INFORMATION HANDOUT

For Contract No. 08-0K2304
At 08-Riv-10-R57.6/R60.9

Identified by
Project ID 0800000337

MATERIALS INFORMATION

Materials Report

.State of California Business, Transportation and Housing Agency

Memorandum

To: **Renee Sasse,**
Office Chief, Design A

Date: **April 13, 2011**

Attention: **William Pan,**
Project Engineer

File No: **08-Riv-10 PM 57.6/60.9**
08-0K230
Grind Mainlines, Slab Replacement, Mill and Overlay Shoulders & Ramps and Construct Ramp Termini

From: **DEPARTMENT OF TRANSPORTATION**
Bruce W. Kean, District 8 Materials Engineer

Subject: **Materials Report**

1.0 GENERAL

1.1 Proposed Improvements

According to your request, this project proposes to diamond grind the existing mainlines in both directions, replace the deteriorated slabs, replace the existing asphalt concrete (AC) lane drop in the eastbound (PM 57.6 to PM 57.8) with rigid pavement, mill and overlay the existing inside and outside asphalt concrete shoulders and all the ramps at Dillon Road intersection on I-10, and construct rumble strips in the inside and outside shoulders in both directions in I-10 near the City of Coachella from the junction of State Route 86S and Interstate 10 to 0.5 mile east of Coachella Channel. Portland Cement Concrete (PCC) Ramp Termini will also be constructed at Dillon Road eastbound and westbound off-ramps.

1.2 Existing Facilities

Within the project limit I-10 is a four-lane freeway with PCC pavement in all four lanes, however, a portion of I-10 eastbound, which is lane no. 3 (lane drop) from PM 57.6 to PM 57.8 (0.2 mile), consists of AC pavement. This area is proposed to be reconstructed as PCC pavement. According to the plans provided to us by the Office of Design A, the inside and outside shoulders are 5 feet and 10 feet wide respectively. Both the eastbound and westbound roadbeds are separated with wide dirt median.

The plans provided to us by the Office of Design A, indicate that the westbound mainlines consist of 0.70' PCC over 0.45' Cement Treated Base over 0.25' Aggregate Base (AB) over 0.50' Aggregate Subbase (AS). For eastbound direction within the project limit, we could not find any as built to identify

the structural sections for the mainlines. However, based on the information obtained from Caltrans photolog and as builts (EA: 452801, Year 1999) in the proximity of the project area, we can conclude that the existing eastbound mainline structural sections within the project limit consist of 0.65' PCC over 0.45' Cement Treated Base over 0.25' Aggregate Base over 0.60' Aggregate Subbase. The inside and outside shoulders consists of AC pavement.

1.3 Climate, Geology

This project is located in an arid desert region with scant rainfall and occasional thunderstorms. The average annual rainfall is approximately 4 inches with a majority of the precipitation occurs between November and April. Annual precipitation ranges from a 1990 low of 0.35 inch up to a 1983 high of 13.68 inches. Temperatures vary greatly between day and night and from winter to summer; the temperature ranges between -4^0C (25^0F) and 54^0C (130^0F). Strong winds and sand storms are common throughout the year.

This project area lies in between Indio and Coachella Valley. Gravelly sands to clayey sands predominate as the native soils in the Indio region. "Sandy to silty clays and clays will also be encountered," per the 1965 Materials Report for Thousand Palms to Dillon Road. Native soils within the Coachella Valley consist of gravelly sands and fine silty sands.

2.0 STRUCTURAL PAVEMENT DESIGN CONSIDERATIONS

Slab Replacement VS Lane Replacement

Slab Replacement is the removal of individual failed slabs (or panels) of concrete pavement when much of the remaining pavement is still in good condition. Slab replacement improves pavement rideability and restores structural integrity while extends service life. Slab Replacement consists of removing the concrete pavement, including the treated base and replacing both layers with rapid strength concrete materials, separated by a bond breaker. The total length of consecutive individual slabs (or concrete panels) to be replaced using these procedures should be less than 100 feet. Diamond grinding of the replaced slabs is recommended to provide a smooth finish.

