Monitoring and Evaluation of Low Volume Roads Trial Sections in Ethiopia – ETH2051D

Four Research Projects - Second Monitoring Report

Final

Alemgena A. Araya (PhD)
Hunduma Chali

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Cover Photo: Images taken during the monitoring

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ReCAP Project Management Unit
Cardno Emerging Market (UK) Ltd
Oxford House, Oxford Road
Thame
OX9 2AH
United Kingdom

AFRICA COMMUNITY ACCESS PARTNERSHIP (AfCAP)

Safe and sustainable transport for rural communities

AfCAP is a research programme, funded by UK Aid, with the aim of promoting safe and sustainable transport for rural communities in Africa. The AfCAP partnership supports knowledge sharing between participating countries in order to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources. AfCAP is brought together with the Asia Community Access Partnership (AsCAP) under the Research for Community Access Partnership (ReCAP), managed by Cardno Emerging Markets (UK) Ltd.

Acronyms, Units and Currencies

$	United States Dollar (US$ 1.00 ≈ provide conversion to local currencies)
ADB	Asian Development Bank
AFCAP	Africa Community Access Partnership
ASCAP	Asia Community Access Partnership
GPS	Global positioning system
LTPP	Long Term Pavement Performance
LHS	Left Hand Side
ReCAP	Research for Community Access Partnership
RHS	Right Hand Side
UK	United Kingdom (of Great Britain and Northern Ireland)
UKAid	United Kingdom Aid (Department for International Development, UK)

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1 Introduction

1.1 Project Background

The Africa Community Access Partnership (AFCAP) is a research programme funded by the UK Government's Department for International Development (DFID). AFCAP is promoting safe and sustainable rural access in Africa. AFCAP supports knowledge sharing between participating countries in order to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources. The first phase of AFCAP commenced in June 2008 and ended in July 2014. The second phase, which will also run for 6 years, commenced on the 1st August 2014. The management of AFCAP 2 is contracted by DFID to Cardno UK. The aim of the new AFCAP initiative, under the overall Research in Community Access Partnership (ReCAP) umbrella, is to build on the programme of high quality research established under AFCAP phase 1 and take this forward to a sustainable future in which the results of the research are adopted in practice and influence future policy.

A significant portfolio of research activities has now been established in the AFCAP participating countries. AFCAP provides technical assistance for these activities and promotes the uptake of the research findings through revised, country specific design standards and specifications.

The Government of the Federal Democratic Republic of Ethiopia (FDRE) through the Roads Research Centre (RRC) of the Ethiopian Roads Authority (ERA) has constructed research sections with the aim of obtaining data that will assist in the rapid expansion of the sealed low-volume roads network. AFCAP has been asked by the ERA through the RRC to support research on utilization of nonstandard materials for Low Volume Sealed Road (LVSR) pavements. As part of this process the constructed trial sections require periodic monitoring and evaluation.

1.2 Report Structure

The main objective of this report is to present the second monitoring and evaluation of the demonstration/research trials with particular reference given to the monitoring activities undertaken, the status and conditions of the trial section together with current measurements.

The report provides details about the general site description and location of the four trail section projects, pavement structure types and section descriptions. Moreover the report consists of a brief discussion about the works performed and their indications and analysis and outcomes of the pavement evaluation performed during the monitoring period.

The four demonstration/research projects described in this second monitoring report are:

- Otta sealing in the village of Gerado (Combolcha – Mekaneselam Road)
- Alternative AC mix design on the Hawsawa-Abala-Irebti road
- Laterite base trial on the Assosa-Kurmuk road
- Otta sealing in the village of Combel

2 Otta Seals in the Village of Gerado

2.1 Site Description

Combolcha town is situated about 376Km North of Addis Ababa and is one of the major towns located within Amhara Regional Government. Approximately 25Km to the North-West of Combolcha town is located another major town called Dessie. The demonstration site is 8Km along the Combolcha – Mekaneselam road section. It starts at a left side junction 20Km on the Combolcha – Dessie road from Combolcha town. The site location is shown on the map in figure 2-1.

Figure 2-1: Site Location

Table 2-1: Sections

Section	Chainages	Length (m)	Surfacing First Seal	Surfacing Second (Upper) Seal	Prime on Base Layer (Y/N)
1	0+100-0+800	700	Double Otta Seal using hard aggregate	Double Otta Seal using hard aggregate	Y
2	0+800-1+100	300	Single Otta Seal (Hard agg.) with crusher sand cover seal	Single Otta Seal (Hard agg.) with crusher sand cover seal	Y
3	1+100-1+500	400	Single Otta Seal (Hard agg.) with crusher sand cover seal)	Double Otta Seal using hard aggregate	Y
4	1+500-2+000	500	Single Otta Seal (Hard agg.) with crusher sand cover seal)	Double Otta Seal using hard aggregate	N
5	2+000-2+200	200	Single Otta Seal (Hard agg.) with crusher sand cover seal)	Single Otta Seal (Hard agg.) with crusher sand cover seal)	N
6	2+200-2+900	700	Double Otta Seal using hard aggregate	Double Otta Seal using hard aggregate	N

2.2 Pavement Description

The existing pavement of the road was constructed in 2011 as part of a new gravel road that comprised 275mm of sub-base course, and 150mm of wearing course material according to the construction records. However, field tests carried out one year later showed 330mm of Upper Gravel Wearing Course on top of 300mm of Lower Gravel Wearing Course.

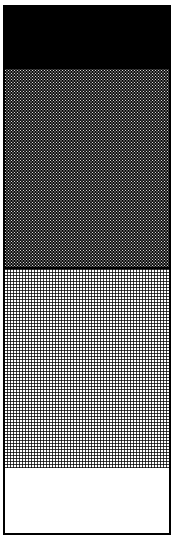


Table 2-2: Pavement Structure

2.3 Monitoring Period

The report incorporates field monitoring and evaluation works performed in December 2017 by the service provider for the second monitoring programme. The weather condition in this monitoring season represents the pavement condition after the wet season in Gerado. During the monitoring period the weather was fully sunny and dry.

The second monitoring programme for the Gerado Village Otta seal demonstration trial section incorporated:-

- Re-Marking of LTPP sections
- Classified traffic counts
- Visual Condition survey
- Drainage Assessment (part of visual condition survey)
- Roughness measurement
- Rut depth measurement
- Deflection Measurement
- DCP tests and
- Trial pit measurements and sampling
- Laboratory tests

Two LTPP sections were established in the first monitoring and evaluation period by the service provider in accordance to the methods set out in the inception report and recommendations given by ERA. DCP, Deflection, Rut depth measurements, trial pit measurement and laboratory tests have been carried out on these LTPP sections. Visual condition survey, drainage assessment and roughness measurements were conducted throughout the trial section.

Accordingly, the report consists of the outcomes and analysis of all the above listed activities as part of the reporting structure of the second monitoring report.

2.1 Marking of LTPP Sections

The start of the first LTPP section begins at the start of the first section and the second LTPP section begins at the start of the second section with respect to the six sections shown in table 2-1, following the two LTPP section established on the first monitoring and evaluation period, sketch diagram/strip map is shown in figure 2.1 below.

The LTPP sections were marked in accordance with the Draft Regional Guidelines for LTPP Monitoring[1] set and templates provided by the AFCAP and ERA in the first monitoring and evaluation period. Since most of the marks had worn out, the service provider re-marked almost all of them in this second monitoring period. Rut depth measurement, Deflection measurement, DCP measurements, Trial pit measurements and laboratory tests were performed on the LTPP sections. Other activities such as the visual condition and drainage condition assessments programmed for the second monitoring cycle were performed on the whole trial section.

[1] Guideline for the Monitoring of Experimental and LTPP Sections in Mozambique, First Draft. Phil Paige-Green, Project No. MOZ2093A, 5th January 2016

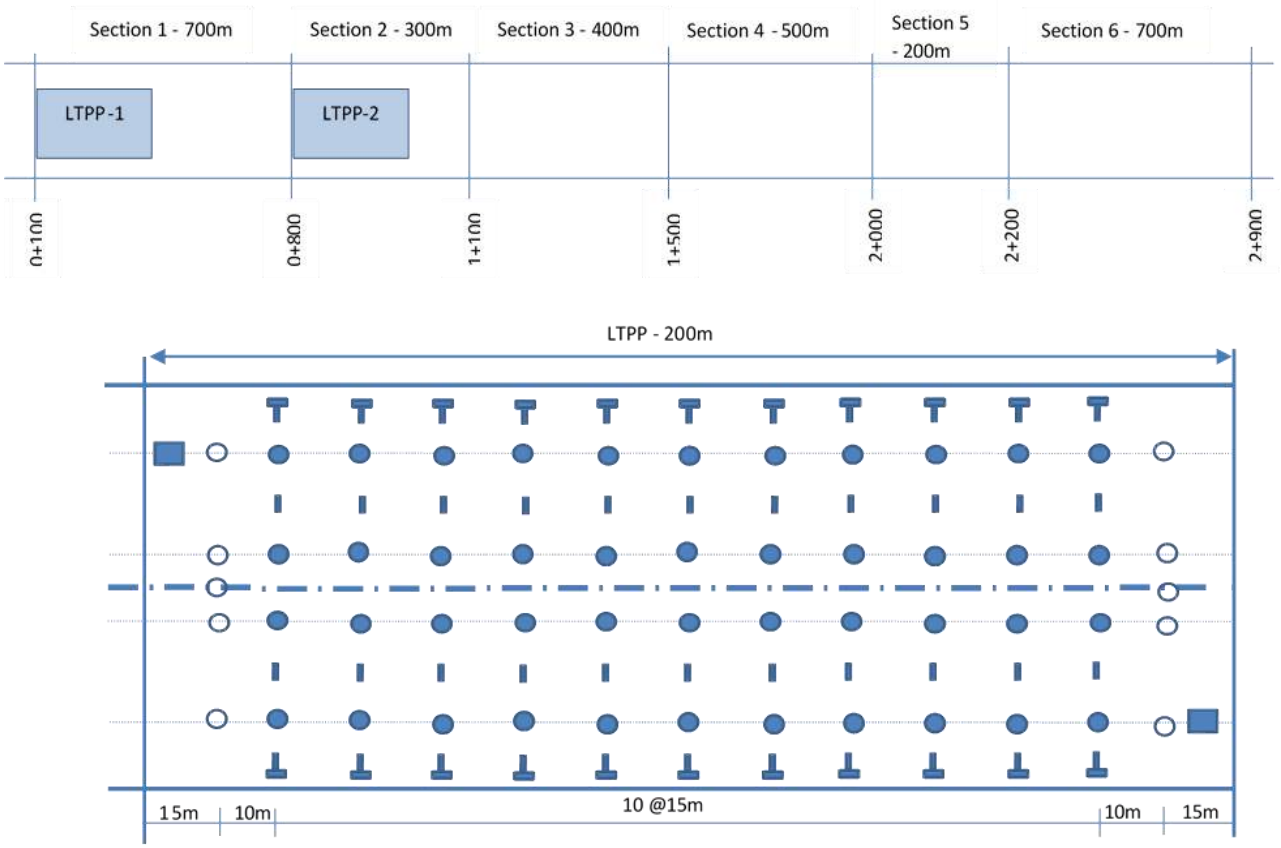


Figure 2-2: Sketch Diagram of the Gerado Trial and LTPP sections

Figure 2-3: Worn out Marks of the LTPP sections

2.2 Traffic Survey

2.2.1 Classified Traffic Counts

Traffic counts were carried out in the project area of the trial section for seven days which includes day time 12 hours for seven days and night time 12 hours for 2 days (one on working days and the other on weekends). Traffic counts with detail dates and time of survey are shown on Annex I. The 12 hours reading are factored to convert to 24 hours reading based up on the reading taken at the night hours. The average daily traffic count is summarized and presented as follows.

Table 2-3: Traffic Volume Summary

Vehicle Type	Daily Volume (vpd)
Motorcycles	20
Bajaj's	17
Cars	11
4×4 Station Wagons (Land Rover)	191
Small Bus <27 Passengers	753
Large Bus > 27 Passengers	89
Small Truck < 3.5 Tonnes	151
Medium Truck 3.5 to 7.0 tonnes	127
Heavy Truck 7.5 – 12 tonne	81
Truck Trailer > 12 tonne	30
Tractors and Agricultural Vehicles	0
ADT	**1469**

During the first monitoring cycle a lot of animal driven carts were recorded together with Bajaj's (Tricycle passenger motors). In the second monitoring period, however, the number of animal carts were not recorded.

Some small buses were seen to provide transport services between Gerado village and Dessie town. Their service, however was observed to operate only as far as midway from Gerado Village to Dessie town. Therefore their traffic only affected half the trial section towards Dessie. In contrast almost all the heavy vehicles observed pass by Gerado village to other destination and therefore affects the entire trial section.

Generally, the Average Daily Traffic (ADT) decreased significantly in the second monitoring period compared to the first monitoring period from 2294 (excluding motorcycle and Bajaj's) in the first monitoring to 1432 (excluding motorcycles and Bajaj's) in the second monitoring. In order to reason out the cause of this change in ADT, a reduction of about 38%, it is necessary to study the trend of ADT that includes the following monitoring periods; such changes could be attributed to seasonal variations or the temporary national and local security and stability issues.

2.2.2 Axle Load Survey

For quite a number of vehicles a four day axle load survey was carried out in the project area. The majority of vehicles surveyed/observed were dump trucks and small trucks. Thus the service provider was able to measure more than 200 vehicles axle load measurement in four days.

Table 2-4: Number of Vehicles surveyed by each category

Vehicle Types	Axle Configuration	Number of Vehicles	Category (see Annex I)
Small Bus - SB	1.2	16	Small Bus
Large Bus - LB	1.2	28	Large Bus
Small Truck - ST	1.2	84	Small Truck
Medium Truck - MT	1.2	16	Medium Truck
Dump Truck - DT	1.2	2	
Dump Truck - DT	1.22	47	Heavy Truck
Water Truck - WT	1.22	0	
Heavy Truck - HT	1.22	16	
Fuel Truck - FT	1.2	0	
	1.22	2	
	1.22+2.2	0	Truck Trailer
	1.22-2.22	1	
Trailer Truck - TT	1.22+2.22	10	
Articulated Truck - AT	1.2-22	0	
	1.22+2.22	3	
	1.22-2222	0	
Total Number of Vehicles Surveyed		**225**	

Table 2-5: Traffic ESA

Vehicle Type	Equivalency Factor	ESA/Day
Small Bus <27 Passengers	1.58	12.64
Large Bus > 27 Passengers	1.25	17.5
Small Truck <3.5 Tonnes	0.65	27.3
Medium Truck 3.5 to 7.0 tonnes	2.82	25.38
Heavy Truck 7.5 - 12Tonne	5.01	45.09
Truck Trailer > 12 tonne	14.07	98.49
Total ESA/day	**226.4**	

2.3 Rutting and Surface Deflection

2.3.1 Rutting

Rutting measurements were taken on the two LTPP sections established on the second and third trial sections and the results are summarized and presented as follows.

Table 2-6: Maximum Rut Depth for LTPP 1 (Section 1)

LTTP Panel	Left Lane		Right Lane	
	Outer Wheel Path	Inner Wheel Path	Outer Wheel Path	Inner Wheel Path
1	12	5	4	2
2	12	8	17	6
3	21	5	10	11
4	13	7	0	4
5	0	0	4	5
6	7	12	0	0
7	0	0	4	6
8	3	8	7	6
9	16	3	7	10
10	11	9	11	17
11	11	0	8	16
Average (mm)	**10**	**6**	**7**	**8**

Table 2-7 : Maximum Rut Depth for LTPP 2 (Section 2)

LTTP Panel	Left Lane		Right Lane	
	Outer Wheel Path	Inner Wheel Path	Outer Wheel Path	Inner Wheel Path
1	5	16	8	5
2	0	0	13	14
3	5	20	10	7
4	5	0	6	8
5	5	0	15	8
6	0	5	9	0
7	7	11	4	12
8	10	0	10	19
9	13	0	8	8
10	10	0	6	26
11	5	0	6	5
Average (mm)	**6**	**5**	**9**	**11**

The average rut depth on both LTPP sections is less than 15 and this indicates low rutting severity. However measurements from some panels on both sections indicated medium severity levels of rutting – in between 15 and 25mm. The 26mm rut depth on the inner right lane of panel 10 of LTPP 2 is the highest. As per the Draft Regional Guideline for LTPP Monitoring rut depth greater than 30mm for paved roads is categorized as severe or dangerous.

2.3.2 Surface Deflection /Non-destructive Test (NDT) Measurement

With the Benkelman Beam instrument provided by ERA rebound deflection measurements were carried out in similar manner to the first monitoring. Accordingly, the rebound test results for this second monitoring and evaluation period are summarized and presented for each LTPP section in the following tables.

Table 2-8: Deflection and Stiffness for LTPP 1

Panel #	D_0 ($\times 10^{-2}$mm)			
	LHS		RHS	
	Outer Wheel Path	Inner Wheel Path	Outer Wheel Path	Inner Wheel Path
1	14	17	17	16
2	22	21	25	17
3	22	20	17	16
4	17	21	18	16
5	16	20	17	17
6	20	20	18	18
7	18	19	19	20
8	19	20	16	22
9	16	17	17	17
10	18	17	19	21
11	17	20	16	18
Average	**18**	**19**	**18**	**18**

Table 2-9: Deflection and Stiffness for LTPP 2

Panel #	D_0 ($\times 10^{-2}$mm)			
	LHS		RHS	
	Outer Wheel Path	Inner Wheel Path	Outer Wheel Path	Inner Wheel Path
1	14	17	14	16
2	22	21	18	17
3	22	20	20	21
4	17	21	20	16
5	16	20	21	17
6	20	20	23	19
7	18	19	20	18
8	19	20	18	19
9	16	17	19	20
10	18	17	20	20
11	17	20	17	18
Average	**14**	**17**	**14**	**16**

Similar to the first monitoring the maximum deflection recorded for the two LTPP sections in the second monitoring is less than 0.3 mm, which indicates that the pavement structure remains sound.

2.4 DCP and Base Moisture

2.4.1 DCP Measurements

Similar to the first monitoring period, the service provider performed DCP tests on the two LTPP sections. For each LTPP section. Five (5) DCP tests were carried out across the road as follows: Outer Wheel Path Left (OWL), Inner Wheel Path Left (IWL), Centreline (CL), Inner Wheel Path Right (IWR), Outer Wheel Path Right (OWR).

Table 2-10: DN values at LTTP cross-section

Depth (mm)	DN values (mm/blow) / LTPP 1 start					
	Specifications	OWL	IWL	CL	IWR	OWR
0 – 150	≤4	15	3	6	4	7
150 – 300	≤9	9	4	7	7	4
300 – 450	≤19	5	2	10	12	9
450 – 600	≤50	8	3	9	5	10
600 – 800	≤50	5	4	12	7	6

Depth (mm)	DN values (mm/blow) / LTPP 1 End					
	Specifications	OWL	IWL	CL	IWR	OWR
0 – 150	≤4	8	4	3	4	4
150 – 300	≤9	9	8	3	4	4
300 – 450	≤19	6	10	7	4	5
450 – 600	≤50	15	6	9	11	10
600 – 800	≤50	5	10	8	6	6

Depth (mm)	DN values (mm/blow) /LTPP 2 Start					
	Specifications	OWL	IWL	CL	IWR	OWR
0 – 150	≤4	7	6	5	5	7
150 – 300	≤9	10	8	8	7	4
300 – 450	≤19	8	9	6	6	6
450 – 600	≤50	8	12	5	24	8
600 – 800	≤50	6	8	9	14	12

Depth (mm)	DN values (mm/blow) / LTPP 2 End					
	Specifications	OWL	IWL	CL	IWR	OWR
0 – 150	≤4	10	5	3	3	5
150 – 300	≤9	12	9	5	3	3
300 – 450	≤19	8	3	5	4	8
450 – 600	≤50	7	8	6	5	7
600 – 800	≤50	7	-	4	5	6

The higher DN values of this second monitoring period seemed to indicate a TLC less than 0.1, mainly the top 150mm layer. This is in contrast to the lesser DN values from the first monitoring, which indicated a TLC higher than 0.1. The reason can be attributed to the seasonal effect that the second monitoring measurement is carried out after a wet season, the seasonal moisture mainly affects the top layers of the pavement.

2.4.2 Moisture Content and DN Values at Trial Pits

On the trial pits, where materials are sampled for laboratory testing, base-course and subbase course natural moisture contents were measured at the same point DCP tests were carried out. Each test point was reinstated carefully to minimize the defects introduced on the site. The results have been summarized and presented in table below.

Table 2-11: DN values and NMC at Trial Pits

Thickness (mm)	Position	DN values (mm/blow) / LTPP1 Start	Moisture Content NMC (%)
64	Base	6	11.3
366	Subbase	8	8.9
342	Subgrade	11	
145	Subgrade	3	

Thickness (mm)	Position	DN values (mm/blow) / LTPP1 End	Moisture Content NMC (%)
198	Base	7	9.6
77	Subbase	2	9.9
660	Subgrade	3	

Thickness (mm)	Position	DN values (mm/blow) / LTPP2 Start	Moisture Content NMC (%)
128	Base	16	7.6
307	Subbase	3	10.7
330	Subgrade	2	

Thickness (mm)	Position	DN values (mm/blow) / LTPP2 End	Moisture Content NMC (%)
68	Base	6	8.7
42	Subbase	2	7.9
15	Subgrade	2	

2.5 Trial Pit Measurements and Laboratory Testing

2.5.1 Trial Pit Measurements and Sampling

In this second monitoring period one of the major activities carried out included trial pit measurements, sampling and laboratory testing on the base, subbase and subgrade materials.

Test pits were excavated in the outer wheel path at the LTPP sections to determine material performance and moisture condition of the base, subbase and subgrade materials of the road pavement.

During test pit trench development the surfacing was first carefully removed causing minimum disturbance of the upper base course material. On exposure of the base course DCP tests were carried out - on the base course and layers underneath. This was followed by sampling of the base material from the test pit, then carefully trimming and cleaning until the next layer was exposed for sampling the subbase material.

Each pavement layers were sampled one by one until the subgrade is reached and it was excavated until it is clear that the in situ material has been reached. Test pits were carefully reinstated with similar quality materials to those removed and the hole sealed with cold-mix asphalt using a vibratory plate compaction machine as shown in figure below.

Figure 2-4: Test Pit trench for sampling and compaction for reinstatement

2.5.2 Laboratory Tests

During sampling of test pits, all samples collected were labelled and described with their material type and depth. Laboratory tests including gradation, Atterberg, dry density and three point CBR test were conducted for the base and subbase materials in a central laboratory. The result of the laboratory test results are summarized as follows.

Table 2-12: Summary of Base Coarse Material Laboratory Test

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit				MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
				2.00	0.425	0.075	LL	PL	PI								
1	Dessie - Gerado, LTPP-2 Right, Start	Upper gravel wearing course	5-30	48	39	34	38	23	15	A-2-6 (1)	1.91	20	Dry Density (g/cc)	1.39	1.79	1.93	73
													CBR %	40.4	68.3	94.3	
													Swell %	1.66	1.42	1.25	
2	Gerado - Dessie, LTPP-2 Left out, End	Upper gravel wearing course	5-30	44	36	31	30	22	8	A-2-4 (0)	1.81	19	Dry Density (g/cc)	1.42	1.68	1.81	62
													CBR %	30.6	53.9	79.1	
													Swell %	1.33	1.29	1.15	
3	Gerado - Dessie, LTPP-1 Left Out, Start	Light brown gravely silty clay	5-25	53	45	39	34	22	12	A-6 (1)	1.84	19	Dry Density (g/cc)	1.54	1.72	1.84	67
													CBR %	34.5	61.1	87.2	
													Swell %	1.41	1.30	1.24	
4	Dessie - Gerado, LTPP-1 Right Out, End	Light brown gravely silty clay	5-30	48	39	34	31	21	10	A-2-4 (0)	1.88	20	Dry Density (g/cc)	1.52	1.74	1.89	71
													CBR %	37.7	60.2	96.1	
													Swell %	1.50	1.33	1.14	

Table 2-13: Summary of Subbase Material Laboratory Test

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit				MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
				2.00	0.425	0.075	LL	PL	PI								
1	Dessie - Gerado, LTPP-2 Right In, Start	Light brown gravely silty clay	30-75	47	38	33	35	23	12	A-2-6 (0)	1.72	22	Dry Density (g/cc)	1.36	1.59	1.72	33
													CBR %	12.6	26.1	47.6	
													Swell %	1.81	1.53	1.21	
2	Gerado - Dessie, LTPP-2 Left out, End	Light brown gravely silty clay	30-75	51	43	36	47	29	18	A-7-6 (2)	1.68	20	Dry Density (g/cc)	1.34	1.58	1.69	22
													CBR %	10.8	20.7	28.8	
													Swell %	2.24	1.87	1.59	
3	Gerado - Dessie, LTPP-1 Left Out, Start	brown gravelly	25-65	45	38	33	47	29	18	A-2-7 (1)	1.72	22	Dry Density (g/cc)	1.32	1.55	34.10	31
													CBR %	11.7	22.5	1.7	
													Swell %	2.14	1.75	1.53	
4	Dessie - Gerado, LTPP-1 Right Out, Start	Light brown gravely silty clay	30-75	47	40	35	35	22	13	A-2-6 (1)	1.77	20	Dry Density (g/cc)	1.35	1.64	1.70	28
													CBR %	13.5	23.4	37.7	
													Swell %	1.57	1.30	1.11	

2.6 Roughness Measurements

Roughness measurement was performed, similar to the first monitoring, using MERLIN roughness measuring instrument, which were available at the research centre of ERA. The outcome of the calibration procedure and the roughness measurements are presented in the following tables

Table 2-14: Calibration Result of the MERLIN

Calibration	
Thickness of Calibration Block (T) =	6
Corresponding Displacement (S) =	65
Scaling Factor (SF) = (10*T)/S =	0.923

Table 2-15: Roughness Result

SECTION	**Right Lane**			**Left Lane**			**Average IRI**
	Initial Reading (D_i)	**Final Reading (D_f) = SF*D_i**	**RI = 0.593+0.0471 *D_f**	**Initial Reading (D_i)**	**Final Reading (D_f) = SF*D_i**	**RI = 0.593+0.0471 *D_f**	
1	76	70	3.90	110	102	5.38	4.64
2	110	102	5.38	81	75	4.11	4.75
3	137	126	6.55	84	78	4.25	5.40
4	97	90	4.81	105	97	5.16	4.98
5	80	74	4.07	79	73	4.03	4.05
6	155	143	7.33	104	96	5.11	6.22

The roughness result shows in the range of 4 to 6 IRI, similar to the first monitoring cycle. This indicates roughness of an old and defective paved road, as per Draft Regional Guideline for LTPP monitoring.

2.7 Visual Condition Assessment

Visual condition data was collected using the formats and protocols on the Draft Regional Guideline. Similar to the first monitoring after conducting the condition assessment and rating based on the Regional Guideline, the suitability condition index is summarised using the South Africa methods.

The analysis is based on an aggregate formula as described in TRH 22: “Pavement Management Systems.

