Summary of PPRC Work Plan for 2007 Strategic Plan

Title of Project	Caltrans Problems Addressed	Tasks	PPRC Deliverables	PSC Road Map Objectives Addressed	PST #
New HVS Projects					
Warm Mix Asphalt Performance Under Heavy Vehicle Simulator Loading (T Bressette, PST Lead; D Jones UCPRC PM) Field HVS Expected start date : summer 07	1. Can density be achieved at lower temperatures in WMA projects? 2. What is the optimum temperature range for compaction of WMA? 3. Can productivity be improved in night time closures if WMA is used? 4. Can construction projects be started earlier and continued later in the year if WMA is used? 5. Will it be possible to transport asphalt longer distances? 6. What are differences between three products: Sasobit, Evatherm, Asphamem? a. Will the additives negatively influence the rutting performance of the asphalt? b. Will the additives negatively influence the fatigue performance of the asphalt? c. Will the additives increase the moisture sensitivity of the asphalt? d. Will lower production temperatures increase the moisture sensitivity of the asphalt? e. Can the additives be used with rubber modified binders, and does the additive influence the performance? 7. By how much will asphalt plant emissions be reduced? 8. What are the energy savings at asphalt plants if WMA is produced? 9. What changes need to be	1. Review national and international status of WMA research 2. Review NCAT lab and field test findings and identify gaps requiring research, eg performance related to rubber modified binders 3. Undertake preliminary laboratory shear and fatigue tests with California binders plus additives to confirm NCAT findings 4. Prepare a workplan for HVS and LTPP experiments that will address questions posed 5. Locate and construct HVS and LTPP experiments 6. Monitor WMA production and construction to answer questions related to construction, emissions and energy 7. Monitor performance under HVS and real traffic to answer questions related to performance 1st priority: HMA: control + 3 products (4) at 50 C RAC-G: control + 3 products (4) at 50 C 2nd priority: repeat same at 20 C with water for moisture sensitivity *HVS tests to be performed at HMA producer site* 8. Assess performance of field and HVS mixes in the laboratory to answer questions related to mix design. (METS and/or UCPRC) per METS plan + Hamburg wheel test 9. Prepare recommendations for the use of WMA in California	• Comparison of short term risk of early failure (rutting and moisture damage) between control and WMA mixes for HMA and RAC-G • Comparison of rutting and moisture damage risk between different WMA prouducts • Pilot assessment of WMA construction issues • Pilot measurement of differences in emissions and energy use. • Recommendations for pilot implementation of WMA	5 Construction Practices	B

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	made to design, production and construction procedures? 10. Which projects are most suited to WMA?				
Extended Life Benefits of Pavement Preservation Treatments (PST Leads: Shatnawi; Farnbach where connected to noise performance; D Jones UCPRC PM) Field HVS Expected start date: Spring 08 or after completion of Warm Mix Asphalt project	1. Do pavement preservation (PP) treatments add cost effective life 2. What is relative effectiveness of different types and mix designs of thin overlays and seal coats for PP in controlling wheelpath cracking 3. What is relative effectiveness of placing PP treatment at time of rehab vs after some trafficking	<u>First Experiment</u> 1. Select list of treatments and construct, including control thin HMA; polymer modified HMA; MB-G; MB-D; RAC-G; RAC-O; OGAC; agg seal coat; rubberized agg seal coat; other (cape seal, microsurfacing)? 2. Perform laboratory fatigue and rutting tests on various rubberized asphalt mixes for ME design models. Include effects of binder content and aggregate size 3. Traffic control section to failure, traffic underlying HMA to damage level determined from control section (no cracking) 4. Place PP treatments, permit some aging. Traffic to failure (cracking). May also test several alternative agg seal designs for bleeding performance under slow traffic, hot conditions. <u>Second Experiment</u> 5. At time of Task 3, also place PP treatments on untrafficked thin HMA 6. Traffic to failure (cracking) *This project should be connected to the non-HVS project (O+R) on pavement preservation in terms of experiment design. Best if HVS tests performed on field site (Caltrans or local government) replicates on mainline test section so that noise measurements can be taken on HVS section after trafficking.*	• Comparison of effectiveness of various treatments in terms of life extension under slow heavy loadings. • Comparison of placing PP treatments at time of rehab vs after damage HMA overlay has been damaged by traffic • Recommendations: - Effectiveness of PP treatments in extending cracking life - Mix design of rubberized thin overlays - Agg seal coat design for bleeding - Timing of PP treatment (at rehab or later)	2 Smoothness, 3 Preservation, 8 Recycling	A
