PCC Surface Characteristics:
Tire-Pavement Noise Program
Part 3: Innovative Solutions/Current Practices

Problem Statement
June, 2005

Project Title:
Part 3: Innovative Solutions/Current Practices

Purpose:
One of the most pressing issues to the Portland Cement Concrete Pavement industry is the surface characteristic issue. Surface characteristics are defined as: those properties of pavement that impact the smoothness, friction, noise, drainage, splash and spray, rolling resistance, and reflectance of the pavement. Although all of these are important, it is the noise issue that has recently begun to significantly affect the U.S. pavement community.

The purpose of this pooled fund study (Part 3) is to fully implement the PCC Surface Characteristics program. This project is related to a larger study involving two other parts (Part 1 and 2). Those two parts are summarized in the attached Appendix B. Part 3 will consist of the continuation of the comprehensive data collection and analysis program on new and existing pavements started in 2005; expand on it so that the research results have a broader range of applicability; and develop innovative texturing techniques that have the potential to significantly reduce noise. Specifically, this study will:

1. Continue the monitoring of the "field experimental sites" constructed in 2005 for an additional four years, through the end of 2010.
2. Monitor additional "field experimental sites" that are constructed around the U.S. through 2010. These sites will consist of both standard or conventional texturing techniques as well as innovative texturing techniques. Potential innovative techniques include:

    a. Stamped, brushed, and other textures/techniques that may be developed, and which call for further investigation
    b. Two-lift construction with exposed aggregate
    c. Pervious or porous concrete
    d. Sprinkle treatment
    e. Shotblasting

    See Appendix A for details on these techniques

    These additional sites, and the time history data for all sites are needed so differences in factors such as those noted below can be included in determining the surface and acoustic durability and the rate of change for different textures:

    a. Climate (wet; dry; freeze; no freeze)
    b. Coarse aggregate type (hard/soft, angularity, composition, etc)
    c. Sand composition and type
    d. Gradation affects
    e. Other mix proportions/requirements (cement content, strength, etc)
    f. Vehicle use (hi/low volumes, traffic mix, many trucks – few trucks, etc.)
    g. Application (urban/rural, ice/snow removal operations, etc.)
    h. Construction variability (tine depth, changes in materials, wind and other climatic factors etc.)
    i. Grinding spacing and other factors

This research is collecting data on three different site types:

Type 1 – New sites
Type 2 – Relatively new, but existing sites
Type 3 – Existing sites of all ages

See Appendix A for details on the site types.

It is anticipated that this research will consist of ten tasks. The tasks are divided into phases with Phase A focusing on the continuation of the work on Type 2 and 3 projects so as to meet the schedules and financing of states that volunteer sites. Phase B will focus on new sites, as well as the continuation of testing on the Type 2 and 3 sites. The split phases will allow time for the pooled funds to be committed and received without holding up the monitoring and data collection work that needs to continue.

Phase A

Task 1. Form Technical Advisory Committee (TAC) and hold initial project planning meeting
Task 2. Select Type 2 and Type 3 sites for inclusion in the study
Task 3. Perform initial data collection for Type 2 and 3 sites

Phase B

Task 4. Select Type 1 sites, layout out texture configurations for site, and construct
Task 5. Perform initial data collection for the first seven days at the Type 1 sites
Task 6. Repeat data collection for all Type 1 and 2 and additional Type 3 sites
Task 7. Write interim report documenting construction and initial testing results
Task 8. Perform annual testing through 2010 for all Type 1 and 2 sites
Task 9. Complete data analysis and write final report
Task 10. Technology Transfer

See Appendix A for details on tasks.

Anticipated Results:

1. Better define the interrelationships between noise, smoothness, friction, and texture, and relate how a change in one characteristic (i.e. noise) impacts the other characteristics.
2. Measure the rate of change in texture, smoothness, friction, and noise over a period of time and determine how factors such as climate, traffic, materials, etc. affect that rate of change.
3. Measure how conventional textures vary, identify the sources for that variation, and to improve the texturing methods and construction processes in order to give more consistent and reproducible results.
4. Recommend the surface characteristics needed to balance the site specific requirements for noise, skid, texture, and smoothness.
5. An extensive program of technology transfer activities will provide public agencies and industry with the results of the study. Sound processes and procedures to implement construction practices that will result in lower pavement noise, as well as acceptable levels of smoothness, friction, and safety will be established.

