13: Concrete Pavement Sustainability

The following research projects are categorized under Track 13.
- TPF-5(129) Recycled Unbound Pavement Materials (MnROAD Study) (ongoing)
- CP Tech Center Briefing Document (complete) and Manual of Practice (ongoing) on Building Sustainable Pavements with Concrete

Concrete Pavement Sustainability

- Must include concrete pavement design, materials construction, use, maintenance, renewal, and recycling
- Must reduce costs, improve the environmental footprint, and increase benefits to society over the life-cycle

Objective:
To identify and conduct research and transfer technology that enhances concrete pavement sustainability through the pavement's life cycle

Sustainability: Cradle-to-Cradle Life Cycle

Sustainability Manual of Practice

- “Best Practices” manual to enhance concrete pavement sustainability
- Focus on practitioners (decision makers, engineers, and contractors)
- Manual will be part of an implementation package to expedite technology transfer
- Workshop and web-based instruction will be developed

"Since its inception in 2005, the CP Road Map has had a significant impact by facilitating and setting direction for concrete pavement research. It has been invaluable to FHWA as a source of input to our internal program planning. Now that research products have begun to emerge, the focus of the CP Roadmap support effort has shifted toward technology transfer with plans for training courses and webinars on proven, ready to use new technologies.” -- Michael Trentacoste, FHWA
CP Road Map E-News May 2011

The CP Road Map E-News is the newsletter of the Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map), a national research plan developed and jointly implemented by the concrete pavement stakeholder community. To find out more about the CP Road Map, or to get involved, contact Dale Harrington, dharrington@snyder-associates.com, 515-964-2020.

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

MAP Brief 7-2: Partial-Depth Repairs for Concrete Pavements has recently been published under CP Road Map Track 7: High-Speed Concrete Pavement Rehabilitation and Construction.

Download MAP Brief 7-2 (973 kb pdf).

News from the Road
News from the Road highlights research around the country that is helping the concrete pavement community meet the research objectives outlined in the CP Road Map.

Illinois Center for Transportation investigates impact of early-entry saws on concrete pavement durability
In January 2011, the Illinois Center for Transportation published Evaluation of the Long-Term Durability of Joints Cut Using Early Entry Saws on Rigid Pavements. This investigation was integrated into an active construction project along Illinois Route 59 in Plainfield, IL that consisted of three 300-foot test cells, each containing 20 joints. During construction, paving and sawing operations were observed and documented, and the FHWA HIPERPAV® analysis tool was used to assess the potential for early-age cracking. Core samples were also taken from the joints and subjected to a battery of tests including freeze-thaw testing, petrographic analysis, and susceptibility to salt scaling. The lack of damage in the areas adjacent to the joints suggest that early-entry sawing is a viable approach for concrete pavements. However, a broader study evaluating long-term performance under different traffic conditions, maintenance practices, and a variety of other factors is recommended before a general adoption of early-entry sawing.

Click here to download the report.

This work is contributing to research objectives outlined in CP Road Map Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction.

Wisconsin study examines deleterious effects of fine particles in concrete aggregates
The Wisconsin Department of Transportation (WisDOT) recently published a report that examined the influence of microfine particles on concrete properties. Currently, WisDOT has a Standard Specification in place to regulate the maximum allowable amount of microfines in order to maintain concrete workability, strength, and durability. However, WisDOT is currently unable to differentiate between the mineralogy of different microfines, which can in turn affect concrete properties. Furthermore, there is often a mismatch between laboratory and field performance, likely due to the nature of the microfines and concrete curing conditions. In this study, aggregate samples were obtained from 28 locations and analyzed for their...
mineralogy and clay content. The impact of total clay content on concrete physical properties, mechanical properties, chemical properties, and microstructure was also measured in order to advance knowledge of the role of clays in concrete performance. Microfines were divided into two categories: dolomitic and igneous. Igneous sources were shown to exhibit the largest occurrence of deleterious effects. The researchers concluded that, although the current WisDOT Standard Specification results in acceptable concrete performance under optimal conditions, it is recommended that a more advanced approach to microfine evaluation be considered in the future.

Click here to download the report.

This research can be categorized under CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design.

Texas researchers seek to prevent horizontal cracking in continuously reinforced concrete pavements
A recent report published by the Texas Department of Transportation (TxDOT) aims to identify the mechanism of horizontal cracking in continuously reinforced concrete pavement (CRCP). This report suggests that horizontal cracks are not due to structural deficiencies, but can be attributed to concrete material properties, environmental conditions during and immediately after placement, and longitudinal steel layouts. In order to investigate the cracking mechanism, numerical analysis and laboratory testing using a horizontal cracking frame were carried out. Furthermore, the influence of rebar temperature and water-to-cement ratio on the bond strength of the rebar were also investigated. Ultimately, the study concluded that longitudinal steel, concrete coefficient of thermal expansion (CTE), and concrete elastic modulus play a significant role in the development of cracks. In addition, it was found that the water-to-cement ratio significantly influenced the rebar-concrete bond strength, and rebar temperature should be monitored during placement.

Click here to download the report.

This research can be categorized under CP Road Map Track 8: Long-Life Concrete Pavements.

WisDOT constructs and tests next generation concrete surface
Recently, the Washington State Department of Transportation (WSDOT) constructed a test section of Next Generation Concrete Surface (NGCS) on I-82 near Sunnyside, WA. This 1,500 foot section was subjected to noise, friction, smoothness, and wear measurements as documented in the April 2011 report, Evaluation of Long-Term Pavement Performance and Noise Characteristics of the Next Generation Concrete Surface. This project is part of a continuing effort by WSDOT to test new methods of decreasing noise generated by highway facilities. Prior to installation of the NGCS, dowel bar retrofit, panel replacement, and conventional diamond grinding were carried out. Afterwards, post-construction noise measurements were conducted using the on-board sound intensity (OBSI) test method, which confirmed a noticeably quieter surface than the previous section. Friction measurements were also very favorable, as expected with a newly ground surface.

Click here to download the report.

This project is meeting research objectives outlined in CP Road Map Track 4: Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements.

Updates from the States: Federal Highway Administration's Turner-Fairbank Highway Research Center
The Federal Highway Administration’s (FHWA’s) Office of Research, Development, and Technology (RD&T) is located at the Turner-Fairbank Highway Research Center (TFHRC), a federally owned and operated national research facility in McLean, Virginia. This world-class facility houses more than 20 laboratories, data centers, and support facilities, and conducts applied and exploratory advanced research in vehicle-highway interaction, nanotechnology, and a host of other types of transportation research in safety, pavements, structures, human-centered systems, operations and intelligent transportation systems, and materials.
Read on for more information about concrete pavement research at the Turner-Fairbank Highway Research Center...

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- Sabrina Garber, The Transtec Group, Program Specialist
- Jesse Kwilosz, The Transtec Group, Program Specialist
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Updates from the States: Texas (April 2011)

Updates from the States: April
The Texas Department of Transportation (TxDOT) concrete pavement research program is a vital link to the success of providing safe, durable, and cost-effective pavement infrastructure to the citizens of Texas. To achieve this, TxDOT partners with universities, other state DOTs, and national centers through programs such as the Transportation Pooled Fund (TPF). Key research facilities include the Center for Transportation Research (CTR), Texas Transportation Institute (TTI), and The Center for Multidisciplinary Research in Transportation (TechMRT). To learn more about each of these organizations, follow the links below:

- CTR: http://www.utexas.edu/research/ctr/index.html
- TTI: http://tti.tamu.edu/
- TechMRT: http://www.depts.ttu.edu/techmrtweb/
- TPF: http://www.poolfund.org/

Figure 1 depicts Texas concrete pavement research projects that are currently ongoing, and recently completed, in addition to Transportation Pooled Fund participation. These projects are categorized according to the appropriate CP Road Map Track. Following Figure 1, titles for each of the projects are listed.

![Visual Representation of the Number of Concrete Pavement Research Projects in Texas](image)

Figure 1. Concrete Pavement Research in Texas Categorized by CP Road Map Tracks

Transportation Pooled Fund (TPF) Studies
Current concrete pavement research work underway in Texas includes work done under various TPF projects. These projects, and how they align under the CP Road Map, include the following.

Track 1: Performance-Based Concrete Pavement Mix Design System
- TPF-5(205) Implementation of Concrete Pavement Mixture Design and Analysis (MDA) Track of Concrete Pavement Road Map
Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements
- TPF-5(165) Development of Design Guide for Thin and Ultrathin Concrete Overlays of Existing Asphalt Pavements

Track 4: Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements
- TPF-5(134) PCC Surface Characteristics - Rehabilitation (MnROAD Study) x

Track 9: Concrete Pavement Accelerated Testing and Long-Term Data Collection
- TPF-5(042) Long-Term Maintenance of Load and Resistance Factor Design Specifications

Track 11: Concrete Pavement Business Systems and Economics
- TPF-5(159) Technology Transfer Concrete Consortium

Track 13: Concrete Pavement Sustainability
- TPF-5(129) Recycled Unbound Pavement Materials (MnROAD Study)

Currently Ongoing Research
Currently ongoing research projects, and how they align under the CP Road Map, are listed here.

Track 1: Performance-Based Concrete Pavement Mix Design System
- Use of Manufactured Sands for Concrete Paving

Track 7: High-Speed Concrete Pavement Rehabilitation and Construction
- Improvements of Partial and Full-Depth Repair Practices for CRCP Distresses
- Material Selection for Concrete Overlays
- Continuously Reinforced Bonded Concrete Overlay of Distressed Jointed Concrete Pavements

Recently Completed Research
Recently completed projects (i.e., ones that have been completed since 2007) and how they align under the CP Road Map, are listed here.

Track 1: Performance-Based Concrete Pavement Mix Design System
- Fiber in Continuously Reinforced Concrete Pavements
- Best Practices for the Use of Siliceous River Gravel in Concrete Paving
- Effects of Supplementary Cementing Materials on the Setting Time and Early Strength of Concrete
- Performance of Continuously Reinforced Concrete Pavement Containing Recycled Concrete Aggregate

Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements
- Best Design and Construction Practices for Concrete Pavement Transition Areas
- Development of the Thickness Design for Concrete Pavement Overlays Over Existing Asphalt Pavement Structures
- Development of Application Guide and Specifications for Geotextiles in Soil and Base
- Develop Mechanistic/Empirical Design for CRCP
- Alternatives to Asphalt Concrete Pavement Subbase for Concrete Pavement
- Subbase and Subgrade Performance Investigation for Concrete Pavement

Track 3: High-Speed Nondestructive Testing and Intelligent Construction Systems
- Pilot Implementation of Bump Detection Profilers for CRCP Construction
- Identification of Compliance Testing Method for Curing Effectiveness
- Laboratory and Field Evaluation of Concrete Paving Curing Effectiveness

Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction
Track 7: High-Speed Concrete Pavement Rehabilitation and Construction
- Construction and Evaluation of Post-Tensioned Pre-stressed Concrete Pavement
- Concrete Pavement Overlays and Failure Mechanisms
- Debonding in Bonded Concrete Overlays Over Continuously Reinforced Concrete Pavements
- Rehabilitation Procedures for Longitudinal Cracks and Joint Separation in Concrete Pavement

Track 9: Concrete Pavement Accelerated and Long-Term Data Collection
- Mechanistic-Empirical Data Collection Approach for Rigid Pavements
- Analysis of Continuously Reinforced Concrete Pavement Behavior Using Information in the Rigid Pavement Database

Track 10: Concrete Pavement Performance
- Improving Portland Cement Concrete Pavement Performance
- Horizontal Cracking Mechanism in CRCP
- Develop Guidelines for Routine Maintenance of Concrete Pavement

Track 11: Concrete Pavement Business Systems and Economics
- Development of a Concrete Pavement Rehabilitation Training CD-ROM
- Considerations for Rigid vs. Flexible Pavement Designs When Allowed as Alternate Bids

Highlights
The following provides more detail on four of the recently completed research projects.

1. Subbase and Subgrade Performance Investigation for Concrete Pavement
2. Construction and Evaluation of Post-Tensioned Prestressed Concrete Pavement Effects of Supplementary Cementing Materials on the Setting Time and Early Strength of Concrete
3. Debonding in Bonded Concrete Overlays Over Continuously Reinforced Concrete Pavements
4. Effects of Supplementary Cementing Materials on the Setting Time and Early Strength of Concrete

Subbase and Subgrade Performance Investigation for Concrete Pavement
The report, Subbase and Subgrade Performance Investigation for Concrete Pavement, authored by Youn su Jung, Dan G. Zollinger, Moon Won, and Andrew J. Wimsatt, documents research efforts by the Texas Transportation Institute under sponsorship of TxDOT. This research seeks to identify alternative materials that can be used to construct a concrete pavement subbase layer that meets fundamental requirements such as resistance to erosion, uniform slab support, and drainability. Several highway sections were investigated using multiple techniques including Ground Penetrating Radar (GPR), Falling Weight Deflectometer (FWD), and visual surveys; the objective is to quantify historical performance. Ultimately, a variety of alternative subbase types was classified according to their field performance and other functional factors. This report, which is currently being updated to reflect new findings, identifies innovative concrete pavement foundations that seek to provide a long service life. Therefore, it can be categorized under CP Road Map Track 8: Long-Life Concrete Pavements. To obtain further information, follow the links below:


Construction and Evaluation of Post-Tensioned Prestressed Concrete Pavement
Recent research performed by Texas Tech University and sponsored by TxDOT concluded with the report titled, Construction and Evaluation of Post-Tensioned Pre-stressed Concrete Pavement. In this report, authors Moon Won and Seong-Cheol Choi document the construction of post-tensioned concrete pavement (PCP) on IH-35 in Hillsboro, TX. This PCP section consists of 9-inch slabs constructed on top of a 4-inch asphalt-stabilized subbase. This is a larger scale version of a 6-inch PCP built in 1985 that has performed very well, but was never the subject of an in-depth evaluation.
The primary objectives of this project were to evaluate and document early-age behavior in the field, and also provide technical assistance to TxDOT and the contractor during the design and construction phases. Various gages, including in-situ coefficient of thermal expansion (CTE) sensors and linear variable differential transducers, were installed in a 300-ft long slab and used to analyze behavior of the PCP due to environmental loading, post-tensioning application, slab temperature variations, and creep and shrinkage effects. In addition, the data were used to calibrate PSCP 3.0, a mechanistic model developed for use as a PCP analysis program. Data will continue to be periodically downloaded, analyzed, and stored in the TxDOT rigid pavement database for years to come. This report, and the research it documents, is an example of work categorized under the CP Road Map Track 7: High-Speed Concrete Pavement Rehabilitation and Construction. For more details about this research, click on the links below.


Debonding in Bonded Concrete Overlays Over Continuously Reinforced Concrete Pavements

A recent report, *Debonding in Bonded Concrete Overlays Over Continuously Reinforced Concrete Pavements*, by the Center for Transportation Research (CTR) investigates debonding mechanisms and their effects on distresses in bonded concrete overlays (BCO). Authors Lucas Lahitou, Seong-Cheol Choi, and Moon Won discuss common types of failure and important design considerations, and current design practices that recognize the importance of bonding but do not address it directly. This research is primarily dedicated to the development of a computer program to mechanistically model debonding from the perspective of both reflective and top-down cracking. Sensitivity analyses were also carried out to evaluate the effects of factors known to have the greatest effect on debonding such as PCC properties, system dimensions and geometry, steel properties, and environmental conditions. Results show that debonding in the presence of non-reflective cracking is the most critical scenario. Furthermore, it is recommended that the existing models be used to develop a design tool that will assist practitioners in the proper selection of design variables and consider a larger number of factors. This work is an example of research that can be categorized under CP Road Map Track 8: Long-Life Concrete Pavements. It is also an example of mechanistic-based concrete pavement design and can therefore be categorized under CP Road Map Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements. Additional information is accessible via the following links:


Effects of Supplementary Cementing Materials on the Setting Time and Early Strength of Concrete

In the recent research report, *Effects of Supplementary Cementing Materials on the Setting Time and Early Strength of Concrete*, authors Maria Juenger, Moon Won, David Fowler, Andre Edson, and Chul Suh of CTR examined the influence of supplementary cementing materials (SCM) on concrete pavement performance. The use of SCM have been shown to enhance concrete durability, provide protection against alkali-silica reaction (ASR), and occasionally prove more economical than cement, in addition to other benefits. However, SCM can also prove to be disadvantageous in the form of increased setting time and decreased early strength gain, especially in cold weather conditions. This report examines various concrete mixes that contain varying amounts of ground granulated blast furnace slag (GGBFS) and fly ash. Maturity testing, semi-adiabatic calorimetry, time of set, early strength, and plastic shrinkage tests were all conducted under realistic conditions. Ultimately, it was shown that slag had no significant effect on setting time while fly ash increased setting time to varying degrees depending on the source. In addition, fly ash decreased strength gains while slag had little effect on early compressive strength and actually increased strength at 3 to 7 days. This work is an example of CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System. The project summary and final report can be read in their entirety here:


About the CP Road Map E-News

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

MAP Brief 1-3 Fly Ash as a Supplementary Cementitious Material in Concrete Mixtures has recently been published under CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System.

Download MAP Brief 1-3 (1.1 mb pdf).

News from the Road
News from the Road highlights research around the country that is helping the concrete pavement community meet the research objectives outlined in the CP Road Map.

FHWA publishes TechBrief on cements
The Federal Highway Administration (FHWA) recently published a TechBrief titled Blended and Performance Cements that focuses on the sustainable aspects associated with these cement types. The TechBrief also discusses how each cement is defined by the American Society for Testing and Materials International, and identifies concrete properties when either cement is used in the mix.

To access the TechBrief, click here.

This work is contributing to research objectives outlined in CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System.

