रेल विकास निगम लिमिटेड
(भारत सरकार का उपक्रम)
Rail Vikas Nigam Limited
(A Government of India Enterprise)

REVISED ALIGNMENT REPORT

ON DOUBILNG OF B.G. LINE BETWEEN CASTLE ROCK TO KULEM OF TINAIGHAT-VASCO-DA-GAMA DOUBLING PROJECT ON SOUTH WESTERN RAILWAY IN UTTARA KANNADA DISTRICT IN THE STATE OF KARNATAKA AND SOUTH GOA DISTRICT IN THE STATE OF GOA (INDIA).

NOVEMBER 2018

AECOM

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1. INTRODUTION

Ministry of Railways have entrusted the doubling of Tinaight-Vasco-da-Gama section to RVNL. Castle Rock-Kulem section falls in Western Ghats and the existing single line is on a gradient of 1 in 37 which is one of the steepest gradients on B.G. in Indian Railway. It was earlier envisaged to construct the new proposed line at a gradient of 1 in 60. Accordingly, report with a ruling gradient of 1 in 60 was prepared and submitted to RVNL. The alignment through new corridor in the Western Ghats was not agreed by Railways and it was decided to alter the ruling gradient to 1 in 37(C) and construct doubling line parallel to the existing Railway line.

2. GENERAL

Considering the environmental concerns, an attempt has been made to keep the alignment as close to the existing alignment as possible. In view of the fact that there are as many as 16 tunnels in the existing alignment, it has not been possible to design the alignment parallel and close to the existing alignment as detours were required at all these tunnel locations for maintaining a minimum mandatory distance between the existing & the proposed tunnels. Further at the location of deep cuttings with rocky formation, the alignment is taken on a detour to provide tunnels at such locations. This has increased the tunnel length but has a number of following advantages:

1) Easy to execute without disturbance to train operation on existing line due to blasting and safety is taken care of.

2) It reduces the disturbance to the forest and continuity of the forest and habitat is maintained.

3) Tunnel does not cause any disturbance at Ground level and tree cutting is not required at locations of Tunnels.

4) Muck generation is reduced in Tunnels as compared to open cuts.

To avoid deep cuttings more numbers of tunnels have been provided in the proposed alignment and therefore the numbers of tunnels have increased from 16 tunnels in the existing alignment to 23 tunnels in the proposed alignment. The total length of the proposed tunnels is 7.32Km as compared to 2.6Km tunnels in the existing railway line. The Tunnel length forms 26.4% of the total length of the proposed alignment.

There are 114 waterways in the existing track which includes 7 major bridges and 107 minor bridges. In the proposed alignment, however, there are 81 Waterways which includes 7 Major bridges and 74 Minor bridges as alignment has shifted towards hill side and tunnel lengths have increased eliminating many waterways.

The maximum curvature in the existing track is 8.3 degrees. In the proposed track, it has been ensured that proposed curve is not sharper than 7.6 degrees. There are 48 curves in the proposed alignment. A list of curves is attached as **ANNEXURE – I.**

The ruling gradient in the existing track is mentioned as 1 in 37, however, after detailed survey it has been found that the actual gradient on some locations is steeper than the ruling gradient. In the proposed alignment however, the ruling gradient has been kept as 1 in 37(C). A list of gradients adopted in the proposed alignment is attached as **ANNEXURE – II.**

The minimum distance between CL of existing track and CL of proposed alignment has been kept as 6.0m, however, the track centre increases near the location of tunnels and major bridges.

3. DESCRIPTION OF PROPOSED ALIGNMENT

1. The Alignment commences at level crossing at Km 23.650 on the Hubli end of Castle Rock Yard (The chainage of starting point is taken same as chainage of existing railway track) and runs by the side of the existing track up to Km 27.050. There is deep valley on the right side and topography does not permit to keep the alignment on the right side because this will require very high retaining walls and excessive height of embankment. Keeping this in view, the proposed alignment has been kept towards the left of existing track (*when we face towards Kulem standing at Castle Rock*) in the entire stretch.

2. **Tunnel No.1**: The alignment after Km 27.050 takes a detour because of tunnel in the existing alignment from Km 27.180 to 27.270. There is a major bridge no. 69 in the existing track before tunnel in this section. In the proposed alignment however, due to detour, the alignment shifts towards hill side and hence, a siphon type bridge of same span arrangement as in existing bridge has been proposed at this location. The proposed Tunnel starts from Km. 27. 150 and ends at Km 27.335, after which alignment becomes parallel again to existing track. The centre line of the alignment has been kept at minimum 19.3m from the centre line of the existing track in tunnel portion which is greater than 2D, where D is the diameter of the existing tunnel. This distance has been considered safe for a parallel tunnel as per preliminary geological studies.

   The height of cut of this tunnel at start portal is 20m and at end portal is 16m.

3. The proposed alignment runs parallel to existing track from Km 27.550 to Km 28.050. There is no major Bridge in this stretch and the alignment has been proposed at a varying track centre distance of 7 m to 10 m c/c from the existing track. From Km 28.050 it is taking detour so as to meet starting point of tunnel no. 2 at Km 28.160, which is at track centre of 19m. The alignment is kept in the left again because of topographical constraints. Although there is a small portion on right side where flat ground is available and alignment could be shifted towards right to avoid cutting in hillside, but that could not be considered due to curvatures and tunnel ahead where

we have to keep the alignment towards the left of the existing track and shifting of alignment from left to right at closer intervals is not possible.

4. **Tunnel No.2**: Tunnel Starts at Km 28.160 and ends at Km 28.750. There is a tunnel in the existing alignment in this stretch. The centre line of the alignment has been kept between 19 m to 26 m from the centre line of the existing track in tunnel portion.

5. The alignment will remain at 26m (apprx) track centre between Km 28.750 and Km 28.900, where tunnel no. 3 is starting.

6. **Tunnel No.3**: There is an existing tunnel of approximate 175m long in the existing track and therefore Tunnel No. 3 between Km 28.900 and Km 29.100 has been proposed in the alignment keeping track centre of 24m, which is min. 3D distance between existing and proposed tunnel where D is the diameter of the existing tunnel. This distance has been considered safe for a parallel tunnel as per preliminary geological studies.

7. **Tunnel No. 4**: The alignment remains at 24m away from existing track as a Tunnel again starts from Km 29.275 and ends at Km 29.550. Tunnel no. 4 has been proposed in the alignment as the height of cutting is varying between 14 m to 46 m in the proposed alignment.

8. The alignment between Km 29.275 to Km 29.830 is in deep cutting and a single tunnel can be provided but there is Major Bridge no. 79 at Km 29.630, and due to this bridge, a gap of 130m has been provided between tunnel no. 4 and tunnel no. 5.

9. **Tunnel No. 5**: As mentioned in preceding para, after a gap of 130 m from the second portal of tunnel no. 4, the tunnel no. 5 have been started from Km 29.680 which ends at Km 29.830.

   There is no existing tunnel at this location but due to greater height of cutting this tunnel no. 4 & 5 have been proposed.

10. **Tunnel No. 6**: After a gap of 95 m from second portal of tunnel no. 5, Tunnel no. 6 has been started. The Tunnel no. 6 has been proposed between Km 29.925 to Km 30.135 at varying track centre between 24m to 34m. The height of cutting in this tunnel is varying between 19m to 32m. There is an existing fully lined tunnel of 131m in length at this location.

11. **Tunnel No. 7**: From Km 30.200 to Km 30.570, Tunnel no. 7 has been proposed as the height of the cutting in this stretch varies between 16m to 50m. The track centre at start portal is 23.1m and at end portal is 26m. There is no tunnel in the existing track at this location.

12. After the tunnel no. 7, alignment comes closer to the existing line to make feasible the connections between proposed main line and existing loop line in the Caranzole yard. However height of cutting varying from 14m to 25m near the approach of the yard but the tunnel is not provided at this location due to the Caranzole yard.

13. **Caranzole Yard**: Caranzole yard starts from Km 31.300 from where 1.037 Km long Catch siding takes off and it ends at start portal of Tunnel no. 08 at Km 32.580. The existing Caranzole yard has one main line and one loop line. In the proposal only main line has been proposed in the Caranzole yard in DN direction. After providing the connections between proposed main line & existing loop line, Existing loop line will be a common loop line for UP & DN main line.

14. **Tunnel No. 08:** Tunnel no. 08 has been proposed between Km 32.580 to Km 32.850. There is no tunnel in the existing alignment at this location but due to the height of cut (varying between aproximate14m to 40m) tunnel has been proposed. The track centre at start portal of tunnel is 17m and 33m at end portal.

15. After the Tunnel no. 08, alignment runs along the existing alignment with varying track centre. There are 3 minor bridges (bridge no. 93, 94 &95) between Km 32.850 to 33.450. The track centres at bridge no. 93, 94 & 95 are 22.6m, 33.4m & 38.1m respectively.

16. **Tunnel No. 09:** Tunnel no. 09 started from Km 33.450 and ends at Km 33.600. The height of cut is varying between 10m to 21m in this tunnel. The track centre at start portal is 35m and at end portal is 22.5.m.

    After this tunnel, a major bridge no. 98 has come across in the alignment at Km 33.650. The existing span arrangement is 7x7.77m arch type in which 4 spans are already closed out of 7 spans and the proposed span arrangement is 1x30.5m with composite girder type superstructure.

    Considering the construction point of view single span of composite girder has been proposed instead of multiple spans. 25.1 m track centre has been kept at this bridge as the Tunnel no. 10 starts from Km 33.705.

17. **Tunnel No. 10:** It starts from Km 33.705 and ends at Km 34.425. This is the second longest tunnel in the section. The track centre at start portal is 36m and 25m at end portal of the tunnel. There are two existing tunnels of 160m and 225m long in this stretch. There are three minor bridges (bridge no 99, 100 & 101) in the existing alignment but due to varying height of cutting between 24m to 118m tunnel no. 10 has been proposed and minor bridges in the proposed alignment are not required.

18. **Major Bridge no. 102** at Km 34.510**:** The existing span arrangement of major bridge 102 is 2x27.4m (Plate girder) and proposed span arrangement is 2x30.5m (composite girder). 17.1m track centre has been kept at this bridge.

19. **Tunnel No. 11:** There is an existing tunnel no. 7 of 52.7m long in the existing alignment hence the Tunnel no. 11 has been proposed from Km 34.560 to Km 34.700. The track centre at start portal is 21m and 24.6m at end portal. The height of cutting is varying between 21m to 25m.

    Major bridge no. 103 at Km 34.825, the existing span arrangement is 3x7.77m (arch) and proposed span arrangement is 1x30.5m (composite girder). The track centre at this bridge is 12.4m.

20. **Tunnel No. 12:** Tunnel no. 12 (170m long) starts from Km 34.980 to and end at Km 35.150. There is an existing minor bridge no. 104 at existing Km 35.070 but due to provision of tunnel no.12, bridge is not required in the proposed alignment. The track centre at this tunnel is 25m and height of cutting is varying between 16.5m to 25m.

    After the tunnel no. 12, a detour has been proposed in the alignment from Km 35.200 to Km 36.100. This detour has been proposed to avoid three sharp curves in the alignment. The track centre in this stretch gradually increases from 25m to 200m and then decreases gradually to 25m.

21. **Tunnel No. 13:** The Tunnel no. 13 (300m long) has been proposed from Km 35.400 to Km 35.700. There is an existing tunnel in the existing alignment of 287m long. The track centre at start portal is 141m and 181m at end portal of this tunnel. The height of cutting is varying between 18m to 80m.

22. Between Km 35.700 to Km 36100, the proposed alignment comes closer to the existing alignment and track centre varies from 181m to 9.6m and then alignment run parallel to the existing alignment up to Km 36.400.

23. **Tunnel No. 14 :** Tunnel no. 14 is proposed between Km 36.500 to Km 36.685. There is no existing tunnel at this location but as the alignment towards hill side and height of cut is more than 18m so this tunnel has been proposed. The track centre is 24m at start portal as well as at end portal of this tunnel.

24. **Tunnel no. 15:** After a small gap of 15m, Tunnel no. 15 starts at Km 36.700 and it ends at Km 37.400. There are two small tunnels of approx. 83m & 106m long in the existing alignment but the proposed tunnel no. 15 is 700m long as the cutting height is more than 30m in this stretch. The track centre at start portal is 24m and 25.5m at end portal of this tunnel.

25. **Dudhsagar Yard:** Existing Dudhsagar yard is between Km 37.300 to Km 38.500. In this yard the proposed doubling line passes through Tunnel no. 16. This was necessary as very deep cutting is involved at this location which may cause heavy disturbance to the running lines during execution of such a deep cutting in the yard portion. Due to provision of the tunnels in this stretch, it is not possible to provide a loop line for down direction at this yard and the proposed doubling line which is the down line will be a run-through line for this yard. However, in the existing Dudhsagar yard the up line and up loop facility is available.

    Tunnel no. 16: This is the longest tunnel (1150m) of this section. This starts from Km 37.650 and end at Km 38.800. The track centre at start portal is 24.2m and 25.5m at end portal. The height of cutting is varying between 14m to 27m.

26. **Tunnel No. 17:** Tunnel no. 17 starts from Km 38.900 and ends at Km 39.010. The track centre at start portal is 24.2m and 20m at end portal. There is no tunnel in the existing alignment at this location but due to approx. 15m. cutting in the alignment the tunnel is proposed.

    Major Bridge 128: This bridge (Dudhsagar Fall) falls between tunnel no. 17 & tunnel no. 18 at Km 39.075 and the track centre at this bridge is required to be kept 19m as the bridge can't be constructed too far from the existing bridge as the water of the fall will come on the proposed track. Due to this constraint 20m track centre is kept at end of tunnel no. 17 and start of tunnel no. 18.

27. **Tunnel No. 18:** Tunnel no. 18 starts from Km 39.195 and ends at Km 39.620. The track centre at start portal is 20m and 37m at end portal. The height of cutting is varying between 19m to 32.5m in this tunnel.

    Major bridge no. 132: Just before the start of tunnel no. 18, there is a major bridge 1x18.29m (Arch) at Km 39.785 and proposed bridge is composite girder of 18.3m. The track centre at this bridge is 24.5m.

28. **Tunnel No. 19:** This Tunnel starts from Km 39.800 and ends at Km 40.000. Track distance between existing and proposed track is 24m at start portal and 31.2m at end portal. Height of cutting is varying between 15m to 25m.

29. **Tunnel No. 20:** After a gap of 50m from tunnel no. 19, Tunnel no. 20 starts. This gap between tunnel no. 19 & tunnel no. 20 is due to decrease in the height of cutting and presence of a small ditch in this location. 300m long tunnel no. 20 starts from Km. 40.050 and ends at Km. 40.350. The track centre at start portal is 36.4m and 24m at end portal of this tunnel. Height of cutting is varying between 15m to 23m in this tunnel.

30. **Tunnel No. 21**: After the Tunnel no. 20, the alignment is along the existing track and track centre varies between 40m to 24m. The proposed tunnel no. 21 (130m long) starts from Km. 40.600 and end at Km. 40.730. There is a tunnel in existing alignment in this stretch of total 127.5 m length. Track Centre at start portal is 28m and 25m at end portal.

    After exiting from tunnel no. 21, the proposed alignment comes closer to the existing alignment and track centre is reduced up to 6.5m at Km 40.900. From Km 40.900 the alignment moves away from the existing track and track centre increases gradually up to 32m at Km 41.250.

