

# **EXECUTIVE SUMMARY OF PALIAD - ATKOT ROAD SH - 001**

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## **PROJECT BRIEF**

This corridor design report explains the findings of the investigations carried out and recommendations made for Project corridor ATKOT – PALIAD (SH - 01) between i) Km 151/200 to Km 153/500 and ii) Km 153/500 to 167/000 is a Maintenance /Rehabilitation corridor of Gujarat State Highway Project - II (GSHP - II). This includes the description of the present road characteristics, the soil and pavement investigation, test results and the pavement treatments (overlay and preparatory works) required for a design life of 5-years. The report is based on the data available from the various surveys conducted in the month of Jan-Feb 2011.

## **1.1 EXISTING ROAD CHARACTERISTICS**

This section of the report summarizes the main characteristics of the existing road and associated roadside features, which are relevant for defining the performance of the existing road pavement and the proposed improvements.

### **1.1.1 EXISTING ROAD CROSS SECTION**

(i) Km 151.200 to 153.500

The existing road cross-section is a four-lane carriageway with footpath and median in part. The average width of the pavement is 7.4m. The road section is generally on depth of fill as 0.30m to 3.00m.

(ii) Km 153.500 to 167.000

The existing road cross-section is a two-lane carriageway. The average width of the pavement is 6.50m with shoulders 0.75m to 2.00m wide on either side of road. The road section is generally on depth of fill as 0.60m to 2.00m.

### **1.1.2 Pavement Type**

The road pavement consists of bituminous wearing courses over water bound macadam base with sub-grade. The average crust thickness of the pavement is 0.45m in sec-A and 0.40m in Sec-B of this corridor.

### **1.1.3 Terrain**

(i) Km 151.200 to 153.500

The Terrain along the alignment is mostly plain and passes through urban development of PALIAD.

(ii) Km 153.500 to 167.000

The Terrain along the alignment is mostly plain. The road section is generally less than 1.75m above the natural ground. A few stretches of road embankment the height of the fill is about 4.5m.

## **1.2 MAINTENANCE WORKS**

(i) Km 151.200 to 153.500

The R & B Department has applied only patch and pot holes repairing treatment in last 5 years. Road Pavement surface is fair to good condition. However there are pavement distress such as cracks, block cracks, defective patching, pot holes are evident on the some of the road surface.

(ii) Km 153.500 to 167.000

The R & B Department has applied only patch and pot holes repairing treatment in last 5 years, in length of Km 153.5 to m161.1, Road Pavement surface is fair to good condition. However there are pavement distress such as cracks, block cracks, defective patching, pot holes are evident on the some of the road surface. In length Km 161.1 to 167.0 R & B has treated the surface with BUSG in selected stretch followed by BM and SDBC.

### **1.3 PROJECT INVESTIGATION SUMMARY**

#### **1.3.1 Drainage**

##### **1.3.1.1 Pavement Surface Drainage**

(i) km 151/200 to Km 153/500

In most of the length there is a footpath on either side with drainage pipe underneath with cleaning chamber. Due to erodation of shoulder edge and commercial developement foot path is damaged in some length and drainage pipes are chocked up. Also some inspectioin chamber is broken/damage resulting rain water flowing on pavement surface due to this road surface is damaged.

(ii) Km 153/500 to km 167/000

Shoulders of the existing road are made up of local soil available. The shoulder does not have adequate slope and due to 6.50m carriageway width for two lane traffic, in most of the corridor length at the edges of the pavement, shoulder is low (eroded and in gutter shape) resulting in ponding of water adjacent to the road surface. The ingress of water in the base and sub grade of the pavement from the shoulders damages the road surface or in some length shoulder is higher then pavement resulting rain water flowing on pavement surface due to this road surface is damaged.

