

APPENDIX A

RESIDENT ENGINEERS PACKET



Rubberized Asphalt Concrete (RAC) Warranty Pilot Projects: Information Packet for Resident Engineers



State of California Department of Transportation

Office of Pavement Standards
Materials Engineering and Testing Services-MS #5
5900 Folsom Boulevard
Sacramento, CA 95819-4612

November 6, 2002

TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	OBJECTIVES OF PILOT PROJECTS	1
3.0	EXPECTED DELIVERABLES	2
4.0	PROJECT SELECTION	2
5.0	SPECIFICATION SUMMARY	3
5.1	SSP 39-485 RUBBERIZED ASPHALT CONCRETE (WARRANTY)	3
5.2	SSP 39-849 WARRANTY	4
6.0	PRE-CONSTRUCTION MEETING	5
6.1	PARTICIPANTS	5
6.2	PROJECT DOCUMENTS	6
6.3	OBJECTIVES AND ISSUES TO BE ADDRESSED	6
7.0	PARTNERING	7
8.0	DATA COLLECTION PLAN AND EVALUATION	8
8.1	RESPONSIBILITIES	8
8.2	CONTRACTOR QUALITY CONTROL (QC) PLAN REQUIREMENTS.....	9
8.3	DATA COLLECTION REQUIRED.....	10
8.3.1	Pre-construction	11
8.3.2	Mix Design and Laboratory Testing Phase	12
8.3.3	Construction.....	12
8.3.4	Post Construction (As-Built).....	15
8.3.5	Annual Monitoring.....	15
9.0	EVALUATION PLAN	16
9.1	EXPECTED OUTCOMES.....	16
9.2	REPORTING.....	16

APPENDIX A: Data Collection & Evaluation Task Breakdown

APPENDIX B: Sample Forms

- B-1 AC Production/Placement Checklist, side 1
- B-2 AC Production/Placement Checklist, side 2
- B-3 Test Result Summary
- B-4 Assistant Resident Engineers Daily Report

LIST OF TABLES

Table 1: RAC Warranty Pilot Projects

LIST OF FIGURES

Figure 1: Example Asphalt Rubber binder Viscosity Testing Log

1.0 INTRODUCTION

Congratulations! Your district will be participating in one of the pilot warranty projects included in the Rubberized Asphalt Concrete (RAC) Evaluation Program. This information packet is intended to help make your job easier by providing an overview of the objectives of the program, information on data collection and testing needs for these pilot projects, and the additional resources that will be available to assist you during construction and subsequent performance monitoring of the warranted pavements.

The pilot projects may include rubberized materials that are unfamiliar to you and your district forces. The specifications have been opened up to allow a wide range of rubberized paving products as long as they include at least 15% scrap tire crumb rubber modifier (CRM) by total mass of binder. Candidate products include asphalt rubber and rubber-modified binder (RMB), or other rubber modified asphalt binder materials that may be produced in the field or at a terminal. The pilot project specifications also allow use of the “dry process” which treats the crumb rubber modifier (CRM) as an aggregate and adds it dry to the mixing unit at the AC plant. The contractor may choose to use either a dense or gap-graded mixture gradation (RAC-D or RAC-G).

Caltrans Materials Engineering and Testing Services (METS) will sample and test construction materials (binder and RAC mix) for the sole purpose of relating material properties to the pavement performance. This sampling and testing is not intended to replace Caltrans normal QA sampling and testing. METS personnel will have no official status on these projects, but are tasked to provide a wide range of technical support to your district personnel as needed. The METS personnel will need some help from the Project Engineer and Project Manager to access various project documents, contractor submittals, and other pertinent information collected by Caltrans such as FWD data used in the structural design, and scheduling notification.

2.0 OBJECTIVES OF PILOT PROJECTS

The Department has initiated selected pilot projects for roadway maintenance/rehabilitation that contain specifications for RAC and include a warranty on the rubberized material and workmanship. These projects are all to be constructed in the 2002 or 2003 construction season. All projects will include a warranty specification. However, the duration will be dependent on the funding program; CapM projects will be warranted for 3 years, and rehabilitation projects for 5. The purpose of these projects is to provide a “level playing field” for all rubber-modified mixtures that contain a minimum of 15% scrap tire rubber by total mass of binder. These may be constructed using the “wet process” (asphalt rubber or MB), “terminal blend” (MB or other), or dry process. No corresponding control sections will be laid. The plan envisages a three to five-year post construction data collection and evaluation phase, depending on the type of project.

The major variables that influence pavement field performance include:

1. Resistance to load related and reflective cracking.
2. Resistance to rutting and shoving.

3. Resistance to aging, raveling, and other types of disintegration failure mechanisms such as potholing and delamination.

These are the primary distresses that will be used to assess performance of these pilot projects under the warranty.

3.0 EXPECTED DELIVERABLES

The expected deliverables from these pilot projects are as follows:

4. Performance assessment of the various RAC products over a 3 to 5-year period, depending on the project.
5. Comparison of different rubber addition methods, in terms of performance and cost effectiveness.
6. Determination of the efficacy of the warranty specification and the resulting process.