Illinois DOT develops design charts based on mechanistic-empirical design for continuously reinforced concrete pavements
The Illinois Center for Transportation recently published Mechanistic-Empirical Design Concepts for Continuously Reinforced Concrete Pavements, which documents research to develop a method for Illinois DOT (IDOT) pavement engineers to design continuously reinforced concrete pavements (CRCP) using mechanistic-empirical (M-E) design models. Ultimately, it was determined that IDOT required an M-E design method that allowed users the flexibility to choose what models could be incorporated at any given point in time. The report outlines what models are included in the current IDOT M-E design method for CRCP. Design charts for CRCP were generated based on these models.

Click here to download the report.

This project is contributing to research objectives outlined in CP Road Map Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements.

FAA recognizes need to evaluate materials-related distress in concrete pavements
The Innovative Pavement Research Foundation recently published a report under the Airport Concrete
Pavement Technology Program. The report, *Final Report for Identification of Materials Related Distress and Projected Pavement Life Concrete Airfield Pavement*, documents research work funded by the Federal Aviation Administration (FAA) and identifies a need for a pavement evaluation procedure that considers the effects of material-related distress in order to assess the risk for development of foreign object debris and the requirements for rehabilitation. Research included a literature review, two site visits, and the development of a protocol for ascertaining a material-related distress rating that complements the standard procedure for a pavement condition index survey (e.g., ASTM D 5340).

[Click here to view the report.]

This research can be categorized under **CP Road Map Track 10: Concrete Pavement Performance**.

**Baylor University research explores microwave sensors for measuring w/cm ratio in concrete mixtures**

Baylor University research is exploring the use of a waveguide cutoff technique for measuring water content and water to cementitious materials (w/cm) ratio in fresh concrete mixtures. The technique involves testing methods that measure a sample of concrete material over a range of microwave frequencies in order to isolate changes in the sample’s ability to store and dissipate energy in the electromagnetic field. The relationship between water content and permittivity is well known and has been demonstrated by others. What makes this research unique is that it is wide-band and can therefore achieve the w/cm measurement, which is more complex that just measuring percentage of water. This kind of technology can potentially improve the quality control process and may help contractors achieve increased durability.

To contact Baylor University Professor Randall Jean, who is in charge of this research, [click here.]

To read a news article on this project, [click here.]

As a precursor to future concrete pavement research, the BEES online tool can be categorized under **CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System**.

**BEES now available online**

BEES, the National Institute of Standards and Technology (NIST) Building for Environmental and Economic Sustainability (BEES) analysis tool, is now available online. BEES is a life-cycle assessment software program developed by the NIST Engineering Laboratory that evaluates building materials, including concrete. The program generates an overall score that is representative of two of the three categories that make up the triple-bottom-line that defines sustainability. BEES, however, is not specific to pavements and may be complicated and tedious for an analysis of a pavements project. BEES does identify the life cycle of portland cement concrete and can prove to be a useful resource during the first steps in establishing metrics for the development of a future pavements-specific tool.

For more information, [click here.]

As a precursor to future concrete pavement research, the BEES online tool can be categorized under **CP Road Map Track 13: Concrete Pavement Sustainability**.

**Updates from the States: Iowa**

Concrete pavement research in Iowa is accomplished through programs operated by the Iowa Department of Transportation (Iowa DOT) Research and Technology Bureau and guided by the Iowa Highway Research Board (IHRB). Pavement research is conducted in-house by the Iowa DOT and through various partnerships.

The Iowa DOT partners with the University of Iowa, Iowa State University, and the University of Northern Iowa to accomplish research goals. The
Institute for Transportation (InTrans) and National Concrete Pavement Technology Center (National CP Tech Center) at Iowa State University are actively involved with the Iowa DOT through DOT-university partnerships on a number of concrete pavement research efforts.

Read on for more information about concrete pavement research in Iowa...

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CP Road Map E-News February 2011

The CP Road Map E-News is the newsletter of the Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map), a national research plan developed and jointly implemented by the concrete pavement stakeholder community. To find out more about the CP Road Map, or to get involved, contact Dale Harrington, dharrington@snyder-associates.com, 515-964-2020.

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

MAP Brief 5-2: Intelligent Compaction for Concrete Pavement Bases and Subbases has recently been published under CP Road Map Track 5: Concrete Pavement Equipment Automation and Advancements.

Download MAP Brief 5-2 (1.1 mb pdf).

News from the Road
News from the Road highlights research around the country that is helping the concrete pavement community meet the research objectives outlined in the CP Road Map.

There’s an app for that...
The American Concrete Pavement Association continues to add to its online applications library. An application for the design of a bonded concrete overlay over asphalt (BCOA) is now available.

To access this application, click here.

This work is contributing to research objectives outlined in CP Road Map Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements.

Louisiana Transportation Research Center evaluates performance of polyurethane foam as a rehabilitation option
A recent Transportation Research Board (TRB) report titled Mitigating Transverse Joint Faulting in Jointed Concrete Pavement with Polyurethane Foam documents research by the Louisiana Transportation Research Center that investigated an economical alternative for rehabilitation of severely faulted jointed concrete pavement. The report concludes that polyurethane foam injected under the slab can be a successful solution for the immediate treatment of faulting. The report warns, however, that load transfer at the joints is reduced because of the process required to install the foam.

Click here for more information and to obtain the report from TRB.

This project is contributing to research objectives outlined in CP Road Map Track 7: High-Speed Construction and Rehabilitation.

FHWA publishes state-of-the-technology report on high-performance materials for highway applications
The Federal Highway Administration (FHWA) recently published Advanced High-Performance Materials for Highway Applications: A Report on the State of the Technology, a summary of non-traditional construction materials that have potential for use in both new construction and rehabilitation of highways. The report is not concrete specific; however, it does include information on the use of innovative cements, aggregates,
and other concrete-related materials, such as curing compounds and concrete surface sealant materials. This work is important because it helps identify the potential for non-traditional materials as possible sustainable alternatives for concrete pavements.

Click here to view the report.

This research can be categorized under CP Road Map Track 13: Concrete Pavement Sustainability.

**TRB report investigates use of silica-rich rice husk as a supplementary cementitious material**

A recent TRB report titled *Fundamental Investigations into Performance of Carbon-Neutral Rice Husk Ash as Supplementary Cementitious Materials* identifies a new method for processing rice husk ash (RHA) for the purpose of using it as a supplementary cementitious material (SCM) in new concrete mixtures. The new processing method increases the RHA’s amorphous silica content, which increases the pozzolanic behavior of RHA. The report presents the results of laboratory tests performed in order to establish material properties and performance as a mineral additive in concrete mixtures. While not necessarily specific to pavements, this work may lead to the development of an advanced material that could potentially be both performance-enhancing and environmentally sustainable.

Click here for more information and to obtain the report from TRB.

This document is contributing to research objectives outlined in CP Road Map Track 12: Advanced Concrete Pavement Materials and Track 13: Concrete Pavement Sustainability.

**Updates from the States: Mississippi**

In recent years, the Mississippi Department of Transportation (MDOT) Research Division has collaborated with various agencies in order to accomplish concrete pavement research work. Under cooperative agreements, MDOT has worked and will continue to work with FHWA, the University of Mississippi, the Mississippi Transportation Research Center (MTRC) at Mississippi State University, and private consultants. MDOT also participates in the Transportation Pooled Fund Program.

In 2006, MDOT sponsored a workshop to identify transportation research needs for the State. These research needs included concrete pavement-related topics such as pavement preservation, concrete mix design and quality control/quality assurance (QC/QA) based on performance specifications, and pavement noise mitigation.

Read on for more information about concrete pavement research in Mississippi...

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CP Road Map E-News January 2011

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

MAP Brief 3-1: SmartCure: An Integral Part of an Intelligent Construction System has recently been published under CP Road Map Track 3: High-Speed Nondestructive Testing and Intelligent Construction.

Download MAP Brief 3-1 (849 kb pdf).

News from the Road
News from the Road highlights research around the country (and, in this issue, around the world) that is helping the concrete pavement community meet the research objectives outlined in the CP Road Map.

ACPA publishes mechanistic-empirical tie bar design approach for concrete pavements
The American Concrete Pavement Association (ACPA) recently published a report by Applied Research Associates that guides readers through a mechanistic-empirical (M-E) design process for tie bars at longitudinal joints. The method applies to pavements in which two, three, and four 12-ft wide lanes are tied together and considers the effects of various subbase materials.

Click here to download the full report.

This project is meeting needs identified in CP Road Map Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements.

Texas conducts evaluation of M-EPDG with TxDOT rigid pavement database
The Texas Department of Transportation (TxDOT) initiated the rigid pavement database project to collect information on the performance of portland cement concrete pavements. A recent TxDOT research report documents efforts to collect performance information on 27 sections of pavement located throughout the state. The purpose of this work was to calibrate the Mechanistic-Empirical Pavement Design Guide (M-E PDG) punchout model. The results of this work suggest that Texas' existing pavement management information system (PMIS) data may be reporting the cause of punchouts incorrectly. This theory, as discussed in the report, is based on the discrepancy between M-E PDG predicted punchouts and actual punchouts per the PMIS.

Click here to access the report.

This work is meeting research needs identified in CP Road Map Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements.

FHWA publishes tech brief on precast, prestressed concrete pavements
The Federal Highway Administration (FHWA) recently published a TechBrief on precast, prestressed concrete pavements for new construction and rehabilitation of existing asphalt pavements. The TechBrief is an eight-page document that provides a summary of precast, prestressed concrete pavements; describes field trial experiences; and discusses recommendations for best practices.

Click here to download the TechBrief.

This project is contributing to research objectives outlined in CP Road Map Track 7: High-Speed Construction and Rehabilitation and Track 11: Concrete Pavement Business Systems and Economics.

**PCA releases updated Design and Control of Quality Concrete Mixtures**
The Portland Cement Association (PCA) recently released a new, fully revised 15th edition of its well-known reference book Design and Control of Quality Concrete Mixtures. This edition highlights the many advances that have occurred in the past decade while providing a concise, current reference on the fundamentals of concrete technology and construction. This manual benefits ready-mixed concrete producers, concrete contractors, material suppliers, architects, engineers, builders, and students.

To order this publication from the PCA bookstore, click here.

This project is meeting needs identified in CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System.

**Cement and Concrete Aggregates Australia publishes Use of Recycled Concrete Aggregates in Construction**
Cement and Concrete Aggregates Australia recently published Use of Recycled Concrete Aggregates in Construction. This 25-page publication introduces readers to a variety of aggregate types categorized as manufactured and recycled aggregates. These aggregate types include foamed blast furnace slag, fly ash aggregates, recycled concrete aggregates, and reclaimed aggregates. While not specific to concrete pavements, this document does provide useful information on a variety of recycled materials that have a potential for use in concrete mixtures. Typical applications (e.g., surface, base, and subbase) and associated limitations are provided.

Click here to download Use of Recycled Concrete Aggregates in Construction.

This document is contributing to research objectives outlined in CP Road Map Track 12: Advanced Concrete Pavement Materials and Track 13: Concrete Pavement Sustainability.

**Updates from the States: Virginia**
The Virginia Department of Transportation (VDOT) research is managed by the Virginia Center for Transportation Innovation and Research (VCTIR). VCTIR (previously known as the Virginia Transportation Research Council or VTRC) performs in-house research as well as engages in partnerships with universities and other DOT’s to accomplish VDOT research goals. One of these partnerships includes the Virginia Tech Transportation Institute (VTI).

VTII is one of the original FHWA/Federal Transit Administration Intelligent Transportation Systems Research Centers of Excellence and is home to VDOT’s Smart Road. The Smart Road is described as a test-bed research facility where projects such as the Pavement Surface Properties Consortium are currently being conducted. The Pavement Surface Properties Consortium project is a transportation pooled fund project that includes support from three other states FHWA; it is an example of how VDOT works with other states to meet research needs.

Read on for more information about concrete pavement research in Virginia...

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CP Road Map E-News November 2010

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MAP Brief 1-2: Deleterious Chemical Effects of Deicing Solutions on Concrete Pavements has recently been published under CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System.

Download MAP Brief 1-2 (849 kb pdf).

News from the Road
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FHWA conducts interlaboratory study on measuring coefficient of thermal expansion of concrete
A national Interlaboratory Study on Measuring Coefficient of Thermal Expansion of Concrete was recently performed by FHWA Turner-Fairbank Highway Research Center, and published in the Transportation Research Record. This paper documents an investigation into the variability of results obtained from different devices used to measure the coefficient of thermal expansion (CTE) in concrete. As a result of this study, recommendations to improve testing methods are presented.

Click here to obtain a copy of the report.

This work is meeting research needs identified in CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System.

Wisconsin research evaluates open-graded base course with doweled and non-doweled transverse joints
Recent research in Wisconsin evaluated the performance of doweled versus non-doweled pavement sections constructed over a base that is either dense graded, asphalt stabilized, cement stabilized permeable, or untreated permeable with one of two different gradation requirements. The pavement sections included in this study are along three U.S. and State highways. The performance evaluation included testing joints for load transfer efficiency, calculating values for Pavement Distress Index (PDI) and International Roughness Index (IRI), and measuring hydraulic conductivity through the base. The study concluded that dense-graded base is the least expensive and meets drainage guidelines, and is therefore recommended.

Click here to read the full report.

This project is contributing to research objectives outlined in CP Road Map Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction and Track 8: Long-Life Concrete Pavements.
Wisconsin DOT develops standardized test procedures for evaluating deicing chemicals
A recent research effort in Wisconsin investigated, evaluated, and developed standard laboratory testing procedures for anticipating pavement performance when deicing chemicals, additives, and admixtures are used. Through a literature review, researchers identified the shortcomings of conventional test methods, and explored alternative tests including differential scanning calorimetry (DSC) and a Modified SHRP Ice Melting Test. It was mentioned, however, that these alternatives should be used for screening purposes only because neither method is comprehensive enough to accurately predict field performance.

Click here to download the full report.

This project is meeting needs identified in CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System.

Toronto research evaluates performance of permeable pavements in cold climates
The University of Guelph together with the Toronto and Region Conservation Authority recently prepared an interim report, documenting the performance evaluation of various permeable pavements including interlocking permeable concrete pavers, pervious concrete, and impervious asphalt. Another interim report is scheduled for completion in March 2011 and the final report will be completed in 2012. At the end of this research effort, the pavements will have been evaluated for over three years, during which time critical performance factors in cold climates will be identified and recommendations for improved design, maintenance, and operation will be presented.

Click here to read the interim report.

This effort is an example of work that can be categorized under the CP Road Map Track 13: Concrete Pavement Sustainability.

Research in Malaysia investigates construction and performance of recycled roller-compacted concrete pavements
A paper presented at the First International Conference on Pavement Preservation, held in April 2010 Newport Beach, California documents research that investigated the use of four different binders (foamed bitumen, bitumen emulsion, cement, and lime binders) for rehabilitating an existing roller-compacted concrete pavement. The type of rehabilitation method presented in this paper is an alternative to the typical rehabilitation methods for roller-compacted concrete pavements in Malaysia, which include a granular and asphalt overlay. The study is an example of innovative pavement design techniques and alternative rehabilitation methods that include recycling the existing pavement.

Click here to read the report.

This project is meeting research needs identified in CP Road Map Track 13: Concrete Pavement Sustainability.

Updates from the States: Washington
To accomplish concrete pavement research, the Washington Department of Transportation (WSDOT) often partners with universities, other State Departments of Transportation, and national centers through programs and organizations such as the Transportation Pooled Fund (TPF), Washington State Transportation Center (TRAC), Transportation Northwest (TransNow), and State Pavement Technology Consortium (SPTC).

TRAC is a partnership between WSDOT, the University of Washington, and Washington State University. TransNow is a Regional University Transportation Center led by the University of Washington. Universities from Idaho, Alaska, and Oregon are
also a part of TransNow. SPTC pools the resources and efforts of the California, Minnesota, Texas, and Washington DOTs for pavement research in an effort to improve design, construction, and maintenance methods and procedures.

Upcoming concrete pavement research at WSDOT includes the evaluation of long-term pavement performance and noise characteristics of next-generation concrete pavement surfaces. WSDOT is also conducting several research projects related to concrete pavement sustainability that are contributing to research needs outlined in CP Road Map Track 13.

Read on for more information about concrete pavement research in Washington...

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Partial-Depth Repairs for Concrete Pavements

Introduction

Partial-depth repairs are defined as the removal and replacement of small areas of deteriorated (or spalled) concrete, typically in joints or cracks. The depth of deterioration can vary from a few millimeters to the full depth of the pavement. Once they begin, spalls tend to grow or propagate under repeated thermal stresses and traffic loading.

Partial-depth repairs restore structural integrity and improve ride quality. Repairs of partially deteriorated joint areas also restore a well-defined, uniform joint-sealant reservoir prior to joint rescaling.

Partial-depth repairs have traditionally been used where joint or crack deterioration is in the top one-third of the slab and the existing load transfer devices (if any) are still functional. This approach has been used in most of the country, with the belief that if deterioration extends below the top one-third, then a full-depth repair is warranted.

However, by using new milling equipment and concrete mixtures, several cold-weather states have successfully demonstrated the use of partial-depth repair techniques in pavements where deteriorated areas are deeper than the top one-third but slightly less than the top one-half of the slab. Thus, partial-depth repairs can now be used for a greater number of deteriorated joint repairs.

This MAP brief discusses three different types of partial-depth repairs:

- **Type 1 - Spot repair**
- **Type 2 - Long joint/crack repair**
- **Type 3 - Bottom half repair**

Types 1 and 2 are standard partial-depth repairs (figure 1), and type 3 repairs are those developed for special repairs including the bottom half of the slab.

**Type 1 - Spot Repairs**

Spot repairs are appropriate in small, shallow areas, where joint or crack deterioration is located in the top one-half of the slab (figure 2). Spot repairs are at least 10 in. long, but less than 6 ft, and are typically used for pavements where the existing load transfer devices (if any) are still functional.

