Proposal for Amendment in Environmental Clearance for Continuation of Ore Transportation by Road applied under para 7 (ii) of EIA Notification, 2006

Dhobil Iron Ore Mining Project
of
M/s Steel Authority of India Limited (SAIL)

At Manoharpur Block, West Singhbhum, Jharkhand

Capacity : 0.75 million tonnes/year
Mine Lease Area: 513.036 ha

Enclosures:

- Pre Feasibility Report
- Environmental Study Report

November, 2016

Project Proponent

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CERTIFICATE NO: NABET/EIA/1417/SA 007

Updated Pre-Feasibility Report
for
Amendment in Environmental Clearance for Continuation of Ore Transportation by Road

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Environmental Clearance granted vide letter no. J-11015/251/2009–IA.II (M) dated 24.01.2012 with subsequent modification dated 01.05.2012

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EXECUTIVE SUMMARY

Steel Authority of India Limited (SAIL), a Maharatna public sector undertaking under Ministry of Steel, Government of India, is the leading steel maker in the country and is having Integrated Steel Plants at Bokaro, Durgapur, Rourkela, Bhilai & Burnpur; Special Steels Plants at Bhadrawati, Durgapur & Salem and a Ferro-alloys Plant at Chandrapur. Also, SAIL is the second largest metalliferous mining outfit in the country with mines spread over the states of Jharkhand, Orissa, Chattisgarh and Madhya Pradesh. These mines are operated as captive sources of raw materials for its integrated steel plants.

One of iron ore leases of SAIL is the Dhobil lease hold covering 513.036 ha under Manoharpur Ore Mines (MOM), Chiria located in Ankua Division of Saranda Reserve Forest in West Singhbhum District of Jharkhand. The Dhobil Iron Ore Mine is presently having capacity of 0.75 million tonnes per year (MTPA). Ore from Dhobil mines is transported by road to the railway siding, which is located approx. 31 km at Manoharpur, and loaded into railway wagons for dispatch. The ore transportation stretch is the only route for ore transportation from the mine lease.

The Dhobil Iron Ore Mining Project of SAIL was granted environmental clearance vide MoEFCC's letter No. J-11015/251/2009–IA.II (M) dated 24th January, 2012 for production of 0.75 million tonnes per year (MTPA) of iron ore involving mine lease area of 513.036 ha, which interalia stipulated [Specific Condition – (v)] to obtain prior environmental clearance from the Standing Committee of the National Board for Wildlife before starting any activity relating to the project at site. This condition was subsequently modified by MoEFCC vide even letter dated 01.05.2012. Subsequent to the modification of the EC, the Consent to Establish and Consent to Operate were issued by Jharkhand State Pollution Control Board (JSPCB), Ranchi on 18.05.2012 and 02.06.2012 respectively and then the project has started the dispatch of iron ore from Dhobil Lease by road started w.e.f. 07.06.2012.

With respect to road transportation, it may be mentioned that in the preamble of the above referred EC letter, under point 4, a reference has been made to the commitment made by SAIL that the ore transportation by road will be undertaken only for five years and thereafter it will be by conveyor only. This point was mentioned as it was envisaged to develop Manoharpur Ore Mines to a fully mechanized mine along with construction of a state of the art conveyor system from mines to siding for evacuation of ore.

With regards to development of Mines, there is a plan to develop a fully mechanized open cast mines covering the four mine leases i.e. Ajitaburu, Budhaburu, Dhobil & Sukri. Under capacity expansion plan, it has been planned to have a common Crushing & Screening Plant having a capacity of 7.0 MTPA ore production and the associated infrastructure facilities like beneficiation, blending, stockpiling, railway sidings, tailing ponds etc., planned in the non-forest land i.e. at Patherbasa near Manoharpur, which is about 15 km away from the mines. Evacuation of ore from the mines to Patharbasa has been envisaged through Long Distance Belt Conveyor (LDBC). However, selecting the proper technology for LDBC was a technical challenge to SAIL considering the hillocks &highly undulating terrain varying topography ranging from 620m to 240 m AMSL in between the mines and Patherbasa and considering the SAIL's objective of minimum forest diversion & least disturbance to wildlife. In order to select the best technology, SAIL has consulted reputed national & international consultants and a direct route along crow-fly distance with a conveyer length of 6.314 km Rope-Con technology (recommended by M/s Hatch, Australian Consultant) is under consideration for evacuation of ore from the mines. Based on the route so considered, a proposal for obtaining Forest Clearance for 17.24 ha forest land involved in the evacuation of ore through LDBC was submitted to Jharkhand State Forest Deptt. on 31st May, 2014, which is under consideration at State Level.

Implementation of the envisaged Chiria Development plan along with the evacuation of ore through LDBC could be undertaken only after grant of forest clearance. It is expected that it may take about 5 years to develop common processing and beneficiation facilities including installation and

commissioning of the LDBC Conveyor system for evacuation of ore. In the meantime, the prescribed time limit of five years for ore transportation by road for Dhobil Iron Ore Mine is expiring on 06.06.2017.

However, in order to ensure transportation of ore from Dhobil Lease, it is proposed to continue the ore transportation through road for a further period of five years beyond June, 2017 to maintain uninterrupted supply of iron ore to the steel plants of SAIL. In the present proposal, it is requested to allow continuation of ore transportation through road for another 5 year. There will be no change from existing ongoing mining and ore transportation activities and thus it is not expected to bring any additional load on the local road infrastructure and also in the air quality of the area. Accordingly, SAIL is submitting herewith an application under para 7 (ii) of EIA Notification, 2006 for allowing continuation of transportation of ore by road for another 5 years beyond June, 2017, for Dhobil Iron ore Mining Project.

Though there is no change in existing ongoing mining and ore transportation activities, in order to assess the existing environmental quality as well as traffic load on the roads, and likely impacts, if any, on the road infrastructure & air quality of the area, due to the continuation of ore transport by road, specific environmental studies viz., Traffic Density Study and Air Quality Impact Predication Study have been carried out and observed from the report that adequate road capacity is available to continue ore transportation by road without adversely affecting the existing available road infrastructure. Further, the air quality impact predication also shows the quality of air within the permissible limit.

The salient features of the project include:

Proposal	Amendment in the Environmental Clearance dated 24.01.2012 and subsequent modification dated 01.05.2015 accorded by MoEFCC with respect to ore transportation mode - requesting to allow continuation of ore transportation through road for another 5-year.
Location of Mine	Dhobil village, Manoharpur Block, West Singhbhum, Jharkhand
Latitude	$22^0$14'57.3" N to $22^0$16'15.8" N
Longitude	$85^0$16'5.6" E to $85^0$17'25.3" E
Area Involved	513.036 ha
Land Ownership	Entire ML in Forest block of Ankua of Saranda Forest Division. FC obtained.
Processing Capacity	0.75 Mt/yr iron ore
Life of Mine	~42
Waste generation	3125 m^3/month
Method of Mining	Open Cast Mechanized Mining
Mineral Transport	Ore transportation by truck (10 & 16 t capacity). The transportation route (~31 km) passes through Ankua Reserve Forest, road connecting Rourkela-Manoharpur and dedicated branch road towards Manoharpur railway.
Number of working days	300 days
Raw Material	HSD: 1545 kl/yr; Explosive: 82.50 t/yr
Water Demand	111 m^3/d (peak demand)
Source of water	Chiria Spring/ Hamsada Nala (~3 Km away)
Man Power	992 persons
Electricity Demand	0.01 MW
Infrastructure	All necessary infrastructures and statutory facilities viz. mine office, rest shelters, canteens, workshop, stores, First Aid center vocational training center, railway siding and other required infrastructures has been made available at mine site. The Chiria township has residential houses, schools, banks, post offices, medical facilities etc.
Cost	Rs. 1990 per tonne of ore including transportation & royalty
CSR Budget	Rs.83.75 lakhs

1.0 INTRODUCTION

Steel Authority of India Limited (SAIL), a Maharatna public sector undertaking under Ministry of Steel, Government of India, is the leading steel maker in the country and is having Integrated Steel Plants at Bokaro, Durgapur, Rourkela, Bhilai & Burnpur and Special Steels Plants at Bhadrawati, Durgapur & Salem and a Ferro-alloys Plant at Chandrapur. Also, SAIL is the second largest mining outfit in the country with mines spread over the states of Jharkhand, Orissa, Chattisgarh and Madhya Pradesh. These mines are operated as captive sources of raw materials for its integrated steel plants. The mines located in Jharkhand, Odisha and Madhya Pradesh are managed by Raw Materials Division (RMD) of SAIL. RMD was formed in 1989 with an aim to achieve self-sufficiency in quality iron ore.

One of iron ore leases under SAIL is the Dhobil Iron Ore Mining Leasehold area (513.036 ha) which is being operated under Manohharpur Ore Mines (MOM), Chiria, located in West Singhbhum district, Jharkhand. Besides Dhobil Mining Lease, there are another five mining leases under Manoharpur Ore Mines i.e. Ajitaburu 323.887 ha, Mclellan (Budhaburu) 823.617 ha, Sukri-LuturBuru 609.554 ha, Ankua 67.178 ha and Tatiburu 38.85 ha covering total mining lease area of 2376.122 ha. The Dhobil Mine is a mechanized opencast iron ore mine situated within Ankua Reserve Forest of Saranda Forest division in West Singhbhum District of Jharkhand.

Dhobil Iron Ore Mining Project of SAIL was granted Environmental Clearance (EC) vide MoEFCC's letter No. J-11015/251/2009–IA.II (M) dated 24th January, 2012 for production of 0.75 million tonnes per year (MTPA) of iron ore involving mine lease area of 513.036 ha. Later on, the EC condition given in point (v) under specific condition was modified on 1st May, 2012. In the preamble of the above referred EC letter, under point 4, a reference has been made to the commitment made by SAIL that the ore transportation by road will be undertaken only for five years and thereafter it will be by conveyor only.

Subsequent to the issue of modified EC grant order, Jharkhand State Pollution Control Board (JSPCB), Ranchi has granted Consent to Establish and Consent to Operate on 18th May, 2012 and 2nd June, 2012 respectively. After obtaining all the required clearances, transportation of iron ore was by road initiated on 7th June, 2012 from Dhobil Lease. The road transportation is the only way of evacuation of ore from mines to railway siding, which is located ~31 km at Manoharpur.

The Manoharpur Ore Mines, Chiria is planned to be develop as a fully mechanized open cast mines covering the four mine leases i.e. Ajitaburu, Budhaburu, Dhobil & Sukri. Under capacity expansion plan, it has been planned to have a common Crushing & Screening Plant having a capacity of 7.0 MTPA ore production and the associated infrastructure facilities like beneficiation, blending, stockpiling, railway

sidings, tailing ponds etc., planned in the non-forest land i.e. at Patherbasa near Manoharpur, which is about 15 km away from the mines. This has been planned in compliance with the direction of MoEFCC to minimize the involvement of forest land in the project.

In order to bring ore from mines to Patherbasa, evacuation of ore has been planned through Long Distance Belt Conveyor (LDBC) which will be starting from Ajitaburu and ending in Patherbasa. However, selecting the proper technology for LDBC was a technical challenge to SAIL considering the hillocks & highly undulating terrain varying topography ranging from 620 m to 240 m AMSL in between the mines and Patherbasa and considering the SAIL's objective of minimum forest diversion & least disturbance to wildlife. In order to select the best technology, SAIL has consulted reputed national & international consultants and a direct route along crow-fly distance with a conveyer length of 6.314 km Rope-Con technology (recommended by M/s Hatch, Australian Consultant) is under consideration for evacuation of ore from the mines.

Based on the route so considered, a proposal for obtaining Forest Clearance for diversion of 17.24 ha of forest land for installation of LDBC was submitted to Jharkhand State Forest Deptt on 31st May, 2014. Further, as directed by DFO, Saranda, online Diversion Proposal was submitted on 5th March, 2016, which is under consideration at State Level but Stage-1 Forestry Clearance is yet to be granted.

However, implementation of the envisaged Chiria Development plan along with the evacuation of ore through Long Distance Belt Conveyor (LDBC) is being delayed due to non-availability of statutory forest clearances. Stage-I FC was granted by the MoEFCC vide letter dated 07.03.2011 for diversion of 595.075 ha of forest land under the leases over the total area of 2376.122 ha for development of Chiria. The report on compliance of Stage-I FC conditions submitted to State Forest Department was forwarded by the State Govt. to MoEFCC with recommendations for grant of Stage-II FC on 22.09.2014. Proposal was pending with MoEFCC for grant of Stage-II, the MoEFCC asked the Regional Office of MoEFCC for site inspection of Chiria leases vide letter dated 21st April 2015 to rule out any violation of provisions of Forest (Conservation) Act, 1980. The site inspection was conducted by CCF (Central), Eastern regional Office of MoEFCC during the period 25-26th June 2015 and report was submitted to MoEFCC on 24th July 2015. The proposal for grant of Stage-II FC is pending with MoEFCC.

It may be mentioned that the construction of LDBC could be undertaken only with expansion project of mines and the same is possible only after grant of forest clearance for both Ajitaburu Lease and for Evacuation Corridor (through which LDBC passes). The construction of LDBC can't be undertaken without grant of Stage-2 FC and it is also estimated that it may take about 5 years to develop a

fully mechanized mines at Chiria including installation & commissioning of the LDBC Conveyor system for evacuation of ore. Meanwhile, SAIL upon receiving these necessary clearances, started the dispatch of iron ore from Dhobil Lease by road from 07.06.2012 thereby the initial 5-year road transportation is valid till 06.06.2017.

In view of above, SAIL is planning to continue the ore transportation through road for another five year to maintain uninterrupted supply of iron ore to it's steel plants. In line with this, SAIL is submitting an application for amendment of the Environmental Clearance for extension of permission for transportation of ore by road for another 5 years under para 7 (ii) of EIA Notification, 2006 for Dhobil Iron ore Mining Project. The Dhobil Iron Ore Mining lease is Category-A project as per EIA Notification–2006 and amendments thereof.

As part of the process for amendment of Environmental Clearance for the project, SAIL is submitting an online application to MoEFCC in the prescribed format (Form I) along with a Pre-Feasibility Report, Environmental Study Report and filled-in proforma for environmental appraisal for mining project. This Pre-Feasibility Report contains information on the proposed project which includes the following:

- Introduction of the Project / Background Information
    - Identification of the Project and the Project Proponent
    - Brief Information of the Project
    - Need for the Project and its Importance to the Country or Region
    - Demand and Supply
    - Import vs. Indigenous Production
    - Export Possibilities
    - Domestic / Export Market
    - Employment Generation
- Project Description
    - Type of Project including Interlinked and Interdependent Project
    - Location
    - Details of Alternate Site
    - Size and Magnitude of Operation
    - Mine Description
    - Mineral Transport
    - Life of the Project
    - Raw Materials
    - Resource Optimization / Recycling and Resource
    - Site Services
    - Wastes
- Site Analysis
    - Connectivity
    - Land Form, Land Use, Ownership

- Land use
- Existing infrastructure
- Soil classification
- Climate
- Social infrastructure available

- Planning Brief
  - Planning Concept
  - Land Use Planning
  - Assessment of Infrastructure Demand
  - Amenities / Facilities
- Proposed infrastructure
- Resettlement and Rehabilitation Plan
- Project Schedule and Cost Estimate
- Analysis of Proposal (Final Recommendation)

ACKNOWLEDGEMENT

MECON wishes to place on record its deep appreciation for the trust reposed in MECON by SAIL and for the active interest and help extended by SAIL officials.

2.0 INTRODUCTION OF THE PROJECT / BACKGROUND INFORMATION:

2.1 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT:

Steel Authority of India Limited (SAIL), a Maharatna public sector undertaking under Ministry of Steel, Government of India, is the leading steel maker in the country and is having integrated steel plants at Bokaro, Durgapur, Rourkela, Bhilai & Burnpur and Special Steels Plants at Bhadrawati, Durgapur & Salem and a Ferro-alloys Plant at Chandrapur. Also, SAIL is the second largest mining outfit in the country with mines spread over the states of Jharkhand, Orissa, Chattisgarh and Madhya Pradesh. These mines commenced their operations as captive sources of raw materials for its integrated steel plants.

One of iron ore leases under SAIL is the Dhobil Iron Ore Mining Leasehold area under Manoharpur Ore Mines covering an area of 513.036 ha. This mine is located in Ankua Reserved Forest of Saranda Forest Division of Singhbhum West district of Jharkhand. The lease was granted for a period of 30 years i.e. from 08.03.1948 to 07.03.1978. The first lease renewal was also granted by the State Govt. and lease deed executed on 06.04.1980 for the period of 20 years i.e. 08.03.1978 to 07.03.1998. Application for 2nd renewal was submitted to Sate Govt. on 06.03.1997 for period of 20 years i.e. from 08.03.1998 to 07.03.2018. Govt. of Jharkhand vide letter dated 22.10.14 imposed some pre-conditions, for second renewal of Dhobil Lease as well as another lease of SAIL i.e. Durgaiburu Lease under Gua Ore Mines, which were challenged by SAIL before the Hon'ble High

Court of Jharkhand at Ranchi. The Durgaiburu lease matter was heard by the Hon'ble High Court, Jharkhand, Ranchi on 27.06.2016 and the court has quashed the conditional order for 2nd renewal issued by Government of Jharkhand and also directed the State Govt. to take action as per the provisions of MMDR Amendment Act, 2015 and Mineral (Mining by Government Company) Rules, 2015 (MMGC Rules, 2015). The Dhobil matter is pending at High Court of Ranchi and is expected to be disposed in line with the Durgaiburu Case.

The Environmental Clearance (EC) for Dhobil mine was accorded by Ministry of Environment, Forest and Climate Change (MoEFCC) for a production capacity of 0.75 Mt/yr from 513.036 ha lease area vide letter No. J-11015/251/2009-IA.II (M) dated 24.01.2012 with subsequent modification dated 1st May, 2012.

The Mining Plan the Dhobil Mining Lease for 2nd renewal period was approved by IBM vide No. CAL/SB/Fe/MP-534, dated 28.10.1998 and the Scheme of Mining for the period from 2013-14 to 2017-18 was also approved by IBM vide no. 314(3)/2012-MCCM(CZ)/S-58/310 dated 06.09.2013.

2.2 BRIEF INFORMATION OF THE PROJECT:

The present proposal is "Category A" project and falls in Sl.no. 1(A) (i) of Schedule: "List of projects or activities requiring prior Environmental Clearance" of MoEFCC Notification dated 14th September, 2006 and amendments thereon. Environmental Clearance for Dhobil mines was granted by MoEFCC vide No. J-11015/251/2009-IA.II(M) dated 24.01.2012 and subsequent modification 1st May, 2012 for 0.75 Mt/yr iron ore production with lease area measuring 513.036 ha. In the EC letter vide point no. 4 (of preamble of EC letter) based on the SAIL's commitment, it was stated that the ore transportation will be undertaken by road for initial five year only and after that conveyor system will be used for ore transportation. The statement in EC letter follows as

"Point 4: The mine working will be opencast by mechanized ……. ***It was committed by proponent that ore transportation by road will be undertaken only for five years and thereafter it will be by conveyor only***. The topography of the area is …… lease period."

As per the commitment and compliance to the stipulated conditions in both Environmental Clearances and Forest Clearance, SAIL has planned to set-up various infrastructure facilities like beneficiation, blending, stockpiling, railway sidings, tailing ponds etc., in the non-forest land i.e. at Pathrbasa near Manoharpur, which is about 15 km away from the Chiria. Evacuation of ore from mines to Patharbasa through Long Distance Belt Conveyor has also been envisaged under the plan. The highly undulating terrain varying topography ranging from 620 to 240 m AMSL in between the mines and Patharbasa with hillocks in between them, has become a challenge for SAIL in respect of selection of route & conveyor technology for

evacuation of ore with minimum forest diversion and least disturbance to wildlife. After detailed studies in consultation with reputed national & international consultants, a direct route along crow-fly distance with a conveyer length of 6.314 km RopeCon technology (recommended by M/s Hatch, Australian Consultant) for evacuation of ore from the mines has been selected. Diversion Proposal for obtaining Forest Clearance for evacuation of ore through LDBC has already been submitted on 31.05.2014 and is under consideration at State Level.