31. **Tunnel No. 22**: It starts from Km 41.250 to Km 41.400. There is an existing tunnel no. 15 of 51m in length in the existing alignment at this location. The track centre at start portal is 32m and 25m at end portal of this tunnel. The height of cutting is varying between 14m to 21m.

    From Km 41.400 to Km 41.625 alignment comes closer to existing track and track centre gradually decreases up to 8m at Km 41.625 and then alignment runs parallel to the existing track with varying track centre between 7m to 9m.

32. **Sonalium Yard**: Existing Sonalium yards is between Km 42.300 to Km 43.400 and Proposed yard starts from the start of 1.25 Km long catch siding which takes off from Km 42.330. Main line and one loop line is proposed in this yard after modifications the existing main line & existing loop line will be UP main line & UP loop line and proposed lines will be DN main & DN loop line. An animal Underpass of 1x12x5.65m has also been proposed in this yard at Km 42.800.

33. **Tunnel No. 23**: After the Sonalium yard, the Tunnel no. 23 starts from Km 43.560 and ends at Km 43.800. There is an existing tunnel no 16 of 150m in length in the existing alignment. The track centre at start portal is 27.8m and 36m at end portal. Cutting height is varying between 15m to 33m in this tunnel.

32. After coming out of the tunnel no. 23 at Km 43.800 the proposed alignment comes closer to the existing track and track centre gradually decreases to 6.3m at Km 44.100. Thereafter alignment runs parallel to existing track up to Kulem yard for a length of approximate 6 Km. The terrain is easy in this portion and alignment runs partly in cutting and partly in embankment. Before reaching to the Kulem yard an Animal Underpass has been proposed at Km 44.565 for both the tracks. The size of this animal underpass is 1x12x5.65m. This is to facilitate animals to cross the railway lines and animal fatalities can be avoided.

4. DETAILS OF CURVES IN PROPOSED ALIGNMENT

The maximum curvature in the existing track is 8.3 degrees. The maximum curvature in the proposed alignment has been kept as 7.6 degrees. There are 48 curves in the proposed alignment. The length of alignment in curvature is 18.04 Km which is 65% of total length. A list of curves is attached as **ANNEXURE -I.**

5. DETAILS OF GRADIENTS IN PROPOSED ALIGNMENT

The designed ruling gradient in existing track is 1 in 37(C), however after doing levelling to take the RLs of existing track at closer interval, it was found that existing gradient is steeper than the ruling gradient at many locations. Also, the gradient changes at frequent intervals in the existing alignment. In the proposed alignment, it has been ensured that maximum gradient is not steeper than 1 in 37. Frequent changes in the gradients, as far as possible, have been avoided. A tabular representation of proposed gradients is attached as **ANNEXURE – II**.

6. DETAILS OF TUNNELS IN THE PROPOSED ALIGNMENT

There are 16 tunnels in the existing track. While designing the proposed alignment efforts have been made to keep it as close to existing track as possible so that minimum infringement is done in the forest area adjoining the existing track. However, in the portions where there are tunnels in the existing alignment, the CL of the proposed alignment has been at a minimum distance of 3D in general from the CL of existing track, where D is the diameter of the tunnel. This has been ensured by taking detours prior to entry portal and ending it after exit portal by introduction of reverse curves. Since the proposed alignment is going deep towards the hill side, the new tunnels are longer in length. Total length of the tunnels in the proposed alignment will be 7.32Km as compared to 2.6Km in the existing track. A list of proposed tunnels along with their tentative lengths is attached as **ANNEXURE – III.** Other details of tunnels such as formation level at portal location and maximum overburden etc. are attached as **ANNEXURE – IV.**

7. DETAILS OF BRIDGES IN THE PROPOSED ALIGNMENT

There are 114 Bridges/ Culverts in the existing track. Out of these, there are 7 major bridges and 107 minor bridges. In the proposed alignment however, 7 major Bridges and 74 minor bridges are proposed. Sufficient track centres has been kept at these locations so that new bridges can be constructed without interfering with existing bridges. There are total 81 bridges in the proposed alignment and the list of the proposed bridges is attached as **ANNEXURE – V.**

In addition to these bridges, 4 animal underpasses have also been proposed for both the tracks to facilitate the animals for crossing the tracks. List of the proposed animal underpasses is attached as **ANNEXURE – VI.**

8. EARTHWORK QUANTITIES

Earthwork quantities generated in cutting and required in embankments have been calculated. The balancing of quantities has also been done by muck generated in cutting being utilised in embankments. The quantity of muck generated in cutting in Formation is 13,96,128 cubic meters approx. The quantity of muck generated in cutting in tunnels is 3,63,416 cubic meter approx. The quantity required for embankments will be 9,49,365 cubic meters approx. The railway cut spoil will be used for the construction of embankment and the unused quantity of muck will be disposed- off.

Keeping in view the nature of the rock, it is expected that entire quantity of muck generated from Cuttings and Tunnels shall be used for Ballast, Coarse Aggregate and Fine Aggregate. It will also be utilised as a blending material for blanketing. The muck generated from the cuttings and the Tunnels will also find its use for gabions. Out of the balance quantity which does not find its use for the project between Castle Rock and Kulem would be disposed-off in the dumping yards. The details of earthwork quantities generated kilometre-wise are attached as **Annexure – VII.** The balancing and disposal of the muck has been shown in **Annexure – VIII.**

9. DETAILS OF EXTRA LAND TO BE ACQUIRED

The vacant land of Railways available alongside the existing Railway Track between Castle rock to Kulem is 16.012 Hectare in Karnataka & 70.795 Hectare in Goa state. (Total Railway Land is available 86.80 Hectare). The available railway land is demarcated by Pillars and it has been measured and marked on the drawing. For doubling of the Railway Line, extra land will be required on left side facing Kulem. Proposed railway land boundary detail is attached **Annexure – VIII.**

It is noteworthy that though the total land to be acquired for the Project in the state of Goa is 50.65 Hectare, out of which 9.40 Hectare is required for the Tunnel area where no physical disturbance of the Fauna or Flora will take place during the construction and operation of the proposed doubling in the tunnel area.

Similarly the total land to be acquired for the Project, in the state of Karnataka is 8.20 Hectare, out of which 2.2 Hectare is required for the Tunnel area where no physical disturbance of the Fauna or Flora will take place during the construction and operation.

SUMMARY OF LAND REQUIREMENT

1. Railway land already available ⟶ 16.012 + 70.795 = **86.80 Ha**
   (In Karnataka) + (In Goa)

2. Proposed land required for doubling ⟶ 8.20 + 50.65 = **58.85 Ha**
   (In Karnataka) + (In Goa)

TABULATION SHOWS FOREST LAND DETAILS

Sr. No.	Description	Area in Hectares	Disturbance to vegetation	No disturbance to vegetation (Tunnels)
1	Karnataka state	8.20	6.0	2.2
2	Goa state	50.65	41.25	9.40
Total		**58.85**	**47.25**	**11.6**

10. GEOLOGY

10.1 Regional Geology

Castle Rock – Kulem is the part of Western Ghats ranges. The topography is very distinctive and is represented by steep hill ranges with steep and narrow river valleys. The general elevation varies between around 90 m to 729 m. As per the regional geology of the area Goa and Karnataka are a part of the Indian Peninsular shield and represent the western Dharwar Craton. Major part of these States is covered by Achaean-Proterozoic rocks except for a narrow coastal zone of Tertiary and Quaternary sediments and Deccan basalts occurring towards north.

The entire proposed tunnel alignment lies in the Joldal, Barcem and Sanvardem Formations of Dharwar supergroup which is overlain by the peninsular gneissic complex. Rock types exposed along entire tunnel are gneisses, migmatites, granitoids, granites, schists, meta-vocanics, meta greywackes, banded ferruginous quartzites with associated manganiferous phyllite/argillite, limestone and thin bands of quartzite intruded by granites and mafic & ultramafic intrusive. A narrow strip in the north-eastern corner of the State is covered by Deccan traps. All the rock types of Goa have undergone laterisation to some extent. Generally iron-manganese phyllites show the laterite profile of about 100m depth while on ultramafic rock it is up to 10m and about 5m on Deccan Trap. Quaternary deposits are represented by beach sands and alluvium.

Eon/Era/ Epoch	Super Group	Group	Formation	Lithology
		Dudhsagar Granite		Porphyritic granite
		Mafic-Ultramafic Complex	Peridotite-Gabbro	Dunite,-peridotite, gabbro complex, Dolerite
ARCHEAN	DHARWAR	CHITRADURGA (Goa Group)	SANDVARDEM	Quartzite
				Phyllite
				Argillite(shale/Mudstone)
			BARCEM	Quartz-chlorite schist
				Quartzite
			JOLDAL	Banded Iron Formation
				Ferruginous phyllite
				Manganiferous phyllite
				Limestone
				Quartzite

Table-1: Showing the Litho-staratigrahy of the Project area.

10.2 Geology along the Tunnel Alignment

Proposed railway Alignments a part of Shimoga- Chitradurga schist belt. The main units exposed in the area are metasedimentary and mafic-ultramafic rocks with beds of ferruginous and manganiferous schist bands other rock types exposed in the vicinity are gabbro and dolerite occurring as sills and dykes. Various rocks exposed in the area along 200m corridor zone (100 m on either side) of the proposed rail alignment, belong to Joldal, Barcem and Sanvardem Formations.

10.2.1 Joldal Formation:

The Joldal Formation mainly consists of quartz-chlorite-biotite/amphibole schist, ferruginous phyllites and manganiferous phyllite Other associated lithologies are thin lenses of carbonaceous and manganiferous chert, quartzite, quartz-sericite schist and magnesian limestone. The limestone, inter- bedded with chert, is relatively high in MgO content.

Ferruginous Phyllite: These schistose rocks are exposed at five different locations along the proposed alignment at chainage from 23650 m to 24618 m, 25440 m to 26137 m, 26325 m to 27867 m, 28068 m to 28250 m and 39940 to 40090m. Major outcrop is located around Castle Rock. They are generally under thick cover of laterite and soil. The ferruginous phyllites with quartzite are mostly associated with fine chlorite schist bands. They form sharp crested ridges due to their hardness and resistance to weathering.

The Ferruginous phyllites are variegated in colour, fresh broken surface is light to deep grey in colour, but weathered and altered surface show reddish brown colour. They are fine grained with well-developed foliation. At places original bedding is seen preserved. They are composed of quartz, plagioclase feldspar in a matrix of sericite, chlorite and quartz. Thin quartzite bands occur as intercalations within ferruginous phyllites. The phyllites and quartzites are essentially composed of quartz and iron ores alternating with ferruginous clays. The phyllites vary in composition from chlorite phyllite, sericite phyllite to chlorite-calcphyllite

Manganese Phyllite: In Castle Rock area Manganiferous phyllite is found at two locations along the proposed alignment at chainage from 24618 m to 25440 m and 27867 m to 28068 m. The Manganiferous phyllites occur as thin linear bodies well within the Ferruginous phyllites. They are exposed on the hill slopes north of Sanvardem village for strike length of 1.25km Most of the Manganiferous phyllites are laterised.

Limestone: The limestone is exposed at chainage between 28250 m and 28564m along proposed rail alignment. They extend over a strike length of about 20 km closely following the structural pattern of the Precambrian rocks. The limestone is massive and crystalline in nature. It carries numerous bands, lenses, veinlets of intercalated chert, quartzite, ferruginous phyllite, micaceous grit. They consist of calcite and dolomite with some tremolite. In composition it is mostly a magnesium rich crystalline limestone.

Quartzite: This quartzite is exposed at chainage from 28564 m to 28800m along the proposed rail alignment.

10.2.2. Barcem Formation:

The Barcem Formation consists of quartz-chlorite schist with thin quartzite and slate intercalations

Quartz-chlorite schist: Quartz-chlorite schists/quartz-sericite schist are exposed at four location at chainage from 28800 m to 30465 m, 34815 m to 35480 m, 35680 m to 36720 m and 40090 m to 40650 m along the proposed rail alignment.

These schists mainly consist of quartz, chlorite and feldspar, and contain traces of highly altered hornblende and augite and iron ore. These schists are exposed along a large tract and display alternate hard and soft bands. The hard massive chlorite schist is usually of pale sea- green to greenish grey in colour and vary from coarse to fine grained; the softer bands are grey in colour. This variation causes differential weathering of bands which has given rise to numerous waterfalls and caves. The schistosity of the hard massive beds produces a marked fissility in them. They consist of yellowish green hornblende and granular quartz with subordinate plagioclase feldspar and mica.

10.2.3. Sanvardem Formation:

The Sanvardem Formation conformably overlies the Barcem Formation. The rocks of this formation are quartz chlorite argillite/phyllite/schist with polymictic conglomerate/breccia, bands of manganiferous chert, metagreywacks and bands of quartzite. The conglomerate/breccia contains rounded to angular clasts of quartzite, gneissic granite, granodiorite and mica schist.

Phyllites: These are exposed at two places at chainage from 30465 m to 30777 m and 43895 m to 44900 m along the proposed rail alignment. The phyllites occupy a major part of the area and are generally under thick cover of lateritic soil. The rocks are green to greenish in colour when fresh and become brownish on weathering. They are very fine grained, friable and highly schistose though bedding can be recognized from presence of colour banding. They consist of greenish chlorite and varying amount of quartz. They contain bands of intraformational polymictic conglomerate and breccia with rounded, sub-rounded to sub-angular clasts of quartzite, granites and granodiorite embedded in a chloritic matrix, In an exposure near Sanvardem the clasts are essentially of quartzite. At places the rock is sheared and mylonitised. The shear zones are traversed by anatomizing veins of quartz and calcite

Argillite/ mudstone/shale: These argillites are exposed at four locations at chainage from 40650 m to 42595 m, 43535 m to 43895 m, 44900 to 46100 m and 49380 m to 51346 m

along the proposed rail alignment. The argillites are fine grained rocks mostly composed of calcareous silt and are chloritised. The argillites are light green to deep grey in colour and consist of quartz in a sericite-chlorite matrix with opaques. They are massive to fissile and show lamination and ill preserved bedding. Many of these argillites are leached phyllite or lithomarges, some of which are nearly pure kaolin.

Quartzite : These quartzite are exposed at four locations along the proposed rail alignment at chainage from 30777 m to 33800 m, 35420 m to 35680 m, 45971 m to 46483 m and 48850 m to 49380 m. The quartzite is hard, massive and white in colour mainly composed of quartz, however at places felspathic and micaceous bands are also present. Due to resistant to weathering and erosion they form prominent ridges. Some of the micaceous quartzite exhibit traces of banding due the presence of iron content and also show ripple marks and current bedding.

10.2.4. INTRUSIVES

A number of younger acid and basic bodies have intruded the above formations. Basic and ultrabasic bodies are represented by gabbro/dolerite dykes trending NW-SE, NE- SW, while the acid intrusive are granites occurring as massive plutons & plugs.

Dolerite dyke: In the present area a thin dolerite dyke is exposed along proposed alignment at chainage from 26137 m to 26325m.It is cutting across the prevailing strike of the country rocks and trend N-S. The rocks are green to grey in colour fine to medium (and occasionally coarse grained) grained with plagioclase feldspar laths and pyroxenes interlocked in ophitic fashion. They are generally hard, massive and compact. They are highly jointed due to which they form bouldary outcrops on spheroidal weathering.

