Table 2 Relation of CAL/APT and PPRC Investigations to Caltrans Clients

Study	Caltrans Programs					
	Design	**Materials**	**Construction**	**Maintenance**	**Districts**	**Strategic Planning Goals ***
1. Fatigue performance	• Input to structural design procedure; thicker AC for higher TI's. • Use of "rich" bottom AC in pavement sections	• Input to improved AC mix design	• Emphasis on improved compaction and AC thickness control	• Emphasis on improved compaction and AC thickness control	• same for District as well as HQ programs	• Reliability • Safety
2. HVS tests (4): drained and undrained sections; dry conditions. Goal 1	• Basis for M-E structural pavement design to mitigate AC fatigue cracking and rutting contributed by untreated materials in structural section	• Input to improved AC mix design	• Emphasis on improved compaction in AC and the use of tack coats between AC lifts	• Emphasis on improved compaction in AC and the use of tack coats between AC lifts	• Emphasis on compaction and use of tack coats	• Reliability • Safety
3. Asphalt treated permeable base laboratory study (Phase of Goal 1)	• Rethink use of ATPB directly under AC surface course; possible elimination of requirement for use	• Modify mix design criteria for ATPB: - increase binder content - use modified binder		• Continued maintenance of drainage systems to prevent water standing in ATPB	• Maintenance of ATPB drainage essential	• Reliability • Safety
4. Tire pressure study using 3-D stress sensor (VRSPTA)	• Input to M.E. design procedure	• Input to AC mix design procedure				
5. HVS tests (10); mix rutting at elevated pavement temperatures Goal 3	• Wide base single tires result in increased rutting in AC	• AC mix design should reflect effects of wide-base tires if a significant proportion of truck traffic	• Improved compaction necessary to mitigate rutting at high temperatures in AC.	• Use of 2 to 1 equivalency for ARHM-GG has to be carefully applied in maintenance applications	• Monitor usage of wide-base single tires in District pavements because of potential for increased AC rutting.	
6. HVS tests (4); two rehabilitation strategies DGAC and ARHM-GG Goal 3	• Need to develop improved overlay design methodology for AC pavements since cracking is reflection from existing cracks	• Develop methods to mitigate reflection cracking in overlay design for cracked AC pavements	• Improve compaction requirements for DGAC and ARHM-GG mixes used in overlays	• 2 to 1 equivalency of ARHM-GG to DGAC satisfactory as long as initial pavement has adequate thickness to mitigate rutting from untreated pavement components	• 2 to 1 equivalency of ARHM-GG to DGAC satisfactory as long as initial pavement has adequate thickness to mitigate rutting from untreated	• Reliability • Safety • Transit

	rather than fatigue				pavement components	
7. HVS tests (3) drained and undrained sections; wet conditions Goal 5	• Reevaluate the use of ATPB directly beneath AC layer. If used, require filter fabric between ATPB and AB.	• If ATPB is used, develop improved mix design recommendations	• Use filter fabric between ATPB and AB • Use increased binder content in ATPB	• Maintain drainage systems to preclude water standing in ATPB	• Use filter fabric between ATPB and AB • Maintain drainage systems	• Reliability • Safety

* Department Strategic Planning Goals: 1) Reliability; 2) Delivery; 3) Safety; 4) Transit; 5) Occupancy