However, implementation of the envisaged Chiria Development plan along with the evacuation of ore through Long Distance Belt Conveyor (LDBC) is being delayed due to non-availability of statutory forest clearances and land acquisition. It is expected that about 5 years will take to develop common processing and beneficiation facilities including installation and commissioning of the LDBC Conveyor system for evacuation of ore from the Manoharpur Ore Mines.

Moreover, the 5 year validity of ore transportation through road is expiring. In order to ensure continual supply of iron ore to the Steel plants, **SAIL is intended to continue existing ore transportation by road for another 5 year similar to the ongoing practice without any change in other EC conditions**.

The present proposal is an application for amendment of EC for allowing ore transportation by road for another 5 years under para 7 (ii) of EIA Notification, 2006 for Dhobil Iron ore Mining Project.

At present Dhobil mines measuring an area of 513.036 ha is in operation with rated capacities of 0.75 Mt/yr. The iron ore from Dhobil mine is transported to the steel plants of SAIL via. Manoharpur railway siding. At present, the ore is being transported through road by 10t and 16t capacity trucks from mines to Manoharpur railway siding. The transportation route passes through Ankua Reserve Forest and road connecting Rourkela-Manoharpur covering total road distance of ~31 km.

In the present proposal, there will be no change from existing ongoing mining and ore transportation activities and thus it is not expected to bring any additional load on the local road infrastructure and also in the air quality of the area. Specific Environmental Study Report (includes Traffic Density Study & air quality impact predication study) and proforma for environmental appraisal for mining project have been prepared and have been submitted separately along with this report. It has been observed that the road capacity is adequate enough to allow continuation of ore transportation through road for another 5 year. Further, the air quality impact prediction also shows that the impact on the quality of air due to ongoing mining activities and ore transportation through road is within the permissible limit and is within the assimilative capacity of the area.

The present proposal will facilitate continuous supply of adequate quantity and consistent quality of iron ore from Dhobil mines to SAIL plants. This project will continue to provide much needed employment to the local people. Economy of the area will continue to facilitate the overall growth of the region in terms of education, health, training, transport etc. The local people's standard of living is will further improve.

2.3 NEED FOR THE PROJECT AND ITS IMPORTANCE TO THE COUNTRY OR REGION:

SAIL's modernization & expansion program has increased hot metal production capacity to 23.2 Mt/yr. Further, SAIL is also working on long term strategic plan "VISION 2025", which will steer the company towards a target of 50 Mt/yr hot metal production in line with the our country's vision of enhancing steel-making capacity to 300 Mt/yr by 2025. Iron ore is one of the key inputs for hot metal production, therefore continuous supply of quality iron ore from mines is a pre-requisite for the success of the expansion & modernization programme. Plant-wise hot metal production & iron ore requirement for SAIL steel plants of Eastern Sector is given below

Table 1: Plant-wise hot metal production & iron ore requirement

Steel Plant	Hot metal production, Mt/yr	Iron ore requirement, Mt/yr
Bokaro Steel Limited (BSL)	5.80	10.73
Durgapur Steel Plant (DSP)	2.50	4.63
Rourkela Steel Plant (RSP)	4.50	8.33
IISCO Steel Plant (ISP)	2.90	5.37
Total	**15.70**	**29.06**

Entire iron ore requirement of SAIL's steel plants of eastern region is being met from mines located in Jharkhand and Odisha viz Kiriburu, Meghahataburu, Gua, Chiria, Barsua, Taldih, Kalta & Bolani iron ore mines. Raw Materials Division (RMD) of SAIL operate these mines and have planned to augment the production and infrastructure facilities of its mines commensurate with SAIL's corporate plan. The capacity expansion envisages enhancement of mining capacity and also upgradation of existing processing plant and/or addition of new units so that the mining complexes are capable to supply required quantity and quality of product viz. ore, ore concentrate and pellets.

Considering the high grade & consistent quality of the iron ore from the Dhobil mine, the iron ore is mainly being supplied to new large capacity furnaces commissioned at IISCO Steel Plant (ISP), Burnpur and Rourkela Steel Plant (RSP) under the ongoing modernization and expansion programme in eastern region as per the requirement. In order to meet the consistent quality of iron ore requirement for the new blast furnaces at ISP and RSP, it is essential to operate

and supply iron ore from Dhobil mine. The project will not only help in continual supply of iron ore to steel plants of SAIL but also help in the overall growth of the region.

2.4 DEMAND AND SUPPLY GAP :

The major usage of iron ore in India is for manufacturing of steel. The major iron ore producing states are Odisha, Jharkhand, Chattisgarh, Karnataka and Goa. India is world's 4th largest iron ore producer and 3rdexporter after Australia and Brazil.

SAIL is implementing its growth plan to enhance hot metal production capacity. In order to meet enhanced requirement of iron ore, production capacity of existing mines at Gua, Bolani, Chiria, Kiriburu, Meghahatuburu, Barsua and Kalta is being expanded to its maximum potential and new mines are also planned to be developed.

Iron ore produced from SAIL's captive mines are used up in the company's steel plants. SAIL's steel plants are being modernized and expanded. The continuation of the present proposal for iron ore production from Dhobil mines will help SAIL to facilitate its increased iron ore requirement.

2.5 IMPORT VS INDIGENOUS PRODUCTION :

Briefed in clause 2.3 and 2.4 above.

2.6 EXPORT POSSIBILITIES :

Iron ore produced from this project will be entirely consumed in SAIL's plants. There is no proposal for export of iron ore from this project.

2.7 DOMESTIC / EXPORT MARKET:

Refer clause 2.6 above.

2.8 EMPLOYMENT GENERATION:

At present, 992 persons (74 regular and 918 contractual) persons are employed at Dhobil Iron Ore Mine. Most of the workers in the mine are from local residents (30 of the regular employees and 815 of the contractual employees are local resident). The officers, supervisors and rest of the workers are housed at SAIL's township at Chiria (~8 Km road distance from mines).

3.0 PROJECT DESCRIPTION

As stated above, Dhobil mine lease is a captive Iron Ore Mine of Raw Materials Division of SAIL and is the supplier of iron ore to SAIL steel plants.

Dhobil mine lease measures 513.036 ha and the entire lease area falls in Ankua Reserve forest. Environmental Clearance for the production of 0.75 Mt/yr iron was granted by MoEFCC vide letter no. J-11015/251/2009-IA.II (M) dated 27.01.2012 for 0.75 Mt/yr with modification dated 01.05.2012. The EC was given with a condition that ore transportation will be undertaken by road for initial five year only and after that covered conveyor system will be used for ore transportation. However, the covered conveyor system could not be installed till now. In view of this, SAIL is submitting this proposal for seeking permission to allow ore transportation through road for another 5 years.

The mine is being operated by mechanized opencast method of mining. The ore transportation from mines to Manoharpur has been restricted sunset and sunrise..

As stated in EC letter, the PCCF cum Chief Wildlife Warden of Jharkhand had confirmed that there is no national park, wildlife sanctuary, biosphere reserve and corridor for Schedule-I fauna within 10 km of the mine lease area. PCCF further stated that the entire mine lease area falls within the core zone of Singhbhum Elephant Reserve. However, the issues related to conservation and protection of endangered fauna has already been addressed at EC stage.
The Jharkhand Govt. has constituted an Expert Committee to prepare Comprehensive Integrated Wildlife Management Plan (IWMP) for West Singhbhum District. The IWMP has been finalized by the Govt. of Jharkhand and is under review by MoEFCC, New Delhi for implementation. Measures suggested by Jharkhand Govt. for the Dhobil mines shall be suitably implemented and demand raised by the State Govt. shall be paid for implementation of the Wild Life Management Plan by the Govt. of Jharkhand.

There is no habitat for migratory birds, archeological site, defense installation and airports within 10 km of the periphery of the lease area. The area is located in Seismic Zone II and is not in landslide prone zone.

3.1 TYPE OF PROJECT INCLUDING INTERLINKED AND INTER-DEPENDENT PROJECT

The project falls under Category "A", as per EIA notification – 2006 and amendments thereon. This is a self-dependent project. The mine is captive source of iron ore for SAIL's plants. Their on ore will be dispatched to SAIL's Steel Plants. It is an opencast iron ore mine with mechanised working. The entire lease area is located in Ankua Reserve forest.

3.2 LOCATION

The Dhobil mine under Manoharpur Ore Mines (MOM) of SAIL is located at Dhobil, Manoharpur, West Singhbhum district of Jharkhand. The mine lease is spread over 513.036 ha in Ankua Forest Reserve Forest which is a part of Saranda Forest Division. Nearest railway station, Manoharpur on Howrah–Mumbai main line of South–Eastern Railway, is located at an aerial distance of ~15.0 km (road distance ~31 km) WNW of the Dhobil mines. The nearest state highway is SH – 4 and is located at an aerial distance of ~4.0 Km (road distance ~15 km) away on WNW side of the Dhobil mines. The nearest functional airport is at Ranchi at ~120 km (aerial distance) from the Dhobil mines. The road distance of SAIL's Steel plants which is being fed by Manoharpur Ore Mines are IISCO Steel Plant (ISP), Burnpur (295 km), Rourkela Steel Plant (RSP) (65 km), Bokaro Steel Plant (261 km), Durgapur Steel Plant (326 km), and Bhilai Steel Plant (~500 km).

Mine lease falls in latitude 22°14´57.3" & 22°16´15.8" N and longitude 85°16´5.6" & 85°17´25.3" E and falls under Survey of India toposheet No. F45H7 (old topo sheet no. 73F/7). As stated above, besides Dhobil Mining Lease, there are another five mining leases under Manoharpur Ore Mines i.e. Ajitaburu, Mclellan (Budhaburu), Sukri-LuturBuru, Anqua and Tatiburu. The location of nearby other mine lease leases with respect to the Dhobil Leases is given below

Table 2: Other Mining Leases

Sl. No.	Name of mines	Distance from Dhobil mines
1.	Sukri-Luturburu	1.0 km west
2.	Ajitaburu	Adjoining on northern side
3.	Budhaburu (McLellan)	Adjoining on northern side
4.	Ankua	1.0 km north
5.	Tatiburu	1.0 km north

Out of the six leases, four leases i.e. Dhobil, Sukri-Luturburu, Ajitaburu and Budhaburu (McLellan) have been operated in the past. Ajitaburu was operated till 1995, Mclellan till 2005 and Sukri till 2009, however these leases are non-operation at present for want of Stage-II Forest Clearance. Two small leases i.e. Ankua and Tatiburu has never been operated. Out of the six mining leases of MoM Chiria, presently mining is continuing in Dhobil at production rate of 0.75 Mt/yr as per the Environment Clearance and approved Mining Plan. Location of the lease area is shown in **Fig. 1.1**. The broken up area of Dhobil mine alongwith other mines under MOM at Chiria is given in **Fig. 1.2**. Location of the Dhobil Mine lease along with ore transportation route is shown in **Drawing No. MEC/G24Z/11/S2/01.**

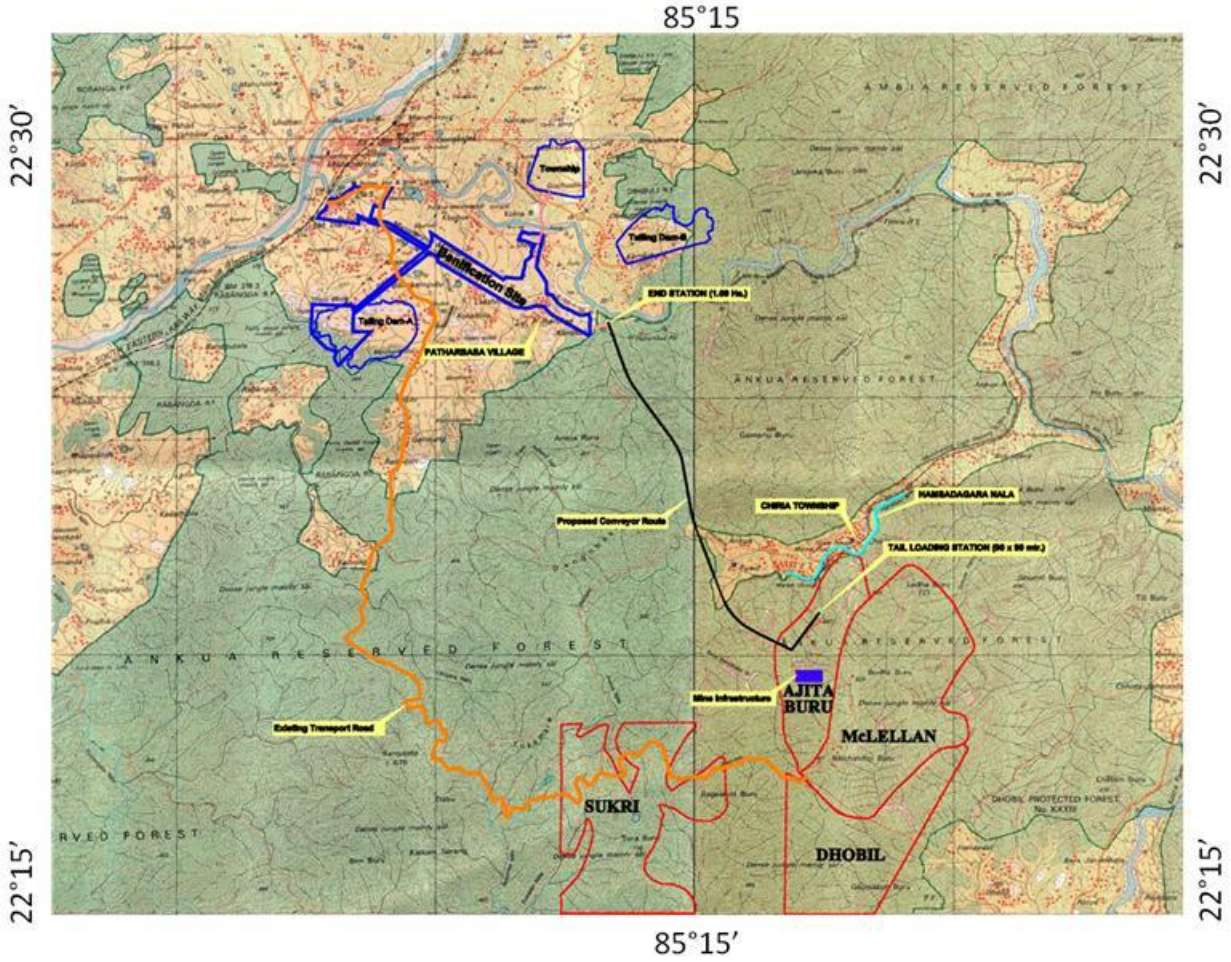
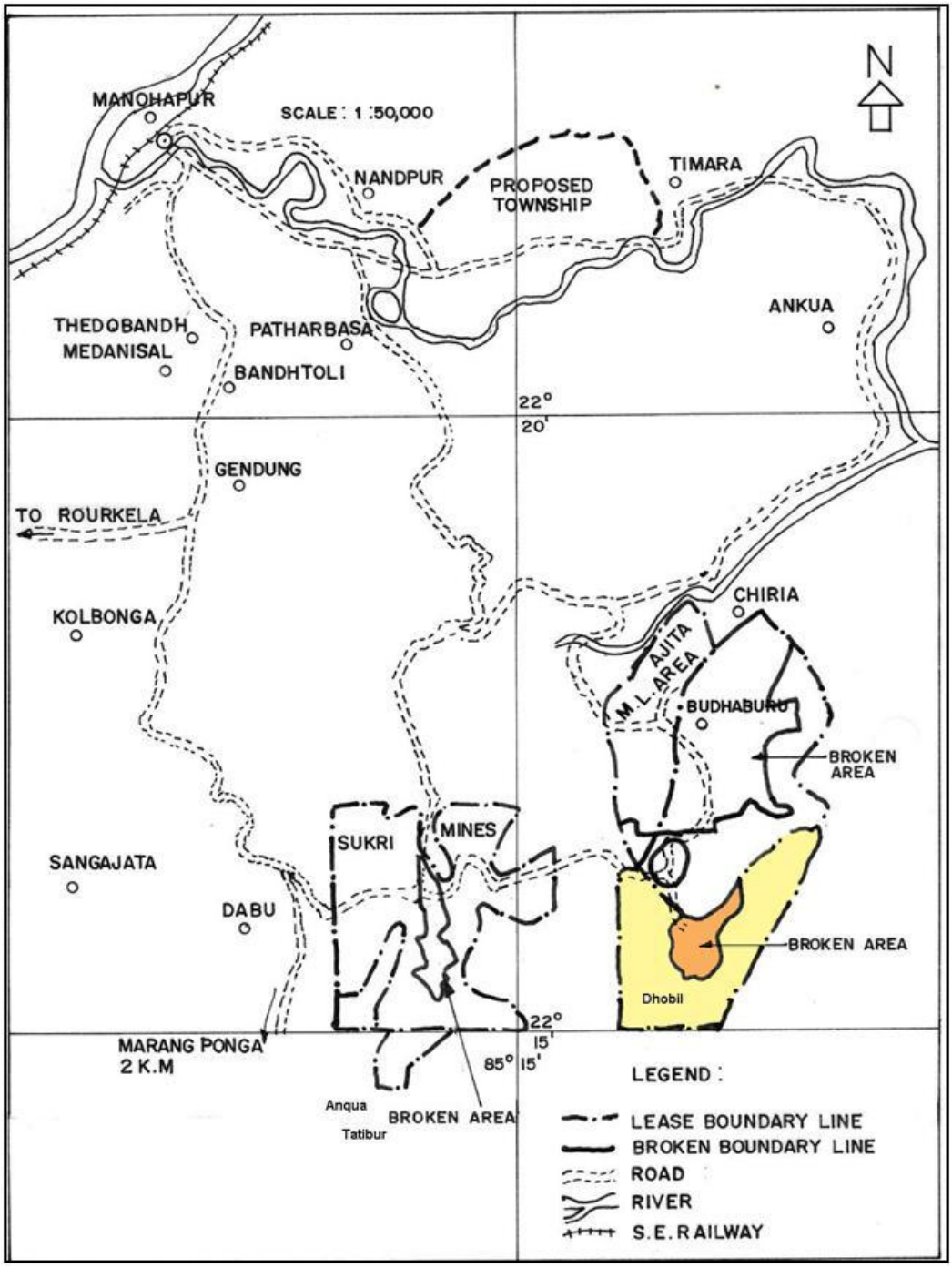


Fig. 1.1: Location of the lease area



Brokenuparea of Dhobil Leasehold Unutilisedarea of Dhobil Leasehold

Fig. 1.2: Location map of Dhobil Mine Leasehold along with other Manoharpur Ore Mines

3.3 DETAILS OF ALTERNATE SITE:

The present proposal envisages continuation of mining of iron ore from 513.036 ha Dhobil mine lease. Since the mining of ore is site specific, possibility of alternate sites for the project is not envisaged.

3.4 SIZE AND MAGNITUDE OF OPERATION:

The Dhobil mine lease is spread over 513.036 ha and the approved production capacity for mining iron ore is 0.75 Mt/yr. The ROM production for last few years is given below

Table 3: ROM production of Dhobil mines

Year	Lump	Fines	ROM
2011-12	0.287	0.062	0.349
2012-13	0.315	0.129	0.444
2013-14	0.333	0.076	0.409
2014-15	0.256	0.061	0.317
2015-16	0.344	0.107	0.451

Values in Mt

The mine is open cast mechanized with 110 mm diameter wagon drill hole drilling and blasting along with shovel - dumper combination. Bench width is 10 m. Drilling operation is carried out by using 110 mm wagon drills and hydraulic excavators of 0.9 m^3 capacities for loading of overburden. Dumpers (10-16 t capacity) do hauling of ore and waste. Blasting is done by using slurry explosives and Nonnel fuses. Spacing and burden in OB is 3.5 m and 3.0 m, while on ore benches spacing and burden are 3.0 m and 2.5 m respectively.