4.0 PROJECT SELECTION

The selection criteria used to identify candidate projects are given below:

7. Projects have been designed based on Caltrans pavement design practices, deflections and half thickness criteria for rubberized asphalt concrete.
8. Projects are of sufficient size to ensure that problems that might arise in start up have time to be resolved.
9. District must be willing to “volunteer” the project as a part of the 2002 or 2003 construction program.
10. Project sites do not have extensive pavement failure that could result in extensive corrective actions not anticipated by the contractor.

Table 1 presents the projects currently planned for the 2002 and 2003 construction season. Some changes in scheduling may occur, and other projects may be added.

Table 1: RAC Warranty Pilot Projects

EA	Co-Rte. PM	Program	Warranty Period
02-258501	Las-395-19.0/39.9	REHAB	5 yr
04-0C6201	Sol-113-0.0/29.6	CapM	3 yr
06-343531	Fre-33-100.0/111.7	REHAB	5 yr

07-105481	Ven-150-24.4/38.6	REHAB	5 yr
08-482301	Sbd-247-46.1/78.1	CapM	3 yr
10-0A5801	Mer-140-27.0/30.2	REHAB	5yr
11-230101	SD-75-11.0/17.40	REHAB	5yr

5.0 SPECIFICATION SUMMARY

Two new standard special provisions (SSP) are fundamental to the proposed pilot projects. These essentially shift most of the risk to the Contractor, which may result in significant increases in bid prices. Major aspects are summarized below.

5.1 SSP 39-485 RUBBERIZED ASPHALT CONCRETE (WARRANTY)

Rubber-modified asphalt binder: Must contain a minimum of 15 percent scrap tire crumb rubber (CRM) by mass of the combined mixture of scrap tire rubber and paving asphalt. The specification allows for, but does not require addition of asphalt modifier (extender oil) or high natural CRM. The binder may be field or terminal blended and there are no physical properties specified for the finished binder. Binder producers must disclose the amount of scrap tire CRM and other rubber types included in the binder, but are not required to submit full formulation information because some terminal blends are proprietary. However, information such as binder mixing times, mixing temperature(s) and maximum holding times must be provided, along with appropriate Material Safety Data Sheets.

CRM: Source must be scrap tires (whole tire or buffings), although it is permitted to add high natural CRM from another source. However, the high natural rubber does not count towards the minimum 15 percent scrap tire requirement. CRM must meet existing limits for fabric and wire contaminants, but gradation and chemical composition limits are not specified.

Rubberized Asphalt Concrete – RAC (W): “Except as provided in these special provisions, the Contractor shall decide all questions which may arise as to the quality of materials furnished and work performed with regards to rubberized asphalt concrete except areas which create a condition hazardous to traffic. Finished surface workmanship shall meet the requirements of these special provisions.” This clause outlines that the Contractor will be allowed to make most of the decisions, unless it directly affects the safety of Caltrans workers or the traveling public. This is in keeping with the long-term warranty concepts.

Caltrans provides “Materials Information” as part of the bid packet, including pavement condition report information, TI for design years, IRI data (as a product of profiler readings through the site) and deflection testing results with rehabilitation design information and calculations.

Contractor submits to the Engineer locations and methods of repairs to the existing pavement in preparation for overlaying, including layer thicknesses, materials samples and mix design calculations for the repair mixes (either conventional or RAC). Since the contractor will warranty the RAC surface for 3 or 5 years, the contractor may want to perform repairs to the existing surface to diminish the long-term risk.

Any modifications to the plans by the Contractor (for the sole purpose of meeting the Warranty performance criteria) must be submitted in writing with working drawings, design calculations and supporting data to the Engineer for approval. However, there is no additional compensation for any work or materials resulting from such modifications. Any changes the contractor makes are at the contractor's expense and should have been considered in the unit cost of the RAC (Warranty).

The top surface of the uppermost layer of rubberized asphalt concrete shall be profiled, in the presence of the Engineer, using a California Profilograph or equivalent in conformance with California Test 526 and as specified in the special provisions.

Product start-up evaluation testing includes evaluating percent air voids in the RAC mixture in conformance with CT 309.