##### **1.3.1.2 Cross Drainage**

(ii) Km 151.200 to 153.500

Existing cross drainage works total 6 Nos. (0 Major Bridges, 2 Minor bridge, 1 Culverts, 3 HP Drain) are adequate in size and numbers. All cross drainage works are in fairly good condition, except 1 minor bridge required to prvide Post and pipe railing in 2 spans with flood guage post on either side. However, minor repairs such as patching and cleaning on the inlet and outlet at the bed level of the culverts need to be carried out. In some of the slab drains and minor bridges reinforcement found exposed is proposed for repairs.

(ii) Km 153.500 to 167.000

Existing cross drainage works total 11 Nos. (0 Major Bridges, 5 Minor bridge, 5 Culverts, 1 HP Drain and 1vented causeway) are adequate in size and numbers. All cross drainage works are in fairly good condition except 3 minor bridges required to prvide R C C hand rail with Kerb, Piers of 1 bridg required Jacketing up to 1.50m height and 1 vented causeway required reconstruction as its width is only 6.1m. and it is with 2 numbers of 600mm dia pipe. However, minor repairs such as patching and cleaning on the inlet and outlet at the bed level of the culverts need to be carried out. In some of the slab drains and minor bridges reinforcement found exposed is proposed for repairs.

### 1.3.1.3 Road Side Drains

(i) km 151/200 to Km 153/500

There is pipe drain underneath footpath, in some length it is chocked and in some length pipe may damaged is proposed to clean and replace new pipe with necessary inspection/cleaning chamber.

(ii) km 153/500 to Km 167/000

There is no existing road side drain along the corridor length. However in length where road formation level is low, kuccha drain proposed.

## 1.4 PAVEMENT CONDITION

### 1.4.1 Pavement Shape

In both section the cross profile of the existing pavement has disturbed through out the road pavement. The profile corrective course is necessary to bring the road cross-fall back to proper camber of 2.5%.

### 1.4.2 Pavement Distress

The pavement is distressed in about 11.21 % of the total paved area. The details of various distresses are as mentioned below:

Distress type	Percentage of Total paved area	Total Distress %
Cracked area (Narrow cracks less than 3mm) :	1.01%	11.21%
Cracked area (Wide cracks more than 3mm) :		
Potholes :	1.22%	
Full Depth Repairs :	8.98%	

## 1.5 SUB - GRADE STRENGTH INVESTIGATIONS

### 1.5.1 Laboratory Test Results

It has been observed from the laboratory test results that the nature of sub - grade soil is of SC type. Maximum dry densities and optimum moisture content for the sub - grade soil varies from 1.57 to 1.80 gm / cc and 13.9 to 19.6% respectively.

### 1.5.2 In situ Compaction

The compaction of sub - grade in the field varies between 88.85 to 91.33% of MDD, which is lower than MORT&H recommendations. The inadequacy of compaction for sub - grade material is one among many causes for distresses in the pavement. However, it indicates that embankment and sub - grade absorbs water during wet season, further affects its strength. The test results of compaction of the sub - grade have been shown in the attachment enclosed with this report.

## 1.6 PAVEMENT DEFLECTIONS

### *CHARACTERISTIC DEFLECTIONS*

The benkleman beam deflection measurements were taken in the month of Jan 2011 in sec i and Feb 2012 in sec ii. The characteristic deflection has been worked out as (mean + 2.0 std deviation). The deflection test results indicate a poor pavement structure in sec i, i. e. Km 151.200 to 153.500 largely due to the poor sub-grade and weak pavement. while in sec ii, i.. e. Km 198.000 to 203.300 it is fair pavement structure.

As per IRC 81 – 1997, 2 Std. Deviation is considered in this corridor as the existing pavement surface is badly damaged.

The IRC 81-1997 has provided charts to ascertain seasonal variations to be applied to the deflection measurement depending on the type of soil and field moisture contents. This factor is varying between 1.02 to 1.20 in sec i and 1.02 to 1.06 in sec ii.