3.5 MINE DESCRIPTION

3.5.1 Geology:

Regional Geology of the area

Geologically, the terrain forms a part of the oldest meta-sedimentary and metavolcanic formations of the Chhotanagpur plateau considered as homotaxial with the Drawers in the Indian geological column. Generally it is believed that the iron rich formations of the Bonai-Keonjhar range form part of the Iron Ore Series. It is assumed that iron ore bearing Banded Iron Formations (BIF) lie between the two discretely argillaceous environments of shales, phyllites, sandstones, lavas, ash and tuff beds, with the basal sandstone conglomerates, occurring at the base of iron ore group which overlies the older metamorphics. Profuse volcanic activity in the form of tuff beds, has also been noticed in the banded iron formations and within the iron ore body itself. The Iron Ore Group of rocks occurs around the Singhbhum granite body.

Local geology and structure

The Manoharpur ore deposit is banded limonite-geothite-meatite assemblage, capping the Budhaburu hill sloping down to 530 m MSL resting on shale BHQ country rock of the Iron

Ore Group. Trending parallel to the major structure, the longest axis of the deposit is N25°E- S25°W which spreads on a visible strike length of over 6.5 km and an average outcrop width of about 3.5 km. The average general strike of the Manoharpur iron ore deposit is N25°E-S25°W with a general dip of 50° in N65°W direction. Two sets of folds and one more set of cross folds are observed in the area. The faults have been integrated on the basis of lithological repetitions/omission. The main fault which can be traced on the surface runs roughly in N-S direction across the entire deposit. The hade of the fault is about 35↑8 towards east. The other structural features are development of foliation, joints striations and pucker lineations. It may be concluded that structurally the deposit has a basin like configuration with an undulating floor marked by BHQ horizon.

Mineral Reserves

The minable reserve at Dhobil Mining Lease as estimated as on 01.04.2013 was 369.31 MT. But the mine is having Forest Clearance for 29.411 ha only and for rest of the area, mine does not have forestry clearance, reserve within 29.411 ha area has only been considered under category 111 of UNFC classification. The ore within broken area having Fe between 45% to 57% has been considered as sub grade ore and placed under category 211 of UNFC classification. Reserve as per UNFC classification as per the approved Scheme of Mining as on 01.04.2013 is given as below:

Table 4: Iron Ore reserve

UNFC Code	Quantity (t)	Quantity (Mt)
111	33,291,000	33.29
211	17,779,000	17.78
221	300,093,360	300.09
222	18,144,000	18.14
Total	369,307,360	369.31

The depletion of the reserves over the last three years is 1.18 Mt. Therefore, the balance minable reserve within 29.411 ha of forest clearance are as on 01.04.2016 is 32.11 MT.

3.5.2 Mineral Processing:

No beneficiation except crushing and screening of ore is done at Mine site. At present, the ore is sized to lumps & fines and loaded into dumpers and transported to railway siding at Manoharpur.

3.6 MINERAL TRANSPORT

The iron ore is being transported from Dhobil mines to Manoharpur Railway siding through truck of 10t-16t capacity covering ~31 km haulage road. Out of total ~31km of haulage distance, ~26km comprises of forest road, ~4km stretch on road connecting Rourkela-Manoharpur and remaining ~1 km is dedicated branch road towards Manoharpur railway

siding. Water Sprinklers (6 nos. of 10 KL) have been deployed on the haul roads for dust control.

As per explained earlier, in the EC, it was committed by SAIL that ore transportation through road will be carried out for 5-yr. only and after 5-year the ore will be transported through covered conveyor. However, the conveyor system could not be commissioned till now and due to this SAIL is requesting MoEFCC to allow them for continuing existing ore transportation via. road for another 5-year. It is envisaged that by this time, the conveyor facilities will be commissioned and ore will be transported through conveyor system only.

3.7 LIFE OF THE PROJECT

Based on balance mineable reserve of 32.11 Mt with in 29.411 ha of forest clearance area the life of mine is ~42 years.

3.8 RAW MATERIALS

The project is for mining & processing of iron ore from the leasehold. Therefore, major resources / materials required for the project are fuels & explosives. At present, explosive requirement is estimated to be 82.50 t/yr and HSD requirement is 1545 kl/yr for the mining equipment/ machinery & DG set for power.

3.9 RESOURCE OPTIMISATION/ RECYCLING AND RESOURCE

The mining of iron ore is being carried out as per the approved Mine Plan and approved Mining Scheme which is based on proper planning and is based on resource optimization. At the end of mine working, the mine lease area will be closed as per approved Mine Closure plan with an aim to develop the mined out areas for some beneficial use which will be compatible with surrounding.

3.10 SITE SERVICES

3.10.1 Water Requirement:

The average demand of Dhobil mining lease is 97 m^3/day while peak demand is about 111 m^3/day. The source of water is Chiria Spring/ Hamsada Nala located at distance of ~3 km from mine lease. The average quantity of water recycled will be 19 m^3/day. The water balance is given below

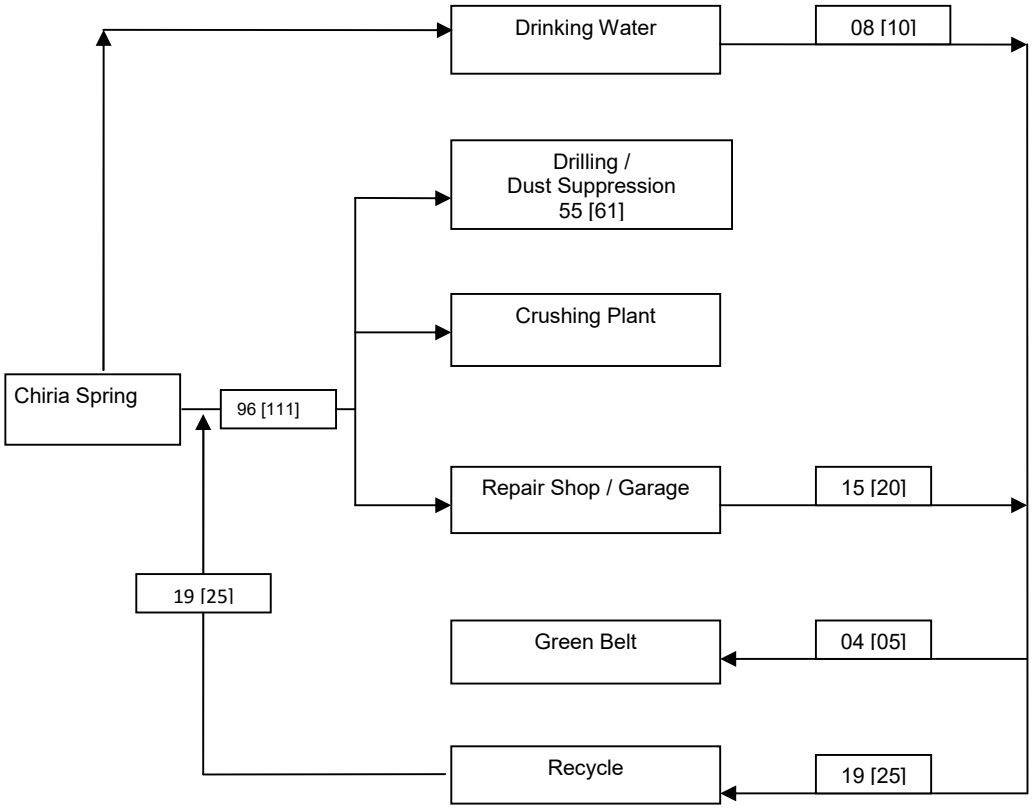


Fig. 03: Water balance

1. Figures are in m³/day
2. Figures outside [ ] corresponds to average daily water demand.
3. Figures within [ ] corresponds to daily demand in peak season.
4. ** Fire Tender proposed in Ajitaburu lease will cater the requirement in this lease.

3.10.2 POWER Requirement

Maximum power demand for the existing project is met by One (1) 10 KVA DG Set. Moreover, in order to meet the breakdown / repair requirement of emergency power, one additional Diesel Generator set has also been envisaged as standby for the proposed mine.

3.10.3 Amenities

As described above, all necessary infrastructures and statutory facilities viz. mine office, rest shelters, canteens, workshop, stores, First Aid center vocational training center, railway siding and other required infrastructures has been made available at mine site. The Chiria township has residential houses, schools, banks, post offices, medical facilities etc.

3.11 WASTES

Wastes will be mainly of laterite from top benches and inter-burden of ore benches. Waste generation is about 6% of total excavation. Overburden waste generated during last few years is given below

Table 5: OB generation in Dhobil mines

Year	OB(t)
2011-12	38761
2012-13	37282
2013-14	18032
2014-15	-
2015-16	12116

The waste materials are kept at designated dump area. It is also proposed that the waste material will be used for backfilling once a particular quarry exhausts.

4.0 SITE ANALYSIS

4.1 CONNECTIVITY

As discussed above, the Dhobil Iron Ore Mine under Manoharpur Ore Mines (MOM) of SAIL is located at village Dhobil, Manoharpur, in West Singhbhum district of Jharkhand. The lease is spread over 513.036 ha in Ankua Forest Reserve Forest under Saranda Forest Division. The lease area falls in latitude 22°14´57.3" & 22°16´15.8" N and longitude 85°16´5.6" & 85°17´25.3" E and falls under Survey of India toposheet No. F45H7 (old toposheet no. 73F/7).

Nearest railway station, Manoharpur on Howrah–Mumbai main line of South – Eastern Railway, is located at an aerial distance of ~31.0 km WNW of the Dhobil mines. The nearest highway is road connecting Rourkela-Manoharpur and is located at an aerial distance of 11.0 Km WNW of the Dhobil mines (road distance ~31 km). The nearest functional airport is at Ranchi at ~240 km (aerial distance 120 km) from the Dhobil mines.

4.2 LAND FORM, LAND USE, OWNERSHIP

The total lease area of 513.036 ha comes under Ankua Reserve Forest. The forestry clearance for the same is available. No private land is involved and there are no R&R issue. There is no proposal to acquire any additional land for the proposal. The land use and ownership is same as envisaged at EC stage.

The lease was granted to erstwhile IISCO, Burnpur for a period of 30 years i.e. from 08.03.1948 to 07.03.1978. The first lease renewal was also granted by the State Govt. and lease deed executed on 06.04.1980 for the period of 20 years i.e. 08.03.1978 to 07.03.1998. Application for 2nd renewal was submitted to State Govt. on 06.03.1997 for period of 20 years i.e. from 08.03.1998 to 07.03.2018.

Subsequent to amalgamation of IISCO Ltd. to SAIL, Department of Mines & Geology, Jharkhand Govt. vide order dated 20.5.2009 changed the name of the Lessee held by erstwhile IISCO Ltd. in favour of SAIL as per the Rule 62 of MCR, 1960. Subsequently, Order of the Commissioner, West Singhbhum, was also issued for change in the name of Lessee from IISCO to SAIL vide order dated 01.07.2009.

Govt. of Jharkhand vide letter dated dt.22.10.14 imposed some pre-conditions, for second renewal of Dhobil Lease as well as another lease of SAIL i.e. Durgaiburu Lease under Gua Ore Mines, which were challenged by SAIL before the Hon'ble High Court of Jharkhand at Ranchi. The Durgaiburu lease matter was heard by the Hon'ble High Court, Jharkhand, Ranchi on 27.06.2016 and the court has quashed the conditional 2nd renewal order issued by Jharkhand Government and also directed State Govt. to take action as per the provisions of MMDR Amendment Act, 2015 and Mineral (Mining by Government Company) Rules, 2015 (MMGC Rules, 2015). The matter is pending at High Court of Ranchi and is expected to be disposed in line with the Durgaiburu Case.

As per the provisions of Mineral (Mining by Govt. Company) Rules, 2015, request letter will be submitted to Govt. of Jharkhand 12 months before i.e. 07.03.2017 for further extension of mining lease periods as per the provisions of Mineral (Mining by Govt. Company) Rules, 2015 for another 20 years i.e. from 08.03.2018 to 07.03.2038.

4.3 TOPOGRAPHY

The topography of the mine lease area is basically hilly and the deposit is occurring on top of a hill and densely forested area having top altitude of about 730 m RL. Geologically, the terrain forms a part of the oldest meta-sedimentary formations of the Chotanagpur plateau, considered as homotaxial with the Dharwars in the Indian geological column.

4.4 LAND USE

As described above, the entire mine lease of 513.036 ha falls in Ankua reserve forest. The activity wise land utilization is given below

Table 6: Activity wise land utilization

Sr. No	Land use category	Existing (Area in ha)	At end of work (Area in ha)
1.	Excavation	18.94	19.16
2.	External subgrade / waste Dump	4.88	5.23
3.	Infrastructure	0.40	0.40
4.	Road	0.70	0.70
5.	Afforestation	3.034	3.921
6.	Balance un occupied area in lease	485.082	483.625
	Total	**513.036**	**513.036**

No change in approved land use plan. The 29.411 ha of forest land is being utilised as per approved Mine Plan and Environmental Clearance.

4.5 EXISTING INFRASTRUCTURE

The mine office, plant building, rest shelters, canteens, workshop, stores, electrical sub-station, First Aid center, Weigh Bridge and other required infrastructure has been made available.

Other amenities and infrastructure, such as township, hospital, stores, workshop, community centre, schools etc. are already present in SAIL's township at Chiria.

4.6 SOIL CLASSIFICATION

As per the District Planning Map of West Singhbhum, published by National Atlas and Thematic Mapping Organization, Kolkata the soil of the area where the project is located is classified as "Red Loamy Soil".

The soil is lateritic, typical of the area. The thickness of the top soil varies from nil (due to outcropping of iron ore to maximum of 60 cm.

4.7 CLIMATE

The study area lies in tropical region where climate is characterised by very hot summers and cool winters. Summer is typically from March to June when monthly temperature ranges from a maximum of 40°C during daytime to a minimum of 20°C at night. Winter is from November to February when the maximum temperature during day goes up to 30°C and minimum temperature at night becomes as low as 10°C.

The average annual rainfall as recorded at IMD observatory at Chaibasa is 1192 mm. The Southwest monsoon lasts from mid-June to mid-September and the area gets more than 80% of the annual rainfall during this period.

4.8 SOCIAL INFRASTRUCTURE AVAILABLE

The mine has been operating since 1948. SAIL, has been providing social amenities to nearby local villagers, most of whom are tribals. SAIL has made arrangements for supply of clean drinking water to nearby villages. The company has built roads, community halls, bus shelters in villages. Village schools have been provided financial and material assistance. Financial grants have been given to village events / festivals. SAIL has a well-equipped hospital at Chiria Township to cater to the needs of the mine's employees and their dependents. Serious cases which cannot be treated at the mines' hospitals are referred to SAIL's Rourkela Steel Plant Hospital or elsewhere. The mines hospitals' facilities are also available to local villagers free of cost. SAIL's doctors hold free medical camps

twice in a week, where medicines are also provide free of charge. SAIL has also been distributing saplings of fruit bearing trees to local villagers free of charge.

5.0 PLANNING BRIEF:

5.1 PLANNING CONCEPT:

Dhobil mine of Manoharpur Ore Mine under RMD-SAIL has been developed to provide iron ore to its steel plant. The all necessary statutory clearances and fund is available to operate the mine with a rated production of 0.75 Mt/yr.

5.2 LAND USE PLANNING:

The entire mine lease is in Ankua reserve forest. The activity wise land utilization is given below

Table 7: Activity wise land utilization

Sr. No	Land use category	Existing (Area in ha)	At end of work (Area in ha)
1.	Excavation	18.94	19.16
2.	External subgrade / waste Dump	4.88	5.23
3.	Infrastructure	0.40	0.40
4.	Road	0.70	0.70
5.	Afforestation	3.034	3.921
6.	Balance un occupied area in lease	485.082	483.625
	Total	**513.036**	**513.036**

No change in approved land use plan. The 29.411 ha of forest land is being utilised as per approved Mine Plan and EC.

At the end of the working, the mine will be closed as per approved Mine Closure Plan. The mine will be developed as Wild life habitat which will be more compatible with surrounding. The waste dumps will be stabilized and biological reclaimed. Plantations will be carried out on benches and floors of unfilled quarries. Greenbelt and plantation will be developed along mine boundary, dump area and afforestation will be carried out in mined out areas, dump areas etc. Plantation will also be carried out as per recommendation of Forest department.

5.3 ASSESSMENT OF INFRASTRUCTURE DEMAND

At present all necessary infrastructures viz. mine office, rest shelters, canteens, workshop, stores, First Aid center, vocational training center, railway siding and other required infrastructures have been made available at mine site. The Chiria township has residential houses, schools, banks, post offices, medical facilities etc.

There are 992 persons (74 regular and 918 contractual) are employed in Dhobil mines. Most of the employee to the tune of 845 persons, specially the unskilled and semiskilled categories are from local villages. The remaining are comprised of the officers, supervisors, some of the office staff, skilled and semiskilled workers are from outside. These people have been provided accommodation in the existing Chiria township of SAIL located at distance of 8 km road distance from Dhobil mine. The man power requirement in future is expected to remain same. All the other infrastructure requirement for the project will remain same as envisaged at EC stage except for the road transportation requirement, which is proposed to be continued for another 5 years.

5.4 AMENITIES / FACILITIES

As described above, all necessary infrastructures and statutory facilities viz. mine office, rest shelters, canteens, workshop, stores, First Aid center vocational training center, railway siding and other required infrastructures have been made available at mine site. The Chiria township has residential houses, schools, banks, post offices, medical facilities etc.

6.0 PROPOSED INFRASTRUCTURE:

The area is well connected by road and rail network. The area is self sufficient to cater the needs of the continuation of mining activities, hence, no major infrastructure is proposed. Townships at Chiria are already in existence with all necessary amenities. At present all necessary infrastructures viz. mine office, rest shelters, canteens, workshop, stores, First Aid center and other required infrastructures have been made available at mine site.

Green Belt & Plantations: The mine is located in forest area. Till now 14050 Sapling covering an area of 7.8 ha has been planted. Details of plantation are given below

Table 8: Afforestation & plantation activities

Year	Plantation	Location
2008-09	5000	Avenue plantation
2009-10	2000	Township
2010-11	2000	Township
2011-12	2000	Township
2012-13	1000	Dump stabilization
2013-14	500	Avenue plantation
2014-15	450	Avenue plantation
2015-16	500	Township
2016-17	600	Dump stabilization & Avenue plantation

CSR Activities: SAIL takes an active role in CSR activities for peripheral development of the region. SAIL is carrying out various socio-economic measures under Corporate Social Responsibility for all its projects at villages surrounding its establishments.

Manoharpur Ore Mines of SAIL, RMD is committed to ensure better living standards, employment generation and training of local youth on a long term sustainable basis. Fund is year marked every year under CSR. There is a dedicated team of senior officers and staff to ensure proper utilization of the fund, evaluation of action taken for upliftment of the neighboring and peripheral villagers. The proposed project shall strengthen the socio economic level of the predominantly backward region. The following are major CSR activities have been undertaken by the Manoharpur Ore Mines over the years;

- Holding of medical camps, supply of medicines to villagers.
- 11- bed Chiria Hospital ISPAT hospital (with temporary extended facilities upto 30 beds) at Chiria
- Improving drinking water supply systems and infrastructure in peripheral villages
- Improvement of education facilities in villages
    - Sponsorship students of local villages for studying in English medium school
    - Total financial support to DAV Public School
    - Total support to run IISCO's middle school at Chiria & Manoharpur
    - Adibasi Nursery Vidyalay, Chiria
    - Residential schooling of the Saranda area children at Manoharpur, Chakradharpur and Rourkela
- Setting up of solar powered street lights in villages
- Construction of roads
- Setting up of community toilets
- Financial and material assistance for village festivals, cultural events and sports activities
- Training, skill development and women empowerment
    - Sponsorship of 77 students from Chiria & peripheral villages for ITI Training (in Ispat ITC, Rourkela, Ambedkar Memorial ITC, Rourkela, Koel ITC, Rourkela, Budhuvir ITC, Rourkela & Indira Memorial ITC, Rourkela
    - Three month residential training village youth in vocational trades like Mason, Motor Cycle repair, Electrical, Carpenter etc at Society for Rural Industrialization, Ranchi.
    - Mushroom cultivation training to local women
    - Training to women in making of 'energy efficient Chullah
    - Fishery pond construction
    - Pisciculture
- Improvement in agricultural activities

Manoharpur Ore Mines, RMD, SAIL has spent about Rs 1654 lakhs over the last seven years under the CSR activities. Annual expenditure towards CSR activities during the last five years are as follows:

Table 9: Expenditure under CSR Activities

S. No	Year	CSR Expenditure (Rs. lakhs)
1	2009-10	95.42
2	2010-11	50.94
3	2011-12	244.09
4	2012-13	902.61
5	2013-14	146.19
6	2014-15	107.60
7	2015-16	106.96
	Total	**1653.81**

Further an amount of Rs. 83.75 lakh has been allocated under CSR budget for 2016-17.