The most common method of removal for spot repairs is the saw and chip method, although milling is becoming more popular for some locations.
Type 2 - Long Joint/Crack Repairs

Long joint/crack repairs are partial-depth repairs in transverse and longitudinal joints or cracks longer than 6 ft and extending from one-third to one-half the depth of the concrete pavement (figure 3). Removal is usually by milling, and a small jackhammer is used for the remaining part of the patch where the mill cannot reach.

Both V-shaped and straight milling heads have been used to remove deteriorated pavement for long joint/crack repairs.

Type 3 – Bottom Half Repairs

As depicted in figure 4, sometimes one or more corners or the edge of a concrete pavement will deteriorate to the full depth for a short distance. Bottom half repairs are used for locations where the deterioration along the partial-depth repair exceeds T/2 in depth. This repair is for work performed in the bottom half of the pavement and its use should be limited to the edges or cross-joint locations that are not greater than 18 in. long.

Material Selection for Partial-Depth Repairs

Material selection for partial-depth repairs depends on these factors:
- Allowable lane closure time
- Ambient temperature
- Cost
- Size of repair
- Estimated performance

High-quality portland cement concrete is generally accepted as the most appropriate material for the repair of existing concrete pavements.

A mix developed by the Minnesota DOT, called 3U18, has been very successful for more than 30 years. This mix results in an 18± hour opening strength of 2,500 psi. Earlier opening times can be achieved with appropriate admixtures. Mixing is done either by hand, ready mix, or mobile concrete mixers. This mix can also be bought in 50 lb bags for small projects.
Cementitious 3U18 Recommended for Use in Partial-Depth Repairs
- 850 lbs Type I Cement
- 295 lbs of water
- 1,328 lbs of coarse aggregate (100% passing 3/8 in. sieve)
- 1,328 lbs of sand (55% passing #4 sieve)
- Target W/C of 0.35
- Type E Water Reducing and Accelerator
- 6.5% air

A wide variety of rapid-setting and high-early-strength proprietary materials have been developed for partial-depth repairs. The materials are easy to place, achieve exceptional early strength, and have been approved for use by a number of highway agencies. They are more expensive but prove useful when traffic requires 5 hours or less opening strength. These and other products are discussed in the Concrete Pavement Preservation Workshop Reference Manual (2008).

Construction Steps for Partial-Depth Repairs

Construction steps for partial-depth repairs are as follows.

1. Determine repair boundaries

The repair area is identified by sounding the deteriorated pavement using a chain, ball peen hammer, or steel pipe. Next, the boundaries for sawing or milling are marked on the pavement. The repair should extend 2 to 4 in. beyond the visible distressed area.

2. Concrete Removal

There are two common methods for removing deteriorated concrete prior to a partial-depth repair: 1) sawing and chipping with a jackhammer and 2) milling.

Sawing and chipping with a jackhammer

The most common method for partial-depth spot repairs is the saw and chip method (typically for Type 1 repairs), where a 2 in. saw cut is used to define the boundary area for the patch and a small (less than 35 lb) jackhammer is used to remove the outside edge of the saw cut in order to eliminate a smooth face and remove the rest of the existing concrete. These patches are either square or rectangular (figure 5).

Milling

Cold milling is another option for removing deteriorated concrete (typically for Type 2 repairs). Milling produces a very rough, irregular surface that promotes a high degree of mechanical interlock between the repair material and the existing slab (figure 6).

3. Repair Area Preparation

Sandblasting, and compressed airblasting are normally sufficient for obtaining an adequately clean surface.

4. Joint Preparation

The most frequent failure of partial-depth repairs at joints occurs due to restrained movement, which results in excessive compressive stresses in the repair material. Partial-depth repairs placed directly against transverse joints and cracks may fail due to compressive forces created when the slabs expand and insufficient room is provided for thermal expansion.
To prevent pavement failure at joints or cracks, a strip of polystyrene or polyethylene compressible material is typically placed in the joint to act as a bond breaker (figure 7). This prevents any of the patch material from entering the joint or crack and preventing movement of the joint. The bond breaker (or at least the upper portion) is normally removed before the joint is sealed. As noted, the compressible material is positioned prior to placement of the patch material.

5. Bonding Agent Application

After the surface of the existing concrete has been cleaned, and just prior to placement of the repair material, the surface should be coated with a cement grout (figure 8) to ensure complete bonding of the repair material to the surrounding concrete. The grout should coat all vertical and horizontal surfaces, should be mixed to the consistency of thick cream, and should be placed immediately before the repair material so the grout does not set.

Successful grout recipes used by many states, including Minnesota consist of the following:

- 2 parts Type I cement
- 1 part water
- 1 part sand

6. Patch Material Placement

General patch material placement guidelines are as follows:

- Batch in small quantities.
- Overfill the patch area by approximately 1/8 in.
- Consolidate the patch material using vibrators or vibrating screeds. Smaller patches are consolidated using small spud vibrators or by hand rodding and tamping.
- Troweling toward the edge is recommended. The surface of the repair should be textured to match that of the surrounding slab as much as possible.
- It is important to work the material away from the center of the patch and towards the edges to promote bonding.

After the patch material has been placed, the edges of the repair should be sealed with grout to help prevent moisture infiltration and the joint re-established by sawing (figure 9).

7. Curing

The most effective curing procedure in hot weather is to apply a white-pigmented curing compound as soon as water has evaporated from the repair surface. Some agencies require curing compound to be applied at 1.5 to 2 times the normal application rate to prevent shrinkage cracks in the repairs.

8. Joint Sealing

The final step in the process is sealing the joint. This helps ensure that incompressibles don’t cause additional spalls to occur.
Preventing Joint Deterioration in Concrete Pavements
A Summary of Current Knowledge

Introduction
Premature deterioration of concrete at joints in pavements has been reported in a number of locations in northern states. The pavements affected include state highways, city and county streets, and parking lots. Not all roadways exhibit deterioration at the joints, but the problem is common enough that a focused research effort is in progress to find preventative measures. The causes behind joint deterioration are not fully understood. In the interim, however, this document describes some of the factors that may be contributing to its occurrence and provides guidelines on how the risks may be reduced.

Occurrence
Joint deterioration is generally observed initially in longitudinal joints, followed by transverse joints, and is most common in pavements ranging in age from 5 to 15 years old. The distress is often initially observed as shadowing (Figure 1), because microcracking near the joints traps water; later, the joint exhibits significant loss of material (Figure 2).

Figure 1. Typical shadowing

Figure 2. Loss of material
Mechanisms

To date, no single mechanism has been found that accounts for all reported occurrences of joint deterioration. Investigations thus far have revealed two separate causes that are currently being investigated: 1) freezing-related deterioration caused by concrete saturation and 2) mechanical deterioration.

In the first and more common form of deterioration, typical characteristics are as follows:

- Concrete that has been saturated for longer periods (Figure 3) has a significantly higher risk of distress, regardless of the source of water.
- Many distressed pavements have been found to have marginal air void systems.
- A variety of potentially aggressive de-icing salts may have been used on these surfaces.
- Once damage starts, it progresses rapidly.

Water that is trapped in a joint will result in longer periods of saturation and thus provide greater risk of freezing-related damage. Water can be trapped behind a failed seal, above a non-cracked joint, or in the joint if the base layer is impermeable.

Researchers have also observed that if the longitudinal joint is cut deeper than the transverse, water in the deeper cut will not have a route to drain out of. In addition, work at Purdue has shown that high concentrations of some salts (used as de-icers) attract water, and thus slow or prevent drying of concrete surfaces that are in contact with them. This is particularly relevant in joints that will tend to act as reservoirs where salt may become concentrated while the pavement surface drains off.

Data from Purdue have shown that increasing the air content slows the rate of saturation of concrete, thus helping to reduce the risk of damage. In addition, requirements for and performance of the air void system are likely to have changed with changing chemical composition of the concrete system, particularly the air entraining admixtures.

In the second, mechanical, form of deterioration (Figure 4), typical characteristics are as follows:

- Damage is normally narrow and shallow, and may be on only one side of the joint.
- Damage starts near the edge of the slab and propagates along the joint rather than outward.
- The cracks often appear around aggregate particles rather than through them, indicating that the first damage may have occurred in the first few hours after placing.

It is likely that poor maintenance of the sawing equipment and/or inappropriate sawing practices are leading to damage around the saw cut that may not be visible initially, but will be exercised and opened up by weathering. Such damaged areas will also tend to act as water traps, thus leading to accelerated freezing-related distress, as described above.

Prevention

Until the causes of the problem have been fully understood, the following recommended approaches are likely to reduce the risk of failure.

In new construction:

1. Use concrete mixtures that are well proportioned using appropriate materials.
   - Use a w/cm between 0.38 and 0.45
   - Select and proportion appropriate supplementary cementitious materials to reduce concrete permeability
   - Choose durable aggregates
   - Select graded aggregate combinations that will make it easier to handle and consolidate the mixture

Figure 3. Evidence of concrete saturation
2. Pay attention to the air void system.
   - Before construction begins, assess the amount of air that may be lost during handling and adjust the mixture accordingly.
   - Monitor the air content carefully and periodically assess the air void system behind the paver.
   - Do not accept air contents that are below the recommended minima.
   - Avoid air void systems that are close to the limits as it may be that the current limits are inappropriate for current conditions and materials.
3. Ensure that fresh concrete is well cured
4. Allow water to leave the hardened concrete. For example:
   - Ensure that the saw cuts initiate a crack so that water can get away (Figure 5), for instance make sure the longitudinal saw cuts are at least T/3 in depth.
   - Ensure that the base has some permeability to allow water to drain away from the joints. Care must be taken to ensure that the load carrying capacity is not compromised and that pumping is prevented.
   - Pay attention to design and construction of drainage systems including requirements to prevent clogging.

**Mitigation / Repair**

In existing pavements that are beginning to show shadowing, the following measures can be used to mitigate or repair the deterioration.

1. Apply surface sealants to the faces of and near existing joints to reduce ingress of water into the concrete
   - Siloxane-based materials have a proven history of reducing permeability of concrete systems. These materials are sprayed on and will have to be re-applied periodically — probably about every 5 to 7 years.
   - Other sealant types are being investigated.
2. Consider limiting the type of deicing salts to sodium chloride.

3. Partial/full depth repairs of the joints may be required if the serviceability of the pavement is compromised. In some cases it is reported that the damage is through full depth of the pavement meaning that a full depth repair is required. Damage limited to the top 1/3 to top 1/2 of the depth may be addressed using a partial depth repair.

4. Pay attention to maintenance of drainage systems including regular inspection and cleaning.

5. Consider retrofitting edge-drains to improve drainage.

Additional details on prevention methodologies are provided in an implementation guide published by the South Dakota Department of Transportation, which can be accessed at http://www.state.sd.us/Applications/HR19ResearchProjects/Projects/SD2002-01_Implementation_Guide_Final.pdf

A future MAP brief will address repair techniques for existing pavements in more detail.

**Future Work**

A Pooled Fund study sponsored by the States of South Dakota, New York, Minnesota, Iowa, Indiana, Wisconsin, and Michigan; FHWA; and the pavement construction industry has been established to fund joint deterioration research.

Work is underway at Iowa State University, Michigan Technological University, and Purdue University to investigate these mechanisms, both in the laboratory and in the field. The goal of this work is to understand the causes, and particularly to understand why some pavements are distressed and others nearby are untouched. Based on this understanding, guidelines for good practice to prevent the problem will be developed.

For more information, contact Peter C. Taylor, Associate Director, National Concrete Pavement Technology Center, 515-294-9333, ptaylor@iastate.edu or visit http://www.cptechcenter.org.
“Moving Advancements into Practice”

MAP Brief 1-3:

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

Fly ash as a supplementary cementitious material in concrete mixtures

Introduction

Fly ash is the most widely used supplementary cementitious material (SCM) in concrete. It is used in about 50 percent of ready-mixed concrete (PCA 2000). When used in conjunction with portland cement, fly ash can enhance the properties of concrete through hydraulic or pozzolanic activity or both.

Hydraulic materials will set and harden when mixed with water. Pozzolanic materials require a source of calcium hydroxide (CH), usually supplied by hydrating portland cement. Class F fly ashes are typically pozzolanic while Class C fly ashes have both hydraulic and pozzolanic characteristics.

Use of fly ash in concrete mixtures has been growing in North America since the 1970s:

- The basic chemical components in fly ash are similar to those of portland cement.
- The judicious use of fly ash is desirable not only for the environment and energy conservation, but also for the technical benefits it provides to concrete.

Fly ash can be used to improve a particular concrete property, like resistance to alkali-aggregate reactivity. However, mixtures containing fly ash should be tested to determine whether (1) the fly ash is indeed improving the property, (2) the dosage is correct (an overdose or undertose can be harmful or may not achieve the desired effect), and (3) there are any unintended effects (for example, a significant delay in early strength gain).

It is also important to remember that different fly ashes may react differently with...
different cements, leading to changes in the performance of a given mixture. Fly ashes should not be switched out without laboratory evaluation to check setting times and strength development at a minimum.

Occasional reports are received of so-called incompatibility, in which unexpected reactions occur between components in the cement and fly ash, leading to rapid stiffening, delayed setting and/or slow strength development. These are most commonly observed in hot weather using fly ashes with high calcium content combined with the use of Type A water-reducing admixtures. Changing the mixture temperature, fly ash source or type of chemical admixture will often resolve the issue; otherwise, seek expert help.

SCMs should comply with the requirements of ASTM C 618 or AASHTO M 295. The table below provides typical chemical analyses and selected properties of typical fly ashes.

Fly ash generally affects concrete as follows:
- Less water is normally required to achieve workability.
- Setting time may be delayed.
- Early strengths may be depressed, but later strengths are increased, because fly ash reaction rates are initially slower but continue longer.
- Heat of hydration is reduced.
- Resistance to alkali-silica reaction and sulfate attack may be improved when the appropriate ash substitution rate is used.

Permeability is reduced; consequently, resistance to chloride ion penetration is improved.

Class F fly ash is generally used at dosages of 15 to 25 percent by mass of cementitious material; Class C fly ash is generally used at dosages of 15 to 40 percent. Dosage should be based on the desired effects on the concrete (Helmuth 1987, ACI 232 2003).

Fly ash is a byproduct of burning finely ground coal in power plants. Fly ashes that are not used as an SCM in concrete or in other applications (ACAA 2011) must be placed in disposal facilities. During combustion of pulverized coal, residual minerals in the coal melt and fuse in suspension and then are carried through the combustion chamber by the exhaust gases. In the process, the fused material cools and solidifies into spherical glassy ash particles (see photo on page 1). The fly ash is then collected from the exhaust gases by electrostatic precipitators or fabric bag filters.

Fly ash is primarily silicate glass containing silica, alumina, calcium, and iron (the same primary components of cement). Minor constituents are sulfur, sodium, potassium, and carbon, all of which can affect concrete properties. Crystalline compounds should be present in small amounts only.

The relative density (specific gravity) of fly ash generally ranges between 1.9 and 2.8. The color is gray or tan. Particle sizes vary from less than 1 μm to more than 100 μm, with the typical particle size measuring under 35 μm. The surface area is typically 300 to 500 m²/kg, similar to cement.

### Chemical analyses and selected properties of Type I cement and several supplementary cementitious materials

<table>
<thead>
<tr>
<th></th>
<th>Type I cement</th>
<th>Class F fly ash</th>
<th>Class C fly ash</th>
<th>GGBF slag</th>
<th>Silica fume</th>
<th>Metakaolin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica (SiO₂) %</td>
<td>22.00</td>
<td>52.00</td>
<td>35.00</td>
<td>35.00</td>
<td>90.00</td>
<td>53.00</td>
</tr>
<tr>
<td>Alumina (Al₂O₃) %</td>
<td>5.00</td>
<td>23.00</td>
<td>18.00</td>
<td>12.00</td>
<td>0.40</td>
<td>43.00</td>
</tr>
<tr>
<td>Iron oxide (Fe₂O₃) %</td>
<td>3.50</td>
<td>11.00</td>
<td>6.00</td>
<td>1.00</td>
<td>0.40</td>
<td>0.50</td>
</tr>
<tr>
<td>Calcium oxide (CaO) %</td>
<td>65.00</td>
<td>5.00</td>
<td>21.00</td>
<td>40.00</td>
<td>1.60</td>
<td>0.10</td>
</tr>
<tr>
<td>Sulfate (SO₃) %</td>
<td>1.00</td>
<td>0.80</td>
<td>0.80</td>
<td>9.00</td>
<td>0.40</td>
<td>0.10</td>
</tr>
<tr>
<td>Sodium oxide (Na₂O) %</td>
<td>0.20</td>
<td>1.00</td>
<td>5.80</td>
<td>0.30</td>
<td>0.50</td>
<td>0.05</td>
</tr>
<tr>
<td>Potassium oxide (K₂O) %</td>
<td>1.00</td>
<td>2.00</td>
<td>0.70</td>
<td>0.40</td>
<td>2.20</td>
<td>0.40</td>
</tr>
<tr>
<td>Total eq. alkali (as Na₂O), %</td>
<td>0.77</td>
<td>2.20</td>
<td>6.30</td>
<td>0.60</td>
<td>1.90</td>
<td>0.30</td>
</tr>
<tr>
<td>Loss on ignition, %</td>
<td>0.20</td>
<td>2.80</td>
<td>0.50</td>
<td>1.00</td>
<td>3.00</td>
<td>0.70</td>
</tr>
<tr>
<td>Blaine fineness, m²/kg</td>
<td>350.00</td>
<td>420.00</td>
<td>420.00</td>
<td>400.00</td>
<td>20,000.00</td>
<td>19,000.00</td>
</tr>
<tr>
<td>Relative density</td>
<td>3.15</td>
<td>2.38</td>
<td>2.65</td>
<td>2.94</td>
<td>2.40</td>
<td>2.50</td>
</tr>
</tbody>
</table>

Fly ash will lose mass when heated to 1,000°C (1,830°F), mainly due to organic volatiles and combustion of residual carbon. This mass loss is referred to as loss-on-ignition (LOI) and is limited in most specifications to less than 6 percent. Class F fly ashes typically contain less than 10 percent calcium (CaO), with 5 percent LOI. Class C materials often contain 18 to 30 percent calcium (CaO), with less than 2 percent LOI.