5.2 SSP 39-849 WARRANTY

11. Contractor is to warranty materials and workmanship of the RAC for 5 years for a rehab project and 3 years for CapM, and to repair defects identified during the warranty period in conformance with the special provisions.
12. If work is suspended for more than 120 days, the Contractor may request in writing that a separate warranty period be established for the portion of RAC work already completed, but no more than one separate warranty period will be allowed.
13. The successful bidder accepts the existing pavement "AS-IS" with no exclusions to the contract. It is the Contractor's option to make modifications and repairs to the existing pavement, but only at no additional cost to the State.
14. Performance criteria are listed and clearly defined in this SSP. Performance criteria include:
 - o Rutting deeper than 6 mm.
 - o Raveling.
 - o Flushing resulting in coefficient of friction less than 0.30 per CT 342.
 - o Delamination.
 - o Cracking (longitudinal, transverse or alligator) greater than 3.0 mm wide.
 - o Potholes.
15. The Engineer will decide all questions that arise as to the performance of the RAC (Warranty) during the warranty period and as to the acceptable fulfillment of the warranty, in conformance with the provisions in Section 5-1.01, "Authority of the Engineer," of the Standard Specifications.
16. Repair requirements for the respective distresses/defects are defined and described in detail in this SSP. Repairs will be made by customary repair methods. The Engineer may approve alternate materials and methods that are considered equal or better. However, no alternative to removing the full depth of the RAC (Warranty) will be allowed.

17. If the total length of repairs, measured along the lane line, exceeds 30 percent of any one-kilometer length of any lane or shoulder, the Engineer may require that an additional 30 mm of RAC shall be placed on all lanes and shoulders of that 1-kilometer length. However if any continuous areas greater than or equal to 300 m long within that length do not have or need repairs, the additional layer need not be applied to those areas.
18. After the Engineer notifies the Contractor of needed repairs, the Contractor has 60 days (subject to weather conditions) to complete repairs, unless pavement conditions become hazardous to traffic. If a hazard is created, the Contractor must make temporary repairs within 2 days, and the work must be completed within 3 days after notification.
19. If the Contractor does not make the required repairs within the time allowed, the Engineer can have the repairs made and bill the Contractor accordingly.

6.0 PRE-CONSTRUCTION MEETING

Pre-construction meetings are considered essential to ensure a successful project. The meeting provides an opportunity for all parties involved in the project to verify individual and group understanding of the project requirements, respective roles, responsibilities, authorities, and to resolve as many issues relating to warranty and performance evaluation as possible before the work begins. The team from Materials Engineering and Testing Services (METS) who participated in developing the specifications should attend in the pre-construction meeting. It is important that participants come prepared and be familiar with the project plans, specifications, and respective work items and assignments so that these can be discussed in detail as needed. At least four hours should be set aside for the RAC (Warranty) and Warranty provisions.

6.1 PARTICIPANTS

All stakeholders in the project should be represented.

20. Caltrans District personnel including RE, District Materials Engineer (DME) and inspectors for AC plant and field construction operations.
21. METS (who participated in developing the specifications and guidelines) and METS testers and inspectors.
22. Contractor personnel representing prime contractor, hot-mix producer, rubber-modified asphalt binder producer/supplier and other subcontractors as appropriate, and HMA plant and paving construction superintendents or foremen.
23. Consultants and QC personnel hired by the Contractor/Producer.

6.2 PROJECT DOCUMENTS

These describe the work required to fulfill the contract and the criteria for acceptance and payment. All parties should carefully review all project documents for conflicts, omissions or errors in order to resolve such issues before work starts. In general, this order of precedence of project documents includes:

24. Special Provisions.
 - o SSP 39-485 Rubberized Asphalt Concrete (Warranty).
 - o SSP 39-849 Warranty.
25. Plans.
26. Related addendums.
27. Standard Specifications (if they will apply).
28. Caltrans Construction Manual (Chapter 6).

6.3 OBJECTIVES AND ISSUES TO BE ADDRESSED

It is useful to have an agenda for the meeting, but make sure that it allows for other items to be included as needed. Topics to be discussed should include, but are not limited to, the following items:

29. Identify roles, relationships, authority, and responsibilities of all of the project participants.
30. Establish communications and reporting procedures and designate appropriate contacts.
31. Discuss partnering arrangements.
32. Identify METS data collection activities and coordination with RE and Contractor.
33. Review project scope.
34. Identify unusual aspects, such as peculiar geometry, special drainage requirements, hauling issues, access constraints, climatic conditions (cold, wet, and fog) and so on.
35. Review project documents and order of precedence.
36. Ask questions as needed to clarify meaning and intent of the project documents and express any related concerns.
37. Identify expected performance and how it will be measured (these are described in detail in SSP 39-849 Warranty, in the Appendix).
38. Work out schedules for materials and paperwork submittals and responses (aggregate sources, binder and mix designs, contractor(s) QC plans, and so on).
39. Identify types of project records required – logs, diaries, daily reports, HMA test results (physical characteristics, in-place density), and so on.
40. Review data collection plans and forms, identify coordinators, contacts, department and contractor personnel involved and responsibilities.