The formula for calculating the VCI (Visual Condition Index) is:

$$\mathrm{VCI} = \left(a * VCI_P + b * VCI_p^2\right)^2$$

Where:

$$VCI_p = 100\left\{1 - C\left[\sum_{n=0}^{n} F_n\right]\right\}$$

a = 0.04

b = 0.0006

VCI_{max} = 100

VCI_{min} = 0

VCI_p = preliminary VCI

F_n = D_n*(E_n^Y_n)*W_n*S_n

n = Visual assessment item number that specified on the condition assessment sheet

D_n = Degree rating of defect n
Range: 0 to 4 for functional defects and
:0 to 5 for other defects

E_n = Extent rating of defect n
Range: Default 3 for functional defects
:0 to 5 for other defects

W_n = Weight for defect n as in the following table

Yn = Extent weight factor of the value shown in the following table

S_n = Small scale factor to be set to 1 for functional degree rating >1, or for other defects degree rating >2, or else the Sn is according to the next table

C = $1/\sum_{n=0}^{n} F_{nmax}$

$F_{n(max)}$ = Fn with degree and extent rating set at maximum

Table 2-16: Weight set for VCI formula

Item #	Defect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)
1	SURFACING FAILURES	6.5	1.0	1.2
2	SURFACING PATCHING	6.5	1.0	1.2
3	SURFACING CRACKS	5	1.0	1.1
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9
5	AGGREGATE LOSS	4	1.0	1.1
6	BLEEDING / FLUSHING	3	0.5	1.0
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0
9	TRANSVERSE CRACKS	4.5	1.0	1.0
10	LONGITUDINAL CRACKS	4.5	1.0	1.0
11	CROCODILE CRACKS	10	1.0	1.3
12	PUMPING	10	1.0	1.3
13	RUTTING	8	0.5	1.0
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0
15	PATCHING	8	0.8	1.1
16	FAILURES / POTHOLES	15	1.0	1.3

17	ROUGHNESS	5.5	0.8	1.0
18	SKID RESISTANCE	3	0.5	1.0
19	SURFACE DRAINAGE	3	0.5	1.0
20	SHOULDERS (unpaved)	3.5	1.0	1.0
21	EDGE DEFECTS	3.5	0.8	1.0

Based on the outcome of the VCI the condition of the sections is calorized as per the following table:

Table 2-17: Condition Categories

Description of category	Condition index range
Very good	85 ≤ VCI ≤ 100
Good	70 ≤ VCI < 85
Fair	50 ≤ VCI < 70
Poor	30 ≤ VCI < 50
Very poor	0 ≤ VCI < 30

Table 2-18: Condition Index for each section

Section #	LHS VCI	RHS VCI	Average VCI	Category	Pictures
1	80	53	67	Fair	
2	70	62	66	Fair	
3	72	85	79	Good	

					
4	76	81	79	Good	
5	78	62	70	Good	
6	58	49	54	Fair	

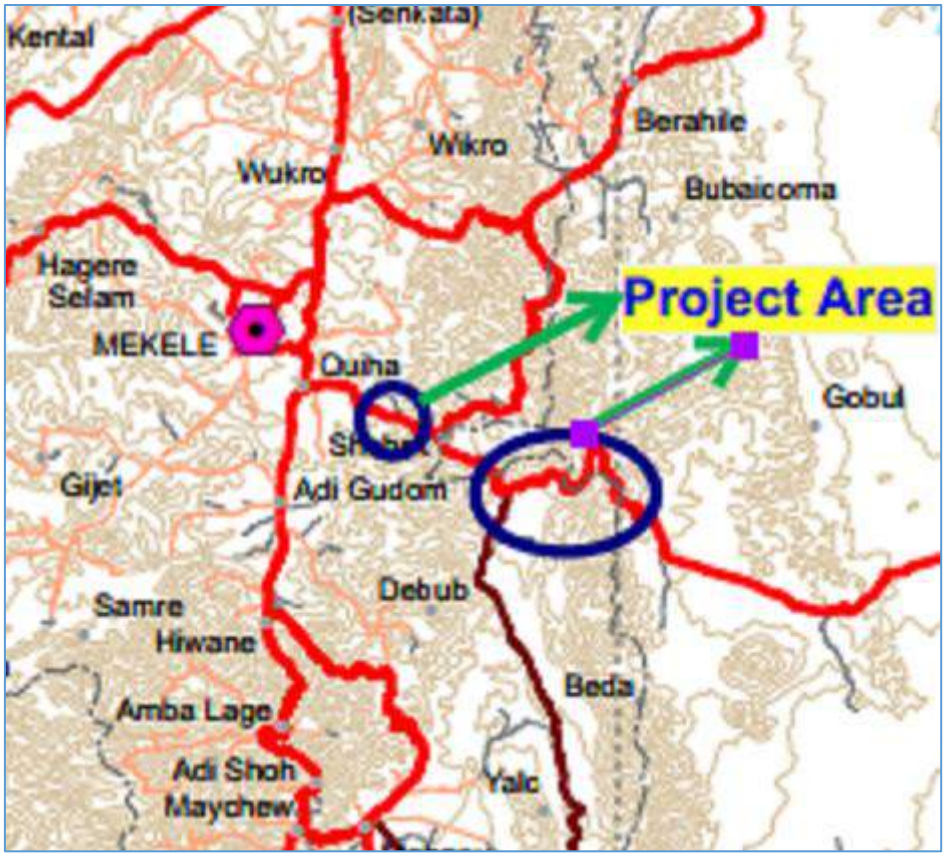
					

The condition survey results in the second monitoring falls under Fair to Good category, it is an indication to the deterioration development through time particularly after wet season comparing to the after dry season first monitoring which was under Good to Very Good category on the trial sections.

3 Revised AC Mix Design – Hawsewa – Abala – Erebti road

3.1 Site Description

The trial sections located on Hawusewa – Abala – Erebti road which is found on both Tigray and Afar Regional Governments. The road starts at a left side Junction 10Km from Mekele town on the road to Addis Ababa around a place called Ashengoda near Wind Turbine Electric Power Station. The road connects Tigray to the port of Djibouti and services mainly heavy trucks. The two LTPP section exists between Hawusewa and Abala villages and the other three exists between Abala and Erebti towns.



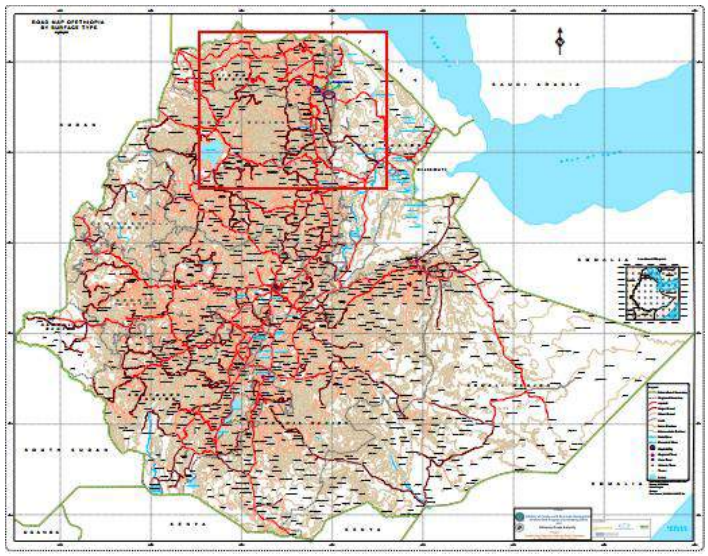


Figure 3-1: Site Location

The LTPP sections, shown in table 3-1, are established base on terrain characteristics, temperature and method of Design.

Table 3-1: LTPP Sections

Section	Chainage	Description
1	9+200 – 9+380	Top of Escarpment (2343m-2347m above sea level)
2	25+100 – 25+300	On Escarpment grade (1826m – 1843m above sea level)
3	38+700 – 39+000	Bottom of Escarpment (1414m – 1422m above sea level)
4	59+740 – 59+940	On Second Escarpment grade (1340m – 1357m above sea level)
5	92+062 – 92+190	On second flat section hot area about 850m above sea level

3.2 Pavement Description

The project road was constructed using 50mm AC, 200mm Crushed stone base and 350mm Selected Natural Sub-Base. Apart from section 3 and 4 of table 3-1 the AC was designed using marshal mix design method, however the two sections (3 and 4) are designed using refusal compaction method and built as a trial section.

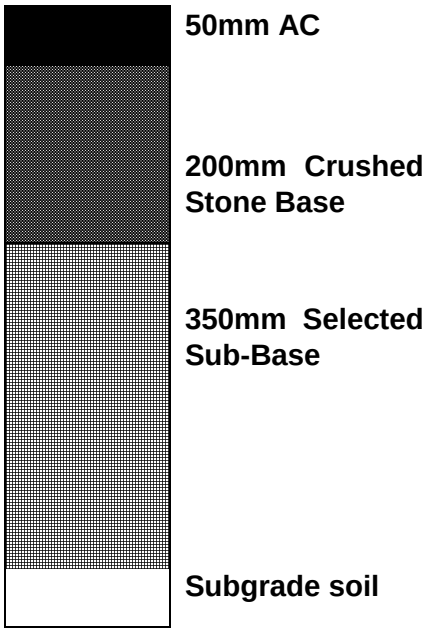


Table 3-2: Pavement Structure

3.3 Monitoring Period

The report incorporates pavement evaluation works conducted by the service provider for the second monitoring programme on December 2017.

During the evaluation there were no rain the majority of time was sunny and dry. The second monitoring programme for Hawusewa – Abala – Erebti AC mix design trial incorporates:-

- Classified traffic counts
- Axle Load Survey
- Visual Condition survey
- Drainage Assessment (part of visual condition survey)
- Deflection measurement

- Rut depth measurement
- Test Pit measurements and sampling
- Laboratory test

Accordingly the report consists of the outcomes and analysis of all the above listed activities as part of the reporting structure of the first cycle monitoring report.

3.4 Traffic Survey

3.4.1 Classified Traffic Counts

Traffic count was carried out around the project area of the trial section for seven days which includes day time 12 hours count for seven days and night time 12 hours count for 2 days (one on working days and the other on weekends). The 12 hours reading are factored to convert to 24 hours reading based up on the reading taken at the night hours. The average daily traffic count is summarized and presented in the following table.

Table 3-3: Traffic Volume Summary

Vehicle Type	**Daily Volume (vpd)**
Motorcycles	75
Bajaj	96
Cars	50
4×4 Station Wagons (Land Rover)	206
Small Bus <27 Passengers	129
Large Bus >27 Passengers	8
Small Truck <3.5 Tonnes	161
Medium Truck 3.5 to 7.0 tonnes	83
Heavy Truck 7.5 - 12Tonne	92
Truck Trailer > 12 tonne	143
Tractors and Agaric Vehicles	11
ADT	**1054**

The Average Daily Traffic (ADT) increased significantly in the second monitoring period compared to the first monitoring period from 641 (excluding motorcycle and Bajaj's) in the first monitoring to 883 (excluding motorcycles and Bajaj's).

3.4.2 Axle Load Survey

Axle load Survey has been carried out on the project area and majority of the vehicle were dump trucks transporting mainly sand form Abala Region to Mekele Area. Due to this sections 1, 2 and 3 influenced by all the vehicles categories however the other two section mainly influenced by the loading of Truck Trailer Categories.

Table 3-4: Number of Vehicles surveyed by each category

Vehicle Types	Axle Configuration	Number of Vehicles	Category
Small Bus - SB	1.2	12	Small Bus
Small Truck - ST	1.2	3	Small Truck
Medium Truck - MT	1.22	6	Medium Truck
Heavy Truck - HT	1.22	15	
Dump Truck - DT	1.22	69	
Fuel Truck - FT	1.22	1	
	1.22+2.2	3	Truck Trailer
	1.22-2.22	16	
Trailer Truck - TT	1.22+2.22	59	
Articulated Truck - AT	1.2+2.2	3	
	1.2+2.22	8	
	1.22+2.22	25	
Total Number of Vehicles Surveyed		**195**	

Table 3-5: Traffic ESA

Vehicle Type	Equivalency Factor	ESA/Day
Small Bus <27 Passengers	0.8	52
Large Bus >27 Passengers	2	8
Small Truck <3.5 Tonnes	0.46	37
Medium Truck 3.5 to 7.0 tonnes	2.61	108
Heavy Truck 7.5 - 12Tonne	26.21	1205
Truck Trailer > 12 tonne	29.36	2260
Total ESA/day	**3670**	

3.5 Rutting and Surface Deflection

3.5.1 Rut Measurement

Rut depth measurement for each 5 LTPP sections during the second monitoring and evaluation period are categorized and summarized in table below.

Table 3-6: Maximum Rut Depth

LTPP 1	1 - Top of Escarpment (2343m-2347m above sea level)			
PANEL	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
1	5	0	0	2
2	3	0	0	2
3	2	0	0	2
4	5	0	0	3
5	3	0	0	2
6	0	0	0	0
7	0	0	0	0
8	3	0	0	0
9	7	0	0	0
10	0	0	0	0
90th Percentile	6	0	0	3

Maximum Rut depth (mm)	7	0	0	3
Average Rut depth (mm)	3	0	0	2

LTPP 2	**2 - On Escarpment (1826m – 1843m above sea level)**			
PANEL	**LEFT LANE**		**RIGHT LANE**	
	Outer Wheel path	**Inner Wheel path**	**Inner Wheel path**	**Outer Wheel path**
1	6	0	0	9
2	4	2	0	3
3	4	0	0	7
4	5	4	0	2
5	2	4	0	0
6	4	0	0	3
7	0	0	0	0
8	14	0	0	0
9	0	3	2	0
10	3	0	0	0
11	6	0	0	0
90th Percentile	6	4	0	7
Maximum Rut depth (mm)	14	4	2	9
Average Rut depth (mm)	5	2	1	3

LTPP 3	**3 - Bottom of Escarpment (1414m – 1422m above sea level)**			
PANEL	**LEFT LANE**		**RIGHT LANE**	
	Outer Wheel path	**Inner Wheel path**	**Inner Wheel path**	**Outer Wheel path**
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	4	0	0	7
8	0	0	0	0
9	0	0	0	2
10	0	0	0	0
11	0	0	0	0
90th Percentile	0	0	0	2
Maximum Rut depth (mm)	4	0	0	3
Average Rut depth (mm)	1	0	0	1

LTPP 4	4 - On Second Escarpment (1340m – 1357m above sea level)					
PANEL	LEFT LANE		RIGHT LANE		RIGHT Climbing Lane	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path	Inner Wheel path	Outer Wheel path
1	11	16	0	0	4	2
2	21	13	0	0	3	5
3	6	0	0	0	5	12
4	27	18	0	0	0	12
5	8	15	0	0	3	5
6	22	14	3	0	0	6
7	12	5	0	0	7	0
8	17	8	3	0	0	3
9	26	14	0	0	0	2
10	12	7	0	0	0	7
11	14	14	0	0	4	10
12	11	8	0	0	0	8
13	11	12	0	0	5	10
90th Percentile	26	16	3	0	5	12
Maximum Rut depth (mm)	27	18	3	0	7	12
Average Rut depth (mm)	13	12	1	0	3	7

LTPP 5	5 - On second flat section hot area about 850m above sea level			
PANEL	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
1	15	14	3	3
2	26	15	6	8
3	27	26	8	9
4	4	13	11	0
5	10	21	13	2
6	3	10	3	0
7	9	18	4	0
90th Percentile	27	23	12	9
Maximum Rut depth (mm)	27	26	13	9
Average Rut depth (mm)	14	17	7	4

The measurements indicate the escarpments on the hot section of the road (LTPP 4) exhibit higher rutting. The Hawusewa – Abala – Erebti road is the preferred route due to its much shorter distance to transport goods from and to Djibouti port to the northern part of the country. However, usually the heavy vehicles leave empty to the Djibouti import export border or leave to other side of the country mostly to Addis Ababa to carry other goods to the border. Moreover, sand carrying dump trucks left Mekele City empty and transport the sand from the Afar region to Mekele most of the time highly loading the vehicle above the legally permitted amount i.e. 8 tonnes for front axle and 10 tonnes for rear axle.

Both the long distance vehicles from Djibouti and Sand dump trucks are loaded towards Mekelle on the left lane and empty from Mekelle on the right lane, thus similar to the first monitoring period the table above clearly indicates that the left hand side (LHS) lane is heavily loaded than the right hand side (RHS) lane.

3.5.2 Surface Deflection /Non-destructive Test (NDT) Measurement

With the Benkelman Beam instrument provided by ERA a rebound deflection measurements has been carried out on the second monitoring. Accordingly the rebound test results for this second monitoring and evaluation period are summarized and presented for each LTPP sections in the following tables.

Table 3-7: Deflection and Stiffness for LTPP 1 – 5

Panel #	LTPP 1, D_0 ($\times 10^{-2}$mm)			
	LHS		RHS	
	Outer Wheel Path	Inner Wheel Path	Outer Wheel Path	Inner Wheel Path
1	17	12	10	11
2	16	13	12	12
3	17	10	13	13
4	13	13	11	11
5	17	14	12	12
6	15	13	11	10
7	15	14	13	12
8	14	17	10	12
9	10	12	10	14
10	14	15	11	12
Average	15	13	11	12

Panel #	LTPP2, D_0 ($\times 10^{-2}$mm)			
	LHS		RHS	
	Outer Wheel Path	Inner Wheel Path	Outer Wheel Path	Inner Wheel Path
1	10	16	15	16
2	9	13	12	16
3	11	12	14	15
4	10	9	19	11
5	12	12	12	16
6	10	13	14	18
7	11	16	18	13
8	10	14	17	13
9	11	10	14	9
10	15	10	16	10
11	11	12	20	11
Average	11	12	16	13

Panel #	LTPP 3, D_0 ($\times 10^{-2}$mm)			
	LHS		RHS	
	Outer Wheel Path	Inner Wheel Path	Outer Wheel Path	Inner Wheel Path
1	11	12	16	10
2	10	12	14	9
3	12	11	13	11
4	13	12	12	14
5	11	10	11	10
6	13	12	11	9
7	14	10	11	11
8	12	9	11	10
9	15	12	14	10
10	11	9	12	11
11	14	8	12	10
Average	12	11	12	10

Panel #	LTPP 4, D_0 ($\times 10^{-2}$mm)					
	LHS		RHS		RIGHT Climbing Lane	
	Outer Wheel Path	Inner Wheel Path	Outer Wheel Path	Inner Wheel Path	Inner Wheel path	Outer Wheel path
1	**14**	**20**	**15**	**14**	**17**	**18**
2	**11**	**18**	**13**	**13**	**18**	**18**
3	**11**	**12**	**12**	**10**	**13**	**16**
4	**14**	**11**	**13**	**11**	**17**	**14**
5	**18**	**12**	**14**	**15**	**13**	**16**
6	**15**	**15**	**13**	**12**	**12**	**15**
7	**12**	**13**	**14**	**13**	**14**	**13**
8	**14**	**14**	**10**	**15**	**16**	**14**
9	**15**	**14**	**12**	**13**	**11**	**13**
10	**10**	**13**	**13**	**14**	**14**	**12**
11	**11**	**13**	**14**	**14**	**14**	**15**
Average	13	14	13	13	14	15

Panel #	LTPP 5, D_0 ($\times 10^{-2}$mm)			
	LHS		RHS	
	Outer Wheel Path	Inner Wheel Path	Outer Wheel Path	Inner Wheel Path
1	16	14	18	17
2	17	15	16	14
3	18	16	17	22
4	20	19	16	20

5	16	21	14	21
6	17	14	13	16
7	21	18	15	14
Average	18	17	16	18

Similar to the first monitoring the maximum deflection recorded for the two LTPP sections in the second monitoring is less than 0.3 mm, which indicates that the pavement structure remains sound.

3.6 DCP and Base Moisture

3.6.1 Moisture Content and DN Values at Trial Pits

On the trial pits, where materials are sampled for laboratory testing, base course and subbase course natural moisture contents were measured at the same point DCP tests were carried out. Each test points has been reinstated carefully to minimize the defects introduced on the site. The results have been summarized and presented in table below.

Table 3-8: DN values and NMC at Trial Pits under AC Designed by Refusal Compaction

Thickness (mm)	Position	DN values (mm/blow) / LTPP3 Start (St. 59+750) LHS	Moisture Content NMC (%)
207	Base	Refusal /coarse granular/	5.2
211	Subbase	4	6.7
119	Subgrade	3	12.6

Thickness (mm)	Position	DN values (mm/blow) / LTPP3 End (St. 59+930) RHS	Moisture Content NMC (%)
200	Base	5	6.1
241	Subbase	2	8.2
223	Subgrade	2	

Thickness (mm)	Position	DN values (mm/blow) / LTPP4 Start (St. 92+050) LHS	Moisture Content NMC (%)
157	Base	2	5.2
261	Subbase	4	9.3
	Subgrade	Refusal	14.2

Thickness (mm)	Position	DN values (mm/blow) / LTPP4 End (St. 92+180) RHS	Moisture Content NMC (%)
215	Base	Refusal /Coarse granular/	4.5
343	Subbase	4	9.8
98	Subgrade	2	

3.7 Trial Pit Measurements and Laboratory Testing

3.7.1 Trial Pit Measurements and Sampling

In this second monitoring period one of the major activities carried out is the trial pit measurements, sampling and laboratory testing on the base, subbase and subgrade materials.

Test pit were excavated in the outer wheel path in the left and right lane alternatively at the two LTTP sections (LTPP3 and LTPP 4), where their AC is mixed based on Refusal Density to determine material performance and moisture condition of the base, subbase and subgrade materials of the road pavement. On completion of the trenching and collection of samples, the pavement has been reinstated to its original condition.

During test pit trench development the AC surfacing was first carefully removed, by using asphalt cutter, causing minimum disturbance of the upper base course material. On exposure of base course DCP test has been carried out on the base course and under layers. Then base material is sampled from test pit and carefully trimmed and cleaned until the next layer is exposed for sampling subbase material.

Each pavement layers were sampled one by one until the subgrade is reached and it was excavated until it is clear that the in situ material has been reached. Test pits has been carefully reinstated with similar quality materials to those removed and the hole sealed with cold-mix asphalt using a vibratory plate compaction machine.

3.7.2 Laboratory Tests

During sampling of test pits a summary of all samples collected has been labelled and described with their material type and location before sending to central laboratory. Laboratory tests including gradation, Atterberg, dry density and three point CBR test has been conducted for the base and subbase materials in a central laboratory. The result of the laboratory test results has been summarized as follows.

Table 3-9: Summary of Base Coarse Material Laboratory Test

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit				MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
				2.00	0.425	0.075	LL	PL	PI								
1	59+750, LHS	Weathered Basaltic gravel	7-29	20	10	7	23	22	1	A-1-a (0)	2.17	10	Dry Density (g/cc)	1.88	2.07	2.18	86
													CBR %	47.6	88.1	111.0	
													Swell %	0.94	0.62	0.47	
2	59+930, RHS	Slight to Moderately weathered Basaltic gravel with light brown	6-30	39	22	10	24	22	2	A-1-a (0)	2.19	12	Dry Density (g/cc)	1.93	2.09	2.20	91
													CBR %	56.4	93.4	128.6	
													Swell %	0.81	0.59	0.41	
3	92+050, LHS	Moderately weathered Basaltic gravel	7-30	22	12	9	25	22	3	A-1-a (0)	2.14	12	Dry Density (g/cc)	1.91	2.09	2.16	92
													CBR %	67.0	104.0	137.4	
													Swell %	0.80	0.47	0.39	
4	92+180, RHS	Moderately weathered Basaltic gravel with clayey silt	7-30	29	20	16	26	22	4	A-2-4 (0)	2.20	12	Dry Density (g/cc)	1.91	2.11	2.21	100
													CBR %	59.9	104.0	141.0	
													Swell %	80.00	0.47	0.39	

Table 3-10: Summary of Subbase Material Laboratory Test

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit				MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
				2.00	0.425	0.075	LL	PL	PI								
1	59+750, LHS	Moderately weathered grave mixed with Light brown silty clay	27-70	30	20	14	33	21	12	A-2-6 (0)	1.90	19	Dry Density (g/cc)	1.67	1.82	45.80	30
													CBR %	17.1	31.4	1.9	
													Swell %	1.52	1.29	1.13	
2	59+930, RHS	Moderately weathered grave mixed with Light brown silty clay	30-67	16	11	7	32	22	10	A-2-4 (0)	1.91	20	Dry Density (g/cc)	1.65	1.80	1.92	37
													CBR %	20.7	35.0	51.2	
													Swell %	1.55	1.29	1.14	
3	92+050, LHS	Grave mixed with silty clay	35-70	24	14	10	35	22	13	A-2-6 (0)	1.88	19	Dry Density (g/cc)	1.58	1.75	1.89	36
													CBR %	13.5	29.7	52.1	
													Swell %	1.93	1.72	1.25	
4	92+180, RHS	Grave mixed with Light brown silty clay	30-65	29	19	15	31	20	11	A-2-6 (0)	1.82	21	Dry Density (g/cc)	1.53	1.70	1.83	33
													CBR %	14.4	27.9	50.3	
													Swell %	1.54	1.31	1.16	

Table 3-11: Summary of Subgrade Material Laboratory Test

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit				MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
				2.00	0.425	0.075	LL	PL	PI								
1	59+750, LHS	Highly to Moderately weathered gravel with Light brown silty clay	75-102	67	43	26	48	30	18	A-2-7 (0)	1.84	22	Dry Density (g/cc)	1.55	1.71	1.83	19
													CBR %	10.4	16.7	25.6	
													Swell %	2.19	1.87	1.65	
3	92+050, LHS	Light brown silty clay mixed with gravels	70-110	54	39	23	39	23	16	A-2-6 (0)	1.69	20	Dry Density (g/cc)	1.35	1.50	1.69	17
													CBR %	6.9	13.6	20.4	
													Swell %	1.97	1.66	1.29	

3.8 Roughness Measurements

Roughness measurement was performed, similar to the first monitoring, using MERLIN roughness measuring instrument which were available at the research centre of ERA. The outcome of the calibration procedure and the roughness measurements are presented in the following tables

Table 3-12: Calibration Result of the MERLIN

Calibration	
Thickness of Calibration Block (T) =	6
Corresponding Displacement (S) =	65
Scaling Factor (SF) = (10*T)/S =	0.923

Table 3-13: Roughness Result

SECTION	Right Lane			Left Lane			Average IRI
	Initial Reading (D_i)	Final Reading (D_f) = SF*D_i	RI = 0.593+0.0471*D_f	Initial Reading (D_i)	Final Reading (D_f) = SF*D_i	RI = 0.593+0.0471*D_f	
1	50	46	2.8	45	42	2.5	2.7
2	46	42	2.6	111	102	5.4	4.0
3	38	35	2.2	36	33	2.2	2.2
4	60	55	3.2	120	111	5.8	4.5
5	51	47	2.8	63	58	3.3	3.1

The roughness result shows in right lane in the range of IRI 2 to 3 for AC surfacing which indicate in good condition. Whereas the left lane it is in range of IRI 2 to 6, specially section 2 and 4 shows IRI of about 5 to 6 which is for a pavement of AC surfacing an indication of a very poor older and defective paved road, as per Draft Regional Guideline for LTPP monitoring. This agrees with the rut measurement illustrated above that the left lane is highly loaded comparing to the right.

3.9 Visual Condition Assessment

Visual condition data was collected using the formats and protocols on the Draft Regional Guideline. Similar to the first monitoring after conducting the condition assessment and rating based on the Regional Guideline, suitability condition index is summarised using the South Africa methods.

The analysis is based on an aggregate formula as described in TRH 22: “Pavement Management Systems.

The formula used for calculating the VCI (Visual Condition Index) is

$$\text{VCI} = \left(a * VCI_P + b * VCI_p^2\right)^2$$

Where:

$$VCI_p = 100\left\{1 - C\left[\sum_{n=0}^{n} F_n\right]\right\}$$

a = 0.04

b = 0.0006 and

VCI_{max} = 100

VCI_{min} = 0

VCI_p = preliminary VCI

F_n = $D_n*(E_n\text{^}Y_n)*W_n*S_n$

n = Visual assessment item number that specified on the condition assessment sheet

D_n = Degree rating of defect n
Range: 0 to 4 for functional defects and
:0 to 5 for other defects

E_n = Extent rating of defect n
Range: Default 3 for functional defects
:0 to 5 for other defects

W_n = Weight for defect n as in the following table

Yn = Extent weight factor of the value shown in the following table

S_n = Small scale factor to be set to 1 for functional degree rating >1, or for other defects degree rating >2, or else the Sn is according to the next table

C = $1/\sum_{n=0}^{n} F_{nmax}$

$F_{n(max)}$ = Fn with degree and extent rating set at maximum

Table 3-14: Weight set for VCI formula

Item #	Defect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)
1	SURFACING FAILURES	6.5	1.0	1.2
2	SURFACING PATCHING	6.5	1.0	1.2
3	SURFACING CRACKS	5	1.0	1.1
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9
5	AGGREGATE LOSS	4	1.0	1.1
6	BLEEDING / FLUSHING	3	0.5	1.0
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0
9	TRANSVERSE CRACKS	4.5	1.0	1.0
10	LONGITUDINAL CRACKS	4.5	1.0	1.0
11	CROCODILE CRACKS	10	1.0	1.3
12	PUMPING	10	1.0	1.3
13	RUTTING	8	0.5	1.0
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0
15	PATCHING	8	0.8	1.1
16	FAILURES / POTHOLES	15	1.0	1.3
17	ROUGHNESS	5.5	0.8	1.0

18	SKID RESISTANCE	3	0.5	1.0
19	SURFACE DRAINAGE	3	0.5	1.0
20	SHOULDERS (unpaved)	3.5	1.0	1.0
21	EDGE DEFECTS	3.5	0.8	1.0

Based on the outcome of the VCI the condition of the sections is calorized as per the following table:

Table 3-15: Condition Categories

Description of category	Condition index range
Very good	85 ≤ VCI ≤ 100
Good	70 ≤ VCI < 85
Fair	50 ≤ VCI < 70
Poor	30 ≤ VCI < 50
Very poor	0 ≤ VCI < 30

Based on the visual condition Survey using the above the visual condition index and the category has been summarized and presented on table below.

Table 3-16: Condition Index for each section

Section	Condition Index			Category
	Left	Right	Avg.	
9+200 – 9+380, Top of Escarpment (2343m-2347m above sea level)	94	92	93	Very Good
				
25+100 – 25+300, On Escarpment (1826m – 1843m above sea level)	89	97	93	Very Good

38+700 – 39+000, Bottom of Escarpment (1414m – 1422m above sea level)	95	90	93	Very Good

59+740 – 59+940, On Second Escarpment (1340m – 1357m above sea level)	65	81	73	Good

92+062 – 92+190, On second flat section hot area about 850m above sea level	76	88	82	Good

The results at section 4 and 5 is inferior from the rest due to rutting and shoving occurred especially on the left lane of the road due to slow moving heavy loading on the escarpments coming from the port Djibouti. Although the overall category of the condition is not changed from the first monitoring the Condition index value of most of the sections show slightly lower than the first monitoring.