Dudhsagar Granite: The rocks of Chitradurga Group (Goa Group) are intruded by the potash rich younger granites (Dudhsagar Granite) which occur as plutons, plugs and apophyses. Two granites bodies are exposed at three locations along the proposed rail alignment between chain-age from 33800 m to 34815 m, 36448m to 39970 m and 46483m to 48850 m. They occur as plutons and plugs/ stock and have an intrusive relation with surrounding schistose rocks of Goa Group and cut across the planer surfaces. They form high hills on either side of Dudhsagar River. Dudhsagar Granite is equivalent to (≈) Chandranath Granite and Canacona Granite).

These granites are medium to coarse grained, inequigranular and vary from greyish white in colour. They are mostly non-foliated, dense and massive though at places weak foliation has developed due to shearing. They consist of quartz, K- feldspar, plagioclase, hornblende, biotite, chlorite and minor muscovite. They are porphyritic in texture with plagioclase and K-feldspar forming the megacryst varying from 1 mm to 13 mm in size. The feldspar occurring as laths are subhedral in shape and at places show preferred orientation along the foliation. The groundmass consists of smaller grains of quartz feldspar, biotite and hornblende.

Widely spaced joints gave rise to bouldary outcrops. At place they have formed cliff faces. Good sections are exposed from south of Caranzol Railway Station to north of Dudhsagar Railway Station.

Summarized details of the Geology along the Proposed Tunnel Alignment provided in the Table below:

Tunnel No.	Chainage	Length (m)	Rock types	Formation	Geological Remarks
1	27150-27335	185	Ferruginous phyllite	Joldal	Moderately Jointed Phyllite, Fractured zone under saturation expected near Portal 2
2	28160-28750	590	Limestone/ Quar-tzite	Joldal/ Bercem	Moderately Jointed/ fractured Quartzite with limestone at northern end
3	28900-29100	200	Limestone/ Quar-tzite	Joldal/ Bercem	Moderately Jointed/ fractured Quartzite with limestone at northern end
4	29275-29550	275	Quartz-chlorite schist	Bercem	Moderately Strong Quartz chlorite Schist, foliated in nature. Saturated zone expected near the portals
5	29680-29830	150	Quartz-chlorite schist	Bercem	Moderately Strong Quartz chlorite Schist, foliated in nature. Saturated zone expected near the portals
6	29925-30135	210	Quartz-chlorite schist	Bercem	Moderately Strong Quartz chlorite Schist, foliated in nature. Saturated zone of 15-20m width expected in mid of the tunnel
7	30200-30570	370	Quartz-chlorite schist	Bercem	Moderately Strong Quartz chlorite Schist, foliated in nature. Saturated zone expected near the portals
8	32550-32850	300	Quartz-chlorite schist	Bercem	Moderately Strong Quartz chlorite Schist, jointed in nature. Water ingress possible near portal 2
9	33450-33600	150	Quartz-chlorite schist	Bercem	Moderately Strong Quartz chlorite Schist, foliated in nature. Saturated zone expected near the portals
10	33705-34425	720	Quartz-chlorite schist/ Granite	Bercem/ Dodhsagar Granite	Moderately Strong Quartz chlorite Schist and compact granite with two joint set, Very steep slopes atP1&P2; jointed.
11	34560-	140	Granite	Dodhsagar	granite with two joint set

Tunnel No.	Chainage	Length (m)	Rock types	Formation	Geological Remarks
	34700			Granite	
12	34980-35150	170	Granite	Dodhsagar	Hard and Compact Granite
13	35400-35700	300	Granite	Dodhsagar	Hard and Compact Granite
14	36500-36685	185	Granite	Dodhsagar	Hard compact Granite
15	36700-37400	700	Granite	Dodhsagar	Hard compact Granite
16	37650-38800	1150	Granite	Dodhsagar	Hard compact Granite
17	38900-39010	110	Granite	Dodhsagar	Hard compact Granite
18	39195-39620	425	Quartz-chlorite schist/ Granite	Berem/ Dodhsagar Granite	Moderately Strong Quartz chlorite Schist and compact granite with two joint set,
19	39800-40000	200	Quartz-chlorite schist/ Granite	Berem/ Dodhsagar Granite	Moderately Strong Quartz chlorite Schist and compact granite with two joint set,
20	40050-40350	300	Quartz-chlorite schist	Bercem	Moderately Strong Quartz chlorite Schist, foliated in nature. Saturated zone expected near the portals
21	40600-40730	130	Quartz-chlorite schist/ Argillite/ shale	Bercem/ Sanvardem	Moderately Strong Quartz chlorite Schist, Moderately Strong Argillite/ Shale
22	41250-41400	150	Argillite/ shale	Sanvardem	Moderately Strong Argillite/ Shale
23	43560-43800	240	Argillite/ shale	Sanvardem	Moderately Strong Argillite/ Shale

10.3 Structure and Tectonics.

10.3.1 Structural setting

The area forms part of regionally folded and faulted Chitradurga (Shimoga) and Chitradurga (Goa) Group of Dharwar Supergroup of Archaean age. The regional configuration of the rocks is that of northwesterly plunging synclinorium (F1) in which a number of antiforms and synforms plunging both towards ESE and WNW have been superposed (F2). A third phase of folding (F3) has given rise to small scale, open warps with northerly plunge.

The rocks of the area are folded into NW plunging anticline and N-S trending syncline (Plate No. 2). Sanvardem in the western part occupies the synclinal core and is underlain in turn by Barcem and Joldal formations.Fold lineation's plunging NW and N are seen on the limbs of minor folds.

10.3.1 Foliation/Bedding

Bedding is noticed in the banded ferruginous quartzite and slates and the prominent trends are (l) NW-SE to NNE-SSE with low to moderate dips due NE and ENE; (2) WNW- ESE to E-W with low to moderate dips towards NNE and E. Foliation is well developed in all the metamorphites of the area, and the prominent regional trends are (l) NW-SE to NNW-SSE with moderate to steep dips towards NE- and ENE (2) N-S with steep dips towards east. (3) E-W to WNW-ESE with moderate to low dips due N and NNE.

10.3.2 Joints

These are the most prominent linear features and are well defined by straight drainage courses, vertical cuts, short straight drainage courses, sharp changes in Report on geological Mapping - Design of railway alignment from Castle Rock to Kulem (27.7 km) drainage lines. There is no indication of movement by way of shear along these lineaments. Absence of triangular facets and other fault line features negate their being faults. In addition there are small linear features which control Ist and IInd order drainage. Three prominent sets of joints in the area are:

1. Bedding joint NE and ENE

2. NE-SW with moderate dips due NW or SE directions.

3. E-W with vertical to steep dips on either direction.

10.3.3 Lineaments:

During the course of mapping in the area some satellite imagery were studied for getting the regional geological &structural set up of the area. Numbers of lineaments were traced during the study. Some of them may be master joints and fractures. They are marked by

straight courses of river channels/nalas, sudden change in nala courses and shifting of geomorphic features.

Two major trends of lineaments viz., NW-SE and NE-SW have been identified in the area (Plate No. 4). The NW-SE trend corresponds to the regional Dharwarian trend and can be traced over long distance and is classified as intermediate lineaments. The NE- SW trending lineaments are numerous in number are shorter in length are designated as minor lineaments. However a in the vicinity of the present area a 60km long NE-SW trending lineament has been traced. Other small lineaments have ENE-WSW, E-W trend.

10.3.4 Tectonics

The Western Ghats are not true mountains but rather faulted edge of an upraised plateau. These are mountains of denudation, the result of domal uplift, rather than deformation. The underlying rocks are ancient- around 2000 million year old, the oldest rocks in the high ranges of the southern Western Ghats. The Western Ghats represent tectonically active region with high rate of up lift, high summit altitudes, steep slopes, deep gorges and large potential for erosion and correspondingly high sedimentation yields. The Western Ghats of Goa and Karnataka which extend in a rough North-South to NNW-SSE direction represent a prominent fault zone. (A R Gokul,1981),

The Castle Rock- Kulem and adjoining area exposes steeply dipping gneisses and schists. Ghats in this section lose their abrupt and precipitous character. The average height falls down to less than 2000ft. Waterfalls are common at the head of rejuvenated rivers. Dudhsagar falls is an ideal example. Goa has been classified in seismic hazard zone II, with less probability of a major earthquake. The younger intrusive Dudhsagar Granite has been dated at 2565±96 Ma (Dhoundiyal et al, 1987) corresponds to Closepet Granite and Chitradurga Granite of Karnataka. Almost, all rock types of Goa have been lateritised to some extent. However, specifically in the area laterisation is not as strongly developed as in other parts. The Quaternary formations are represented by alluvium.

On regional scale a number of faults have affected the rocks of Goa Supergroup, however, none of these faults cuts across the proposed corridor of rail alignment although minor faults/slips and folds are present in the area which are of significant. These structural features may have some bearing locally during the construction stage. However they are not expected to pose any major problem to the alignment.

10.4 Seismicity

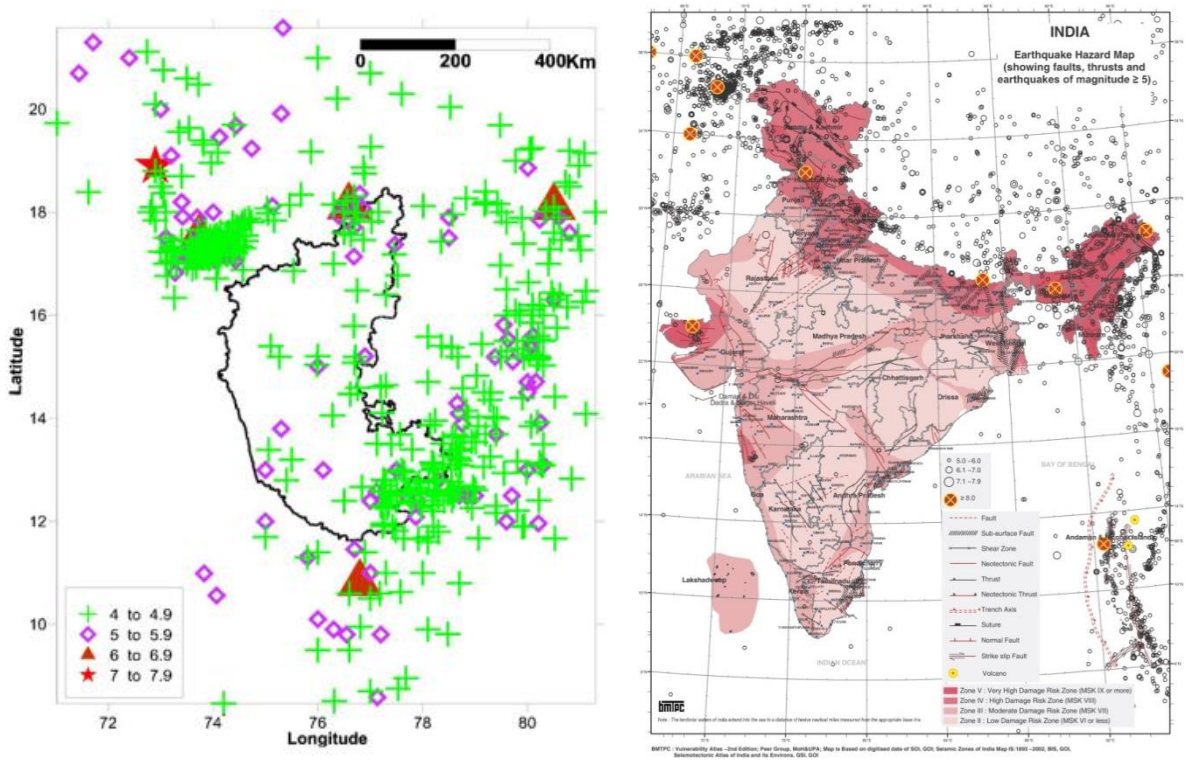
The study area falls in Zone II of the seismic Zonation map of India which indicates that the area has only moderate earthquake and not prone to high seismic events.

In recent years much of the seismic activity in the state of Karnataka has been in the south, in the Mysore-Bangalore region. Historically tremors have occurred in many other parts of

the state such as Bellary. Recent studies have identified several active faults in the region, in particular in the coastal plain near the towns of Bhatkal and Udipi, trending in an ESE-WNW direction. Many of the faults continue offshore into the Arabian Sea trending in the same direction. There is also no evidence of the southward continuation of the West Coast Fault in the Konkan regions of the neighbouring state of Maharashtra as previously believed. However, it must be stated that proximity to faults does not necessarily translate into a higher hazard as compared to areas located further away, as damage from earthquakes depends on numerous factors such as subsurface geology as well as adherence to the building codes.

According to the new seismic hazard map (BIS), the project area lies in Zones II. The coastal districts as well as the northern interior districts along the border with Maharashtra, lie in Zone II, where a maximum MSK intensity of VII can be expected.

The rocks, in general, are competent with granite being the most competent hard rocks and phyllites being the least competent and susceptible to weathering. Also the alignment is expected to encounter more or less same structures with earlier proposed alignments. It is also observed that the structural elements are at right angles to the generalized trend of the alignment, therefore not much criticality is expected.



Seismic hazard map of India with map of project area (showing red boxed)

11. SCOPE OF GEO-TECHNICAL INVESTIGATION REQUIRED FOR DETAILED DESIGN

Detailed Geo-technical investigations are required to be done at the tunnel portal locations, low cover reaches/weak zone sand at major bridges.

The investigation shall be comprehensive enough to determine the following parameters of rock mass as well as superficial material:

i. Engineering properties of soil/rock
ii. The location and extent of rock layer and other week features
iii. Soft pockets if any under the hard strata
iv. The geological features like type of rock, fault, fissures, porosity etc.
v. Ground Water Table/permeability characteristics
vi. Artesian condition, if any
vii. Depth of weak zones, its extent and its impact over a site
viii. Whether isolated boulder or intact rock information
ix. Extent and character of weathered zone
x. Joint frequency in the rock
xi. Any other information as per the instructions of Engineer-in-charge

General Scope of Work shall comprise of Boring NX size bore holes by Diamond Core Drilling machine, should be capable of providing a sufficient rotary motion and capable of drilling angular holes, where required by the prevailing geological site conditions.

The recovered core should be placed in the core box with the upper (surface) end of the core at the upper-left corner of the core box. The cores with proper markings should be placed into core boxes at appropriate spacing, with blocks. Soft or friable cores, or those which change materially upon drying, should be wrapped in plastic film or seal in wax, or both as required by the engineer. Spacer blocks or slugs properly marked should be used to indicate any noticeable gap in recovered cores which might indicate a change or void in the formation. The fractured, bedded and/or jointed pieces of the core should be reassembled in the sequential order of their recovery before keeping the same in the core box. Sub-surface structures, including the dip of strata, the occurrence of seams, fissures, cavities and broken areas are among the most important items to be detected and described. Continuous water pressure tests to be done at every 3m interval standard penetration test are to be carried out in soft strata at an interval of every 1.50 meter. The log of bore hole should be prepared as per IS 4464 : 1972, IS 4078 : 1980, IS 5313 : 1980. The geotechnical investigations should follow the following specifications:

- Drilling of Boreholes in all type of soils including conducting standard penetration test and collection of disturbed and undisturbed soil samples from boreholes as per the instructions of engineer-in-charge.

- Core Logging, core Indexing, Storage & Preservation of drill cores as per approved / agreed procedure, maintenance of drilling records as per approved / agreed procedure and maintenance of drilling records as per approved procedure and sampling etc. as relevant IS code.