**Effects of fly ash in concrete**

SCMs in concrete affect a wide range of fresh and hardened concrete properties. Some of the effects may be considered desirable and are the reason why the materials are used. Other side effects may be less desirable and have to be accommodated. An understanding of all the potential effects is essential to prevent surprises.

The effects of SCMs on properties of fresh and hardened concrete are briefly discussed in the following sections. (For more information, see chapter 5 of the Integrated Materials and Construction Practices: State-of-the-Practice Manual [IMCP manual] for a complete discussion of concrete properties.)

In most cases, the extent of change in concrete behavior will depend on the particular material used, the amount used, and the properties of other ingredients in the concrete mixture.

Trial batching with unfamiliar material combinations is essential to provide assurance of critical concrete properties.

**Fresh properties**

In fresh concrete, fly ash can affect workability and setting times in the following ways:

- Fly ash will generally increase workability.
- The rate of slump loss (stiffening) may be increased if there are chemical incompatibilities.
- Setting times may be delayed and early strength gain slowed.

All of these factors can have a significant effect on the timing of finishing and saw cutting in pavements; thus, it is important that the performance of the cementitious system being selected for a project be tested in trial batches well before the project starts. Trial batches need to be tested at the temperatures expected when the paving operation will be conducted.

**Durability/Permeability**

Fly ashes generally improve potential concrete durability by reducing permeability. Almost all durability-related failure mechanisms involve the movement of fluids through the concrete. Tests show that the permeability of concrete decreases as the quantity of hydrated cementitious materials increases and the water-cementitious materials ratio decreases. With adequate curing, fly ash generally reduces the permeability and absorption of concrete.

**Alkali-silica reactivity resistance**

Alkali-silica reactivity (ASR) of most reactive aggregates can be controlled with the use of fly ash. Low-calcium Class F fly ashes have reduced reactivity expansion up to 70 percent or more in some cases. At optimum dosage, some Class C fly ashes can also reduce reactivity; however, at low dosage (referred to as a pessimum limit), a high-calcium Class C fly ash, as well as a low-calcium Class F fly ash, can exacerbate ASR.

SCMs reduce ASR (Bhatry 1985) by:

1. Providing additional calcium silicate hydrates (C-S-H) that chemically tie up the alkalis in the concrete.
2. Diluting the alkali content of the system.
3. Reducing permeability, thus slowing the ingress of water.

It is important to determine the optimum and pessimum dosages for a given set of materials to maximize the reduc-

<table>
<thead>
<tr>
<th>Effect of pozzolans in cement paste</th>
</tr>
</thead>
<tbody>
<tr>
<td>In very broad terms, the primary reaction in hydrating cement is the following:</td>
</tr>
<tr>
<td>water + cement = calcium silicate hydrate (C-S-H) + calcium hydroxide (CH)</td>
</tr>
<tr>
<td>Calcium silicate hydrate (C-S-H) is the primary compound that contributes to the strength and impermeability of hydrated cement paste. Calcium hydroxide (CH) is not as strong and is more soluble, so it is somewhat less desirable.</td>
</tr>
<tr>
<td>Adding a pozzolan like fly ash, in the presence of water, results in conversion of the calcium hydroxide (CH) to more calcium silicate hydrate (C-S-H):</td>
</tr>
<tr>
<td>calcium hydroxide (CH) + pozzolan + water = calcium silicate hydrate (C-S-H)</td>
</tr>
<tr>
<td>This conversion is a significant benefit of adding pozzolans like fly ash to the mixture. (See chapter 4 of the IMCP manual, for a detailed description of cement chemistry and hydration, including the effects of specific SCMs on the hydration process.)</td>
</tr>
</tbody>
</table>
tion in reactivity and to avoid dosages and materials that can aggravate reactivity. Dosage rates should be verified by tests, using the AASHTO protocol (AASHTO PP 65-10 Determining the Reactivity of Concrete Aggregates and Selecting Appropriate Measures for Preventing Deleterious Expansion in New Concrete Construction).

Sulfate resistance

With proper proportioning and materials selection, fly ash can improve the resistance of concrete to external sulfate attack. This is done primarily by reducing permeability and by reducing the amount of reactive elements (such as tricalcium aluminate, C₃A) that contribute to expansive sulfate reactions.

One study showed that for a particular Class F ash, an adequate amount was approximately 20 percent of the cementitious system (Stark 1989). It is effective to control permeability through mixtures with low water-cementitious materials ratios. Concretes with Class F ashes are generally more sulfate resistant than those with Class C ashes.

Resistance to freeze-thaw damage and deicer scaling

There is a perception that concrete containing fly ash is more prone to frost-related damage than plain concrete. This is partially due to the severity of the test methods used (ASTM C 666, ASTM C 672), but may also be related to the changing bleed rates and finishing requirements for concretes with fly ash (Taylor 2004).

With or without fly ash, concrete that is exposed to freezing cycles must have sound aggregates, adequate strength, a proper air-void system, and proper curing methods.

For concrete subject to deicers, the ACI 318 building code states that the maximum dosage of fly ash should be 25 percent by mass of cementitious materials. Total SCM content should not exceed 50 percent of the cementitious material. Concretes, including paving mixtures, with SCMs at dosages higher than these limits may still be durable, however.

Drying shrinkage

When used in low to moderate amounts, the effect of fly ash on the drying shrinkage of concrete of similar strength is generally small and of little practical significance.

For more information

For more information see chapters 3 and 5 of the IMCP manual, or contact Peter Taylor, ptaylor@iastate.edu, 515-294-9333.

References


American Concrete Institute (ACI) Committee 232. 2003. Use of Fly Ash in Concrete. 232.2R. Farmington Hills, MI: American Concrete Institute.


Intelligent Compaction for Concrete Pavement Bases and Subbases

Introduction

Unfortunately, many concrete pavement failures in the United States are related to inadequate foundation layers—the soils and aggregates in the natural subgrade and in the subbase. One factor in foundation-related pavement failures is poor compaction practices. The use of conventional compaction machines, even when skillfully operated, cannot ensure uniform pavement foundation layer support conditions.

A relatively new “smart” technology—intricate compaction (IC)—has the potential to significantly improve compaction processes, with continuous recording of compaction data that can aid in controlling uniformity of support conditions.

This MAP Brief provides a brief overview of IC technology, research, and implementation issues.

What is IC?

Intelligent compaction (IC) technologies consist of machine-integrated sensors and control systems that provide a record of machine-ground interaction on an onboard display unit in real-time using global positioning systems (GPS). With feedback control and automatic adjustment of vibration amplitude, frequency and/or speed during the compaction process, the technology is referred to as “intelligent” compaction. Without the vibration feedback control system, the technology is commonly referred to as continuous compaction control (CCC).

Benefits of IC

The major potential benefits of IC can be categorized as follows:

- Improved uniformity through optimized compaction control
- Increased productivity (each pass is optimized; unnecessary passes are eliminated)
- Identification of non-compactable and unstable areas
- Continuous record of material-related stiffness parameter values
- Ultimately, reduced pavement failure and repair costs

Figure 1. Smooth-drum roller equipped with onboard display unit
Improved uniformity through optimized compaction activities

Using on-board color-coded compaction data that is available in real-time, the roller operator can optimize compaction efforts, leading to improved uniformity. Optimization algorithms are being researched and should add value to this process in the near future through additional "intelligence" and increased automation for the process.

Increased productivity

Because IC systems are designed to rapidly determine compaction quality, compaction can be more efficient. The contributions to compaction from other equipment on the projects can be easily documented. For some projects, it is expected that equivalent or better levels of density can be achieved in less time and with fewer passes.

Identification of non-compactable areas

By comparing the results of subsequent passes, IC systems identify areas that are not compacting as desired. The non-subjective capability to detect projects or portions of projects that will not provide sufficient support allows personnel to address the problem by removing and replacing underlying materials, stabilizing and re-compacting the underlying materials, drying wet soils, or modifying the compaction requirements.

Continuous record of material-related stiffness values

The ability to continuously monitor material-related stiffness parameters values, both as an aid to "on the fly" compaction adjustments and as a partial acceptance tool for in-place material, is an exciting development in highway engineering.

In addition, accumulated records could support identification of optimum pavement modulus values or other values for use in design or performance specifications. Ongoing research is focused on better understanding how IC values can be linked to pavement design/performance values for foundation layers.

Reduced costs

Improvements in the efficiency of compaction operations when IC is used may result in lower construction and maintenance/repair costs for the paving contractor and, ultimately, State DOTs and the traveling public.

How IC works

Instrumentation

The machine-ground interaction measurements provide an indication of ground stiffness/strength and, to some extent, degree of compaction. Most of the IC/CCC technologies are vibratory-based systems applied to single-drum, self-propelled, smooth-drum rollers (figure 1). IC/CCC technologies have also been applied to vibratory double-drum compactors and self-propelled padfoot compactors. Currently, there are at least seven IC/CCC systems/parameters:

- compaction meter value (CMV)
- oscillometer value (OMV)
- compaction control value (CCV)
- roller-integrated stiffness (ks)
- omega value (ω)
- vibratory modulus (Evib)
- machine drive power (MDP)

The CMV, OMV, CCV, ks, ω, and Evib measurement systems are accelerometer-based technologies. The CMV, OMV, and CCV systems calculate the ratio of selected frequency harmonics for a set time interval. The ks, ω, and Evib measurement systems calculate ground stiffness or elastic modulus based on a drum-ground interaction model and some assumptions.

The MDP measurement system is based on the principle of machine rolling resistance and works in both vibratory and non-vibratory mode of operation.

The type of technology used by each roller manufacturer and the way their system captures compaction results may be different, but they all provide information to the roller operator in real-time by integrating compaction measurements with GPS data and a computer display for the operators.

Documentation

On-board software collects a continuous record of data—roller location (i.e., northing, easting, and elevation); roller speed; number of passes; compaction measurements, etc.—that are mapped with a color-coded system and displayed on an on-board monitor.

Research and information on IC

National Pooled Fund Study TPF-5(954)

As part of a national pooled-fund study, researchers in several States are field testing existing and emerging IC technologies, with the goal of accelerating the development of IC quality control and quality assurance specifications for subgrades and bases. Researchers are focusing on the following:

- Providing a reliable method to capture the maximum potential value added from current IC technology and currently used/available QC/QA field-testing equipment (dynamic cone, FWD, plate load tests, nuclear density, Moisture, temperature, cores, etc.)
• Developing an experienced and knowledgeable IC expertise base within the participating State Departments of Transportation (DOTs)
• Identifying and prioritizing needed research to improve IC equipment and QC/QA field-testing equipment. Prioritization will be based on simplifying IC usage, achieving greater IC value (cost-benefit), and improving accuracy

The study involves 12 State DOTs (Georgia, Indiana, Kansas, Maryland, Minnesota, Mississippi, North Dakota, New York, Pennsylvania, Texas, Virginia, and Wisconsin), FHWA, and programs at seven universities. Demonstration projects have been conducted in all 12 participating States and California.

For more information on the pooled fund study, visit www.intelligentcompaction.com.

NCHRP Project 21-09

Under National Highway Cooperative Research Program (NCHRP) Project 21-09, the Colorado School of Mines and Iowa State University conducted research to determine the reliability of intelligent compaction systems and to develop recommended construction specifications for the application of intelligent compaction systems in soils and aggregate base materials.

The researchers collected and analyzed intelligent and traditional compaction data. Their analysis of the data confirmed the importance of determining moisture, layer depth, and the foundation layer with the accuracy of intelligent compaction data. The report includes target values for the modulus of different soil types as well as preliminary recommended construction specifications for intelligent compaction systems.

View the report online at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_676.pdf.

Iowa State University field demonstration project

Objectives

The objective of this field demonstration project was to evaluate the compaction meter value (CMV) system—an intelligent compaction (IC) technology on the Volvo SD116DX smooth drum vibratory roller—for use in quality control (QC) and quality assurance (QA) during reconstruction of pavement foundation layers (e.g., subgrade, subbase, and base layers). The following research tasks were established for the study:

- Obtain data to evaluate future IC specifications.
- Develop content for future educational and training materials for DOT and contractor personnel.

Project description

This demonstration project was located on I-29 in Monona County, Iowa. The project involved reconstructing the pavement foundation layers (base, subbase, and subgrade) of the existing Interstate highway. The existing subgrade layer was undercut to about 0.30 to 0.60 m below the existing grade. The exposed subgrade in the excavation was scarified and recompacted. The excavation was then replaced with a 0.30 to 0.45 m thick recycled asphalt (“special backfill subgrade treatment”) subbase layer and a 0.15 m thick recycled concrete base layer. Crushed limestone material was also used for the subbase layer in some areas.

The Volvo SD116DX smooth-drum vibratory roller used on this project (Figure 2) was equipped with a compaction meter value (CMV) system and global positioning system (GPS) outfitted by Trimble, Inc. (Figure 3). A total of 11 test sections...
were constructed and tested by the ISU research team. Three in situ testing methods were used to evaluate the in situ soil compaction properties and obtain correlations with CMV: (1) Humboldt nuclear gauge (NG) to measure soil dry unit weight (Yd) and moisture content, (2) Zorn light weight deflectometer (LWD) setup with 300 mm plate diameter to measure elastic modulus and (3) dynamic cone penetrometer (DCP) to determine California bearing ratio (CBR).

Summary of key findings

- Data from calibration strips indicated that CMV measurements and all the point measurements on the recycled asphalt subbase layer were higher than on the underlying subgrade layer. Similarly, values on the recycled concrete base layer were higher than on the subbase layer.
- Correlations developed from this project yielded statistically significant correlations between CMV and LWD modulus point measurements. No statistically significant relationships were found between CMV and NG density measurements.
- CMV maps obtained on the subbase and the overlaid recycled concrete base layers (figure 4) indicate that “soft” and “stiff” zones in the subbase layer maps are reflected on the recycled concrete base layer maps, emphasizing the importance of preparing a uniform subgrade support layer.
- CMV maps were able to effectively delineate “soft” and “stiff” zones.
- Repeatability of CMV measurements was evaluated in this study. Results indicated that the CMV measurement error was about ±1.1% for low-amplitude settings at a nominal machine speed of about 4 km/h.

IC implementation issues

Realizing that a national forum is needed to provide broad leadership that can rapidly address the needs and challenges facing DOTs with the adoption of IC technologies, the Iowa DOT initiated the Technology Transfer Intelligent Compaction Consortium (TTICCC) project under pooled fund study TPF-5(233).

The purpose of this pooled fund project is to identify, support, facilitate, and fund IC research and technology transfer initiatives. At this time, the following 11 State highway agencies are part of this pooled fund study: California DOT, Georgia DOT, Iowa DOT, Kentucky DOT, Missouri DOT, Mississippi DOT, Ohio DOT, Pennsylvania DOT, Utah DOT, Virginia DOT, and Wisconsin DOT.

As part of this project, a workshop was held on December 14-15, 2010, to identify and prioritize a list of IC implementation/research needs (table 1). Developing IC specifications and correlations between IC measurements and in situ point measurements were rated as the top two research/implementation needs.

<table>
<thead>
<tr>
<th>Prioritized IC/CCC Technology Research/Implementation Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Intelligent Compaction and In situ Correlations (24&quot;)</td>
</tr>
<tr>
<td>2. Intelligent Compaction Specifications/Guidance (19&quot;)</td>
</tr>
<tr>
<td>3. Data Management and analysis (8&quot;)</td>
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<tr>
<td>4. Project Scale Demonstrations and Case Histories (7&quot;)</td>
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<tr>
<td>5. Education/Certification Programs (4&quot;)</td>
</tr>
<tr>
<td>6. Understanding Impact of Non-Uniformity on Performance (4&quot;)</td>
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<tr>
<td>7. Standardization of Roller Outputs and Format Files (4&quot;)</td>
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<tr>
<td>8. IC Compaction Research Database (3&quot;)</td>
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<td>9. In Situ Testing Advancements and New Mechanistic Based GC/QA (2&quot;)</td>
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<tr>
<td>10. Understanding Roller Measurement Influence Depth (1&quot;)</td>
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<tr>
<td>11. IC Technology Advancements and Innovations (1&quot;)</td>
</tr>
<tr>
<td>12. Sustainability (1&quot;)</td>
</tr>
<tr>
<td>13. Standardization of Roller Sensor Calibration Protocols (0&quot;)</td>
</tr>
</tbody>
</table>

Table 1. Prioritized IC technology research/implementation needs from the 2010 TTICCC workshop
"Moving Advancements into Practice"

MAP Brief 3-1:

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

SmartCure: An Integral Part of an Intelligent Construction System

Introduction

The SmartCure System is a new technology, developed by the Federal Highway Administration, that uses various measuring devices and computer software to provide continuous, real-time, and site-specific recommendations for concrete pavement curing. These recommendations are based on immediate ambient conditions (including wind speed, relative humidity, air temperature, and concrete surface temperature), job-specific concrete materials, and user-defined thresholds (figure 1).

How SmartCure works

SmartCure measuring devices collect ambient weather conditions and concrete surface temperatures at set time intervals (e.g., every two minutes) for as long as the software is set to run. This data is transferred to a laptop and stored in a computer software program. The software organizes the data and calculates evaporation rate, bleed rate, and set times. Measured and calculated data are organized and displayed by the software for easy viewing by any user.

Threshold values for evaporation rate, temperature of the concrete, and air temperature are inputs to the software. The thresholds indicate critical conditions at which the risk for damage to the pavement is higher if proper curing methods are not followed. When any of the data (i.e., measured or calculated) are close to or above threshold values, the software alerts the user and generates recommendations for how to handle that risk.