## 1.7 TRAFFIC

The traffic loading adopted for the design of the road pavement is for a period of 5-years. Assuming an uniform growth rate for commercial traffic at 5.0%, the MESA (Million Equivalent Standard Axle) for a period of 5-year design life works out to be 18.30 (April 2013, Base year) for census post near Village Babarkot (Km151/2-4).

**Table No. 1.7.1**  
**Traffic Census Data (Collected from concern R&B Division)**

Sr. No.	Period Month/year	Avg. Traffic intensity/day in PCU	CV/day bus & trucks	Remarks
Station near Village Babarkot (Km151/2-4)				
1	Oct-09	5901	2167	
2	Apr-10	6361	2323	
3	Apr-11	6680	2439	

*traffic census data collected by concern R&BD Division*

## 1.8 PAVEMENT OVERLAY DESIGN

The thickness of the Bituminous Overlay has been calculated as per IRC 81 – 1997, based on characteristic deflections and projected traffic loading. The overlay treatment consists of Dense Bituminous Macadam overly in a thickness of 50 to 60mm and 30mm Bituminous Concrete wearing course (except in Km 161+2 to 167+0, as it was recently treated by R & BD) The designed and adopted thickness of the overly for each homogenous section of the corridor is calculated and shown below in Table 1.8.1.

(Overlay thickness proposed with consideration of 25 mm thickness of PCC as integral part of BM and thickness of BC proposed equivalent to 140% for BM)

**Table No. 1.8.1**

( i ) Km 151.200 to Km 153.500

( ii ) Km 153.500 to Km 162.100

**Table showing overly Thickness Proposed.**

Chainage	Tempratu in C	Seasonal Factor	MESA	Deflection in mm	Std. Deviation in mm	Characteristic deflec.	Overlay thickness Reqd	Total Thickness Proposed (incl. 25 mm extra PCC & BC)	Splitting of Overlay thickness Proposed		Actual thickness of OL Proposed	
									PCC (MIN)	Thickness of (DBM+BC)*1.4 Equivalent to 140% BM	DBM	BC
<b>Km. 151/200 to 153/500</b>												
151.2 to 152	27	1.20	18.30	1.3228	0.1979	1.7186	150	151	25	126	60	30
152 to 153	30	1.16	18.30	1.2215	0.1500	1.5215	145	151	25	126	60	30
153 to 153.5	35	1.02	18.30	0.9874	0.1407	1.2689	110	137	25	112	50	30
<b>Km. 153/500 to 162/100</b>												

153.5 to 154	25	1.20	18.30	0.936	0.1859	1.3078	110	137	25	112	50	30
154 to 155	26	1.15	18.30	0.896	0.1664	1.2287	100	137	25	112	50	30
155 to 156	28	1.10	18.30	0.889	0.1175	1.1238	90	137	25	112	50	30
156 to 157	30	1.09	18.30	0.885	0.1206	1.1263	90	137	25	112	50	30
157 to 158	34	1.08	18.30	0.696	0.1328	0.9611	70	137	25	112	50	30
158 to 159	36	1.07	18.30	0.639	0.1213	0.8814	65	137	25	112	50	30
159 to 160	35	1.12	18.30	0.635	0.1088	0.8530	65	137	25	112	50	30
160 to 161	34	1.10	18.30	0.670	0.1011	0.8720	65	137	25	112	50	30
161 to 162.1	32	1.15	18.30	0.671	0.0847	0.8406	65	137	25	112	50	30

For graphical representation please refer attached graph

## **1.9 PAVEMENT PREPARATORY WORKS**

The pavement preparatory work includes repair to distressed areas such as crack sealing, full depth repair, pothole repair. The preparatory works will be carried out on the existing pavement surface prior to application of profile corrective course. The preparatory work is proposed to be carried out as per the methodology explained in para No. 1.9.1.