- Core recovery shall obtained by contractor during drilling operations to carry out interpretation of geological conditions. 90 to 100% core recovery should be recovered. However, in circumstances where poor rock conditions are encountered during drilling operations other parameters like rate of penetration water losses shall be recorded judiciously and it should be brought to knowledge of Engineer-in-charge.

- In-situ Permeability Test in overburden and rock as per IS code 5529 Part-I and 5529 Part-II.

- Testing of soil and rock sample as specified.

- Preparation of bore logs, location plan, lithological sections of Boreholes, filed tests data sheets by using suitable software/programme on computer.

- Preparation of Geotechnical report including field and laboratory data, analysis of data in consultation with Engineer-in-charge.

- Analysis and other integrated laboratory studies as required.

- Any other activity, as and when required during work execution in consultation with Engineer-in-charge.

- All the above works shall be carried out as per relevant IS specifications and as per the instructions of Engineer-in-charge.

Depth of Exploration – (IS:1892-1979) The depth of exploration required depends on the type of proposed structure, its total weight, the size, shape and disposition of the loaded areas, soil profile, and the physical properties of the soil that constitute each individual stratum. Normally, it should be one and a half times the width of the footing below foundation level. For tunnels, it is recommended to explore at least 3m below the formation

level. In certain cases, it may be necessary to take at least one bore hole or cone test or both to twice the width of the foundation. If a number of loaded areas are in close proximity the effect of each is additive. In such cases, the whole of the area may be considered as loaded and exploration should be carried out up to one and a half times the lower dimension. In weak soils, the exploration should be continued to a depth at which the loads can be carried by the stratum in question without undesirable settlement and shear failure. In any case, the depth to which seasonal variations affect the soil should be regarded as the minimum depth for the exploration of sites.

11.1 LABORATORY TESTS TO BE CONDUCTED

Following tests are generally required to be conducted in laboratory on soil samples collected from site:

i. Tri axial Tests
ii. Consolidation Test
iii. Direct Shear test
iv. Sieve Analysis
v. Hydrometer analysis
vi. Atterberg limit
vii. Moisture content
viii. Bulk density
ix. Specific gravity

Certain laboratory tests are to be carried out for rock samples;

Mechanical properties determined by laboratory testing:

• Friction angle

• Cohesion c

• Compressibility

Mechanical properties determined by field testing:

• Shear strength

• Penetration N (Standard Penetration Test).

• Deformability E (Plate bearing, Dilatometer).

Ground water condition

Triaxial compressive strength

Tensile strength (Brazilian Test)

Shear strength of joints

Poisson's ratio

Petrographic Analysis

It is proposed that bore holes shall be planned one each at each abutment and piers for all Major Bridges and each tunnel portal should also be explored by one bore hole.

11.2 DRILLING PLAN FOR BRIDGES

It is proposed that bore holes will be dug at abutment locations for major bridges and undisturbed samples collected. The locations of the bore holes are shown in the following table:

DRILLING PLAN FOR MAJOR BRIDGES				
S. No.	**CHAINAGE OF BRIDGE C/L**	**BRIDGE No.**	**No. OF BORE HOLES**	**REMARKS**
1.	27130	69	2	On both ends of Bridge
2.	29630	79	5	On each abutment & pier of Bridge
3.	33650	98	2	On both ends of Bridge
4.	34510	102	3	On each abutment & pier of Bridge
5.	34825	103	2	On both ends of Bridge
6.	39075	128	2	On both ends of Bridge
7.	39785	132	2	On both ends of Bridge

12. COMPARISON OF PROPOSED ALIGNMENT AND EXISTING ALIGNMENT

ALIGNMENT / PARAMETER	EXISTING ALIGNMENT	PROPOSED ALIGNMENT
LENGTH	27.638 KM	27.700 KM
NUMBER OF TUNNELS	16	23
TOTAL LENGTH OF TUNNELS	2.6 KM	7.32 KM
LENGTH OF LONGEST TUNNEL	409 M	1150 M
NUMBER OF BRIDGES/CULVERTS	114	81
TOTAL BRIDGE LENGTH	0.513 KM	0.437 KM
MAXIMUM HEIGHT OF BRIDGE	30 M	34 M
SHARPEST DEGREE OF CURVATURE	8.3	7.6

ANNEXURES

ANNEXURE - I

LIST OF PROPOSED CURVES					
SR. NO.	CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS	DEGREE
1	45	25291.88	25914.21	237	7.4
2	46	26105.36	26524.41	251	7.0
3	47	26574.65	26715.44	247	7.1
4	48	26715.44	26844.81	230	7.6
5	49	27004.90	27502.69	255	6.9
6	50	27543.59	27947.66	237	7.4
7	51	28007.97	28418.70	350	5.0
8	52	28643.40	28896.29	250	7.0
9	53	28925.26	29254.37	270	6.5
10	54	29542.97	29844.71	550	3.2
11	55	29879.48	30534.89	363	4.8
12	56	31048.97	31303.40	230	7.6
13	57	31383.60	31679.46	230	7.6
14	58	31679.46	31995.48	245	7.1
15	59	31995.48	32335.78	295	5.9
16	60	32507.15	32928.01	400	4.4
17	61	33029.22	33569.79	230	7.6
18	62	33648.26	34094.77	250	7.0
19	63	34295.12	34536.66	350	5.0
20	64	34632.01	35175.38	252	6.9

LIST OF PROPOSED CURVES					
SR. NO.	CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS	DEGREE
21	65	35334.03	36118.50	550	3.2
22	66	36343.52	36707.61	380	4.6
23	67	36887.31	37279.73	230	7.6
24	68	37376.21	37805.91	248	7.1
25	69	37966.81	38131.03	500	3.5
26	70	38388.67	38835.17	240	7.3
27	71	38846.37	39364.50	294	6.0
28	72	39455.04	40046.68	298	5.9
29	73	40226.75	40385.03	500	3.5
30	74	40409.02	40720.78	230	7.6
31	75	40894.07	41566.95	240	7.3
32	76	41689.12	41833.38	230	7.6
33	77	41833.38	42340.87	250	7.0
34	78	42663.10	42903.71	230	7.6
35	79	42915.25	43298.85	230	7.6
36	80	43339.35	43883.39	255	6.9
37	81	43944.60	44148.87	350	5.0
38	82	44148.87	44510.72	300	5.8
39	83	44720.73	45077.17	580	3.0
40	84	45077.17	45287.76	590	3.0
41	85	45402.78	45641.51	600	2.9

LIST OF PROPOSED CURVES					
SR. NO.	**CURVE NO.**	**START CHAINAGE**	**END CHAINAGE**	**RADIUS**	**DEGREE**
42	86	45767.81	46215.85	610	2.9
43	87	46578.90	46842.88	360	4.9
44	88	47141.30	47364.97	430	4.1
45	89	47832.29	48392.68	490	3.6
46	90	48512.23	48683.31	450	3.9
47	91	48790.18	49148.47	500	3.5
48	92	49202.74	49628.02	350	5.0

ANNEXURE– II

LIST OF PROPOSED GRADIENTS			
SR. NO	CHAINAGE		GRADIENT
	FROM (M)	TO (M)	
1	23650	24325	1 in 230 (R)
2	24325	24550	1 in 450 (F)
3	24550	24900	1 in 560 (R)
4	24900	25500	1 in 45.5 (F)
5	25500	26200	1 in 44.5 (F)
6	26200	27100	1 in 42 (F)
7	27100	27525	1 in 41.2 (F)
8	27525	27975	1 in 41.6 (F)
9	27975	28575	1 in 40 (F)
10	28575	29275	1 in 58.5 (F)
11	29275	29525	1 in 37 (F)
12	29525	29900	1 in 39 (F)
13	29900	30550	1 in 39.8 (F)
14	30550	31325	1 in 37 (F)
15	31325	31825	1 in 41 (F)
16	31825	32375	1 in 40 (F)
17	32375	32925	1 in 44.6 (F)
18	32925	33625	1 in 37 (F)
19	33625	34175	1 in 41.3 (F)
20	34175	34775	1 in 50 (F)

LIST OF PROPOSED GRADIENTS			
SR. NO	CHAINAGE		GRADIENT
	FROM (M)	TO (M)	
21	34775	35780	1 in 42 (F)
22	35780	36125	1 in 48 (F)
23	36125	36825	1 in 40.0 (F)
24	36825	37300	1 in 41.7 (F)
25	37300	37825	1 in 41.5 (F)
26	37825	38325	1 in 39.1 (F)
27	38325	38750	1 in 98 (F)
28	38750	38975	1 in 41.5 (F)
29	38975	39750	1 in 41 (F)
30	39750	40075	1 in 45 (F)
31	40075	40192	1 in 37.5 (F)
32	40192	41075	1 in 41.7 (F)
33	41075	41600	1 in 50 (F)
34	41600	41950	1 in 41.6 (F)
35	41950	42600	1 in 41.3 (F)
36	42600	43110	1 in 190 (F)
37	43110	43625	1 in 37 (F)
38	43625	44012	1 in 204 (F)
39	44012	44300	1 in 52 (F)
40	44300	44650	1 in 155 (F)
41	44650	45125	1 in 48 (F)

LIST OF PROPOSED GRADIENTS			
SR. NO	CHAINAGE		GRADIENT
	FROM (M)	TO (M)	
42	45125	46450	1 in 49 (F)
43	46450	47375	1 in 715 (F)
44	47375	48175	1 in 75.5 (F)
45	48175	48575	1 in 94 (F)
46	48575	49475	1 in 98.3 (F)
47	49475	49950	1 in 120 (F)

ANNEXURE – III

LIST OF PROPOSED TUNNELS				
SR. NO	TUNNEL NO	CHAINAGE		LENGTH (M)
		FROM	TO	
1	1	27150	27335	185
2	2	28160	28750	590
3	3	28900	29100	200
4	4	29275	29550	275
5	5	29680	29830	150
6	6	29925	30135	210
7	7	30200	30570	370
8	8	32580	32850	275
9	9	33450	33600	150
10	10	33705	34425	720
11	11	34560	34700	140
12	12	34980	35150	170
13	13	35400	35700	300
14	14	36500	36685	185
15	15	36700	37400	700
16	16	37650	38800	1150
17	17	38900	39010	110
18	18	39195	39620	425
19	19	39800	40000	200
20	20	40050	40350	300

LIST OF PROPOSED TUNNELS				
SR. NO	TUNNEL NO	CHAINAGE		LENGTH (M)
		FROM	TO	
21	21	40600	40730	130
22	22	41250	41400	150
23	23	43560	43800	240
TOTAL TUNNEL LENGTH (m)				**7320**

ANNEXURE – IV

DETAILS OF PROPOSED TUNNELS					
TUNNEL NO	**PORTAL**	**CHAINAGE OF PORTAL (M)**	**RL AT THE TOP OF PORTAL (M)**	**FORMATION LEVEL AT PORTAL (M)**	**MAXIMUM OVERBURDEN**
1	1	27150	549.375	528.889	24.08
	2	27335	540.161	524.399	
2	1	28160	527.75	504.345	84.7
	2	28750	511.307	490.979	
3	1	28900	511.598	488.415	43.09
	2	29100	506.58	484.927	
4	1	29275	495.963	482.004	46.2
	2	29550	510.494	474.607	
5	1	29680	484.701	471.401	76.9
	2	29830	492.842	467.555	
6	1	29925	487	465.023	31.7
	2	30135	484.924	460.023	
7	1	30200	475.096	458.148	49.85
	2	30570	454.769	448.763	
8	1	32580	413.601	398.9	39.5
	2	32850	410.097	391.915	
9	1	33450	397.801	375.994	21.9
	2	33600	386.127	371.94	
10	1	33705	383.008	369.448	118.3

DETAILS OF PROPOSED TUNNELS					
TUNNEL NO	**PORTAL**	**CHAINAGE OF PORTAL (M)**	**RL AT THE TOP OF PORTAL (M)**	**FORMATION LEVEL AT PORTAL (M)**	**MAXIMUM OVERBURDEN**
	2	34425	396.133	352.947	
11	1	34560	363.241	350.447	24.9
	2	34700	368.634	347.447	
12	1	34980	352.832	341.185	22.48
	2	35150	353.446	337.018	
13	1	35400	391.651	331.066	80.65
	2	35700	341.946	323.923	
14	1	36500	326.217	305.456	24.79
	2	36685	322.163	301.081	
15	1	36700	316.085	300.456	26.79
	2	37400	298.343	283.53	
16	1	37650	294.711	277.506	74.87
	2	38800	270.68	254.96	
17	1	38900	266.767	252.55	16.69
	2	39010	265.382	249.524	
18	1	39195	266.603	245.255	32.57
	2	39620	247.878	234.89	
19	1	39800	246.007	230.73	24.94
	2	40000	241.593	226.285	
20	1	40050	244.382	225.174	23.09
	2	40350	233.137	217.71	

DETAILS OF PROPOSED TUNNELS					
TUNNEL NO	**PORTAL**	**CHAINAGE OF PORTAL (M)**	**RL AT THE TOP OF PORTAL (M)**	**FORMATION LEVEL AT PORTAL (M)**	**MAXIMUM OVERBURDEN**
21	1	40600	228.778	211.714	30.78
	2	40730	224.515	208.717	
22	1	41250	218.194	196.823	18.7
	2	41400	208.192	193.823	
23	1	43560	168.989	151.964	33.2
	2	43800	164.175	149.131	

ANNEXURE – V

LIST OF BRIDGES

DETAILS OF EXISTING BRIDGES						DETAILS OF PROPOSED BRIDGES				
BRIDGE NO.	CHAINAGE	SPAN	BRIDGE TYPE	HFL	BED LEVEL	BRIDGE NO.	CHAINAGE	SPAN OF PROPOSED BRIDGE	TYPE OF PROPOSED BRIDGE	C/C distance
56	24886	1X2.44	Box	576.33	576.18		No proposed Bridge. Existing bridge is used			
57	25450	2X2.97	Box	566.58	565.28	57	25455	2x3.0x3.0	RCC Box	8.35
58	25710	1X0.61	Pipe	561.56	556.73	58	25708	1.20x1.20	RCC Box	9.85
59	26015	1X2.54	Arch	547.79	547.24	59	26005	1x3.0x3.0	RCC Box	7.8
60	26110	1X1.22	Pipe	551.83	551.28	60	26100	1x1.20X1.20	RCC Box	7.75
61	26220	1X1.98	Slab	550.59	549.58	61	26212	2X1.20X1.20	RCC Box	8.2
62	26380	2X1.22	Slab	546.79	546.04	62	26378	2X1.20X1.20	RCC Box	8.4
63	26482	1X2.44	Box	540.18	539.53	63	26480	1x3.0X3.0	RCC Box	7.0
64	26634	1X3.05	Slab	539.79	538.72	64	26635	1x3.0X2.0	RCC Box	6.5
65	26733	1X0.61	Pipe	537.10	536.74	65	26732	1x1.20x1.20	RCC Box	6.7
66	26790	1X2.44	Box	534.55	534.15	66	26787	1x3.0X2.0	RCC Box	6.4