41. Verify sampling and testing frequencies, test methods, and procedures for addressing failures.
42. Clarify site preparation requirements and verify plans, methods and materials.
43. Identify equipment and operations to be used for binder manufacture and transfer into HMA plant, and hot mix production, hauling, placement and compaction.
44. Present paving plan, including number of haul trucks, haul distance, and tarp use, width for each pass and longitudinal joint locations.
45. Coordinate progress schedules for work items including proposed RAC production and placement rates.
46. Identify plant location (rubber-modified asphalt binder and hot mix plant locations may differ).
47. Discuss details of production start up evaluation (test strip construction).
48. Arrange for the Resident Engineer or designated representative to observe binder production equipment and operations before (if terminal blend) or during all phases of binder production.
49. Set deadlines and turn-around time for reporting plant and field test results.
50. Discuss safety issues, designate Contractor Safety Officer, and present traffic control plans.
51. Define dispute resolution procedures.
52. Establish methods of maintaining communication during construction.
53. Determine means and methods for maintaining communication during the warranty period.
54. Establish document control and authority procedures.
55. Other items to be added as needed.

7.0 PARTNERING

The Engineer and Contractor for these pilot RAC projects are encouraged to use the partnering process. The overall purpose of partnering is to form a non-adversarial relationship between the Department and the Contractor to promote successful completion of the contract to the benefit of both parties. Typical goals of partnering agreements are to complete the work:

56. On time.
57. At cost.
58. With minimal conflicts.

Caltrans Special Provisions (SSP 5-150) further state that the purpose of the partnering relationship is “to maintain a cooperative communication and to mutually resolve conflicts at the lowest responsible management level.” Partnering agreements can be used to establish what types of decisions can be made at the respective levels of project management, from inspector/foreman to RE/Project Manager, and to establish response deadlines for various types of situations that may arise during pavement construction.

Warranty projects present special circumstances for all parties involved and may provide a special opportunity for partnering. Department inspection and oversight requirements are quite different when the Contractor accepts most of the risk and provides its own QC. Experience with warranty projects is likely to be limited for all parties, and a cooperative approach may be helpful for all parties involved.

The data collection requirements for these pilot projects bring METS into the partnering picture. METS will need to make arrangements with District personnel and establish lines of communications and coordination for the following items:

59. To assure that necessary material samples are safely obtained and stored until they can be transported for laboratory testing.
60. Assistance with traffic control when conducting core sampling, nuclear density testing or visual condition surveys.
61. To obtain pertinent information regarding job scheduling, materials placement and other project events that may be useful for the analysis of these projects.

This sampling and testing are solely for information for the performance evaluation and shall in no way replace Caltrans normal Quality Assurance (QA) sampling and testing.

8.0 DATA COLLECTION PLAN AND EVALUATION

METS personnel will generally be responsible for data collection and management for:

62. Long-term evaluation of the RAC warranty specifications.
63. Evaluation of long-term pavement performance.

The METS engineers and technicians will need the cooperation and assistance of both Department and Contractor personnel in collecting the necessary information and sampling materials for subsequent testing and characterization.

8.1 RESPONSIBILITIES

Although these Warranty Projects fall under the umbrella of non-QC/QA projects, some quality assurance testing will need to be performed by Caltrans (see Chapter 6 of the Caltrans Construction Manual). This will ensure the contractors ability to conform to their own mix design and allows for evaluating uniformity of production.

Responsibilities will be as follows:

64. **METS Coordinator (Terrie Bressette):** Will review all plans for supplemental inspection and testing.
65. **METS Support (Mark Potter/Anne Stonex):** Will coordinate all data collection from the field. Will also ensure appropriate equipment and personnel are on site for data collection.
66. **RE and District Lab:** Responsible for oversight of the Contractor's fulfillment of a QC Plan and for independently verifying that the QC test results being submitted by the Contractor are representative of the asphalt concrete being produced, and are within conformance for material properties and qualities to the mix design submitted by the contractor.
67. **RE:** Responsible for construction of the project and contract administration. *Contract administration is to be conducted as for any paving project.* Also will provide assistance to METS coordinators in accessing and collecting all data, including project materials submittals, Contractors' QC daily reports, Caltrans daily logs or diaries of project events, and scheduling information.
68. **METS Lab:** Responsible for all testing required to support data collection for evaluation of pilot project performance. METS lab may provide quality assurance testing at the RE's written request.
69. **Contractor:** Responsible for materials supply, construction, and scheduling thereof. Contractor will provide a quality control plan prior to job commencement for approval by the RE. In addition, the contractor will provide mix design data, binder formulation (for proprietary products, this may be limited to scrap tire rubber content for specification compliance) and test data or binder samples for testing, and daily reports including but not limited to: QC test results on the RAC mix, placement locations, compaction results, and materials data and COC's from supplier(s).
70. **RE and Contractor:** Will determine any dispute resolution needs. At the request of the RE, the METS support will record the outcomes as project data.

8.2 CONTRACTOR QUALITY CONTROL (QC) PLAN REQUIREMENTS

The requirements for the contractor Quality Control (QC) Plan should include the following items.

71. **Existing Pavement:** Verification that plans for required repairs have been reviewed and approved and that the repairs are executed satisfactorily.
72. **Materials:** This includes identifying what materials will be used in the rubberized binder and in the RAC mixture. Source/supplier information should be included for all materials along with product certifications and methods for tracing custody from source to contractor.