### **1.9.1 Full Depth Repairs**

The road surfaces where the depth of depression is greater than 75mm and exceeding in an area 1 Sqm., will receive full depth repair treatments for estimate purpose. During execution of FDR's area shall be identified by Engineer as per actual requirement of the site condition.

The full depth repair treatment shall be carried out by dismantling the existing pavement and excavating the sub-base and sub - grade to a depth of 30 cm. Dismantling of the pavement and excavation will be carried out in a length and width not less than 5m and 2.5m respectively.

The exposed surface of sub-grade will be loosened up to a depth of 20 cm and re-compacted to 97% of MDD with required camber. On the compacted sub-grade, GSB material will be laid to a 30.0cm compacted thickness. A Wet Mix Macadam of adequate thickness (equal to existing crust thickness) be provided over the compacted sub-base. However, the thickness of each layer of WMM layer shall not exceed 150mm. The final WMM layer will be laid to a proper camber and treated with primer and surface dressing (second coat).

### **1.9.2 Pothole Repairs**

The potholes shall be repaired with granular base course material and bituminous macadam depending upon its depth.

### **1.9.3 Filling of Depressions.**

The depressions on the surface of road pavement shall be filled up in layers by bituminous material in accordance with the MORT&H Specification.

### **1.9.4. Crack Sealing:**

Slurry seal will fill up the cracks on the pavement more than 3 mm in width, where as cracks less than 3 mm in width will be treated by fog sealing.

### **1.9.5 Details of Distresses Adopted for Preparatory Works**

The details of cracked area, potholes repairs area and area for full depth repair for bituminous pavements are shown in table in table 1.2 for each chainage individually.

**Table 1.2: Adopted Preparatory Work**

Chainage in Km	Proposed Area			Area covered in RC / Raising Length			Total Area				
	Crack Area		Pothole Area M <sup>2</sup>	Crack Area		Pothole Area M <sup>2</sup>	Crack Area		Pothole Area M <sup>2</sup>		
	Cracks 0 to 10 mm Slurry Seal / Fog Spray M <sup>2</sup>	Area for Full Depth Repair M <sup>2</sup>		Cracks 0 to 10 mm Slurry Seal / Fog Spray M <sup>2</sup>	Area for Full Depth Repair M <sup>2</sup>		Cracks 0 to 10 mm Slurry Seal / Fog Spray M <sup>2</sup>	Area for Full Depth Repair M <sup>2</sup>			
<b>Km 151.200 to Km 153.500</b>											
151.2 to 152	88	1125	130	0.00	0.00	0.00	88.00	1125.00	130.00		
152 to 153	271	1875	356	0.00	0.00	0.00	271.00	1875.00	356.00		
153 to 153.5	245	2750	280	0.00	0.00	0.00	245.00	2750.00	280.00		
Sub Total A	604.00	5750.00	766.00	0.00	0.00	0.00	604.00	5750.00	766.00		
<b>Km 153.500 to Km 162.100</b>											
153.5 to 154	15.00	25.00	5.00	0.00	0.00	0.00	15.00	25.00	5.00		
154 to 155	10.00	325.00	14.00	0.00	0.00	0.00	10.00	325.00	14.00		
155 to 156	12.00	250.00	33.00	0.00	0.00	0.00	12.00	250.00	33.00		
156 to 157	8.00	212.50	27.00	0.00	0.00	0.00	8.00	212.50	27.00		
157 to 158	20.00	150.00	9.00	0.00	0.00	0.00	20.00	150.00	9.00		
158 to 159	18.00	75.00	5.00	0.00	0.00	0.00	18.00	75.00	5.00		
159 to 160	23.00	75.00	58.00	0.00	0.00	0.00	23.00	75.00	58.00		
160 to 161	35.00	62.50	21.00	0.00	0.00	0.00	35.00	62.50	21.00		
161 to 162.1	42.00	100.00	15.00	0.00	0.00	0.00	42.00	100.00	15.00		
Sub Total B	183.00	1275.00	187.00	0.00	0.00	0.00	183.00	1275.00	187.00		
Total A+B	787.00	7025.00	953.00	0.00	0.00	0.00	787.00	7025.00	953.00		
	Fog Spray @ 15%	Slurry Seal @ 85%		Fog Spray @ 15%	Slurry Seal @ 85%		Fog Spray @ 15%	Slurry Seal @ 85%			
	118.05	668.95	7025.00	953.00	0.00	0.00	0.00	118.05	668.95	7025.00	953.00
Add 15% for possible variation at the time of actual execution	17.71	100.34	1053.75	142.95	0.00	0.00	0.00	17.71	100.34	1053.75	142.95
<b>Total (A)</b>	135.76	769.29	8078.75	1095.95	0.00	0.00	0.00	135.76	769.29	8078.75	1095.95
<b>Say CF to BoQ</b>	140.00	770.00	8080.00	1100.00	0.00	0.00	0.00	<b>140.00</b>	<b>770.00</b>	<b>8080.00</b>	<b>1100.00</b>
The Area of FDR and cracked Area has been increased by 15% in cost estimates and BoQ (Due to possible variation at the time of actual execution of work)											