DETAILS OF EXISTING BRIDGES						DETAILS OF PROPOSED BRIDGES				
BRIDGE NO.	CHAINAGE	SPAN	BRIDGE TYPE	HFL	BED LEVEL	BRIDGE NO.	CHAINAGE	SPAN OF PROPOSED BRIDGE	TYPE OF PROPOSED BRIDGE	C/C distance
67	26903	1X2.45	Arch	529.37	528.77	67	26902	1x3.0x4.0	RCC Box	6.6
68	27032	1X3.05	Slab	530.96	530.69	68	27033	1x3.0X2.0	RCC Box	6.8
69	27140	1X18.3+ 1X12.29	Steel Girder	526.53	524.82	69	27130	1X18.3 + 1X12.2	Composite Girder	17.8
70	27400	1X1.22	Pipe	520.68	520.08	70	27373	1x2.0X1.8	RCC Box	21.27
71	27836	4X1.22	Pipe	508.31	507.71	71	27813	2X3.00X2.0	RCC Box	7.6
72	28122	1X2.21	Slab	497.96	497.01	72	28100	1x3.0x4.00	RCC Box	10.6
73	28300	1X0.91	Slab				No proposed bridge. Alignment in tunnel.			
74	28765	1X2.59	Arch	488.52	487.87					
75	28908	2X3.05	Box	486.70	486.10	75	28885	2.0x3.0	RCC Box	25.18
75A	29110	1X0.91	Box	484.30	483.70	75A	29104	1x1.20x1.20	RCC BOX	24.4
76	29177	1X2.4	Arch	466.76	466.26	76	29177	1x3.0x3.00	RCC Box	25.7
77	29433	1X2.47	Slab	475.50	474.77		No proposed bridge. Alignment in tunnel.			
78	29513	1X3.05	Slab	474.64	474.04					

DETAILS OF EXISTING BRIDGES						DETAILS OF PROPOSED BRIDGES				
BRIDGE NO.	CHAINAGE	SPAN	BRIDGE TYPE	HFL	BED LEVEL	BRIDGE NO.	CHAINAGE	SPAN OF PROPOSED BRIDGE	TYPE OF PROPOSED BRIDGE	C/C distance
79	29613	4X18.29	RCC/PSC Girder	461.52	460.82	79	29630	4x18.3	Composite Girder	45.5
80	29818	2X1.22	Pipe	462.58	461.38	80	29835	1X3.0	RCC Box	34.8
81	30119	1X1.0	Slab	458.48	457.83		No proposed bridge. Alignment in tunnel.			
82	30568	1X0.91	Slab	447.80	447.70					
83	30753	1X0.91	Slab	443.11	442.81	83	30715	1X1.2	RCC Box	37.54
84	30977	1X1.52	Slab	438.09	437.39	84	30948	2.0X1.2	RCC Box	9.2
85	31124	1X0.91	Slab	434.41	433.94	85	31084	1.2x1.20	RCC Box	14.14
87	31600	1X1.21	Arch	410.15	409.10		Existing Bridge is proposed as Animal Underpass by increasing the size.			
88	32080	2X0.3	Slab	410.23	410.09	88	32025	1.2x1.20	RCC Box	11.12
89	32212	1X0.91	Slab	407.09	406.47	89	32157	1.2x1.20	RCC Box	12.5
90	32276	1X1.83	Slab	406.65	405.30	90	32230	2.0X1.80	RCC Box	11.76
91	32407	1X1.83	Slab	403.20	401.53	91	32356	2.0X1.20	RCC Box	12

DETAILS OF EXISTING BRIDGES						DETAILS OF PROPOSED BRIDGES				
BRIDGE NO.	CHAINAGE	SPAN	BRIDGE TYPE	HFL	BED LEVEL	BRIDGE NO.	CHAINAGE	SPAN OF PROPOSED BRIDGE	TYPE OF PROPOSED BRIDGE	C/C distance
92	32874	1X0.61	Slab	391.38	390.23	92	32855	1X1.2X1.2	RCC Box	33.87
93	33076	1X0.91	Slab	385.27	384.82	93	33064	1.2x1.20	RCC Box	22.6
94	33222	1X0.91	Slab	380.58	380.28	94	33193	1X1.2X1.2	RCC Box	33.4
95	33388	1X0.61	Slab	376.46	376.14	95	33335	1X1.2X1.2	RCC Box	38.17
96	33542	1X0.61	Box	373.56	373.35		No proposed bridge. Alignment in tunnel.			
97	33631	1X0.61	Slab	371.18	370.93					
98	33734	7X7.77	Arch	358.56	363.38	98	33650	1X30.5	Composite Girder	25.11
99	33816	1X7.77	Arch	361.85	360.55		No proposed bridge. Alignment in tunnel.			
100	34066	2X0.3	Slab		358.36					
101	34148	1X7.77	Arch	350.99	349.89					
102	34500	2X27.43	Plate Girder	322.45	318.50	102	34510	2X30.50	Composite Girder	17.14
103	34827	3X7.77	Arch	332.85	331.57	103	34825	1X30.50	Composite Girder	12.37

DETAILS OF EXISTING BRIDGES						DETAILS OF PROPOSED BRIDGES				
BRIDGE NO.	CHAINAGE	SPAN	BRIDGE TYPE	HFL	BED LEVEL	BRIDGE NO.	CHAINAGE	SPAN OF PROPOSED BRIDGE	TYPE OF PROPOSED BRIDGE	C/C distance
104	35070	1X0.61	Slab	337.38	337.23		No proposed bridge. Alignment in tunnel.			
105	35300	1X0.91	Arch	323.89	323.64	105	35275	1X1.2X1.2	RCC Box	44.84
106	35805	1X3.05	Arch	307.69	306.69	106	35780	3.0X4.00	RCC Box	151.7
107	36065	1X1.52	Arch	305.15	304.15	107	36095	2.00X2.00	RCC Box	9.7
108	36298	1X1.1	Slab	308.88	308.68	108	36328	1.20x1.20	RCC Box	6.7
109	36434	1X1.08	Slab	303.79	303.36	109	36465	1.20x1.20	RCC Box	18.1
110	36562	1X0.91	Slab	300.23	299.81		No proposed bridge. Alignment in tunnel.			
111	36652	1X1.06	Slab							
112	36677	1X0.61	Slab		299.216	112	36690	1.2x1.20	RCC Box	24.15
113	36804	1X1.11	Slab				No proposed bridge. Alignment in tunnel.			
114	37112	1X0.91	Slab							
115	37300	1X0.45	Slab	283.78	283.74					
117	37518	1X1.98	Arch	266.34	264.34	117	37502	2.00x2.00	RCC Box	31.7
117A	37616	1X1.33	Box	273.44	272.38	117A	37600	2.00X2.00	RCC Box	35.212

DETAILS OF EXISTING BRIDGES						DETAILS OF PROPOSED BRIDGES				
BRIDGE NO.	CHAINAGE	SPAN	BRIDGE TYPE	HFL	BED LEVEL	BRIDGE NO.	CHAINAGE	SPAN OF PROPOSED BRIDGE	TYPE OF PROPOSED BRIDGE	C/C distance
118	37685	1X3.05	Slab	273.96	272.17		No proposed bridge. Alignment in tunnel.			
119	37812	1X1.67	Slab	269.38	269.05					
120	37955	1X3.05	Slab	265.52	264.82					
121	38175	1X0.61	Slab	259.80	259.40					
122	38242	1X1.7	Slab	260.73	260.59					
123	38317	1X0.91	Slab	260.24	259.26					
124	38419	1X0.61	Slab	256.67	256.29					
125	38484	1X1.61	Slab	256.32	255.87					
126	38910	1X1.05	Arch	253.20	253.01	126	38847	1.20x1.20	RCC Box	27.08
127	39018	1X0.61	Slab	251.38	251.18		No proposed bridge. Alignment in tunnel.			
128	39111	4x7.6 +2x18.3	Arch	240.18	237.50	128	39075	1X38.4	Composite Girder	19.15
129	39245	1X1.61	Slab	241.55	241.30		No proposed bridge. Alignment in tunnel.			
130	39531	1X1.7	Slab							
131	39588	1X0.91	Slab	233.43	233.13					

DETAILS OF EXISTING BRIDGES						DETAILS OF PROPOSED BRIDGES				
BRIDGE NO.	CHAINAGE	SPAN	BRIDGE TYPE	HFL	BED LEVEL	BRIDGE NO.	CHAINAGE	SPAN OF PROPOSED BRIDGE	TYPE OF PROPOSED BRIDGE	C/C distance
132	39774	1X18.29	Arch	221.91	219.73	132	39785	1X18.3	Composite Girder	24.5
133	40014	1X0.61	Slab	225.26	225.06	133	40045	1.20x1.20	RCC Box	36.4
134	40100	1X1.22	Slab	222.75	220.03		No proposed bridge. Alignment in tunnel.			
135	40189	1X0.91	Slab	220.77	220.32					
136	40959	2X0.13	Pipe	198.75	198.65	136	40972	1.20x1.20	RCC Box	15.4
137	41068	2X2.59	Box	173.41	171.41	137	41095	2X3.00X3.00	RCC Box	26.98
138	41458	1X2.45	Slab	190.21	188.05	138	41535	3.00X3.00	RCC Box	12.3
139	41827	1X1.22	Arch	165.36	165.00	139	41905	1.20x1.20	RCC Box	9.6
140	42115	1X0.61	Arch	167.54	167.24	140	42175	1.20x1.20	RCC Box	18.841
141	42303	1X0.91	Slab	170.97	170.73	141	42345	1.20x1.20	RCC Box	11.5
142	42712	1X3.05	Arch	147.07	144.97	142	42770	3.00X3.00	RCC Box	13.5
143	43080	1X0.91	Slab	161.98	161.57	143	43132	1.20x1.20	RCC Box	13.67
144	43435	1X4.57	Arch	135.22	133.43	144	43488	2X3.00X2.00	RCC Box	22.6

DETAILS OF EXISTING BRIDGES						DETAILS OF PROPOSED BRIDGES				
BRIDGE NO.	CHAINAGE	SPAN	BRIDGE TYPE	HFL	BED LEVEL	BRIDGE NO.	CHAINAGE	SPAN OF PROPOSED BRIDGE	TYPE OF PROPOSED BRIDGE	C/C distance
145	43812	1X1.52	Arch	138.97	138.47	145	43908	2.00X1.20	RCC Box	23.2
146	43954	1X3.05	Arch	130.64	130.14	146	44040	3.00X2.00	RCC Box	6.35
147	44195	1X0.76	Pipe	130.96	130.46	147	44290	1.2x1.20	RCC Box	6.96
148	44508	1X0.61	Arch	127.14	126.09	148	44600	1.2x1.20	RCC Box	6.416
149	44700	1X0.61	Slab	135.71	135.58	149	44795	1.2x1.20	RCC Box	6.9
150	44907	1X1.22	Pipe	127.44	126.89	150	45000	1.2x1.20	RCC Box	6.58
151	45039	1X0.76	Pipe	121.94	121.74	151	45133	1.2x1.20	RCC Box	6.1
152	45150	1X1.52	Arch	119.83	118.88	152	45245	2.00X2.00	RCC Box	6.18
153	45269	1X0.75	Slab	124.13	124.06	153	45361	1.2X1.20	RCC Box	6.2
154	45565	1X1.22	Pipe	110.63	110.09	154	45660	1.2x1.20	RCC Box	5.95
155	45667	1X0.91	Arch	112.64	112.24	155	45763	1.2x1.20	RCC Box	6.18
156	45994	1X2.36	Slab	103.60	102.40	156	46090	3.0X3.0	RCC Box	6.27
157	46350	1X0.91	Arch	98.00	97.00	157	46442	1.2x1.20	RCC Box	6.11

DETAILS OF EXISTING BRIDGES						DETAILS OF PROPOSED BRIDGES				
BRIDGE NO.	CHAINAGE	SPAN	BRIDGE TYPE	HFL	BED LEVEL	BRIDGE NO.	CHAINAGE	SPAN OF PROPOSED BRIDGE	TYPE OF PROPOSED BRIDGE	C/C distance
158	46785	1X1.52	Arch	93.68	93.00	158	46875	2.00X2.00	RCC Box	6.518
159	47113	1X1.83	Slab	100.22	99.45	159	47200	1X2.00	RCC Box	6.4
160	47488	1X1.83	Slab	97.32	96.22	160	47575	1X2.00	RCC Box	5.992
161	47750	1X1.52	Arch	88.15	87.45	161	47832	2.00X2.00	RCC Box	6.14
162	47958	1X0.91	Arch	84.22	83.72	162	48045	1.2x1.20	RCC Box	6.8
163	48310	2X0.3	Pipe	82.22	81.20	163	48402	1.2x1.20	RCC Box	6.033
164	48407	1X1.22	Pipe	81.31	80.66	164	48500	1.2x1.20	RCC Box	6.075
165	48617	1X3.05	Arch	75.91	75.11	165	48707	3.00X3.00	RCC Box	6.29
166	48770	1X0.91	Arch	78.41	77.61	166	48860	1.2x1.20	RCC Box	6.5
167	49030	1X1.37	Box	78.02	77.42	167	49122	2.00X2.00	RCC Box	6.17
168	49445	1X1.52	Arch	74.80	72.70	168	49538	2.00X2.00	RCC Box	5.9
169	49845	1X1.83	Slab	72.82	72.17	169	49920	2.00X1.20	RCC Box	5.9

ANNEXURE – VI

DETAILS OF PROPOSED ANIMAL UNDERPASS BRIDGES

S. No.	BRIDGE NO.	CHAINAGE	SPAN OF PROPOSED BRIDGE	TYPE OF PROPOSED BRIDGE	PROPOSED FORMATION LEVEL	PROPOSED RAIL LEVEL	BED LEVEL	HFL (m)	REMARKS
1	87	31558	1X12X5.65	RCC BOX	422.685	423.423	409.100	410.150	Existing Minor Bridge 87, Proposed as Animal Underpass with changed span. Available Fill height - 14.419m
2	136A	41075	1X12X5.65	RCC BOX	200.323	201.061	193.673	-	Available Fill height - 18.772m
3	142A	42800	1X12X5.65	RCC BOX	164.619	165.357	158.087	-	Available Fill height - 8.057m
4	147A	44565	1X12X5.65	RCC BOX	139.199	139.937	132.549	-	Available Fill height - 13.174m

ANNEXURE – VII

ESTIMATION OF EARTHWORK QUANTITIES					
SR. NO.	FROM (M)	TO (M)	CUTTING IN FORMATION (CUM)	CUTTING IN TUNNELS (CUM)	FILLING (CUM)
1	23650	24000	5,816	0	0
2	24000	25000	7,722	0	0
3	25000	26000	60,232	0	22,092
4	26000	27000	44,441	0	6,776
5	27000	28000	39,577	8737	12,414
6	28000	29000	28,842	32586	311
7	29000	30000	59,960	28337	25,860
8	30000	31000	90,822	26211	4,169
9	31000	32000	2,10,447	13932	12,090
10	32000	33000	92,309	14168	2,206
11	33000	34000	1,35,102	21016	0
12	34000	35000	1,07,387	27628	8,313
13	35000	36000	17,090	21252	31,349
14	36000	37000	35,116	22905	19,073
15	37000	38000	44,087	35420	94,872
16	38000	39000	1,16,166	42505	0
17	39000	40000	89,246	29990	5,625
18	40000	41000	92,589	20307	22,518
19	41000	42000	67,581	7084	1,02,348

ESTIMATION OF EARTHWORK QUANTITIES					
SR. NO.	**FROM (M)**	**TO (M)**	**CUTTING IN FORMATION (CUM)**	**CUTTING IN TUNNELS (CUM)**	**FILLING (CUM)**
20	42000	43000	18,850	0	99,633
21	43000	44000	30,482	11335	58,429
22	44000	45000	569	0	87,399
23	45000	46000	0	0	30,944
24	46000	47000	211	0	52,855
25	47000	48000	1,484	0	49,449
26	48000	49000	0	0	1,22,487
27	49000	50000	0	0	78,151
	TOTAL:		**13,96,128**	**3,63,416**	**9,49,365**