At the completion of this overall study, it is anticipated that it will be possible to specify the desirable surface characteristics of individual projects prior to construction to meet the site specific requirements for noise, skid, texture, and smoothness.

Project Schedule and Budget

It is assumed that the project will start in mid 2006 and Tasks 2 through 6 will be completed by 2008 (construction and initial testing will occur in 2006 and 2007). Task 8, perform annual testing to collect texture, noise, smoothness, and skid data, will be done through 2010. Task 9 will be completed as the field work is being completed in 2010. Task 10, the technology transfer element, will be initiated after the first two years of data become available and continue through the end of the study.

Project Schedule

Year	06	06	06	07	07	07	07	08	08	08	08	09	09	09	09	10	10	10	10
Task Quarter	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1. Form TAC & hold meeting																			
2. Type 1 site layout/construction																			
3. Type 1 initial data collect																			
4. Type 2 & 3 site selection																			
5. Type 2 & 3 initial data collection																			
6. Additional Type 1 & 2 data collection																			
7. Write interim report																			
8. Perform annual testing																			
9. Data analysis & write final report																			
10. Technology Transfer																			

Pooled Fund Activities

States included in the pooled fund will be funding part of the field measurements and coordination of work for the new sites. This work will target those projects from the earlier phase of the field study (Part 2) that show good results and are worth further evaluation relative to constructability and consistency. Also included will be projects that will involve new, innovative processes or equipment that is developed as the project moves forward.

In addition, the pooled fund will cover the cost of the on-going technology transfer that will provide the States the results of the overall study (Parts 1, 2, and 3) and the ways that they can incorporate the study results into their activities to meet noise, friction, and safety requirements. The technology transfer elements will be centered around on-site meetings with the management level staff members of each of the participating states. The technology transfer program will also include technical memorandums and conference presentations indicating the study results and recommendations.

Part 3 Anticipated Project Cost Allocation Summary

Funding Source											
Work Activity	*Pooled Fund**		*FHWA*		*ACPA*		*PCC Center*		*Total*		
	Phase A	*Phase B*	*Phase A*	*Phase B*	*Phase A*	*Phase B*	*Phase A*	*Phase B*	*Phase A*	*Phase B*	*Combined*
Technical Evaluation and Coordination	--	--	$20,000	$25,000	$15,000	$15,000	$15,000	$10,000	$50,000	$50,000	$100,000
Field Measurement and Coordination (new sites)	--	$395,000	--	$185,000	--	--	--	$65,000	--	$645,000	$645,000
Field Measurement and Coordination (existing sites)	--	--	--	--	$100,000	$200,000	--	--	$100,000	$200,000	$300,000
Data Analysis and Report Writing	$20,000	$105,000	$20,000	$55,000	--	--	$20,000	$30,000	$60,000	$190,000	$250,000
State DOT Travel and Coordination	$8,000	$32,000	--	--	--	--	--	--	$8,000	$32,000	$40,000
Technology Transfer	--	$100,000	--	--	--	--	--	--	--	$100,000	$100,000
TOTAL	**$28,000**	**$632,000**	**$40,000**	**$265,000**	**$115,000**	**$215,000**	**$35,000**	**$105,000**	**$218,000**	**$1,217,000**	**$1,435,000**
* 12 states @ $20,000 for first two years = $480,000 12 states @ $15,000 for third year = $180,000 $660,000											

Financing
In addition to the pooled fund activities, the other funders, including the Federal Highway Administration, industry (represented by the American Concrete Paving Association), and the PCC Center at Iowa State University will be financing some of the same elements as the pooled fund, as well as the other elements of Part 3 of the study. These other elements include the technical evaluations and the field measurements and coordination for the existing sites.

This consortium of funders has previously committed to finance the initial two parts of this study in the total amount of $1,043,700 (See Appendix B). Although no specific commitment can be claimed for Part 3 at this time, it is expected that the entities previously committed to the project will complete the funding. This funding will finalize the study by providing further work on the innovative solutions that are identified in the first two parts of the study and the continuation of the field measurements to insure that the longer term information is obtained and analyzed.