4 Assosa-Kurmuk Laterite Base Trials

4.1 Site Description

The trial base is located at the far western region of Ethiopia within the Benishangul Gumuth Regional Government of Ethiopia. It is located at 49Km along the Assosa – Kumruk Road which begin from the capital of regional government Assosa Town. The trial section also located within a small town administration called Kibur Hamsa i.e. 2Km after passing the centre of the town.

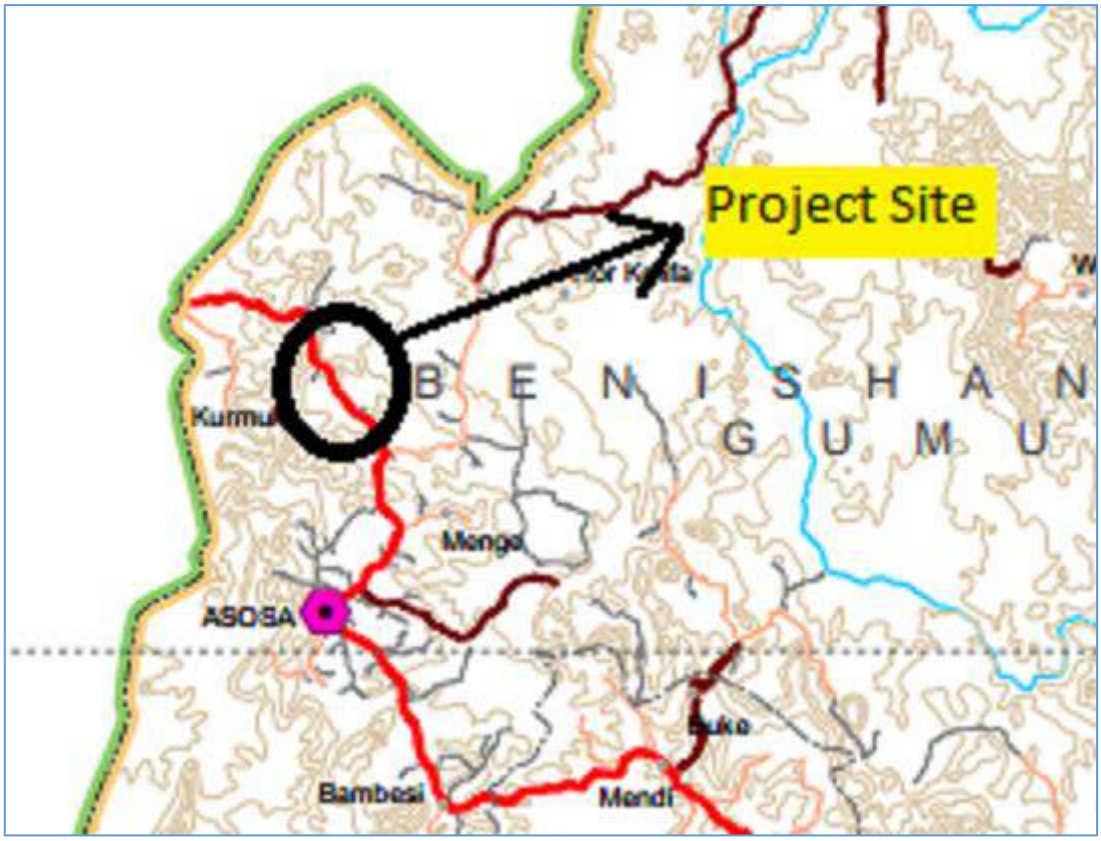


Figure 4-1: Site Location

Table 4-1: Sections

Section	Chainage	Length	Description
1	49+140 – 49+225	85	Unsealed Shoulder on Cut Section (UC1)
2	49+225 – 49+290	65	Unsealed Shoulder on Fill Section (UF1)
3	49+290 – 49+393	103	Sealed Shoulder on Fill Section (SF1)
4	49+393 – 49+496	103	Sealed Shoulder on Cut Section (SC1)
5	49+496 – 49+602	106	Unsealed Shoulder on Cut Section (UC2))
6	49+602 – 49+712	110	Sealed Shoulder on Fill Section (SF2)
7	49+712 – 49+970	258	Unsealed Shoulder on Fill Section (UF2)

4.2 Pavement Description

The existing pavement was constructed with a laterite sub-base of thickness 150mm, the base material used is laterite of 200mm thickness. The surfacing aggregate size is 9.5mm second layer aggregate placed on a first layer of 19mm aggregate.

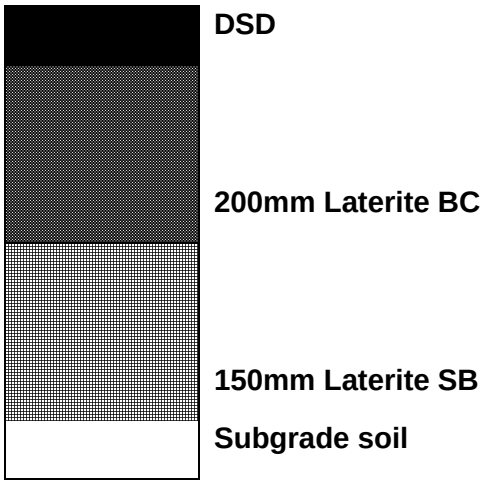


Table 4-2: Pavement Structure

4.3 Mobilization and Setting up Measurement Sections

As illustrated in the first monitoring and evaluation report that marked points were already found visible and easily identifiable except that some markings were encountered worn out which need re-marking for future reference. The same LTTP sections and points were used for this second monitoring and the measurements were taken on these points.

4.4 Monitoring Period

The report incorporates pavement evaluation works performed by the service provider for the second monitoring programme on December 2017/January 2018. The weather condition in this season is the end of the rain season but during the monitoring period the weather was fully sunny and dry. As per the terms of reference the second monitoring programme for Assosa – Kumruk laterite base trial incorporates:-

- Classified traffic counts
- Visual Condition survey
- Drainage Assessment (part of visual condition survey)
- Roughness measurement
- Rut depth measurement
- DCP tests
- Trial pit measurements and sampling
- Laboratory tests

Accordingly the report consists of the outcomes and analysis of all the above listed activities as part of the reporting structure of the second monitoring cycle report.

4.5 Traffic Survey

4.5.1 Classified Traffic Counts

Traffic count was carried out around the project area of the trial section for seven days which includes day time 12 hours for seven days and night time 12 hours for 2 days (one on working days and the other on weekends). The 12 hours reading are factored to convert to 24 hours reading based up on the reading taken at the night hours. The average daily traffic count is summarized and presented in table 4-3.

Table 4-3: Traffic Volume Summary

Vehicle Type	Daily Volume (vpd)
Motorcycles	33
Bajaj	185
Cars	0
4×4 Station Wagons (Land Rover)	40
Small Bus <27 Passengers	97
Large Bus >27 Passengers	0
Small Truck <3.5 Tonnes	4
Medium Truck 3.5 to 7.0 tonnes	6
Heavy Truck 7.5 - 12Tonne	1
Truck Trailer > 12 tonne	4
Tractors and Aggric Vehicles	0
Daily Total	**371**

Similar to the first monitoring the road do not carry considerable heavy vehicles, about half of the traffic count are bajaj (Tuk-Tuk) transporting local people around the test section to the centre of the

town Kibure Hamsa. The overall traffic increase from 230 (including motorcycle and bajaj) in the first monitoring to 371 (including motorcycle and bajaj) in the second monitoring.

4.5.2 Axle Load Survey

Axle load Survey has been carried out on the project area, all in all the traffic volume is quite small this time and majority of the vehicle were dump trucks and small trucks. Thus the service provider was able to measure a limited vehicles for the axle load measurement in four days.

Table 4-4: Number of Vehicles surveyed by each category

Vehicle Types	Axle Configuration	Number of Vehicles	Category
Small Bus - SB	1.2	3	Small Bus
Small Truck - ST	1.2	3	Small Truck
Medium Truck - MT	1.2	1	Medium Truck
Water Truck - WT	1.22	0	Heavy Truck
Dump Truck - DT	1.22	5	
Heavy Truck - HT	1.22	1	
Fuel Truck - FT	1.2	1	
	1.22	1	
	1.22+2.2	0	Truck Trailer
	1.22+2.22	0	
Trailer Truck - TT	1.22+2.22	0	
Articulated Truck - AT	1.2-22	0	
	1.22-222	0	
	1.22-2222	0	
Total Number of Vehicles Surveyed		**15**	

Table 4-5: Traffic ESA

Vehicle Type	Equivalency Factor	ESA/Day
Small Bus <27 Passengers	0.09	4.36
Small Truck <3.5 Tonnes	0.22	0.44
Medium Truck 3.5 to 7.0 tonnes	5.97	17.91
Heavy Truck 7.5 - 12Tonne	4.79	2.4
Total ESA/day	**25**	

4.6 Rut Depth Measurements

Rut depth measurement has been performed on 74 marked panels and for each panel four reading has been taken on outer and inner wheel paths for both left and right lanes. Out of which the 52 panels were on trial sections which were already established during previous evaluation works. And the other 22 panels were marked for the two control LTPP section with 11 panels each.

Figure 4-2: Rut depth measurement using 2m standard straight edge and measuring wedge.

As recommended on the Draft Regional Guideline the rut depth measurement was taken using standard 2m straight edge with a measuring wedge us shown in picture above.

Table 4-6: Average Rut Depth (mm)

Section	Left Lane		Right Lane	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel Path
Unsealed Shoulder on Cut Section (UC1)	7	6	6	5
Unsealed Shoulder on Fill Section (UF1)	6	7	4	7
Sealed Shoulder on Fill Section (SF1)	8	3	4	5
Sealed Shoulder on Cut Section (SC1)	5	3	6	5
Unsealed Shoulder on Cut Section (UC2)	5	4	6	5
Sealed Shoulder on Fill Section (SF2)	7	2	6	4
Unsealed Shoulder on Fill Section (UF2)	7	2	5	11
Control Section - Unsealed Cut (CS1 – UC)	2	1	2	1
Control Section - Unsealed Fill (CS2 – UF)	2	2	3	2

The average rut depth measurement for all roads section is considerably lower than 20mm in this second monitoring too similar to the first monitoring which shows the pavement structures are sound and defects are due to surfacing.

The result also shows that there is no considerable difference in sealed and unsealed shoulders on fill sections, moreover although there is small difference for cut sections that unsealed shoulders shows marginal increment in rut depth the difference is not significant.

At this stage in terms of the rut depth measurement results, the rut depth measurement at the trial section is more than that of the control section. And it also shows that road formation have a marginal effect on the rut depth.

Moreover, comparing this second monitoring rut depths to the first monitoring rut depth measurements, generally it shows a slight increment in the rut depths in most section as expected. However, some sections show slight decrease in rut depth with a very exceptional decrease of in rut depth measurement at the control section - unsealed shoulder cut section (CS1-UC) from average rut depth of 7.8mm in the first monitoring to 1.5mm in the second monitoring which might be attributed to a result of traffic load wander or human error in measurements.

4.7 DCP and Base Moisture Measurements

4.7.1 DCP Measurements

DCP measurements performed on all the trial section near the previously tested points and on the two LTPP sections established on the new control sections. The DCP test performed on the Outer Wheel Path Left (OWL), Inner Wheel Path Left (IWL), Centreline (CL), Inner Wheel Path Right (IWR), and Outer Wheel Path Right (OWR). The outcome has been summarized and present as follows.

Table 4-7: DN values at cross-sections

Depth (mm)	DN values (mm/blow) / UC1					
	Specifications (E.g. TLC 0.1)	OWL	IWL	CL	IWR	OWR
0 – 150	≤4	5	5	5	6.5	7
150 – 300	≤9	4	7	5	4.5	7
300 – 450	≤19	7	7	7	5	7
450 – 600	≤50	12	10	7	7	12.5
600 – 800	≤50	12	7	5	12	17

Depth (MM)	DN Values (mm/blow) / UF1					
	Specifications	OWL	IWL	CL	IWR	OWR
0 -150	≤ 4	7	7	6	6	8
150 - 300	≤ 9	7	6	6	6	7.5
300 - 450	≤ 19	11	13	14	14.5	10.5
450 - 600	≤ 50	17	20	18	22	33
600 - 800	≤ 50	14	23	14	17	16

Depth (MM)	DN Values (mm/blow) / SF1					
	Specifications	OWL	IWL	CL	IWR	OWR
0 -150	≤ 4	9.5	7.5	10	6	7
150 - 300	≤ 9	5.5	8	6.5	6.5	13
300 - 450	≤ 19	15	13	12	11.5	32
450 - 600	≤ 50	21	26	28	15.5	19
600 - 800	≤ 50	29	15	13.5	21	21

Depth (MM)	DN Values (mm/blow) / SC1					
	Specifications	OWL	IWL	CL	IWR	OWR
0 -150	≤ 4	10	8.5	8	6.5	8
150 - 300	≤ 9	8	8	8.5	6.5	8
300 - 450	≤ 19	10	11	17	7	12
450 - 600	≤ 50	7.5	15	16	9	13
600 - 800	≤ 50	6	13	14	6	20

Depth (MM)	DN Values (mm/blow) / UC2					
	Specifications	OWL	IWL	CL	IWR	OWR
0 -150	≤ 4	6	4.5	4	4.5	4
150 - 300	≤ 9	6	4	4	6.5	5.5
300 - 450	≤ 19	16	5	5.5	7	5
450 - 600	≤ 50	35	5	4.5	7	4
600 - 800	≤ 50	19	4	6	7.5	6.5

Depth (MM)	DN Values (mm/blow) / SF2					
	Specifications	OWL	IWL	CL	IWR	OWR
0 -150	≤ 4	6.5	6	5.5	7	8
150 - 300	≤ 9	7	6	4.5	10	11
300 - 450	≤ 19	13	10.5	14	16	16
450 - 600	≤ 50	7	13	17.5	13	13
600 - 800	≤ 50	12	13.5	17	17	29

Depth (MM)	DN Values (mm/blow) / UF2					
	Specifications	OWL	IWL	CL	IWR	OWR
0 -150	≤ 4	4.5	2	2	2	2.5
150 - 300	≤ 9	9	3.5	6	5	4.5
300 - 450	≤ 19	19.5	17.5	9	7	8
450 - 600	≤ 50	17.5	13	10.5	11.5	11
600 - 800	≤ 50	17	17	15	12	10.5

Depth (MM)	DN Values (mm/blow) / CS1-UC1					
	Specifications	OWL	IWL	CL	IWR	OWR
0 -150	≤ 4	8	6	3	6	5
150 - 300	≤ 9	9.5	5.5	7	7	6
300 - 450	≤ 19	7.5	6	6.5	5	5
450 - 600	≤ 50	5	10	8.5	6.5	4.5
600 - 800	≤ 50	--	3	8	4.5	5.5

Depth (MM)	DN Values (mm/blow) / CS1-UC2					
	Specifications	OWL	IWL	CL	IWR	OWR
0 -150	≤ 4	4	4	4	4	4
150 - 300	≤ 9	10	11.5	15	13	10.5
300 - 450	≤ 19	20	18	23	17	12
450 - 600	≤ 50	18	17	18	19	18
600 - 800	≤ 50	20	18.5	20	20	16.5

Depth (MM)	DN Values (mm/blow) / CS2-UF1					
	Specifications	OWL	IWL	CL	IWR	OWR
0 -150	≤ 4	--	--	4	--	7.5
150 - 300	≤ 9	5	--	4	--	5.5
300 - 450	≤ 19	6	--	--	--	--
450 - 600	≤ 50	5.5	--	--	--	--
600 - 800	≤ 50	--	--	--	--	--

Depth (MM)	DN Values (mm/blow) / CS2-UF2					
	Specifications	OWL	IWL	CL	IWR	OWR
0 -150	≤ 4	3.5	--	2	--	4
150 - 300	≤ 9	6	--	4	--	7
300 - 450	≤ 19	11.5	--	10.5	--	9.5
450 - 600	≤ 50	4.5	--	6	--	3
600 - 800	≤ 50	6	--	5.5	--	3

The DCP reading on some of the sections regardless of their shoulder condition and road formations shows deviation from the required specification mainly on the upper 150mm. This may be connected with infiltration of water via the pavement and the unpaved shoulders in the wet season. This deviation /inferior condition of the upper 150mm/ is more pronounced, unexpectedly, in some of the sealed shoulder sections than unsealed shoulder sections.

Comparing the second monitoring DN values to the first monitoring DN values of the top 150mm layer on the seven trial sections, it shows that sections UC1, UF1, SF1 and SC1 increase about 10 – 20% where as SF2 and UF2 decrease by more than 20% while there is no significant change on section UC2. For the control sections CS1-UC1 shows significant increase with more than 30% and the other three i.e. CS1-UC2, CS2-UF1 and CS2-UF2 show a decrease more than about 20%.

4.7.2 Base Moisture Content

Samples has been taken from the base material to measure field moisture content in the outer wheels on both directions and on the centre of the road, adequate reinstating work has been done on the test points after the DCP tests and base moisture measurements. The field moisture content measured for the laterite base trial section in most of the cut and fill sections shown in table below are generally above the optimum moisture content (OMC) reported during construction which is in the range of 11.2 – 16.3% with an average OMC 14.8%.

Table 4-8: Measured Moisture content along the site

SECTION	Field Moisture Content [%]		
	Outer Left Wheel-path	Center line	Outer Right Wheel-path
Unsealed Shoulder on Cut Section(UC1)	16.9	21.6	13.4
Unsealed Shoulder on Fill Section (UF1)	15.6	15.3	18.7
Sealed Shoulder on Fill Section(SF1)	17.3	14.2	16.9
Sealed Shoulder on Cut Section(SC1)	20.2	18.6	21.6
Unsealed Shoulder on Cut Section(UC2)	6.7	8.9	11.4
Sealed Shoulder on Fill Section(SF2)	15.3	9.6	11.5
Unsealed Shoulder on Fill Section(UF2)	14.7	13.8	15.9
Control Section - Unsealed Cut Start (CS1-UC1)	19.7	16.2	13.9
Control Section - Unsealed Cut End (CS1-UC2)	13.6	18.9	20.5
Control Section - Unsealed Fill Start (CS2-UF1)	14.6	13.4	8.9
Control Section - Unsealed Fill End (CS2-UF2)	3.8	2.5	4.3

4.7.3 DN Values and Moisture Content at Trial Pits

On the trial pits where base, subbase and subgrade materials are sampled for laboratory testing, natural moisture contents were measured at the same point where DCP tests are conducted. Each test points has been reinstated carefully to minimize the defects introduced on the site. The results have been summarized and presented in table below.

Table 4-9: DN values and NMC at Trial Pits

Thickness (mm)	Position	DN values (mm/blow) / UC1 LHS /Test Pit #1/	Moisture Content NMC (%)
190	Base	7	
170	Subbase	17	14.6
	Subgrade	18	21.3

Thickness (mm)	Position	DN values (mm/blow) / SF1 RHS /Test Pit #3/	Moisture Content NMC (%)
215	Base	7	
180	Subbase	9.5	25.6
	Subgrade	14.5	24.5

Thickness (mm)	Position	DN values (mm/blow) / UC2 LHS /Test Pit #5/	Moisture Content NMC (%)
205	Base	9.5	
160	Subbase	16	22.1
	Subgrade	22	20.8

Thickness (mm)	Position	DN values (mm/blow) / UF2 RHS /Test Pit #7/	Moisture Content NMC (%)
190	Base	6	
145	Subbase	15	19.4
	Subgrade	19	19.2

Thickness (mm)	Position	DN values (mm/blow) / CS1-UC1 LHS /Test Pit #8/	Moisture Content NMC (%)
190	Base	8	
155	Subbase	12.5	20.8
	Subgrade	21	22.9

Thickness (mm)	Position	DN values (mm/blow) / CS1-UC2 RHS /Test Pit #9/	Moisture Content NMC (%)
205	Base	13	
190	Subbase	17	23.5
	Subgrade	20	18.6

Thickness (mm)	Position	DN values (mm/blow) / CS2-UF1 LHS /Test Pit #10/	Moisture Content NMC (%)
205	Base	5	
185	Subbase	6	16.7
	Subgrade	5	15.3

Thickness (mm)	Position	DN values (mm/blow) / CS2-UF2 RHS /Test Pit #11/	Moisture Content NMC (%)
210	Base	7	
195	Subbase	13	18.3
	Subgrade	15	17.4

4.8 Trial Pit Measurements and Laboratory Testing

4.8.1 Trial Pit Measurements and Sampling

In this second monitoring period one of the major activities carried out is the trial pit measurements, sampling and laboratory testing on the base, subbase and subgrade materials. Test pit were excavated in the right and left lanes alternatively for the trial sections to determine material performance and moisture condition of the base, subbase and subgrade materials of the road pavement. On completion of the trenching and collection of samples, the pavement has been reinstated to its original condition.

During test pit trench development the surfacing was first carefully removed causing minimum disturbance of the upper base coarse material. On exposure of base coarse DCP test has been carried out on the base and under layers. Then base material is sampled from test pit and carefully trimmed and cleaned until the next layer is exposed for sampling subbase and subgrade materials.

A total of eight test pits has been trenched, sampled from each layer and reinstated back. Four test pits are on selected trial sections and the other four at start and end of the two control sections listed as follows.

Table 4-10: Sections

Test Pit Label	Section	Chainage	Description
Test Pit #1	1	49+140 – 49+225	Unsealed Shoulder on Cut Section (UC1)
Test Pit #3	3	49+290 – 49+393	Sealed Shoulder on Fill Section (SF1)
Test Pit #5	5	49+496 – 49+602	Unsealed Shoulder on Cut Section (UC2))
Test Pit #7	7	49+712 – 49+970	Unsealed Shoulder on Fill Section (UF2)
Test Pit #8	8	Start	Control Section - Unsealed Cut Start (CS1-UC1)
Test Pit #9	8	End	Control Section - Unsealed Cut End (CS1-UC2)
Test Pit #10	9	Start	Control Section - Unsealed Fill Start (CS2-UF1)
Test Pit #11	9	End	Control Section - Unsealed Fill End (CS2-UF2)

4.8.2 Laboratory Tests

During sampling of test pits all samples collected has been labelled and described with their material type and depth. Laboratory tests including gradation, Atterberg, dry density and three point CBR test has been conducted for the base and subbase materials in a central laboratory. The result of the laboratory test results has been summarized as follows.

Table 4-11: Summary of Base Coarse Material Laboratory Test

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit				MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
				2.00	0.425	0.075	LL	PL	PI								
1	Test # 1 Unsealed Shoulder on Cut Section -1 (UC-1), Outer wheel at LHS	Lateritiec Base	3-22	50	41	33	27	20	7	A-2-4 (0)	1.84	21	Dry Density (g/cc)	1.41	1.71	1.84	33
													CBR %	17.6	28.2	42.3	
													Swell %	1.41	1.26	0.84	
2	Test # 3 Sealed Shoulder on Fill Section -1 (SF-1), Outer wheel at RHS	Lateritiec Base	3-25	50	36	22	31	20	11	A-2-6 (0)	1.81	19	Dry Density (g/cc)	1.58	1.70	1.82	56
													CBR %	19.4	51.1	79.3	
													Swell %	1.80	1.54	1.34	
3	Test # 5 Unsealed Shoulder on Cut Section -2 (UC-2), Outer wheel at LHS	Lateritiec Base	2-23	22	17	14	34	22	12	A-2-6 (0)	1.84	19	Dry Density (g/cc)	1.51	1.69	1.85	64
													CBR %	26.3	51.1	88.1	
													Swell %	1.83	1.56	1.32	
4	Test # 7 Unsealed Shoulder on Fill Section -2 (UF-2), Outer wheel at RHS	Lateritiec Base	2-21	27	18	13	36	23	13	A-2-6 (0)	1.82	19	Dry Density (g/cc)	1.39	1.68	1.82	71
													CBR %	34.4	61.7	88.1	
													Swell %	1.68	1.40	1.26	

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit										
				2.00	0.425	0.075	LL	PL	PI		MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
5	Test # 8 Control Section-1 Start (CS1-UC1), Outer wheel at LHS	Lateritic Base	3-23	17	10	7	26	22	4	A-1-a (0)	2.06	11	Dry Density (g/cc)	1.71	1.94	2.06	92
													CBR %	44.1	88.1	118.1	
													Swell %	0.97	0.72	0.46	
6	Test # 9 Control Section-1 End (CS1-UC2), Outer wheel at RHS	Lateritic Base	2-23	12	8	6	25	22	3	A-1-a (0)	2.05	11	Dry Density (g/cc)	1.67	1.90	2.05	104
													CBR %	51.1	88.1	141.0	
													Swell %	0.80	0.47	0.39	
7	Test # 10 Control Section-2 Start (CS2-UF1) Outer wheel at LHS	Lateritic Base	2-23	48	37	31	27	23	4	A-2-4 (0)	2.03	13	Dry Density (g/cc)	1.71	1.90	2.03	90
													CBR %	35.2	81.1	119.8	
													Swell %	0.89	0.62	0.39	
8	Test # 11 Control Section-2 End (CS2-UF2) Outer wheel at RHS	Lateritic Base	2-21	26	19	12	26	22	4	A-1-a (0)	2.15	12	Dry Density (g/cc)	1.80	2.02	2.16	99
													CBR %	52.9	93.4	132.2	
													Swell %	0.58	0.36	0.29	

Table 4-12: Summary of Subbase Material Laboratory Test

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit				MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
				2.00	0.425	0.075	LL	PL	PI								
1	Test # 1 Unsealed Shoulder on Cut Section -1 (UC-1), Outer wheel at LHS	Lateritic Sub base	22-39	50	41	36	45	28	17	A-7-6 (2)	1.66	21	Dry Density (g/cc)	1.23	1.53	1.67	23
													CBR %	8.8	19.4	30.0	
													Swell %	2.22	1.91	1.72	
2	Test # 3 Sealed Shoulder on Fill Section -1 (SF-1), Outer wheel at RHS	Lateritic Sub base	25-42	48	36	31	37	23	14	A-2-6 (0)	1.71	21	Dry Density (g/cc)	1.28	1.57	1.72	28
													CBR %	15.9	22.9	37.0	
													Swell %	2.22	1.88	1.51	
3	Test # 5 Unsealed Shoulder on Cut Section -2 (UC-2), Outer wheel at LHS	Lateritic Sub base	23-39	58	50	45	38	24	14	A-6 (3)	1.67	20	Dry Density (g/cc)	1.39	1.57	1.68	27
													CBR %	12.6	24.7	38.8	
													Swell %	2.18	1.89	1.47	
4	Test # 7 Unsealed Shoulder on Fill Section -2 (UF-2), Outer wheel at RHS	Lateritic Sub base	21-36	63	54	48	33	21	12	A-6 (3)	1.69	21	Dry Density (g/cc)	1.27	1.57	1.70	25
													CBR %	12.3	22.9	31.7	
													Swell %	1.83	1.56	1.39	

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit				MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
				2.00	0.425	0.075	LL	PL	PI								
5	Test # 8 Control Section-1 Start (CS1-UC1), Outer wheel at LHS	Lateritic Sub base	23-39	57	49	44	40	24	16	A-6 (4)	1.73	19	Dry Density (g/cc)	1.29	1.60	1.74	23
													CBR %	10.6	21.1	28.2	
													Swell %	1.85	1.53	1.35	
6	Test # 9 Control Section-1 End (CS1-UC2), Outer wheel at RHS	Lateritic Sub base	23-42	69	60	55	42	27	15	A-7-6 (6)	1.73	21	Dry Density (g/cc)	1.42	1.63	1.74	34
													CBR %	15.9	31.7	45.8	
													Swell %	1.82	1.49	1.28	
7	Test # 10 Control Section-2 Start (CS2-UF1) Outer wheel at LHS	Lateritic Sub base	23-41	28	18	10	32	20	12	A-2-6 (0)	1.77	20	Dry Density (g/cc)	1.39	1.64	1.78	32
													CBR %	15.9	28.2	40.5	
													Swell %	1.94	1.65	1.25	
8	Test # 11 Control Section-2 End (CS2-UF2) Outer wheel at RHS	Lateritic Sub base	25-46	50	40	34	38	24	14	A-2-6 (1)	1.75	21	Dry Density (g/cc)	1.37	1.62	1.76	31
													CBR %	17.6	28.2	38.8	
													Swell %	2.08	1.73	1.41	

Table 4-13: Summary of Subgrade Material Laboratory Test

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit				MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
				2.00	0.425	0.075	LL	PL	PI								
1	Test # 1 Unsealed Shoulder on Cut Section -1 (UC-1), Outer wheel at LHS	Highly weathered cobbels with yellowish silty clay soil	39-85	97	86	60	51	32	19	A-7-5 (10)	1.68	21	Dry Density (g/cc)	1.31	1.58	1.68	14
													CBR %	7.2	12.6	18.0	
													Swell %	3.44	2.80	2.39	
2	Test # 3 Sealed Shoulder on Fill Section -1 (SF-1), Outer wheel at RHS	Brownish silty clay soil with some weathered friable gravels	43-90	88	66	43	30	21	9	A-4 (1)	1.69	23	Dry Density (g/cc)	1.35	1.54	1.69	19
													CBR %	7.2	16.2	21.6	
													Swell %	1.65	1.44	1.28	
3	Test # 5 Unsealed Shoulder on Cut Section -2 (UC-2), Outer wheel at LHS	Raddish to brown silt clay	39-105	93	82	61	44	27	17	A-7-6 (9)	1.62	21	Dry Density (g/cc)	1.44	1.54	1.63	13
													CBR %	8.1	13.5	19.8	
													Swell %	2.22	1.93	1.38	
4	Test # 7 Sealed Shoulder on Fill Section -2 (SF-2), Outer wheel at RHS	Weathered gravel mixed with yellowish to brown silty clay	36-95	90	78	55	42	25	17	A-7-6 (17)	1.66	21	Dry Density (g/cc)	1.25	1.51	1.66	17
													CBR %	9.9	14.4	20.7	
													Swell %	2.06	1.76	1.58	

S/ No	Station (KM)	Material Description	Depth (cm)	AASHTO T 27			AASHTO T 89 & 90			Soil Classification	Proctor Density AASHTO T 180		3 - Point CBR AASHTO T 193				
				% Passing Sieve (mm)			Atterberg Limit										
				2.00	0.425	0.075	LL	PL	PI		MDD (g/cc)	OMC %	No of Blows	10	30	65	CBR at 95% MDD
5	Test # 8 Unsealed Shoulder on Cut Section -1 (UC-1), Outer wheel at LHS	Light brown silty clay with gravel and cobbles	39-90	94	84	57	50	32	18	A-7-5 (9)	1.55	22	Dry Density (g/cc)	1.32	1.46	1.56	10
													CBR %	3.6	9.0	16.2	
													Swell %	2.39	2.06	1.78	
6	Test # 9 Unsealed Shoulder on Cut Section -1 (UC-1), Outer wheel at RHS	Light ot reddish brown silty clay soil with some of weathered gravels	42-88	92	76	59	47	29	18	A-7-6 (9)	1.65	20	Dry Density (g/cc)	1.24	1.52	1.66	10
													CBR %	3.6	9.0	11.7	
													Swell %	2.47	1.96	1.63	
7	Test # 10 Outer wheel at LHS	Light ot reddish brown silty clay soil	42-89	98	78	67	52	32	20	A-7-5 (14)	1.63	20	Dry Density (g/cc)	1.21	1.50	1.64	9
													CBR %	4.5	8.1	10.8	
													Swell %	2.82	2.39	1.80	
8	Test # 11 Outer wheel at RHS	Light ot reddish brown silty clay soil	45-90	91	82	49	44	27	17	A-7-6 (5)	1.64	20	Dry Density (g/cc)	1.22	1.50	1.65	12
													CBR %	7.2	10.8	14.4	
													Swell %	1.92	1.63	1.42	

4.9 Roughness Measurements

Roughness measurement was performed, similar to the first monitoring, using MERLIN roughness measuring instrument which were available at the research centre of ERA. The roughness measurements are presented in the following tables.