Lane Replacement, on the other hand, is the removal of consecutive slabs of 100 feet or more in total length that would be replaced and may include the removal /replacement of base and subbase depending on whether they are still in good condition or not. Lane Replacement is done when the concrete pavement structure has deteriorated to the point that preservation strategies are not practical or cost effective. When at least 10% of the slabs in a given lane require replacement, replacing the entire lane has typically been more cost-effective alternative than slab replacement. This can be verified on a project-by-project basis with life cycle cost analysis.

Selection of Slab Replacement or Lane Replacement strategy will be determined by the existing pavement conditions as stipulated above. If Slab Replacement is selected as the appropriate strategy, the pavement structural section to be utilized should be the same as the existing structural section. On the

other hand, if Lane Replacement is selected, the pavement structural sections recommended in Section 5.1 of this report should be followed.

3.0 SLAB REPLACEMENT STRATEGY

As mentioned in Section 2.0, the pavement structural section for slab replacement should be the same as the existing structural section. A field inspection would determine which or how many slabs would require replacement. Slab Replacement shall conform to Caltrans Standard Plan P8 (Jointed Plain Concrete Pavement – Individual Slab Replacement), Slab Layout – Type II. We recommend saw-cutting through the existing Portland Cement Concrete pavement (PCCP) and RMCTB (Road Mixed Cement Treated Base). After removing the old pavement and the base, the earthen or granular subgrade should be compacted as per Caltrans guidelines which will be followed by pouring Rapid Strength Concrete (RSC) to the existing grade of the old dense base. After the new RSC base has been hardened sufficiently, expansion joint filler (flexible foam) should be placed across the transverse and longitudinal joint faces and be extended to the excavation's full depth. Top of the expansion joint filler should flush with the top of the pavement. After that a bond breaker of a polyethylene film should be placed onto the new RSC base which will be followed by installing Dowel Bars and placing RSC to the finished grade (FG) of the PCCP, matching the existing pavement's grade.

The following are the guidelines for identifying slab replacement repair areas:

-All slabs with 2 or more corner breaks.

-All slabs with 3rd stage cracking (not more than 10%).

-Slabs with segments that are moving relative to each other.

-Slabs with longitudinal or transverse cracks more than 0.042 foot wide. Depending on traffic level, lower-severity cracks may also need to be included to ensure that additional repairs will not be needed within the target rehabilitation design life.

-Cracks with spalling and loss of concrete greater than 0.49 foot from the crack centerline and loss of aggregate interlock.

-Slabs damaged by lack of support due to settlement, base failure, or excessive curing.

We recommend the whole process of slab replacement shall conform to Caltrans "Slab Replacement Guidelines" (dated January 2004).

4.0 PAVEMENT DESIGN PARAMETERS

4.1 Traffic Index (TI)

The following Traffic Index values (TI) were provided in the memorandum dated February 01, 2011 from the Office of Forecasting.

08 - Riv-10 PM 57.6/ 60.9

Forecasted Period	Lanes + Inside Shoulder* + first 2 ft of the Outside Shoulder	Outside Shoulder
20-Year	16.0	10.0
40-Year	18.0	11.0

* See page 610-9 of Highway Design Manual

All Ramps at Dillon Road Interchange

Forecasted Period	TI
20-Year	10.0
40-Year	11.0

4.2 R- values for Basement Soil

District 11 Materials Report Riv 10 PM 44.1 to 61.3 Thousands Palms to Dillon Road, EA 037511 dated December 29, 1965 shows two R-values within our current project limits. Station 1448 + 00 R-value = 56 and Station 1452 + 50 R-value = 14 & 20. This project used a design R-value of 15.

Materials Report for the construction of a Freeway on State Route 64 from Dillon Road to Cactus City, W.O. 11QV375 (5) dated March 30, 1960 states that this project is divided into 3 units in regard to quality of materials. At Sta 555 test results show that materials have 85% to 90% passing the #30 and 81% passing the #200 and R–value of 20. This Materials Report shows 1 R-value in or near our current project limits, R-value = 22.

Based on the above information, for lane replacement (if any), lane drop portion and ramp termini, an R-value of 15 will be adequate in designing the rigid pavement structural sections and we will select the Type II soil.