7.0 REHABILITATION & RESETTLEMENT (R&R) PLAN

It is an existing project wherein the entire lease area falls in forest land. No private land is involved hence the project does not involve any R&R issue.

8.0 PROJECT SCHEDULE & COST ESTIMATE

8.1 Likely Date of Start of Construction and likely date of completion:

The Dhobil mine is in operation based on approved Mine Plan and EC. The EC is granted for mining of iron ore with a condition that ore transportation through road is allowed for 5 year only (till June 2017) and after this time period the ore will be transported only by covered conveyor system. However, the conveyor system could not be installed. In view of this, SAIL is seeking permission for extension of ore transportation through road for another 5 year.

8.2 Estimated Project Cost Along and Economic Viability of the Project

Cost of iron ore mining at Dhobil Mine is about Rs. 1990 /t of ore including transportation & royalty. The project is very much essential and technical necessity to ensure adequate and uninterrupted supply of iron ore to the modernized / expanded SAIL steel plants.

9.0 ANALYSIS OF PROPOSAL (FINAL RECOMMENDATION)

In the present proposal, there will be no change from existing ongoing mining and ore transportation activities and thus it is not expected to bring any additional load on the local road infrastructure and also in the air quality of the area.

The project has following benefits:

- It ensures the availability of iron ore to meet the SAIL's hot metal requirement
- It will continue to add the revenue generation of the District / State.
- The mine will continue to generate employment, both direct and indirect which will lead to further economic growth of the industrial sector as well as country.
- SAIL shall provide educational facilities, bus shelters, medical facilities and other amenities to local villages under the company's community development programme.

Keeping in view of the iron ore requirement of SAIL to achieve targeted hot metal production in line with India's steel sector requirement and social development of the local region linked with the proposed project, continuation of the project will be beneficial.

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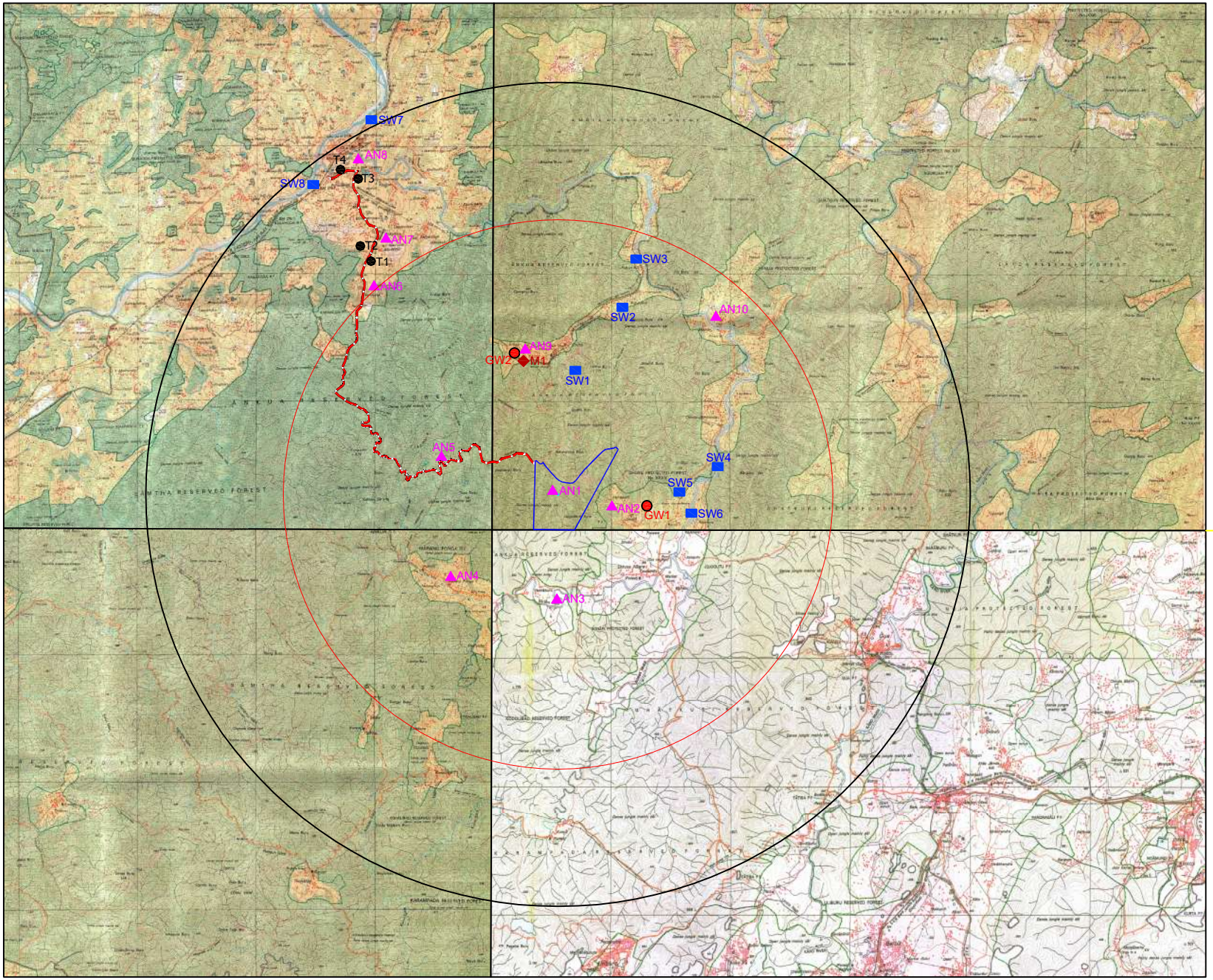


N
W E
S

LEGEND

MONITORING STATION

M METEROLOGICAL MONITORING M1

M1 - Chiria Mine Office

AN AMBIENT AIR QUALITY & NOISE LEVEL (AN1 TO AN10)

AN1 - Dhobil Mine
AN2 - Dhobil Village
AN3 - Hatnaburu
AN4 - Morang
AN5 - Sukri ML
AN6 - Gendung
AN7 - Bachamgutu
AN8 - Manoharpur Railway Station / Siding
AN9 - Chiria Guest House
AN10 - Dhori

SW SURFACE WATER (SW1 TO SW8)

SW1 - Chiria Spring
SW2 - Hamsada Nala
SW3 - Koina river downstream w.r.t. Hamsad Nala
SW4 - Koina River downstream w.r.t. Dhobil ML stream
SW5 - Dhobil ML stream going toward Koina river
SW6 - Koina river upstream w.r.t. Dhobil ML stream
SW7 - Koel river upstream w.r.t. Manoharpur Railway siding
SW8 - Koel river downstream w.r.t. Manoharpur Railway siding

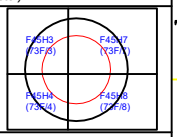
GW GROUND WATER (GW1 TO GW2)

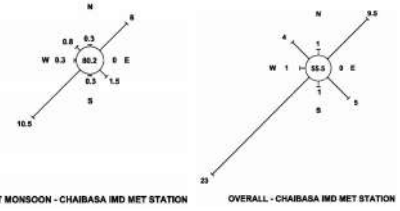
GW1 - Dhobil village
GW2 - Chiria Township / Guest House

T TRAFFIC DENSITY (T1 TO T4)

T1 - Forest Road - Near Forest Check post at the end of forest road before joining Rourkela - Manoharpur road
T2 - Rourkela - Manoharpur road - Near Meena Bazar on Rourkela - Manoharpur road (100 m towards Rourkela before forest road junction)
T3 - Rourkela - Manoharpur road - Near Medasai village on Rourkela - Manoharpur road before joining approach road towards Railway siding (On Rourkela - Manoharpur and, 50 m before turning to branch road going towards railway siding, before power sub-station)
T4 - Branch road from Rourkela - Manoharpur road, after turning from power sub-station, going towards railway siding (From Secondary data collected from mine dispatch register)

Dhobil ML
15 km Buffer
10 km Buffer
Ore Transportation Route





POST MONSOON - CHAIBASA IMD MET STATION

OVERALL - CHAIBASA IMD MET STATION

STEEL AUTHORITY OF INDIA LIMITED

स्टील अथॉरिटी ऑफ़ इंडिया लिमिटेड

मेकॉन लिमिटेड

MECON LIMITED

ISO 9001 Company

SECTION	ENV. ENGG.
LOCATION	RANCHI
DESIGNED	S.B
DRAWN	M.P
CHECKED AND VERIFIED	V.S
APPROVED	S.K.S
DATE	05.10.2016

DHOBIL IRON ORE MINING PROJECT

MAP SHOWING DHOBIL MINE LEASE, TRANSPORTATION ROUTE AND MONITORING LOCATION

SCALE – AS SHOWN | SHEET 1 OF 1 | REV 0

DRG.No.MEC/G24Z/11/S2/01

Environmental Study Report
for
Amendment in Environmental Clearance for Continuation of Ore Transportation by Road

Dhobil Iron Ore Mining Project
of
M/s Steel Authority of India Limited (SAIL)

At Manoharpur Block, West Singhbhum, Jharkhand

Capacity : 0.75 million tonnes/year
Mine Lease Area: 513.036 ha

Environmental Clearance granted vide letter no.
J-11015/251/2009–IA.II (M) dated 24.01.2012
with subsequent modification
dated 01.05.2012

Report serial no. MEC/11/S2/G24Z/ESR/2288/R.0 **November, 2016**

Project Proponent **Environmental Consultant**

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1.0 BACKGROUND

1.1 General

Steel Authority of India Limited (SAIL), a Maharatna public sector undertaking under Ministry of Steel, Government of India, is the leading steel maker in the country and is having Integrated Steel Plants at Bokaro, Durgapur, Rourkela, Bhilai & Burnpur; Special Steels Plants at Bhadrawati, Durgapur & Salem and a Ferro-alloys Plant at Chandrapur. Also, SAIL is the second largest mining outfit in the country with mines spread over the states of Jharkhand, Orissa, Chattisgarh and Madhya Pradesh. These mines are operated as captive sources of raw materials for its integrated steel plants. The mines located in Jharkhand, Odisha and Madhya Pradesh are managed by Raw Materials Division (RMD) of SAIL. RMD was formed in 1989 with an aim to achieve self-sufficiency in quality iron ore.

One of iron ore leases under SAIL is the Dhobil lease hold of Manoharpur Ore Mines (MOM), located in Ankua Reserve Forest of Saranda forest division in West Singhbhum District of Jharkhand of mine lease area 513.036 ha. At present Dhobil Mine is in operation with rated capacity of 0.75 Mt/yr. Ore from Dhobil mines is transported by road to the railway siding situated at Manoharpur and loaded into railway wagons for dispatch. Ore from the mine to the railway siding is transported by trucks through forest road, Rourkela –Manoharpur road and the branch road connecting Rourkela – Manoharpur road to railway siding covering over a total distance of ~31 km. The ore transportation stretch is the only route for ore transportation from the mine lease (ML). SAIL has been allowed for transportation of ore from the existing forest stretch and as per the stipulated conditions SAIL repairs and maintains the forest road.

Dhobil Iron Ore Mining Project of SAIL was granted environmental clearance vide MoEFCC's letter No. J-11015/251/2009–IA.II (M) dated 24th January, 2012 for production of 0.75 million tonnes per year (MTPA) of iron ore involving mine lease area of 513.036 ha. In the preamble of the above referred EC letter, under point 4, a reference has been made to the commitment made by SAIL that the ore transportation by road will be undertaken only for five years and thereafter it will be by conveyor only. However, construction of Long Distance Belt Conveyor (LDBC) can't be undertaken till date for want of statutory forest clearance as the same involves forest land. The above mentioned EC letter vide Specific Condition no. (v) stipulated to obtain "prior environmental clearance from the Standing Committee of the National Board for Wildlife before starting any activity relating to the project at site". This condition was subsequently modified by MoEFCC vide even letter dated 01.05.2012 as "necessary wildlife clearance, as applicable, shall also be obtained". Subsequent to the modification

of the EC, the Consent to Establish and Consent to Operate were issued by Jharkhand State Pollution Control Board (JSPCB), Ranchi on 18.05.2012 and 02.06.2012 respectively. SAIL upon receiving these necessary clearances, started the dispatch of iron ore from Dhobil Lease by road from 07.06.2012 thereby the initial 5-year road transportation is valid till 06.06.2017.

In view of above, SAIL is planning to continue the ore transportation through road for another five year to maintain un-interrupted supply of iron ore to it's steel plants. In line with this, SAIL is submitting an application for amendment of Environmental Clearance for extension of permission for transportation of ore by road for another 5 years, as per the details given below:

Sl. No.	Permission as per EC granted	Amendment - Present proposal
Transportation		
1.	"It was committed by the proponent that ore transportation by road will be undertaken only for five years and thereafter it will be by conveyor only."	It is requested to allow continuation of ore transportation by road for another 5 years and thereafter by conveyor system only.

The delay in establishment of ore transportation conveyor system may be attributed to the followings:

In addition to the Dhobil Mining Lease, there are three other main mining leases i.e. Ajitaburu, Budhaburu and Sukri, under Manoharpur Ore Mines, Chiria. SAIL has envisaged to develop a fully mechanized open cast mining covering all the main leases i.e Ajitaburu, Budhaburu, Dhobil and Sukri, with a common Crushing & Screening and Beneficiation Plant having a capacity of 7.0 MTPA ore production. Further that in compliance with the directions of MoEFCC, to minimize the involvement of forest land in the project, the infrastructure facilities like beneficiation, blending, stockpiling, railway sidings, tailing ponds etc., have been planned in the non-forest land i.e. at Pathrbasa near Manoharpur, which is about 15 km away from the mines. Evacuation of ore from mines to Patharbasa through Long Distance Belt Conveyor (LDBC) has also been envisaged under the plan. The highly undulating terrain varying topography ranging from 620 to 240 m AMSL in between the mines and Patharbasa with hillocks in between them, was a challenge for SAIL in respect of selection of route & conveyor technology for evacuation of ore with minimum forest diversion and least disturbance to wildlife. In this regard, reputed national and international consultants have been contacted and selected a direct route along crow-fly distance with a conveyer length of 6.314 km Rope-Con technology

(recommended by M/s Hatch, Australian Consultant) for evacuation of ore from the mines. Diversion Proposal for obtaining Forest Clearance for evacuation of ore through LDBC has already been submitted on 31.05.2014 and is under consideration at State Level.

However, implementation of the envisaged Chiria Development plan along with the evacuation of ore through Long Distance Belt Conveyor (LDBC) is being delayed due to non-availability of statutory forest clearances. Stage-I FC was granted by the MoEFCC vide letter dated 07.03.2011 for diversion of 595.075 ha of forest land under the leases over the total area of 2376.122 ha for development of Chiria. The report on compliance of Stage-I FC conditions submitted to State Forest Department was forwarded by the State Govt. to MoEFCC with recommendations for grant of Stage-II FC on 22.09.2014. Proposal was pending with MoEFCC for grant of Stage-II, the MoEFCC asked the Regional Office of MoEFCC for site inspection of Chiria leases vide letter dated 21st April, 2015 to rule out any violation of provisions of Forest (Conservation) Act, 1980. The site inspection was conducted by CCF (Central), Eastern regional Office of MoEFCC during the period 25-26th June, 2015 and report was submitted to MoEFCC on 24th July, 2015. The proposal for grant of Stage-II FC is pending with MoEFCC since then.

It is anticipated that development of common facilities like ore processing and beneficiation including installation and commissioning of the LDBC Conveyor system for evacuation of ore from the Manoharpur Ore Mines will be completed in about 5 years.

In view of above, SAIL is planning to continue the ore transportation through road for another five year to maintain uninterrupted supply of iron ore to it's steel plants. In line with this, SAIL is submitting an application for amendment of the Environmental Clearance for extension of permission for transportation of ore by road for another 5 years under para 7 (ii) of EIA Notification, 2006 for Dhobil Iron ore Mining Project. The Dhobil Iron Ore Mining lease is Category-A project as per EIA Notification–2006 and amendments thereof. Though there is no change in scope of the work as envisaged in the EC letter except for continuation of ore transport by road for another 5 years. Specific environmental studies viz., one month base line data generation including traffic density studies, and Air Quality Impact Predication Study have been carried out and presented in the report.

1.2 Environmental sensitivity

The entire mine lease area falls within the core zone of Singhbhum Elephant Reserve. The Principle Chief Conservator of Forests, Biodiversity Conservation cum Chief Wildlife Warden, Jharkhand vide their letter No. 189(WL)09-10/654 dated 15.09.2009 stated that the Dhobil mine lease area falls within the core area of the Singhbhum Elephant Reserve and that no national park/wildlife sanctuary/biosphere reserve are located within 10km of the lease.

1.3 Purpose of the Study Report

This report is a supplement to the SAIL's application to MoEFCC for amendment in Environmental Clearance, i.e permission for continuation of ore transportation from Dhobil Mine to Manoharpur Railway Siding by road for another 5 years.

1.4 Scope of the Study Report

This study reports attempts to assess the following:

- Existing air pollution load in the study area in general and particularly in the ore transportation route (due to ore transportation by road).
- Pollution load due to the ore transportation by road at the rated mine production capacity.
- Existing traffic load on the ore transportation route (mine to railway siding).
- Estimated Design service PCU volume as per IRC: 64-1990 of the ore transportation route.
- Existing noise levels in the study area in general and particularly around the ore transportation route (due to ore transportation by road).
- Existing surface and ground water quality in the study area due to ongoing mining and other anthropogenic activities in the area.

2.0 LOCATION

Dhobil mine is the constituent mine of Manoharpur Ore Mines (MOM) of SAIL, present in the Chiria Iron Ore reserve in West Singhbhum District of Jharkhand. Dhobil lease area (513.036 ha) lies between Latitude 22º14'57.3"N to 22º16'15.8"N and Longitude 85º16'5.6" to 85º17'25.3"E and covered on SOI (Survey of India) Topo-Sheet No. F45H7 (old topo-sheet no. 73F/7).

The ore from Dhobil mine is transported by road (~31 km) to Manoharpur railway siding (on Mumbai – Howrah line of South Eastern Railway). From the railway siding the ore gets transported to different SAIL's steel plant, namely to Burnpur (~295 km), Rourkela (~65 km), Bokaro (~261 km), Durgapur (~326 km), and Bhilai (~500 km).

The ore from Dhobil Mines is transported by dumpers through forest road, Rourkela –Manoharpur road and branch road (from Rourkela –Manoharpur road) to Manoharpur railway siding. The haulage distance of ore transportation from mine to railway siding is about 31 km. This is the only connecting road between Dhobil ML and Manoharpur railway siding, where the ore is loaded onto railway wagons via hydraulic loaders, for railway dispatch. The ore haulage distance of 31km, comprises of forest road (~ 26.1km), Rourkela-Manoharpur road (~3.7km) and branch road from Rourkela–Manoharpur road to railway siding (~1.2km).