Figure 4-3: Roughness measurement using MERLIN for Assossa - Kumruk trial section

Table 4-14: Calibration results of the MERLIN

Calibration	
Thickness of Calibration Block (T) =	6
Corresponding Displacement (S) =	65
Scaling Factor (SF) = (10*T)/S =	0.923

Table 4-15 Roughness Measurements

SECTION		**Right Lane**			**Left Lane**			**Average IRI**
	Length	**Initial Reading (D_i)**	**Final Reading (D_f) = SF*D_i**	**RI = 0.593+0.0471*D_f**	**Initial Reading (D_i)**	**Final Reading (D_f) = SF*D_i**	**RI = 0.593+0.0471*D_f**	
Unsealed Shoulder on Cut Section(UC1)		71	66	3.68	123	114	5.94	**4.81**
Unsealed Shoulder on Fill Section (UF1)		91	84	4.55	90	83	4.51	**4.53**
Sealed Shoulder on Fill Section(SF1)		89	82	4.46	94	87	4.68	**4.57**
Sealed Shoulder on Cut Section(SC1)		81	75	4.11	68	63	3.55	**3.83**
Unsealed Shoulder on Cut Section(UC2)		64	59	3.38	77	71	3.94	**3.66**
Sealed Shoulder on Fill Section(SF2)		64	59	3.38	82	76	4.16	**3.77**
Unsealed Shoulder on Fill Section(UF2)		71	66	3.68	71	66	3.68	**3.68**
Control Section - Unsealed Cut		72	66	3.72	53	49	2.90	**3.31**
Control Section - Unsealed Fill		47	43	2.64	66	61	3.46	**3.05**

The result shows the trial sections do not show considerable difference in roughness and all have a fair ridding quality with an IRI in the range of 3 to 5. The trail sections roughness measurement shows slightly more than the roughness of the control sections both in cut and fill sections. Moreover, the roughness measurement of this second monitoring is also slightly higher (on average about 10%) than roughness measured during the first monitoring.

4.10 Visual Condition Assessment

Similar to the first monitoring visual condition data was collected using the formats and protocols on the Draft Regional Guideline. Similar to the first monitoring after conducting the condition assessment and rating based on the Regional Guideline, the suitability condition index is summarised using the South Africa methods.

The analysis is based on an aggregate formula as described in TRH 22: Pavement Management Systems.

The formula for calculating the VCI (Visual Condition Index) is

$$\text{VCI} = \left(a * VCI_P + b * VCI_p^2\right)^2$$

Where:

$$VCI_p = 100\left\{1 - C\left[\sum_{n=0}^{n} F_n\right]\right\}$$

a = 0.04

b = 0.0006 and

VCI_{max} = 100

VCI_{min} = 0

VCI_p = preliminary VCI

F_n = $D_n*(E_n\text{^}Y_n)*W_n*S_n$

n = Visual assessment item number that specified on the condition assessment sheet

D_n = Degree rating of defect n
Range: 0 to 4 for functional defects and
:0 to 5 for other defects

E_n = Extent rating of defect n
Range: Default 3 for functional defects
:0 to 5 for other defects

W_n = Weight for defect n as in the following table

Yn = Extent weight factor of the value shown in the following table

S_n = Small scale factor to be set to 1 for functional degree rating >1, or for other defects degree rating >2, or else the Sn is according to the next table

C = $1/\sum_{n=0}^{n} F_{nmax}$

$F_{n(max)}$ = Fn with degree and extent rating set at maximum

Table 4-16: Weight set for VCI formula (TRH 22)

Item #	Defect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)
1	SURFACING FAILURES	6.5	1.0	1.2
2	SURFACING PATCHING	6.5	1.0	1.2
3	SURFACING CRACKS	5	1.0	1.1
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9
5	AGGREGATE LOSS	4	1.0	1.1
6	BLEEDING / FLUSHING	3	0.5	1.0
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0
9	TRANSVERSE CRACKS	4.5	1.0	1.0
10	LONGITUDINAL CRACKS	4.5	1.0	1.0
11	CROCODILE CRACKS	10	1.0	1.3
12	PUMPING	10	1.0	1.3
13	RUTTING	8	0.5	1.0
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0
15	PATCHING	8	0.8	1.1
16	FAILURES / POTHOLES	15	1.0	1.3
17	ROUGHNESS	5.5	0.8	1.0
18	SKID RESISTANCE	3	0.5	1.0
19	SURFACE DRAINAGE	3	0.5	1.0
20	SHOULDERS (unpaved)	3.5	1.0	1.0
21	EDGE DEFECTS	3.5	0.8	1.0

Based on the outcome of the VCI the condition of the sections is calorized as per the following table:

Table 4-17: Condition Categories

Description of category	Condition index range
Very good	85 ≤ VCI ≤ 100
Good	70 ≤ VCI < 85
Fair	50 ≤ VCI < 70
Poor	30 ≤ VCI < 50
Very poor	0 ≤ VCI < 30

Table 4-18: Condition Index for each Section

SECTION	VCI		Pictures
	L	R	
Unsealed Shoulder on Cut Section(UC1)			

			
Unsealed Shoulder on Fill Section (UF1)	92	93	
Sealed Shoulder on Fill Section(SF1)	97	97	
Sealed Shoulder on Cut Section(SC1)	96	98	
Unsealed Shoulder on Cut Section(UC2)	93	93	
Sealed Shoulder on Fill Section(SF2)	95	98	
Unsealed Shoulder on Fill Section(UF2)	88	90	
Control Section - Unsealed Cut(CS1-UC)	97		

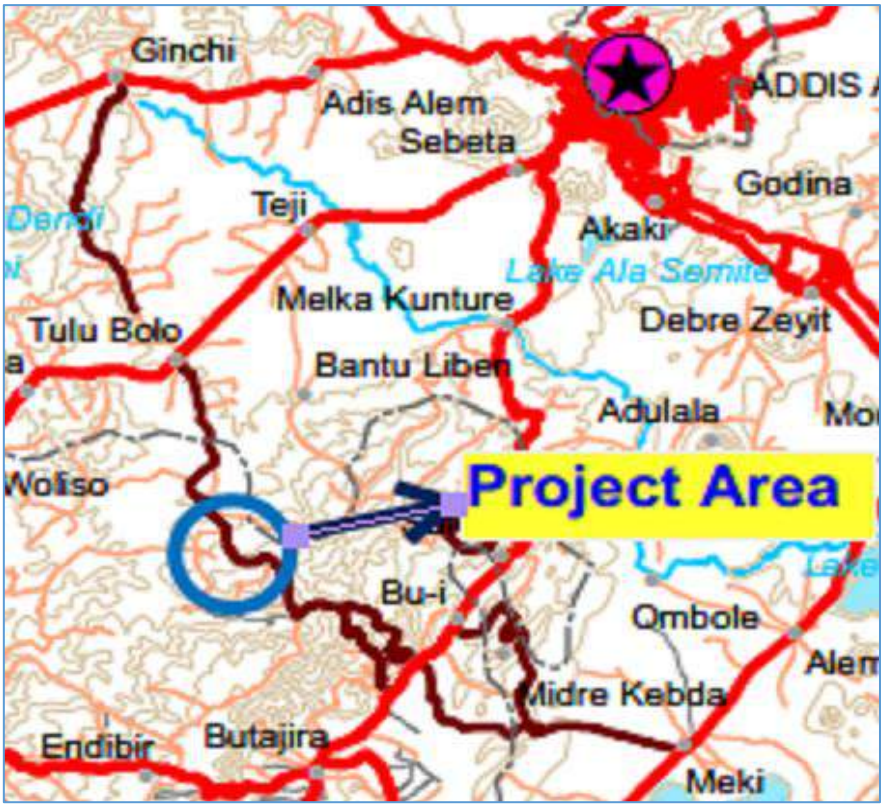
Control Section - Unsealed Fill (CS2-UF)	96	

Based up on the visual assessment all the section fall under the very good condition.

5 Otta Seal Surfacing at Combel

5.1 Site Description

The demonstration project is located in the village of Combel situated to the South of Addis Ababa, 37km from Tulubolo along the Tulubolo - Kela road. The road links Addis – Jimma and Addis – Butajira – Sodo road. And Combel village located at the South People Nations and Nationality Regional Government. The trial section begins at 37+400 Km after a 75m transition section.



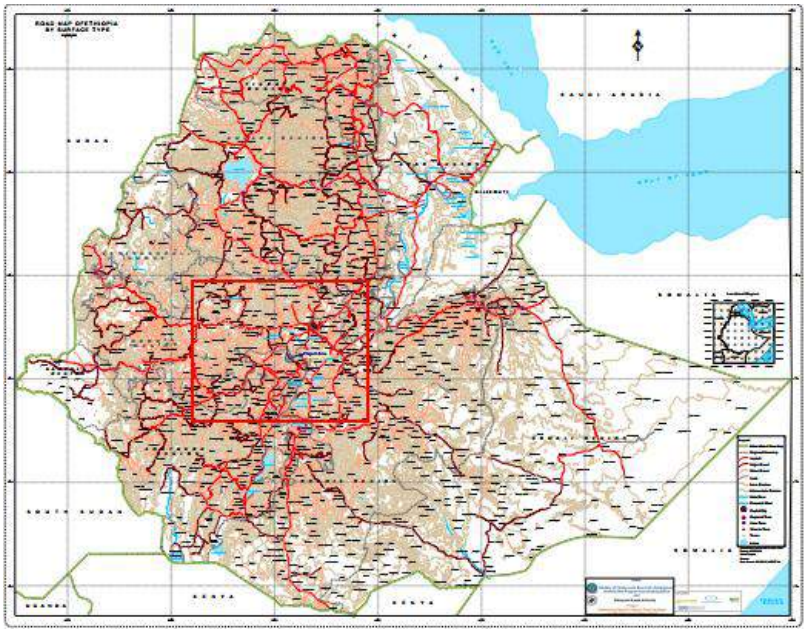


Figure 5-1: Site Location

This demonstration project in Combel comprises nine sections of various lengths using the following different types of aggregate:

- Crushed hard basalt aggregate,
- Natural screened weathered basalt,
- Volcanic screened Cinder aggregate
- The above aggregates combined with a crusher dust seal.

The nine sections are in-between the 75m and 30m transition zones at the beginning and at end respectively.

Table 5-1: Sections

Section	Chainages	Length (m)	Description of the Double Seal
1	37+400–37+500	100	Crusher dust seal on crusher dust seal
2	37+500–37+650	150	Otta seal crushed basalt on Otta seal cinder aggregate
3	37+650–37+700	50	Otta cinder aggregate on Otta cinder aggregate
4	37+700–38+000	300	Otta seal weathered basalt on Otta seal weathered basalt
5	38+000–38+260	260	Crusher dust seal on Otta seal crushed basalt
6	38+260–38+390	130	Otta seal crushed basalt on Otta seal crushed basalt
7	38+390–39+100	710	Crushed dust seal on Otta seal crushed basalt
8	39+100–39+250	150	Otta Cinder aggregate on Otta seal crushed basalt
9	39+250–39+300	50	Crusher dust seal on Otta seal crushed basalt

5.2 Pavement Description

Description of existing pavement and cross-section or designed pavement – drawing may be best.

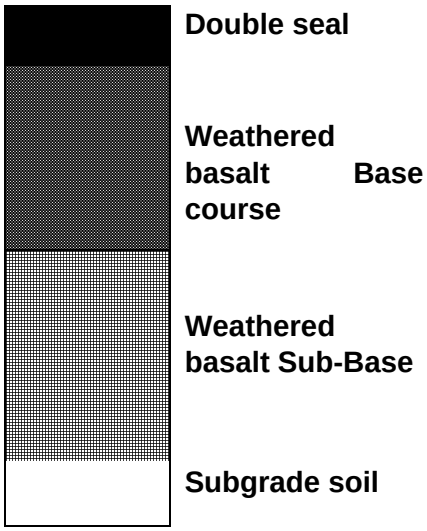


Table 5-2: Pavement Structure

5.3 Monitoring Period

The report incorporates pavement evaluation works performed by the service provider for the second monitoring programme on December 2017.

During the evaluation was sunny and dry and the second monitoring programme for Combel village Otta seal demonstration section incorporates:-

- Classified traffic counts
- Visual Condition survey
- Roughness measurement and
- Drainage Assessment (part of visual condition survey)

Accordingly the report consists of the outcomes and analysis of all the above listed activities as part of the reporting structure of the second cycle monitoring report.

5.4 Traffic Survey

Traffic count was carried out at Combel village located at the centre of the project for seven days which include day time 12 hours for seven days and night time 12 hours for 2 days (one on working days and the other on weekends). The 12 hours counts are factored to convert to 24 hours counts based up on the counts taken at the night hours. The average daily traffic count is summarized and presented as follows.

Table 5-3: Traffic Volume Summary

Vehicle Type	Daily Volume (vpd)
Motorcycles	63
Bajaj	1
Cars	5
4×4 Station Wagons (Land Rover)	11
Small Bus <27 Passengers	36
Large Bus >27 Passengers	2
Small Truck <3.5 Tonnes	42
Medium Truck 3.5 to 7.0 tonnes	1

Heavy Truck 7.5 - 12Tonne	0
Truck Trailer > 12 tonne	0
Tractors and Agriculture Vehicles	0
ADT	**160**

5.5 Roughness Measurements

Roughness measurement was performed, similar to the first monitoring, using MERLIN roughness measuring instrument which were available at the research centre of ERA. The roughness measurements are presented in the following tables.

Table 5-4: Calibration result of the MERLIN

Calibration	
Thickness of Calibration Block (T) =	6
Corresponding Displacement (S) =	65
Scaling Factor (SF) = (10*T)/S =	0.923

Table 5-5: Roughness values

SECTION		**Left Lane**			**Right Lane**			**Average**
	Length (m)	**Initial Reading (D_i)**	**Final Reading (D_f) = SF*D_i**	**RI = 0.593+0.0471*D_f**	**Initial Reading (D_i)**	**Final Reading (D_f) = SF*D_i**	**RI = 0.593+0.0471*D_f**	
1. crusher Dust seal ON crusher Dust seal	100	91	84	4.55	90	83	4.51	**4.53**
2. otta seal crushed basalt ON otta seal cinder Agg.	150	120	111	5.81	104	96	5.11	**5.42**
3. otta cinder Agg. ON otta cinder Agg.	50	106	98	5.20	91	84	4.55	**4.88**
4. otta seal weathered basalt ON otta seal weathered basalt	300	104	96	5.11	127	117	6.11	**5.61**
5. crusher Dust seal ON otta seal crushed basalt	260	103	95	5.07	153	141	7.24	**6.16**
6. otta seal crushed basalt ON otta seal crushed basalt	130	90	83	4.51	96	89	4.77	**4.64**
7. crusher Dust seal ON otta seal crushed basalt	710	102	94	5.03	85	78	4.29	**4.66**
8. otta cinder Agg. ON otta seal crushed basalt	150	82	76	4.16	91	84	4.55	**4.35**
9. crusher Dust seal otta seal On crushed basalt	50	110	102	5.38	114	105	5.55	**5.46**

The result shows all sections have roughness values of IRI above 4 which would be typical for older and damaged pavements as per Draft Regional Guideline, especially section 5 shows highest roughness with IRI more than 6. However, in comparison to the first monitoring period there is no significant pavement deterioration in relation to roughness increment except section 9 which shows significant increment of roughness from IRI less than 4 to more than 5.

5.6 Visual Condition Assessment

Visual condition data was collected using the formats and protocols on the Draft Regional Guideline. Similar to the first monitoring after conducting the condition assessment and rating based on the Regional Guideline, the suitability condition index is summarised using the South Africa methods.

The analysis is based on an aggregate formula as described in TRH22: Pavement Management Systems.

The formula for calculating the VCI (Visual Condition Index) is

$$\mathrm{VCI} = \left(a * VCI_P + b * VCI_p^2\right)^2$$

Where:

$$VCI_p = 100\left\{1 - C\left[\sum_{n=0}^{n} F_n\right]\right\}$$

a = 0.04

b = 0.0006 and

VCI_{max} = 100

VCI_{min} = 0

VCI_p = preliminary VCI

F_n = D_n*(E_n^Y_n)*W_n*S_n

n = Visual assessment item number that specified on the condition assessment sheet

D_n = Degree rating of defect n
Range: 0 to 4 for functional defects and
:0 to 5 for other defects

E_n = Extent rating of defect n
Range: Default 3 for functional defects
:0 to 5 for other defects

W_n = Weight for defect n as in the following table

Yn = Extent weight factor of the value shown in the following table

S_n = Small scale factor to be set to 1 for functional degree rating >1, or for other defects degree rating >2, or else the Sn is according to the next table

C = $1/\sum_{n=0}^{n} F_{nmax}$

$F_{n(max)}$ = Fn with degree and extent rating set at maximum

Table 5-6: Weight set for VCI formula

Item #	Defect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)
1	SURFACING FAILURES	6.5	1.0	1.2
2	SURFACING PATCHING	6.5	1.0	1.2
3	SURFACING CRACKS	5	1.0	1.1
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9
5	AGGREGATE LOSS	4	1.0	1.1
6	BLEEDING / FLUSHING	3	0.5	1.0
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0
9	TRANSVERSE CRACKS	4.5	1.0	1.0
10	LONGITUDINAL CRACKS	4.5	1.0	1.0
11	CROCODILE CRACKS	10	1.0	1.3
12	PUMPING	10	1.0	1.3
13	RUTTING	8	0.5	1.0
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0
15	PATCHING	8	0.8	1.1
16	FAILURES / POTHOLES	15	1.0	1.3
17	ROUGHNESS	5.5	0.8	1.0
18	SKID RESISTANCE	3	0.5	1.0
19	SURFACE DRAINAGE	3	0.5	1.0
20	SHOULDERS (unpaved)	3.5	1.0	1.0
21	EDGE DEFECTS	3.5	0.8	1.0

Based on the outcome of the VCI the condition of the sections is calorized as per the following table:

Table 5-7: Condition Categories

Description of category	Condition index range
Very good	$85 \leq VCI \leq 100$
Good	$70 \leq VCI < 85$
Fair	$50 \leq VCI < 70$
Poor	$30 \leq VCI < 50$
Very poor	$0 \leq VCI < 30$

Based on the Visual Condition Survey using the above the visual condition index and the category have been summarized and presented on the following table for the second monitoring cycle.

Table 5-8: Condition Index for each Section

Section	Description	Condition Index	Category
1	Crusher dust seal on crusher dust seal	91	Very Good
			
2	Otta seal crushed basalt on Otta seal cinder aggregate	81	Good
			
3	Otta cinder aggregate on Otta cinder aggregate	91	Very Good

			
4	Otta seal weathered basalt on Otta seal weathered basalt	79	Good
			
5	Crusher dust seal on Otta seal crushed basalt	82	Good

			
6	Otta seal crushed basalt on Otta seal crushed basalt	83	Good
			
7	Crushed dust seal on Otta seal crushed basalt	84	Good

			
8	Otta Cinder aggregate on Otta seal crushed basalt	94	Very Good
			
9	Crusher dust seal on Otta seal crushed basalt	96	Very Good

From the above, similar to the first monitoring all the trial sections are deemed to be in good to very good condition. This is due to there being very little structural failures in the road pavements. The majority of the failures on the sections are surface failures in the form of materials loss and surface cracks.

Most of the sections have defects arising from poor construction. Improper application of material and migration of materials by traffic during the curing process of the Otta seal left the surfacing with a rough appearance. However, currently no signs of active material loss are visible and if closely observed the pavement have better performance than what is expected from first appearance.

In comparison to the first monitoring survey section 6 i.e. Otta seal crushed basalt on Otta seal crushed basalt show a deterioration from very good condition to good condition whereas section 8 evaluation result changed from good condition in the first monitoring to very good in the second monitoring which is illogical as the pavement has not benefited from any surfacing improvement through maintenance or rehabilitation. Such discrepancies are encountered due to the subjective nature of the visual evaluation mechanism despite that the survey is conducted by the same evaluator.

APPENDIX I: Gerado Otta Seal Road Measurements

Appendix IA: Traffic Count and Axle Load Measurement Summary

TRAFFIC COUNT SUMMARY FORM for Gerado Otta Seal Road														
Date	**Day**		**Motorcycles**	**Bajaj**	**Passenger Cars**	**4×4 Station Wagons (Land Rover)**	**Small Bus >27 Passengers**	**Larg Bus >27 Passengers**	**Small Truck <3.5 Tonnes**	**Medium Truck 3.5 to 7.0 tonnes**	**Heavy Truck 7.5 - 12Tonne**	**Truck Trailer > 12 tonne**	**Tractors and Aggric Vehicles**	**Daily Factored Totals**
04-12-2017	Monday		14	14	8	124	877	91	34	21	39	10	0	1464
05-12-2017	Tuesday	Day	5	9	8	143	765	95	57	27	60	33	0	1470
		Ngt.	3	1	2	40	84	10	65	33	17	13	0	
06-12-2017	Wednesday		14	17	17	154	679	51	93	49	44	28	4	1473
07-12-2017	Thursday		17	15	10	174	633	61	65	42	127	13	13	1463
08-12-2017	Friday		12	17	6	183	686	109	70	52	76	13	0	1543
02-12-2017	Saturday	Day	13	15	7	119	566	43	39	17	34	9	1	1215
		Ngt.	4	6	1	37	59	14	102	95	18	16	0	
03-12-2017	Sunday		16	14	4	141	547	90	64	53	46	19	0	1657
ADT			20	17	11	191	753	89	151	127	81	30	0	1469

Axle Load Measurement Dessie- Gerado Road

Vehicle	Axle Configuration	Axle 1	Axle 2	Axle 3	Axle 4	Axle 5	Axle 6	Axle 7	Total Load	ESA Axle 1	ESA Axle 2	ESA Axle 3	ESA Axle 4	ESA Axle 5	ESA Axle 6	ESA Axle 7	Total ESA
MB	1.2	23	0	47	0	0	0	0	7	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.09
ST	1.2	22	0	22	0	0	0	0	4.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
ST	1.2	21	0	23	0	0	0	0	4.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MT	1.22	79	0	144	137	0	0	0	36	0.86	0.00	12.88	10.30	0.00	0.00	0.00	24.04
MT	1.22	80	0	154	158	0	0	0	39.2	0.91	0.00	17.43	19.56	0.00	0.00	0.00	37.90
MT	1.22	52	0	132	0	0	0	0	18.4	0.13	0.00	8.71	0.00	0.00	0.00	0.00	8.84
MT	1.22	52	0	46	37	0	0	0	13.5	0.13	0.00	0.08	0.03	0.00	0.00	0.00	0.24
DT	1.22	50	0	47	44	0	0	0	14.1	0.11	0.00	0.08	0.06	0.00	0.00	0.00	0.26
MB	1.2	21	0	22	0	0	0	0	4.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DT	1.22	48	0	58	61	0	0	0	16.7	0.09	0.00	0.22	0.27	0.00	0.00	0.00	0.58
ST	1.2	34	0	64	0	0	0	0	9.8	0.02	0.00	0.34	0.00	0.00	0.00	0.00	0.35
ST	1.2	34	0	47	0	0	0	0	8.1	0.02	0.00	0.08	0.00	0.00	0.00	0.00	0.10
DT	1.22	51	0	34	56	0	0	0	14.1	0.12	0.00	0.02	0.18	0.00	0.00	0.00	0.32
MT	1.22	50	0	38	27	0	0	0	11.5	0.11	0.00	0.03	0.01	0.00	0.00	0.00	0.15
DT	1.2	86	0	119	109	0	0	0	31.4	1.27	0.00	5.46	3.68	0.00	0.00	0.00	10.41
MT	1.22	78	0	151	142	0	0	0	37.1	0.82	0.00	15.95	12.10	0.00	0.00	0.00	28.86
MB	1.2	85	0	156	0	0	0	0	24.1	1.20	0.00	18.47	0.00	0.00	0.00	0.00	19.67
MT	1.22	72	0	145	141	0	0	0	35.8	0.57	0.00	13.29	11.72	0.00	0.00	0.00	25.58
ST	1.2	49	0	73	0	0	0	0	12.2	0.10	0.00	0.61	0.00	0.00	0.00	0.00	0.71
DT	1.22	54	0	105	94	0	0	0	25.3	0.16	0.00	3.11	1.89	0.00	0.00	0.00	5.16
DT	1.22	60	0	51	49	0	0	0	16	0.25	0.00	0.12	0.10	0.00	0.00	0.00	0.47
DT	1.22	53	0	53	55	0	0	0	16.1	0.14	0.00	0.14	0.17	0.00	0.00	0.00	0.46
MT	1.22	66	0	136	106	0	0	0	30.8	0.38	0.00	9.96	3.25	0.00	0.00	0.00	13.59
MT	1.22	64	0	48	45	0	0	0	15.7	0.34	0.00	0.09	0.07	0.00	0.00	0.00	0.50
DT	1.22	43	0	52	49	0	0	0	14.4	0.06	0.00	0.13	0.10	0.00	0.00	0.00	0.29