Study	Caltrans Programs					
	Design	**Materials**	**Construction**	**Maintenance**	**Districts**	**Strategic Planning Goals ***
8. Comparison of AASHTO and Caltrans design methods	• Move to ME pavement design procedure for AC pavements • Require greater thicknesses of AC for TI's > 11	• Develop guidelines for thicker AC pavements for TI's > 11 within current design procedure			• Use greater thicknesses of AC for TI's > 11	• Reliability • Safety • Transit
9. I-710 Freeway rehabilitation; mix and structural pavement designs – LLPRS	• Move to ME design for LLPRS	• Evaluate use of RSST-CH for mixes containing modified binders • Change requirements for mix design for LLPRS with AC mixes	• Improve compaction requirements for all components of AC pavements; • Base AC compaction control on ASTM-D2041	• Evaluate surface courses used for new LLPRS; replace at appropriate times to insure continued performance	• Improve compaction requirements for all components of AC pavements; • Base AC compaction control on ASTM-D2041	• Reliability • Safety • Transit • Occupancy
10. Pay-factor study, QC/QA-asphalt concrete	• Performance models used in pay factor determinations can be used in ME design procedures for new and overlaid pavements	• Consideration required for QC/QA evaluation, including: - lot size - no of samples - daily vs. total project pay factors, etc.	• Provides performance-based measure of the relative importance of asphalt content degree of compaction, aggregate gradation, and AC thickness and their combined effects on pavement performance	• Provides performance-based measure of the relative importance of asphalt content degree of compaction, aggregate gradation, and AC thickness and their combined effects on pavement performance	• Initially perform shadowing studies to compare new pay factor approach with current procedure	• Reliability • Delivery
11. Fatigue parameter, PG binder specifications (Initially Materials group is the client; eventually the other groups, if and when the PG system is adopted, will also become clients.)		• Evaluate use of PG binder specifications with changed fatigue requirement for adoption by Caltrans				• Reliability

Study	Caltrans Programs					
	Design	**Materials**	**Construction**	**Maintenance**	**Districts**	**Strategic Planning Goals ***
12. HVS tests (22) FSHCC test sections at Palmdale, CA, SR14; evaluate new material as well as concrete pavement design options to LLPRS Goal 4	• For long-life concrete pavement design incorporate use of dowels and tied shoulders; establish different joint spacings and recommendations for non-erodable bases for different climatic regions in California.	• Reconsider use of FSHCC for long-life pavements; • Increase flexural strength requirements of conventional PCC for pavement design purposes	• Implement changed construction practices reflected by changed design requirements		• Expand use of dowels in concrete pavement rehabilitation projects • Use higher flexural strength concrete (e.g. 650 psi vs. 550 psi strength)	• Reliability • Safety
13. Long-term durability of concrete mixes considering sulfate resistance and ASR Phase of Goal 4 (and 9)	• Reevaluate use of FSHCC for reinstructional rehabilitation with construction windows longer than 10 hours	• Fast setting hydraulic cements (FSHC) may be susceptible to sulfate attack; contractor provide evidence that mix with FSHC is sulfate resistance. • ASR screening should be required for FSHCC.	• Enforce sulfate resistance and ASR guidelines developed by Materials	• For slab replacement using FSHCC require evidence of sulfate resistance and ASR resistance	• For slab replacement using FSHCC require evidence of sulfate resistance and ASR resistance	• Reliability • Safety
14. Shrinkage and environmental effects on the performance of FSHCC pavements at Palmdale, CA Phase of Goal 4	• Evaluate use of shorter joint spacings and use of asphalt concrete bases in hot climates for concrete pavements • Consider more extensive use of dowels and tie bars to reduce environmental effects	• Prepare applicable shrinkage requirements for all concrete mixes used in pavements				• Reliability • Safety

