



## ABOUT ENGINEERING DEPARTMENT

### ➤ FUNCTIONS OF ENGINEERING DEPARTMENT

Engineering Department is responsible for

- Maintenance of Track, Bridges, Tunnels, Stations and other structures.
- Construction of new stations, additional loop lines and other structures.
- Construction of siding, Road Over bridges/Road Under Bridges etc.

### ➤ TRACK MAINTENANCE SYSTEM

The Track maintenance system on Konkan Railway is fully mechanised. The maintenance system can be broadly divided into 3 distinct tiers

- a) The top tier, which is the backbone of the maintenance system, comprises of 3 Track tamping machine for tamping the plain track and 2 Turnout tamping machine for tamping the points and crossings. The 3 Track tamping machines and 2 Turnout tamping machine is used for the tamping of entire length of 739.760 kms. and turnouts. Based on the Track Recording Car runs and Oscillation Monitoring System results, locations needing attention are identified and machines deployed to attend to these locations. Moreover systematic tamping of track is being done once in two years.
- b) The middle tier consists of Mobile Maintenance Gang (MMG) units, which are responsible for tamping of isolated spots, conventionally known as slack picking. For attending the track, there are 9 Rail Maintenance Vans (RMV), 1 under each Senior Section Engineer covering a jurisdiction of 70 – 80 kms for track maintenance. One mobile maintenance gang with 1 rail maintenance van is available under each Section engineer which moves over a jurisdiction of 80 kms. The gang comprises of 6 multi skilled men who are trained to attend isolated weld / rail fracture besides attending isolated spots for track maintenance. Photographs showing Rail Maintenance Van is available in Photo gallery.
- c) The bottom tier comprises of track maintenance and monitoring gangs under the Junior Engineer/Permanent way. Under each Junior Engineer, the track mobile maintenance gang carries out maintenance for a track



length of 30-40 kms with a gang strength of 12 trackmen. The maintenance gang moves over the entire jurisdiction and attends to isolated spots with off track tampers. The gang attends one or two spots every day for attention to bridge approaches, switch expansion joint, transition portion of curve, etc.

#### LEVEL CROSSINGS (LC)

There are total 90 Manned Level Crossings in Konkan Railway.

**There is no “Unmanned Level crossing”.**

#### ➤ **GEO-TECH SAFETY WORKS OF CUTTINGS AND TUNNELS**

Konkan Railway is passing through a difficult terrain and on one side of the alignment is in the Western coastline of India and to the east of the line is the Western ghat having a long mountain range. KRCL is having an intensive rainfall averaging nearly 3500 – 4000mm per annum and its intensity frequently exceeds 50mm per hour. The strata in which the line is constructed is of lateritic soil, boulder mixed with soil and jointed basalt rock. There are 91 tunnels with a total cumulative length 84.496 kms and 564 cuttings with a cumulative length of 226.71 kms.

Cuttings are of depth varying from 10 to 45 m. In this the top layer is of lateritic soil with depths varying from the top and basalt rock strata at the bottom. In few cuttings a red bole zone exists between these two layers. Laterite is of reddish brown colour due to presence of Iron Oxides. They are very porous and permeable. Due to very high precipitation in Konkan Region, seepage of water takes place in cuttings and laterite soil absorbs water, which increases its density but decreases its shear strength. Also the presence of clay material below the top hardened lateritic mass weakens the cutting when it absorbs the water resulting in slope failure and soil slips.

The lateritic rocks, with the leptomargic clay combinations are undergoing constant geological change, and the experience has been that the slopes are turning out to be unstable under the heavy rainfall condition.

A committee consisting of three Senior Officers are inspecting the cuttings and tunnels annually and making their recommendations for works to be taken up. Sectional Engineers and Assistant Engineers are regularly inspecting their sections and maintaining a list of all vulnerable locations and monitoring their behavior throughout the year. In addition, a team of Research Design and Standard Organization (RDSO) of Indian Railway have also inspected the cuttings and made their recommendations. Based on the recommendations of the above committee/team, essential works have been identified and completed.



Various geo-tech safety works completed for stabilization of cuttings/tunnels are

During the last 20 years number of boulder falls / soil slips in cuttings are as below :

1998 – 1999	110 nos.
1999 – 2000	132 nos.
2000 – 2001	123 nos.
2001 – 2002	44 nos.
2002 – 2003	29 nos.
2003 – 2004	71 nos.
2004 – 2005	35 nos.
2005 – 2006	66 nos.
2006 – 2007	13 nos.
2007 – 2008	26 nos.
2008 – 2009	12 nos.
2009 – 2010	08 nos.
2010 – 2011	17 nos.
2011 – 2012	10 nos.
2012 – 2013	05 nos.
2013 – 2014	05 nos.
2014 – 2015	02 nos.
2015 – 2016	00 no.
2016 – 2017	03 nos.
2017 – 2018	03 nos.
2018 – 2019	03 no.
<b>TOTAL</b>	<b>717 nos.</b>

- FLATTENING OF CUTTING SLOPES, CONSTRUCTION OF TOE WALL, BALLAST RETAINING WALL, LINING OF CATCH WATER DRAINS.