DT	1.22	56	0	52	47	0	0	0	15.5	0.18	0.00	0.13	0.08	0.00	0.00	0.00	0.40
TT	1.22-2.22	82	0	149	149	134	99	96	70.9	1.02	0.00	15.02	15.02	9.32	2.39	2.08	44.85
ST	1.2	22	0	28	0	0	0	0	5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
DT	1.22	49	0	44	0	49	0	0	14.2	0.10	0.00	0.06	0.00	0.10	0.00	0.00	0.26
DT	1.22	53	0	35	33	0	0	0	12.1	0.14	0.00	0.02	0.02	0.00	0.00	0.00	0.18
MT	1.22	85	0	59	78	0	0	0	22.2	1.20	0.00	0.23	0.82	0.00	0.00	0.00	2.25
DT	1.22	56	0	47	41	0	0	0	14.4	0.18	0.00	0.08	0.05	0.00	0.00	0.00	0.31
DT	1.22	45	0	53	57	0	0	0	15.5	0.07	0.00	0.14	0.20	0.00	0.00	0.00	0.41
MB	1.2	49	0	57	0	0	0	0	10.6	0.10	0.00	0.20	0.00	0.00	0.00	0.00	0.30
SB	1.2	27	0	38	0	0	0	0	6.5	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.04
DT	1.22	77	0	115	121	0	0	0	31.3	0.77	0.00	4.68	5.89	0.00	0.00	0.00	11.34
ST	1.2	35	0	71	0	0	0	0	10.6	0.02	0.00	0.53	0.00	0.00	0.00	0.00	0.56
ST	1.2	20	0	22	0	0	0	0	4.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	23	0	25	0	0	0	0	4.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
ST	1.2	27	0	48	0	0	0	0	7.5	0.01	0.00	0.09	0.00	0.00	0.00	0.00	0.10
ST	1.2	29	0	52	0	0	0	0	8.1	0.01	0.00	0.13	0.00	0.00	0.00	0.00	0.14
FT	1.22-2.22	51	0	50	37	35	38	0	21.1	0.12	0.00	0.11	0.03	0.02	0.03	0.00	0.31
ST	1.2	29	0	31	0	0	0	0	6	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02
DT	1.22	72	0	80	68	0	0	0	22	0.57	0.00	0.91	0.44	0.00	0.00	0.00	1.92
ST	1.2	31	0	84	0	0	0	0	11.5	0.01	0.00	1.14	0.00	0.00	0.00	0.00	1.15
ST	1.2	37	0	75	0	0	0	0	11.2	0.03	0.00	0.68	0.00	0.00	0.00	0.00	0.71
ST	1.2	51	0	74	0	0	0	0	12.5	0.12	0.00	0.64	0.00	0.00	0.00	0.00	0.76
ST	1.2	24	0	50	0	0	0	0	7.4	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.11
MB	1.2	45	0	55	0	0	0	0	10	0.07	0.00	0.17	0.00	0.00	0.00	0.00	0.24
DT	1.22	52	0	45	39	0	0	0	13.6	0.13	0.00	0.07	0.04	0.00	0.00	0.00	0.24
ST	1.2	48	0	45	0	0	0	0	9.3	0.09	0.00	0.07	0.00	0.00	0.00	0.00	0.16
ST	1.2	36	0	90	0	0	0	0	12.6	0.03	0.00	1.55	0.00	0.00	0.00	0.00	1.58
ST	1.2	26	0	35	0	0	0	0	6.1	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.03
ST	1.2	37	0	59	0	0	0	0	9.6	0.03	0.00	0.23	0.00	0.00	0.00	0.00	0.26
ST	1.2	25	0	19	0	0	0	0	4.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
ST	1.2	35	0	72	0	0	0	0	10.7	0.02	0.00	0.57	0.00	0.00	0.00	0.00	0.59
MT	1.2	45	0	89	0	0	0	0	13.4	0.07	0.00	1.48	0.00	0.00	0.00	0.00	1.55
LB	1.2	49	0	44	0	0	0	0	9.3	0.10	0.00	0.06	0.00	0.00	0.00	0.00	0.16
MT	1.2	75	0	72	0	0	0	0	14.7	0.68	0.00	0.57	0.00	0.00	0.00	0.00	1.25

LB	1.2	54	0	69	0	0	0	0	12.3	0.16	0.00	0.47	0.00	0.00	0.00	0.00	0.63
LB	1.2	25	0	53	0	0	0	0	7.8	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.15
ST	1.2	50	0	80	0	0	0	0	13	0.11	0.00	0.91	0.00	0.00	0.00	0.00	1.03
LB	1.2	52	0	95	0	0	0	0	14.7	0.13	0.00	1.98	0.00	0.00	0.00	0.00	2.11
DT	1.22	63	0	88	73	0	0	0	22.4	0.31	0.00	1.40	0.61	0.00	0.00	0.00	2.32
LB	1.2	38	0	64	0	0	0	0	10.2	0.03	0.00	0.34	0.00	0.00	0.00	0.00	0.37
ST	1.2	30	0	69	0	0	0	0	9.9	0.01	0.00	0.47	0.00	0.00	0.00	0.00	0.48
LB	1.2	50	0	91	0	0	0	0	14.1	0.11	0.00	1.63	0.00	0.00	0.00	0.00	1.74
ST	1.2	20	0	25	0	0	0	0	4.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
DT	1.22	49	0	43	39	0	0	0	13.1	0.10	0.00	0.06	0.04	0.00	0.00	0.00	0.19
DT	1.22	51	0	37	41	0	0	0	12.9	0.12	0.00	0.03	0.05	0.00	0.00	0.00	0.19
MT	1.2	49	0	45	0	0	0	0	9.4	0.10	0.00	0.07	0.00	0.00	0.00	0.00	0.17
TT	1.22-2.22	55	0	66	134	154	120	119	64.8	0.17	0.00	0.38	9.32	17.43	5.67	5.46	38.43
DT	1.2	60	0	91	67	0	0	0	21.8	0.25	0.00	1.63	0.41	0.00	0.00	0.00	2.30
LB	1.2	47	0	67	0	0	0	0	11.4	0.08	0.00	0.41	0.00	0.00	0.00	0.00	0.50
ST	1.2	19	0	22	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DT	1.22	41	0	59	44	0	0	0	14.4	0.05	0.00	0.23	0.06	0.00	0.00	0.00	0.34
ST	1.2	26	0	39	0	0	0	0	6.5	0.01	0.00	0.04	0.00	0.00	0.00	0.00	0.04
DT	1.22	48	0	51	50	0	0	0	14.9	0.09	0.00	0.12	0.11	0.00	0.00	0.00	0.32
ST	1.2	23	0	37	0	0	0	0	6	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.03
DT	1.22	46	0	53	54	0	0	0	15.3	0.08	0.00	0.14	0.16	0.00	0.00	0.00	0.38
LB	1.2	23	0	48	0	0	0	0	7.1	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.10
LB	1.2	58	0	74	0	0	0	0	13.2	0.22	0.00	0.64	0.00	0.00	0.00	0.00	0.86
ST	1.2	42	0	75	0	0	0	0	11.7	0.05	0.00	0.68	0.00	0.00	0.00	0.00	0.73
DT	1.22	70	0	152	150	0	0	0	37.2	0.50	0.00	16.43	15.48	0.00	0.00	0.00	32.41
LB	1.2	40	0	159	0	0	0	0	19.9	0.04	0.00	20.12	0.00	0.00	0.00	0.00	20.16
DT	1.22	71	0	119	120	0	0	0	31	0.53	0.00	5.46	5.67	0.00	0.00	0.00	11.67
DT	1.22	55	0	44	42	0	0	0	14.1	0.17	0.00	0.06	0.05	0.00	0.00	0.00	0.28
DT	1.22	49	0	52	46	0	0	0	14.7	0.10	0.00	0.13	0.08	0.00	0.00	0.00	0.31
DT	1.22	51	0	50	48	0	0	0	14.9	0.12	0.00	0.11	0.09	0.00	0.00	0.00	0.32
HT	1.22+2.22	61	78	83	87	84	108	108	60.9	0.27	0.00	1.08	1.33	1.14	3.53	3.53	10.88
ST	1.2	41	0	121	0	0	0	0	16.2	0.05	0.00	5.89	0.00	0.00	0.00	0.00	5.93
DT	1.22	52	0	43	51	0	0	0	14.6	0.13	0.00	0.06	0.12	0.00	0.00	0.00	0.31
MT	1.2	30	0	52	0	0	0	0	8.2	0.01	0.00	0.13	0.00	0.00	0.00	0.00	0.14

HT	1.22+2.22	64	107	109	154	132	108	0	67.4	0.34	0.00	3.68	17.43	8.71	3.53	0.00	33.68
ST	1.2	58	0	39	0	0	0	0	9.7	0.22	0.00	0.04	0.00	0.00	0.00	0.00	0.25
ST	1.2	31	0	108	0	0	0	0	13.9	0.01	0.00	3.53	0.00	0.00	0.00	0.00	3.54
MT	1.22	77	0	94	80	0	0	0	25.1	0.77	0.00	1.89	0.91	0.00	0.00	0.00	3.57
TT	1.22-2.22	81	0	112	117	119	106	105	64	0.97	0.00	4.16	5.06	5.46	3.25	3.11	22.00
ST	1.2	51	0	91	0	0	0	0	14.2	0.12	0.00	1.63	0.00	0.00	0.00	0.00	1.75
ST	1.2	19	0	36	0	0	0	0	5.5	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.03
DT	1.22	49	0	50	0	0	0	0	9.9	0.10	0.00	0.11	0.00	0.00	0.00	0.00	0.21
LB	1.2	30	0	64	0	0	0	0	9.4	0.01	0.00	0.34	0.00	0.00	0.00	0.00	0.35
ST	1.2	20	0	46	0	0	0	0	6.6	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.08
ST	1.2	34	0	52	0	0	0	0	8.6	0.02	0.00	0.13	0.00	0.00	0.00	0.00	0.15
ST	1.2	34	0	52	0	0	0	0	8.6	0.02	0.00	0.13	0.00	0.00	0.00	0.00	0.15
ST	1.2	49	0	83	0	0	0	0	13.2	0.10	0.00	1.08	0.00	0.00	0.00	0.00	1.18
DT	1.22	49	0	51	40	0	0	0	14	0.10	0.00	0.12	0.04	0.00	0.00	0.00	0.26
ST	1.2	36	0	80	0	0	0	0	11.6	0.03	0.00	0.91	0.00	0.00	0.00	0.00	0.94
MT	1.2	45	0	106	0	0	0	0	15.1	0.07	0.00	3.25	0.00	0.00	0.00	0.00	3.31
ST	1.2	32	0	78	0	0	0	0	11	0.01	0.00	0.82	0.00	0.00	0.00	0.00	0.83
ST	1.2	27	0	48	0	0	0	0	7.5	0.01	0.00	0.09	0.00	0.00	0.00	0.00	0.10
ST	1.2	19	0	20	0	0	0	0	3.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	24	0	83	0	0	0	0	10.7	0.00	0.00	1.08	0.00	0.00	0.00	0.00	1.08
ST	1.2	26	0	37	0	0	0	0	6.3	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.03
ST	1.2	26	0	37	0	0	0	0	6.3	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.03
LB	1.2	41	0	62	0	0	0	0	10.3	0.05	0.00	0.29	0.00	0.00	0.00	0.00	0.34
DT	1.22	44	0	51	54	0	0	0	14.9	0.06	0.00	0.12	0.16	0.00	0.00	0.00	0.34
DT	1.22	42	0	49	52	0	0	0	14.3	0.05	0.00	0.10	0.13	0.00	0.00	0.00	0.28
DT	1.22	39	0	48	56	0	0	0	14.3	0.04	0.00	0.09	0.18	0.00	0.00	0.00	0.31
LB	1.2	48	0	69	0	0	0	0	11.7	0.09	0.00	0.47	0.00	0.00	0.00	0.00	0.56
LB	1.2	52	0	68	0	0	0	0	12	0.13	0.00	0.44	0.00	0.00	0.00	0.00	0.57
ST	1.2	22	0	26	0	0	0	0	4.8	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
DT	1.22	48	51	47	0	0	0	0	14.6	0.09	0.00	0.08	0.00	0.00	0.00	0.00	0.18
LB	1.2	25	0	40	0	0	0	0	6.5	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.05
ST	1.2	52	0	76	0	0	0	0	12.8	0.13	0.00	0.73	0.00	0.00	0.00	0.00	0.86
LB	1.2	42	0	54	0	0	0	0	9.6	0.05	0.00	0.16	0.00	0.00	0.00	0.00	0.21
LB	1.2	55	0	66	0	0	0	0	12.1	0.17	0.00	0.38	0.00	0.00	0.00	0.00	0.55

TT	1.22-2.22	57	0	54	43	39	36	40	26.9	0.20	0.00	0.16	0.06	0.04	0.03	0.04	0.51
ST	1.2	20	0	21	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MT	1.2	48	0	117	0	0	0	0	16.5	0.09	0.00	5.06	0.00	0.00	0.00	0.00	5.15
TT	1.22-2.22	65	0	144	133	118	120	129	70.9	0.36	0.00	12.88	9.01	5.26	5.67	7.85	41.04
MB	1.2	26	0	47	0	0	0	0	7.3	0.01	0.00	0.08	0.00	0.00	0.00	0.00	0.09
MB	1.2	56	0	64	0	0	0	0	12	0.18	0.00	0.34	0.00	0.00	0.00	0.00	0.52
MB	1.2	41	0	58	0	0	0	0	9.9	0.05	0.00	0.22	0.00	0.00	0.00	0.00	0.26
AT	1.22+2.22	54	39	39	62	71	61	0	32.6	0.16	0.00	0.04	0.29	0.53	0.27	0.00	1.29
ST	1.2	21	0	24	0	0	0	0	4.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MT	1.2	53	0	112	0	0	0	0	16.5	0.14	0.00	4.16	0.00	0.00	0.00	0.00	4.30
DT	1.22	49	0	52	46	0	0	0	14.7	0.10	0.00	0.13	0.08	0.00	0.00	0.00	0.31
LB	1.2	68	0	55	0	0	0	0	12.3	0.44	0.00	0.17	0.00	0.00	0.00	0.00	0.61
ST	1.2	19	0	26	0	0	0	0	4.5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
ST	1.2	21	0	23	0	0	0	0	4.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
ST	1.2	21	0	33	0	0	0	0	5.4	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02
ST	1.2	24	0	50	0	0	0	0	7.4	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.11
DT	1.22	49	0	51	57	0	0	0	15.7	0.10	0.00	0.12	0.20	0.00	0.00	0.00	0.42
ST	1.2	26	0	84	0	0	0	0	11	0.01	0.00	1.14	0.00	0.00	0.00	0.00	1.15
LB	1.2	41	0	73	0	0	0	0	11.4	0.05	0.00	0.61	0.00	0.00	0.00	0.00	0.65
MB	1.2	36	0	59	0	0	0	0	9.5	0.03	0.00	0.23	0.00	0.00	0.00	0.00	0.26
FT	1.22	65	0	103	91	0	0	0	25.9	0.36	0.00	2.85	1.63	0.00	0.00	0.00	4.84
LB	1.2	37	0	65	0	0	0	0	10.2	0.03	0.00	0.36	0.00	0.00	0.00	0.00	0.39
MT	1.2	36	0	45	0	0	0	0	8.1	0.03	0.00	0.07	0.00	0.00	0.00	0.00	0.09
MT	1.2	49	0	51	0	0	0	0	10	0.10	0.00	0.12	0.00	0.00	0.00	0.00	0.22
LB	1.2	55	0	55	0	0	0	0	11	0.17	0.00	0.17	0.00	0.00	0.00	0.00	0.34
ST	1.2	21	0	30	0	0	0	0	5.1	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
DT	1.22	52	0	45	50	0	0	0	14.7	0.13	0.00	0.07	0.11	0.00	0.00	0.00	0.31
HT	1.22	88	0	87	97	0	0	0	27.2	1.40	0.00	1.33	2.18	0.00	0.00	0.00	4.92
ST	1.2	25	0	72	0	0	0	0	9.7	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.57
MT	1.2	39	0	116	0	0	0	0	15.5	0.04	0.00	4.87	0.00	0.00	0.00	0.00	4.91
MT	1.2	28	0	107	0	0	0	0	13.5	0.01	0.00	3.39	0.00	0.00	0.00	0.00	3.39
ST	1.2	27	0	51	0	0	0	0	7.8	0.01	0.00	0.12	0.00	0.00	0.00	0.00	0.13
ST	1.2	29	0	77	0	0	0	0	10.6	0.01	0.00	0.77	0.00	0.00	0.00	0.00	0.78
ST	1.2	71	0	133	0	0	0	0	20.4	0.53	0.00	9.01	0.00	0.00	0.00	0.00	9.54

ST		1.2	25	0	44	0	0	0	0	6.9	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.07
ST		1.2	24	0	81	0	0	0	0	10.5	0.00	0.00	0.97	0.00	0.00	0.00	0.00	0.97
TT	1.22-2.22		62	0	46	45	36	33	33	25.5	0.29	0.00	0.08	0.07	0.03	0.02	0.02	0.49
MT		1.2	45	0	115	0	0	0	0	16	0.07	0.00	4.68	0.00	0.00	0.00	0.00	4.75
ST		1.2	20	0	23	0	0	0	0	4.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MB		1.2	18	0	38	0	0	0	0	5.6	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.03
ST		1.2	22	0	44	0	0	0	0	6.6	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.06
MT		1.22	63	0	62	64	0	0	0	18.9	0.31	0.00	0.29	0.34	0.00	0.00	0.00	0.94
ST		1.2	29	0	72	0	0	0	0	10.1	0.01	0.00	0.57	0.00	0.00	0.00	0.00	0.58
MT		1.2	27	0	42	0	0	0	0	6.9	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.06
ST		1.2	48	0	109	0	0	0	0	15.7	0.09	0.00	3.68	0.00	0.00	0.00	0.00	3.77
ST		1.2	34	0	68	0	0	0	0	10.2	0.02	0.00	0.44	0.00	0.00	0.00	0.00	0.46
ST		1.2	19	0	22	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST		1.2	40	0	123	0	0	0	0	16.3	0.04	0.00	6.34	0.00	0.00	0.00	0.00	6.38
ST		1.2	23	0	51	0	0	0	0	7.4	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.12
ST		1.2	27	0	61	0	0	0	0	8.8	0.01	0.00	0.27	0.00	0.00	0.00	0.00	0.28
ST		1.2	21	0	20	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DT		1.22	75	0	136	140	0	0	0	35.1	0.68	0.00	9.96	11.35	0.00	0.00	0.00	21.99
ST		1.2	18	0	23	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST		1.2	24	0	28	0	0	0	0	5.2	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
MT		1.2	52	0	120	0	0	0	0	17.2	0.13	0.00	5.67	0.00	0.00	0.00	0.00	5.80
TT	1.22-2.22		59	0	62	49	71	65	70	37.6	0.23	0.00	0.29	0.10	0.53	0.36	0.50	2.02
ST		1.2	24	0	30	0	0	0	0	5.4	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02
LB		1.2	22	0	47	0	0	0	0	6.9	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.09
DT		1.22	49	0	52	50	0	0	0	15.1	0.10	0.00	0.13	0.11	0.00	0.00	0.00	0.34
DT		1.22	51	0	54	52	0	0	0	15.7	0.12	0.00	0.16	0.13	0.00	0.00	0.00	0.41
LB		1.2	24	0	32	0	0	0	0	5.6	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02
LB		1.2	30	0	48	0	0	0	0	7.8	0.01	0.00	0.09	0.00	0.00	0.00	0.00	0.10
MB		1.2	25	0	38	0	0	0	0	6.3	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.04
MT		1.2	41	0	88	0	0	0	0	12.9	0.05	0.00	1.40	0.00	0.00	0.00	0.00	1.45
DT		1.22	46	0	52	49	0	0	0	14.7	0.08	0.00	0.13	0.10	0.00	0.00	0.00	0.31
MB		1.2	26	0	88	0	0	0	0	11.4	0.01	0.00	1.40	0.00	0.00	0.00	0.00	1.41
ST		1.2	19	0	32	0	0	0	0	5.1	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02
AT	1.22+2.22		61	49	42	40	52	36	0	28	0.27	0.00	0.05	0.04	0.13	0.03	0.00	0.52

AT	1.22+2.22	61	49	42	40	52	36	0	28	0.27	0.00	0.05	0.04	0.13	0.03	0.00	0.52
MB	1.2	43	0	77	0	0	0	0	12	0.06	0.00	0.77	0.00	0.00	0.00	0.00	0.83
DT	1.22	49	0	53	57	0	0	0	15.9	0.10	0.00	0.14	0.20	0.00	0.00	0.00	0.44
LB	1.2	59	0	105	0	0	0	0	16.4	0.23	0.00	3.11	0.00	0.00	0.00	0.00	3.34
ST	1.2	29	0	85	0	0	0	0	11.4	0.01	0.00	1.20	0.00	0.00	0.00	0.00	1.21
ST	1.2	20	0	25	0	0	0	0	4.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
ST	1.2	25	0	27	0	0	0	0	5.2	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
ST	1.2	53	0	93	0	0	0	0	14.6	0.14	0.00	1.80	0.00	0.00	0.00	0.00	1.94
ST	1.2	14	0	23	0	0	0	0	3.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DT	1.22	48	0	53	56	0	0	0	15.7	0.09	0.00	0.14	0.18	0.00	0.00	0.00	0.42
DT	1.22	53	0	50	49	0	0	0	15.2	0.14	0.00	0.11	0.10	0.00	0.00	0.00	0.35
MT	1.22	79	0	144	151	0	0	0	37.4	0.86	0.00	12.88	15.95	0.00	0.00	0.00	29.70
MT	1.22	81	0	155	146	0	0	0	38.2	0.97	0.00	17.94	13.71	0.00	0.00	0.00	32.62
HT	1.22	64	0	85	79	0	0	0	22.8	0.34	0.00	1.20	0.86	0.00	0.00	0.00	2.40
ST	1.2	19	0	26	0	0	0	0	4.5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
ST	1.2	24	0	28	0	0	0	0	5.2	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
TT	1.22-2.22	35	0	59	40	45	36	40	25.5	0.02	0.00	0.23	0.04	0.07	0.03	0.04	0.43
ST	1.2	24	0	30	0	0	0	0	5.4	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02
LB	1.2	22	0	42	0	0	0	0	6.4	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05
DT	1.22	49	0	58	50	0	0	0	15.7	0.10	0.00	0.22	0.11	0.00	0.00	0.00	0.43
DT	1.22	51	0	53	49	0	0	0	15.3	0.12	0.00	0.14	0.10	0.00	0.00	0.00	0.36
LB	1.2	24	0	32	0	0	0	0	5.6	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02
LB	1.2	30	0	39	0	0	0	0	6.9	0.01	0.00	0.04	0.00	0.00	0.00	0.00	0.05
DT	1.22	49	0	53	46	0	0	0	14.8	0.10	0.00	0.14	0.08	0.00	0.00	0.00	0.32
MB	1.2	28	0	42	0	0	0	0	7	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.06
MT	1.2	41	0	88	0	0	0	0	12.9	0.05	0.00	1.40	0.00	0.00	0.00	0.00	1.45
DT	1.22	46	0	52	50	0	0	0	14.8	0.08	0.00	0.13	0.11	0.00	0.00	0.00	0.32
MB	1.2	26	0	88	0	0	0	0	11.4	0.01	0.00	1.40	0.00	0.00	0.00	0.00	1.41
ST	1.2	19	0	32	0	0	0	0	5.1	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02

Appendix IB: Rut Depth Measurement Gerado Otta Seal Road

SECTION	LTPP 1			
Panel	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
1	12	5	4	2
2	12	8	17	6
3	21	5	10	11
4	13	7	0	4
5	0	0	4	5
6	7	12	0	0
7	0	0	4	6
8	3	8	7	6
9	16	3	7	10
10	10	0	6	26
11	5	0	6	5
90^{th} Percentile	16	8	10	11
Maximum Rut depth (mm)	21	12	17	26
Average Rut depth (mm)	9	5	6	8

SECTION	LTPP 2			
Panel	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
1	5	16	8	5
2	0	0	13	14
3	5	20	10	7
4	5	0	6	8
5	5	0	15	8
6	0	5	9	0
7	7	11	4	12
8	10	0	10	19
9	13	0	8	8
10	10	0	6	26
11	5	0	6	5
90th Percentile	10	16	13	19
Maximum Rut depth (mm)	13	20	15	26
Average Rut depth (mm)	6	5	9	11

Appendix IC: Roughness Measurement Gerado Otta Seal Road

Calibration	
Thickness of Calibration Block (T) =	6
Corresponding Displacement (S) =	65
Scaling Factor (SF) = (10*T)/S =	0.923

SECTION	**Right Lane**			**Left Lane**			**Average**
	Initial Reading (D_i)	**Final Reading (D_f) = SF*D_i**	**RI = 0.593+ 0.0471*D_f**	**Initial Reading (D_i)**	**Final Reading (D_f) = SF*D_i**	**RI = 0.593+ 0.0471*D_f**	
Section 1	76	70	3.90	110	102	5.38	4.64
Section 2	110	102	5.38	81	75	4.11	4.75
Section 3	137	126	6.55	84	78	4.25	5.40
Section 4	97	90	4.81	105	97	5.16	4.98
Section 5	80	74	4.07	79	73	4.03	4.05
Section 6	155	143	7.33	104	96	5.11	6.22

Appendix ID: DCP and Base Moisture Measurement Gerado Otta Seal Road

LTPP 1 Start						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications (e.g. TCL 0.1)	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
0 -150	≤ 4	4	3	3	2	3
150 - 300	≤ 9	6	5	2	3	3
300 - 450	≤ 19	3	5	3	6	3
450 - 600	≤ 50	5	5	4	1	4
600 - 800	≤ 50	8	5	4	3	-

LTPP 1 End						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
0 -150	≤ 4	2	2	3	2	2
150 - 300	≤ 9	3	2	3	3	2
300 - 450	≤ 19	3	3	2	3	2
450 - 600	≤ 50	2	3	3	2	5
600 - 800	≤ 50	2	3	-	3	3

LTPP 2 Start						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
1 -150	≤ 4	2	3	2	2	1
151 - 300	≤ 9	3	3	3	4	-
301 - 450	≤ 19	3	2	3	2	-
451 - 600	≤ 50	3	-	1	-	-
601 - 800	≤ 50	-	-	-	-	-

LTPP 2 End						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
2 -150	≤ 4	2	3	2	1	2
152 - 300	≤ 9	2	3	1	2	3
302 - 450	≤ 19	3	4	2	-	3
452 - 600	≤ 50	3	4	2	-	1
602 - 800	≤ 50	1	2	2	-	0

SECTION	**Moisture Content %**				
	Outer wheel at LHS	**Inner wheel at LHS**	**Center**	**Inner wheel at RHS**	**Outer wheel at RHS**
LTPP 1 Start, Toward Combolcha	10.7	7.9	8.9	9.9	10.9
LTPP 1 End, Toward Mekaneselam	11.9	12.9	13.9	14.9	8.2
LTPP 2 Start, Toward Combolcha	9.2	9.4	8	9.4	6.7
LTPP 2 End, Toward Mekaneselam	4.6	4.1	3.5	3.2	3.6

Appendix IE: Visual Condition Index Gerado Otta Seal Road

	Section-1 R		a								
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$	
1	SURFACING FAILURES	6.5	1.0	1.2	5	5	448.41214	5	5	448.41214	
2	SURFACING PATCHING	6.5	1.0	1.2	5	2	149.3307861	5	5	448.41214	
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358	
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	3	5	76.62059303	5	5	127.7009884	
5	AGGREGATE LOSS	4	1.0	1.1	3	5	140.9542732	5	5	234.9237886	
6	BLEEDING / FLUSHING	3	0.5	1.0	3	4	72	5	5	150	
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	1	1	15	5	5	1215.492448	
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646	
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300	
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250	
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
11	CROCODILE CRACKS	10	1.0	1.3	1	1	10	5	5	810.3282983	
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983	
13	RUTTING	8	0.5	1.0	2	5	160	5	5	400	
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200	
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772	
16	FAILURES / POTHOLES	15	1.0	1.3	5	2	369.343324	5	5	1215.492448	
17	ROUGHNESS	5.5	0.8	1.0	2	3	33	4	3	66	
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36	
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36	
20	SHOULDERS (unpaved)	3.5	1.0	1.0	4	3	42	4	3	42	
21	EDGE DEFECTS	3.5	0.8	1.0	3	3	31.5	4	3	42	
						SF_n=	1570.661116		SF_{nmax}=	8598.484726	

→	Priminary VCI = VCI$_P$ $=100\{1-C[\sum_{-}(n=0)\text{^}n$	81.7333
→	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561
→	VCI= $(a*[\![VCI]\!]_P+b*[\![VCI]\!]_p$	**53**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

	Section-1 L		a								
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$	
1	SURFACING FAILURES	6.5	1.0	1.2	3	5	269.047284	5	5	448.41214	
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214	
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358	
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	3	5	76.62059303	5	5	127.7009884	
5	AGGREGATE LOSS	4	1.0	1.1	2	3	53.57391235	5	5	234.9237886	
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150	
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448	
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646	
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300	
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250	
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
11	CROCODILE CRACKS	10	1.0	1.3	2	1	40	5	5	810.3282983	
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983	
13	RUTTING	8	0.5	1.0	0	0	0	5	5	400	
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	1	1	2	5	5	200	
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772	
16	FAILURES / POTHOLES	15	1.0	1.3	2	1	60	5	5	1215.492448	
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66	
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36	
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36	
20	SHOULDERS (unpaved)	3.5	1.0	1.0	2	3	21	4	3	42	
21	EDGE DEFECTS	3.5	0.8	1.0	3	3	31.5	4	3	42	
						SF_n=	575.9417894		SF_{nmax}=	8598.484726	

→	Priminary VCI = VCI$_P$ $=100\{1-C[\sum_{-}(n=0)\text{^}n$	93.3018
→	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561
→	VCI= $(a*[\![VCI]\!]_P+b*[\![VCI]\!]_p$	**80**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

	Section-2 R		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	F_n= $D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	F_{nmax}= $D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	5	4	343.0720568	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	4	4	144	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	3	12	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	1	1	6.4	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	5	3	625.6751266	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	2	3	33	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	0	3	0	4	3	42
						$\sum F_n$=	1210.032233		$\sum F_{nmax}$=	8598.484726