- o Binder: Non-proprietary information on CRM type and content, grade of base asphalt, other additives.
 - o RAC: Aggregates, lime and/or other additives.
 - o Identify types of binders and mixtures: asphalt rubber, MB, dense-graded, and gap-graded mixes.
73. **Binder Manufacturing:** This part of the plan may be the responsibility of the binder supplier (subcontractor) and should include non-proprietary details on the production process and binder design, including whether the binder will be prepared at the AC plant or at a terminal for transport to the AC plant, binder production and test logs of viscosity, reaction time and other pertinent data per batch (particularly AC plant blend but may also apply to terminal products), storage time (both AC plant and terminal blends) and whether agitation is required.
74. **Manufacture of RAC Mix:** This includes identifying;
- o AC plant type and location.
 - o Mix design details: Recommended and actual mixing temperatures, gradation, binder content, stability, and mixture voids analysis.
75. **Quality Control sampling and testing plan:** Identifying what frequencies and methods the contractor will use for QC sampling and testing of the component materials (rubberized binder and aggregates), and for RAC mixture production and compaction.
76. **Transportation:** Haul distances and arrangements for continuity of work (number of haul trucks, use of materials transfer vehicles, and so on).
77. **Placement (lay down):** Equipment type, work plan, surface preparation.
78. **Compaction:** Types and number of rollers, test strip rolling pattern and density data, and compaction temperature requirements for rubberized binder.
79. **Data collection arrangements of contractor:** This needs to be coordinated with the RE and with the METS support (with the RE's permission).
80. **Other items:** Contingency for weather, traffic or other special conditions that may affect product performance (coordinate with binder supplier).

8.3 DATA COLLECTION REQUIRED

Although these Warranty Projects fall under the umbrella of non-QC/QA projects, some Quality Assurance testing will need to be performed by Caltrans (see Chapter 6 of the Caltrans Construction Manual). This will ensure the contractor's ability to conform to their own mix design and allow for evaluating the uniformity of production. Responsibilities will be as follows:

81. **RE:** is responsible for oversight of sampling and testing in conformance with the Caltrans Construction Manual and evaluating the test results for QA.
82. **METS Support:** will be responsible for long-term pavement performance evaluation and for sampling and testing for materials characterization to support the performance evaluation. METS support may provide assistance with QA sampling or testing if requested by the RE.

It is intended that all data related to the pilot projects will be stored in a central Access database. METS personnel will enter test data when it becomes available. Data should be backed-up every time new data has been entered. Security protocols will be used to protect against unauthorized inputs, and checks for input accuracy will be instituted. This avoids the problem of accumulating boxes of papers or logbooks that could be misplaced or damaged. Paper forms will be digitized for electronic input and storage. It is intended that the database would become available for viewing and subsequent use of the materials, construction and monitoring information, possibly through the Caltrans intranet. Data collection is planned in five phases as follows.

83. Pre-construction
84. Mix Design and Laboratory Testing
85. Construction
86. Post Construction
87. Annual Monitoring

8.3.1 *Pre-construction*

Items of information to be collected prior to construction should include the following:

88. Project documents.
89. Pavement Condition Survey maps and photos.
90. Deflection testing data, and core sampling information including thickness and damage to existing pavement (moisture or other) used for the structural design.
91. Crack mapping of existing pavement (selected performance evaluation sections), as datum for analysis of overlay's performance with respect to reflective cracking.
92. Rut measurement of selected performance evaluation sections.
93. Traffic data and profile used for the structural (i.e. thickness) design.
94. Maintenance history.
95. Agreed repair requirements and mapping thereof.

All of the mapping and sampling will be tied to milepost and photo or video log information and identified on plan map. Video logs provide an excellent sense of overall site and pavement conditions, and can easily be tied to mileposts, stations, and other landmarks during annual evaluations.

Upon receipt of the designs for the binders and RAC mixtures, METS personnel will provide technical assistance to the respective Districts regarding what to look for during rubberized binder and/or RAC mixture production and paving operations. Procedures and needs for sampling and testing may vary considerably depending on the types of rubberized products selected for use.

8.3.2 Mix Design and Laboratory Testing Phase

Items of information to be collected as a part of this phase should include the following:

96. Material properties for RAC wearing course components (e.g. binder and aggregate).
97. Climatic and environmental information for designing the binder.
98. Binder design and testing, including basic information on type and location of production process.
99. Mix design: DG or GG target gradation, target binder content, maximum theoretical and bulk specific gravities, air voids, voids in mineral aggregate (VMA), voids filled with asphalt (VFA), Hveem stability, etc.
100. Moisture sensitivity evaluation (CTM 371) as applicable.

8.3.3 Construction

Items of information to be collected as a part of the construction phase include the following:

101. Material sources and certificates of compliance.
102. Field-blended rubberized binder production logs (See Figure 1 for an example).
103. Plant type and make and CT109 status.
104. Paving dates and times.
105. Paving equipment: make and status.
106. Rollers: make and status.
107. Haul distance and equipment used.
108. Delivery temperature (mix).
109. Placement temperature (mix).
110. Compaction temperature.
111. Distance from screed to breakdown roller.
112. Ambient and grade temperatures, weather conditions, wind etc.