ANNEXURE – VIII

BALANCING / DISPOSAL OF MUCK GENERATED

Sr. No.	ITEM	QUANTITY OF MUCK (Cum)
1	Generated in Cutting in Formation	13,96,128
2	Generated in Cutting in Tunnels	3,63,416
3	To be used in Filling	4,88,645
4	To be used in Ballast, Aggregates, Gabion Walls etc....	4,00,000
5	To be Dumped at Dumping Yards/ or transported outside the section at contractor's cost	8,70,899

ANNEXURE –IX

LAND ACQUISITION AREA STATEMENT DETAIL

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
1	25500	15.05	37.63	22.58
2	25525	14.54	40.42	25.88
3	25550	13.73	41.26	27.53
4	25575	14.94	40.42	25.48
5	25600	15.28	43.35	28.07
6	25625	15.15	46.87	31.72
7	25650	18.42	48.45	30.03
8	25675	19.07	47.78	28.71
9	25700	18.52	50.40	31.88
10	25725	18.82	53.41	34.59
11	25750	16.46	54.12	37.66
12	25775	17.83	50.48	32.65
13	25800	18.93	51.77	32.84
14	25825	19.44	51.10	31.66
15	25850	20.46	50.00	29.54
16	25875	18.9	46.60	27.70
17	25900	15.87	31.81	15.94
18	25925	14.9	30.83	15.93
19	25950	14.56	30.48	15.92
20	25975	14.35	30.04	15.69
21	26000	14.41	29.72	15.31
22	26025	14.52	29.44	14.92
23	26050	14.63	29.17	14.54
24	26075	14.74	28.89	14.15
25	26100	14.98	28.54	13.56
26	26125	15.34	28.42	13.08
27	26150	15.33	27.64	12.31
28	26175	16.01	28.58	12.57
29	26200	17.42	27.18	9.76
30	26225	17.38	26.88	9.50
31	26250	18.7	28.04	9.34
32	26275	20.67	28.15	7.48
33	26300	18.96	27.28	8.32
34	26325	19.25	29.72	10.47
35	26350	18.84	27.55	8.71

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
36	26375	20.89	27.26	6.37
37	26400	20.54	28.99	8.45
38	26425	19.4	26.24	6.84
39	26450	19.07	26.64	7.57
40	26475	19.01	27.44	8.43
41	26500	19.18	29.02	9.84
42	26525	18.87	31.80	12.93
43	26550	18.08	35.18	17.10
44	26575	17.76	38.37	20.61
45	26600	17.94	41.07	23.13
46	26625	17.82	42.44	24.62
47	26650	20.38	41.92	21.54
48	26675	22.94	39.35	16.41
49	26700	24.73	36.27	11.54
50	26725	26.81	32.57	5.76
51	26750	28.42	28.99	0.57
52	26775	18.38	26.84	8.46
53	26800	14.38	28.80	14.42
54	26825	15.15	59.29	44.14
55	26850	16.12	60.03	43.91
56	26875	17.81	58.88	41.07
57	26900	19.21	58.80	39.59
58	26925	19.62	58.39	38.77
59	26950	22.25	58.52	36.27
60	26975	22.25	58.22	35.97
61	27000	18.72	57.58	38.86
62	27025	16.35	58.46	42.11
63	27050	16.16	60.90	44.74
64	27075	16.5	62.99	46.49
65	27100	18.22	63.77	45.55
66	27125	17.68	62.66	44.98
67	27150	15.96	22.24	6.28
68	27175	21.07	25.68	4.61
69	27200	22.52	27.65	5.13
70	27225	21.35	30.05	8.70
71	27250	17.85	32.51	14.66
72	27275	13.89	27.22	13.33
73	27300	15.24	28.41	13.17
74	27325	14.11	29.72	15.61
75	27350	10.94	34.54	23.60

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
76	27375	10.23	32.67	22.44
77	27400	11.81	29.10	17.29
78	27425	15.5	58.79	43.29
79	27450	16.36	66.09	49.73
80	27475	14.98	70.14	55.16
81	27500	11.18	60.89	49.71
82	27525	11.78	19.76	7.98
83	27550	15.66	22.68	7.02
84	27575	18.64	27.78	9.14
85	27600	15.23	21.07	5.84
86	27625	17.24	27.59	10.35
87	27650	15.5	30.94	15.44
88	27675	13.12	33.62	20.50
89	27700	13.45	32.75	19.30
90	27725	11.12	29.45	18.33
91	27750	11.09	25.87	14.78
92	27775	13.25	25.06	11.81
93	27800	16.36	27.56	11.20
94	27825	14.5	25.21	10.71
95	27850	15.8	26.06	10.26
96	27875	16.45	26.62	10.17
97	27900	11.63	21.83	10.20
98	27925	9.25	19.56	10.31
99	27950	9.01	19.44	10.43
100	27975	9.93	20.46	10.53
101	28000	11.7	22.33	10.63
102	28025	12.97	23.70	10.73
103	28050	13.97	24.78	10.81
104	28075	14.43	25.35	10.92
105	28100	14.67	85.55	70.88
106	28125	14.68	84.64	69.96
107	28150	18.69	83.91	65.22
108	28175	24.51	24.51	0.00
109	28200	28.59	28.59	0.00
110	28225	30.07	30.07	0.00
111	28250	28.98	28.98	0.00
112	28275	28.09	28.09	0.00
113	28300	32.15	32.15	0.00
114	28325	34.86	34.86	0.00
115	28350	36.13	36.13	0.00

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
116	28375	35.92	35.92	0.00
117	28400	33.45	33.45	0.00
118	28425	29.1	30.44	1.34
119	28450	28.33	31.13	2.80
120	28475	26.54	30.79	4.25
121	28500	25.06	30.77	5.71
122	28525	23.45	30.62	7.17
123	28550	22.06	30.69	8.63
124	28575	20.55	30.63	10.08
125	28600	19.1	30.64	11.54
126	28625	17.67	30.67	13.00
127	28650	16.37	30.82	14.45
128	28675	14.83	30.74	15.91
129	28700	13.75	29.74	15.99
130	28725	13.74	29.70	15.96
131	28750	15.53	36.10	20.57
132	28775	11.07	33.24	22.17
133	28800	8.48	29.04	20.56
134	28825	8.71	27.21	18.50
135	28850	11.28	24.66	13.38
136	28875	16.48	21.98	5.50
137	28900	23.27	24.69	1.42
138	28925	25.9	31.59	5.69
139	28950	21.49	32.11	10.62
140	28975	17.54	38.68	21.14
141	29000	14.97	33.81	18.84
142	29025	14.94	31.68	16.74
143	29050	17.52	32.24	14.72
144	29075	23.39	36.08	12.69
145	29100	30.61	43.95	13.34
146	29125	22.18	38.92	16.74
147	29150	14.98	39.57	24.59
148	29175	10.93	40.93	30.00
149	29200	9.54	40.90	31.36
150	29225	10.27	43.22	32.95
151	29250	11.8	44.04	32.24
152	29275	13.44	44.56	31.12
153	29300	14.92	44.92	30.00
154	29325	16.59	33.31	16.72
155	29350	18	33.45	15.45

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
156	29375	18.99	33.17	14.18
157	29400	19.36	32.27	12.91
158	29425	19.23	30.88	11.65
159	29450	18.98	29.36	10.38
160	29475	19.03	28.14	9.11
161	29500	20.07	27.92	7.85
162	29525	14.28	27.26	12.98
163	29550	10.62	30.61	19.99
164	29575	9.15	36.03	26.88
165	29600	9.71	41.80	32.09
166	29625	12.06	49.10	37.04
167	29650	15.75	56.50	40.75
168	29675	19.18	62.74	43.56
169	29700	21.26	66.04	44.78
170	29725	20.77	66.01	45.24
171	29750	17.73	62.36	44.63
172	29775	16.28	57.81	41.53
173	29800	14.6	50.68	36.08
174	29825	13.83	42.66	28.83
175	29850	12.04	45.78	33.74
176	29875	12.42	42.61	30.19
177	29900	12.32	39.96	27.64
178	29925	13.14	28.98	15.84
179	29950	14.84	31.38	16.54
180	29975	21.81	36.28	14.47
181	30000	26.66	37.96	11.30
182	30025	29.22	38.67	9.45
183	30050	29.49	38.81	9.32
184	30075	26.7	37.60	10.90
185	30100	24.85	36.17	11.32
186	30125	26.98	34.10	7.12
187	30150	27.03	49.28	22.25
188	30175	25.6	48.76	23.16
189	30200	23.36	47.53	24.17
190	30225	20.83	46.15	25.32
191	30250	18.31	29.86	11.55
192	30275	15.64	30.34	14.70
193	30300	18.03	33.18	15.15
194	30325	18.45	35.71	17.26
195	30350	16.75	37.36	20.61

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
196	30375	16.98	34.83	17.85
197	30400	21.35	38.13	16.78
198	30425	24.73	42.08	17.35
199	30450	25.66	42.30	16.64
200	30475	26.74	43.57	16.83
201	30500	26.07	44.74	18.67
202	30525	22.68	39.80	17.12
203	30550	18.91	32.51	13.60
204	30575	19.32	43.94	24.62
205	30600	19.6	40.10	20.50
206	30625	21.25	46.70	25.45
207	30650	20.19	51.98	31.79
208	30675	17.26	55.51	38.25
209	30700	16.03	59.27	43.24
210	30725	15.14	58.84	43.70
211	30750	17.97	62.12	44.15
212	30775	19.41	64.01	44.60
213	30800	18.32	58.34	40.02
214	30825	16.31	50.72	34.41
215	30850	16.71	45.52	28.81
216	30875	16.26	41.03	24.77
217	30900	16.39	40.66	24.27
218	30925	14.93	38.69	23.76
219	30950	13.91	37.17	23.26
220	30975	14.84	28.57	13.73
221	31000	16.87	31.68	14.81
222	31025	17.23	33.13	15.90
223	31050	17.35	34.33	16.98
224	31075	17.6	43.20	25.60
225	31100	17.67	37.62	19.95
226	31125	17.14	36.09	18.95
227	31150	14.71	32.10	17.39
228	31175	16.26	34.99	18.73
229	31200	15.86	28.77	12.91
230	31225	12.96	22.43	9.47
231	31250	16.28	23.89	7.61
232	31275	18.33	22.16	3.83
233	31300	17.77	20.46	2.69
234	31325	19.51	42.86	23.35
235	31350	19.75	44.52	24.77

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
236	31375	19	45.19	26.19
237	31400	18.24	46.42	28.18
238	31425	17.14	47.70	30.56
239	31450	16.37	46.62	30.25
240	31475	14.38	45.60	31.22
241	31500	13.9	54.62	40.72
242	31525	15.89	36.03	20.14
243	31550	15.5	32.81	17.31
244	31575	15.91	29.25	13.34
245	31600	18.46	35.97	17.51
246	31625	21.2	29.40	8.20
247	31650	25.11	34.08	8.97
248	31675	32.05	49.67	17.62
249	31700	31.64	56.74	25.10
250	31725	26.3	58.49	32.19
251	31750	21.56	56.57	35.01
252	31775	22.06	60.12	38.06
253	31800	24.19	67.23	43.04
254	31825	23.82	71.79	47.97
255	31850	23.04	76.46	53.42
256	31875	21.3	71.43	50.13
257	31900	17.31	59.60	42.29
258	31925	18.09	52.97	34.88
259	31950	23.53	57.59	34.06
260	31975	26.34	60.91	34.57
261	32000	26.55	60.59	34.04
262	32025	24.08	54.34	30.26
263	32050	19.99	46.26	26.27
264	32075	17.04	39.37	22.33
265	32100	15.65	34.60	18.95
266	32125	15.96	35.95	19.99
267	32150	19.01	39.47	20.46
268	32175	16.85	34.07	17.22
269	32200	16.65	35.74	19.09
270	32225	19.28	37.48	18.20
271	32250	17.35	32.37	15.02
272	32275	18.17	33.91	15.74
273	32300	21.19	36.26	15.07
274	32325	20.12	34.60	14.48
275	32350	19.36	33.27	13.91

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
276	32375	20.14	73.10	52.96
277	32400	21.05	76.10	55.05
278	32425	22.47	81.62	59.15
279	32450	23.69	80.29	56.60
280	32475	21.99	74.92	52.93
281	32500	19.37	68.42	49.05
282	32525	16.53	61.29	44.76
283	32550	14.27	54.65	40.38
284	32575	13.11	30.94	17.83
285	32600	14.15	36.85	22.70
286	32625	13.16	39.27	26.11
287	32650	12.84	40.90	28.06
288	32675	15.01	47.74	32.73
289	32700	15.92	52.21	36.29
290	32725	15.44	53.53	38.09
291	32750	15.38	52.13	36.75
292	32775	15.41	15.41	0.00
293	32800	15.52	15.52	0.00
294	32825	99.99	99.99	0.00
295	32850	16.19	56.20	40.01
296	32875	12.82	48.64	35.82
297	32900	10.93	42.46	31.53
298	32925	11.2	39.37	28.17
299	32950	11.47	38.07	26.60
300	32975	12.77	37.80	25.03
301	33000	15.71	40.39	24.68
302	33025	16.4	41.88	25.48
303	33050	17.29	43.56	26.27
304	33075	18.04	45.17	27.13
305	33100	17.67	40.42	22.75
306	33125	15	44.33	29.33
307	33150	13.18	41.37	28.19
308	33175	15.65	45.27	29.62
309	33200	15.64	45.79	30.15
310	33225	16.11	47.57	31.46
311	33250	17.39	51.85	34.46
312	33275	16.12	49.54	33.42
313	33300	16.56	52.10	35.54
314	33325	17.06	52.81	35.75
315	33350	15.04	51.98	36.94

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
316	33375	15.79	53.76	37.97
317	33400	15.18	50.96	35.78
318	33425	12.04	48.40	36.36
319	33450	14.34	37.65	23.31
320	33475	14.43	35.75	21.32
321	33500	12.83	32.45	19.62
322	33525	15.92	32.90	16.98
323	33550	16.78	33.20	16.42
324	33575	16.36	31.70	15.34
325	33600	17.74	33.59	15.85
326	33625	16.71	39.30	22.59
327	33650	14.44	40.01	25.57
328	33675	12.99	41.48	28.49
329	33700	12.87	44.30	31.43
330	33725	12.28	39.84	27.56
331	33750	12.82	43.77	30.95
332	33775	16	47.87	31.87
333	33800	17.04	53.60	36.56
334	33825	18.64	62.44	43.80
335	33850	22.82	71.48	48.66
336	33875	18.67	70.12	51.45
337	33900	15.92	72.70	56.78
338	33925	15.37	75.56	60.19
339	33950	12.68	74.17	61.49
340	33975	13.37	74.17	60.80
341	34000	15.95	77.28	61.33
342	34025	14.04	74.68	60.64
343	34050	12.51	70.80	58.29
344	34075	10.69	64.42	53.73
345	34100	9.13	56.26	47.13
346	34125	8.74	49.09	40.35
347	34150	10.39	43.96	33.57
348	34175	14.61	41.40	26.79
349	34200	16.58	41.62	25.04
350	34225	16.86	41.40	24.54
351	34250	17.22	41.26	24.04
352	34275	17.53	41.05	23.52
353	34300	18.06	40.87	22.81
354	34325	18.33	40.20	21.87
355	34350	18.73	38.66	19.93