Location of the Dhobil Mine lease along with ore transportation route is shown in **Drawing No. MEC/G24Z/11/S2/01.**

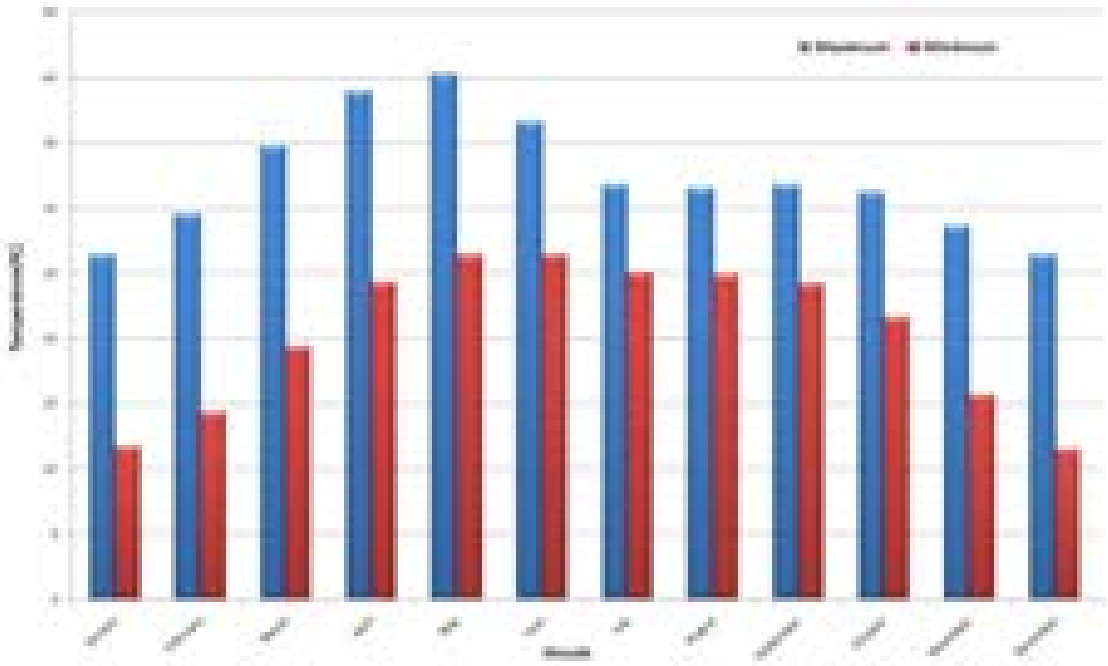
3.0 PHYSIOGRAPHY & LOCAL GEOLOGY

The Dhobil lease area with MOM is hilly and the deposit is occurring on top of a hill and densely forested area having top altitude of about 730m RL. The deposit is banded limonite-geothite-hematite assemblage capping the hills down to 420m RL resting on a shale-BHQ country rock. The general elevation varies from 420m AMSL to 730m AMSL. The Iron ore deposits of 513.036 ha of Dhobil leasehold is a part of the famous Chiria Block and covers the Southern portion of the deposit. Geologically, the terrain forms a part of the oldest meta-sedimentary formations of the Chotanagpur plateau, considered as homotaxial with the Dharwars in the Indian geological column.

4.0 CLIMATE

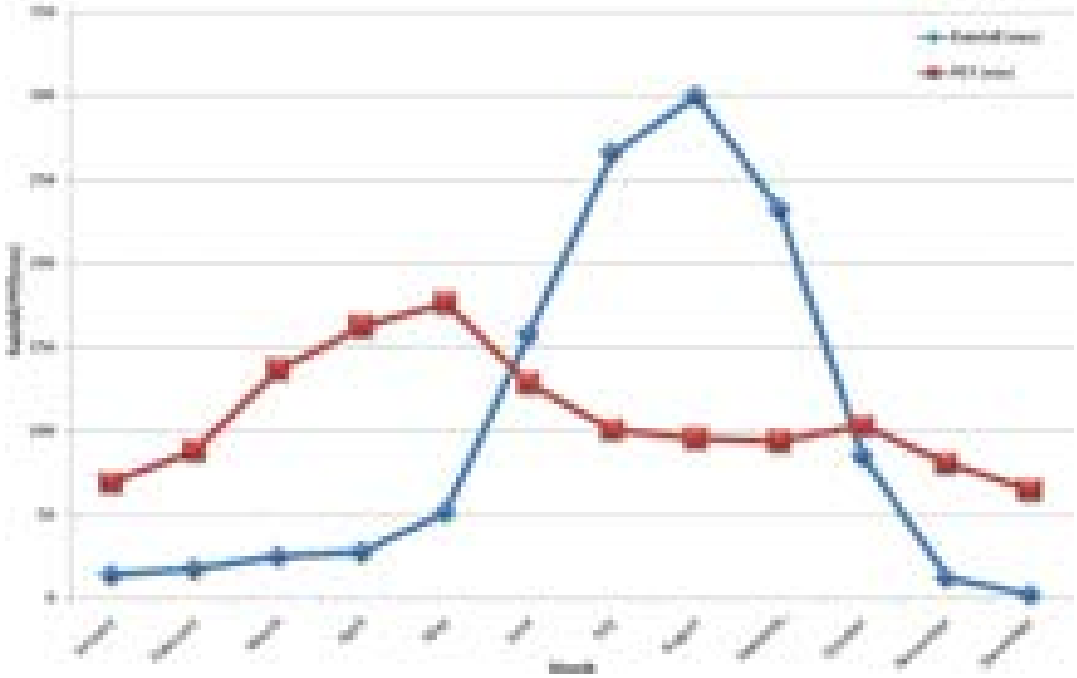
The study area lies in tropical region where climate is characterised by very hot summers and cool winters. Summer is typically from March to June when monthly temperature ranges from a maximum of 40°C during daytime to a minimum of 20°C at night. Winter is from November to February when the maximum temperature during day goes up to 30°C and minimum temperature at night becomes as low as 10°C. Monthly variation in daily average maximum and minimum temperature as recorded at India Meteorological Department's (IMD) observatory, Chaibasa (about ~120 km away) is illustrated as **Fig.1.1**.

The average annual rainfall as recorded at IMD observatory at Chaibasa is 1192 mm and average number of rainy days is 22. The Southwest monsoon lasts from mid-June to mid-September and the area gets more than 80% of the annual rainfall during this period. Monthly Variation in rainfall vis-a-vis potential evapotranspiration as recorded at IMD's observatories at Chaibasa is illustrated as **Fig.1.2**.



Source: Climatological Tables and Observations in India, India Meteorological Department, Chaibasa.

Fig.1.1: Monthly variation of daily avg. maximum and minimum temperature



Source : Climatological Tables and Observations in India, India Meteorological Department, Chaibasa

Fig.1.2: Monthly variation of Rainfall vis-à-vis Potential evapo-transpiration

5.0 BASELINE DATA GENERATION

The baseline environmental status has been aimed to assess the impact of ongoing mining activities (including ore transportation by road) and other anthropogenic activities in the study area.

The study area considered for monitoring was taken as 10 km radius around Dhobil mine and along the ore transportation route from Dhobil mine to Manoharpur railway siding. The environmental components selected for the study area monitoring are, metrology, ambient air, noise, road traffic, and water.

Whereas, to assess the impact of ore transportation by road (including other transportation activities in the region), monitoring was conducted along the ore transportation route for ambient air, noise and road traffic. For the purpose, the ore transportation route has been divided in to different stretches, as follows:

- Stretch 1: Forest road from ML boundary to forest check post at Gendung village - total distance is about 26.1 km.
- Stretch 2: Rourkela–Manoharpur road from forest road junction to the junction from where road to railway siding branches - total distance is about 3.7 km.
- Stretch 3: The branch road from Rourkela–Manoharpur road to railway siding - total distance is about 1.2km.

Monitoring of baseline data for study area (including road ore transportation route) was conducted for one month, i.e. October, 2016. Baseline data generation was conducted for the followings:

- Meteorology at one location
- Ambient air quality at 10 locations
- Surface and Ground water quality at 10 locations
- Noise levels at 10 locations
- Traffic density at 3 locations

The baseline monitoring stations were selected in the study area in general and along ore transportation route in particular.

Traffic studies were also conducted to assess the traffic density / load on all the ore transportation stretches.

5.1 Meteorology

Prevailing micro-meteorological conditions regulates the dispersion and dilution of air pollutants in the atmosphere. In view of the above meteorological station was set up at Admin Building, Chiria Mine. The location is marked in **Drawing No. MEC/G24Z/11/S2/01**.

The following parameters were recorded at hourly intervals continuously for the month of October, 2016.

- Wind speed
- Wind Direction
- Air Temperature
- Relative humidity

Whereas, rainfall was recorded on hourly basis.

Tables 1.1 gives the summary of monitored meteorological data for October, 2016.

Table 1.1: Summarised Meteorological Data for October, 2016

Month	Wind speed (m/s)			Temperature (°C)			Relative humidity (%)			Rainfall (mm)		
	Mean	Max.	% of Calm	Mean	Highest	Lowest	Mean	Highest	Lowest	Total	24 hrs. highest	No. of rainy days
Oct, 2016	0.54	7.3	66.98	25.52	35.3	15.0	80.49	97.4	27.3	379	66.5	12

Wind frequency distribution as monitored is given at **Table 1.2**. From the table it can be seen that during October, 2016. Overall including day and night the predominant wind direction is from South (S, 4.94 %), followed by West (W, 4.78%), WSW (4.01%), SE (3.24%) and SW (2.62%). The calm conditions prevailed for 66.98% of the time. During day time predominant wind direction was W (9.57%) followed by S (9.26%), WSW (7.72%), SE (6.17%); calm conditions prevailed for 36.11% of the time. During night time the predominant wind is SSE (0.93%) followed by S (0.62%) and calm condition prevailed for 97.24% of the time. As per IMD (Chaibasa) wind-rose the predominant wind directions are south-west and north-east. Local terrain features may be responsible for alteration of predominant wind direction in the study area.

Table 1.2 : Wind Frequency Distribution at Admin Building (core zone)

A. 24 hours Overall

Direction	Velocity Ranges (m/s)						Sum %
	0.44 - 2.0	2.0 - 3.0	3.0 - 4.0	4.0 - 5.0	5.0 - 6.0	>= 6.0	
N	0.31	0.00	0.00	0.00	0.00	0.00	0.31
NNE	0.46	0.46	0.15	0.00	0.00	0.00	1.08
NE	1.54	0.62	0.00	0.00	0.00	0.00	2.16
ENE	0.46	0.62	0.00	0.00	0.00	0.00	1.08
E	0.93	0.31	0.15	0.15	0.00	0.00	1.54
ESE	0.62	0.31	0.00	0.00	0.15	0.15	1.23
SE	2.01	0.93	0.31	0.00	0.00	0.00	3.24
SSE	1.08	0.62	0.00	0.00	0.00	0.00	1.70
S	4.48	0.46	0.00	0.00	0.00	0.00	4.94
SSW	2.31	0.00	0.00	0.00	0.00	0.00	2.31
SW	2.62	0.00	0.00	0.00	0.00	0.00	2.62
WSW	3.09	0.77	0.15	0.00	0.00	0.00	4.01
W	4.17	0.31	0.31	0.00	0.00	0.00	4.78
WNW	0.93	0.62	0.00	0.00	0.00	0.00	1.54
NW	0.31	0.00	0.00	0.00	0.00	0.00	0.31
NNW	0.15	0.00	0.00	0.00	0.00	0.00	0.15
SUM %	**25.46**	**6.02**	**1.08**	**0.15**	**0.15**	**0.15**	**33.02**
						CALM % (V<0.44 m/s) =	**66.98**

B. Day Time (0600 – 1800 Hrs.)

Direction	Velocity Ranges (m/s)						Sum %
	0.44 - 2.0	2.0 - 3.0	3.0 - 4.0	4.0 - 5.0	5.0 - 6.0	>= 6.0	
N	0.62	0.00	0.00	0.00	0.00	0.00	0.62
NNE	0.93	0.93	0.31	0.00	0.00	0.00	2.16
NE	3.09	1.23	0.00	0.00	0.00	0.00	4.32
ENE	0.93	1.23	0.00	0.00	0.00	0.00	2.16
E	1.85	0.62	0.31	0.31	0.00	0.00	3.09
ESE	1.23	0.62	0.00	0.00	0.31	0.31	2.47
SE	4.01	1.54	0.62	0.00	0.00	0.00	6.17
SSE	1.23	1.23	0.00	0.00	0.00	0.00	2.47
S	8.33	0.93	0.00	0.00	0.00	0.00	9.26
SSW	4.63	0.00	0.00	0.00	0.00	0.00	4.63
SW	5.25	0.00	0.00	0.00	0.00	0.00	5.25
WSW	5.86	1.54	0.31	0.00	0.00	0.00	7.72
W	8.33	0.62	0.62	0.00	0.00	0.00	9.57
WNW	1.85	1.23	0.00	0.00	0.00	0.00	3.09
NW	0.62	0.00	0.00	0.00	0.00	0.00	0.62
NNW	0.31	0.00	0.00	0.00	0.00	0.00	0.31
Sub-Total	**49.07**	**11.73**	**2.16**	**0.31**	**0.31**	**0.31**	**63.89**
						CALM (V<0.44 m/s) =	**36.11**

C. Night time (1800 – 0600 Hrs.)

Direction	Velocity Ranges (m/s)						Sum %
	0.44 - 2.0	2.0 - 3.0	3.0 - 4.0	4.0 - 5.0	5.0 - 6.0	>= 6.0	
N	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.00	0.31	0.00	0.00	0.00	0.00	0.31
SSE	0.93	0.00	0.00	0.00	0.00	0.00	0.93
S	0.62	0.00	0.00	0.00	0.00	0.00	0.62
SSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	0.31	0.00	0.00	0.00	0.00	0.00	0.31
W	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM %	**1.85**	**0.31**	**0.00**	**0.00**	**0.00**	**0.00**	**2.16**
						CALM (V<0.44 m/s) =	**97.24**

The overall (day-night), day and night time wind-rose diagrams is given in **Figs. 1.3.1, 1.3.2** and **1.3.3,** respectively.

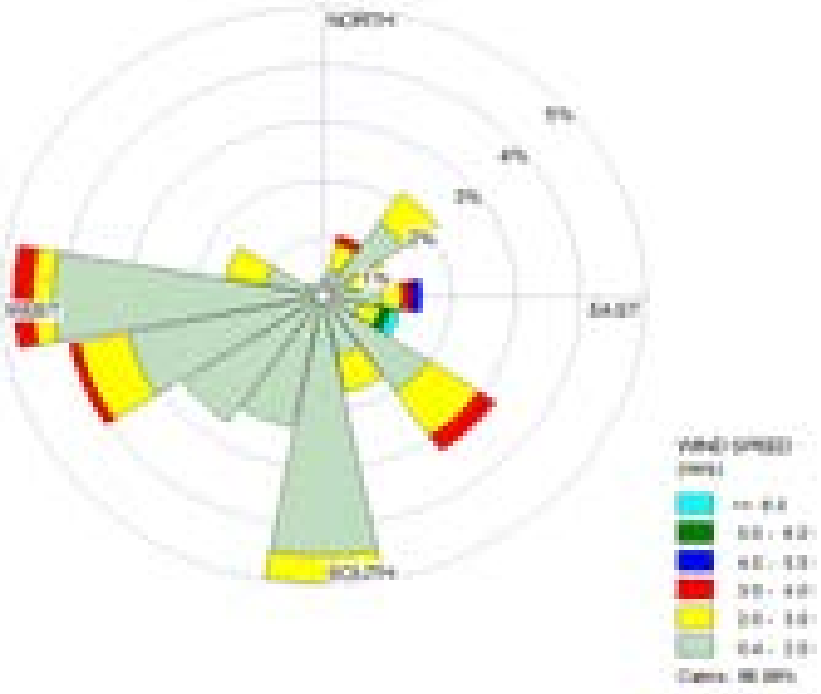


Fig. 1.3.1: Wind Rose at Admin Building (24 hours overall)

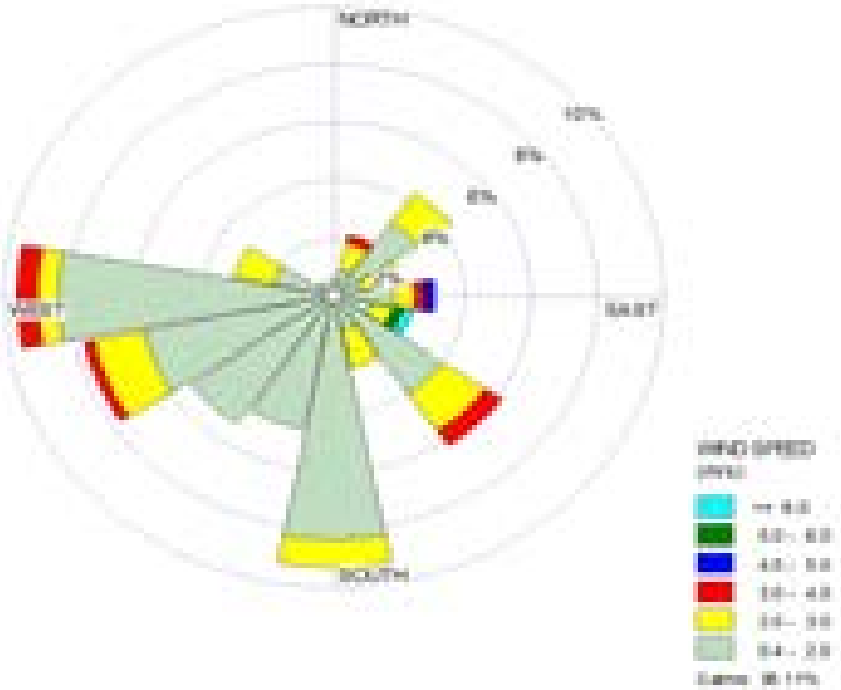


Fig. 1.3.2: Wind Rose at Admin Building (Day)

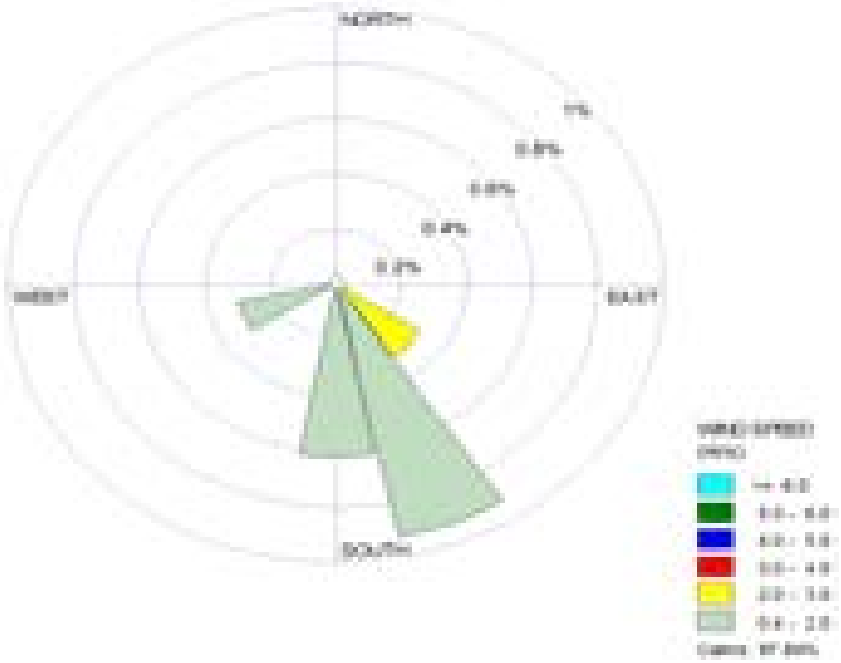


Fig. 1.3.3: Wind Rose at Admin Building (Night)

5.2 Ambient Air Quality

General

The Ambient Air Quality (AAQ) monitoring was conducted to assess the air quality in the study area, due to ongoing mining and other anthropogenic activities. However, particular emphasis was given to assess the AAQ in the ore transportation route. To quantify the impact of ore-transportation by road, the existing ambient air quality within mine lease and in and around the ore-transportation route were monitored. For the purpose, sensitive receptors were identified and were given due importance while selecting the locations for Ambient Air Quality monitoring.

The AAQ was monitored with respect to Respirable Particulate Matter (PM_{10} and $PM_{2.5}$), Sulphur-dioxide (SO_2), Oxides of Nitrogen (NOx) and Carbon Monoxide (CO). Ten locations were selected for establishing Ambient Air Quality monitoring Network. The list of selected AAQ Stations is given in **Table 1.3** and marked in **Drawing No. MEC/G24Z/11/S2/01**.

To assess the baseline AAQ due to ongoing ore transportation activity, five AAQ monitoring locations were located in the ore transportation route covering the different road stretches **(Table 1.3)**.