113. Other climatic conditions reported at any significant change.
114. In-place voids (air voids, VMA, VFA, based on CT 309, maximum theoretical specific gravity and in-place density).
115. Sampling verification and designation, test results.
116. Ride/roughness data (from profilograph).
117. Time to opening to traffic.
118. RE and inspector diaries (copies).

District personnel would routinely collect most of these items on a typical pavement construction project. METS personnel will assist District personnel as needed and will be available throughout construction to perform additional testing and data collection required by the pilot projects.

ASPHALT RUBBER BINDER VISCOSITY TESTING LOG	
Project Name/No.	
Date	
Binder Producer	
Tested By	

BINDER INFORMATION

Blend Proportions

Asphalt Cement Source and Grade		
Asphalt Modifier Source & Description		% by AC Mass:
Asphalt Cement and Modifier		% by ARB Mass:
Scrap Tire CRM Source & Description		% by ARB Mass:
High Natural CRM Source & Description		% by ARB Mass:

Viscometer Make, Model and Serial #: _____

*Cycle Start Time	Batch Number	Temp. (°C) ARB Tank	Temp. (°C) of Viscosity 1.1 Test (190 ± 2°C)	Measured Viscosity** Pa•(x10 ⁻³)	Time Tested	Comments

*The cycle begins when tank is fully loaded and at 190±2°C (374±4°F)

**Measured at 190±2°C (374±4°F) NOTE: cP=Pa•x(x10⁻³)

Figure 1: Example Asphalt Rubber Binder Viscosity Testing Log

8.3.4 Post Construction (As-Built)

Items to be collected after construction to document the pavement surface as built should include:

119. Deflection testing and test temperature using the FWD (structural verification) 11 months after construction, then again upon completion of the warranty period.
120. As-built pavement condition survey, video log, and pavement condition photographs, including reference points for all data points (locations of measurements and/or distress as datum for future analysis), 11 months after construction, then annually thereafter.
121. Additional core sampling for verifying compaction and other mixture properties, on an as needed basis.
122. Sampling and testing of areas with reported major deviations in the construction phase, on an as needed basis.

8.3.5 Annual Monitoring

Data collection activities for the Performance Evaluation Sections should be completed in conjunction with warranty enforcement data collection, beginning 11 months after construction and continuing on an annual basis, for a period of 3 to 5 years, depending on the type of project. The following activities shall be included:

- Deflection testing, including required temperature measurements (11 months after construction, then again post warranty)
- Distress mapping of Performance Evaluation Sections
- Distress monitoring of the entire project for the enforcement of warranty (including locations of distresses)
- Pavement condition photographs
- Video Log

Although the required performance monitoring period may end with the expiration of the warranty period at the end of three or five years, this relatively short interval may not provide adequate information about the performance of RAC materials in your district. These pilot projects and the well-documented performance evaluation sections provide a unique opportunity for districts to objectively evaluate long-term performance of in-place RAC materials. If it is possible to continue periodic monitoring until these RAC pavements require rehabilitation, your district could obtain important data about the types of RAC distress that occur and their respective rates of development. Tracking frequency, type, and cost of

maintenance activities would provide valuable information needed for realistic Life Cycle Cost Analysis (LCCA), for comparing use of RAC with other overlay and rehabilitation strategies in your area. Although personnel and resources are always in short supply, continued monitoring of these pilot projects could turn out to be a very effective use of limited district resources that METS strongly recommends and encourages.

9.0 EVALUATION PLAN

9.1 EXPECTED OUTCOMES

The evaluation plan will produce a database that tracks all pilot projects for at least five years. The nature of the projects and materials used will dictate what valid comparisons can be made between projects and materials, but the data will be organized and available from a single location for downloading and further analysis. A series of reports will be generated to allow decision makers to assess the performance of the respective treatments and the success of the warranty provisions.

9.2 REPORTING

The reporting plan may vary as appropriate for specific circumstances and projects, but the basic framework is envisaged as follows:

123. Reporting templates will be set up in Microsoft Access for all collected data and projects.
124. During construction and corresponding testing phases of each project, the METS support or designate(s) will report daily.
125. The District Laboratories will report all test results to the RE, for the purposes of QA. The RE will report to the METS Coordinator, by providing copies of all QC, QA and additional testing, profilograph and daily diaries. *Informational data from the METS Coordinators materials testing will be made available to the RE at their request.*
126. The METS support will report to the METS coordinator, as needed, during project construction and submit summary reports to the METS Coordinator on a regular basis.
127. The METS support will prepare interim reports and a final draft report.