Each entity involved will realize information valued at many times the amount of their financial contribution due to the leveraging of different dollars. The information and data from all three parts of this study will prove to be very valuable as the completed information will allow highway officials to determine a surface treatment technique that will provide them with the appropriate noise, friction, and safety elements for their project.

State Project Responsibility
Participation in the pooled fund does not require involvement in field site activities. States involved with the project that participate in field experiment sites will be required to provide staff and financial resources. The involvement varies in accordance with the type of project involved.

Type 1 (new) projects will involve the following activities:

- Pay for extra contractor costs for different textures that are to be used
- Provide traffic control for all testing activities
- Complete friction tests utilizing an ASTM E274 trailer along with an ASTM E 524 smooth tire

Type 2 (existing) and 3 (existing and new) projects will involve the following activities:

- Provide traffic control for all testing activities
- Complete friction tests utilizing an ASTM E274 trailer along with an ASTM E 524 smooth tire

Project Administration
The Iowa DOT, through the Portland Cement Concrete Pavement Technology Center (PCC Center) at Iowa State University, will provide administrative management and be the lead research institution on the pooled fund activities. The PCC Center will also provide administrative management and be the lead research institution in the other elements included in the three part study. The main work activities of the PCC Center will be to establish the Technical Advisory Committee (TAC), coordinate with the involved states to identify research sites, coordinate with the researchers on data collection, ensure compliance with the established schedule, and complete the technology transfer coordination.

The PCC Center has extensive experience in concrete pavement materials, design, and construction. Other key members of the team include Ted Ferragut, PE, TDC Partners, Ltd.; Dr. Rob Rasmussen, The Transtec Group, Austin, Texas; Dr. Steve Karamihas, UMTRI, and Ulf Sandberg, VTI (Sweden).

It is believed that this team will offer the experience and expertise necessary for the successful completion of this three part study.

The Technical Advisory Committee will keep the project well grounded with the State DOT and industry perspective and help speed technology transfer.

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The details of the Part 3 Research Plan are included in Appendix A and the summary of the overall three part study is explained in Appendix B.

APPENDIX A

Part 3 Innovative Solutions/Current Practices Research Plan

Conventional Texture Advancements
This research is to supplement current field experiments already underway on conventional textures. This research is collecting data on three different site types:

- Type 1 – New sites
- Type 2 – Relatively new, but existing sites
- Type 3 – Existing sites of all ages

Type 1 – New site studies call for the simultaneous and continuous measurement of noise, smoothness, friction, and texture. These sites can be either new construction or new diamond grinding sites. The objective is to identify the rate of change in the properties, and link them all back to specific changes in noise. The study distinguishes itself from other studies in that it includes the collection of mega-, macro-, and micro-texture data using a variety of test equipment, and that it is done early and repeated over the first seven days of operation. After the first seven days, additional testing will be done at 30 days, 180 days, 360 days, and yearly after that, or until the rates of changes in key properties have stabilized.

Each Type 1 study will include up to ten texture patterns at one 6000-ft site or two 3000-ft sites. Each test section's texture will include variations in geometry (e.g., width and depth) and will be 500 ft. long plus have an intermediate gap of 100 ft. between each texture configuration. Test sections will be flat, tangent roadway geometrics, if possible, to eliminate bias and interference in the noise and friction measurements. Type 1 test sites will also have one of the texture or grinding configurations placed at a minimum length of 2500 feet in order to determine construction variability.

The data to be collected for a Type 1 study is:

- Noise inside the vehicle
- Noise at the tire-pavement interface
- Noise at the wayside
- Surface texture
- Smoothness
- Friction
- Concrete properties

Equipment identified to date includes CPX, interior noise measurement equipment, wayside (pass-by) noise measurement equipment, inertial profiling, Dynamic Friction Tester (DFT), Circular Texture Meter (CTM), advanced line-laser-based texture equipment, and friction (skid) trailers. The ISU team has all the equipment available to them, with the exception of skid trailers, which will be sought from the local DOT.

A **Type 2** project is similar to Type 1 except it will address recently constructed sites with varying surface textures. The study will measure any rates of change from that point forward. The objectives of a Type 2 study are to minimize the cost of the experiment and to collect data from existing work that has promising noise characteristics and texture.