Table 1.3: Ambient Air Quality (AAQ) Monitoring Stations

Sl. No.	Location	Station Code	Distance (km) from ML	Direction	Remarks (location with respect to ore transportation route)
1.	Dhobil Mine	AN1	Core zone	Core zone	Stretch 1 : Ore transportation - start of forest road (mine gate)
2.	Dhobil Village	AN2	~0.8	E	-
3.	Hatnaburu	AN3	~2.5	S	-
4.	Morang	AN4	~3.3	SW	-
5.	Sukri ML	AN5	~3.4	W	Stretch 1 : Ore transportation - forest road (Ankura RF Stretch)
6.	Gendung	AN6	~8.7	NW	Stretch 1 : Ore transportation end of forest road (forest check post)
7.	Bachamgutu (Close to Rourkela-Manoharpur road)	AN7	~9.7	NW	Stretch 2 : Ore transportation Rourkela-Manoharpur road
8.	Manoharpur Railway Station / Siding	AN8	~12.6	NW	Stretch 3 : End of ore transportation route
9.	Chiria Guest House	AN9	~4.0	N	-
10.	Dhori	AN10	~6.0	NE	-

Methods of Sampling and Analysis

The methods of sample collection, equipments used and analysis procedures as followed are given in **Table 1.4.** Samples of 24 hourly duration were taken for monitoring $PM_{2.5}$, PM_{10}, SO_2 and NO_x twice a week for four weeks. CO was monitored on hourly basis on selected days.

Table 1.4: Methodology of Sampling & Analysis and Equipment used

Sl. No.	Parameter	Instrument/ Apparatus Used	Methodology	Reference
1.	SO_2 (µg/m^3)	RDS with Impinger Tube, Spectro–photometer	Improved West & Gaecke Method	MoEFCC G.S.R 826 (E) dtd. 16.11.09
2.	NO_x (µg/m^3)	RDS with Impinger Tube, Spectro–photometer	Modified Jacobs & Hoccheiser Modified (Na-Arsenite) Method	
3.	PM_{10}(µg/m^3)	Respirable Dust Sampler	Gravimetric	
4.	$PM_{2.5}$(µg/m^3)	$PM_{2.5}$ Fine-Dust Sampler	Gravimetric	
5.	CO (mg/m^3)	NDIR Spectrophotometer	Non Dispersive Infra Red (NDRI) Spectoscopy	

Results and Discussion

The AAQ at various locations as observed were compared with National Ambient Air Quality Standards (NAAQS, 2009) as given in **Table 1.5**.

Table 1.5: National Ambient Air Quality Standards

Sl	Parameter	Time Weighted Average	Concentration in Ambient Air	
			Industrial, Residential, Rural & Other Areas	Ecologically Sensitive Area (Notified by Central Government)
1	SO_2 ; (µg/m^3)	Annual*	50	20
		24 Hours**	80	80
2	NOx ; (µg/m^3)	Annual*	40	30
		24 Hours**	80	80
3	PM_{10}; (µg/m^3)	Annual*	60	60
		24 Hours**	100	100
4	$PM_{2.5}$; (µg/m^3)	Annual*	40	40
		24 Hours**	60	60
5	CO; (mg/m^3)	8 Hours**	02	02
		1 Hours**	04	04

* *Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals*

** *24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be compiled with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days.*

The results of ambient air quality monitoring at different locations are summarised in **Table 1.6**. From the table following observation are made:

Particulate Matter ($PM_{2.5}$): The Value of $PM_{2.5}$ ranges between 13.5 µg/m^3 to 47 µg/m^3. However, the C_{98} value of $PM_{2.5}$ ranges between 29.2 µg/m^3 to 46.3 µg/m^3. The results are well within the norm as prescribed by CPCB **(Fig 1.4.1)**.

Particulate Matter (PM_{10}): The Value of PM_{10} ranges between 35.8 µg/m^3 to 86.0 µg/m^3. However, the C_{98} value of PM_{10} ranges between 56.9 µg/m^3 to 85.0 µg/m^3. The results are well within the norm as prescribed by CPCB **(Fig 1.4.2)**.

Sulphur Dioxide (SO_2): The Value of SO_2 ranges between <4.0 µg/m^3 to 8.5 µg/m^3. However, the C_{98} value of SO_2 ranges between 5.7 µg/m^3 to 8.4 µg/m^3. The results are well within the norm as prescribed by CPCB **(Fig 1.4.3)**.

Oxides of Nitrogen (NO_X): The Value of NOX ranges between <10.0 µg/m^3 to 17.9 µg/m^3. However, the C_{98} value of NO_X ranges between 13.9 µg/m^3 to 17.4 µg/m^3. The results are well within the norm as prescribed by CPCB **(Fig 1.4.4)**.

Carbon Monoxide (CO): The results are well within the norm as prescribed by CPCB **(Fig 1.4.5)**.

Table 1.6: Summarised Ambient Air Quality in the Study area

Monitoring equipment	$PM_{2.5}$ Respirable Dust Sampler (RDS)			PM_{10} Respirable Dust Sampler (RDS)			SO_2 RDS & Spectrophoto-Meter			NOx RDS & Spectrophoto-meter			CO NDIR Spectrophotometer		
Equipment sensitivity	**Detection Limit: 5 $\mu g/m^3$**			**Detection Limit: 5 $\mu g/m^3$**			**Detection Limit: 4$\mu g/m^3$**			**Detection Limit: 10 $\mu g/m^3$**			**Detection Limit: 0.057 mg$/m^3$**		
Monitoring station	**Max.**	**Min.**	**C_{98}**	**Max.**	**Min.**	**C_{98}**	**Max.**	**Min.**	**C_{98}**	**Max.**	**Min.**	**C_{98}**	**Max.**	**Min.**	**C_{98}**
(AN1) Dhobil Mine	35.8	17.9	35.7	77.1	49.2	76.1	7.2	4.9	7.1	15.3	11.4	15.2	1.4	0.2	1.4
(AN2) Dhobil Village	38.6	22.3	37.7	80.7	50.7	79.7	6.0	<4	6.0	16.4	10.7	16.0	2.9	0.2	2.8
(AN3) Hatnaburu	33.6	21.0	33.1	67.9	42.9	66.8	7.1	4.8	7.1	14.1	<10	14.1	2.2	0.5	1.8
(AN4) Morang	37.8	21.8	37.5	83.7	56.8	82.5	7.8	4.2	7.6	17.6	10.6	17.1	2.8	0.2	2.8
(AN5) Sukri ML	31.8	13.5	31.7	57.1	35.8	56.9	7.3	<4	7.2	17.9	11.4	17.4	2.6	0.2	2.6
(AN6) Gendung	31.7	14.2	31.4	72.9	41.4	77.4	7.1	4.1	7.0	16.4	<10	16.1	2.2	0.2	2.2
(AN7) Bachamgutu	34.6	19.8	34.4	70.8	41.6	70.5	7.2	4.1	7.0	14.5	<10	14.4	1.9	0.1	1.7
(AN8) Manoharpur Railway siding	47.0	19.7	46.3	82.0	41.8	80.1	8.5	4.6	8.4	16.5	10.1	16.4	2.2	0.4	2.1
(AN9) Chiria Guest House	31.2	22.2	31.0	86.0	49.3	85.0	5.7	<4	5.7	14.0	<10	13.9	1.6	0.2	1.4
(AN10) Dhori	29.2	19.6	29.2	67.7	40.4	67.2	7.6	<4	7.6	15.3	<10	15.3	1.3	0.3	1.3

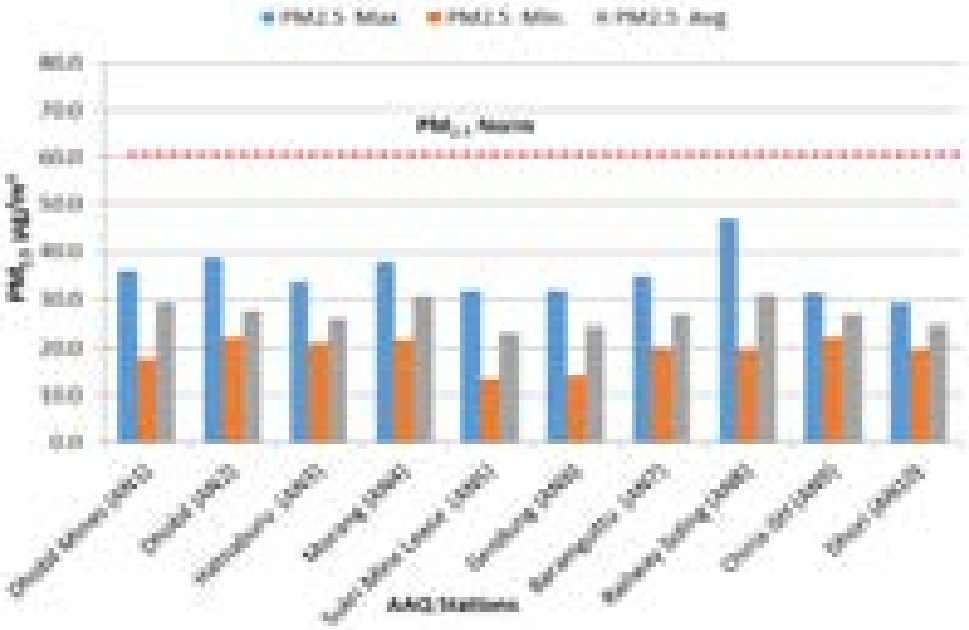


Fig 1.4.1: $PM_{2.5}$ levels at different AAQ locations in the study area

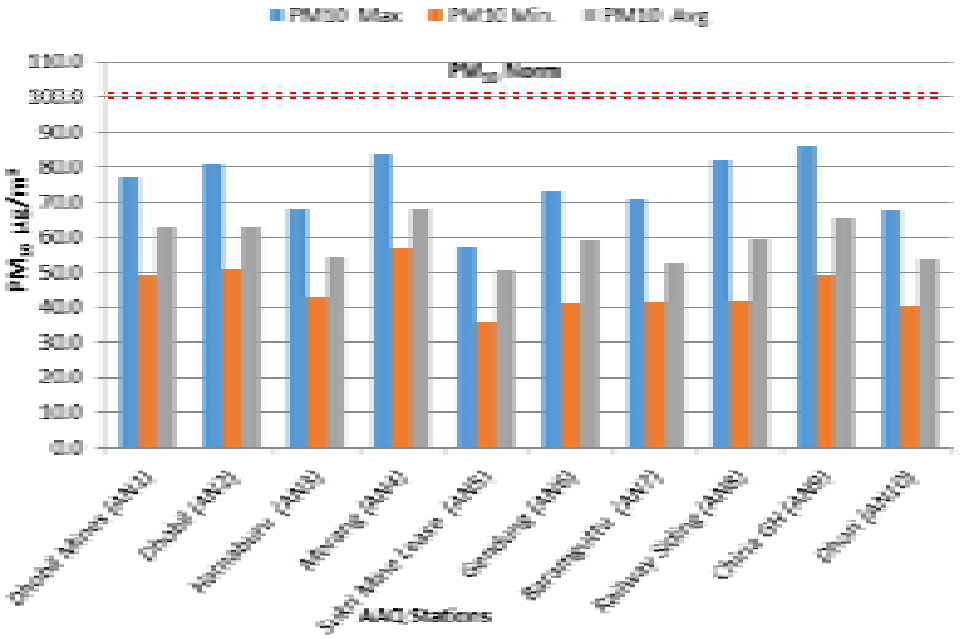


Fig 1.4.2: PM_{10} levels at different AAQ locations in the study area

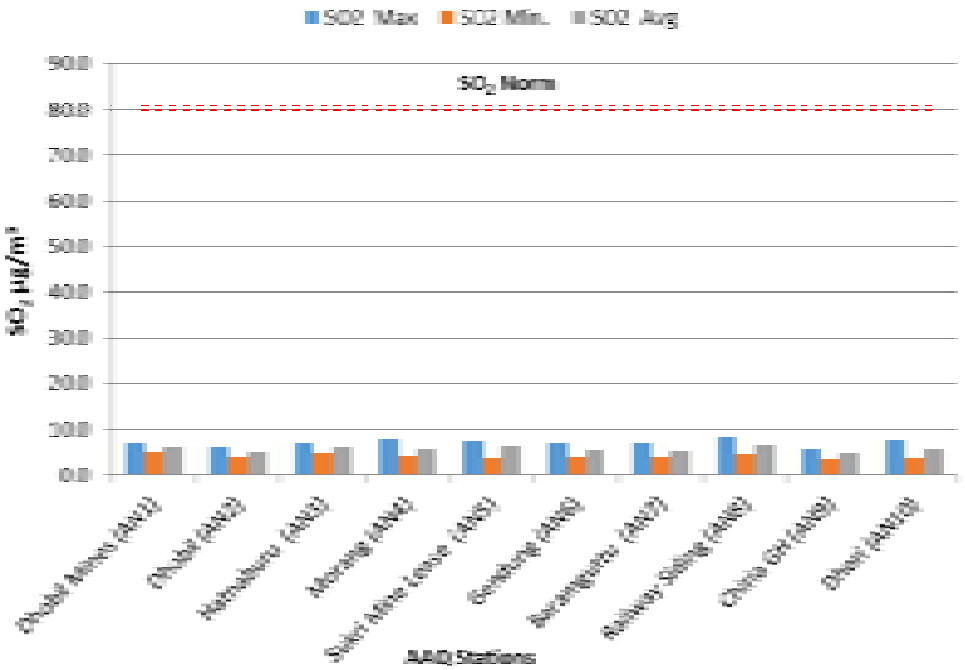


Fig 1.4.3: SO_2 levels at different AAQ locations in the study area

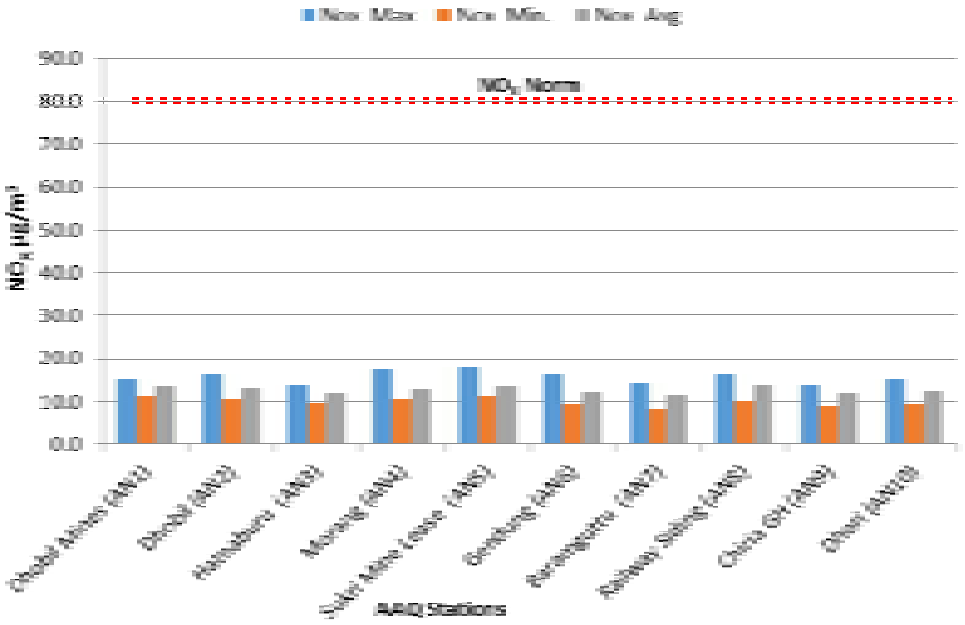


Fig 1.4.4: NOx levels at different AAQ locations in the study area

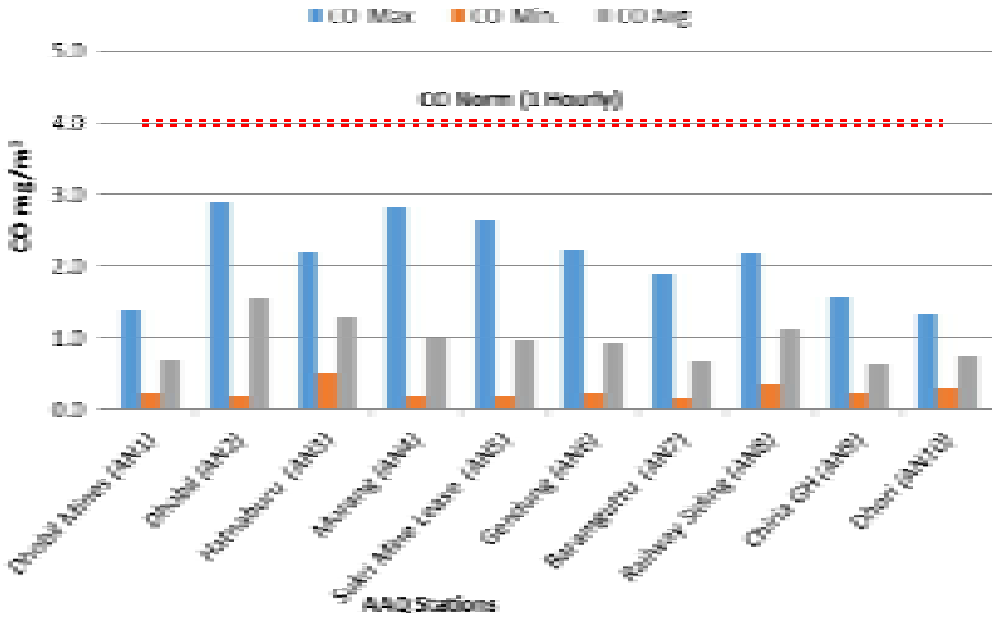


Fig 1.4.5: CO levels at different AAQ locations in the study area

5.3 Water Quality

Water Quality Monitoring stations, Frequency and Mode of Sampling

Water samples (grab) were collected from ten (10) locations, covering two ground water (GW) and eight surface water (SW) samples. The sampling locations are given in **Table 1.7** and marked in **Drawing No. MEC/G24Z/11/S2/01**.

Table 1.7: Water sampling locations

Sl. No.	Location	Station No.	Type	Location from nearest Plant boundary (km)
1.	Dhobil Village	GW 1	Ground water	~2.1 on E
2.	Chiria Township / Guest house	GW 2	Ground water	~4.17 on NW
3.	Chiria Spring	SW 1	Surface water	~3 on N
4.	Hamsada Nala	SW 2	Surface water	~5 on N
5.	Koina river downstream w.r.t. Hamsada Nala	SW 3	Surface water	~7.1 on NE
6.	Koina river downstream w.r.t. Dhobil ML stream	SW 4	Surface water	~3.9 on E
7.	Dhobil ML stream going towards Koina river	SW 5	Surface water	~3.1 on E
8.	Koina river upstream w.r.t. Dhobil ML stream	SW 6	Surface water	~3.7 on E
9.	Koel river upstream w.r.t. Manoharpur Railway Siding	SW 7	Surface water	~13.8 on NW
10.	Koel river downstream w.r.t Manoharpur Railway Siding	SW 8	Surface water	~12.8 on NW

The ground water quality is given **Table 1.8.** The results have been compared with the drinking water quality standards specified in IS:10500 (2012). The all the parameters of ground water in the study area are within the desirable limits of IS:10500.

The surface water quality is shown in **Table 1.9.** The results have been compared with the drinking water quality standards specified in IS 10500 as well as Water Quality Criteria specified by Central Pollution Control Board (as given in **Table 1.10**).

The results show that different parameters in all the water samples are within the desirable limits as specified in IS:10500 for respective parameters. When compared with Surface Water Quality Criteria as specified by Central Pollution Control Board, the water quality at all the stations are falling under Class B surface water quality criteria except for SW8, which falls in Class C, due to total Coliform count above 500 MPN/100ml.