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
356	34375	16.55	35.38	18.83
357	34400	12.9	31.86	18.96
358	34425	10.98	36.71	25.73
359	34450	11.66	36.30	24.64
360	34475	11.48	34.95	23.47
361	34500	11.02	35.00	23.98
362	34525	10.8	35.36	24.56
363	34550	10.55	37.34	26.79
364	34575	11.66	25.36	13.70
365	34600	12.63	28.69	16.06
366	34625	12.76	30.68	17.92
367	34650	13.59	32.76	19.17
368	34675	14.41	30.58	16.17
369	34700	17.26	28.61	11.35
370	34725	19.19	38.97	19.78
371	34750	19.67	38.04	18.37
372	34775	18.07	34.95	16.88
373	34800	18.25	32.64	14.39
374	34825	17.78	29.43	11.65
375	34850	17.94	31.85	13.91
376	34875	17.23	35.32	18.09
377	34900	14.31	36.92	22.61
378	34925	15.66	38.74	23.08
379	34950	19.03	42.41	23.38
380	34975	19.46	43.37	23.91
381	35000	17.38	27.05	9.67
382	35025	20.99	29.06	8.07
383	35050	22.15	31.35	9.20
384	35075	20.91	33.75	12.84
385	35100	17.07	26.56	9.49
386	35125	19.91	28.90	8.99
387	35150	19.63	41.03	21.40
388	35175	17.54	42.41	24.87
389	35200	14.76	43.92	29.16
390	35225	11.51	41.64	30.13
391	35250	10.34	40.44	30.10
392	35275	11.8	41.87	30.07
393	35300	15.49	45.54	30.05
394	35325	11.51	41.53	30.02
395	35350	10	39.97	29.97

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
396	35375	10.88	40.90	30.02
397	35400	14.91	33.92	19.01
398	35425	15.72	23.46	7.74
399	35450	17.37	25.35	7.98
400	35475	19.07	27.10	8.03
401	35500	19.54	27.66	8.12
402	35525	21.74	29.95	8.21
403	35550	22.18	30.29	8.11
404	35575	20.08	28.17	8.09
405	35600	16.62	24.77	8.15
406	35625	18.33	26.03	7.70
407	35650	18.03	26.11	8.08
408	35675	18.09	26.11	8.02
409	35700	13.94	95.90	81.96
410	35725	13.35	96.29	82.94
411	35750	12.74	96.83	84.09
412	35775	12.35	92.25	79.90
413	35800	11.95	91.62	79.67
414	35825	10.09	89.90	79.81
415	35850	10.27	90.39	80.12
416	35875	12.87	93.46	80.59
417	35900	18.34	99.57	81.23
418	35925	13.3	90.13	76.83
419	35950	11.14	81.03	69.89
420	35975	11.25	74.16	62.91
421	36000	13.77	69.59	55.82
422	36025	10.08	58.61	48.53
423	36050	8.87	29.67	20.80
424	36075	10.03	26.97	16.94
425	36100	13.5	26.54	13.04
426	36125	13.51	22.62	9.11
427	36150	13.83	21.86	8.03
428	36175	14.24	22.57	8.33
429	36200	14.49	22.45	7.96
430	36225	13.98	21.53	7.55
431	36250	13.48	21.20	7.72
432	36275	12.96	21.16	8.20
433	36300	12.42	21.09	8.67
434	36325	12.5	22.80	10.30
435	36350	12.56	24.23	11.67

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
436	36375	12.7	25.50	12.80
437	36400	12.5	26.44	13.94
438	36425	15.31	32.74	17.43
439	36450	16.6	35.96	19.36
440	36475	15.54	35.80	20.26
441	36500	12.91	34.19	21.28
442	36525	18.17	36.96	18.79
443	36550	20.54	36.77	16.23
444	36575	20.96	35.38	14.42
445	36600	18.64	32.61	13.97
446	36625	17.8	31.84	14.04
447	36650	16.29	28.91	12.62
448	36675	14.3	27.45	13.15
449	36700	12.27	38.09	25.82
450	36725	12.29	28.17	15.88
451	36750	12.36	28.20	15.84
452	36775	12.53	28.34	15.81
453	36800	12.39	28.17	15.78
454	36825	12.69	28.43	15.74
455	36850	12.76	28.46	15.70
456	36875	12.67	28.32	15.65
457	36900	12.5	28.67	16.17
458	36925	15.49	30.97	15.48
459	36950	17.05	31.46	14.41
460	36975	15.91	32.96	17.05
461	37000	13.57	34.18	20.61
462	37025	16.36	35.57	19.21
463	37050	17.86	37.76	19.90
464	37075	17.05	36.53	19.48
465	37100	14.61	34.94	20.33
466	37125	17.96	35.49	17.53
467	37150	18.89	36.26	17.37
468	37175	17.28	36.93	19.65
469	37200	14.45	31.71	17.26
470	37225	17.29	31.60	14.31
471	37250	18.65	33.50	14.85
472	37275	17.96	33.97	16.01
473	37300	16.26	29.91	13.65
474	37325	18.09	29.38	11.29
475	37350	20.39	29.32	8.93

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
476	37375	21.3	29.33	8.03
477	37400	22.38	48.26	25.88
478	37425	17.54	45.61	28.07
479	37450	15.73	43.56	27.83
480	37475	16.88	44.46	27.58
481	37500	20.14	50.11	29.97
482	37525	16.58	50.81	34.23
483	37550	15.63	51.41	35.78
484	37575	17.03	51.16	34.13
485	37600	21.9	55.78	33.88
486	37625	17.15	55.38	38.23
487	37650	15.1	39.66	24.56
488	37675	15.53	39.73	24.20
489	37700	18.85	40.46	21.61
490	37725	19.72	39.18	19.46
491	37750	22.99	39.77	16.78
492	37775	18.81	33.85	15.04
493	37800	17.33	34.70	17.37
494	37825	10.38	30.38	20.00
495	37850	16.27	40.28	24.01
496	37875	16.97	44.99	28.02
497	37900	16.98	49.01	32.03
498	37925	17.41	53.46	36.05
499	37950	17.45	57.38	39.93
500	37975	17.54	61.36	43.82
501	38000	16.5	64.33	47.83
502	38025	19.39	69.40	50.01
503	38050	20.81	67.99	47.18
504	38075	19.51	65.75	46.24
505	38100	15.94	62.36	46.42
506	38125	18.2	57.79	39.59
507	38150	18.79	51.33	32.54
508	38175	20.1	45.61	25.51
509	38200	21.73	41.03	19.30
510	38225	18.7	37.11	18.41
511	38250	16.67	34.26	17.59
512	38275	15.53	32.31	16.78
513	38300	15.21	31.18	15.97
514	38325	14.95	30.88	15.93
515	38350	14.75	30.64	15.89

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
516	38375	14.49	30.34	15.85
517	38400	14.04	30.07	16.03
518	38425	15.78	29.86	14.08
519	38450	16.54	31.10	14.56
520	38475	16.13	33.31	17.18
521	38500	14.11	33.97	19.86
522	38525	17.04	36.15	19.11
523	38550	18.09	39.69	21.60
524	38575	16.18	42.66	26.48
525	38600	13.34	38.09	24.75
526	38625	16.1	40.69	24.59
527	38650	17.11	43.74	26.63
528	38675	15.32	43.50	28.18
529	38700	12.1	36.45	24.35
530	38725	15.05	39.17	24.12
531	38750	16.38	42.69	26.31
532	38775	15.33	33.64	18.31
533	38800	13.32	31.21	17.89
534	38825	17.55	31.77	14.22
535	38850	21.84	29.42	7.58
536	38875	24.68	24.68	0.00
537	38900	26.28	26.28	0.00
538	38925	34.37	34.37	0.00
539	38950	45.99	45.99	0.00
540	38975	59.03	59.03	0.00
541	39000	74.46	74.46	0.00
542	39025	92.23	92.23	0.00
543	39050	111.17	111.17	0.00
544	39075	70.18	70.18	0.00
545	39100	56.64	56.64	0.00
546	39125	46.71	47.22	0.51
547	39150	39.58	44.97	5.39
548	39175	34.65	48.02	13.37
549	39200	25.94	30.88	4.94
550	39225	20.31	29.66	9.35
551	39250	17.29	28.70	11.41
552	39275	16.11	37.23	21.12
553	39300	13.12	32.55	19.43
554	39325	13.01	34.02	21.01
555	39350	15.01	35.29	20.28

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
556	39375	16.84	39.58	22.74
557	39400	16.38	41.48	25.10
558	39425	15.94	43.39	27.45
559	39450	16.05	44.04	27.99
560	39475	18.19	45.56	27.37
561	39500	20.33	46.36	26.03
562	39525	22.74	45.54	22.80
563	39550	23.59	45.03	21.44
564	39575	18.95	42.43	23.48
565	39600	16.61	40.10	23.49
566	39625	16.72	44.15	27.43
567	39650	15.14	40.56	25.42
568	39675	12.59	38.88	26.29
569	39700	12.57	38.01	25.44
570	39725	15.2	38.23	23.03
571	39750	20.75	38.57	17.82
572	39775	19.66	33.73	14.07
573	39800	21.04	29.68	8.64
574	39825	21.14	28.13	6.99
575	39850	21.04	28.67	7.63
576	39875	21.47	30.78	9.31
577	39900	21.22	29.14	7.92
578	39925	19.66	29.65	9.99
579	39950	19.22	30.41	11.19
580	39975	21.43	35.87	14.44
581	40000	25.53	59.97	34.44
582	40025	26.32	60.47	34.15
583	40050	27.1	42.21	15.11
584	40075	26.54	44.50	17.96
585	40100	25.5	46.31	20.81
586	40125	23.8	47.46	23.66
587	40150	20.07	44.66	24.59
588	40175	15.17	39.86	24.69
589	40200	13.19	37.99	24.80
590	40225	13.32	37.35	24.03
591	40250	16.05	36.40	20.35
592	40275	21.97	37.81	15.84
593	40300	23.95	34.04	10.09
594	40325	26.6	32.53	5.93
595	40350	29.3	38.73	9.43

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
596	40375	30.09	37.76	7.67
597	40400	28.08	33.98	5.90
598	40425	24.6	31.80	7.20
599	40450	19.86	29.53	9.67
600	40475	21.08	33.37	12.29
601	40500	21.5	35.62	14.12
602	40525	19.09	32.94	13.85
603	40550	16.22	30.54	14.32
604	40575	19.03	39.81	20.78
605	40600	19.22	32.32	13.10
606	40625	17.18	30.22	13.04
607	40650	18.15	33.88	15.73
608	40675	22.04	33.74	11.70
609	40700	23.27	31.03	7.76
610	40725	23.11	34.15	11.04
611	40750	22.96	33.34	10.38
612	40775	22.95	32.31	9.36
613	40800	23.04	31.37	8.33
614	40825	21.71	29.02	7.31
615	40850	17.63	44.25	26.62
616	40875	15.12	51.18	36.06
617	40900	15.48	55.35	39.87
618	40925	14.31	55.98	41.67
619	40950	13.07	59.23	46.16
620	40975	14.36	58.75	44.39
621	41000	18.35	61.48	43.13
622	41025	13.97	56.45	42.48
623	41050	12.46	61.93	49.47
624	41075	13.39	64.85	51.46
625	41100	16.82	70.82	54.00
626	41125	13.37	64.47	51.10
627	41150	12.32	67.07	54.75
628	41175	13.82	72.15	58.33
629	41200	17.51	75.26	57.75
630	41225	14.05	71.84	57.79
631	41250	12.74	31.81	19.07
632	41275	14.15	35.72	21.57
633	41300	18.26	39.80	21.54
634	41325	13.98	33.17	19.19
635	41350	12.3	26.59	14.29

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
636	41375	13.26	28.81	15.55
637	41400	16.81	38.48	21.67
638	41425	12.61	32.94	20.33
639	41450	10.97	36.52	25.55
640	41475	11.75	35.05	23.30
641	41500	14.69	37.22	22.53
642	41525	15.17	37.14	21.97
643	41550	15.49	54.30	38.81
644	41575	15.74	53.33	37.59
645	41600	16	24.18	8.18
646	41625	13.25	20.57	7.32
647	41650	11.36	17.83	6.47
648	41675	11.24	17.30	6.06
649	41700	13.88	22.20	8.32
650	41725	11.46	18.19	6.73
651	41750	11.21	16.10	4.89
652	41775	11.79	15.38	3.59
653	41800	12	21.59	9.59
654	41825	17.11	32.69	15.58
655	41850	20.23	41.52	21.29
656	41875	20.82	47.33	26.51
657	41900	19.51	44.07	24.56
658	41925	21.11	43.57	22.46
659	41950	20.92	41.50	20.58
660	41975	18.28	35.95	17.67
661	42000	15.36	31.02	15.66
662	42025	17.55	31.57	14.02
663	42050	18.64	35.58	16.94
664	42075	17.53	35.76	18.23
665	42100	14.6	31.13	16.53
666	42125	17.42	34.47	17.05
667	42150	18.93	40.84	21.91
668	42175	17.61	41.01	23.40
669	42200	14.89	36.76	21.87
670	42225	16.28	36.88	20.60
671	42250	16.2	39.56	23.36
672	42275	14.45	35.44	20.99
673	42300	12.64	29.38	16.74
674	42325	12.69	30.88	18.19
675	42350	12.59	32.11	19.52

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
676	42375	12.55	32.14	19.59
677	42400	12.7	32.36	19.66
678	42425	12.49	32.22	19.73
679	42450	12.5	32.29	19.79
680	42475	12.51	32.33	19.82
681	42500	12.5	32.35	19.85
682	42525	13.89	33.76	19.87
683	42550	15.3	35.02	19.72
684	42575	16.92	35.18	18.26
685	42600	18.75	35.56	16.81
686	42625	15.96	31.32	15.36
687	42650	14.03	28.47	14.44
688	42675	11.55	28.94	17.39
689	42700	11.96	35.34	23.38
690	42725	10.27	44.39	34.12
691	42750	11.27	57.33	46.06
692	42775	11.06	69.45	58.39
693	42800	12.44	84.06	71.62
694	42825	11.4	101.48	90.08
695	42850	11.8	56.45	44.65
696	42875	12.55	48.44	35.89
697	42900	12.44	41.49	29.05
698	42925	16.43	54.64	38.21
699	42950	17.84	64.25	46.41
700	42975	16.37	65.23	48.86
701	43000	12.85	62.81	49.96
702	43025	16.62	68.21	51.59
703	43050	18.26	44.38	26.12
704	43075	17.36	40.85	23.49
705	43100	14.56	35.31	20.75
706	43125	17.39	40.15	22.76
707	43150	18.52	43.27	24.75
708	43175	17.51	33.44	15.93
709	43200	15.01	30.41	15.40
710	43225	17.2	35.20	18.00
711	43250	18.66	37.38	18.72
712	43275	19.11	35.57	16.46
713	43300	20.02	34.94	14.92
714	43325	15.37	28.42	13.05
715	43350	13.38	28.16	14.78