APPENDIX A
Data Collection & Evaluation Task Breakdown

Draft Task Breakdown for RAC Warranty Projects*

	Warranty Component
Pre-Construction	Task 1-Develop forms, data entry protocols, and Access database. Task 2-Gather historical data. Task 3-Collect mix design and asphalt rubber manufacturing data. Task 4-Develop data collection plan. Task 5-Collect FWD deflection data. Task 6-Collect structural and materials data (cores, test pits) as needed. Task 7-Evaluate pre-overlay repair plan and monitor repairs. Task 8-Determine locations of performance evaluation sections.
Construction	Task 1-Sample materials for materials testing. Task 2-Evaluate overall construction uniformity/variability.
Post Construction	Task 1-Post Construction FWD deflections. Task 2-Periodic performance evaluation (distress and rutting). Task 3-Evaluation of needed repair methods. Task 4-Monitoring of repair methods and extent of required repairs. Task 5-Evaluation of repair effectiveness. Task 6-Initial performance evaluation section deflections. Task 7-Initial performance evaluation section distress. Task 8-Coring performance sections for materials testing. Task 9-Closeout monitoring and report.

*All data are to be entered and stored in a single data file.

APPENDIX B

Sample Forms

PROJECT IDENTIFICATION					
PROJECT EA	ROUTE	POST KILOMETERS		COMPLETION DATE (Contract)	
COMPLETION DATE (Expected)	DATE PROBLEM DETECTED	CURRENT DATE	JOB SUSPENDED <input type="checkbox"/> YES <input type="checkbox"/> NO	AC (Tonnes Produced To Date)	AC (Tonnes Remaining)
PROBLEM STATEMENT					

MIX PROPERTIES					
TYPE MIX	TYPE GRADING	MAX GRADING (mm)	ADDITIVES	AGGREGATE TYPE	ASPHALT GRADE
<input type="checkbox"/> A	<input type="checkbox"/> DENSE	<input type="checkbox"/> 38	<input type="checkbox"/> LIME	<input type="checkbox"/> A or	<input type="checkbox"/> AR-1000 <input type="checkbox"/> PBA-1
<input type="checkbox"/> B	<input type="checkbox"/> GAP	<input type="checkbox"/> 19	<input type="checkbox"/> LIQUID ANTI-STRIP	<input type="checkbox"/> B	<input type="checkbox"/> AR-2000 <input type="checkbox"/> PBA-1a
<input type="checkbox"/> RECYCLED	<input type="checkbox"/> OPEN GRADED	<input type="checkbox"/> 12.5	<input type="checkbox"/> CEMENT	<input type="checkbox"/> ABSORPTIVE or	<input type="checkbox"/> AR-4000 <input type="checkbox"/> PBA-2
	<input type="checkbox"/> COARSE	<input type="checkbox"/> 9.5	<input type="checkbox"/> OTHER	<input type="checkbox"/> NON-ABSORPTIVE	<input type="checkbox"/> AR-8000 <input type="checkbox"/> PBA-3
	<input type="checkbox"/> MEDIUM			<input type="checkbox"/> OTHER	<input type="checkbox"/> AR-16000 <input type="checkbox"/> PBA-4
					<input type="checkbox"/> PBA-5
					<input type="checkbox"/> PBA-6a
					<input type="checkbox"/> PBA-6b
					<input type="checkbox"/> PBA-7

APPEARANCE <input type="checkbox"/> OK <input type="checkbox"/> SEGREGATED <input type="checkbox"/> RICH <input type="checkbox"/> DRY <input type="checkbox"/> TENDER <input type="checkbox"/> COLOR <input type="checkbox"/> OTHER	PLANT TYPE <input type="checkbox"/> BATCH or <input type="checkbox"/> CONTINUOUS <input type="checkbox"/> PORTABLE or <input type="checkbox"/> STATIONARY	BACKGROUND DATA - Attach Test Method 109 verification, mix design, plant and street test results ACTUAL ASPHALT CONTENT - Attach test results (including target asphalt content, source and date; note lift and location) ACTUAL STABILITY OF STREET SAMPLES - Attach test results (note lift and location) TEST MAXIMUM DENSITY - Attach test results (note lift and location) MIX SUPPLIER AND LOCATION(S) -
---	--	---

FIELD CONDITIONS (at paving operation)				
GENERAL	WEATHER	AIR TEMPERATURE (°C)	SURFACE TEMPERATURE (°C)	MX TEMP AT PLANT (°C)
<input type="checkbox"/> COASTAL	<input type="checkbox"/> CLEAR	<input type="checkbox"/> UNDER 4	<input type="checkbox"/> UNDER 4	<input type="checkbox"/> UNDER 121
<input type="checkbox"/> VALLEY	<input type="checkbox"/> CLOUDY	<input type="checkbox"/> 4-9	<input type="checkbox"/> 4-15	<input type="checkbox"/> 121-134
<input type="checkbox"/> MOUNTAIN	<input type="checkbox"/> FOGGY	<input type="checkbox"/> 10-15	<input type="checkbox"/> 16-26	<input type="checkbox"/> 135-162
<input type="checkbox"/> DESERT	<input type="checkbox"/> RAINY or WORSE	<input type="checkbox"/> 16-20	<input type="checkbox"/> 27-37	<input type="checkbox"/> 163-190
	<input type="checkbox"/> HUMID or	<input type="checkbox"/> 21-25	<input type="checkbox"/> 38-48	<input type="checkbox"/> 191-204
	<input type="checkbox"/> DRY	<input type="checkbox"/> 26-32	<input type="checkbox"/> 49-60	<input type="checkbox"/> GREATER THAN 204
	<input type="checkbox"/> WINDY or	<input type="checkbox"/> 33-38	<input type="checkbox"/> GREATER THAN 60	
	<input type="checkbox"/> CALM	<input type="checkbox"/> GREATER THAN 38		