4.3 Pavement Design Life

As per memorandum dated February 01, 2011 from the Office of Forecasting, the projected Annual Average Daily Traffic (AADT) in the year 2033 is 50,400. Based on this information and according to Caltrans Highway Design Manual, Section 612.2, the minimum pavement design life for New Construction and Reconstruction should be 20 or 40-year and the one with the lowest life-cycle cost should be selected.

5.0 RIGID PAVEMENT RECOMMENDATIONS

5.1 Structural Sections for Lanes and Shoulders

Utilizing the current TI values (see Section 4.1) and the appropriate R-values (from historical research, see Section 4.2) for the project limit, we recommend the following pavement structural sections for lane replacement (if any) and for the lane drop portion in the Route I-10 eastbound (PM 57.6 to PM 57.8).

For the lane drop portion (PM 57.6 to PM 57.8), which is proposed to be reconstructed as a rigid pavement, the first 2 ft of the outside shoulder has to be constructed as a rigid pavement as per Caltrans Highway Design Manual (HDM) Topic 613.5 2(a) for shoulder pavement structure requirements. For this portion we recommend to construct the whole width of the outside shoulder as a rigid pavement.

In determining these pavement structural sections, we have used the procedure described in Section 623.1 of the July 1, 2008 Edition of the HDM. This procedure utilized "Type II" soil, "Desert" climate region, and Table 623.1 (I) and assumed without lateral support. The lean concrete base (LCB) thickness for the shoulders has been increased to 0.50 foot to match the LCB thickness for the adjacent mainline and we recommend the top of the LCB under the mainline and shoulder be at the same horizontal plane at 2% slope and the JPCP (or RSC) for the shoulders be tapered according to the proposed cross slope.

I-10 Mainline - Jointed Plain Concrete Pavement (JPCP)

Structural Section	20-Year		40-Year	
	Lanes + Inside Shoulder + First 2 ft of the Outside Shoulder (TI=16.0)	Outside Shoulder* (TI=10.0)	Lanes + Inside Shoulder + First 2 ft of the Outside Shoulder (TI=18.0)	Outside Shoulder* (TI=11.0)
JPCP	1.25'	0.80'	1.30'	0.85'
HMA Type A (Bond Breaker)	0.10'	0.10'	0.10'	0.10'
Lean Concrete Base (LCB)	0.50'	0.50'	0.50'	0.50'
Class 2 Aggregate Subbase	0.70'	0.60'	0.70'	0.60'

* If the shoulder width is 5 feet or less, as per Caltrans HDM Topic 613.5 2(a), shoulder shall have the same structural section as the adjacent mainline.

I-10 Mainline - Rapid Set Concrete (RSC)

Structural Section	20-Year		40-Year	
	Lanes + Inside Shoulder + First 2 ft of the Outside Shoulder (TI=16.0)	Outside Shoulder* (TI=10.0)	Lanes + Inside Shoulder + First 2 ft of the Outside Shoulder (TI=18.0)	Outside Shoulder* (TI=11.0)
RSC	1.25'	0.80'	1.30'	0.85'
Polyethylene Film	6 mils	6 mils	6 mils	6 mils
RSC	0.50'	0.50'	0.50'	0.50'
Class 2 Aggregate Subbase	0.70'	0.60'	0.70'	0.60'

* If the shoulder width is 5 feet or less, as per Caltrans HDM Topic 613.5 2(a), shoulder shall have the same structural section as the adjacent mainline.

5.2 Structural Sections for Ramp Termini

The following three recommended alternatives for structural sections for Ramp Termini at Dillon Road eastbound (EB) and westbound (WB) off-ramps were obtained from the July 1, 2008 Edition of the HDM, using the Rigid Pavement Design Catalog, Table 623.1(I), "Desert" climate region, Type II soil, and assuming without lateral support.