New Non-HVS Projects					
Quieter, Smoother, More Durable Pavement Surfaces (PST Leads on	1. What is continued performance of Div of Env Analysis and general QPR sections 2. Based on PPRC 4.16 results, how	1. Continue noise, smoothness and condition survey monitoring of 4.16 sections for third year (23 ES and 52 QP sections), no traffic closures required, update performance models. *Only*	• Long-term performance data for ES and QP asphalt sections, including life of noise	1 PMS, 2 Smoothness, 3	O+R

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Tasks: 1,2-Farnbach, 3,4-Shatnawi 5,6,7-Shatnawi and Farnbach; E Kohler, UCPRC PM)	can mix designs be improved for noise, permeability and durability 3. How do mixes developed in Europe and other states compare with Caltrans mixes 4. How well does performance (smoothness, noise, cracking, rutting) of most promising mixes compare in side-by-side field sections when used for pavement preservation on flexible and rigid pavement 5. What are effects of other pavement preservation treatments on noise, smoothness, surface distresses compared to various HMA types throughout the state? 6. What are the best treatments (traditional and innovative) to economically restore smoothness and quietness to existing road surfaces?	*perform if warranted by results of 1st two years.* 2. Based on results of 4.16 develop several new mix OG mix designs in laboratory, tested for permeability, durability (Hamburg?), noise (impedance?). Evaluate by same means several mixes from Danes/Dutch, results of NCHRP OG study (NCAT). *Next step would be HVS testing or field pilots if lab work successful.*2. 3. Based on results of 4.16 and Task 2 and selection of other PP treatments, identify 6 most promising preservation treatments (4 to 6 flexible, 2 rigid), and apply to 12 test sections following PPSTAG (2 pavement types, 1.5 traffics [high/low for flexible, high for rigid], 2 existing conditions, 2 climates). 4. Characterize materials placed (Caltrans, UCPRC, Chico State). Include control sections. 5. Measure before and after noise, smoothness and condition. *Plan to monitor until failure, and perform LCCA when done. Show annual costs and LCCA costs.* 6. Analyze results, model where applicable, compare extended life with cost 7. Make recommendations for implementation	reduction • New mix designs with better performance, including documentation of mix designs, material specifications, prediction of field noise performance • Improved mix designs for noise and durability of current Caltrans mixes • Side-by-side performance comparison of pavement preservation treatments for asphalt and concrete pavements • Recommendations for best practice for noise, smoothness, durability, cost-effectiveness	Preservation, 4 Quiet Pavement	
Studies to Support Implementation of Enterprise Pavement Management System (M Essex, PST Lead; J Harvey, UCPRC PM)	1. What are the data elements and database architecture required to meet the needs of the Enterprise Pavement Management System? 2. How can data collection be made more efficient, and of higher quality through automation and other means? 3. What are the quantitative benefits of the EPMS?	*Subject to work plan developed by CT and consultant* 1. Meet with CT and consultants and CT IT to advise on existing structure data elements, construction as-built data elements, condition survey data collection needs and equipment/analysis systems. 2. Organize pilots with CT and consultants? GPR, automated condition survey, as-built data gathering, testing database 3. Make recommendations for implementation	• Recommendations regarding data elements • Recommendations for more economical, repeatable and accurate data collection • Assessment of benefits of implementation of improved systems	1 PMS	Q
Caltrans Mechanistic-Empirical Design,	1. Benefits (in terms of cost?) of ME design compared to the current flexible pavement pavement design	*These tasks follow the detailed Caltrans work plan for this project for FY 07/08* 1. Finish field calibration/validation of MEPDG,	• Report detailing the results of field calibration of	6 ME Design	V