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
716	43375	14.41	32.36	17.95
717	43400	17.52	37.05	19.53
718	43425	14.1	32.22	18.12
719	43450	13.39	30.56	17.17
720	43475	15.18	38.43	23.25
721	43500	19.28	42.43	23.15
722	43525	14.51	36.27	21.76
723	43550	11.95	29.50	17.55
724	43575	12.14	29.31	17.17
725	43600	14.68	36.07	21.39
726	43625	11.48	35.01	23.53
727	43650	11.11	34.46	23.35
728	43675	13.39	36.53	23.14
729	43700	18.37	44.61	26.24
730	43725	17.75	45.17	27.42
731	43750	17.56	43.70	26.14
732	43775	17.57	40.14	22.57
733	43800	17.37	49.41	32.04
734	43825	16.25	46.88	30.63
735	43850	15.32	44.73	29.41
736	43875	15.21	41.01	25.80
737	43900	16.45	38.51	22.06
738	43925	12.31	31.21	18.90
739	43950	10.74	26.49	15.75
740	43975	11.87	24.48	12.61
741	44000	15.79	42.27	26.48
742	44025	16.14	40.56	24.42
743	44050	17.15	39.65	22.50
744	44075	17.62	38.28	20.66
745	44100	17.62	38.12	20.50
746	44125	22.3	22.30	0.00
747	44150	25.51	25.51	0.00
748	44175	26.64	26.64	0.00
749	44200	25.33	25.33	0.00
750	44225	25.99	25.99	0.00
751	44250	24.45	47.85	23.40
752	44275	20.89	47.86	26.97
753	44300	17.56	47.04	29.48
754	44325	20.88	50.75	29.87
755	44350	23.91	54.39	30.48

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
756	44375	25.27	56.59	31.32
757	44400	24.97	36.89	11.92
758	44425	23.61	35.27	11.66
759	44450	22.1	33.59	11.49
760	44475	20.68	32.08	11.40
761	44500	18.92	30.49	11.57
762	44525	18.4	30.31	11.91
763	44550	17.67	29.93	12.26
764	44575	16.8	29.40	12.60
765	44600	15.94	28.39	12.45
766	44625	14.74	26.64	11.90
767	44650	13.86	25.20	11.34
768	44675	13.41	24.20	10.79
769	44700	13.8	24.33	10.53
770	44725	11.94	22.47	10.53
771	44750	11.11	21.63	10.52
772	44775	10.94	21.47	10.53
773	44800	12.06	22.03	9.97
774	44825	12.15	22.53	10.38
775	44850	13.3	23.81	10.51
776	44875	15.58	25.25	9.67
777	44900	18.69	28.44	9.75
778	44925	16.39	24.36	7.97
779	44950	14.87	20.71	5.84
780	44975	14.43	14.68	0.25
781	45000	14	14.00	0.00
782	45025	15.27	15.27	0.00
783	45050	15.65	16.05	0.40
784	45075	15.09	16.83	1.74
785	45100	13.45	15.73	2.28
786	45125	15.07	16.66	1.59
787	45150	15.6	18.83	3.23
788	45175	15.29	20.98	5.69
789	45200	14.49	20.84	6.35
790	45225	14.03	18.76	4.73
791	45250	13.48	17.06	3.58
792	45275	12.88	15.29	2.41
793	45300	12.42	14.88	2.46
794	45325	11.41	14.41	3.00
795	45350	11.17	14.71	3.54

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
796	45375	11.38	15.46	4.08
797	45400	12.44	17.23	4.79
798	45425	10.89	16.59	5.70
799	45450	10.37	16.30	5.93
800	45475	10.86	15.38	4.52
801	45500	12.5	17.37	4.87
802	45525	13.65	19.41	5.76
803	45550	15.24	24.10	8.86
804	45575	16.98	22.78	5.80
805	45600	18.69	21.98	3.29
806	45625	16.99	18.61	1.62
807	45650	15.49	16.63	1.14
808	45675	13.8	14.83	1.03
809	45700	11.98	11.98	0.00
810	45725	13.41	13.41	0.00
811	45750	14.09	15.40	1.31
812	45775	13.97	16.97	3.00
813	45800	12.65	16.80	4.15
814	45825	14.17	17.41	3.24
815	45850	14.56	16.90	2.34
816	45875	14.02	18.11	4.09
817	45900	12.42	16.67	4.25
818	45925	14.03	17.97	3.94
819	45950	14.42	18.13	3.71
820	45975	13.91	17.39	3.48
821	46000	12.41	18.40	5.99
822	46025	14.34	21.67	7.33
823	46050	15.27	23.93	8.66
824	46075	15.02	25.02	10.00
825	46100	13.98	60.65	46.67
826	46125	14.05	57.66	43.61
827	46150	13.94	54.56	40.62
828	46175	13.98	15.71	1.73
829	46200	14	16.34	2.34
830	46225	14.51	16.76	2.25
831	46250	14.93	17.09	2.16
832	46275	15.34	17.41	2.07
833	46300	16	17.71	1.71
834	46325	19.52	20.78	1.26
835	46350	22.93	23.77	0.84

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
836	46375	26.94	27.37	0.43
837	46400	30.46	30.46	0.00
838	46425	26.43	26.43	0.00
839	46450	22	22.00	0.00
840	46475	18.11	18.11	0.00
841	46500	13.89	13.89	0.00
842	46525	15.79	15.79	0.00
843	46550	16.95	16.95	0.00
844	46575	16.24	17.41	1.17
845	46600	14.5	19.04	4.54
846	46625	17.83	27.99	10.16
847	46650	19.76	35.31	15.55
848	46675	20.23	41.08	20.85
849	46700	18.95	40.32	21.37
850	46725	19.59	38.58	18.99
851	46750	19.08	35.82	16.74
852	46775	18.22	32.78	14.56
853	46800	17.42	30.75	13.33
854	46825	17.27	29.37	12.10
855	46850	17.22	28.05	10.83
856	46875	17.34	26.90	9.56
857	46900	16.98	24.79	7.81
858	46925	16.89	22.74	5.85
859	46950	16.43	21.11	4.68
860	46975	16.02	20.35	4.33
861	47000	15.81	19.91	4.10
862	47025	16.51	20.43	3.92
863	47050	17.37	21.10	3.73
864	47075	18.05	21.44	3.39
865	47100	18.87	20.27	1.40
866	47125	20.22	20.22	0.00
867	47150	19.97	19.97	0.00
868	47175	17.92	17.92	0.00
869	47200	18.27	22.35	4.08
870	47225	18.68	26.88	8.20
871	47250	17.66	29.92	12.26
872	47275	15.97	29.87	13.90
873	47300	15.22	27.52	12.30
874	47325	14.33	24.59	10.26
875	47350	13.87	22.05	8.18

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
876	47375	14.93	19.65	4.72
877	47400	17.71	19.91	2.20
878	47425	20.48	22.46	1.98
879	47450	23.8	24.67	0.87
880	47475	24.21	24.21	0.00
881	47500	24.3	24.30	0.00
882	47525	24.22	24.22	0.00
883	47550	23.41	23.41	0.00
884	47575	20.83	20.83	0.00
885	47600	18.01	18.01	0.00
886	47625	15.08	15.08	0.00
887	47650	13.84	13.84	0.00
888	47675	13.41	13.41	0.00
889	47700	13.33	15.65	2.32
890	47725	12.86	17.29	4.43
891	47750	12.77	17.65	4.88
892	47775	12.49	17.83	5.34
893	47800	13.15	47.65	34.50
894	47825	13.81	46.55	32.74
895	47850	12.45	43.42	30.97
896	47875	11.94	41.12	29.18
897	47900	13.1	40.65	27.55
898	47925	14.04	44.61	30.57
899	47950	14.61	48.31	33.70
900	47975	16.73	53.70	36.97
901	48000	20	61.46	41.46
902	48025	16.73	30.77	14.04
903	48050	15.04	25.54	10.50
904	48075	14.61	21.56	6.95
905	48100	15.47	24.11	8.64
906	48125	17.63	27.81	10.18
907	48150	19.15	29.03	9.88
908	48175	17.7	27.30	9.60
909	48200	17.53	26.88	9.35
910	48225	16.28	22.50	6.22
911	48250	13.93	20.91	6.98
912	48275	12.71	20.85	8.14
913	48300	12.36	22.01	9.65
914	48325	12.28	22.45	10.17
915	48350	12.44	23.06	10.62

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
916	48375	14.71	26.50	11.79
917	48400	17.54	30.24	12.70
918	48425	20.71	34.31	13.60
919	48450	20.56	34.12	13.56
920	48475	19.53	31.12	11.59
921	48500	18.22	27.85	9.63
922	48525	19.95	29.12	9.17
923	48550	20.54	30.69	10.15
924	48575	20.24	33.78	13.54
925	48600	21.86	38.18	16.32
926	48625	23.08	40.48	17.40
927	48650	23.96	42.49	18.53
928	48675	23.44	40.75	17.31
929	48700	23.93	39.73	15.80
930	48725	24.15	64.51	40.36
931	48750	24.93	65.37	40.44
932	48775	26.7	67.21	40.51
933	48800	26.33	66.95	40.62
934	48825	26.07	66.94	40.87
935	48850	26.86	68.14	41.28
936	48875	24.68	68.10	43.42
937	48900	23.38	40.41	17.03
938	48925	22.77	32.97	10.20
939	48950	21.8	27.96	6.16
940	48975	22.15	27.16	5.01
941	49000	23.79	28.55	4.76
942	49025	21.66	27.47	5.81
943	49050	20.53	25.42	4.89
944	49075	19.42	22.36	2.94
945	49100	18.99	22.41	3.42
946	49125	18.74	25.23	6.49
947	49150	17.36	27.00	9.64
948	49175	16.92	30.40	13.48
949	49200	18.52	34.60	16.08
950	49225	18.4	37.00	18.60
951	49250	17.44	38.43	20.99
952	49275	20.04	38.63	18.59
953	49300	21.28	36.76	15.48
954	49325	20.33	32.76	12.43
955	49350	21.43	29.78	8.35

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
956	49375	22.18	32.48	10.30
957	49400	21.26	33.48	12.22
958	49425	21.35	34.25	12.90
959	49450	24.85	95.74	70.89
960	49475	26.38	102.20	75.82
961	49500	25.77	106.69	80.92
962	49525	23.64	32.31	8.67
963	49550	22.91	35.38	12.47
964	49575	23.11	37.09	13.98
965	49600	23.26	36.03	12.77
966	49625	23.55	35.16	11.61
967	49650	23.13	33.59	10.46
968	49675	23.38	32.74	9.36
969	49700	24.26	32.76	8.50
970	49725	25.17	32.80	7.63
971	49750	25.18	31.94	6.76
972	49775	21.31	28.25	6.94
973	49800	17.63	24.77	7.14
974	49825	13.66	20.98	7.32
975	49850	14.01	21.84	7.83
976	49875	14.73	23.34	8.61
977	49900	14.07	23.46	9.39
978	49925	30.29	40.74	10.45
979	49950	28.4	40.85	12.45
980	49975	25.08	37.82	12.74
981	50000	21.87	33.69	11.82
Catch Siding 1				
1	31550	37.34	59.61	22.27
2	31575	42.43	70.09	27.66
3	31600	49.66	82.74	33.08
4	31625	59.55	97.25	37.7
5	31650	72.46	114.32	41.86
6	31675	82.94	133.43	50.49
7	31700	94.84	153.52	58.68
8	31725	107.04	173.99	66.95
9	31750	119.25	193.48	74.23
10	31775	158.71	212.14	53.43
11	31800	182.16	192.99	10.83
12	31825	189.97	200.68	10.71
13	31850	195.58	206.37	10.79

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
14	31875	197.91	208.52	10.61
15	31900	196.7	207.03	10.33
16	31925	192.87	202.96	10.09
17	31950	165.62	244.53	78.91
18	31975	135.7	225.04	89.34
19	32000	129.22	208.86	79.64
20	32025	121.6	191.68	70.08
21	32050	113.11	174.29	61.18
22	32075	106.71	158.21	51.5
23	32100	102	143.53	41.53
24	32125	99.18	130.54	31.36
25	32150	98.22	118.98	20.76
26	32175	101.23	113.73	12.5
27	32200	95.65	11.66	-83.99
28	32225	92.84	115.66	22.82
29	32250	94.79	120.36	25.57
30	32275	98.94	125.92	26.98
31	32300	105.61	131.73	26.12
32	32325	126.82	136.56	9.74
33	32350	133.76	149.71	15.95
34	32375	140.78	162.41	21.63
35	32400	147.12	169.54	22.42
Catch Siding 2				
1	42850	86.58	134.42	47.84
2	42875	104.5	153.02	48.52
3	42900	122.79	171.17	48.38
4	42925	139.62	187.68	48.06
5	42950	154.31	232.53	78.22
6	42975	165.95	212.74	46.79
7	43000	177.41	221.49	44.08
8	43025	191.21	228.04	36.83
9	43050	195.93	232.54	36.61
10	43075	198.12	234.52	36.4
11	43100	196.86	233.63	36.77
12	43125	193.89	228.65	34.76
13	43150	189.67	221.99	32.32
14	43175	183.45	212.71	29.26
15	43200	173.01	195.2	22.19
16	43225	160.29	178.92	18.63
17	43250	145.78	164.46	18.68

S. No.	Chainage	Existing Distance	Proposed Distance	Difference between Ex. & Prop.
18	43275	129.78	149.71	19.93
19	43300	113.66	134.44	20.78
20	43325	98.8	12.49	-86.31
21	43350	85.95	110.67	24.72
22	43375	72.73	98.38	25.65
23	43400	61.78	80.85	19.07
24	43425	54.55	73.63	19.08
25	43450	49.91	60.07	10.16
26	43475	47.18	65.36	18.18
27	43500	46.38	63.87	17.49
28	43525	48.28	64.96	16.68
29	43550	52.63	68.79	16.16
30	43575	59.61	74.99	15.38
31	43600	69.06	83.59	14.53
32	43625	80.87	94.74	13.87

ANNEXURE –X

VEGETATION SURVEY

TREE COUNT IN THE AFFECTED CORRIDOR FROM CASTLE ROCK TO KULEM																		
Sample No.	From	To	GIRTH															
			0.30m to 1.0 m					1.1m to 2.0m						2.1m to 3.0m				
			Anjan	Kala	Nana	Katkatti	Beth	Anjan	Kala	Nana	Katkatti	Coconut	Pao	Anjan	Kala	Nana	Katkatti	Pao
KARNATAKA																		
1	26	26.5	22	2	19		3	11	6	17	5	2		4		5		
2	26.5	27	19	3	16		1	13	11	16	2	1		5		7	1	
TOTAL TREE COUNT BASED ON THE SAMPLING IN KARNATAKA																		
	25	30	102	13	95	0	11	60	43	81	18	8	0	21	0	30	3	0
																	TOTAL:	**485**
GOA																		
3	36	36.5	202	79	30	12		25	31	42	6	4	7	7	4	7	3	2
4	43	43.5	199	75	27	9	5	21	23	38	9	2	5	5	4	9	3	2
5	43.8	44	104	11	19	2	3	10	12	22	4		2	2	1	4	1	
TOTAL TREE COUNT BASED ON THE SAMPLING IN GOA																		
	30	51	3703	1213	561	171	46	410	484	746	139	49	99	101	68	146	51	27
																	TOTAL:	**8014**
TOTAL TREE COUNT BASED ON THE SAMPLING IN THE PROJECT AREA																		
	Km 25	Km 51	3805	1226	656	171	57	470	527	827	157	57	99	122	68	176	54	27
																	TOTAL:	**8499**