For graphical representation please refer attached Graphs

## 1.9.6. Profile Corrective Course

The quantity of bituminous macadam for profile corrective course has been worked out on the basis of data obtained from the detailed level survey on existing pavement. The transverse profile will be corrected by providing Profile Corrective Course (PCC) to bring the camber upto 2.5%. and also longitudinal profile hump correction by considering lumpsum quantity over and above for profile correction is proposed. The proposed quantity of BM for profile Correction is worked out on bases of initial levels and given in Table 1.3 The profile corrective course will bring the road pavement to proper camber. Super – elevation will be provided on curves as per site requirement and quantity for the same is worked out and incorporated in cross profile correction.

**Table 1.3 : Quantity of BM for Profile Corrective Course**

Chainage in Km			Proposed Quantity of PCC (Cum) with B M material	Remarks
<b>KM. 151/200 to 153/500</b>				
<b>Four Lane</b>				
151200	to	152000	547.67	
152000	to	153000	644.92	
153000	to	153500	203.57	
Sub Total (Cum) (A)			<b>1396.17</b>	
<b>KM. 153/500 to 162/100</b>				
153500	to	154000	172.80	
154000	to	155000	230.22	
155000	to	156000	287.36	
156000	to	157000	254.15	
157000	to	158000	244.45	
158000	to	159000	248.43	
159000	to	160000	273.28	
160000	to	161000	239.90	
161000	to	162000	295.73	
162000	to	162100	21.51	
Sub Total (Cum) (B)			<b>2267.81</b>	
Grand Total (Cum) A+B			<b>3663.98</b>	
Add 10% for probable increase in Qty.			<b>366.40</b>	
Surface area			<b>89940.00</b>	
Add 25 mm Extra PCC Qty. for Minimum Thickness			<b>2248.50</b>	
Grand Total (Cum)			<b>4882.71</b>	
Say C F to BoQ			<b>4885.00</b>	
Average PCC Thickness (m)			<b>0.054</b>	

The Quantity for PCC with B M material is considered to be increased by 10% in cost estimated and BoQ (due to possible variation at the time of actual execution of works) and 25 mm extra thickness of PCC has been proposed to avoid dragging of paver screed and feathering to zero

## 1.10 OVERLAY AND WEARING COURSE

1.10.1 The Dense Bituminous Macadam overlay 50mm to 60 mm is adopted for each homogeneous section will be provided over the profile corrective course. The details of kilometer wise thickness proposed to be provided for overlay in each homogeneous section has been shown in table No. 1.8.1 above.

1.10.2 Wearing course with 30mm thick bituminous concrete is proposed.

## 1.11 SHOULDERS

The shoulders wherever deficient in width shall be extended to 1.5m by earthwork. The top surface of the shoulders shall be treated with compacted granular sub base material in a depth varying between 25cm to 30cm. The slope of the shoulders are to be maintained at 1.5(H) : 1.0(V).