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Phase 2: Implementation (B Farnbach, PST Lead; V Kannekanti, UCPRC PM)	method? 2. What improvements are being made in the MEPDG models from version to version. 3. Should rigid catalog be updated based on new version of MEPDG and calibration by UCPRC 4. What is the comparison of CalME and MEPDG flexible module (for both new and rehab designs)? 5. Should Caltrans replace and/or modify existing flexible pavement design method (both new and rehab design procedures) 6. Will other states participate in developing/evaluating/using CalME 7. What are the typical values for various material properties to be used as inputs for various ME procedures	CalME & RadiCAL in summer 07 2. Update the rigid catalog based on field calibration and/or release of new versions of the software 3. Partner with other states to enhance/validate the models in CalME 4. Include features in CalME that would enable CalME to be used when lab testing results are not available 5. Evaluate rehab procedures in the MEPDG (not included in the work plan as of now) 6. Perform comparisons between MEPDG flexible module & CalME for Caltrans decision making 7. Develop a simplied tool for flexible pavement design using either CalME or MEPDG flexible module or both (new and rehab designs?) 8. Case study (test section for CalME)????? 9. Perform laboratory testing on typical materials, try to develop relationships between simple test properties and ME properties, starting from available relationships	MEDPG & CalME • Updated JPCP catalog based on field calibration and may be based on new versions of MEPDG • Memo summarizing the effects of changes in MEDPG versions • A simplified tool for flexible pavement design (new, rehab?) based on ME • Document summarizing the comparision results between MEPDG & CalME, how they are different from current design practice, for both new and rehab designs • Next version of CalME • Library of ME properties for typical Caltrans materials, relationships to simple test properties		
100-Year Concrete Pavements (T Pyle, PST Lead; J Harvey. UCPRC PM)	1. What new concrete pavement design and construction concepts are available and can be implemented in California to extend pavement life to 100 years? 2. Where is 100 yr concrete pavement the most cost-effective option?	*These tasks follow the detailed Caltrans work plan for this project for FY 07/08* 1. Identify candidate project locations. 2. Obtain traffic data. 3. Develop construction schedules using CA4PRS. 4. Assist with Life Cycle Cost Analysis	• Candidate project locations • Traffic data projections • Construction schedules • Life cycle cost analysis	7 Long-Life Pavement	Z
Version 2 of Manual for Caltrans Life Cycle Cost Analysis (B Farnbach, PST Lead; EB Lee UCPRC PM)	1. What are more accurate maintenance and rehabilitation schedules and cost data than the preliminary tables in current version? 2. How can calculations and table look-ups be coded into easier to use software?	1. Update life cycle tables and add additional treatments and widening with performance data from other studies 2. Update cost data where available 3. Develop spreadsheet for traffic/construction productivity calculations and M&R table look-up and integrate into RealCost (with FHWA)	• Improved information in the Caltrans LCCA manual • Easier to use procedures to save time and reduce errors • Training	1 PMS, 6 ME Design, 7 Long Life pavements	II

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	3. How can changes be coded directly into RealCost? 4. How can effective training be provided to Caltrans users through case studies and on-line training?	4. Integrate components into RealCost with FHWA 5. Assist Caltrans with implementation, including case studies 6. Develop on-line training			
Continuing non-HVS Projects					
2.4.2 "Pulverization" -- Deep in-situ recycling (DISR) using recycled AC as unbound base: field and laboratory testing (T Bressette, PST Lead; B Steven, UCPRC PM)	1. What is field performance of pilot projects built up to 2006? 2. What are the ME design properties of pulverized AC, measured in the field over several years, and in the laboratory under various conditions, including lime treatment? 3. Should preliminary gravel factor be updated based on newer data? 4. What is the life cycle cost compared to alternative strategies?	1. Complete last round of field monitoring summer 07. 2. Complete analyses of field and laboratory data, and update ME analysis and gravel factor in summer 07. 3. Complete life cycle cost analysis based on predicted performance from first two tasks in fall 07.	• Updated gravel factor • ME design data for materials • Recommendations for strategy selection based on life cycle cost analysis	8 Recycling	