Table 1.8: Ground Water Quality in the Study Area

Sl. No.	Parameter	Norms*		GW1	GW2
		Desirable limits **	Permissible limits ***	06.10.2016	
	Organoleptic and Physical Parameters				
1.	Colour, Hazen units, Max	5	15	<5	<5
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH Value	6.5 to 8.5	No Relaxation	Agreeable	Agreeable
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
5.	Total dissolved solids, mg/l	500	2000	87	263
	General Parameters Concerning Substances Undesirable in Excessive Amounts				
6.	Aluminium (as Al), mg/l	0.03	0.2	<0.01	<0.01
7.	Boron (as B), mg/l, max.	0.5	1	<0.05	<0.05
8.	Calcium (as Ca), mg/l, max.	75	200	<10.0	27
9.	Chloride (as Cl),mg/l, max.	250	1000	10	<8.0
10.	Copper (as Cu), mg/l, max.	0.05	1.5	0.01	0.01
11.	Fluoride (as F), mg/l, max.	1.0	1.5	<0.1	0.11
12.	Iron (as Fe), mg/l, max.	0.3	No Relaxation	0.2	<0.01
13.	Magnesium (as Mg), mg/l, max.	30	100	4	16
14.	Manganese (as Mn), mg/l, max.	0.1	0.3	0.1	<0.005
15.	Nitrate (as NO_3), mg/l, max.	45	No Relaxation	3.0	<1.0
16.	Phenolic compounds (as C_6H_5OH), mg/l, max.	0.001	0.002	<0.001	<0.001
17.	Sulphate (as SO4), mg/l, max.	200	400	<4	4
18.	Total alkalinity(as $CaCO_3$), mg/l	200	600	44	176
19.	Total hardness(as $CaCO_3$), mg/l, max	200	600	40	132
20.	Zinc (as Zn), mg/l, max.	5	15	0.38	1.13
	Parameters Concerning Toxic Substances				
21.	Cadmium (as Cd), mg/l, max.	0.003	No relaxation	<0.005	<0.005
22.	Cyanide (as CN), mg/l, max.	0.05	No relaxation	<0.01	<0.01
23.	Lead (as Pb), mg/l, max.	0.01	No relaxation	<0.01	<0.01
24.	Mercury,(as Hg), mg/l, max.	0.001	No relaxation	<0.0005	<0.0005
25.	Nickel (as Ni), mg/l, max.	0.02	No relaxation	<0.005	<0.005
26.	Total arsenic (as As), mg/l, max.	0.01	0.05	<0.005	<0.005
27.	Total chromium (as Cr), mg/l, Max.	0.05	No relaxation	<0.005	<0.005

* Drinking Water Specification, IS : 10500 (1991), Second Revision-May 2012

**Requirement (desirable limits) ***Permissible limits in the absence of alternate source

Table 1.9: Results of Surface Water Analysis in the Study Area

Sl. No.	Parameter	Norms*		SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
		Desirable limits **	Permissible limits ***	06.10.2016							
	Organoleptic and Physical Parameters										
1.	pH Value	6.5 to 8.5	No Relaxation	7.19	7.21	7.18	7.23	7.40	7.35	6.37	6.65
2.	Total dissolved solids, mg/l	500	2000	62	128	116	105	162	122	133	141
	General Parameters Concerning Substances Undesirable in Excessive Amounts										
3.	Aluminium (as Al), mg/l	0.03	0.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4.	Boron (as B), mg/l, max.	0.5	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5.	Calcium (as Ca), mg/l, max.	75	200	<10.0	10	<10	<10	11	<10	10	11
6.	Chloride (as Cl),mg/l, max.	250	1000	8	10	<8	8	10	14	12	17
7.	Copper(as Cu), mg/l, max.	0.05	1.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8.	Fluoride (as F), mg/l, max.	1.0	1.5	<0.1	0.5	<0.1	0.5	<0.1	0.2	<0.1	<0.1
9.	Iron (as Fe), mg/l, max.	0.3	No Relaxation	<0.01	<0.01	0.14	<0.01	<0.01	0.12	<0.01	0.08
10.	Magnesium (as Mg), mg/l, max.	30	100	2	4	4	5	5	6	4	6
11.	Manganese (as Mn), mg/l, max.	0.1	0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
12.	Nitrate (as NO_3), mg/l, max.	45	No Relaxation	4.8	2.4	4.2	<1.0	<1.0	<1.0	<1.0	3.2
13.	Phenolic compounds(as C_6H_5OH), mg/l, max.	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
14.	Sulphate (as SO4), mg/l, max.	200	400	0.5	5.9	17.2	1.2	19.1	1.1	1.5	9.4
15.	Total alkalinity(as $CaCO_3$), mg/l	200	600	24	64	44	60	76	62	68	56
16.	Total hardness(as $CaCO_3$), mg/l, max	200	600	16	40	32	40	48	44	40	52
17.	Zinc (as Zn), mg/l, max.	5	15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

	Parameters Concerning Toxic Substances										
18.	Cadmium (as Cd), mg/l, max.	0.003	No relaxation	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
19.	Cyanide (as CN), mg/l, max.	0.05	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
20.	Lead (as Pb), mg/l, max.	0.01	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21.	Mercury,(as Hg), mg/l, max.	0.001	No relaxation	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
22.	Nickel (as Ni), mg/l, max.	0.02	No relaxation	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
23.	Total arsenic (as As), mg/l, max.	0.01	0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
24.	Total chromium (as Cr), mg/l, Max.	0.05	No relaxation	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Additional Characteristics										
25.	Total Coliform bacteria, MPN/100ml	-	-	31	40	460	330	110	48	400	540
26.	D.O mg/l	-	-	7.3	7.6	7.4	7.3	7.2	7.0	5.9	6.7
27.	BOD, mg/l	-	-	1.0	1.8	2.6	2.4	2.0	1.8	2.5	3.0
28.	Sodium Absorption Ratio (SAR)	-	-	0.98	1.10	1.00	0.82	1.19	1.05	1.24	0.85

* Drinking Water Specification, IS : 10500 (1991), Second Revision-May 2012

**Requirement (desirable limits) ***Permissible limits in the absence of alternate source

Table 1.10: Water Quality Criteria as per Central Pollution Control Board (CPCB)

Parameters	Class A	Class B	Class C	Class D	Class E
1. pH	6.5–8.5	6.5–8.5	6.0-9.0	6.5–8.5	6.0–8.5
2. Dissolved oxygen (as O_2), mg/l, min	6	5	4	4	-
3. BOD, 3 days at 27° C, max	2	3	3	-	-
4.Total coliform organism, MPN/100 ml, max	50	500	5000	-	-
5. Free ammonia (as N), mg/l, max	-	-	-	1.2	-
6. Electrical conductivity, μmhos/cm, max	-	-	-	-	2250
7. Sodium absorption ratio, max.	-	-	-	-	26
8. Boron (as B), mg/l, max.	-	-	-	-	2

Class A: Drinking water source without conventional treatment but after disinfection
Class B: Outdoor bathing (organised)
Class C: Drinking water source after conventional treatment and after disinfection
Class D: Propagation of Wild life and Fisheries
Class E: Irrigation, Industrial Cooling, and Controlled Waste Disposal
Below E: Not meeting A, B, C, D & E Criteria

5.4 Noise level

General

Noise monitoring were carried out at ten (10) locations as listed in **Table 1.11** and marked in **Drawing No. MEC/G24Z/11/S2/01**.

Table 1.11: Ambient Noise Monitoring Stations

Sl. No.	Location	Station Code	Distance from ML (km)	Direction	Type of Area	Remarks (location with respect to ore transportation route)
1.	Dhobil Mine	AN1	Core zone	Core zone	Industrial	Stretch 1 : Ore transportation - start of forest road (mine gate)
2.	Dhobil Village	AN2	~0.8	E	Residential	-
3.	Hatnaburu	AN3	~2.5	S	Residential	-
4.	Morang	AN4	~3.3	SW	Residential	-
5.	Sukri ML	AN5	~3.4	W	Industrial	Stretch 1 : Ore transportation - forest road (Ankura RF Stretch)
6.	Gendung	AN6	~8.7	NW	Residential	Stretch 1 : Ore transportation end of forest road (forest check post)
7.	Bachamgutu (Close to Rourkela-Manoharpur road)	AN7	~9.7	NW	Residential	Stretch 2 : Ore transportation Rourkela-Manoharpur road
8.	Manoharpur Railway Station/Siding	AN8	~12.6	NW	Industrial	Stretch 3 : End of ore transportation route
9.	Chiria Guest House	AN9	~4.0	NW	Residential	-
10.	Dhori	AN10	~6.0	NE	Residential	-

Leq. noise level was recorded at hourly intervals, continuously for 24 hours by operating the noise-recording instrument for fifteen minutes during each hour.

Results and Discussions

The results of ambient noise monitoring are summarised in **Table 1.12**. The results have been compared with MoEFCC norms (Noise Regulation & Control - Rules, 2000), as given in **Table 1.13**.

Ambient noise levels at Dhobil mines (AN1), Sukri ML (AN5) and at Monoharpur Railway siding (AN8) is within the norm for "Industrial Area". Remaining at all the stations, except for Bachamgutu (AN7) the noise levels are within the permissible limits as specified for residential zone. The higher noise levels at AN7 is due to the location being close to Rourkela-Manoharpur road, wherein the road traffic may have lead to higher noise levels.

Table 1.12: Summarised Results of Noise Monitoring

Stn. No.	Location	Results					
		Day (0600-2200 hr.)			Night (2200-0600 hr.)		
		Max.	Min.	Avg.*	Max.	Min.	Avg.*
AN1	Dhobil Mine	63.5	36.2	59.2	35.1	31.5	33.2
AN2	Dhobil Village	44.8	34.9	41.2	32.5	28.6	30.9
AN3	Hatnaburu	45.8	37.3	42.6	34.2	30.2	32.3
AN4	Morang	49.7	39.7	45.6	39.4	33.5	36.2
AN5	Sukri ML	44.6	31.4	41.6	33.2	30.6	31.9
AN6	Gendung	49.5	32.2	46.7	30.2	28.3	29.3
AN7	Bachamgutu	60.5	36.5	56.4	39.2	28.4	34.3
AN8	Manoharpur Railway siding	56.4	40.7	51.8	43.8	37.5	41.1
AN9	Chiria Guest House	46.2	34.7	42.7	35.3	32.2	34.0
AN10	Dhori	46.4	35.6	42.9	33.8	30.6	32.2

** Logarithmic Averages.* *All Values in dB (A).*

Table 1.13: Ambient Air Quality norms in respect of Noise

Type of Area	Day (0600 - 2200 hrs).	Night (2200 – 0600 hrs.)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

All Values in dB (A)

5.5 Traffic Survey

General

Ore produced at Dhobil Mine is transported by dumpers from the mine to Railway siding situated at Manoharpur which passes through forest road (~26.0 km), Rourkela–Manoharpur road (~3.7 km) and approach road (~1.2km) covering overall a distance of ~31km.
The forest road almost in the entire course passes through hilly terrain Average speed of vehicles on this road is ~20–30 km/hr. The stretch of Rourkela – Manoharpur road used is a two lane with ~1 m shoulder on each side.

Traffic density was monitored for two wheelers (motor-cycles & scooters), Light Motor Vehicles - including cars, jeeps / SUVs (LMV) and Heavy Motor Vehicles - including buses and trucks (HMV). The counting was done on hourly basis for 24 hours, separately for vehicles moving two and fro at the three locations. The monitoring was conducted for consecutive 7 days, i.e from 19.10.2016 to 25.10.2016.

In order the assess the existing traffic on various stretches of ore transporting route, sampling locations were selected as given in **Table 1.14** and marked in **Drawing No. MEC/G24Z/11/S2/01**. Traffic survey was conducted on 24 hourly basis for seven days at each location. Whereas, the traffic density due to ore transportation was collected from Dhobil mines office at the gate (after weigh bridge) as recorded / maintained in ore / truck dispatch register (secondary source).

The traffic survey locations were selected to cover the followings:

1. **T1 (Stretch 1):** Classified volume count of all vechicles either entering the forest road going towards Dhobil ML area or exiting from the forest road. As other vehicles are not permitted on this road, the traffic load on this road reflects the traffic due to ore transportation plus the villages Gendung and Chota Gendung situated on this road.
2. **T2:** Classified volume count of vehicles of Rourkela –Manoharpur road, either (i)coming from Rourkela and going towards Manoharpur (ii)coming from Manoharpur and going towards Rourkela. T2 location is on Rourkela – Manoharpur road, about 100m before joining ore transportation route and provides the traffic density on Rourkela–Manoharpur road before receiving the traffic due to ore transportation.
3. **T3 (Stretch 2):** Classified volume count of vehicles including the traffic load of T1 and T2. The ore transportation trucks uses this Rourkela –Manoharpur road stretch before taking turn towards railway siding.
4. **T4 (Stretch 3):** Classified volume count of ore transportation trucks moving towards railway siding from mines (carrying ore) and returning back from railway siding after unloading. The data for this location is collected from ore / truck dispatch register (Dhobil mine's gate, after weigh bridge).

Table 1.14: Traffic Density Monitoring Locations

Station Code	Location	Road Stretch
T1	Stretch 1 : Forest Road - Near Forest Check post at the end of forest road before joining Rourkela –Manoharpur road	Forest Road
T2	Rourkela Manoharpur road - Near Meena Bazar on Rourkela – Manoharpur road (100 m towards Rourkela before forest road junction)	Major District Road
T3	Stretch 2 : Rourkela –Manoharpur road - Near Medasai village on Rourkela –Manoharpur road before joining approach road towards Railway siding (On Rourkela –Manoharpur road, 50 m before turning to branch road going towards railway siding, before power sub-station)	Major District Road
T4	Stretch 3 : Branch road from Rourkela –Manoharpur road, after turning from power sub-station, going towards railway siding (From Secondary data collected from mine dispatch register)	Branch road leading to railway siding

The status of the road at T1, T2, T3 and T4 locations are shown in **Figs. 1.5, 1.6, 1.7** and **1.8**.

Fig. 1.5: Photograph showing Traffic Monitoring location T1 near Forest Check post on end of forest road before joining Rourkela –Manoharpur road

Fig. 1.6: Photograph showing Traffic Monitoring location T2 on Rourkela – Manoharpur road coming from Rourkela

Fig. 1.7: Photograph showing Traffic Monitoring location T3 on Rourkela – Manoharpur road

Fig. 1.8: Photograph showing Traffic Monitoring location T4 on branch road from Rourkela-Manoharpur Road

The seven days average traffic density data at T1, T2 and T3 is given in **Tables 1.15.1, 1.15.2 & 1.15.3**. The observed traffic density was converted in to Passanger car Unit (PCU) by following the the guidelines of "IRC: 64.1990: Guidelines for Capacity of Roads in Rural Areas". According to the guidelines, one truck is equivalent to 3 PCUs, car is considered equivalent to 1PCU and one two-wheeler is equivalent to 0.5 PCU.

Table 1.15.1 shows the monitored traffic density at T1, i.e, Forest Road before joining Rourkela–Manoharpur road near forest check-post. This road is a forest road connecting Dhobil mines to Manoharpur railway siding via Rourkela–Manoharpur road. This road is mostly used (for ore transportation) and repaired / maintained by SAIL.

The traffic density in terms of passenger car unit (PCU) at this location is highest for heavy motor vehicle (HMV) followed by two wheelers and light motor vehicles and heavy motor vehicles. Total Passenger Car Units (PCUs) contribution of HMV, two-wheelers and light motor vehicle (LMV) is 1056, 46, and 16, respectively. Total traffic density (PCU) at this location is 1118 per day. Highest Peak hour volume is 139 PCUs during 06:00 to 07:00 hrs. However, the Peak hours of traffic load are from morning 06:00hrs to evening 19:00hrs.

Fig.1.9 shows the hourly traffic load on the forest road, it can be seen that the highest PCU is of HMV, plying between 06:00 hrs to 18:00 hrs. The values are in unison with fact that the statutory permission for plying transportation vehicle on this road is only between sunrise and sunset.

Table 1.15.1: Seven days average Traffic Density at location T1

Time in 00.00 Hrs	T1: Forest Road before joining Rourkela–Manoharpur road near Forest Check-Post												
	2 wheelers				LMV				HMV				Total PCU/day
	To R.S	To Mines	Total	PCU /day	To R.S	To Mines	Total	PCU /day	To R.S	To Mines	Total	PCU /day	
00.00 – 01.00	0	0	0	0	0	0	0	0	0	0	0	0	0
01.00 – 02.00	0	0	0	0	0	0	0	0	0	0	0	0	0
02.00 – 03.00	0	0	0	0	0	0	0	0	0	0	0	0	0
03.00 – 04.00	0	0	0	0	0	0	0	0	0	0	0	0	0
04.00 – 05.00	0	0	0	0	0	0	0	0	0	0	0	0	0
05.00 – 06.00	0	0	0	0	0	0	0	0	0	0	0	0	0
06.00 – 07.00	3	2	5	3	1	1	2	2	8	37	45	135	139
07.00 – 08.00	3	3	6	3	0	0	1	1	2	19	20	61	65
08.00 – 09.00	4	6	10	5	1	1	1	1	6	5	11	33	39
09.00 – 10.00	3	3	6	3	1	1	1	1	18	12	30	91	95
10.00 – 11.00	5	4	9	4	0	1	1	1	22	19	41	123	128
11.00 – 12.00	4	4	8	4	2	1	3	3	22	21	43	129	135
12.00 – 13.00	3	3	7	3	1	1	2	2	12	16	29	86	91
13.00 – 14.00	3	3	6	3	0	0	1	1	10	10	19	58	62
14.00 – 15.00	4	2	6	3	1	0	1	1	18	7	24	73	77
15.00 – 16.00	3	4	7	3	0	0	1	1	17	5	22	65	69
16.00 – 17.00	4	5	9	5	0	1	1	1	21	7	29	86	92
17.00 – 18.00	3	5	8	4	0	1	1	1	18	10	28	84	88
18.00 – 19.00	2	3	4	2	0	0	1	1	5	4	9	27	29
19.00 – 20.00	0	1	1	0	0	0	0	0	2	0	2	7	8
20.00 – 21.00	0	0	0	0	0	0	0	0	0	0	0	0	0
21.00 – 22.00	0	0	0	0	0	0	0	0	0	0	0	0	0
22.00 – 23.00	0	0	0	0	0	0	0	0	0	0	0	0	0
23.00 – 00.00	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**45**	**46**	**92**	**46**	**8**	**8**	**16**	**16**	**181**	**171**	**352**	**1056**	**1118**

R.S. Railway Siding; PCU : Passenger Car Unit; LMV : Light Motor Vehicle; HMV : Heavy Motor Vehicle

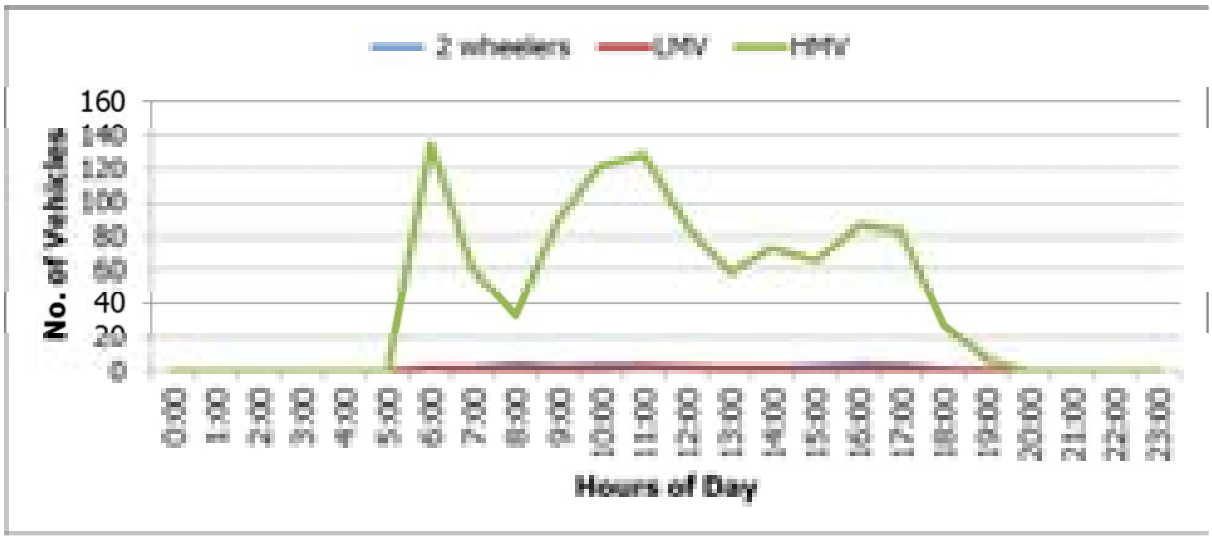


Fig. 1.9: Average Traffic Density in terms of Passenger Car Unit (PCU) at location T1.