## 1.12 CROSS DRAINAGE WORKS AND ROAD SIDE DRAINS

(i) Km 151.200 to 153.500

Out of 6 CD structures all CD structures need minor repairs such as, repairs to parapets, exposed reinforcement & honey comb with PMC in slab culvert. Also Proposed to repair Post and Pipe railing in one Minor bridge. In general silt and vegetation removal are warranted at inlet and outlet of culverts.

(ii) Km 153.500 to 167.000

Out of 11 CD structures all CD structures need minor repairs such as, repairs to parapets, reconstruction of damaged head wall and exposed reinforcement in slab culvert. Proposed to provide R C C railing parapet with Kerb to 5 Minor bridges. In 1 minor bridge jacketing to piers up to 1.5m height is proposed. And 1 vented causeway proposed for reconstruction. In general silt and vegetation removal are warranted at inlet and outlet of culverts. The details of CD works, which are in damaged condition and requiring reconstruction / repairs are as shown in table No. 1.4.

**Table 1.4 : Description of Damaged Cross Drainage Works**

Type of Cross Drainage	Total Nos. Required Repairs	Nature of damages	Remarks
Hume Pipe Culvert	4 No.	---	Proposed to raise parapet height
Slab Culvert	4 Nos.	Pointing to Abutment is damaged, reinforcement in the slab exposed.	Minor Pointing to Abutment and plaster to exposed reinforcement portion of slab is proposed.
Vented Causeway	1 No.	Existing width is of 6.10m and with 2 numbers of 600mm HP	Reconstruction is proposed with 3 numbers 900mm NP-4 HP.
Major Bridge	0 No.	---	---
Minor Bridge	7 Nos.	Parapet is fully damaged/Broken, in 1 MJBR Masonry of all pier is damaged.	R C C Hand Rail with Kerb is proposed and jacketing to all pier of 1 MJBR up to 1.50m height is proposed for protecting to masonry.
Protective work	1 No.	Protective wall near causeway is adjacent to B T edge and also required extension	Propose new Protective wall at sufficient distance and required length

The side drains and CD works that have been blocked due to silting and vegetation are to be cleared out. Some minor repairs need to be done in few structures.

## 1.13 ROAD FURNITURE AND SAFETY WORKS



### **1.13.1 Road Marking**

Road marking at junctions, center - line marking and edge marking in corridor length and pedestrian crossing marking will be provided in village area, near school and edge marking at all curvature and narrow minor bridges with hot applied thermoplastic compound with reflectorising glass beads.

### **1.13.2 Night safety Delineation**

For night safety point of view cat eye (Raised pavement marker) in center line and at edge, kerb guard signage with long delineator at median kerb gap/end, while small delineator on median kerb will be provided. C C road delineator with reflective stripes and reflector in outer edge of curvature is also proposed.

### **1.13.3 Sign Boards**

Reflectorised sign boards like cautionary signs, mandatory signs, informatory signs, place identification signs, chevron signs in curvature, stop signs, give way signs, advance direction signs/junction board signs as well as route marker signs, pedestrian crossing signs, bump / rumble strip signs are proposed for night safety and informations.

### **1.13.4 Crash Barrier**

Crash barrier near by minor bridges high bank is also proposed for safety point of view

### **1.13.5 Kilometer / Hectometer Stones**

Missing Kilometer stones, 5th Kilometre stones and Hectometer stones are proposed. Also removing and refixing of existing Km stones, 5th Km stones and Hectometer stones are proposed. All road signs such as cautionary, mandatory, hazard marker and advance direction, place identification are missing will be erected on the alignment of this corridor.

### **1.13.6 Existing Road Furniture**

Existing road furnitures will be repainted / refurbished after repairs/re-erection wherever required and usefull.