MIX TEMP AT WINDOW (°C)	MIX TEMP AT BREAKDOWN ROLLER (°C)	DISTANCE, PAVER TO BREAKDOWN ROLLER (METER)	WINDOW LENGTH (Meter)	AVERAGE ONE WAY HAUL TIME (hours)
<input type="checkbox"/> UNDER 65	<input type="checkbox"/> UNDER 65	<input type="checkbox"/> UNDER 15	<input type="checkbox"/> 0	<input type="checkbox"/> UNDER 1/2
<input type="checkbox"/> 65-89	<input type="checkbox"/> 65-89	<input type="checkbox"/> 15-75	<input type="checkbox"/> 0-30	<input type="checkbox"/> 1/2-1
<input type="checkbox"/> 90-125	<input type="checkbox"/> 90-125	<input type="checkbox"/> 76-150	<input type="checkbox"/> 31-61	<input type="checkbox"/> 1-2
<input type="checkbox"/> GREATER THAN 125	<input type="checkbox"/> 126-150	<input type="checkbox"/> 151-229	<input type="checkbox"/> 62-91	<input type="checkbox"/> 2-3
	<input type="checkbox"/> GREATER THAN 150	<input type="checkbox"/> 230-300	<input type="checkbox"/> 92-122	<input type="checkbox"/> GREATER THAN 3
		<input type="checkbox"/> GREATER THAN 300	<input type="checkbox"/> 123-152	
			<input type="checkbox"/> GREATER THAN 152	

CEM3501



AC PRODUCTION/PLACEMENT CHECKLIST
CEM-3501 (REV. 11/2000)

Page 2 of 2
Back

STRUCTURAL PROPERTIES

PAINT BINDER (tack coat)	TACK SPREAD RATE (liters per metered square)	MIX THICKNESS (Compacted)	UNDERLYING CONDITIONS	
<input type="checkbox"/> ASPHALT	<input type="checkbox"/> 0.45	FIRST LIFT	<input type="checkbox"/> AC	<input type="checkbox"/> OK
<input type="checkbox"/> EMULSION	<input type="checkbox"/> 0.68	SECOND LIFT	<input type="checkbox"/> PCC	<input type="checkbox"/> GRINDER PREPARED
<input type="checkbox"/> OTHER	<input type="checkbox"/> 0.95	THIRD LIFT	<input type="checkbox"/> ATPB	<input type="checkbox"/> CRACK & SEAT
	<input type="checkbox"/> 1.13		<input type="checkbox"/> AB	<input type="checkbox"/> PRE LEVELLED
	<input type="checkbox"/> OTHER		<input type="checkbox"/> OTHER	<input type="checkbox"/> CRACKED
				<input type="checkbox"/> FABRIC
				<input type="checkbox"/> OTHER

PAVER

MAKE

MODEL

PAVER OPTIONS

- PICKUP MACHINES
- SCREED EXT. (length)
- SKI (length)
- JOINT MATCHER
- GRADE WIRE
- OTHER

MECHANICAL PROPERTIES

NUCLEAR DENSITY GAGE

<input type="checkbox"/> METHOD SPECIFICATION	or	MAKE	CALIBRATION (date)
<input type="checkbox"/> END RESULT COMPACTION	SPECIAL PROVISION	MODEL	AVERAGE RELATIVE COMPACTION

BREAKDOWN ROLLER(S)	INTERMEDIATE ROLLER(S)	FINISH ROLLER(S)
TYPE	TYPE	TYPE
WEIGHT	WEIGHT	WEIGHT

IF VIBRATORY ROLLERS ARE USED:	ON CALTRANS APPROVED LIST <input type="checkbox"/> YES <input type="checkbox"/> NO		
MAKE	SPEED	FREQUENCY	AMPLITUDE
MODEL	ACTUAL	ACTUAL	ACTUAL
	SPECIFIED	SPECIFIED	SPECIFIED

* A completed copy of this form should be filed in Category 35 of the Project Documents. A description of the form is included in the *Construction Manual*.

ADA Notice For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 263-2041 or TDD (916) 263-2044 or write Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814.



California Department of Transportation • Construction Manual • July 2001

A-1.56

Sample Forms