Background on curing

Curing concrete is a vital step in the pavement construction process. Proper curing minimizes moisture loss from the surface of the pavement caused by evaporation and reduces thermal gradients, thus decreasing the
potential for pavement damage caused by plastic shrinkage cracking and spalling (crusting of surface mortar) (figure 2). A variety of curing methods are currently used in the field. The most common include the use of liquid curing compounds. In cold weather, polyethylene sheeting and cotton mats or burlap covers are sometimes used. Applying the right curing method at the right time is vital in order for the pavement to meet its design objectives. Knowing the relationship between the concrete materials and the environment in which the pavement is being constructed is key to ensuring that the right curing method is applied at the right time.

The relationship between materials and the environment is not always intuitive. There are tools and guidelines that most contractors are familiar with and use regularly in construction. For example, the International Guide to Curing Concrete by the American Concrete Institute (ACI 308R-01) includes a nomograph that helps contractors calculate evaporation rate based on air temperature, relative humidity, concrete temperature, and wind velocity (figure 3).

Tools such as the ACI nomograph are helpful in that they provide general knowledge and recommendations for how to properly cure concrete for a variety of environments and conditions. However, a site-specific tool used during construction that continuously measures real-time ambient conditions and provides real-time guidelines for proper curing in those conditions would be of significantly greater benefit to paving contractors. The need for such a tool and the intention of improving current curing practices led to the development of a SmartCure prototype.

Field trials that tested the potential and ability of a SmartCure prototype validated the benefit of such a tool for contractors. The system prototype, however, needed to be further developed in order for it to be more practical in the field. For example, the prototype was a completely wired system, which made setup on the cure cart somewhat cumbersome. Recent SmartCure improvements have overcome this limitation.

**SmartCure components**

SmartCure consists of several measuring devices connected to a laptop computer operating a Windows® based software program. The measuring devices include a weather station, global positioning system (GPS), and an infrared (IR) temperature sensor. The weather station measures ambient air temperature, relative humidity, and wind speed. The GPS device provides latitude and longitude to identify location. The IR sensor measures the concrete surface temperature.

The information measured by the weather station, GPS, and IR sensor is sent to the laptop. In the prototype, this was accomplished via a wired connection between the measuring devices and the laptop. Recent improvements, however, include a wireless connection, which allows the laptop to be set up anywhere. It is connected to one of two XPress™ Ethernet Bridge modems. There must be continuous line-of-sight between the two modems in order for the laptop to receive any data from the measuring devices. As long as line-of-sight is not compromised, the laptop can be up to two miles away from the cure cart.

The weather station and the second XPress™ Ethernet Bridge modem are mounted to one end of a collapsible pole. The IR sensor is attached to the other end of the same pole. The pole is secured to the front of the cure cart and the length of the
pole is adjusted so that the IR sensor is positioned as close as possible to the surface of the fresh concrete (figure 4).

For practical reasons, the weather station and modem should be positioned above the cure cart at a sufficient height to avoid excessive wind obstruction caused by the cure cart. The GPS has a magnetic back and is attached to the cure cart directly. The weather station, modem, GPS, and IR sensor are connected via cables to a serial-to-Ethernet server (figure 5).

The serial server is secured inside a white metal box that must be mounted onto the cure cart. Housed inside the box, along with the server, is an inverter, which is used to provide power to the IR sensor, modem, and GPS. Power is supplied by either a direct connection to the cure cart motor battery or a 12-volt battery that can be supplied and attached to the cure cart.

**Using the software**

All of the data sent over the wireless connection from the measuring devices to the laptop is logged by the SmartCure software. The software calculates evaporation, bleed rates, and set time rates (initial and final), while monitoring critical thresholds that are defined by the user as an input to the software. When thresholds are approached, the software triggers an alert to the user by generating recommendations on the selection of curing methods, curing applications, curing durations, and temperature management issues.

Inputs to the SmartCure software include material properties for mixture constituents, general site information, any known laboratory testing results for bleed rate and set times, and user-defined thresholds for evaporation rate, ambient air temperatures, and concrete surface temperatures. Default values for all inputs are based on a normal concrete paving mixture and generally accepted tolerances.

The more inputs the user can provide that are specific to the job, the more accurate SmartCure will be in predicting calculated values. Inputs for user-defined thresholds require the user to select from a set of default options. Any number of these options can be selected by the user. The default options identify critical values above which the recommendation for a type of curing procedure specific to that situation is provided. These critical values and recommendations for procedures can be modified to reflect local and/or State specifications or experience.

Once all inputs have been entered and the software starts to collect and log data, the user can view the data on one of

![SmartCure Prototype Weather Station and IR Sensor](image)

*Figure 4. SmartCure prototype in the field*

![Schematic of SmartCure system components](image)

*Figure 5. Schematic of SmartCure system components*
three screens: Main, Overview, or Details. The Main screen graphics show immediate measured values for air temperature, concrete surface temperature, relative humidity, and wind speed (figure 6). Calculated values for evaporation rate are also displayed. Measured and calculated data are logged every two minutes; this interval can be adjusted by the user. A summary of data for each station can be viewed in the overview screen. A station is typically 100 feet in length, but the user can modify this value when entering general site information inputs. A summary of data over time can be viewed in the Details screen.

Upon completion of data collection, the user can opt for the software to generate a report of all logged data that can be printed as a hard copy. A User's Manual is currently being developed that will provide detailed guidance on how to properly set up SmartCure components in the field and instruct the user on how to use the SmartCure software. It is expected to be available in spring or summer 2011.

**SmartCure in the field**

Field evaluations of the SmartCure prototype were performed in Houston, TX, Kansas City, KS, and Martinsburg, WV. The goal of each evaluation was to validate the performance of the system with regard to functionality, reliability, and accuracy. The FHWA mobile testing lab was present for two of the three evaluations and performed set time and bleed rate tests. The results of the FHWA mobile lab testing were used as inputs to the SmartCure software, and helped validate the software’s ability to predict these rates in the field.

The field evaluations proved that SmartCure can perform well in the field and that it could be a useful tool for a contractor, contingent upon improvements to the prototype that would make it more practical for a field environment.

Improvements following the field trials have included incorporating a wireless connection between the laptop and the measuring devices. This allows the laptop to be set up along the side of the paving operation, or even in a vehicle parked alongside the paving job (figure 7).

**Conclusion**

Made to be more practical for the field and proven to work successfully, SmartCure is intended to improve curing practices by providing guidelines for proper curing methods based on immediate ambient conditions. Currently, FHWA is in review of the recent improvements to the prototype. Additional improvements can easily be made as refinements are identified that will continue to make SmartCure even more practical for use in the field.

**For more information**

For information on how to obtain SmartCure or any additional literature, please contact Fred Faridazar at the Federal Highway Administration Turner-Fairbank Highway Research Center, 202-493-3076, fred.faridazar@fhwa.dot.gov.

**Resources**

*Standard Practice for Curing Concrete, ACI 308R-01, American Concrete Institute, 2001.*


Deleterious Chemical Effects of Deicing Solutions on Concrete Pavements

Introduction

Safety and mobility are key concerns for State Highway Agencies (SHAs), especially during the winter season, when ice and snow accumulation on roads and bridges can create hazardous or impassable driving conditions. Various chemicals, including magnesium, sodium, and calcium chloride; calcium magnesium acetate; and urea, are used by SHAs as anti-icing and deicing solutions on transportation infrastructure.

The effectiveness of these chemicals for deicing and anti-icing has been demonstrated. However, the possible detrimental effects to concrete in transportation structures have not been fully examined and documented. Although these chemicals offer possible cost savings advantages to SHAs, the true cost effectiveness cannot be determined without establishing the potential for chemical attack and premature deterioration, leading to costly rehabilitation or replacement.

Recent research at Michigan Technological University and the University of Toronto examined the chemical effects of deicing and anti-icing chemicals on portland cement concrete and recommended changes to concrete mixture designs, construction practices, and winter maintenance procedures that will not compromise concrete durability.

Research Description

The degradation of concrete used in pavements and bridges that may occur as a result of attack by deicing and anti-icing solutions is the result of an increased concentration of dissociated calcium, magnesium, and chloride ions in the concrete pore water. These ions are available to combine with materials in the concrete to form expansive or weak reaction products, such as brucite or magnesium silicate hydrates.

The dissociated chloride ions in the pore water solution are well documented as a primary cause of reinforcing steel corrosion. In addition, the study identified the formation of destructive oxychlorides as a potentially significant cause of deterioration.

A series of field explorations and laboratory experiments were performed, including the characterization of concrete field specimens from both pavement sites and bridge decks, laboratory experiments on portland cement mortar, and laboratory experiments on portland cement concrete.

Characterization of field specimens

In general, the pavement sites examined lacked unambiguous evidence of distress associated with deicers. The research team also obtained cores from a number of bridge decks that were exhibiting distress. Although these bridge decks were, in recent years, maintained using various non-NaCl deicers, they had been in service for numerous years and, as a result, have been exposed to NaCl deicers for a significant portion of their service lives. Ultimately, because of this history, any distress identified would be difficult to associate with a specific deicing chemical.

Deicing and Anti-icing Chemical Acronyms

- CaCl₂ - Calcium chloride
- CMA - Calcium magnesium acetate
- MBAP - Magnesium chloride-based agricultural product
- MgCl₂ - Magnesium Chloride
- NaCl - Sodium Chloride
Observations of all field specimens include the following:

- Calcium hydroxide depletion along cracks and surfaces exposed to deicing solutions.
- Higher chloride ingress rates (diffusion rates) for concrete with deicer exposure at early ages.

**Laboratory experiments on portland cement mortar**

Three different mortar mixtures were prepared using 20-30 Ottawa sand (ASTM C778), ASTM C150 Type I/II cement, and variable water-cementitious (w/c) ratios of 0.40, 0.50, 0.60. Two-inch diameter by four-inch high [50 mm by 100 mm] mortar cylinders were prepared and then soaked in solutions of CaCl$_2$ (17 wt. %), MgCl$_2$ (15 wt. %), NaCl (17.8 wt. %), and saturated lime water at 40° F [4.4° C] for 84 days.

The specimens exposed to CaCl$_2$ and MgCl$_2$ (figures 1 and 2) exhibited severe deterioration, while those exposed to NaCl and lime water did not show any signs of deterioration (figures 3 and 4).

Other mortar specimens (cubes and length change bars) were prepared using a w/c of 0.485 and cement-sand ratio of 2.75, per the ASTM recommended mixture for mortar specimens (ASTM C1012-04, “Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution”). However, these specimens were immersed in three molar concentration solutions of the respective deicers and subjected to tests at various time intervals. The specimens exhibited significant loss in strength and expansion, as shown in figures 5 and 6, as well as mass gain.

In all cases, petrographic analysis found that the observed deterioration was caused by the formation of expansive calcium oxychloride and magnesium oxychloride. The oxychloride phases form through a chemical reaction between calcium hydroxide in the hardened cement paste and chloride ions from the deicer.

**Laboratory experiments on portland cement concrete**

Concrete mixtures used in this experiment were made with a high quality, partially crushed gravel coarse aggregate (maximum aggregate size of 1 inch [25 mm]), natural sand, 564 lb/ yd$^3$ [335 kg/m$^3$] ASTM C150 Type I/II cement, visnol resin air entraining agent (air content of 6 ± 1%), and a w/c of 0.45 and 0.55. Two additional mixtures were prepared—one made with 15% replacement of cement with Class F fly ash and another made with 35% replacement of cement with ground blast furnace slag (GBFS).

Specimens were moist cured at 100% humidity for one day, de-molded and then wet cured in lime saturated baths for 27 days. Specimens cast were standard four-inch diameter by eight-inch high [100 mm by 200 mm] cylinders, which in
turn were sectioned to produce three four-inch diameter by two-inch high [100 mm by 50 mm] specimens per cylinder.

The specimens were immersed in the same deicers used in the mortar experiments, as well as calcium magnesium acetate and a magnesium chloride-based agricultural product. The concrete specimens were exposed under the same conditions used in the mortar experiments (i.e. for both solution strength and temperature) but for longer times, up to 500 days. Deterioration of the concrete specimens resembled that seen for the mortar specimens (figures 7-8). In all cases, the observed distress was associated with the formation of the oxychloride phases seen in the mortar specimens.

**Effects of fly ash and slag**

In all cases, concrete mixtures prepared using Class F fly ash or GBFS performed significantly better than those made with portland cement alone, with no distress observed in specimens after 500 days of exposure (figure 9). Quantitatively, the reduction in chloride ingress observed was shown by a dramatic reduction in diffusivity for all deicers, a reduction in sorptivity, and microstructurally by reduced calcium hydroxide depletion and oxychloride formation.

**Conclusions**

- Exposure of concrete and mortar to NaCl results in little to no chemical interaction or related distress. NaCl appears to be safe for use as a deicing and anti-icing chemical with respect to possible chemical interaction with concrete. NaCl should still be considered harmful to concrete in terms of its potential to induce corrosion in embedded steel, given its demonstrated ability to diffuse into concrete more readily than the other deicers tested.

- Exposure of concrete and mortar to MgCl2 and CaCl2-based deicing chemicals results in significant chemical interaction and related distress. Both appear to not be safe for use as a deicing or anti-icing chemical with respect to possible damage to concrete.

- In all cases, the observed distress is less as the concentration of deicer is reduced. Therefore, if MgCl2 and CaCl2-based deicing chemicals are used, they should be used at the lowest possible concentration.

- Results were mixed regarding the effect of w/c on performance of concrete and mortars exposed to deicing chemicals. Although the general parameters (i.e. sorptivity, bulk diffusion, rapid chloride permeability) improved with decreasing w/c as expected, the performance in low temperature immersion was, in many cases, opposite of expected. That is, the low w/c mixtures often performed worse.

- In general, concrete mixtures containing 35% GBFS showed the lowest susceptibility to chemical degradation by deicing chemicals, concrete mixtures containing 15% Class F fly ash were next best, and straight portland cement mixtures were the worst performing. One exception is that with the tests performed, concrete mixtures containing fly ash had a diffusion coefficient higher than that measured for straight portland cement mixtures. However, in other experiments such as the low temperature immersion test, concrete mixtures containing fly ash performed better.

- In general, sealants were very effective at reducing chloride ingress at 60 days. The siloxane appeared to perform better than the silane. After 500 days exposure, both sealants showed reduced effectiveness.
Recommendations for Future Work

As a result of this research, clear evidence was presented that MgCl₂ and CaCl₂ both chemically attack concrete, causing increased permeability, loss of strength, expansion, and cracking. Also, this research has identified viable maintenance and mitigation strategies, recognizing that these deicing chemicals are a key part of modern winter maintenance strategies and that SHAs need to continue their use for that purpose.

However, a number of questions were not answered as part of this research and it is important that SHAs continue research in this area. One unanswered question pertains to how these deicing chemicals impact the life-cycle of concrete pavements and bridges. This question has become more important in light of recent reports from a number of states regarding premature distress along longitudinal and transverse joints.

In a number of upper-Midwestern states, for example, several concrete pavements constructed since 1999 have developed unexpected scaling/spalling with associated dark-staining along joints (figure 10), particularly the longitudinal, centerline joint. Initial studies have identified a number of possible causes, including chemical attack from deicers. Understanding the cause of this reported premature deterioration is integral to understanding the life-cycle impact of deicers on concrete.

Other suggested areas for additional research

- Further testing to determine the effect of different replacement levels of supplementary cementitious materials on the resistance of concrete to deicers and anti-icing chemicals
- A detailed experiment to determine the effects of w/c on deicer-related distress
- A study of highway deicer chemical contributions to alkali-silica reaction (ASR)
- Further testing to better understand field reports of scaling/spalling and joint-related distress related to use of MgCl₂ and CaCl₂.

For More Information

The executive summary, final report, and guidelines are available for viewing at the South Dakota Department of Transportation website:
<http://www.state.sd.us/Applications/HR19ResearchProjects/oneproject_search.asp?projectnbr=SD2002-01>

For additional information, contact Dr. Lawrence Sutter, Michigan Technological University, 906-487-2268, lsutter@mtu.edu.
CP Road Map
Project Team Conference Call
November 1, 2010
Meeting Minutes

Attendees: Sabrina Shields-Cook, Sabrina Garber, Rob Rasmussen, Dale Harrington, Melisse Leopold (taking minutes)

- National CP Tech Center is in Chicago on November 16th. Same thing needs to be presented at this meeting that would be presented at the CP Road Map Executive Committee meeting. Need to get the research in progress done for the meeting. Dale & Melisse will prepare slides for framework and track meetings.

- Sabrina SC is finishing the Stringless paving and will send to Dale to review prior to sending to Ahmad.

- Dale looked over the Pennsylvania information and thought it looked good. Sabrina Garber heard from Lydia and Michael and they liked the e-news highlight. Michael was going to send it to others at PennDOT. Dale felt it should go out today to Sabrina SC today if they don’t hear back from PennDOT since Lydia felt it looked good.

- Sabrina SC is dealing with other items at InTrans and has not had a lot of time to devote to CP Tech Center tasks. Dale stated that Intelligent Compaction will fall behind as they had discussed before and should be moved down the list for now.

- Dale felt the Noise and Quieter Pavement tech brief is excellent and felt a combination of what makes a quieter pavement combined with the language of noise would make a good MAP brief. Rob and Sabrina felt it would be too long to combine both into one. Rob felt that combining noise specifications, better practices and how to pick the right texture would make a good MAP brief. Rob stated they could do a MAP Brief on the European testing that was done recently. Dale suggested teaching them the noise of quieter pavements. Developing quieter pavement would include the principals that were found and develop a MAP Brief. Sabrina has worked on the Deicer MAP Brief and felt it could be done for November. She received comments from Larry Sutter and worked on the photos. Sabrina Garber suggested preparing latest ASR protocols. Dale stated the topics have already been approved by FHWA. However he could try to get FHWA approval for the ASR topic however the topics where approved by CP Road MAP ExCom. Sabrina suggested something on smart cure or intelligent construction which FHWA is very big on right now. It was decided that Rob and Sabrina Garber will draft something on Smart Cure as a MAP Brief.

- Sabrina SC stated she is almost done with the Intelligent Compaction MAP Brief.