4.6 Development of Rehabilitation Construction Productivity Analysis Products 4.6A: CA4PRS 4.6B: CWZ Traffic (4.6A: B Farnbach, PST Lead; 4.6B: C Suszko, PST Lead; EB Lee, UCPRC PM) *Much of this work is funded through pooled fund studies*	Overall questions: 1. What are realistic construction staging plans for urban rehab projects? 2. Are schedule estimates for the PS&E packages realistic based on resource constraints? New questions: 3. How can CA4PRS be extended to consider road user cost? 4. How can CA4PRS be extended to consider widening and interchange rehabilitation? 5. How to develop comprehensive TMP for rehab projects in compliance with new FHWA rules?	1. Complete CA4PRS V 2.0 to include traffic delay and add road user cost and cost modules 2. Complete CA4PRS V2.5: Widening and interchange modules. 3. Collect data in the field and use to develop strategies to reduce the impact of construction work zones on traffic flow 4. Continued interaction with AASHTO and other state DOT groups through pooled fund projects and other activities	• CA4PRS software enhancements in Versions 2.0 and 2.5 • Outreach and implementation to districts and other agencies • CWZ capacity estimate model	5 Construction Practices	
4.12 Development of Mix and Structural Design and Construction	1. Is DISR an appropriate technology for California? 2. What factors are important for project selection (project selection	1. Review national and international status of DISR research and implementation 2. Undertake a mechanistic sensitivity analysis to identify appropriate applications	• ME materials and structure data • Performance evaluations of pilot projects	8 Recycling	

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Guidelines for Deep In-Situ Recycling (DISR) of Cracked Asphalt Concrete as Stabilized or Unstabilized Bases (T Bressette, PST Lead; D Jones UCPRC PM)	guide)? 3. What factors are important for rehabilitation design using DISR (structural and mix design guides)? 4. What factors are important for construction on DISR projects (construction guide)? 5. What are the potential advantages (eg cost savings, environmental) of using DISR vs conventional rehabilitation?	3. Assess projects constructed in California 4. Assess planned projects (pre construction, construction, post construction) 5. Undertake laboratory testing to identify key variables in mix design 6. Prepare project selection guidelines 7. Prepare mix design recommendations 8. Prepare structural design recommendations 9. Prepare construction recommendations	• Mix design, structural design, construction recommendations		
4.14 Innovative Contracting Methods For Transportation Infrastructure Rehabilitation/ Reconstruction 4.14A: Warranty 4.14B: Incentives (C Suszko, PST Lead; EB Lee UCPRC PM)	1. What projects should include a warranty and which should not? 2. How long should the duration of the warranty be, and what should the warranty cover? 3. How much Incentive/Disincentive is most appropriate to encourage contactors yet not waste agency budget?	1. Literature review for innovation contracting methods. 2. Warranty project evaluation based on pavement performance estimate from historical PMS data and warranty cost calculator. 3. I/D evaluation to balance road user cost and agency budget (time-cost trade-off) 4. Evaluation procedure for estimate of A (cost)+B(schedule) contract	• A procedural framework and an engineering model for a warranty project evaluation in bid stage • A procedural framework and an engineering model for an I/D project for the PS&E package • Implementation and outreach	5 Construction Practices	
4.15 Life Cycle Cost Analysis in Network Level Strategy Selection (B Farnbach, PST Lead; EB Lee UCPRC PM)	1. How to do LCCA and with what kind of tools? 2. Which rehab strategies selected on the project level are the most economical? 3. Where are LLPRS projects more economical than other strategies using new LCCA procedures? 4. What are the network lvel consequences of not investing in pavement preservation due to budget constraints?	1. Develop analysis framework that can help determine the optimal investment stream at the corridor and network level, maximizing total net benefits under budgetary constraints. 2. Develop multi-year investment analysis procedure that determines the best allocation of funding among programs for roadway preservation.	• Analysis framework • Investment analysis procedure	1 PMS, 7 Long Life Pavement	
4.16 Investigation of Improved Open Graded Mix	1. Which of the current Caltrans asphaltic treatments (open-graded, rubberized open-graded, rubberized	*Most of the approved work is expected to be completed before the end of June 07. The remaining work should be:*	• Final project report answering the questions. • Recommendations for	2 Smoothness, 4 Quiet	