→	Priminary VCI = VCI_P $=100\{1-C[\sum_{-}(n=0)\text{^}n$	85.9274
→	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561
→	$VCI=(a*[\![VCI]\!]_P+b*[\![VCI]\!]_p'$	**62**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

	Section-2 L		a								
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$	
1	SURFACING FAILURES	6.5	1.0	1.2	5	5	448.41214	5	5	448.41214	
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214	
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358	
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	3	5	76.62059303	5	5	127.7009884	
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886	
6	BLEEDING / FLUSHING	3	0.5	1.0	1	2	3	5	5	150	
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448	
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646	
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300	
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250	
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983	
12	PUMPING	10	1.0	1.3	2	5	324.1313193	5	5	810.3282983	
13	RUTTING	8	0.5	1.0	0	0	0	5	5	400	
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200	
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772	
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448	
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66	
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36	
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36	
20	SHOULDERS (unpaved)	3.5	1.0	1.0	2	3	21	4	3	42	
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42	
						SF_n=	917.2640523		SF_{nmax}=	8598.484726	

→	Priminary VCI = VCI$_P$ $=100\{1-C[\sum_{-}(n=0)\text{^}n$	89.3323
→	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561
→	VCI= $(a*[\![VCI]\!]_P+b*[\![VCI]\!]_p$	**70**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

Section-3 R											
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	3	4	205.8432341	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	3	5	76.62059303	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1			0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	3	4	72	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	0	0	0	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	2	3	33	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	2	3	21	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
						SF_n=	439.3638271		SF_{nmax}=	8598.484726

→	Priminary VCI = VCI$_{P}$ $=100\{1-C[\sum_{-}(n=0)\text{^}n$	94.8902
→	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561
→	VCI= $(a*[\![VCI]\!]_{-}P+b*[\![VCI]\!]_{-}p'$	**85**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

	Section-3 L		a								
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$	
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214	
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214	
3	SURFACING CRACKS	5	1.0	1.1	1	4	22.9739671	5	5	293.6547358	
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	3	5	76.62059303	5	5	127.7009884	
5	AGGREGATE LOSS	4	1.0	1.1	2	4	73.51669472	5	5	234.9237886	
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150	
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448	
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646	
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300	
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250	
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
11	CROCODILE CRACKS	10	1.0	1.3	4	2	196.9831061	5	5	810.3282983	
12	PUMPING	10	1.0	1.3	3	3	250.2700507	5	5	810.3282983	
13	RUTTING	8	0.5	1.0	0	0	0	5	5	400	
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200	
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772	
16	FAILURES / POTHOLES	15	1.0	1.3	3	1	90	5	5	1215.492448	
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66	
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36	
19	SURFACE DRAINAGE	3	0.5	1.0	4	3	36	4	3	36	
20	SHOULDERS (unpaved)	3.5	1.0	1.0	3	3	31.5	4	3	42	
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42	
						SF_n=	831.4644116		SF_{nmax}=	8598.484726	

→	Priminary VCI = VCI$_P$ $=100\{1-C[\sum_{-}(n=0)\text{^}n$	90.3301
→	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561
→	VCI= $(a*[\![VCI]\!]_P+b*[\![VCI]\!]_p$	**72**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

	Section-4 R		a								
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$	
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214	
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214	
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358	
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	2	5	51.08039535	5	5	127.7009884	
5	AGGREGATE LOSS	4	1.0	1.1	1	5	23.49237886	5	5	234.9237886	
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150	
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448	
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646	
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300	
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250	
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983	
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983	
13	RUTTING	8	0.5	1.0	3	4	192	5	5	400	
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200	
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772	
16	FAILURES / POTHOLES	15	1.0	1.3	5	1	150	5	5	1215.492448	
17	ROUGHNESS	5.5	0.8	1.0	2	3	33	4	3	66	
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36	
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36	
20	SHOULDERS (unpaved)	3.5	1.0	1.0	3	3	31.5	4	3	42	
21	EDGE DEFECTS	3.5	0.8	1.0	2	3	21	4	3	42	
						SF_n=	538.5727742		SF_{nmax}=	8598.484726	

→	Priminary VCI = VCI$_P$ $=100\{1-C[\sum_{-}(n=0)\text{^}n$	93.7364
→	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561
	VCI= $(a*[\![VCI]\!]_P+b*[\![VCI]\!]_{p'}$	**81**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

	Section-4 L		a								
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$	
1	SURFACING FAILURES	6.5	1.0	1.2	3	5	269.047284	5	5	448.41214	
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214	
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358	
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	3	5	76.62059303	5	5	127.7009884	
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886	
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150	
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448	
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646	
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300	
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250	
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983	
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983	
13	RUTTING	8	0.5	1.0	2	4	128	5	5	400	
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200	
15	PATCHING	8	0.8	1.1	1	1	6.4	5	5	469.8475772	
16	FAILURES / POTHOLES	15	1.0	1.3	5	1	150	5	5	1215.492448	
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66	
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36	
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36	
20	SHOULDERS (unpaved)	3.5	1.0	1.0	3	3	31.5	4	3	42	
21	EDGE DEFECTS	3.5	0.8	1.0	3	3	31.5	4	3	42	
						SF_n=	715.267877		SF_{nmax}=	8598.484726	

→	Priminary VCI = VCI_P $=100\{1-C[\sum_{-}(n=0)\text{^}n$	91.6815
→	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561
→	$VCI=(a*[\![VCI]\!]_P+b*[\![VCI]\!]_p$	**76**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

	Section-5 R		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	5	3	242.9175332	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	2	2	42.8709385	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	4	5	102.1607907	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	2	5	93.96951545	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	3	4	72	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	5	3	135	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	2	64	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	1	1	2	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	5	2	369.343324	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	2	3	21	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	2	3	21	4	3	42
						SF_n=	1215.462102		SF_{nmax}=	8598.484726

→	Priminary VCI = $VCI_P = 100\{1-C[\sum(n=0)\text{^}n$	85.8642
→	$C=1/\sum(n=0)\text{^}n$	0.000116299561
→	$VCI=(a*[VCI]_P+b*[VCI]_p$	**62**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

	Section-5 L		a								
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$	
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214	
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214	
3	SURFACING CRACKS	5	1.0	1.1	2	5	117.4618943	5	5	293.6547358	
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	3	5	76.62059303	5	5	127.7009884	
5	AGGREGATE LOSS	4	1.0	1.1	3	5	140.9542732	5	5	234.9237886	
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150	
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448	
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646	
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300	
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250	
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	2	3	54	5	5	225	
11	CROCODILE CRACKS	10	1.0	1.3	2	1	40	5	5	810.3282983	
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983	
13	RUTTING	8	0.5	1.0	0	0	0	5	5	400	
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200	
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772	
16	FAILURES / POTHOLES	15	1.0	1.3	5	1	150	5	5	1215.492448	
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66	
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36	
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36	
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42	
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42	
						SF_n=	640.1367605		SF_{nmax}=	8598.484726	

→	Priminary VCI = VCI$_P$ $=100\{1-C[\sum_{-}(n=0)\text{^}n$	92.5552
→	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561
→	VCI= $(a*[\![VCI]\!]_P+b*[\![VCI]\!]_p$	**78**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

	Section-6 R		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	3	4	205.8432341	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	3	5	76.62059303	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	5	160	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	4	4	294.0667789	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	5	4	909.4299399	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	3	3	49.5	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
						$\sum F_n =$	1736.860546		$\sum F_{nmax} =$	8598.484726
	Priminary VCI = VCI_P $=100\{1-C[\sum_{-}(n=0)\text{^}n$	79.8004								
	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561								
	$VCI=(a*[\![VCI]\!]_{-}P+b*[\![VCI]\!]_{-}p'$	**49**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

	section-6 L		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	3	4	205.8432341	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1			0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	3	5	76.62059303	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	2	2	34.2967508	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	2	3	36	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	5	160	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	5	2	171.483754	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	5	3	625.6751266	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
						SF_n=	1378.019459		SF_{nmax}=	8598.484726

→	Priminary VCI = VCI$_P$ $=100\{1-C[\sum_{-}(n=0)\text{^}n$	83.9737
→	$C=1/\sum_{-}(n=0)\text{^}n$	0.000116299561
→	VCI= $(a*[\![VCI]\!]_P+b*[\![VCI]\!]_p$	**58**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

APPENDIX II: Hawsewa – Abala – Erebti Road Revised AC Mix Design Measurements

Appendix IIA: Traffic Count and Axle Load Measurement Summary

TRAFFIC COUNT SUMMARY FORM for Hawsewa – Abala – Erebti Road														
Date	**Day**		**Motorcycles**	**Bajaj**	**Passenger Cars**	**4×4 Station Wagons (Land Rover)**	**Small Bus >27 Passengers**	**Larg Bus >27 Passengers**	**Small Truck <3.5 Tonnes**	**Medium Truck 3.5 to 7.0 tonnes**	**Heavy Truck 7.5 - 12Tonne**	**Truck Trailer > 12 tonne**	**Tractors and Aggric Vehicles**	**Daily Factored Totals**
11-12-2017	Monday		102	65	59	221	105	7	178	113	104	176	3	1314
12-12-2017	Tuesday	Day	128	68	69	195	161	4	193	114	142	124	2	1378
		Ngt.	4	7	5	41	31	0	40	5	8	37	0	
13-12-2017	Wednesday		95	60	50	185	162	5	157	150	108	131	0	1207
07-12-2017	Thursday		28	147	24	178	65	2	103	12	39	50	8	762
08-12-2017	Friday		27	103	23	137	38	0	90	8	38	77	5	639
09-12-2017	Saturday	Day	61	85	60	147	62	4	100	36	45	85	11	869
		Ngt.	3	17	5	44	27	0	30	4	15	27	1	
10-12-2017	Sunday		63	70	42	137	120	2	128	83	100	146	9	1142
ADT			75	96	50	206	129	8	161	83	92	143	11	1054

Axle Load Measurment Hawsawa - Abala - Erebti Road

Vehicle	Axle Configuration	Axle 1	Axle 2	Axle 3	Axle 4	Axle 5	Axle 6	Axle 7	Total Load	ESA Axle 1	ESA Axle 2	ESA Axle 3	ESA Axle 4	ESA Axle 5	ESA Axle 6	ESA Axle 7	Total ESA
TT	1.22-2.22	44	0	44	44	34	40	36	24.2	0.06	0.00	0.06	0.06	0.02	0.04	0.03	0.27
FT	1.22-2.22	46	0	51	36	51	46	41	27.1	0.08	0.00	0.12	0.03	0.12	0.08	0.05	0.46
FT	1.22-2.22	52	0	49	34	44	46	38	26.3	0.13	0.00	0.10	0.02	0.06	0.08	0.03	0.42
TT	1.22-2.22	46	0	51	36	51	46	41	27.1	0.08	0.00	0.12	0.03	0.12	0.08	0.05	0.46
TT	1.22	54	0	64	62	0	0	0	18	0.16	0.00	0.34	0.29	0.00	0.00	0.00	0.78
DT	1.22	74	0	201	177	0	0	0	45.2	0.64	0.00	57.78	32.60	0.00	0.00	0.00	91.03
FT	1.22-2.22	76	0	124	95	120	121	108	64.4	0.73	0.00	6.57	1.98	5.67	5.89	3.53	24.37
FT	1.22-2.22	80	0	114	127	118	126	118	68.3	0.91	0.00	4.50	7.32	5.26	7.06	5.26	30.32
AT	1.22+2.22	84	116	114	130	122	143	0	70.9	1.14	4.87	4.50	8.13	6.11	12.49	0.00	37.24
AT	1.22+12.22	88	120	125	117	118	125	0	69.3	1.40	5.67	6.82	5.06	5.26	6.82	0.00	31.03
AT	1.22+2.22	74	110	115	127	130	126	0	68.2	0.64	3.83	4.68	7.32	8.13	7.06	0.00	31.68
AT	1.22+2.22	80	129	130	131	122	119	0	71.1	0.91	7.85	8.13	8.42	6.11	5.46	0.00	36.89
AT	1.22+2.22	69	110	117	121	124	111	0	65.2	0.47	3.83	5.06	5.89	6.57	3.99	0.00	25.82
FT	1.22-2.22	35	0	100	122	123	100	88	56.8	0.02	0.00	2.50	6.11	6.34	2.50	1.40	18.87
TT	1.22+2.22	47	56	48	44	34	34	25	28.8	0.08	0.18	0.09	0.06	0.02	0.02	0.00	0.46
AT	1.22+2.22	76	149	122	111	137	120	0	71.5	0.73	15.02	6.11	3.99	10.30	5.67	0.00	41.82
TT	1.22-2.22	56	0	48	44	34	34	28	24.4	0.18	0.00	0.09	0.06	0.02	0.02	0.01	0.38
TT	1.22-2.22	124	0	143	120	167	122	110	78.6	6.57	0.00	12.49	5.67	25.10	6.11	3.83	59.77
TT	1.22-2.22	137	0	122	137	112	122	129	75.9	10.30	0.00	6.11	10.30	4.16	6.11	7.85	44.82
DT	1.22	69	0	157	157	0	0	0	38.3	0.47	0.00	19.01	19.01	0.00	0.00	0.00	38.49
TT	1.22	56	0	59	82	0	0	0	19.7	0.18	0.00	0.23	1.02	0.00	0.00	0.00	1.44
DT	1.22	63	0	133	142	0	0	0	33.8	0.31	0.00	9.01	12.10	0.00	0.00	0.00	21.42
DT	1.22	76	0	135	128	0	0	0	33.9	0.73	0.00	9.64	7.58	0.00	0.00	0.00	17.95
DT	1.22	46	0	118	127	0	0	0	29.1	0.08	0.00	5.26	7.32	0.00	0.00	0.00	12.65
TT	1.22-2.22	87	0	188	167	144	163	154	90.3	1.33	0.00	42.77	25.10	12.88	22.50	17.43	122.01
DT	1.22	69	0	149	159	0	0	0	37.7	0.47	0.00	15.02	20.12	0.00	0.00	0.00	35.61
DT	1.22	83	0	176	172	0	0	0	43.1	1.08	0.00	31.78	28.66	0.00	0.00	0.00	61.52
TT	1.22	59	0	81	75	0	0	0	21.5	0.23	0.00	0.97	0.68	0.00	0.00	0.00	1.88
AT	1.2+2.22	71	123	152	110	90	0	0	54.6	0.53	6.34	16.43	3.83	1.55	0.00	0.00	28.69

AT	1.2+2.22	77	121	109	111	113	0	0	53.1	0.77	5.89	3.68	3.99	4.33	0.00	0.00	18.66
DT	1.22	53	0	120	125	0	0	0	29.8	0.14	0.00	5.67	6.82	0.00	0.00	0.00	12.63
AT	1.22+2.22	52	155	127	139	111	115	0	69.9	0.13	17.94	7.32	10.99	3.99	4.68	0.00	45.06
DT	1.22	95	0	194	179	0	0	0	46.8	1.98	0.00	49.26	34.30	0.00	0.00	0.00	85.54
DT	1.22	69	0	143	134	0	0	0	34.6	0.47	0.00	12.49	9.32	0.00	0.00	0.00	22.27
DT	1.22	56	0	47	47	0	0	0	15	0.18	0.00	0.08	0.08	0.00	0.00	0.00	0.35
AT	1.2+2.22	79	140	132	83	89	0	0	52.3	0.86	11.35	8.71	1.08	1.48	0.00	0.00	23.48
TT	1.22	42	0	85	83	0	0	0	21	0.05	0.00	1.20	1.08	0.00	0.00	0.00	2.33
AT	1.22+2.22	64	43	43	45	36	37	0	26.8	0.34	0.06	0.06	0.07	0.03	0.03	0.00	0.57
AT	1.2+2.22	57	62	45	47	50	0	0	26.1	0.20	0.29	0.07	0.08	0.11	0.00	0.00	0.75
TT	1.22-2.22	42	0	44	41	46	40	38	25.1	0.05	0.00	0.06	0.05	0.08	0.04	0.03	0.31
AT	1.2+2.22	54	57	52	57	44	0	0	26.4	0.16	0.20	0.13	0.20	0.06	0.00	0.00	0.75
FT	1.22-2.22	56	0	47	46	37	33	38	25.7	0.18	0.00	0.08	0.08	0.03	0.02	0.03	0.42
FT	1.22	38	0	74	76	0	0	0	18.8	0.03	0.00	0.64	0.73	0.00	0.00	0.00	1.40
AT	1.2+2.22	61	131	123	134	115	0	0	56.4	0.27	8.42	6.34	9.32	4.68	0.00	0.00	29.03
DT	1.22	86	0	127	135	0	0	0	34.8	1.27	0.00	7.32	9.64	0.00	0.00	0.00	18.22
DT	1.22	80	0	192	168	0	0	0	44	0.91	0.00	47.02	25.78	0.00	0.00	0.00	73.71
TT	1.22-2.22	70	0	104	135	105	129	113	65.6	0.50	0.00	2.98	9.64	3.11	7.85	4.33	28.41
TT	1.22-2.22	74	0	122	147	89	92	38	56.2	0.64	0.00	6.11	14.14	1.48	1.72	0.03	24.12
TT	1.22-2.22	75	0	129	139	114	147	119	72.3	0.68	0.00	7.85	10.99	4.50	14.14	5.46	43.63
DT	1.22	80	0	128	137	0	0	0	34.5	0.91	0.00	7.58	10.30	0.00	0.00	0.00	18.79
TT	1.22	84	0	112	123	0	0	0	31.9	1.14	0.00	4.16	6.34	0.00	0.00	0.00	11.64
DT	1.22	48	0	51	46	0	0	0	14.5	0.09	0.00	0.12	0.08	0.00	0.00	0.00	0.29
TT	1.22	54	0	63	87	0	0	0	20.4	0.16	0.00	0.31	1.33	0.00	0.00	0.00	1.80
AT	1.2+2.22	74	127	133	83	83	0	0	50	0.64	7.32	9.01	1.08	1.08	0.00	0.00	19.13
DT	1.22	55	0	85	39	0	0	0	17.9	0.17	0.00	1.20	0.04	0.00	0.00	0.00	1.41
SB	1.2	26	0	28	0	0	0	0	5.4	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01
DT	1.22	69	0	107	106	0	0	0	28.2	0.47	0.00	3.39	3.25	0.00	0.00	0.00	7.10
DT	1.22	72	0	111	109	0	0	0	29.2	0.57	0.00	3.99	3.68	0.00	0.00	0.00	8.24
MB	1.2	44	0	99	0	0	0	0	14.3	0.06	0.00	2.39	0.00	0.00	0.00	0.00	2.45
MB	1.2	22	0	19	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DT	1.22	93	0	97	94	0	0	0	28.4	1.80	0.00	2.18	1.89	0.00	0.00	0.00	5.87
DT	1.22	62	0	52	47	0	0	0	16.1	0.29	0.00	0.13	0.08	0.00	0.00	0.00	0.51
FT	1.22-2.22	75	0	136	154	97	127	108	69.7	0.68	0.00	9.96	17.43	2.18	7.32	3.53	41.10

DT	1.22	62	0	52	47	0	0	0	16.1	0.29	0.00	0.13	0.08	0.00	0.00	0.00	0.51
DT	1.22	61	0	50	45	0	0	0	15.6	0.27	0.00	0.11	0.07	0.00	0.00	0.00	0.45
TT	1.22-2.22	61	0	58	55	44	26	42	28.6	0.27	0.00	0.22	0.17	0.06	0.01	0.05	0.77
FT	1.22-2.22	61	0	50	48	50	30	40	27.9	0.27	0.00	0.11	0.09	0.11	0.01	0.04	0.63
SM	1.2	47	0	54	0	0	0	0	10.1	0.08	0.00	0.16	0.00	0.00	0.00	0.00	0.24
TT	1.22-2.22	60	0	138	128	104	139	130	69.9	0.25	0.00	10.64	7.58	2.98	10.99	8.13	40.57
TT	1.22-2.22	89	0	121	119	86	113	108	63.6	1.48	0.00	5.89	5.46	1.27	4.33	3.53	21.95
DT	1.22	72	0	126	176	0	0	0	37.4	0.57	0.00	7.06	31.78	0.00	0.00	0.00	39.42
AT	1.22+2.22	83	113	107	148	114	117	0	68.2	1.08	4.33	3.39	14.57	4.50	5.06	0.00	32.93
DT	1.22	58	0	49	48	0	0	0	15.5	0.22	0.00	0.10	0.09	0.00	0.00	0.00	0.41
TT	1.22	40	0	92	83	0	0	0	21.5	0.04	0.00	1.72	1.08	0.00	0.00	0.00	2.84
TT	1.22-2.22	80	0	149	135	86	118	112	68	0.91	0.00	15.02	9.64	1.27	5.26	4.16	36.26
TT	1.22-2.22	72	0	143	123	101	133	120	69.2	0.57	0.00	12.49	6.34	2.61	9.01	5.67	36.69
MT	1.22	40	0	92	83	0	0	0	21.5	0.04	0.00	1.72	1.08	0.00	0.00	0.00	2.84
TT	1.22-2.22	70	0	124	123	177	123	121	73.8	0.50	0.00	6.57	6.34	32.60	6.34	5.89	58.24
FT	1.22-2.22	70	0	123	118	144	125	118	69.8	0.50	0.00	6.34	5.26	12.88	6.82	5.26	37.06
TT	1.22-2.22	66	0	132	115	107	115	114	64.9	0.38	0.00	8.71	4.68	3.39	4.68	4.50	26.35
MB	1.2	29	0	32	0	0	0	0	6.1	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02
MB	1.2	39	0	36	0	0	0	0	7.5	0.04	0.00	0.03	0.00	0.00	0.00	0.00	0.06
DT	1.22	78	0	165	166	0	0	0	40.9	0.82	0.00	23.77	24.43	0.00	0.00	0.00	49.02
DT	1.22	75	0	142	162	0	0	0	37.9	0.68	0.00	12.10	21.89	0.00	0.00	0.00	34.67
DT	1.22	94	0	112	113	0	0	0	31.9	1.89	0.00	4.16	4.33	0.00	0.00	0.00	10.38
TT	1.22-2.22	72	0	141	82	136	119	0	55	0.57	0.00	11.72	1.02	9.96	5.46	0.00	28.73
DT	1.22	94	0	112	113	0	0	0	31.9	1.89	0.00	4.16	4.33	0.00	0.00	0.00	10.38
DT	1.22	80	0	163	147	0	0	0	39	0.91	0.00	22.50	14.14	0.00	0.00	0.00	37.55
MT	1.22	40	0	92	83	0	0	0	21.5	0.04	0.00	1.72	1.08	0.00	0.00	0.00	2.84
SB	1.2	24	0	46	0	0	0	0	7	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.08
SB	1.2	20	0	33	0	0	0	0	5.3	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02
SB	1.2	31	0	66	0	0	0	0	9.7	0.01	0.00	0.38	0.00	0.00	0.00	0.00	0.40
FT	1.22-2.22	61	0	58	55	44	26	42	28.6	0.27	0.00	0.22	0.17	0.06	0.01	0.05	0.77
FT	1.22-2.22	57	0	55	50	40	31	39	27.2	0.20	0.00	0.17	0.11	0.04	0.01	0.04	0.57
MT	1.22	58	0	93	95	0	0	0	24.6	0.22	0.00	1.80	1.98	0.00	0.00	0.00	4.00
DT	1.22	71	0	164	121	0	0	0	35.6	0.53	0.00	23.13	5.89	0.00	0.00	0.00	29.55
MT	1.22	62	0	47	52	0	0	0	16.1	0.29	0.00	0.08	0.13	0.00	0.00	0.00	0.51

FT	1.22-2.22	52	0	58	51	32	47	35	27.5	0.13	0.00	0.22	0.12	0.01	0.08	0.02	0.59
AT	1.22+2.22	54	34	44	41	37	37	0	24.7	0.16	0.02	0.06	0.05	0.03	0.03	0.00	0.34
TT	1.22-2.22	61	0	58	55	44	26	42	28.6	0.27	0.00	0.22	0.17	0.06	0.01	0.05	0.77
AT	1.22+2.22	53	42	40	36	35	30	0	23.6	0.14	0.05	0.04	0.03	0.02	0.01	0.00	0.29
SB	1.2	20	0	27	0	0	0	0	4.7	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
SB	1.2	25	0	37	0	0	0	0	6.2	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.03
TT	1.22-2.22	87	0	145	146	138	117	123	75.6	1.33	0.00	13.29	13.71	10.64	5.06	6.34	50.37
DT	1.22	59	0	129	140	0	0	0	32.8	0.23	0.00	7.85	11.35	0.00	0.00	0.00	19.43
TT	1.22-2.22	81	0	131	141	108	121	117	69.9	0.97	0.00	8.42	11.72	3.53	5.89	5.06	35.58
DT	1.22	69	0	121	109	0	0	0	29.9	0.47	0.00	5.89	3.68	0.00	0.00	0.00	10.04
AT	1.22+2.22	97	110	122	143	120	118	120	83	2.18	3.83	6.11	12.49	5.67	5.26	5.67	41.21
MB	1.2	49	0	79	0	0	0	0	12.8	0.10	0.00	0.86	0.00	0.00	0.00	0.00	0.97
DT	1.22	57	62	0	0	0	0	0	11.9	0.20	0.29	0.00	0.00	0.00	0.00	0.00	0.49
TT	1.22-2.22	74	0	134	137	106	118	117	68.6	0.64	0.00	9.32	10.30	3.25	5.26	5.06	33.82
MB	1.2	22	0	29	0	0	0	0	5.1	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
DT	1.22	57	0	60	45	0	0	0	16.2	0.20	0.00	0.25	0.07	0.00	0.00	0.00	0.52
TT	1.22-2.22	67	0	143	135	120	120	110	69.5	0.41	0.00	12.49	9.64	5.67	5.67	3.83	37.71
TT	1.22-2.22	76	0	130	137	109	110	106	66.8	0.73	0.00	8.13	10.30	3.68	3.83	3.25	29.91
TT	1.22-2.22	75	0	139	132	88	115	115	66.4	0.68	0.00	10.99	8.71	1.40	4.68	4.68	31.15
DT	1.22	60	0	59	40	0	0	0	15.9	0.25	0.00	0.23	0.04	0.00	0.00	0.00	0.52
TT	1.22-2.22	69	0	151	145	116	123	115	71.9	0.47	0.00	15.95	13.29	4.87	6.34	4.68	45.60
TT	1.22-2.22	71	0	126	132	107	108	117	66.1	0.53	0.00	7.06	8.71	3.39	3.53	5.06	28.28
TT	1.22+2.22	60	48	52	39	44	38	0	28.1	0.25	0.09	0.13	0.04	0.06	0.03	0.00	0.60
DT	1.22	62	0	42	57	0	0	0	16.1	0.29	0.00	0.05	0.20	0.00	0.00	0.00	0.54
SB	1.22	26	0	65	0	0	0	0	9.1	0.01	0.00	0.36	0.00	0.00	0.00	0.00	0.37
DT	1.22	59	0	48	58	0	0	0	16.5	0.23	0.00	0.09	0.22	0.00	0.00	0.00	0.54
MB	1.2	42	0	124	0	0	0	0	16.6	0.05	0.00	6.57	0.00	0.00	0.00	0.00	6.62
MB	1.2	24	0	84	0	0	0	0	10.8	0.00	0.00	1.14	0.00	0.00	0.00	0.00	1.14
TT	1.22-2.22	59	0	52	60	40	29	19	25.9	0.23	0.00	0.13	0.25	0.04	0.01	0.00	0.67
TT	1.22-2.22	81	0	132	136	128	111	109	69.7	0.97	0.00	8.71	9.96	7.58	3.99	3.68	34.89
AT	1.22+2.22	86	116	122	148	126	112	0	71	1.27	4.87	6.11	14.57	7.06	4.16	0.00	38.04
TT	1.22-2.22	68	0	139	132	98	120	112	66.9	0.44	0.00	10.99	8.71	2.28	5.67	4.16	32.25
DT	1.22	52	0	165	160	0	0	0	37.7	0.13	0.00	23.77	20.70	0.00	0.00	0.00	44.60
TT	1.22	41	0	90	81	0	0	0	21.2	0.05	0.00	1.55	0.97	0.00	0.00	0.00	2.57