- Dale asked if Sabrina and Rob were prepared to do the research in progress and Rob stated they can prepare it. He will talk to Dale later this week.

- Rob does not need to go to Chicago for the CP Tech Center meeting. Dale will send the CP Tech Center agenda to the team and asked them to look at the agenda to see if there are tasks for them to do.
Attendees: Tom Cackler, Peter Taylor, Sharon Prochnow, Rob Rasmussen, Dale Harrington, Melisse Leopold (taking minutes)

- TOPR submitted as $199,366.00 FHWA reduced it to $185,412.00. When additional funds are available the will okay up to the $199,366.00. ISU is working on a new subcontract for the entire amount for TOPR 4 to Snyder & Associates.

- Rob and Dale reviewed Transtec’s budget for TOPR 4. Transtec wants to make sure they cover what the Center needs for TOPR 4 objectives. Some things were identified during the development of TOPR 4 that there are not funds available to complete the reorganization task. There is some money for the CP Road Map that is not yet obligated. Send Sharon a budget of what funds are needed to cover Transtec’s costs up until November 1st and she will increase the subcontract for TOPR 3 as they have some budget left to cover. Transtec will get their October invoice to Snyder & Associates and then Dale will let Sharon know what is needed.

- Dale would like Sabrina Garber to work on the tech briefs and e-news, doing the research and the content for the e-news. Also she will work on one MAP Brief and the PowerPoint for the ExCom meeting. Sabrina was going to serve as the secretary at the Track Leadership meetings. Rob will adjust Transtec hours to work on these items.

- During the conference call with Ahmad he stated he wanted a MAP Brief every month and we agreed to do it. Sharon stated we are committed to doing them every month and may not be able to get additional money. Dale stated we may be able to do one every other month and drop the reorganization of the CP Road Map or the number of tracks leadership meetings that Rob and Dale are running. Dale stated we now have some historical information to back up the budget request. Tom is concerned that we are committed to doing the e-news/MAP Briefs every month however Dale stated we actually are doing the MAP briefs every six weeks.

- On TOPR 3 the Center has $12,000 left, need to do the final report. This could be used towards TOPR 4. Need to write the request so we are clear that it is for work that was not previously identified.

- A lot of time is spent on the state highlights for the e-news. Most of the Transtec budget for TOPR 4 will be spent on the e-news/MAP Brief task and the remaining budget will be used for the ExCom meeting prep and track leadership meetings.

- The priorities are the e-news and the MAP Briefs, the track meetings, the leadership meetings, then track reorganization.
• Dale suggested talking to Ahmad and telling him about the feedback we have received from the different states on the e-news/MAP Briefs and tell him how well it is being received. We need to also let the ExCom know how well it is doing also.

• Dale will review the scope for Transtec for TOPR 4 and suggested that we not modify the budget. Rob will send Dale an updated version.

• Following are the priorities for Dale:
  
  o Work out a subcontract with Transtec, stay within the budget but revise the scope.
  
  o Prepare enough information where we are going for the November 15th CP Tech Center Executive Committee meeting as it pertains to the CP Road Map
  
  o Prepare the report for TOPR 3

Sabrina Garber jointed the conference call:

• Dale asked Sabrina Garber to put together the CP Road Map accomplishments that we have done for the CP Tech Center Executive Committee meeting.

• Melisse will send Rob and Sabrina the CP Tech Center ExCom agenda.

• Sabrina Garber sent the e-news to Sabrina SC and it should be ready to be sent out. Dale received Sam Tyson and Ahmad’s comments on the stringless paving MAP Brief and sent them to Sabrina SC.

• The next MAP Brief will be the deicer and Sabrina SC sent it to Dale and he will review the draft and get the comments back to her. Ahmad had previously felt there were some things missing and Sabrina SC spoke to Larry Sutter and revised the brief.

• Sabrina Garber will develop the Smart Cure MAP Brief for December.

• Rob is working on developing a listing of the various comments that we received on the Overlay Design project. Dale stated they were going to send the comments to the ETG, which Leif is a part of, and get their input and then the conference call is being held on November 17th before we have the call with FHWA, ACPA, and the CP Tech Center which includes Rob Rasmussen. Then hold the call with FHWA, ACPA, and the CP Tech Center and Dale will suggest November 20th for the call.

• Need to be careful with the budget for the Overlay Design Guide. We can ask to extend the effort to include new analysis that can be added to the Overlay Design Guide.

• Need to get more information from Leif on the New York unbonded distress study. Dale did not feel it should be presented to the ETG for design and feels we need a lot more information and that it was not a design issue. Tom agreed with getting more information and felt it should not be taken to the ETG. Dale felt it should go to the overlay committee if needed.
• Integrated Solutions Manual status is Sabrina has looked at Dale’s comments and has received Wayne’s comments. Sabrina and Dale will have a call on November 11th with Wayne to discuss all the comments and then she will make changes as agreed to on the call. It will then be sent to publications.

• ACPA annual meeting – Tom will go for the Chapter meeting on Tuesday. On Friday is the strategic board and Jerry asked Tom to work on a presentation regarding the relationship between ACPA and the Center and also give an update on the Center.

• Recycled Aggregate development plan is being directed by Peter Taylor. Sabrina Garber sent an email to take a look at the library to see if there is something that is not in there that should be included. She will send information on the survey and get comments.

• On the Manual of Practice the chapters will be reviewed with the committee chapter by chapter. Peter will send an email to the authors to get the chapters submitted for review. Would like to get the chapters reviewed prior to December 25, 2010.

Meeting adjourned at 11:10a.m. CST
Attendees: Sabrina Shields-Cook, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- The Deicer MAP Brief should be near completion and Dale has sent her his comments.
- Sabrina Garber will work on the Smart Cure MAP Brief for December.
- Sabrina Garber will contact Washington State this week and should receive some information after the holidays. She will contact Jeff Ulhmeyer and a few others.
- Rob mentioned if we send a MAP Brief out in late December it may not get read due to the holiday backlog. Suggested combining the two for a Holiday issue.
- Sabrina Garber has collected links and some information on the state highlights for the E-news. She should have a draft written by Wednesday of this week although it will not have been reviewed by Washington state.
- Rob Rasmussen will be presenting at the ACPA Conference in December.
- Dale suggested having a MAP Brief as a handout for the ACPA meeting. Dale will check with Tom or Sharon to make sure there is a live link in the meeting room so they can get on the website.
- Sabrina Shields-Cook stated the Deicer MAP Brief is ready. She is waiting for Larry Sutter’s okay to print it. Would like to Ahmad’s comments by next week if possible. Would like to wait until Larry’s okay prior to sending it to FHWA. Sabrina SC will send it to Dale for review after Peter has seen it. Sabrina Shields-Cook will ask Peter Taylor to review it and address some of the questions.
- Dale probably won’t attend the ACPA meeting in December. Tom may need additional support from Rob. Rob confirmed that he would be available to help out at the meeting.
Attendees: Sabrina Shields-Cook, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- Integrated Solutions cross section coming from John Kivern on pervious and Dale will send it to Sabrina Garber.

- Deicer MAP Brief – As soon as Figures 5 & 6 are redone it will be sent to Ahmad to review. Tom is going to remind Larry Sutter to review and approve the MAP Brief for printing.

- Sabrina Garber – November issue of e-news she is waiting to hear back from Jeff Uhlmeyer. She will follow-up with Jeff. He is looking over the list of projects that will be highlighted and approve the list of individuals to contact at the Washington DOT.

- Sabrina Garber will start working on the Smart Cure MAP Brief for the December issue. She felt she could develop it within a week.

- CP Road Map Pool fund states – there are six states. We are highlighting those states in the e-news. Rob will look up the list of states to see if there are any remaining to be highlighted. Iowa is one that has not been highlighted. Dale will call Ahmad to let him know we are highlighting the Pool Fund states as they are putting funds into the project and that we will be highlighting Iowa (the chairperson for the Pool Fund states).

- Pennsylvania, Iowa, Mississippi, New York, Virginia, Michigan, are the Pool Fund states. Iowa, Mississippi and Virginia need to be highlighted within the next three months. Virginia (Dec/Jan) will be the next state to highlight and then Mississippi (Jan/Feb) followed by Iowa (Feb/Mar) for the e-news highlights.

- Rob is speaking on the SHARP 2 work at the ACPA annual meeting. He will be available to help Tom with his meetings at ACPA. Tom has the CP Road Map update presentation for the ACPA meeting. Dale will call Tom to suggest having the Stringless Paving MAP Brief as a handout. Rob stated at the CP Tech ExCom meeting it received a lot of compliments. Sabrina Shields-Cook will have them printed and sent to Tom at the ACPA meeting.

- Dale and Melisse will prepare the TOPR 3 report. Sabrina Garber sent Dale some information for the report. The CP Road Map ExCom meeting is scheduled for January 11, 2011 in Chicago with the location to be decided (near the airport).

- Dale and Melisse are working on the presentation for the CP Road Map ExCom meeting. Sabrina Garber sent Dale a table of national research that is ongoing (some could be done). The information will be put in the presentation.

- For the CP Road Map project we do not do research however we are tasked with coordinating research.
- A table showing the track leadership meetings was in the presentation for the CP Tech ExCom meeting. Most track leadership meetings occurred late last year or early this year. We do not have the budget to do seven tracks. How can we hold meaningful meetings? Dale will talk with Rob to see what tracks we could hold meetings with so we can let them know at the executive meeting.

- Other subjects for the MAP Briefs are Smart Cure (December), Intelligent Compaction (January), Recycled Aggregates (February). Should probably do the Recycled Aggregates after March with the project is to be complete.

- The MAP Brief topics will be put on the agenda for the Executive Committee to discuss to get new topics.
Attendees: Tom Cackler, Peter Taylor, Sabrina Shields-Cook, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- Email with Steve Muench and Sabrina Garber regarding the Washington e-news highlights. Steve was concerned with the correctness of the first paragraph and sent revised text for the paragraph. Tom reviewed the proposed revisions and felt it was okay to include. Dale was concerned with the statement about green roads being a useful tool. Rob suggested softening the sentence to state that green roads are proposed as a useful tool. Tom reviewed the paragraph and it was agreed to change the sentence to “Additional research continues with the goal of the green roads approach.” With these revisions it is ready to finalize and send out. Dale sent Sabrina Shields-Cook all of Tom and Dale’s edits.

- Dale looked at Turner Fairbanks research (2007-08 latest information on the website). Dale suggested he call Ahmad and asked him to send what Turner Fairbanks has done on concrete pavement research under SAFETYLU to include it in our current database and when he feels the time is right to highlight the research that Turner Fairbanks has done. Rob and Dale will call Ahmad to discuss the research for Turner Fairbanks. They will call Ahmad after the e-news has been sent and discuss research and see if they would like to be highlighted in the e-news.

- Sabrina Garber is working on the Smart Cure MAP Brief and the next e-news article. Sabrina Shields-Cook is working on the foundation news.

- Dale will send Rob and Peter TOPR 2 report and asked that they send him what they remember happened over the last two years to be included in the TOPR 3 report.

- An email will be sent out for the next Sustainability Manual of Practice conference call. We will also be setting overlay conference call and Design.
Attendees: Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- On December 16, 2010 FHWA requested a conference call with Tom & Sharon. Ahmad felt that without his interfering 2 tech briefs would have been put out that were incorrect. Tom stated he was aware some tech briefs were sent to him for review which is how it was done previously. Now the tech briefs are sent to Ahmad after they are ready for distribution. Ahmad stated that the tech brief have been fine with the current method.

- FHWA is very concerned that we will be late on the quarterly reports even though we have not been late before. Need to be very careful going forward.

- TOPR 3 has been extended to March 2011. The report is in draft form and is about 60% done. Ahmad wants it turned into him by mid February 2011.

- Need to notify FHWA if we are near 75% complete of the work.

- Virginia is the highlight this month in the e-news. Virginia is unavailable for comments until after the holidays. Rob will let Dale know the status of the Smart Cure MAP brief.

- Executive Committee agenda draft was sent to Transtec. Want to go through the philosophy of working together. The research is not all that we do; need to look at working together to solve concrete pavement issues using many different resources. The CP Road Map is a state of mind. Now the emphasis is on dissemination of information sent to people and then they can look at the research that is going on in the country which is totally related to concrete pavements. Dale reviewed the agenda. Would like everyone to talk about what they have done in the last five years. Dale spoke to Ahmad and asked him what research has been done by Turner Fairbanks. Dale told Ahmad the agenda would be sent to him by Tom Cackler for his review and he would like Turner Fairbanks included on the agenda. Rob should attend the CP Road Map Executive Committee meeting.

- Rob should be aware of what TRB research that is sent to us for reporting at the meeting.

- On item number 4 of the agenda Dale and Peter will send Rob examples on what has been done.

- Rob will contact Sharon and/or Denise to see who is attending the meeting.

- Looking at the database sheets a lot of work has been done on track 2. Will show them the trends that have been done nationally. Sabrina Garber should double check the research that has been done on the tracks.

- Dale, Rob and Melisse will continue to talk and work on the agenda over the next couple of weeks.
Attendees: Tom Cackler, Sabrina Shields-Cook, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- Dale reviewed the last project team call with Tom Cackler and updated the team on the last few calls and what was discussed.

- Sabrina Garber stated Virginia DOT representatives regarding their research have not responded back from her contacts probably due to the holidays. Mr. Sprinkel in the materials division is excited to work with them and be highlighted. She will continue to contact them and get their input for the highlight. Washington was the last month that was highlighted. There will not be a December e-news due to the holidays. Virginia will be the January 2011 highlight. Sabrina Garber felt it should be complete my early next week.

- Sabrina Garber stated the Smart Cure MAP Brief should be reviewed by Rob Rasmussen today and then she will forward it to Dale for his review.

- The Intelligent Compaction MAP Brief will be the next issue after the Smart Cure. Sabrina Shields-Cook is working on the Intelligent Compaction MAP Brief. Tom suggested George Chan from FHWA may be a good resource. Sabrina Shields-Cook stated the information on the website is very technical. Rob R. stated he will send Sabrina Shields-Cook a link for some information that isn’t so technical.

- Pennsylvania and Virginia have been done. New York, Iowa and possibly Turner Fairbanks could be highlighted. Dale received an email response from Ahmad and agreed that Turner Fairbanks would be a good one to highlight. Ahmad would like it to be highlighted in March. Dale suggested highlighting New York for February. Dale will look at the Pool fund listing to see who is listed.

- The agenda for the Executive Committee meeting – Dale would like to turn in the TOPR 3 report at the meeting to the Executive committee. Melisse will send Sabrina SC a draft of the TOPR 3 report after Dale’s review for printing.

- Sabrina Shields-Cook will be attending the CP Road Map Executive committee meeting and she will take the minutes of the meeting. Dale reviewed the agenda with the team. Rob Rasmussen will also attend along with Sabrina Garber. Under Item 3 interactions, research in progress and database Dale will do the introduction and then Sabrina Garber will give an overview of what has been accomplished. Melisse will send the updated working agenda to the project team who are attending and presenting at the meeting.

- Rob R will do the impacts presentation. Rob R will use the slides from the CP Tech Center board meeting to prepare his presentation. For the impacts presentation Dale suggested that Rob use the listing from the TRB Trish database and talk about trends.
- Melisse will send Rob the presentation that was used in the CP Tech Center ex com meeting along with Sabrina’s database information.

- Everyone will send Dale their presentations by Thursday night for finalization on Friday.

- Tom suggested under the tracks to focus on the unmet needs and to present it in the context of what is going on and to prioritize the unmet needs.

- Dale will present on the TOPR 3 accomplishments and he will also present on TOPR 4. He will ask the committee for their input on MAP Briefs and state highlights after the NC2 states have been highlighted.

- Tom would like to get the committee engaged on where they see the Road Map going and where they have seen the impacts and to identify the model. Discuss the pool fund and who will lead it in the future. Sandra Larson is willing to lead the pool fund if FHWA is no longer interested.

- Dale asked if there will be a conference call line for the states that are unable to attend the CP Road Map ExCom meeting. Dale suggested to brief the pool fund states on the future funding of the road map. Tom will work on calling the states.

- Peter Taylor has some good examples of impacts for Rob’s presentation and Dale will ask Peter for them. Rob has some surface characteristics examples. They will discuss the philosophy of the CP Road Map with regard to collaboration and the research needs.
Attendees: Tom Cackler, Peter Taylor, Sabrina Shields-Cook, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- Randy Batty could not be at the meeting last week. He emailed Tom and he is on the pavement rehabilitation TRB committee AFD70. They are discussing a road map for pavement preservation and he wanted to know if it would be okay to recommend folding it into the CP Road Map program. Tom stated that would be great. He stated a meeting has been setup with Cheryl Ritgers and Sandra Larson for Monday next week to discuss the future of the road map. Sabrina Garber is planning to attend the AFD70 committee meeting at TRB and she will make a few remarks on the CP Road Map. Tom will forward the email from Randy Batty to Rob, Sabrina and Dale.

- Dale stated the Smart Cure MAP Brief was done well. He added some figures/pictures that he thought would help. Sabrina Garber felt the nomographic chart would be good to include. The first picture that was inserted into the MAP Brief is a better picture to include on the first page. Sabrina Garber will include the captions for the added pictures. The plastic shrinkage will be included in the MAP Brief. Tom suggested they include where interested people can get the program and how it will be available. Sabrina stated at the end of the tech brief it will be noted that the documents are currently under review at FHWA and note they can contact FHWA for further information.

- Dale reviewed the links for the e-news and was very pleased on the RCC modeling section. The research paper was about coming up with the right decision for the RCC design. Dale will call Wayne with PCA to tell him about the article so he is aware. This is one referenced by research in France.

- E-News Highlight (Virginia) is almost ready for review. Early age shrinkage will be included in this highlight. It will be sent to Virginia today for their comments and then sent to Dale for his review. They will try to get the MAP Brief finalized so Dale can give him the MAP Brief to him at TRB.