Alternative 1- JPCP and LCB

I-10 EB and WB Off-Ramps - Jointed Plain Concrete Pavement (JPCP)

Structural Section	20-Year TI = 10.0 (ft)	40-Year TI =11.0 (ft)
JPCP	0.80	0.85
HMA Type A (Bond Breaker)	0.10	0.10
Lean Concrete Base (LCB)	0.40	0.40
Class 2 Aggregate Subbase	0.60	0.60

Alternative 2 - Rapid Set Concrete (RSC)

I-10 EB and WB Off-Ramps - Rapid Set Concrete (RSC)

Structural Section	20-Year TI = 10.0 (ft)	40-Year TI =11.0 (ft)
RSC	0.80	0.85
Polyethylene Film	6 mils	6 mils
RSC	0.40	0.40
Class 2 Aggregate Subbase	0.60	0.60

Alternative 3 – JPCP and AB

I-10 EB and WB Off-Ramps – JPCP and Aggregate Base (AB)

Structural Section	20-Year TI = 10.0 (ft)	40-Year TI =11.0 (ft)
JPCP	0.90	0.95
Class 2 Aggregate Base (AB)	1.00	1.30

The Project Engineer should verify that the rigid pavement for the Ramp Termini extend to at least 150 feet for unsignalized intersections or to the first set of signal loops on signalized intersections.

6.0 MILL AND OVERLAY

The proposed project includes cold plane and overlay the inside and outside shoulders in both directions in Route 10 within the project limit and Dillon Road EB and WB On Ramps and Off Ramps. Based on the facts that within the project limit, all the existing mainlines consist of PCC pavement, so our best recommendation is to reconstruct the inside and outside shoulders with PCC pavement (refer to the Table in Section 5.1), instead of cold plane and overlay with HMA. However, all other alternatives are listed below:

Alternative 1 –Mill and Overlay with HMA Type - C

- Conduct a field-review and locate specific areas of severe distress such as rutting greater than 0.60 inch and/or spalling pavement.
- Cold plane existing structural section 0.20 ft.
- Digout the localized areas of severe pavement failure to a maximum depth of 0.50 foot or to the top of the base (whichever is less), and backfilling with HMA Type - C.
- Seal cracks wider than 0.20 inch.
- Place 0.20 ft HMA Type - C

Alternative 2 - Mill and Overlay with Rubberized HMA Gap Graded (RHMA- G)

- Conduct a field-review and locate specific areas of severe distress such as rutting greater than 0.60 inch and/or spalling pavement.
- Cold plane existing structural section 0.20 ft.
- Digout the localized areas of severe pavement failure to a maximum depth of 0.50 foot or to the top of the base (whichever is less), and backfilling with HMA Type - A.
- Seal cracks wider than 0.20 inch.
- Place 0.20 ft of Rubberized HMA Gap Graded (RHMA – G)

Alternative 3 –Mill and Overlay with HMA Type - A

- Conduct a field-review and locate specific areas of severe distress such as rutting greater than 0.60 inch and/or spalling pavement.
- Cold plane existing structural section 0.20 ft.
- Digout the localized areas of severe pavement failure to a maximum depth of 0.50 foot or to the top of the base (whichever is less), and backfilling with HMA Type - A.
- Seal cracks wider than 0.20 inch.
- Place 0.20 ft HMA Type - A

Note: The information obtained from the field review would determine which of the above strategies will be necessary to preserve the pavement in good condition.

7.0 RUMBLE STRIPS

The new rumble strips in the inside and outside shoulders in both directions within the project limit should be ground-in indentations type and constructed according to the Standard Plan A40B.

8.0 GRINDING EXISTING PAVEMENT

The proposed project scope includes grinding existing PCC pavement in the mainlines in both eastbound and westbound directions within the project limit. Diamond grinding is used as a preventive maintenance strategy to enhance surface friction characteristics in order to improve skid resistance and reduce the risk of hydroplaning. Diamond grinding also improves drainage by correcting transverse slope. A gang – mounted diamond saw blades are used to shave off a thin 0.005 – 0.06 foot of the top layer of an existing concrete surface in order to restore smoothness and to enhance surface friction and safety of an old pavement.

Grinding should comply with the Section 42 "Groove and Grind Pavement" of Caltrans Standard Specifications (May 2006 edition, for projects using English units) and Chapter 5 of MTAG Volume II – Rigid Pavement Preservation 2nd Edition (December 2007).

9.0 EARTHWORK

Any imported or local borrow required should conform to Section 19-7 of the Standard Specifications and the minimum R-value shall not be less than 15.