Study	Caltrans Programs					
	Design	**Materials**	**Construction**	**Maintenance**	**Districts**	**Strategic Planning Goals ***
15. Evaluation of proposed LLPR Strategies for rigid pavements; design and constructability considerations	• Develop suitable joint spacings for the climatic regions identified in Study 18b. • Include the use of dowels for TI's > 10 • Increase flexural strength requirements for concrete • Prepare guidelines for non-erodable base selection as a function of climatic regions	• Prepare guidelines for higher flexural strength concrete for pavement use	• Prepare suitable construction guidelines for dowel placement at the time of construction	• Develop guidelines for effective joint sealing	• Use dowels in new and reconstructed pavements for TI's > __ • Use increased flexural strength in concrete (eg. 650 psi MR)	• Reliability • Safety • Transit • Occupancy
16. Constructability analyses for Long Life pavement construction	• Evaluate constructability analyses results in the project design phase	• Develop suitable materials specifications and temperature requirements for long life pavement construction	• Use constructability analysis program for all long-life freeway rehabilitation projects		• Use constructability analysis program in all freeway rehabilitation projects	• Delivery
17. Computer program (MultiCool) for deforming pavement temperatures during AC placement			• Provide contractors with MultiCool program for AC placement	• Provide contractors with MultiCool program for AC placement	• Provide contractors with MultiCool program for AC placement	• Delivery
18. Mechanistic-empirical pavement design and performance-based mix design and analysis	• Implement new pavement design and rehabilitation methodologies for both AC and concrete pavement systems	• Implement AC mix design procedure (using shear test) and stiffness/modulus characterization for pavement components			• Follow Headquarters Design and Materials lead in implementing new design and materials evaluation procedures	• Reliability • Safety • Transit • Occupancy

Study	Caltrans Programs					
	Design	**Materials**	**Construction**	**Maintenance**	**Districts**	**Strategic Planning Goals ***
19. Performance characteristics of compacted untreated granular materials	• Incorporate stiffness/modulus characteristics of representative materials into new pavement design and rehabilitation methodologies	• Develop standard procedures which can be used by Districts as well as headquarters for measuring granular material properties • Prepare improved specifications for controlling the characteristics of granular materials • Replace CTM 216 with Mod. AASHTO comp. procedure (T-180)	• Implement improved compaction requirements for untreated granular materials	• Implement improved compaction requirements for untreated granular materials	• Implement improved compaction requirements for untreated granular materials	• Reliability • Safety
20. Non-destructive monitoring of water contents in untreated components of existing structural pavement sections		• Determine feasibility of the use of ground penetrating radar for defining the in-situ water contents of in-place materials as a part of the pavement evaluation process				• Reliability
21. Studies related to Caltrans pavement management systems (PMS)				• Implement changes to *Caltrans Pavement Survey Manual* • Implement recommended modifications to data base structure and to data collection methodology		• Reliability
23. Assessment of economic benefits from implementation of findings from CAL/APT program	• Include “rich bottom layer” in thick AC pavement design methodology		• Increase AC compaction requirements • Use tack coat between AC layers	• Increase AC compaction requirements • Use tack coat between AC layers	• Increase AC compaction requirements • Use tack coat between AC layers	• Reliability • Safety

Study	Caltrans Programs					
	Design	**Materials**	**Construction**	**Maintenance**	**Districts**	**Strategic Planning Goals ***
25. Dowel bar retrofit of rigid pavements			• Implement dowel bar retrofit program on existing high trafficked concrete pavements	• Implement dowel bar retrofit program on existing high trafficked concrete pavements	• Implement dowel bar retrofit program on existing high trafficked concrete pavements	• Reliability • Safety • Occupancy • Transit
31. Implementation projects						
d. Use of RAP for stabilized unbound bases and subbases	• Include provision in design manual for use of RAP as base or subbase	• Develop specifications for the use of RAP as base or subbase - Untreated - Stabilized with foamed asphalt	• Work with Districts to implement the use of RAP in reconstructed pavements	• Implement the use of RAP in maintenance operations	• Implement the use of RAP in maintenance and rehab. operations	• Reliability
e. Chip seal specifications		• Develop new chip seal specifications based on South African technology	• Implement improved chip seal construction practices	• Implement improved chip seal construction practices	• Implement improved chip seal construction practices	• Reliability • Safety
f. Dynamic cone penetrometer		• Develop guidelines for use of dynamic cone penetrometer for use by District Personnel			• Implement the use of the dynamic cone penetrometer in both new construction and existing pavement evaluation	• Reliability
g. Use of Rapid Compaction Control Device (RCCD)			• Prepare guidelines for use of RCCD		• Implement use of RCCD	• Reliability