AT	1.2+2.22	79	137	81	75	75	96	0	54.3	0.86	10.30	0.97	0.68	0.68	2.08	0.00	15.57
DT	1.22	80	0	158	158	0	0	0	39.6	0.91	0.00	19.56	19.56	0.00	0.00	0.00	40.03
DT	1.22	85	0	166	174	0	0	0	42.5	1.20	0.00	24.43	30.19	0.00	0.00	0.00	55.82
DT	1.22	82	0	143	131	0	0	0	35.6	1.02	0.00	12.49	8.42	0.00	0.00	0.00	21.92
TT	1.22-2.22	61	0	66	61	43	55	42	32.8	0.27	0.00	0.38	0.27	0.06	0.17	0.05	1.20
DT	1.22	73	0	157	175	0	0	0	40.5	0.61	0.00	19.01	30.98	0.00	0.00	0.00	50.59
DT	1.22	85	0	158	155	0	0	0	39.8	1.20	0.00	19.56	17.94	0.00	0.00	0.00	38.70
DT	1.22	84	0	143	144	0	0	0	37.1	1.14	0.00	12.49	12.88	0.00	0.00	0.00	26.51
MT	1.22	45	0	91	82	0	0	0	21.8	0.07	0.00	1.63	1.02	0.00	0.00	0.00	2.72
DT	1.22	83	0	183	183	0	0	0	44.9	1.08	0.00	37.88	37.88	0.00	0.00	0.00	76.84
AT	1.22+2.22	54	52	59	44	42	39	0	29	0.16	0.13	0.23	0.06	0.05	0.04	0.00	0.67
DT	1.22	84	0	176	184	0	0	0	44.4	1.14	0.00	31.78	38.82	0.00	0.00	0.00	71.74
TT	1.22-2.22	84	0	150	144	103	141	114	73.6	1.14	0.00	15.48	12.88	2.85	11.72	4.50	48.58
TT	1.22-2.22	68	0	137	141	92	156	129	72.3	0.44	0.00	10.30	11.72	1.72	18.47	7.85	50.49
AT	1.22+2.22	68	127	119	131	135	140	0	72	0.44	7.32	5.46	8.42	9.64	11.35	0.00	42.62
TT	1.22-2.22	73	0	143	142	99	136	114	70.7	0.61	0.00	12.49	12.10	2.39	9.96	4.50	42.04
TT	1.22-2.22	70	0	130	140	108	132	118	69.8	0.50	0.00	8.13	11.35	3.53	8.71	5.26	37.48
AT	1.22+2.22	57	41	38	42	35	51	0	26.4	0.20	0.05	0.03	0.05	0.02	0.12	0.00	0.47
TT	1.22-2.22	58	0	57	58	47	45	40	30.5	0.22	0.00	0.20	0.22	0.08	0.07	0.04	0.82
TT	1.22-2.22	61	0	50	48	44	26	42	27.1	0.27	0.00	0.11	0.09	0.06	0.01	0.05	0.59
TT	1.22-2.22	59	0	47	51	42	31	43	27.3	0.23	0.00	0.08	0.12	0.05	0.01	0.06	0.56
AT	1.2+2.2	71	136	87	79	0	0	0	37.3	0.53	9.96	1.33	0.86	0.00	0.00	0.00	12.69
AT	1.2+2.2	69	116	75	83	0	0	0	34.3	0.47	4.87	0.68	1.08	0.00	0.00	0.00	7.10
FT	1.22-2.22	64	0	154	139	98	127	111	69.3	0.34	0.00	17.43	10.99	2.28	7.32	3.99	42.35
TT	1.22-2.22	79	0	149	151	83	90	98	65	0.86	0.00	15.02	15.95	1.08	1.55	2.28	36.75
AT	1.22+2.22	57	45	43	32	40	49	0	26.6	0.20	0.07	0.06	0.01	0.04	0.10	0.00	0.48
AT	1.22+2.22	52	51	30	39	67	38	0	27.7	0.13	0.12	0.01	0.04	0.41	0.03	0.00	0.74
TT	1.22-2.22	56	0	62	60	46	57	43	32.4	0.18	0.00	0.29	0.25	0.08	0.20	0.06	1.06
TT	1.22-2.22	60	0	53	45	43	29	40	27	0.25	0.00	0.14	0.07	0.06	0.01	0.04	0.57
DT	1.22	83	0	125	127	0	0	0	33.5	1.08	0.00	6.82	7.32	0.00	0.00	0.00	15.21
DT	1.22	76	0	119	134	0	0	0	32.9	0.73	0.00	5.46	9.32	0.00	0.00	0.00	15.51
DT	1.22	39	0	66	54	0	0	0	15.9	0.04	0.00	0.38	0.16	0.00	0.00	0.00	0.58
DT	1.22	62	0	151	161	0	0	0	37.4	0.29	0.00	15.95	21.29	0.00	0.00	0.00	37.53
AT	1.22+2.22	70	136	125	88	86	68	0	57.3	0.50	9.96	6.82	1.40	1.27	0.44	0.00	20.39

DT	1.22	62	0	151	161	0	0	0	37.4	0.29	0.00	15.95	21.29	0.00	0.00	0.00	37.53
AT	1.2+2.2	64	119	92	97	0	0	0	37.2	0.34	5.46	1.72	2.18	0.00	0.00	0.00	9.69
DT	1.22	94	0	184	173	0	0	0	45.1	1.89	0.00	38.82	29.42	0.00	0.00	0.00	70.13
DT	1.22	75	0	163	166	0	0	0	40.4	0.68	0.00	22.50	24.43	0.00	0.00	0.00	47.61
TT	1.22-2.22	61	0	118	137	113	133	105	66.7	0.27	0.00	5.26	10.30	4.33	9.01	3.11	32.27
TT	1.22-2.22	61	0	106	131	119	125	107	64.9	0.27	0.00	3.25	8.42	5.46	6.82	3.39	27.59
MT	1.22	40	0	92	82	0	0	0	21.4	0.04	0.00	1.72	1.02	0.00	0.00	0.00	2.78
TT	1.22-2.22	56	0	57	49	40	38	37	27.7	0.18	0.00	0.20	0.10	0.04	0.03	0.03	0.58
TT	1.22-2.22	74	0	151	137	113	128	121	72.4	0.64	0.00	15.95	10.30	4.33	7.58	5.89	44.69
TT	1.22-2.22	72	0	149	141	117	130	102	71.1	0.57	0.00	15.02	11.72	5.06	8.13	2.73	43.23
DT	1.22	68	0	158	178	0	0	0	40.4	0.44	0.00	19.56	33.44	0.00	0.00	0.00	53.44
ST	1.2	32	0	67	0	0	0	0	9.9	0.01	0.00	0.41	0.00	0.00	0.00	0.00	0.43
TT	1.22-2.22	40	0	45	47	40	36	40	24.8	0.04	0.00	0.07	0.08	0.04	0.03	0.04	0.30
ST	1.2	38	0	80	0	0	0	0	11.8	0.03	0.00	0.91	0.00	0.00	0.00	0.00	0.95
ST	1.2	21	0	21	0	0	0	0	4.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DT	1.22	60	0	52	52	0	0	0	16.4	0.25	0.00	0.13	0.13	0.00	0.00	0.00	0.51
FT	1.22-2.22	61	0	50	48	43	25	40	26.7	0.27	0.00	0.11	0.09	0.06	0.00	0.04	0.57
FT	1.22-2.22	59	0	47	52	50	32	39	27.9	0.23	0.00	0.08	0.13	0.11	0.01	0.04	0.61
AT	1.22+2.22	110	149	117	138	102	159	0	77.5	3.83	15.02	5.06	10.64	2.73	20.12	0.00	57.41
TT	1.22-2.22	79	0	195	174	148	158	143	89.7	0.86	0.00	50.41	30.19	14.57	19.56	12.49	128.09
TT	1.22-2.22	71	0	195	174	148	158	143	88.9	0.53	0.00	50.41	30.19	14.57	19.56	12.49	127.76
TT	1.22-2.22	85	0	184	181	173	192	169	98.4	1.20	0.00	38.82	36.05	29.42	47.02	26.48	178.99
TT	1.22-2.22	40	0	93	80	0	0	0	21.3	0.04	0.00	1.80	0.91	0.00	0.00	0.00	2.76
TT	1.22+2.22	71	0	195	147	158	148	143	86.2	0.53	0.00	50.41	14.14	19.56	14.57	12.49	111.70
TT	1.22-2.22	92	0	193	175	84	109	106	75.9	1.72	0.00	48.13	30.98	1.14	3.68	3.25	88.89
TT	1.22-2.22	86	0	191	194	150	173	160	95.4	1.27	0.00	45.92	49.26	15.48	29.42	20.70	162.05
DT	1.22	82	0	145	137	0	0	0	36.4	1.02	0.00	13.29	10.30	0.00	0.00	0.00	24.61
DT	1.22	60	0	41	56	0	0	0	15.7	0.25	0.00	0.05	0.18	0.00	0.00	0.00	0.48
DT	1.22	86	0	183	174	0	0	0	44.3	1.27	0.00	37.88	30.19	0.00	0.00	0.00	69.34
DT	1.22	81	0	160	167	0	0	0	40.8	0.97	0.00	20.70	25.10	0.00	0.00	0.00	46.76
DT	1.22	76	0	166	177	0	0	0	41.9	0.73	0.00	24.43	32.60	0.00	0.00	0.00	57.76
AT	1.22+2.2	60	56	54	49	46	0	0	26.5	0.25	0.18	0.16	0.10	0.08	0.00	0.00	0.77
AT	1.22+2.22	55	41	49	39	29	31	39	28.3	0.17	0.05	0.10	0.04	0.01	0.01	0.04	0.41
DT	1.22	71	0	184	170	0	0	0	42.5	0.53	0.00	38.82	27.19	0.00	0.00	0.00	66.55

DT	1.22	91	0	189	182	0	0	0	46.2	1.63	0.00	43.80	36.96	0.00	0.00	0.00	82.39
HT	1.22	50	0	94	94	0	0	0	23.8	0.11	0.00	1.89	1.89	0.00	0.00	0.00	3.89
HT	1.22	49	0	74	82	0	0	0	20.5	0.10	0.00	0.64	1.02	0.00	0.00	0.00	1.77
TT	1.22-2.22	95	0	119	142	132	119	113	72	1.98	0.00	5.46	12.10	8.71	5.46	4.33	38.04
HT	1.22	45	0	82	76	0	0	0	20.3	0.07	0.00	1.02	0.73	0.00	0.00	0.00	1.82
HT	1.22	43	0	85	75	0	0	0	20.3	0.06	0.00	1.20	0.68	0.00	0.00	0.00	1.94
TT	1.22-2.22	77	0	122	124	94	108	73	59.8	0.77	0.00	6.11	6.57	1.89	3.53	0.61	19.48
TT	1.22-2.22	84	0	152	140	106	128	118	72.8	1.14	0.00	16.43	11.35	3.25	7.58	5.26	45.01
DT	1.22	77	0	165	172	0	0	0	41.4	0.77	0.00	23.77	28.66	0.00	0.00	0.00	53.20
HT	1.22	43	0	84	73	0	0	0	20	0.06	0.00	1.14	0.61	0.00	0.00	0.00	1.80
HT	1.22	40	0	86	79	0	0	0	20.5	0.04	0.00	1.27	0.86	0.00	0.00	0.00	2.17
DT	1.22	85	0	175	186	0	0	0	44.6	1.20	0.00	30.98	40.76	0.00	0.00	0.00	72.94
TT	1.22-2.22	47	0	140	170	127	103	115	70.2	0.08	0.00	11.35	27.19	7.32	2.85	4.68	53.48
DT	1.22	71	0	145	173	0	0	0	38.9	0.53	0.00	13.29	29.42	0.00	0.00	0.00	43.24
DT	1.22	77	0	173	173	0	0	0	42.3	0.77	0.00	29.42	29.42	0.00	0.00	0.00	59.60
DT	1.22	84	0	144	148	0	0	0	37.6	1.14	0.00	12.88	14.57	0.00	0.00	0.00	28.60
DT	1.22	68	0	172	162	0	0	0	40.2	0.44	0.00	28.66	21.89	0.00	0.00	0.00	50.99
DT	1.22	73	0	160	168	0	0	0	40.1	0.61	0.00	20.70	25.78	0.00	0.00	0.00	47.08
TT	1.22-2.22	70	0	75	55	35	41	40	31.6	0.50	0.00	0.68	0.17	0.02	0.05	0.04	1.46
AT	1.22+2.22	69	123	131	165	138	151	0	77.7	0.47	6.34	8.42	23.77	10.64	15.95	0.00	65.59
AT	1.22+2.22	60	120	116	159	142	166	0	76.3	0.25	5.67	4.87	20.12	12.10	24.43	0.00	67.44
HT	1.22	43	0	80	73	0	0	0	19.6	0.06	0.00	0.91	0.61	0.00	0.00	0.00	1.58
AT	1.22+2.22	79	113	109	131	165	138	151	88.6	0.86	4.33	3.68	8.42	23.77	10.64	15.95	67.65
TT	1.22-2.22	58	0	139	135	126	115	110	68.3	0.22	0.00	10.99	9.64	7.06	4.68	3.83	36.42
AT	1.22+2.22	60	58	61	70	44	53	0	34.6	0.25	0.22	0.27	0.50	0.06	0.14	0.00	1.44
FT	1.22-2.22	70	0	109	93	104	129	128	63.3	0.50	0.00	3.68	1.80	2.98	7.85	7.58	24.40

Appendix IIB: Rut Depth Measurement Hawsewa – Abala – Erebti Road

Hawsewa - Abala - Erebti Road Rut Depth Measurement

LTPP 1	1 - Top of Escarpment (2343m-2347m above sea level)			
PANEL	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
1	5	0	0	2
2	3	0	0	2
3	2	0	0	2
4	5	0	0	3
5	3	0	0	2
6	0	0	0	0
7	0	0	0	0
8	3	0	0	0
9	7	0	0	0
10	0	0	0	0
90^{th} Percentile	6	0	0	3
Maximum Rut depth (mm)	7	0	0	3
Average Rut depth (mm)	3	0	0	2

LTPP 2	2 - On Escarpment (1826m – 1843m above sea level)			
PANEL	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
1	6	0	0	9
2	4	2	0	3
3	4	0	0	7
4	5	4	0	2
5	2	4	0	0
6	4	0	0	3
7	0	0	0	0
8	14	0	0	0
9	0	3	2	0
10	3	0	0	0
11	6	0	0	0
90^{th} Percentile	6	4	0	7
Maximum Rut depth (mm)	14	4	2	9
Average Rut depth (mm)	5	2	1	3

LTPP 3	3 - Bottom of Escarpment (1414m – 1422m above sea level)			
PANEL	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	4	0	0	3
8	0	0	0	0
9	0	0	0	2
10	0	0	0	0
11	0	0	0	0
90th Percentile	0	0	0	2
Maximum Rut depth (mm)	4	0	0	3
Average Rut depth (mm)	1	0	0	1

LTPP 4	4 - On Second Escarpment (1340m – 1357m above sea level)					
PANEL	LEFT LANE		RIGHT LANE		RIGHT Climbing Lane	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path	Inner Wheel path	Outer Wheel path
1	11	16	0	0	4	2
2	21	13	0	0	3	5
3	6	0	0	0	5	12
4	27	18	0	0	0	12
5	8	15	0	0	3	5
6	22	14	3	0	0	6
7	12	5	0	0	7	0
8	17	8	3	0	0	3
9	260	14	0	0	0	2
10	12	7	0	0	0	7
11	14	14	0	0	4	10
12	11	8	0	0	0	8
13	11	12	0	0	5	10
90th Percentile	26	16	3	0	5	12
Maximum Rut depth (mm)	260	18	3	0	7	12
Average Rut depth (mm)	34	12	1	0	3	7

LTPP 5	5 - On second flat section hot area about 850m above sea level			
PANEL	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
1	15	10	3	4
2	14	3	0	6
3	12	10	0	3
4	14	4	3	4
5	24	13	6	4
6	27	24	6	6
7	24	22	10	7
90^{th} Percentile	24	17	6	11
Maximum Rut depth (mm)	27	24	10	14
Average Rut depth (mm)	16	9	3	6

Appendix IIC: Visual Condition Index Hawsewa – Abala – Erebti Road

Condition Index Summary

SECTION	Condition Index	Category
Section-1: 9+200 – 9+380, Top of Escarpment (2343m-2347m a.s.l.)	93	Very Good
Section-2: 25+100 – 25+300, On Escarpment (1826m – 1843m a.s.l.)	93	Very Good
Section-3: 38+700 – 39+000, Bottom of Escarpment (1414m – 1422m a.s.l.)	92	Very Good
Section-4: 59+740 – 59+940, On Second Escarpment (1340m – 1357m a.s.l.)	73	Good
Section-5: 92+062 – 92+190, On second flat section hot area about 850m a.s.l.)	82	Good

	section1 R		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	5	44.841214	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	2	5	93.96951545	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	5	20	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	1	1	15	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	0	3	0	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
						$\sum F_n$=	212.2107294		$\sum F_{nmax}$=	8598.484726

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 97.532

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **92**

a= 0.04000

b= 0.00060

VCI_{max}= 100

VCI_{min}= 0

	Section 1 L		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	5	44.841214	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	1	1	5	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	1	5	23.49237886	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	1	5	22.5	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	5	20	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0		3	0	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0		3	0	4	3	42
						SF_n=	156.3335929		SF_{nmax}=	8598.484726

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	98.1818
$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.000116299561
$VCI = (a * VCI_P + b * VCI_p^2)^2$	**94**
a=	0.04000
b=	0.00060
VCI_{max}=	100
VCI_{min}=	0

	Section 2 R		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	1	5	23.49237886	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	0	0	0	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0		3	0	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0		3	0	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0		3	0	4	3	42
						SF_n=	72.37742828		SF_{nmax}=	8598.484726

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 99.1583

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

VCI = $\left(a * VCI_P + b * VCI_p^2\right)^2$ = **97**

a= 0.04000

b= 0.00060

VCI_{max}= 100

VCI_{min}= 0

	Section 2 L									
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	2	3	97.16701329	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	2	5	93.96951545	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	0	0	0	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	2	5	80	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0		3	0	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0		3	0	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0		3	0	4	3	42
						$\sum F_n$=	313.5215782		$\sum F_{nmax}$=	8598.484726

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 96.3538

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **89**

a= 0.04000

b= 0.00060

VCI_{max}= 100

VCI_{min}= 0

	Scetion 3 R									
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	2	2	59.73231446	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	2	5	93.96951545	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	2	5	60	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	5	20	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0		3	0	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0		3	0	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0		3	0	4	3	42
						SF_n=	268.5868793		SF_{nmax}=	8598.484726

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 96.8763

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

VCI = $\left(a * VCI_P + b * VCI_p^2\right)^2$ **90**

a= 0.04000

b= 0.00060

VCI_{max}= 100

VCI_{min}= 0

	Section 3 L									
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	2	2	59.73231446	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	1	5	23.49237886	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	5	20	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0		3	0	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0		3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0		3	0	4	3	42
						$\sum F_n$=	139.6097427		$\sum F_{nmax}$=	8598.484726

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 98.3763

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **95**

a= 0.04000

b= 0.00060

VCI_{max}= 100

VCI_{min}= 0

	Scetion 4 R									
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	1	1	5	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	1	2	8.5741877	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	2	3	250.2700507	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	1	1	8	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	3	5	240	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0		3	0	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0		3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
							SF_n=	565.4442384		SF_{nmax}= 8598.484726

→	Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	93.4239
→	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.000116299561
→	$VCI = (a * VCI_P + b * VCI_p^2)^2$	**81**
	a=	0.04000
	b=	0.00060
	VCI_{max}=	100
	VCI_{min}=	0

	Section 4 L									
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	2	4	137.2288227	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	2	5	486.196979	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	5	5	400	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0		3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	3	3	31.5	4	3	42
						$\sum F_n$=	1098.125802		$\sum F_{nmax}$=	8598.484726

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 87.2288

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **65**

a= 0.04000

b= 0.00060

VCI_{max}= 100

VCI_{min}= 0

Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	2	14.93307861	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2			0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1			0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	1	1	4	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	1	5	121.5492448	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	4	5	320	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	1	1	15	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0		3	0	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0		3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	2	3	21	4	3	42
						$\sum F_n$=	541.5673728		$\sum F_{nmax}$=	8598.484726

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 93.7016

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

VCI = $\left(a * VCI_P + b * VCI_P^2\right)^2$ **81** 81

a= 0.04000

b= 0.00060

VCI_{max}= 100

VCI_{min}= 0

APPENDIX III: Assosa - Kurmuk Laterite Base Measurements

Appendix IIIA: Traffic Count and Axle Load Measurement Summary

TRAFFIC COUNT SUMMARY FORM for Assosa - Kumruk Road														
Date	**Day**		**Motorcycles**	**Bajaj**	**Passenger Cars**	**4×4 Station Wagons (Land Rover)**	**Small Bus >27 Passengers**	**Large Bus >27 Passengers**	**Small Truck <3.5 Tonnes**	**Medium Truck 3.5 to 7.0 tonnes**	**Heavy Truck 7.5 - 12Tonne**	**Truck Trailer > 12 tonne**	**Tractors and Aggric Vehicles**	**Daily Factored Totals**
01-01-2018	Monday		28	379	0	22	260	0	4	1	0	2	0	856
02-01-2018	Tuesday	Day	17	81	0	38	30	0	5	5	5	2	0	236
		Ngt.	11	19	0	11	5	0	2	3	0	2	0	
03-02-2018	Wednesday		30	149	0	20	35	2	4	0	0	0	0	305
04-01-2018	Thursday		8	105	0	22	65	0	5	8	0	6	0	278
29-12-2017	Friday		24	124	1	63	40	0	0	4	2	3	0	334
30-12-2017	Saturday	Day	28	102	0	29	26	0	5	10	0	3	0	255
		Ngt.	5	24	0	7	13	0	0	1	0	2	0	
31-12-2017	Sunday		20	107	0	27	91	1	1	1	0	0	0	327
ADT			33	185	0	40	97	0	4	6	1	4	0	371

Axle Load Measurement Assosa-Kumruk Road

Vehicle	Axle Configuration	Axle 1	Axle 2	Axle 3	Axle 4	Axle 5	Axle 6	Axle 7	Total Load	ESA Axle 1	ESA Axle 2	ESA Axle 3	ESA Axle 4	ESA Axle 5	ESA Axle 6	ESA Axle 7	Total ESA
FT	1.22	48	0	57	58	0	0	0	16.3	0.09	0.00	0.20	0.22	0.00	0.00	0.00	0.51
DT	1.22	50	0	53	49	0	0	0	15.2	0.11	0.00	0.14	0.10	0.00	0.00	0.00	0.35
DT	1.22	59	0	63	73	0	0	0	19.5	0.23	0.00	0.31	0.61	0.00	0.00	0.00	1.15
DT	1.22	47	0	51	54	0	0	0	15.2	0.08	0.00	0.12	0.16	0.00	0.00	0.00	0.36
MB	1.2	23	0	44	0	0	0	0	6.7	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.07
HT	1.22	61	0	128	118	0	0	0	30.7	0.27	0.00	7.58	5.26	0.00	0.00	0.00	13.11
DT	1.22	51	0	48	53	0	0	0	15.2	0.12	0.00	0.09	0.14	0.00	0.00	0.00	0.36
ST	1.2	28	0	61	0	0	0	0	8.9	0.01	0.00	0.27	0.00	0.00	0.00	0.00	0.28
ST	1.2	31	0	65	0	0	0	0	9.6	0.01	0.00	0.36	0.00	0.00	0.00	0.00	0.37
ST	1.2	18	0	27	0	0	0	0	4.5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
MB	1.2	24	0	48	0	0	0	0	7.2	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.10
MT	1.2	52	0	140	0	0	0	0	19.2	0.13	0.00	11.35	0.00	0.00	0.00	0.00	11.48
FT	1.2	29	0	68	0	0	0	0	9.7	0.01	0.00	0.44	0.00	0.00	0.00	0.00	0.45
MB	1.2	22	0	51	0	0	0	0	7.3	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.12
DT	1.22	84	0	129	132	0	0	0	34.5	1.14	0.00	7.85	8.71	0.00	0.00	0.00	17.70

Appendix IB: Rut Depth Measurement Assosa – Kumruk Road

Rut Depth Measurement Assosa - Kumruk Road				
SECTION	**Unsealed Shoulder on Cut Section(UC1)**			
SUB SECTION	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
UC1-1	5	6	0	10
UC1-2	8	3	6	4
UC1-3	0	9	9	0
UC1-4	8	10	6	9
UC1-5	11	0	9	0
UC1-6	10	0	5	0
90th Percentile	11	10	9	10
Maximum Rut depth (mm)	11	10	9	10
Average Rut depth (mm)	7	5	6	4

SECTION	**Sealed Shoulder on Cut Section(SC1)**			
SUB SECTION	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
SC1-1	6	0	0	5
SC1-2	4	5	5	0
SC1-3	2	6	6	3
SC1-4	5	0	4	7
SC1-5	3	5	8	6
SC1-6	6	0	9	5
SC1-7	0	5	5	0
SC1-8	0	7	12	0
90th Percentile	6	7	10	7
Maximum Rut depth (mm)	6	7	12	7
Average Rut depth (mm)	4	4	7	4

SECTION	Sealed Shoulder on Fill Section(SF1)			
SUB SECTION	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
SF1-1	8	5	0	6
SF1-2	4	0	9	8
SF1-3	4	0	6	0
SF1-4	10	5	0	4
SF1-5	8	4	0	3
SF1-6	11	6	0	6
SF1-7	6	4	6	6
SF1-8	5	0	3	0
SF1-9	8	0	9	5
90^{th} Percentile	11	6	9	7
Maximum Rut depth (mm)	11	6	9	8
Average Rut depth (mm)	8	3	4	5

SECTION	Unsealed Shoulder on Fill Section (UF1)			
SUB SECTION	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
UF1-1	8	0	0	9
UF1-2	6	8	8	4
UF1-3	7	7	0	7
UF1-4	6	11	8	5
90^{th} Percentile	8	11	8	9
Maximum Rut depth (mm)	8	11	8	9
Average Rut depth (mm)	6	7	4	7

SECTION	Unsealed Shoulder on Cut Section(UC2)			
SUB SECTION	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
UC2-1	13	0	5	6
UC2-2	0	7	6	7
UC2-3	3	6	6	6
UC2-4	4	3	5	3
UC2-5	0	0	5	0
UC2-6	6	4	4	5
90^{th} Percentile	10	7	6	7
Maximum Rut depth (mm)	13	7	6	7
Average Rut depth (mm)	5	4	6	5

SECTION	Sealed Shoulder on Fill Section(SF2)			
SUB SECTION	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
SF2-1	7	6	5	6
SF2-2	5	0	8	3
SF2-3	9	0	4	3
SF2-4	3	10	5	10
SF2-5	7	8	9	8
SF2-6	10	9	3	11
90^{th} Percentile	10	10	9	11
Maximum Deflection	10	10	9	11
Average Rut depth	7	6	6	7

SECTION	Unsealed Shoulder on Fill Section(UF2)			
SUB SECTION	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
UF2-1	4	0	0	5
UF2-2	2	0	0	10
UF2-3	4	3	0	0
UF2-4	18	5	4	3
90^{th} Percentile	14	5	3	19
Maximum Rut depth (mm)	18	5	4	10
Average Rut depth (mm)	7	2	1	5

SECTION	Control Section - Unsealed Cut			
SUB SECTION	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
00+025	0	0	0	0
00+040	0	0	0	0
00+055	0	0	0	0
00+070	6	2	4	2
00+085	0	0	0	0
00+100	0	0	0	0
00+115	0	0	0	0
00+130	0	0	0	0
00+145	0	0	0	0

00+160	2	0	3	2
00+175	3	2	3	4
90th Percentile	3	2	3	2
Maximum Rut depth (mm)	6	2	4	4
Average Rut depth (mm)	1	1	1	1

SECTION	**Control Section - Unsealed Fill**			
SUB SECTION	LEFT LANE		RIGHT LANE	
	Outer Wheel path	Inner Wheel path	Inner Wheel path	Outer Wheel path
00+025	0	0	0	0
00+040	0	0	8	4
00+055	0	0	3	0
00+070	4	2	4	0
00+085	2	4	2	2
00+100	0	0	4	2
00+115	4	0	2	2
00+130	2	4	3	2
00+145	2	2	2	2
00+160	0	0	0	0
00+175	4	2	4	0
90th Percentile	4	4	4	2
Maximum Rut depth (mm)	4	4	8	4
Average Rut depth (mm)	2	2	3	2

Appendix IIIC: Roughness Measurement Assosa – Kumruk Road

Calibration	
Thickness of Calibration Block (T) =	6
Corresponding Displacement (S) =	65
Scaling Factor (SF) = (10*T)/S =	0.923

SECTION	Right Lane			Left Lane			Average
	Initial Reading (D_i)	Final Reading (D_f) = SF*D_i	RI = 0.593+ 0.0471*D_f	Initial Reading (D_i)	Final Reading (D_f) = SF*D_i	RI = 0.593+ 0.0471*D_f	
Unsealed Shoulder on Cut Section(UC1)	71	66	3.68	123	114	5.94	3.68
Unsealed Shoulder on Fill Section (UF1)	91	84	4.55	90	83	4.51	3.68
Sealed Shoulder on Fill Section(SF1)	89	82	4.46	94	87	4.68	4.57
Sealed Shoulder on Cut Section(SC1)	81	75	4.11	68	63	3.55	3.83
Unsealed Shoulder on Cut Section(UC2)	64	59	3.38	77	71	3.94	3.66
Sealed Shoulder on Fill Section(SF2)	64	59	3.38	82	76	4.16	3.77
Unsealed Shoulder on Fill Section(UF2)	71	66	3.68	71	66	3.68	3.68
Control Section - Unsealed Cut	72	66	3.72	53	49	2.90	3.31
Control Section - Unsealed Fill	47	43	2.64	66	61	3.46	2.05