10.0 MATERIALS SPECIFICATIONS

10.1 Earthwork

- Clearing and grubbing is recommended as per section 16 of the Standard Specifications, to remove vegetation, topsoil, and any artificial fills or debris, and to prepare the site for the proposed facilities.
- Earthwork should conform to Section 19 of the Standard Specifications.
- The subgrades for paved areas should be compacted to a minimum relative compaction of 95%, as per Section 19-5.03 "Relative Compaction (95 Percent)" of the Standard Specifications.
- The subgrades to receive pavements should have a minimum R-value of 15, including any imported or local borrow.

10.2 Base Materials

- Aggregate Base (AB) should be Class 2 Aggregate Base, and conform to Section 26 of the Standard Specifications.
- Aggregate Subbase (AS) should be Class 2 Aggregate Subbase, and conform to Section 25 of the Standard Specifications.
- We prefer Lean Concrete Base (LCB) for the base layer in the JPCP structural sections. LCB should conform to Section 28 of the Standard Specifications.

10.3 Rigid Pavement

- Jointed Plain Concrete Pavement (JPCP), previously referred to as Portland Cement Concrete (PCC) pavement, shall conform to Section 40 of the May 2006 Standard Specifications.
- Lean Concrete Base shall conform to Section 28 of the May 2006 Standard Specifications.
- Slab Replacement shall conform to Caltrans SSP 40-020.
- Slab Replacement shall conform to Caltrans Standard Plan P8 (Jointed Plain Concrete Pavement – Individual Slab Replacement), Slab Layout – Type II.
- Slab Replacement shall conform to Caltrans "Slab Replacement Guidelines" (dated Jan 2004).
- Grinding of existing PCC pavement shall conform to Caltrans SSP 42-050.
- Specifications for lane replacement using RSC will be provided by Materials Engineering Branch.

10.4 Flexible Pavement

- **Hot Mix Asphalt (HMA):**

  a) Type A (HMA-A): aggregate will comply with the ¾ inch grading. The minimum lift thickness is 0.20 foot and the maximum lift thickness is 0.35 foot.
  b) Type A (HMA Bond Breaker): aggregate will comply with the 3/8 inch grading.
  c) Type C (HMA-C): aggregate will comply with the ½ inch grading. The minimum lift thickness is 0.15 foot and the maximum lift thickness is 0.25 foot.
  d) Type G (RHMA-G): aggregate will comply with the ¾ inch grading. The minimum lift thickness is 0.20 foot and the maximum lift thickness is 0.20 foot.

- **Asphalt Binder:**

  Caltrans is now using the performance graded (PG) system (replacing the "aged residue" or "AR" classification) for asphalt binder specification.

  a) Type A (HMA-A): PG 64-28 PM
  b) Type C (HMA-C): PG 64-28 PM
  c) Type G (RHMA-G): PG 64-16
  d) Type A (HMA Bond Breaker): PG 64-16

- Aggregates for the HMA or RHMA mix are to be treated with lime slurry marination.
- Prime Coat shall be applied to base material prior to placing hot mix asphalt concrete.
- Tack Coat shall be applied to the existing AC surface and between successive layers of HMA.

11.0 REFERENCE

- District 11 Materials Report Riv 10 PM 44.1 to 61.3 Thousands Palms to Dillon Road, EA 037511 dated December 29, 1965.
- Materials Report for the Construction of a Freeway on State Route 64 from Dillon Road to Cactus City, W.O. 11QV375 (5) dated March 30, 1960.
- Highway Design Manual – Sixth Edition @006), California Department of Transportation.
- Jointed Plain Concrete Pavement (JPCP) Preservation and Rehabilitation Design Guide (September 18, 2008)
- Slab Replacement Guidelines (January 2004).
- MTAG Volume II – Rigid Pavement Preservation 2nd Edition (December 19, 2007)

12.0 CLOSURE

Our findings and recommendations were obtained in accordance with generally accepted professional principles in Materials Engineering, and are based on the results of the historical research, and Caltrans Highway Design Manual guidelines.

If you have any questions, you may call Kazi Ahmed at 383-4040, or me at 383-4044.

BWK:KA