- The Executive Committee minutes are pretty significant. The committee felt we are doing what they expect us to do particularly on the database. They asked us to add a couple of columns to the database. Sabrina will add them and she will need time to go back to the states that are already done. It would take a couple of days to update. The information to include is on tech transfer resources and projects that are going on. Jerry Voigt stated he would send Sabrina Garber a list of projects that are ongoing.

- Tom stated there was a lot of discussion on future emphasis on technology transfer and training. Any training we do could be linked into the original projects in the database.

- Need to develop an accomplishment report so the states can use it to request additional funds. A lot of the information would be what was presented at the meeting last week. Dale stated all the data is in the TOPR 3 report.
• Tom may be we can identify what the messages are and show them to Nancy Richardson.

• Sabrina SC stated they were interested in the different research projects and how they are connected to the road map.

• If Ahmad has edits to the TOPR 3 report the presentation that Rob R. did could be included which includes the different projects.

• Sabrina Garber sent her notes from the CP Road Map ExCom meeting to Sharon Prochnow.

• A lot of the states will finalize their decisions in March on funding. Sabrina Shields-Cook will try to get the tech brief drafted by the end of next week and have it ready to go the first week in February. The pooled fund states will be acknowledged on the e-news and state who the current sponsors are.

• Sabrina Garber sent Dale a spreadsheet on the Virginia research for the highlights. Dale stated they are the only state in the Field Application program that is going to build something this year.

• Turner Fairbanks will be highlighted in the March e-news. Sharon Prochnow will send Rob Ahmad’s presentation from the ExCom meeting.

• Sabrina Shields-Cook has the February issue written. She has Iowa highlighted on the intelligent compaction. Tom suggested including Minnesota. Dale suggested including a colored US map showing the states that have done intelligent compaction projects.

• The next state highlight will be on New York.
Attendees: Tom Cackler, Sabrina Shields-Cook, Peter Taylor, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- Dale mentioned he liked the SmartCure layout. Tom had not heard anything from Ahmad. Dale stated he would check with Ahmad later in the day if we had not heard from him.

- Sabrina Garber sent out an email to everyone on the Virginia highlight. She heard back from most of the contacts and it will be ready to go at 2pm today. Sabrina Shields-Cook will get it out tomorrow which is February 1, 2010.

- Dale stated we need to get going on the next e-news. He stated me need to make sure we have the best quality sent for the figures and photos.

- Dale stated it was presented to the board on January 11th what we were proposing for the next tech brief would be foundations. Sabrina SC stated she only has one section left to write for the tech brief and was not concerned about getting it done.

- Sabrina Garber has not started on the New York highlight; she will start her contacting tomorrow. Peter Taylor suggested contacting Don Streeter and it was also suggested to contact Gary Fredricks. Dale suggested contacting Jim Shea with ACPA to see if he has any suggestions.

- The effective use of fly ash and slag cement in slated for March. We also talked about featuring FHWA. Dale asked if we would want to feature ACPA or PCA?

- The other industry highlights could be added as a link where FHWA will be an actual highlight. After July we have covered the state sponsors, Iowa, Michigan, Mississippi, New York, Pennsylvania, Virginia.

- Minutes from the CP Road Map Executive Committee meeting. Tom gave Sharon his comments on the combined minutes from Sabrina Garber and Sharon. Tom stated Sharon sent out the meeting minutes and presentations last Wednesday and asked if they had any comments. They included all the comments that she had received and are considered final.

- Dale will put together some action items from the meeting and send to Rob.

- CP Road Map book needs to be updated and Dale asked how we should proceed with getting input. Tom suggested having an input session via web conference. Needs to be done efficiently and need to minimize the external review due to budget and time constraints. A team meeting has been scheduled for February 23rd at 10:30 a.m. to review the framework and discuss how to proceed on the update.
• Sabrina Garber stated she sat in on a number of committee meetings and that the CP Road Map was well represented and received. Dale suggested contacting the committees and show in the e-news that they are using the road map.
CP Road Map
Project Team Conference Call
February 7, 2011
Meeting Minutes

Attendees: Tom Cackler, Sabrina Shields-Cook, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- A discussion was held on the surface characteristics latest information on specifications and letting the public know what is there and how to utilize the information. Encourage industry to work with the contractors. Have a one on one meeting with suppliers to share the results of the study and the system the CP Tech Center uses. May need a nondisclosure from the suppliers. Rob will develop a draft notice for the Center. The Center will send to industry that the Center is available with this information and would like to share it with however is interested.

- Dale stated the surface characteristics presentation at the ICPA workshop went well. Dale will ask John Cunningham to send the PowerPoint presentation that was used at ICPA to Rob. The interlayer presentation was presented by Jim Grove and it went well too.

- Dale has some notes that he will send to the group from the CP Tech Center ExCom meeting on things to do.

- The project team meeting on the CP Road Map Manual update may need to be moved from February 23rd. Dale will let the team no sometime this week if it needs to be moved.

- The SmartCure MAP Brief and e-news went out Friday, February 4, 2011. Most of Sam Tyson’s revisions were made.

- The Intelligent Compaction MAP Brief is nearing completion. Sabrina Shields-Cook stated it should be ready for internal review by early next week. Dale stated he would like to get it to Ahmad the week of February 14th for his review.

- Sabrina Garber stated the work with New York is coming along. She is trying to make contact with people from New York. She is having problems with their website in regards to getting information. She will call Gary and see if he can help here with the information. It was decided Sabrina Garber will contact Randy to see if we can get the information to report on Mississippi this month and hold New York for a later month.

- Dale asked Rob and Tom to think about how to approach the rewrite of the CP Road Map. Don’t really want a large committee involved but need to have some industry involved. Tom will talk with ACPA and PCA to see if they have someone to work with us as an industry representative. Tom suggested asking the TRB Committees and NCC to appoint a representative. Rob suggested asking for representatives for only the tracks that will be updated. Sabrina Garber suggested the construction committee from TRB. Roger Schmidt is the chairman and will be contacted.
Attendees: Tom Cackler, Sabrina Shields-Cook, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- Mississippi – Sabrina stated they are not doing much. Spoke to Wouter and they are not doing much. They are doing a pooled fund project on overlays. Dale suggested highlighting their work on the pooled fund project on the tech demo project for research. Tom suggested interviewing someone on their interest in the future.

- MAP Brief on Intelligent Compaction Sabrina Shields-Cook will have it out probably by Wednesday of this week. David White or one of his staff is reviewing it prior to sending to our group. Sabrina Shields-Cook will send it to Dale once it is in layout form. Dale will then send it to Ahmad.

- The CP Road Map manual update project team meeting is now scheduled for February 28, 2011. Tom had suggested contacting a committee member from TRB, and ACPA and PCA to see if they have a representative that would want to join the committee. Tom will talk to ACPA, PCA and NCC to see about getting a representative to join. Sabrina Garber is on the TRB committee (AS1850) and she will see about getting a representative to join the committee for reviewing draft the document. Dale will talk to Ahmad about the committee.

- Tom and Dale had a discussion with Ahmad on TOPR 5. Will work in the future on training and Ahmad will be sending some information. Sabrina Shield-Cook is working on a white paper for TOPR 5 and will send it to Dale and Rob for the review once she adds Sandra’s comments (Tom reviewed it with Sandra Larson and got her comments).

- Sabrina Garber went to the Preservation subcommittee (AFP70) at TRB. They are going to look at all the road maps that exist and draw their information together. She left our road map information with the subcommittee.
Attendees: Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- Mississippi is coming along fine. Sabrina has the reports ready and has contacted the individuals on the highlights. The highlights should be ready to go by the end of this week. The E-news will be sent to Dale for his review.

- Sabrina has not had the opportunity to contact the AASHTO, AFD70 committee, she will contact them today.

- Dale and the Center are working on a whitepaper that is close to being done and will be sent to FHWA (Ahmad).
CP Road Map
Project Team Conference Call
February 28, 2011
Meeting Minutes

Attendees: Tom Cackler, Peter Taylor, Sabrina Shields-Cook, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- Dale and Rob will talk about the schedule for the
- Sabrina Garber received Dale’s comments on the e-news. She moved the links per Dale’s suggestion.
- On the highlights comments Sabrina moved the pie chart to the end. Dale will talk with Sabrina Garber about his comments. Sabrina Garber will send the e-news and highlights to Sabrina Shields-Cook today.
- The MAP Brief “Intelligent Compaction” Tom has reviewed and there are some gaps on the research that is being worked on and should be ready by the end of the week. Tom will send it to Ahmad once it is ready.
- FHWA – Turner Fairbanks will be highlighted for the March issue and Sabrina Garber will start on it this week. Sabrina Garber and Rob will clear with Ahmad if he wants to see a draft or work with his staff for the editing and then send him the highlights. Tom will talk to Gina to see if they would like some of FHWA highlighted.
- The next MAP Brief on the list is “Effective Use of Fly Ash and Slag Cement”. This will be written by Peter Taylor (4-pages). Some of the IMCP technical summaries would be helpful for reference on the development of the MAP Brief.
- Suggested holding the next CP Road Map Executive Committee meeting after the NCC meeting being held in April. The Score meeting is being held in March and Sandra Larson will be attending the meeting. Could have the Executive meeting call the week of March 28th or April 4th. Denise will find a time for the meeting.
- The whitepaper is being revised; adding a quote from Ahmad’s suggestion. It will be sent to Sandra and she can take it to the Score meeting and Tom will visit with her to see how to roll it out with the states.
- In the March e-news we want to bring attention that the pool fund is being extended and provide a link or reference to the whitepaper. The paper’s title is: “CP Road Map Pooled Fund Impacts and Accomplishments”.
- Sabrina Garber spoke to Roger Schmidt from the FHWA sub-committee and he will be happy to participate with redefining the research need for the various tracks and the priorities for the CP Road Map.
- Reorganization of the CP Road Map manual and who should be on the committee. Suggested we should do it internally and then roll it out for a limited review due to funds. Get the current challenges from the states and then roll it out. The strongest input should
come from the states. Tom will contact Brent Trautman and ask him to identify three people from NCC as representatives and let Dale know how he suggests. Ahmad may be included from FHWA. ACPA Headquarters; will ask Jerry Voigt for a suggestion, PCA for someone and one ACPA Chapter Executive. Dale will contact John Becker for an ACPA Chapter Executive suggestion. Dale will call Steve Kosmatka on a PCA representative suggestion.

- Dale will develop an email outline and send it to Ahmad for his review.

- Money in the CP Road Map for Tom Van Dam in TOPR 4 for sustainability. He will help cover the Con Expo sustainability presentation. The sustainability meeting will be held as a web meeting.
CP Road Map
Project Team Conference Call
March 7, 2011
Meeting Minutes

Attendees: Tom Cackler, Sabrina Shields-Cook, Rob Rasmussen, Dale Harrington, Melisse Leopold (taking minutes)

- Tom will call David White as he is reviewing the MAP Brief. The e-news for the month is done and Sabrina Shields-Cook is waiting for the MAP Brief.

- Sabrina Garber continues to work on the articles for March.

- Tom, Sabrina Shields-Cook and Dale talked with Ahmad about the whitepaper and got all the quotes. Ahmad would like deliverables given to Sandra so she can take them with her to her meeting. Tom and Sabrina Shields-Cook will talk about how to include the deliverables. There is room for the quotes. Ahmad wants the Overlay Guide, IMCP Guide, etc included however these have been kept separate from the CP Road Map along with keeping out the Center. Sabrina will insert the quotes and Tom will look it over again. At this time it was decided not to include references to the materials.

- Sabrina Garber will talk directly with Ahmad to get the Turner Fairbanks information for the highlights. It was felt there would not be enough room to include Suneel’s office. They will just concentrate on Turner Fairbanks.

- Effective Use of Fly Ash and Slag Cement – Ahmad wanted to make sure Peter Taylor includes the work that Turner Fairbanks is doing.

- The next CP Road Map Executive Committee meeting Denise Wagner is sending out an email to get dates for availability to hold the call.

- Rob has staff to work on the CP Road Map book update. Look at the tracks to see what is new or need to be changed. On Foundations and Sustainability do we close those and make a new track. Look at the tracks to see if they need to be consolidated. There is a big shift towards preservation, make sure we have a track focused on preservation. Rob will talk with Dale and discuss a proposal of what the work and budget will be for the update. No rewrite of the track, identify priority tracks.

- Include a link to the whitepaper on the next e-news (April) after Sandra has her meeting.

- Dale will contact some of the representatives for the CP Road Map update committee after we have a good scope and budget.
CP Road Map
Project Team Conference Call
March 14, 2011
Meeting Minutes

Attendees: Tom Cackler, Rob Rasmussen, Dale Harrington, Melisse Leopold (taking minutes)

- The whitepaper has been approved by all members. Sandra would like copies of the whitepaper with the packet.

- Sabrina Garber is working on the e-news highlights (FHWA Turner-Fairbanks) with Ahmad. The links will be done by the end of this week and highlights next week.

- Peter Taylor is working on the fly ash and should have it done by next week.

- Ahmad does not mind if we contact Suneel's office if there is room for FHWA in the e-news however the team agreed to stay with Turner Fairbanks only since there is a lot to cover.

- Dale stated he would need to take some of his funds to have ROB and Sabrina G. help update the CP Road Map books. Dale and Rob will talk tomorrow morning at 8:30a.m. to discuss the process forward.

- Tom will send Rob and Dale a copy of the final whitepaper.

- Tom stated we should start thinking about the Executive Committee meeting. Sandra Larson would like a packet for her meeting next week. The Executive Committee meeting is scheduled for March 29, 2011. It will be an hour long web based meeting. The NCC call follows the ExCom meeting.
  - We have given them an update of what has been done. Now it is time to talk to them about what is coming with the national training on TOPR 5 and we can use the flyers we developed.
  - Ahmad would like to talk about TOPR 5 on the Friday call with CP Tech Center.
  - The main emphasis of TOPR 4 is to update the Guide and TOPR 5 main emphasis is training.
  - Ask them what they would like to see in future MAP Briefs.
  - There are several modules that need to be developed for the national training. Tom stated we need to come up with a comprehensive approach to concrete pavements, need a packet that highlights the products and makes it easy for agencies to scope and specify together. Something like superpave.
  - Rob agreed we need to brand the Road Map better. Dale suggested Integrated Pavements as an example for superpave. However, PCA is using that title. May need to get some marketing ideas or hold a roundtable discussion.
- Rob will look at a listing of what some of the training elements are and send to Dale by Friday.

- Dale will have the S&A's graphic department develop a system collage for the Road Map fashion that shows where the technology transfer needs are in the system. If it can be ready we should send it to the Executive Committee for discussion on the conference call.
Attendees: Tom Cackler, Rob Rasmussen, Dale Harrington, Melisse Leopold (taking minutes)

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Attendees: Tom Cackler, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- The whitepaper is out. Ahmad has 50 copies he gave to Cheryl Rittger. Ahmad sent a packet with Sandra Larson for the Score meeting tomorrow. She will let us know how the meeting goes.

- They will bring copies and update the NCC group at the next meeting. It will also be in the next E-News.

- Iowa will be highlighted in the next E-News and Sabrina Garber has made some good contacts, one being Mark Dunn.

- Tom will leave Peter a note about his MAP Brief on Fly Ash to see where it is. Needs to be to Ahmad sometime next week.

- The next MAP Brief is joint deterioration which Peter Taylor will be involved in also.

- The Intelligent compaction MAP Brief has been reviewed by Ahmad and he said it is fine. He would like the Colorado piece included and Tom sent a note to Sabrina Shields-Cook to include and should be done within the next day or two. Would like to call this the March one and shift the MAP Briefs one month and publish one in July prior to closing the contract. The total number would be delivered. Will call the MAP Briefs what they are when published and then at the end of the contract in June call the last one the July issue. Tom prefers to call this issue the February issue and try to catch up.

- Sabrina Shields-Cook sent a note to Tom that the E-News is ready to go and the MAP Brief should be sent out tomorrow. Sabrina has Peter’s MAP Brief on Fly Ash and she will send it to Tom and Dale for review.

- Sabrina Garber is still working on getting Iowa highlights done.

- Ahmad sent an email Mr. Sixbey will be obligating the remainder of the fund ($13,954) for TO4 by June 1st. Dale will work with the TOPR 3 budget to help Transtec finish the June E-News.

- Ahmad will send TOPR 5 which will be similar to the TOPR 4 however it will be for training for the pooled fund states. He will extend the contract so the training can be offered through the winter.

- Tom asked if the agenda for the Executive Committee meeting looks fine. Dale reviewed it and sent his comments. Tom stated Sandra or Ahmad can give an update on the Score meeting. Update on TOPR 4 activities will be Dale and Rob. Ahmad will brief the group on TOPR 5. Will get feedback from the group on training they would like to see happen.
• Dale stated that Tom mentioned we need to come up with a comprehensive approach for concrete pavements. One of the things to put in TOPR 5 is we need to develop a packet for agencies. Rob is looking at marketing ideas. They will try to hold a roundtable discussion at NCC to get some ideas on branding.

• Tom will have Denise send out the agenda and the login information for the Executive Committee meeting. Need to develop slides this week.

• Dale will work on developing a graphic on the systems collage.

• Need a one page on Compass training. Transtec will develop a one page flyer on the Compass training.

• The conference call on March 28 is cancelled as Dale will be traveling and they plan to have a call on Friday, March 25 at 1:30p.m. with the team. Will review the slides for the Executive Committee meeting.
CP Road Map
Project Team Conference Call
April 4, 2011
Meeting Minutes

Attendees: Tom Cackler, Peter Taylor, Sabrina Shields-Cook, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- Sabrina Garber sent the following update via email: I am still working on it. I did receive a response from Mark, but he only listed a few of the projects that are listed on the DOT website. I am doing my best to get a complete list put together that includes DOT, ISU, and University of Iowa projects.

As for the links, I am waiting to hear back from a professor on a few details for one of the summaries.