Appendix IIID: DCP and Base Moisture Measurement Assosa – Kumruk Road

Unsealed Shoulder on Fill Section (UF1)						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications (e.g. TCL 0.1)	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
0 -150	≤ 4	6.3	5.8	4.8	5.1	5.4
150 - 300	≤ 9	13.6	8.8	7.3	9.4	13.6
300 - 450	≤ 19	9.7	9.4	13.6	27.3	10.7
450 - 600	≤ 50	11.1	8.3	9.4	8.3	8.8
600 - 800	≤ 50	8.3	9.1	10.3	7.1	10.0

Sealed Shoulder on Fill Section (SF1)						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
0 -150	≤ 4	6.4	8.6	6.3	8.8	6.3
150 - 300	≤ 9	6.0	14.3	11.1	10.7	16.7
300 - 450	≤ 19	8.8	15.0	17.6	11.1	30.0
450 - 600	≤ 50	7.9	11.5	10.3	9.4	13.6
600 - 800	≤ 50	10.0	10.0	20.0	11.4	18.2

Sealed Shoulder on Cut Section (SC1)						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
1 -150	≤ 4	6.3	5.6	7.9	5.8	7.1
151 - 300	≤ 9	7.1	11.1	8.8	7.5	9.4
301 - 450	≤ 19	8.8	13.6	10.0	12.0	13.6
451 - 600	≤ 50	7.5	13.0	17.6	20.0	14.3
601 - 800	≤ 50	23.5	13.8	13.8	12.1	21.1

Unsealed Shoulder on Cut Section (UC2)						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
2 -150	≤ 4	4.5	5.6	3.9	5.0	5.8
152 - 300	≤ 9	5.9	6.7	4.7	5.0	9.7
302 - 450	≤ 19	7.9	5.7	14.3	5.2	15.0
452 - 600	≤ 50	11.1	11.1	7.7	11.5	12.5
602 - 800	≤ 50	9.8	10.3	8.5	18.2	11.8

Sealed Shoulder on Fill Section (SF2)						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
1 -150	≤ 4	7.9	8.8	10.0	11.5	10.7
151 - 300	≤ 9	11.5	8.3	10.7	9.4	10.0
301 - 450	≤ 19	7.1	9.7	11.5	16.7	11.1
451 - 600	≤ 50	10.0	9.4	12.5	21.4	12.0
601 - 800	≤ 50	12.5	10.8	16.0	10.0	11.8

Unsealed Shoulder on Fill Section (UF2)						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
2 -150	≤ 4	7.1	5.0	5.8	6.8	7.9
152 - 300	≤ 9	7.1	6.5	6.8	10.7	9.4
302 - 450	≤ 19	10.0	10.0	8.8	10.0	11.5
452 - 600	≤ 50	15.0	15.0	10.0	11.5	15.0
602 - 800	≤ 50	13.3	10.0	9.1	8.3	12.5

Control Section - Unsealed Cut (CS1-UC1)						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
3 -150	≤ 4	3.0	4.2	3.5	3.0	4.3
153 - 300	≤ 9	5.6	5.4	4.3	6.5	10.0
303 - 450	≤ 19	8.8	7.1	7.5	7.9	11.5
453 - 600	≤ 50	9.4	6.3	5.2	7.1	13.6
603 - 800	≤ 50	14.3	8.0	6.3	7.4	11.1

Control Section - Unsealed Cut (CS1-UC2)						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
2 -150	≤ 4	7.1	3.7	3.6	3.5	4.4
152 - 300	≤ 9	10.0	10.0	9.4	9.4	11.5
302 - 450	≤ 19	18.8	10.7	6.3	16.7	18.8
452 - 600	≤ 50	18.8	7.5	8.3	15.0	18.8
602 - 800	≤ 50	14.3	9.5	11.1	16.7	18.2

Control Section - Unsealed Fill (CS2-UF1)						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
3 -150	≤ 4	2.6	2.1	2.4	2.1	2.9
153 - 300	≤ 9	8.3	4.7	6.8	12.5	7.1
303 - 450	≤ 19	7.9	10.7	15.0	30.0	7.9
453 - 600	≤ 50	7.1	18.8	18.8	10.0	6.5
603 - 800	≤ 50	9.1	20.0	16.7	12.5	16.7

Control Section - Unsealed Fill (CS2-UF2)						
Depth (MM)	**DN Values (mm/blow)**					
	Specifications	**OWL**	**IWL**	**CL**	**IWR**	**OWR**
4 -150	≤ 4	4.8	3.9	2.6	6.3	2.1
154 - 300	≤ 9	7.9	3.9	4.8	6.3	6.5
304 - 450	≤ 19	9.4	7.5	5.6	6.8	18.8
454 - 600	≤ 50	10.7	5.8	6.3	5.4	12.5
604 - 800	≤ 50	14.3	12.5	9.5	7.7	11.8

Appendix IIIE: Visual Condition Index Assosa – Kumruk Road

Condition Index Summary

SECTION	Average CI (Condition Index)
Unsealed Shoulder on Cut Section(UC1)	95
Unsealed Shoulder on Fill Section (UF1)	93
Sealed Shoulder on Fill Section(SF1)	97
Sealed Shoulder on Cut Section(SC1)	97
Unsealed Shoulder on Cut Section(UC2)	93
Sealed Shoulder on Fill Section(SF2)	96
Unsealed Shoulder on Fill Section(UF2)	89
Control Section - Unsealed Cut(CS1-UC)	97
Control Section - Unsealed Fill (CS2-UF)	96

	UF1 R										
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	F_n= D_n*(E_n^Yn)*W_n*S_n	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	F_{nmax}= D_{nmax}*(E_{nmax}^Yn)*W_n*S_n
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2			0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1			0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	1	1.5	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1			0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	1	1.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	2	64	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
						$\sum F_n$=	114.6		$\sum F_{nmax}$=	8598.484726
	Priminary VCI = VCI_P $= 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	98.66720703								
	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
	VCI = $\left(a * VCI_P + b * VCI_P^2\right)^2$	**96**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

	UF1 L		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	Maximum Degree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	3	96	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	0	3	0	4	3	42
						SF_n=	162.2		SF_{nmax}=	8598.484726
	Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	98.11362112								
	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
	VCI = $\left(a * VCI_P + b * VCI_p^2\right)^2$	**94**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

	SC1 R		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	F_n= D_n*(E_n^Yn)*W_n*S_n	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	F_{nmax}= D_{nmax}*(E_{nmax}^Yn)*W_n*S_n
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	1	4	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0		3	0	4	3	42
						$\sum F_n$=	46.2		$\sum F_{nmax}$=	8598.484726
	Priminary VCI = VCI_P $= 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	99.46269603								
	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
	VCI = $\left(a * VCI_P + b * VCI_P^2\right)^2$	**98**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

	SC1 L		a								
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	Maximum Degree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$	
1	SURFACING FAILURES	6.5	1.0	1.2	1	2	14.93307861	5	5	448.41214	
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214	
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358	
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884	
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886	
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150	
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448	
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646	
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300	
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250	
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225	
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983	
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983	
13	RUTTING	8	0.5	1.0	1	3	12	5	5	400	
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200	
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772	
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448	
17	ROUGHNESS	5.5	0.8	1.0	2	3	33	4	3	66	
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36	
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36	
20	SHOULDERS (unpaved)	3.5	1.0	1.0	2	3	21	4	3	42	
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42	
						SF_n=	111.8330786		SF_{nmax}=	8598.484726	

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	98.6993862
$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00
$VCI = \left(a * VCI_P + b * VCI_p^2\right)^2$	**96**
a=	0.04000
b=	0.00060
VCI_{max}=	100
VCI_{min}=	0

UF2 R		a							
Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886
BLEEDING / FLUSHING	3	0.5	1.0	1	1	1.5	5	5	150
SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
RUTTING	8	0.5	1.0	3	4	192	5	5	400
UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
FAILURES / POTHOLES	15	1.0	1.3	1	1	15	5	5	1215.492448
ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
EDGE DEFECTS	3.5	0.8	1.0		3	0	4	3	42
					SF_n=	261.2		SF_{nmax}=	8598.484726
Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	96.96225546								
$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
$VCI = (a*VCI_P + b*VCI_P^2)^2$	**91**								
a=	0.04000								
b=	0.00060								
VCI_{max}=	100								
VCI_{min}=	0								

	UF2 L		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	F_n= D_n*(E_n^Yn)*W_n*S_n	Maximum Degree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	F_{nmax}= D_{nmax}*(E_{nmax}^Yn)*W_n*S_n
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	1	5	23.49237886	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	2	3	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	1	1	15	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	3	5	240	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	0	3	0	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0		3	0	4	3	42
						SF_n=	329.6923789		SF_{nmax}=	8598.484726

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	96.1656921
$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00
$VCI = \left(a * VCI_P + b * VCI_P^2\right)^2$	**88**
a=	0.04000
b=	0.00060
VCI_{max}=	100
VCI_{min}=	0

	SF1 R		a							
Item #	**Deffect Type**	**Weight (W_n)**	**Small degree (S_n)**	**Extent Weight (Y_n)**	**Degree Ratting of Defect (D_n)**	**Extent Rating of Defect (E_n)**	**F_n= D_n*(E_n^Yn)*W_n*S_n**	**MaximumDegree Ratting of Defect $(D_n)_{max}$**	**Maximum Extent Rating of Defect $(E_n)_{max}$**	**F_{nmax}= D_{nmax}*(E_{nmax}^Yn)*W_n*S_n**
1	SURFACING FAILURES	6.5	1.0	1.2	0	0	0	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	5	7.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	4	16	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	0	3	0	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	3	3	31.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
						$\sum F_n$=	78.78504942		$\sum F_{nmax}$=	8598.484726
	Priminary VCI = VCI_P $= 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	99.08373333								
	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
	VCI = $\left(a * VCI_P + b * VCI_P^2\right)^2$	**97**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

	SF1 L		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	F_n= D_n*(E_n^Yn)*W_n*S_n	MaximumDegree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	F_{nmax}= D_{nmax}*(E_{nmax}^Yn)*W_n*S_n
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	5	20	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	1	1	2	5	5	200
15	PATCHING	8	0.8	1.1	1	1	6.4	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	1	1	15	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	0	3	0	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	0	3	0	4	3	42
						$\sum F_n$=	81.1		$\sum F_{nmax}$=	8598.484726
	Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	99.05681056								
	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
	VCI = $\left(a * VCI_P + b * VCI_P^2\right)^2$	**97**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

	UC2 R		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	Maximum Degree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	4	128	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	1	2	36.9343324	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	0	3	0	4	3	42
						SF_n=	193.6343324		SF_{nmax}=	8598.484726
	Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	97.74804121								
	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
	VCI = $\left(a * VCI_P + b * VCI_p^2\right)^2$	**93**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

	CUC2 L		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	Maximum Degree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	2	14.93307861	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	0	0	0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	5	20	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	1	1	15	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
						SF_n=	94.03307861		SF_{nmax}=	8598.484726
	Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	98.90639942								
	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
	VCI = $\left(a * VCI_P + b * VCI_p^2\right)^2$	**97**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

	SF2 R		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	Maximum Degree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	0	0	0	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	1	2	8.5741877	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	5	20	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	0	3	0	4	3	42
						SF_n=	64.2741877		SF_{nmax}=	8598.484726
	Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	99.25249402								
	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
	VCI = $\left(a * VCI_P + b * VCI_p^2\right)^2$	**98**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

	SF2 L		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	Maximum Degree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	0	0	0	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	0	0	0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	1	1	4	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	0	0	0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	3	96	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	0	3	0	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	0	3	0	4	3	42
						SF_n=	131.2		SF_{nmax}=	8598.484726
	Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	98.47414976								
	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
	VCI = $\left(a * VCI_P + b * VCI_p^2\right)^2$	**95**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

	CS 1									
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	Maximum Degree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	2	1	12	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1			0	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0			0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	1	1	4	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	2	3	21	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
						SF_n=	74.1		SF_{nmax}=	8598.484726

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	99.13822
$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.0001163
$VCI = (a * VCI_P + b * VCI_p^2)^2$	**97**
a=	0.04000
b=	0.00060
VCI_{max}=	100
VCI_{min}=	0

	CS 2		a							
Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Ratting of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	Maximum Degree Ratting of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	1	6.5	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	0	0	0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	0	0	0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	2	1	16	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	2	1	12	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3	0	0	0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2	0	0	0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0	0	0	0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0	0	0	0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	0	0	0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	0	0	0	5	5	810.3282983
12	PUMPING	10	1.0	1.3	0	0	0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	0	0	0	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0	0	0	0	5	5	200
15	PATCHING	8	0.8	1.1	0	0	0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3	0	0	0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	3	3	49.5	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	1	3	4.5	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	1	3	10.5	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
						SF_n=	118.2850494		SF_{nmax}=	8598.484726
	Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$=	98.62435007								
	$C = 1/\sum_{n=0}^{n} F_{nmax}$=	0.00								
	VCI = $\left(a * VCI_P + b * VCI_p^2\right)^2$	**96**								
	a=	0.04000								
	b=	0.00060								
	VCI_{max}=	100								
	VCI_{min}=	0								

APPENDIX IV: Combel Otta Seal Road Measurements

Appendix IVA: Traffic Count and Axle Load Measurement Summary

TRAFFIC COUNT SUMMARY FORM for Combel Otta Seal														
Date	**Day**		**Motorcycles**	**Bajaj**	**Passenger Cars**	**4×4 Station Wagons (Land Rover)**	**Small Bus >27 Passengers**	**Larg Bus >27 Passengers**	**Small Truck <3.5 Tonnes**	**Medium Truck 3.5 to 7.0 tonnes**	**Heavy Truck 7.5 - 12Tonne**	**Truck Trailer > 12 tonne**	**Tractors and Aggric Vehicles**	**Daily Factored Totals**
22-01-2018	Monday		52	0	5	5	20	0	18	2	0	0	0	127
16-01-2018	Tuesday	Day	113	4	5	9	20	0	28	0	0	0	0	235
		Ngt.	13	0	0	4	13	12	10	4	0	0	0	
17-01-2018	Wednesday		72	0	1	11	42	8	36	0	0	0	0	215
18-01-2018	Thursday		64	0	3	12	27	1	27	2	1	0	0	172
19-01-2018	Friday		31	0	8	10	20	0	32	0	0	0	0	133
20-01-2018	Saturday	Day	33	0	3	7	22	0	14	0	0	0	0	115
		Ngt.	9	0	1	2	3	0	17	4	0	0	0	
21-01-2018	Sunday		25	0	5	0	11	0	32	0	0	0	0	121
ADT			63	1	5	11	36	2	42	1	0	0	0	160

Axle Load Measurement Combel Road

Vehicle	Axle Configuration	Axle 1	Axle 2	Axle 3	Axle 4	Axle 5	Axle 6	Axle 7	Total Load	ESA Axle 1	ESA Axle 2	ESA Axle 3	ESA Axle 4	ESA Axle 5	ESA Axle 6	ESA Axle 7	Total ESA
MB	1.2	24	0	24	0	0	0	0	4.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
ST	1.2	18	0	20	0	0	0	0	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	14	0	32	0	0	0	0	4.6	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02
ST	1.2	15	0	19	0	0	0	0	3.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	17	0	18	0	0	0	0	3.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	18	0	20	0	0	0	0	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MB	1.2	29	0	49	0	0	0	0	7.8	0.01	0.00	0.10	0.00	0.00	0.00	0.00	0.11
ST	1.2	17	0	18	0	0	0	0	3.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MB	1.2	26	0	47	0	0	0	0	7.3	0.01	0.00	0.08	0.00	0.00	0.00	0.00	0.09
ST	1.2	18	0	17	0	0	0	0	3.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MB	1.2	24	0	43	0	0	0	0	6.7	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.06
ST	1.2	23	0	24	0	0	0	0	4.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MB	1.2	12	0	20	0	0	0	0	3.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MB	1.2	26	0	42	0	0	0	0	6.8	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.06
MB	1.2	29	0	72	0	0	0	0	10.1	0.01	0.00	0.57	0.00	0.00	0.00	0.00	0.58
MB	1.2	30	0	50	0	0	0	0	8	0.01	0.00	0.11	0.00	0.00	0.00	0.00	0.12
ST	1.2	25	0	27	0	0	0	0	5.2	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
MB	1.2	26	0	63	0	0	0	0	8.9	0.01	0.00	0.31	0.00	0.00	0.00	0.00	0.32
ST	1.2	19	0	21	0	0	0	0	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MB	1.2	24	0	38	0	0	0	0	6.2	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.04
MB	1.2	27	0	44	0	0	0	0	7.1	0.01	0.00	0.06	0.00	0.00	0.00	0.00	0.07
ST	1.2	20	0	22	0	0	0	0	4.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ST	1.2	21	0	20	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	19	0	21	0	0	0	0	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MB	1.2	22	0	36	0	0	0	0	5.8	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.03
ST	1.2	19	0	22	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	21	0	23	0	0	0	0	4.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MB	1.2	27	0	49	0	0	0	0	7.6	0.01	0.00	0.10	0.00	0.00	0.00	0.00	0.11
MB	1.2	33	0	48	0	0	0	0	8.1	0.02	0.00	0.09	0.00	0.00	0.00	0.00	0.11
MB	1.2	25	0	33	0	0	0	0	5.8	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02
MB	1.2	26	0	38	0	0	0	0	6.4	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.04
MB	1.2	27	0	31	0	0	0	0	5.8	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02
MB	1.2	30	0	57	0	0	0	0	8.7	0.01	0.00	0.20	0.00	0.00	0.00	0.00	0.21
ST	1.2	19	0	22	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	23	0	25	0	0	0	0	4.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MB	1.2	23	0	36	0	0	0	0	5.9	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.03
ST	1.2	22	0	21	0	0	0	0	4.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	27	0	71	0	0	0	0	9.8	0.01	0.00	0.53	0.00	0.00	0.00	0.00	0.54
ST	1.2	19	0	22	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	20	0	21	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MB	1.2	27	0	71	0	0	0	0	9.8	0.01	0.00	0.53	0.00	0.00	0.00	0.00	0.54
MB	1.2	24	0	35	0	0	0	0	5.9	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.03
ST	1.2	22	0	21	0	0	0	0	4.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	35	0	73	0	0	0	0	10.8	0.02	0.00	0.61	0.00	0.00	0.00	0.00	0.63
MB	1.2	30	0	49	0	0	0	0	7.9	0.01	0.00	0.10	0.00	0.00	0.00	0.00	0.11
MB	1.2	30	0	49	0	0	0	0	7.9	0.01	0.00	0.10	0.00	0.00	0.00	0.00	0.11
MB	1.2	26	0	29	0	0	0	0	5.5	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02
ST	1.2	18	0	22	0	0	0	0	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	19	0	19	0	0	0	0	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MB	1.2	28	0	38	0	0	0	0	6.6	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.04
MB	1.2	30	0	67	0	0	0	0	9.7	0.01	0.00	0.41	0.00	0.00	0.00	0.00	0.42

ST	1.2	29	0	48	0	0	0	0	7.7	0.01	0.00	0.09	0.00	0.00	0.00	0.00	0.10
ST	1.2	27	0	54	0	0	0	0	8.1	0.01	0.00	0.16	0.00	0.00	0.00	0.00	0.16
ST	1.2	19	0	22	0	0	0	0	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MB	1.2	25	0	38	0	0	0	0	6.3	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.04
ST	1.2	19	0	21	0	0	0	0	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	26	0	63	0	0	0	0	8.9	0.01	0.00	0.31	0.00	0.00	0.00	0.00	0.32
MB	1.2	25	0	38	0	0	0	0	6.3	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.04
ST	1.2	18	0	25	0	0	0	0	4.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
ST	1.2	18	0	20	0	0	0	0	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST	1.2	23	0	44	0	0	0	0	6.7	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.07
MB	1.2	24	0	48	0	0	0	0	7.2	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.10
MB	1.2	26	0	55	0	0	0	0	8.1	0.01	0.00	0.17	0.00	0.00	0.00	0.00	0.18
MB	1.2	28	0	48	0	0	0	0	7.6	0.01	0.00	0.09	0.00	0.00	0.00	0.00	0.10
MB	1.2	26	0	48	45	0	0	0	11.9	0.01	0.00	0.09	0.07	0.00	0.00	0.00	0.17
ST	1.2	22	0	33	0	0	0	0	5.5	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02
DT	1.2	40	0	49	56	0	0	0	14.5	0.04	0.00	0.10	0.18	0.00	0.00	0.00	0.32
ST	1.2	19	0	21	0	0	0	0	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix IVB: Roughness Measurement Combel Otta Seal Road

Calibration	
Thickness of Calibration Block (T) =	6
Corresponding Displacement (S) =	65
Scaling Factor (SF) = (10*T)/S =	0.923

SECTION	length (m)	Right Lane			Left Lane			Average
		Initial Reading (D_i)	Final Reading (D_f) = SF*D_i	RI = 0.593+ 0.0471*D_f	Initial Reading (D_i)	Final Reading (D_f) = SF*D_i	RI = 0.593+ 0.0471*D_f	
1. crusher Dust seal ON crusher Dust seal	100	91	84	4.55	90	83	4.51	4.55
2. otta seal crushed basalt ON otta seal cinder Agg.	150	120	111	5.81	104	96	5.11	4.55
3. otta cinder Agg. ON otta cinder Agg.	50	106	98	5.20	91	84	4.55	4.88
4. otta seal weathered basalt ON otta seal weathered basalt	300	104	96	5.11	127	117	6.11	5.61
5. crusher Dust seal ON otta seal crushed basalt	260	103	95	5.07	153	141	7.24	6.16
6. otta seal crushed basalt ON otta seal crushed basalt	130	90	83	4.51	96	89	4.77	4.64
7. crusher Dust seal ON otta seal crushed basalt	710	102	94	5.03	85	78	4.29	4.66
8. otta cinder Agg. ON otta seal crushed basalt	150	82	76	4.16	91	84	4.55	4.35
9. crusher Dust seal otta seal On crushed basalt	50	78	72	3.98	69	64	3.59	3.79

Appendix IVC: Visual Condition Index Combel Otta Seal Road

Section: 1. Crusher dust seal on crusher dust seal
Lane: Both

Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Rating of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Rating of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	2	3	97.16701329	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2			0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1			0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	3	4	110.2750421	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	1	1.5	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0			0	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	2	3	21	4	3	42
						$\sum F_n$=	285.5271048		$\sum F_{nmax}$=	8598.484726

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 96.6793

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **89.781**

a= 0.04000

b= 0.00060

VCI_{max}= 100

VCI_{min}= 0

Section: 2. Otta seal crushed basalt on otta seal cinder aggregate
Lane: Both

Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Rating of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Rating of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	4	5	358.729712	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2			0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	3	1	30	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	4	5	187.9390309	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	2	4	48	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0	1	1	4.5	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3	3	1	60	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	3	96	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	2	3	33	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	2	3	21	4	3	42
						$\sum F_n$=	881.5537923		$\sum F_{nmax}$=	8598.484726

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 89.7476

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **70.942**

a= 0.04000
b= 0.00060
VCI_{max}= 100
VCI_{min}= 0

Section: 3. Otta cinder agg. On otta cinder agg.
Lane: Both

Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Rating of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Rating of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	3	2	89.59847169	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2			0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1			0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	3	2	51.4451262	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0			0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0			0	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	2	3	33	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	2	3	21	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	2	3	21	4	3	42
						$\sum F_n$=	258.4286473		$\sum F_{nmax}$=	8598.484726

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 96.9945

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **90.717**

a= 0.04000
b= 0.00060
VCI_{max}= 100
VCI_{min}= 0

Section: 4. Otta seal weathered basalt on otta seal weathered basalt
Lane: Both

Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Rating of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Rating of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	4	5	358.729712	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2			0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1			0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	3	5	140.9542732	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	2	5	60	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	2	64	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	2	3	33	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	0	3	0	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	2	3	21	4	3	42
						$\sum F_n$=	702.0690346		$\sum F_{nmax}$=	8598.484726

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 91.835

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **76.276**

a= 0.04000
b= 0.00060
VCI_{max}= 100
VCI_{min}= 0

Section: 5. Crusher dust seal on otta seal crushed basalt
Lane: both

Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Rating of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Rating of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	4	5	358.729712	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2			0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	2	4	91.8958684	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	3	5	140.9542732	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	2	3	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	2	64	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	2	3	33	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	2	3	18	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	2	3	21	4	3	42
						$\sum F_n$=	754.964903		$\sum F_{nmax}$=	8598.484726

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

Primiary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 91.2198

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **74.674**

a= 0.04000
b= 0.00060
VCI_{max}= 100
VCI_{min}= 0

Section: 6. Otta seal cursched basalt on otta seal crushed basalt
Lane: Both

Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Rating of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Rating of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	1	2	14.93307861	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2			0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	3	4	137.8438026	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9			0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	3	3	80.36086853	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	2	3	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0	2	2	64	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	2	3	33	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	3	3	27	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	3	3	31.5	4	3	42
						$\sum F_n$=	409.6377497		$\sum F_{nmax}$=	8598.484726

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 95.2359

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **85.588**

a= 0.04000
b= 0.00060
VCI_{max}= 100
VCI_{min}= 0

Section: 7. Crusher dust seal on otta seal crushed basalt
Lane: Both

Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Rating of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Rating of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	4	5	358.729712	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	2	3	97.16701329	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1			0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9	1	5	6.385049419	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	3	5	140.9542732	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0	1	2	3	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0			0	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	3	3	27	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	2	3	21	4	3	42
						$\sum F_n$=	685.4360479		$\sum F_{nmax}$=	8598.484726

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 92.0284

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **76.784**

a= 0.04000
b= 0.00060
VCI_{max}= 100
VCI_{min}= 0

Section: 8. Otta cinder aggregate on otta seal crushed basalt
Lane: Both

Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Rating of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Rating of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	3	5	269.047284	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2	2	4	137.2288227	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1			0	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9			0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	4	5	187.9390309	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0			0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0			0	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	1	3	4.5	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	2	3	21	4	3	42
						$\sum F_n$=	650.9151376		$\sum F_{nmax}$=	8598.484726

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

Priminary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 92.4299

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **77.848**

a= 0.04000
b= 0.00060
VCI_{max}= 100
VCI_{min}= 0

Section: 9. Crusher dust seal on otta seal crushed basalt
Lane: Both

Item #	Deffect Type	Weight (W_n)	Small degree (S_n)	Extent Weight (Y_n)	Degree Rating of Defect (D_n)	Extent Rating of Defect (E_n)	$F_n = D_n*(E_n\text{^}Yn)*W_n*S_n$	MaximumDegree Rating of Defect $(D_n)_{max}$	Maximum Extent Rating of Defect $(E_n)_{max}$	$F_{nmax} = D_{nmax}*(E_{nmax}\text{^}Yn)*W_n*S_n$
1	SURFACING FAILURES	6.5	1.0	1.2	3	5	269.047284	5	5	448.41214
2	SURFACING PATCHING	6.5	1.0	1.2			0	5	5	448.41214
3	SURFACING CRACKS	5	1.0	1.1	2	1	20	5	5	293.6547358
4	BINDER CONDITION (DRY / BRITTLE)	3	0.5	0.9			0	5	5	127.7009884
5	AGGREGATE LOSS	4	1.0	1.1	4	5	187.9390309	5	5	234.9237886
6	BLEEDING / FLUSHING	3	0.5	1.0			0	5	5	150
7	SURFACING DEFORMATION / SHOVING	15	1.0	1.3			0	5	5	1215.492448
8N	BOCK/STABILISATION CRACKS (NARROW SPACING)	8	1.0	1.2			0	5	5	551.8918646
8M	BLOCK/STABILISATION CRACKS (MEDIUM SPACING)	6	1.0	1.0			0	5	5	300
8L	BLOCK/STABILISATION CRACKS (LARGE SPACING)	5	1.0	1.0			0	5	5	250
9	TRANSVERSE CRACKS	4.5	1.0	1.0			0	5	5	225
10	LONGITUDINAL CRACKS	4.5	1.0	1.0			0	5	5	225
11	CROCODILE CRACKS	10	1.0	1.3			0	5	5	810.3282983
12	PUMPING	10	1.0	1.3			0	5	5	810.3282983
13	RUTTING	8	0.5	1.0			0	5	5	400
14	UNDULATIONS / SETTLEMENT	4	0.5	1.0			0	5	5	200
15	PATCHING	8	0.8	1.1			0	5	5	469.8475772
16	FAILURES / POTHOLES	15	1.0	1.3			0	5	5	1215.492448
17	ROUGHNESS	5.5	0.8	1.0	1	3	13.2	4	3	66
18	SKID RESISTANCE	3	0.5	1.0	3	3	27	4	3	36
19	SURFACE DRAINAGE	3	0.5	1.0	2	3	18	4	3	36
20	SHOULDERS (unpaved)	3.5	1.0	1.0	0	3	0	4	3	42
21	EDGE DEFECTS	3.5	0.8	1.0	1	3	8.4	4	3	42
						$\sum F_n$=	543.5863149		$\sum F_{nmax}$=	8598.484726

$C = 1/\sum_{n=0}^{n} F_{nmax}$= 0.000116299561

Primary VCI = $VCI_P = 100\{1 - C[\sum_{n=0}^{n} F_n]\}$= 93.6781

$VCI = (a * VCI_P + b * VCI_p^2)^2$ = **81.225**

a= 0.04000
b= 0.00060
VCI_{max}= 100
VCI_{min}= 0