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Designs (flexible part of Caltrans Quieter Pavement Research plan) (B Farnbach, PST Lead; E Kohler, J Signore, UCPRC PM)	gap-graded, dense graded) are performing the best in terms of noise, friction, distresses? 2.Does the answer depend on traffic or rainfall influence? 3. How long does the noise reduction last for these pavement types? 4. Can the On-Board Sound Intensity (OBSI) levels be predicted knowing pavement materials, surface condition, and climate/traffic? 5. Is impedance measured in the lab correlated with OBSI measured in the field?	1. Final analysis and report writing of main objectives (field work scheduled for March-May 07, may be delayed by weather) 2. Specific second-level analysis of data not directly associated with tire noise, like pavement friction and smoothness outside initial scope, if requested by Caltrans.	implementation. • Recommendations for Phase 2, development of new mixes (*scope of work included in Project O+R described above*).	Pavement	
Following Projects Dependent on Funding from Division of Environmental Analysis (to be determined after delivery of UC Davis report in April, 2007					
Performance of Pervious Pavement Designs Under HVS Loading (B Farnbach, PST Lead; J Signore/B Steven UCPRC PM) UC HVS at new Davis site Expected start date if funded by DEA: Summer 08 After 9 months of lab work	1. Can pervious pavement designs withstand heavy truck traffic 2. Can pervious pavement designs achieve zero runoff from the pavement structure 3. What are the failure mechanisms of permeable pavement under heavy vehicle traffic at varying speeds 4. What are construction difficulties for pervious pavements 5. Can recycled materials (such as waste PCC) can be used in pervious pavements. *This HVS project to proceed after completion of laboratory portion of non-HVS Project P, described below). This project contingent on Div of Env Analysis participating in funding*	1. Build HVS test sections for 6 concept pavements and instrument for stormwater runoff 2. Include 2 subgrades e. Test at two temperature is asphalt surface (20/50C), one if concrete 3. Perform HVS tests with water applied to pavement surface (6 x 2 x 1.5 = 18 tests) *HVS tests to be performed at UCD HVS test site*	• Comparison of structural capacity under narrow range of conditions, and mechanism of failure • Determine effectiveness in capturing stormwater for different subgrades and designs • Verification data for flow models • Evaluation of constructability for moving to pilots on UCD campus • Recommendations for implementation of pervious pavement structures for different traffic, subgrade, rainfall conditions	Stormwater Best Practices, 5 Constructio n	
Pervious Pavements (if HVS test using other funds moves	1. What are the flow and ME design properties of pervious concrete slab conceptual designs developed by UCPRC?	1. Lab testing of pervious concrete slab shoulder designs for strength and flow 2. Lab testing of pervious pavement materials for ME design properties, flow, storage capacity	• Optimization of pervious concrete slabs for drainage and strength • Design properties for	Stormwater Best Practices, 5 Constructio	P

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ahead, then include with it) (B Farnbach, PST Lead; J Signore, UCPRC PM) *This work plan to be updated based on results of TO16 project with Div of Environmental Analysis. Work on this project contingent on DEA participation in funding*	2. What are the ME design, flow and storage properties of pervious materials, including recycled materials such as PCC plant waste. 3. What are the final designs for HVS test sections based on preliminary designs to be completed with DEA funding? 4. What is the performance of these designs in full-scale sections placed on the UCD campus and subjected to heavy vehicle traffic?	3. Final designs of HVS and UCD test sections 4. Testing of materials from test sections 5. Design and monitoring of full-scale sections built on UCD campus. 6. Analyze results 6. Make recommendations for implementation	pervious pavement materials • Recommendations for design • Recommendations for use of recycled materials in pervious pavements.	n	
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NOTE: PST# = Pavement Steering Committee Objective Number:
1. Pavement Management System
2. Smoothness
3. Preservation
4. Quiet Pavements
5. Construction Practices
6. Mechanistic-Empirical Design
7. Long Life Pavements
8. Recycling