A **Type 3** study calls for a one-time visit to various sites around the country, collecting noise and texture data. The objectives of these studies are to compile sufficient data to "index" the current

situation, elect possible candidates sites for Type 2 studies, and provide a long-term resource for data analysis and further investigation, should it be warranted.

The Iowa DOT has committed to the construction of one Type 1 test site and are looking for additional Type 1 and 2 sites for the 2005 construction season. Similarly, representatives from the Minnesota and Pennsylvania concrete paving industry have indicated their willingness to work with their DOTs to find additional sites.

It is desired to have duplicate Type 1 new construction and Type 1 diamond grinding sites constructed with different aggregate types and traffic volumes. For Type 2 sites, it is ideal to find up to eight additional Type 2 test sites. Type 3 test sites that add value to the research will be included as new sites with different textures are found and can be arranged to be measured. Currently, it is estimated there will be approximately ten Type 3 test sites.

Note: The exact number of Type 1, 2 and 3 test sites to be built and monitored depend on the available funding.

Innovative Solutions

In addition to supplementing the conventional texture studies above, it is desired to have this pooled fund study develop innovative textures, and then analyze them as part of the Type 1 and 2 field experimental studies. Potential textures include:

1. Stamped, brushed, and other textures/techniques that may be developed, and which consider further investigation
2. Two-lift construction with exposed aggregate
3. Pervious or porous concrete
4. Sprinkle treatment
5. Shotblasting

The sponsors of this program believe that it is possible to develop an alternative texture to tining that can be placed in fresh concrete at approximately the same cost as conventional tining, but will have better surface characteristic properties than conventional tining. It is hoped that these methods can be developed and evaluated along with the other innovative textures listed here.

Two-lift construction involves the placement of two wet-on-wet layers or bonding wet to dry layers of concrete, instead of the homogenous single layer commonly placed in concrete paving. The bottom layer is thick and consists of lower quality (lower durability or strength), locally available aggregate or recycled aggregate (such as recycled asphalt, concrete rubble, or local aggregate). The top layer is thin and consists of high-quality aggregate designed to provide better resistance to freeze-thaw damage, reduced noise, or improved friction.

Pervious or porous concrete pavement is a special blend of Portland Cement, coarse aggregate (no sand), and water. Because of the absence of sand, the void space is between 15% and 30%. These voids allow rainwater to percolate through the pavement rather than off of it without compromising the strength, durability, or integrity of the concrete structure itself. Pervious concrete is not a proprietary product; it is a "recipe" for concrete which can be made to order by any concrete batch plant.

Note: pervious concrete was originally developed as one of several technologies to address stormwater drainage problems.

Sprinkle treatment is a technique where small stone chips are impregnated onto the wet concrete surface. Though this technique was used in the 1970s and '80s in the United States, the equipment was rented from England and process never caught on. It is believed that it could be used for skid and noise applications, now that functional issues have become more important. Note that for sprinkle treatments to be effective, innovative application equipment needs to be available.

Shotblasting is a procedure in which specialized equipment propels tiny steel shot onto the pavement surface. The shot impacts the surface and removes a thin layer of mortar and aggregate, which creates an open porous surface texture that has increased skid numbers and reduced noise characteristics.

Specific Tasks

It is anticipated that this research will consist of ten tasks. The tasks are divided into phases with Phase A focusing on the continuation of the work on Type 2 and 3 projects so as to meet the schedules and financing of states that volunteer sites. Phase B will focus on new sites, as well as the continuation of testing on the Type 2 and 3 sites. The split phases will allow time for the pooled funds to be committed and received without holding up the monitoring and data collection work that needs to continue.

Phase A

- Task 1. Form Technical Advisory Committee (TAC) and hold initial project planning meeting
- Task 2. Select Type 2 and Type 3 sites for inclusion in the study
- Task 3. Perform initial data collection for Type 2 and 3 sites

Phase B

- Task 4. Select Type 1 sites, layout out texture configurations for site, and construct
- Task 5. Perform initial data collection for the first seven days at the Type 1 sites
- Task 6. Repeat data collection for all Type 1 and 2 and additional Type 3 sites
- Task 7. Write interim report documenting construction and initial testing results
- Task 8. Perform annual testing through Year 5 for all Type 1 and 2 sites
- Task 9. Complete data analysis and write final report
- Task 10. Technology transfer

Task 1 – Form Technical Advisory Committee (TAC) and hold project planning meeting. The primary role of the TAC is to provide direction for the research team. The TAC will consist of up to two members from each participating entity (state DOTs, FHWA, the International Grinding & Grooving Association, and the concrete paving industry) sponsoring this project. Their task will be to help organize the specifics of the cooperative work tasks and oversee the accomplishments of these tasks. It is hoped that that by having each state represented, the texture patterns for each site can be coordinated in order to get the largest matrix of test patterns as possible.