The links should be ready for review early next week. The highlight, however, will not be ready for review until the end of next week.

- Rob is working on the budget breakdown and will get it to Dale.

- Dale and Melisse will work on setting up the committee conference call.

- Sabrina Shields-Cook stated the MAP Brief has been sent to Dale and Peter for their review. Dale will look at it this afternoon after Peter’s review. It needs one last copy edit before being sent to Ahmad.

- Peter will develop the Joint Deterioration MAP Brief for April. Then Partial Depth approach will be the next MAP Brief that Dale will develop.

- Tom and Dale will work on the budget estimate for TOPR 5 on Wednesday of this week. Rob’s time will be estimated according to the number of E-News that will be done. Transtec’s rates will go up slightly the beginning of next year. TOPR 5 will run from June 30, 2011 to May 31, 2012. The scope will be: A) Provide a training workshop in each of the 6 TPF members. B) Remains the same as under TO#4: track and exec committee support C) Remains the same as under TO#4: Communication and outreach. Rob will check the scope and hours once Tom and Dale develop it this week.
CP Road Map
Project Team Conference Call
April 11, 2011
Meeting Minutes

Attendees: Tom Cackler, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold
taking minutes)

- Email from Ahmad on Task A for TOPR 5 added 4 webinars and 6 training sessions
  (workshops), one for each of the participating TPF states.

- Dale stated the tasks for TOPR 5 need to be trimmed. MAP Briefs and e-news will be
done every two months under TOPR 5. Tom and Dale will rework the budget and send it
to Rob for his review also. Tom stated we will hold teleconference for meetings not face
to face.

- Rob suggested holding the workshops on things we have already developed depending on
what they (state) would like to hear about. Maybe three subjects for a 6 hour workshop.

- Dale stated we need to develop a day session for concrete overlays if a state wants that
workshop. Tom stated we need to look at the tasks and budget to see where we are with
the training. Tom stated we could suggest what ones are suited for day training. Dale
stated we send as a single packet.

- Dale stated we should give the states the choice of either going there to give the training
or give them a webinar. Tom stated IPS would be a good one for a 1 ½ hour webinar.
Dale thought surface characteristics is a good one for a 1 ½ hour webinar. Dale stated we
will develop a table showing what topics are suited for webinars and which are best
suited for longer presentations. Then we can look at them to see how to recommend.

- Tom stated we should do a webinar for all six pooled fund states.

- Sabrina Garber stated she is developing a draft on the Iowa highlight and will send it to
them today for review.

- Dale stated he had reviewed and returned the e-news to Sabrina Garber and that it was
well done. Tom stated the Fly Ash MAP Brief is ready also.

- Dale stated that Peter is involved with the Joint Deterioration MAP Brief which is the
next one.

- Dale felt the FHWA highlight would take a lot of effort going through the review
process. Sabrina stated all the pooled fund states except New York have been
highlighted as they did not have much going on at the time. Sabrina will check with New
York again to see if they have any new research to report on.

- Washington and Indiana have been highlighted which are outside of the pooled fund
states. Dale suggested Kansas. Washington and Minnesota have been done. Rob
suggested Texas. Tom and everyone felt that Texas would be great. Sabrina will move
forward with Texas for the next state highlight (April). That would leave FHWA for the final highlight under TOPR 4.

- Dale stated we could do Kansas for the state highlight in TOPR 5.
- Dale talked to Jerry Voigt about the CP Road Map update committee and he will send him a suggestion for a member. He also spoke to Gordon and he will join the committee. Dale will send an email to the committee members to introduce the process to them.
- Dale/Melisse will send Rob the amendment to his contract for updating the CP Road Map manual. The CP Road Map update committee will all be at NCC so they will plan to have an introduction meeting at dinner on Monday night.
Attendees: Sabrina Shields-Cook, Rob Rasmussen, Sabrina Garber, Dale Harrington, Melisse Leopold (taking minutes)

- The e-news highlights Dale reviewed with Sabrina Garber and she answered a few of his questions. They will publish David White's 2008 research in the E-news. The tech brief is done.

- The next tech brief is Joint Deterioration which is Peter's. Sabrina SC will check with Peter Taylor.

- Rob received the TOPR 5 budget that Dale sent him. Rob felt it looked good. Ahmad gave Tom and Dale concurrence on the TOPR 5 budget.

- Starting in July they will be going every other month for the E-news and Tech briefs.

- Texas highlights will be for April and FHWA for May, Dale will talk to Tom about if we need one for June. We only have budget left for April and May issues. That is it for TOPR 4. Kansas will be highlighted for June.

- Ahmad wants two conference calls plus the one face to face for the CP Road Map Committee under TOPR 5 (every quarter). Do not have budget for Transtec to attend. Ahmad wants the face to face this year in October or November (not January).

- Update Manual - Gordon Smith, Jerry Voigt will give Dale the ACPA representative, Three state DOTs, plus Ahmad. Dale will send an email today and will ask them if they can get together at NCC for an introduction meeting with them. Draft will be to Dale May 20th week. They will have the conference call with the committee on June 2, 2011. Sabrina Garber asked if Dale still wants Roger Schmidt involved (TRB subcommittee member, Florida DOT). They felt he should be included and Sabrina will send Dale his contact information.
CP Road Map
Project Team Conference Call
May 2, 2011
Meeting Minutes

Attendees: Tom Cackler, Peter Taylor, Rob Rasmussen, Dale Harrington, Melisse Leopold (taking minutes)

- Dale stated the call went well this morning with the fresh committee. Dale sent Jerry Voigt email restating that the CP Road Map would be a refresh only. Dale also called Jerry and discussed it with him. Jerry understood and he was very gracious on the call this morning. We got a lot of unanimity with the committee and they understand what the scope is for the project.

- Dale stated in 2005 an Executive Summary was developed and subsequent to that FHWA developed a CP Road Map Executive Summary with a little bit of a different approach. Ahmad suggested doing the CP Road Map Executive Summary update under the CP Road Map MAP Brief under TOPR 5. It would be one of the five MAP Briefs under TOPR 5. Tom asked if it could be complete before the next CP Road Map Executive Committee. Dale and Rob felt it could be done.

- Dale stated the current e-News and highlights were very well done. He sent his comments to Rob this morning. Dale stated there was a lot of information on the overlay research projects being done. Dale stated this should be the standard to show the Executive Committees and Advisory Boards.

- Dale asked Peter how the Joint Deterioration MAP Brief information is coming and he started it this morning.

- Lisa from Texas sent her e-news comments and the corrections will be made. Rob stated it should be revised this morning.

- Dale stated once Peter has the Joint Deterioration MAP Brief done they will send it to Ahmad. The next MAP Brief is Preservation that Dale will develop.

- Dale stated he received Gina and Rob’s comments on the Overlay Design. It is ready to be distributed. Dale and Tom will talk about that tomorrow at their meeting.

- Tom stated that TOPR 5 outline is done. Have until June 2, 2011 to get it in to FHWA. A lot of the budgeting work has been done. Doing Task A, six training sessions, webinar/workshops. Tom is going to see if Colorado has joined the Pooled Fund group.

- Task B will have a physical meeting with the Executive Committee and two web-based meetings. Also, web-based meetings with all the tracks. More meetings where added than we originally planned on however the training is less than originally expected.

- Task C is to continue the CP Road Map E-news on a bi-monthly schedule (at least 5 E-news).
- Dale asked for a copy of what was submitted to FHWA on the TOPR 5 budget. Tom will ask Sharon to send it to Dale.

- Dale and Rob will review the TOPR 5 outline and send comments to Tom.

- Dale stated that Sabrina Garber’s recommendation of Roger Schmitt the TRB representative was on the call this morning and Dale felt he was a good addition.
CP Road Map
Project Team Conference Call
May 2, 2011
Meeting Minutes

Attendees: Tom Cackler, Peter Taylor, Rob Rasmussen, Dale Harrington, Melissa Leopold
(taking minutes)

- Dale stated the call went well this morning with the fresh committee. Dale sent Jerry Voigt email restating that the CP Road Map would be a refresh only. Dale also called Jerry and discussed it with him. Jerry understood and he was very gracious on the call this morning. We got a lot of unanimity with the committee and they understand what the scope is for the project.

- Dale stated in 2005 an Executive Summary was developed and subsequent to that FHWA developed a CP Road Map Executive Summary with a little bit of a different approach. Ahmad suggested doing the CP Road Map Executive Summary update under the CP Road Map MAP Brief under TOPR 5. It would be one of the five MAP Briefs under TOPR 5. Tom asked if it could be complete before the next CP Road Map Executive Committee. Dale and Rob felt it could be done.

- Dale stated the current e-News and highlights were very well done. He sent his comments to Rob this morning. Dale stated there was a lot of information on the overlay research projects being done. Dale stated this should be the standard to show the Executive Committees and Advisory Boards.

- Dale asked Peter how the Joint Deterioration MAP Brief information is coming and he started it this morning.

- Lisa from Texas sent her e-news comments and the corrections will be made. Rob stated it should be revised this morning.

- Dale stated once Peter has the Joint Deterioration MAP Brief done they will send it to Ahmad. The next MAP Brief is Preservation that Dale will develop.

- Dale stated he received Gina and Rob’s comments on the Overlay Design. It is ready to be distributed. Dale and Tom will talk about that tomorrow at their meeting.

- Tom stated that TOPR 5 outline is done. Have until June 2, 2011 to get it in to FHWA. A lot of the budgeting work has been done. Doing Task A, six training sessions, webinar/workshops. Tom is going to see if Colorado has joined the Pooled Fund group.

- Task B will have a physical meeting with the Executive Committee and two web-based meetings. Also, web-based meetings with all the tracks. More meetings where added than we originally planned on however the training is less than originally expected.

- Task C is to continue the CP Road Map E-news on a bi-monthly schedule (at least 5 E-news).
• Dale asked for a copy of what was submitted to FHWA on the TOPR 5 budget. Tom will ask Sharon to send it to Dale.

• Dale and Rob will review the TOPR 5 outline and send comments to Tom.

• Dale stated that Sabrina Garber’s recommendation of Roger Schmitt the TRB representative was on the call this morning and Dale felt he was a good addition.
CP Road Map
Project Team Conference Call
May 31, 2011
Meeting Minutes

Attendees: Tom Cackler, Rob Rasmussen, Dale Harrington, Melisse Leopold (taking minutes)

- Ahmad is still waiting for some feedback from his people at FHWAS on the E-news highlights.
- Dale and Sabrina are working on the Partial Depth patches MAP Brief. Should be close to being ready to go.
- Jesse who works with Rob will write the June issue of the e-news. Peter will due the June 2011 MAP Brief on Identifying and Avoiding Incompatible Combinations of Concrete Materials.
- Rob stated the June e-news highlights should be done by the end of this week.
- Dale stated the CP Road Map refreshing call is tomorrow. He stated the current track structure has been outlined by Dave Merrick and it was revised. Dale hasn’t seen anything since getting it down to 12 tracks. Rob stated that Dave did confirm it was reduced to 12 tracks. Dale would like this sent to the committee today. Rob will ask Dave for the current version and send it to Dale to send to the committee. This will be discussed on the conference call tomorrow.
- Dale stated he would like to talk to Peter on the changes on the Mix track. Peter will send Dale some information today. Dale asked Peter to go through the eight subtracks of the sustainability track and will give to the committee and let them know Peter is working on this track name changes. Dale does not want to cover these tomorrow he just wants to give the titles to them. Wants to concentrate on the Mix track to tell them what we are doing.
- Need to be clear why we did the proposed tracks and Dale will cover Peter’s subjects. Rob stated this will be a web conference so if he has anything to go over he can send it to Rob and they will put it on the screen.
- Peter will get the subtitles under the work statements done and send to Dale for the committee call tomorrow. Peter will have some headings for the work statements which will include what it is about. He will not have the full problem statements done at this time as he is still working on these.
- Dale stated on TOPR 5 Sharon had made some changes that Dale sent to Rob. Dale has some comments and will get those to Sharon today. Dale stated we need to be careful about adding anything and said no to almost everything she wanted to add. Tom agreed. Dale stated we do not have any funds to hold track meetings. However we can collaborate and encourage collaboration with the state meetings however we cannot initiate the meetings. Tom agreed. Dale stated that Sabrina Garber’s time is being reduced and Jesse will be included in TOPR 5.
CP Road Map
Project Team Conference Call
June 6, 2011
Meeting Minutes

Attendees: Peter Taylor, Sabrina Shields-Cook, Rob Rasmussen, Dale Harrington, Melisse Leopold (taking minutes)

- Dale stated Ahmad sent the e-news and he though it looked good. Ahmad made some relatively minor adjustments. Rob stated he made some corrections to the formatting and typos. Sabrina Shield-Cook will accept the changes that Ahmad made with the adjustments and will finalize.

- Jessie is working on the e-news for June with the New York DOT.

- Peter Taylor is working on the Identifying and Avoiding Incompatible Combinations of Concrete Materials MAP Brief for June.

- Melisse and Snyder & Associates graphics department are working on the CP Road Map impacts document that will be sent to PCA.

- Dale/Melisse asked Sabrina Garber to update the database with the FHWA and TRB track associations. Rob stated that the database has been updated and will be sent to Dale today.

- TOPR 5 was sent to Ahmad and we are waiting to hear from FHWA.

- On the refreshing the Road Map PCA (Fares) would like an update on sustainability. Peter is working on that update and will send it to Dale today.

- The mix track and sustainability track updates. Peter stated that he inserted some lines on the spreadsheet for project statements that need to be inserted for the mix track and sent them to Dave Merrick and Dale. Peter will develop the project statements for the mix track.

- Dale stated we have a contractual obligation to complete the refreshing by June 30th which is when the last conference call will be held with the committee. We need to have the draft to the committee by June 23rd for their review prior to the final call. The final call will be held on June 30th at 10:00a.m. (that is the only time Ahmad is available).
Attendees: Tom Cackler, Peter Taylor, Rob Rasmussen, Dave Merrick, Dale Harrington, Melisse Leopold (taking minutes)

- Ahmad sent comments on e-news and he thought they looked good. Sabrina SC made adjustments according to Ahmad's comments. Partial Depth repair was corrected per Sam's comments and it was sent out too for May.

- The CP Road Map Impacts packet has been sent out to Steve K. Also will overnight hardcopies to him today. Dale will bring Tom Cackler a copy tomorrow. Will send Rob an electronic copy.

- TOPR 5 status – Tom stated a signed copy was received on Friday and he sent it to Sharon. Takes effect June 8, 2011– June 30, 2012. Sharon will send it to Dale/Melisse and Melisse will get Rob's contract processed.

- Peter stated on Friday he sent the Mix track problem statements and he will next look at sustainability. Peter has one more he will send to Dave Merrick on Mix track. Rob and Dave will go with what they have by Friday to get it out for the call with the Refreshing Committee.

- Under the track concrete pavement equipment and advancement Dale asked if Dave has been separating the construction and systems? They are not going to rename subtracks. Intelligent construction systems is Track 3. What to be clear between intelligent construction and intelligent systems.

- On track 8, Construction, overlay construction and simulation.

- Yes intelligent compaction going to be in track 10.

- Sustainability – concrete pavement decisions was moved out of economic and into pavement sustainability. The committee wanted it moved.

- Track 11 name is fine.

- Peter is working on the next MAP Brief.

- New York highlight should be done today and will send the e-news to Dale this week. This will complete our obligation for TOPR 4. Melisse will prepare the final report for TOPR 4.

- The next e-news and MAP Brief will go out for August 2011. Will start working on it now to get the review process going. Would like to get it out for review by July 15th.

- Need to come up with some items for the next series of MAP Briefs. Peter and Tom suggested checking with Ahmad to clarify the next series. Tom suggested a MAP Brief on Two Lift Paving.
• The next call will be on Tuesday next week at 10:30 a.m. and the team will have some suggested topics for the next series of MAP Briefs. Tom and Peter will not be on the call next week. Tom suggested starting and electronic list which Dale will start and send to the team.
Attendees: Tom Cackler, Peter Taylor, Rob Rasmussen, Sabrina Shields-Cook, Dale Harrington, Melisse Leopold (taking minutes)

- Dale received a call from Ahmad and he asked why we have yellow on some sheets and blue on others of the refreshing documents. Blue is what we want you to read and comment. He was concerned about covering all of the comments in two hours. Dale stated he was probably right but we will proceed and see if we have to adjust and Dale will ask Tom how to proceed at that time.

- Dale felt it Rob or Dave should lead the discussion on Thursday’s call with the committee. Rob stated there was a lot of effort put into the refreshing of the documents.

- Dale stated that Ahmad felt we were pushing the committee with too much information. Dale told Ahmad we are trying to get this done with a limited amount of money and time.

- Dale stated that Rob and his team put in extra effort and thanked him for a very good job on refreshing the documents.

- Dale and Sabrina received Peter’s draft of the MAP Brief. Dale reviewed it and thought it was well done. Sabrina will work on formatting the MAP Brief this week and the earliest she could have it done would be Wednesday, it will be done this week.

- TOPR 4 has been extended (time only) for the cleanup work for the refreshing to July 31, 2011 (need to check this for sure with Sharon).

- Under TOPR 5 we contractual agreed to do 5 E-news. Ahmad accepted the state highlight suggestions and added one additional one.

- Dale thanked Sabrina for doing good work on the Partial Depth Repair document.

- Dale will check with Sharon on the dates for TOPR 5.

- Peter stated there are problem statements written for Track 1. He is concerned about Track 12 as there are not problem statements written for all of the titles that the committee gave to the team. Peter will be go the rest of this week and won’t be able to write the problem statements. Will need close coordination to get the committee comments to Sabrina. She will put together the cover and formatting the edits. She will get Dale and Tom’s input on the cover. Dale sent Sabrina the edit’s that Transtec did for her review.

- The next MAP Brief will be for August and Dale will send an email to Rob on the state highlights. Rob is ready to start on the highlights. He will start with the first one on the list.

- Sabrina received the highlight links from Rob for this month’s E-news.