During construction, the cuttings were very hard and required blasting and slope was found to be adequate. However, once exposed to repeated cycles of heavy rains and seismic activities and weathering action, the internal characteristics of

soil and boulder interface underwent changes which made the slopes vulnerable to failures. The only solution is providing proper slopes to the cuttings Therefore as a permanent measure, the existing cutting slopes are flattened.

- PREVENTING SOIL EROSION.

After carrying out flattening of cutting slope in soil to 1:1 with 4 to 6 m wide berms at every 6 to 8 m height, grass plantation with locally available grass or vetiver grass is planted on the slopes to prevent soil erosion.

- PROVISION OF STEEL BOULDER NET.

Boulder netting is a boulder fall protective measure adopted. There are many instances where the loose boulder were trapped in the boulder net preventing accidents. Photographs showing boulder trapped in boulder net is available in Photo gallery.

- PROVISION OF ROCK BOLTING.

Rock bolting has been completed in tunnels to anchor loose boulders to the parent rock and prevent them from falling. In this system, rock failures are prevented through the tensile loading of pattern bolts, thereby, placing the rock strata under compression and preventing the development of tension in weak rock strata. Photograph showing Rock bolting is available in Photo gallery.

- PROVISION OF SHOTCRETING.

Shotcreting work has been completed in tunnels to arrest the boulder falls. This is a very effective rock support system. This is highly economical compared to conventional steel support or concrete lining. When shotcrete is spread / applied with pressure on the jointed / fractured rock strata, it fills the openings like cracks, fissures, joint planes and helps in minimizing the rock displacement by way of rock mass. Photograph showing Shotcreting is available in Photo gallery.

- PROVISION OF GABION WALL.

Gabion walls have been used as retaining walls. A Gabion is a box of steel mesh which is filled with boulders and placed side by side and these are tied together to make a wall. The advantage of gabion wall is that it is totally permeable and therefore hydrostatic pressure does not build up behind the retaining wall. Photograph showing Gabion wall is available in Photo gallery.



- ABSTRACT OF VARIOUS GEO-TECH SAFETY WORKS COMPLETED IN CUTTINGS AND TUNNELS IS AS UNDER.

Sr.NO	Item of work	Quantity
1	Flattening of slope & creation of berms	9309344 Cum
2	RCC Retaining Wall	33222 Cum
3	Gabion Wall	39124 Cum
4	Micro piling	56944 Rmt
5	Catch water drain (CWD) lining	34303 Cum
6	Shotcreting of Tunnels	783018 Sqm
7	Rock Bolting of Tunnels	2062.26 MT
8	Soil nailing	42358 Rmt
9	Boulder netting	1216000 Sqm

- ABSTRACT OF YEARWISE EXPENDITURE ON GEO-TECH SAFETY WORKS

Year	Approximate Expenditure (₹ in Crores)
1999-2000	3.45
2000-01	6.63
2001-02	8.35
2002-03	5.20
2003-04	23.68
2004-05	33.64
2005-06	21.60
2006-07	29.96
2007-08	35.16
2008-09	32.48
2009-10	26.39
2010-11	18.80
2011-12	20.46
2012-13	26.02

Year	Approximate Expenditure (₹ in Crores)
2013-14	17.13
2014-15	8.17
2015-16	4.58
2016-17	0.59
2017-18	0.52
2018-19	0.15
<b>TOTAL -</b>	<b>322.96</b>

➤ **TRAFFIC FACILITY WORKS AND OTHER WORKS COMPLETED**

Sr. No	Details of works	Works completed
1	Commissioning of New crossing stations	Zarap between Kudal and Sawantwadi stations. Vinhare between Karanjadi and Diwankhavati stations. Nandikur between Padubidri and Mulki stations. Madure between Sawantwadi and Pernem stations and Loliem between Cancona and Asnoti stations.
2	Commissioning of New halt stations	Sape-Wamne between Veer and Karanjadi stations. Chitrapur between Murudeshwar and Bhatkal stations and Innanje station between Udupi and Padubidri stations. Veravali station between Adavali and Vilavade stations. Saundal station between Vilavade and Rajapur road stations.
3	Commissioning of additional Passenger loop lines at stations	Kolad, Karanjadi, Kamathe, Aravali Rd, Nivsar, Vilavade, Nandgaon, Kankavali, Sindhurg, Sawantwadi, Thivim, Karmali, Madgaon, Balli, Ankola, Surathkal and Thokur.
4	Commissioning of Goods loop lines at stations	Ratnagiri, Sawantwadi and at Verna
5	Commissioning of new sidings	Udupi Power Corporation Limited at Nandikur and by pass at Thokur. MMLP for CONCOR at Balli.

Sr. No	Details of works	Works completed
6	Improvement of Riding Quality of track	Member Engineering, Railway Board and Commissioner of Railway Safety during their various inspections have appreciated the good riding quality and well maintenance of track
7	Others	<ol style="list-style-type: none"> <li>1. Construction of coal siding at Ratnagiri completed &amp; commissioned on 15<sup>th</sup> March'13.</li> <li>2. Extension of ballast siding at Sindhudurg completed &amp; commissioned on 31<sup>st</sup> March'13.</li> <li>3. Commissioner of Railway Safety inspection conducted on 12<sup>th</sup> and 13<sup>th</sup> April 2018. Speed run was conducted. CRS has remarked that the running during speed run was good.</li> </ol>

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