Initially, the TAC will meet early after the project award to organize the testing plan. Afterwards, it will meet at a minimum of once a year to advise on subsequent work, and to help on technology transfer. It is anticipated that by involving the DOTs early in the process, and by getting their feedback on the program on a regular basis, the task of getting "buy in" for the use of technology is enhanced.

The pooled fund will support State DOT travel to TAC meetings for two participants from each participating state.

Task 2 - Select up to eight Type 2 sites and ten Type 3 sites for inclusion in the study. Type 2 and 3 sites are intended to add additional information about currently used texturing procedures.

The purpose of Type 2 sites is to capture points on life curve after the first year since construction (for conventional textures) or grinding. Type 2 sites should be one to three years old (time since construction or since grinding) and ideally have been included in previous texture experiments (e.g., Marquette, Arizona SR 202, Mohave). Anecdotal outliers, showing either good or bad performance could also be included. Each section should be between one and five miles.

Type 3 test sites are one time testing sites of grinding, and other PCC surfaces of interest intended to capture texture and noise data in sufficient quantity to "index" the current situation and provide a long-term resource for data analysis and further investigation. Each site should be at least one mile long.

Data to be collected at the Type 2 and 3 sites will be:

- Texture – both micro- and macro-texture. Currently, it is anticipated that micro-texture testing will be tested using the Dynamic Friction Tester (DFT) and macro-texture will be gathered using Circular Texture Meter (CTM) and High speed laser-based devices.
- Friction – This will be tested using the locked-wheel trailer with a smooth test tire (ASTM E 274) and DFT tests.
- Noise – Near field, in-vehicle, and far-field (pass by) noise will be tested. Currently, it is anticipated that near-field noise will be tested by the CPX method. In-vehicle and pass-by testing will be collected by SAE J 1477 *Measurement of Interior Sound Levels for Light Vehicles* and ISO-11819-1 test respectively.

Note: Texture and pass-by noise testing for Type 2 and 3 sites will depend on the availability of traffic control, and an assessment of the acoustical conditions at the site. Also, all testing will be carefully referenced (spatially) to allow for subsequent repeat tests in the following years.

Task 3 – Perform initial data collection for Type 2 and 3 sites as outlined in Task 4.

Task 4 – Select up to four Type 1 sites, layout out texture test configurations, and construct. As discussed earlier, each Type 1 test site could consist of up to ten texture patterns at one 6000-ft site or two 3000-ft sites. Each test section's texture will include variations in geometry (e.g., width and depth) and will be 500 ft. long plus have an intermediate gap of 100 ft. between each texture configuration. Each site will contain some combination, but not all of the following configurations:

- Innovative textures
- Longitudinal tines (Up to five configurations)
- Burlap drag (one configuration)
- Turf drag (one configuration)
- Diamond Grinding (up to 12 configurations)

The test sections configurations themselves will be organized such that each texture will occur in at least two climatic regions and maximize the combination of characteristic on Page 2.

Task 5– Perform initial data collection for the first seven days at the Type 1 sites. The data collection for the first seven days will consist of:

- Texture – both micro- and macro-texture. Currently, it is anticipated that micro-texture testing will be tested using the Dynamic Friction Tester (DFT) and macro-texture will be gathered using Circular Texture Meter (CTM) and High speed laser-based devices.
- Friction – This will be tested using the locked-wheel trailer with a smooth test tire (ASTM E 274) and DFT tests.

- Noise – Near field, in-vehicle, and far-field (pass-by) noise will be tested. Currently, it is anticipated that near-field noise will be tested by the CPX method. In-vehicle and pass-by testing will be collected by SAE J 1477 *Measurement of Interior Sound Levels for Light Vehicles* and ISO-11819-1 test respectively.
- Smoothness – It is recommended to use high-speed inertial profiler with a very high sampling and recording frequency (to help assess macro-texture). If the line-laser unit is available, it should be used, even if a low-speed device is needed. This sensor will help to characterize the longitudinal textures much better than a spot laser.
- Splash/Spray – Conduct a visual (subjective) assessment of the splash and spray characteristics of each section during/after rainfall activity.
- Construction/site measurements. Currently, it is anticipated that the following tests will be performed on site:
    - Concrete tests – laboratory (e.g., strength, modulus, aggregate tests)
    - Concrete – field (e.g., workability, maturity)
    - Environmental conditions during construction/grinding and evaluation period
    - Construction conditions: saw-cutting timing, geometry; texture operations timing, geometry; curing timing, methods
    - Construction operations and control variability (texture depth, width, patterns, etc.)

Task 6 – Perform additional first year data collection on Type 1 sites. This task consists of repeating the testing at all Type 1 sites at approximately 30 days and 180 days.

Task 7 – Write interim report documenting construction and initial testing results.

Task 8 – Perform annual testing through Year 5 for all Type 1 and 2 sites. Repeat testing of all Type 1 and 2 sites in order to build a time history of test results.

Task 9 – Complete data analysis and write final report. This consists of analysis of all data and reporting on relationships between texture, noise, skid, and other pavement surface characteristics.

Task 10 – Complete on-site management meetings with pooled fund participating states, develop technical memorandums and conference/workshop presentations on the study and recommendations for change.

Expected Results:

- A better understanding of the interrelationships between the desirable surface characteristics so that individual projects can have their surface characteristics defined prior to construction to meet the site specific requirements for noise, skid, texture, and smoothness.
- An understanding of durability of different textures due to different environmental, loading, material, and construction practices.
- A database of surface textures with related noise, smoothness, and skid characteristics.
- Construction guidelines and recommendations, as well as testing and measurement quality control aspects for individual texture properties so that the final texture is optimized to be as stable as possible.
- Final report and other technology transfer tools.

APPENDIX B

0VERALL STUDY SUMMARY
PART 1, 2, 3 PCC SURFACE CHARACTERISTICS

Background:
In response to this emerging issue, the concrete pavement industry has experimented with new tining patterns, converted to longitudinal tining in some places, and even used diamond grinding simply to quiet the noise on otherwise acceptable pavement. In some cases, sound concrete pavement has been overlaid with asphalt for noise considerations.

No single solution has emerged to address the noise issue. Furthermore, the overall surface characteristic issue is extremely complex, since noise is closely tied to smoothness, friction, splash and spray, and other pavement properties. The following elements have not been adequately addressed in the past:

1. No solution has been entirely effective, and even nominally similar projects are leading to conflicting results.
2. There is no information on how changes in one characteristic (i.e. noise) affect (either beneficially or detrimentally) the other characteristics (i.e. friction, smoothness, splash and spray, etc) of the pavement.
3. There is no information on the long-term surface and acoustic durability of the different textures put forth in the Marquette Report.
4. New data collection and analysis tools for noise (CPX) and texturing (line laser) are now available.

As a result, the industry must develop an overall strategic research approach to the problem before the already limited research and construction funds are expended unnecessarily.

To address these deficiencies, in 2004 and 2005, the Federal Highway Administration, Iowa State University, and the American Concrete Pavement Association started a five-year, multi-million dollar PCC Surface Characteristics Program. This program is administered through Iowa State University's PCC Center. The purpose of the program is to determine the interrelationship among noise, friction, smoothness, and texture properties of concrete pavements. It consists of the following:

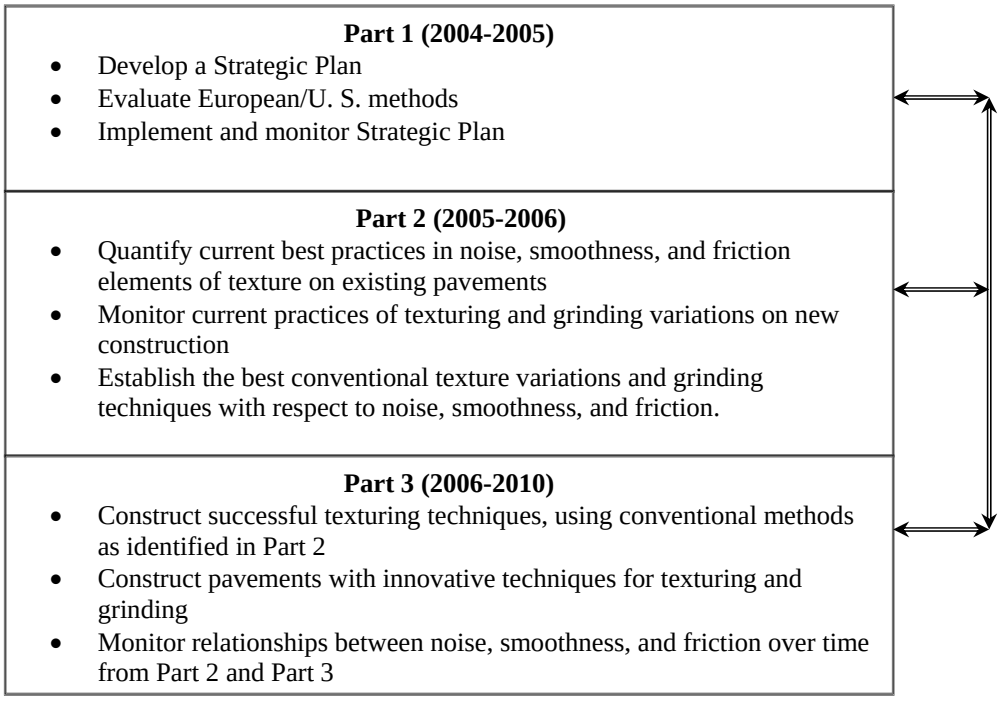
- **Part 1: Portland Cement Concrete Pavement Surface Characteristics** (referred to as Project 15 of FHWA/ISU Cooperative Agreement No. DTFH61-01X-0042)
- **Part 2: 2005-2006 Field Experiment Plan of Current Surface Characteristics Practices**
- **Part 3: 2006-2010 Innovative Surface Characteristics Solutions**

Part 1: *"Portland Cement Concrete Pavement Surface Characteristics" (Project 15)* is currently underway and calls for the development a long-term Strategic Plan under Task 1. Task 2 is the comprehensive documentation on all concrete pavement noise reduction trials with a specific focus on European and U.S. methods. This investigation includes interviews with many of the innovators that have worked with these techniques firsthand. The report compiles information on design, bidding, construction, quality control, maintenance, and field evaluations. Finally, Task 3, referred to as "Strategic Plan Management," provides continuous plan management that allows for tracking of the Strategic Plan activities for a 12-month period.

Part 2: *"Field Experiment Plan of Current Surface Characteristics Practices"* consists of the collection, measurement, and analysis of noise, skid, texture, and smoothness data for conventional texturing variations and grinding techniques on pavements. In order to meet the overall program

schedule, this work will need to be underway in the summer of 2005. However, monitoring is anticipated to continue for at least four years on an annual basis under Part 3.

Part 3: *"Innovative Surface Characteristics Solutions"* is a future program to develop innovative texturing techniques that have the potential to reduce noise by an order of magnitude or more, while also not degrading the other surface characteristics (smoothness, friction, drainage, etc) of the pavement. It also includes successful texturing techniques using conventional methods as identified in Part 2. The second element of the program is to continue the monitoring of the sites chosen in Part 2 through 2010. The interrelationship among the three parts of the program is summarized below.



Proposed Project Funding

Sponsor	**Part 1** *Strategic Plan* 2004-2005	**Part 2** *Current Practices Field Experiment* 2005-2006	**Part 3** *Innovative Solutions/ Current Practices & Field Exp./Analysis* 2006-2010	Total
FHWA	$150,000	$211,000	$305,000	$666,000
ACPA	--	$261,000	$330,000	$591,000
PCC Center	$175,000	$150,000	$140,000	$465,000
IHRB	--	$96,700	--	$ 96,700
Pooled Fund	--	--	12 states 2 years @ $20,000/yr.= $480,000 1 year @ $15,000 = $180,000	$660,000
Total	**$325,000**	**$718,700**	**$1,435,000**	**$2,478,700**