Table 1.15.2 shows the monitored traffic density at **T2**, i.e, Rourkela (ROU) - Manoharpur (MHP) road, near Meena Bazar (100m towards ROU from the forest road junction). This is Rourkela - Manoharpur road and the monitoring location is just before the junction point of forest road, thus the traffic load at this location depicts the usual traffic on the Rourkela–Manoharpur road.

The traffic density in terms of passenger car unit (PCU) at this location is highest for LMV (327) followed by HMV (259) and two wheelers (208). Total traffic density (PCU) at this location is 794 per day. Highest Peak hour volume is 71 PCUs during 06:00 to 07:00 hrs and 17:00 to 18:00. However, the Peak hours of traffic load are from morning 06:00hrs to evening 22:00hrs.

The traffic density shows a mix use of this road. **Fig. 1.10** shows the hourly traffic load on the Rourkela–Manoharpur road. It can be seen that the highest PCU is LMV, plying between 06:00 hrs to 22:00 hrs followed by HMV which is shown to ply between 06:00 hrs to 19:00 hrs.

Table 1.15.2: Seven days average Traffic Density at location T2

Time in 00.00 Hrs	T2: Rourkela (ROU) - Manoharpur (MHP) Road - Near Meena Bazar (100 m towards Rourkela from forest road junction												
	2 wheelers				LMV				HMV				Total PCU/day
	To MHP	To ROU	Total	PCU /day	To MHP	To ROU	Total	PCU /day	To MHP	To ROU	Total	PCU /day	
00.00 – 01.00	0	0	0	0	0	0	0	0	0	0	0	0	0
01.00 – 02.00	0	0	0	0	0	0	0	0	0	0	0	0	0
02.00 – 03.00	0	0	0	0	0	0	0	0	0	0	0	0	0
03.00 – 04.00	0	0	0	0	0	0	0	0	0	0	0	0	0
04.00 – 05.00	0	0	0	0	0	0	0	0	0	0	0	0	0
05.00 – 06.00	0	0	0	0	0	0	0	0	0	0	0	0	0
06.00 – 07.00	7	4	11	5	7	5	11	11	2	3	5	15	32
07.00 – 08.00	11	8	19	9	7	6	12	12	1	2	2	6	28
08.00 – 09.00	16	13	28	14	12	9	21	21	2	5	7	21	56
09.00 – 10.00	17	17	34	17	14	13	26	26	4	3	7	20	63
10.00 – 11.00	18	20	38	19	13	15	28	28	3	5	8	24	71
11.00 – 12.00	19	19	37	19	14	16	30	30	4	3	6	19	68
12.00 – 13.00	16	17	32	16	12	13	25	25	1	2	3	9	50
13.00 – 14.00	14	12	26	13	11	9	21	21	2	6	7	22	56
14.00 – 15.00	15	19	34	17	12	12	24	24	2	2	4	12	52
15.00 – 16.00	18	17	36	18	13	14	27	27	3	2	6	17	62
16.00 – 17.00	18	17	35	17	11	13	24	24	3	3	6	18	58
17.00 – 18.00	19	21	40	20	14	14	29	29	3	4	7	22	71
18.00 – 19.00	11	10	21	11	9	10	18	18	3	2	5	16	45
19.00 – 20.00	6	7	12	6	9	6	14	14	3	3	6	19	40
20.00 – 21.00	5	4	9	5	6	4	10	10	2	2	4	12	27
21.00 – 22.00	3	2	4	2	3	3	6	6	1	1	2	7	15
22.00 – 23.00	1	0	1	0	1	0	1	1	0	0	0	0	1
23.00 – 00.00	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**211**	**205**	**417**	**208**	**166**	**162**	**327**	**327**	**37**	**49**	**86**	**259**	**794**
PCU : Passenger Car Unit; LMV : Light Motor Vehicle; HMV : Heavy Motor Vehicle													

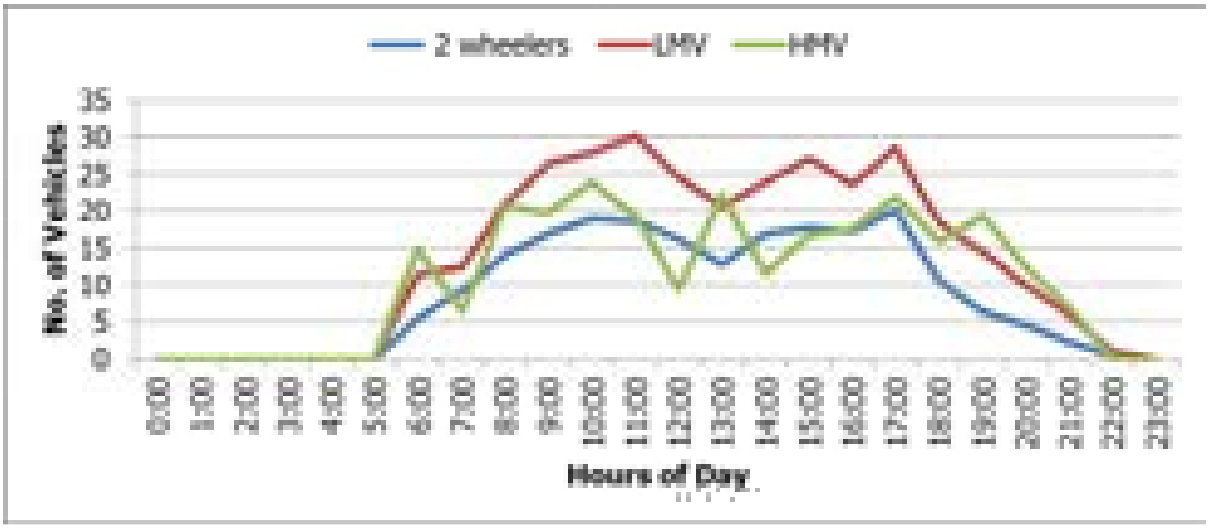


Fig. 1.10: Average Traffic Density in terms of Passenger Car Unit (PCU) at location T2.

Table 1.15.3 shows the monitored traffic density at **T3**, i.e, Rourkela (ROU) - Manoharpur (MHP) road, near Medsai Village (before joining approach road to Railway siding). This road is connecting Rourkela - Manoharpur and the monitoring location is just before the branch road leading to railway siding, thus the traffic load at this location depicts the usual traffic on the Rourkela–Manoharpur road plus the traffic load coming via forest road (as at T1).

The traffic density in terms of passenger car unit (PCU) at this location is highest for HMV (1230) followed by LMV (340) and two wheelers (255). Total traffic density (PCU) at this location is 1824 per day. Highest Peak hour volume is 203 PCUs during 11:00 to 12:00. However, the Peak hours of traffic load are from morning 06:00hrs to evening 20:00hrs.

The traffic density shows a mix use of this road. **Fig. 1.11** shows the hourly traffic load on the Rourkela–Manoharpur road at location T3. It can be seen that the highest PCU is HMV, plying between 06:00 hrs to 20:00 hrs followed by LMV which is shown to ply between 06:00 hrs to 19:00 hrs.

Table 1.15.3: Seven days average Traffic Density at location T3

Time in 00.00 Hrs	T3- Rourkela (ROU) - Manoharpur (MHP) Road - Near Medasai Village before joining approach road to Railway siding												
	2 wheelers				LMV				HMV				Total PCU/day
	To MHP	To ROU	Total	PCU /day	To MHP	To ROU	Total	PCU /day	To MHP	To ROU	Total	PCU /day	
00.00 – 01.00	0	0	0	0	0	0	0	0	0	0	0	0	0
01.00 – 02.00	0	0	0	0	0	0	0	0	0	0	0	0	0
02.00 – 03.00	0	0	0	0	0	0	0	0	0	0	0	0	0
03.00 – 04.00	0	0	0	0	0	0	0	0	0	0	0	0	0
04.00 – 05.00	0	0	0	0	0	0	0	0	0	0	0	0	0
05.00 – 06.00	0	0	0	0	0	0	0	0	0	0	0	0	0
06.00 – 07.00	11	6	17	9	7	6	13	13	6	33	39	116	138
07.00 – 08.00	21	14	35	18	9	9	18	18	4	9	13	40	76
08.00 – 09.00	19	20	39	20	14	11	25	25	10	9	19	57	102
09.00 – 10.00	22	20	42	21	15	15	30	30	23	17	39	118	169
10.00 – 11.00	23	25	48	24	14	15	30	30	23	21	44	133	186
11.00 – 12.00	21	23	45	22	15	19	34	34	24	25	49	146	203
12.00 – 13.00	22	23	45	23	14	15	29	29	17	18	35	106	157
13.00 – 14.00	16	15	31	16	11	9	20	20	12	9	21	63	98
14.00 – 15.00	18	23	41	20	13	14	27	27	17	9	25	75	123
15.00 – 16.00	22	20	42	21	14	16	30	30	20	9	29	88	138
16.00 – 17.00	21	20	41	20	12	14	26	26	27	10	37	111	158
17.00 – 18.00	23	26	49	24	16	15	31	31	24	17	41	123	179
18.00 – 19.00	9	11	21	10	8	10	18	18	4	5	9	28	56
19.00 – 20.00	4	4	7	4	3	3	6	6	1	5	6	18	28
20.00 – 21.00	2	2	4	2	1	1	2	2	1	1	2	5	9
21.00 – 22.00	1	1	2	1	0	1	1	1	0	0	0	1	3
22.00 – 23.00	0	1	1	0	0	0	1	1	0	0	0	0	1
23.00 – 00.00	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**254**	**255**	**509**	**255**	**167**	**172**	**340**	**340**	**213**	**197**	**410**	**1230**	**1824**

PCU : Passenger Car Unit; LMV : Light Motor Vehicle; HMV : Heavy Motor Vehicle

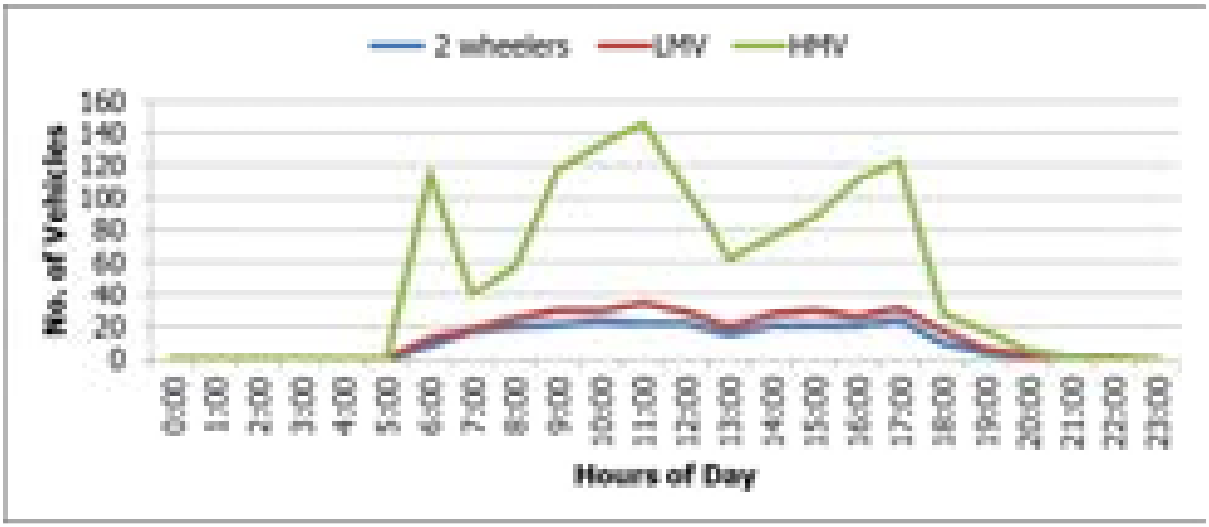


Fig.1.11: Average Traffic Density in terms of Passenger Car Unit (PCU) at location T3

Summarised traffic density monitored data at all the three locations for the study period is given in **Table 1.16**.

Table 1.16: Summarized Traffic Density data: Total Traffic on both ways (nos.)

(a) T1: Near Forest Check post at the end of forest road before joining Rourkela–Manoharpur road (T1)

Date	TWO WHELLER		LMV		HMV		Total Vehicles	Traffic in PCU/Day
	To R.S	To Mines	To R.S	To Mines	To R.S	To Mines		
19.10.2016	36	36	8	8	171	207	466	1186
20.10.2016	37	40	7	9	242	216	551	1429
21.10.2016	40	44	11	10	235	195	535	1353
22.10.2016	51	54	8	10	213	180	516	1250
23.10.2016	35	38	7	8	0	0	88	52
24.10.2016	55	50	4	3	184	180	476	1152
25.10.2016	62	63	10	9	222	219	585	1405
Average	**45**	**46**	**8**	**8**	**181**	**171**	**460**	**1118**
Maximum	**62**	**63**	**11**	**10**	**242**	**219**	**585**	**1429**

(b) T2: Near Meena Bazar on Rourkela - Manoharpur Road before Forest Check post (T2)

Date	TWO WHELLER		LMV		HMV		Total Vehicles	Traffic in PCU/Day
	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU		
19.10.2016	203	192	145	147	21	35	743	658
20.10.2016	201	184	169	148	33	51	786	762
21.10.2016	202	202	145	163	30	28	770	684
22.10.2016	183	192	160	170	23	31	759	680
23.10.2016	234	253	207	195	56	62	1007	1000
24.10.2016	243	209	151	137	37	41	818	748
25.10.2016	214	207	182	172	61	95	931	1033
Average	**211**	**206**	**166**	**162**	**37**	**49**	**831**	**795**
Maximum	**243**	**253**	**207**	**195**	**61**	**95**	**1007**	**1033**

* Rourkela-ROU, Manoharpur-MHP

(c) T3: Near Medasai village on Rourkela–Manoharpur road before joining approach road towards Railway siding (T3)

Date	TWO WHELLER		LMV		HMV		Total Vehicles	Traffic in PCU/Day
	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU		
19.10.2016	244	241	161	167	211	193	1217	1783
20.10.2016	251	244	168	173	256	255	1347	2122
21.10.2016	240	249	152	192	236	230	1299	1987
22.10.2016	205	235	155	152	221	181	1149	1733
23.10.2016	283	305	227	219	59	64	1157	1109
24.10.2016	324	269	142	153	219	203	1310	1858
25.10.2016	232	243	166	151	288	253	1333	2178
Average	**254**	**255**	**167**	**172**	**213**	**197**	**1259**	**1824**
Maximum	**324**	**305**	**227**	**219**	**288**	**255**	**1347**	**2178**

* Rourkela-ROU, Manoharpur-MHP

6.0 IMPACT ASSESSMENT OF ORE TRANSPORTATION BY ROAD

SAIL is planning to continue its present ore transportation mode (via trucks) from Dhobil mine lease to Manoharpur railway siding through the existing ore-transportation route, for additional five years. Subsequently, as the originally envisaged and approved conveyor system facilities gets establish / commissioned, ore will be transported through conveyor system.

The ongoing section attempts to evaluate the impact of ore transportation through road in the exisitng route passing through three stretches, namely, forest road, Rourkela-Manoharpur road and approach road to railway siding. Herein, the assessment of impact has been done with respect to ambient air and traffic load in the subsequent section, as follows:

- **Section 6.1** deals with the assessment of level of impact on ambient air quality with respect to assimilative capacity of the air shed.
- **Section 6.2** deals with the assessment of level of impact on road traffic with repect to carrying capacity of the above three stretches.

6.1 Impact on Ambient Air Quality Due to Continuation of Ore Transport through Road

Baseline data of ambient air quality was collected in October, 2016. The summarised results are presented in **Table 1.6.** The AAQ monitoring results are given results are given in **Annexure 1**.

The ROM despatched during the month of October, 2016 was 46602 t which is approximately 15,898 t (~16,000 t) less than the monthly target of ore dispatch. It is to be noted that the monitored ambient air quality reflects the impact of ongoing ROM production and despatch through road. In present case, the ambient air quality modeling has been carried out considering the load of this yearly deficit i.e. difference of 191868 t (~200000 t).

Modelling Methodology

The fugitive dust emissions due to transport of iron ore through road via trucks have been estimated using the methodologies outlined in the AP-42 (USEPA) and National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EET) for Mining Version 3.1 (Jan. 2012) (Australia). Using the model, maximum 24-hour ground-level PM10 concentrations at the nearest sensitive receiver to the site has been predicted. ISC3 model is designed to predict ground-level concentrations or dry deposition of pollutants emitted from one or more sources, which may be stacks, area sources, volume sources, open pits or any combination of these. ISC3 is essentially a statistical Gaussian plume model that requires a time series of both meteorological and source emission data.

Baseline ambient air quality data was collected during October, 2016. During this period the mining activities was going on e.g. mining of iron ore, loading/ unloading ore/OB, transportation of ore by truck through haul roads, Rourkela–Manoharpur road and finally up to railway siding. As discussed above, air quality modeling has been carried out for the ore and waste generated for ROM handling of ~200000t.

Grid System

ISC3 can calculate concentrations both on a set grid (typically Cartesian) or at specified locations. In the present study the model was configured to predict the ground-level concentrations on uniform and discrete receptors (which were considered at AAQ monitoring station).

Meteorological Data

As stated above in **Table 1.2** the meteorological monitoring data generated during October, 2016 showed that that the overall the predominant wind direction is found to be from South S (4.94 %), followed by West (W, 4.78%), WSW (4.01%), SE (3.24%) and SW (2.62%). The calm conditions prevailed for ~66.98% of the time. During day time, the predominant wind direction was W (9.57%) followed by S (9.26%), WSW (7.72%), SE (6.17%); calm conditions prevailed for 36.11% of the time. During night time, the predominant wind is SSE (0.93%) followed by S (0.62%) and calm condition prevailed for 97.24% of the time. As per IMD (Chaibasa) wind-rose the predominant wind directions are south-west and north-east.

A time series air quality meteorological data file, containing hourly averaged values of (i) Wind speed and direction; (ii) Ambient air temperature (iii) Pasqual-Gifford stability class; and (iv) Atmospheric mixing height were pre-requisite for the modeling studies. The wind speed, direction and temperature data were obtained from meteorological measurements recorded at site. Atmospheric stability categories were determined using Turner's method as described in USEPA (1998). Mixing heights were collected from the CPCB publication on "spatial variations of mixing heights over India".

Estimation of dust

Dust emission sources were identified based on mining activities of the project. Mining and material handling operations like drilling, loading of materials into haul trucks, movement of dumper (wheel) generated dust, truck dumping of waste material and ore, unloading of materials from haul trucks, wind erosion from waste dump and ore stack yard were considered for dust emission sources.

Drilling

Emission volumes from drilling of blast holes are potentially impacted by a number of factors such as depth of hole, moisture content and silt content. Equations developed by CIMFR have been used to estimate these emissions.

Loading / Unloading Operations

Emissions from loading and unloading activities were estimated using the default emission factors using the equations developed by CIMFR and also from National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EET) for Mining Version 3.1 (Jan. 2012) (Australia).

Vehicles and wheel generated dust

The contribution to dust emissions from vehicles traveling along unpaved haul road and other roads has been estimated using the equation developed by CIMFR. As stated above, the transportation route consists of ~26 km road through forest, ~4 km Rourkela–Manoharpur road and ~1 km branch road from Rourkela–Manoharpur road to railway siding.

Dust estimates summary

Activity wise dust emissions during excavation of ore have been estimated. The expected emissions from quarry area, waste dump areas, ore stack area and transport of ore and overburden through haul roads, loading and unloading at railway siding wherever applicable have been estimated. Dust generation at Dhobil mine site is estimated to be 0.00000007337 $g/m^2/s$, at railway siding is estimated to be 0.0000002215 $g/m^2/s$ and from haul road is estimated to be 0.00454 g/s and 0.00327 g/s from other roads. Haul road is main source of emissions.

Impact on ambient air quality

Considering all monitored days of meteorological data, GLCs were computed for PM_{10} emission from mine related activities. The maximum ground level concentration due to proposed activities will be ~6 $\mu g/m^3$ and likely to occur near railway siding. Predicted Isopleths for PM_{10} concentrations have presented in **Fig: 1.12**.

Predicted Futuristic Ground-level Dust Concentrations

The results represent the maximum GLC that are predicted due to mineral transportation by road in the surrounding areas. Isopleths have presented in **Fig 1.12.**

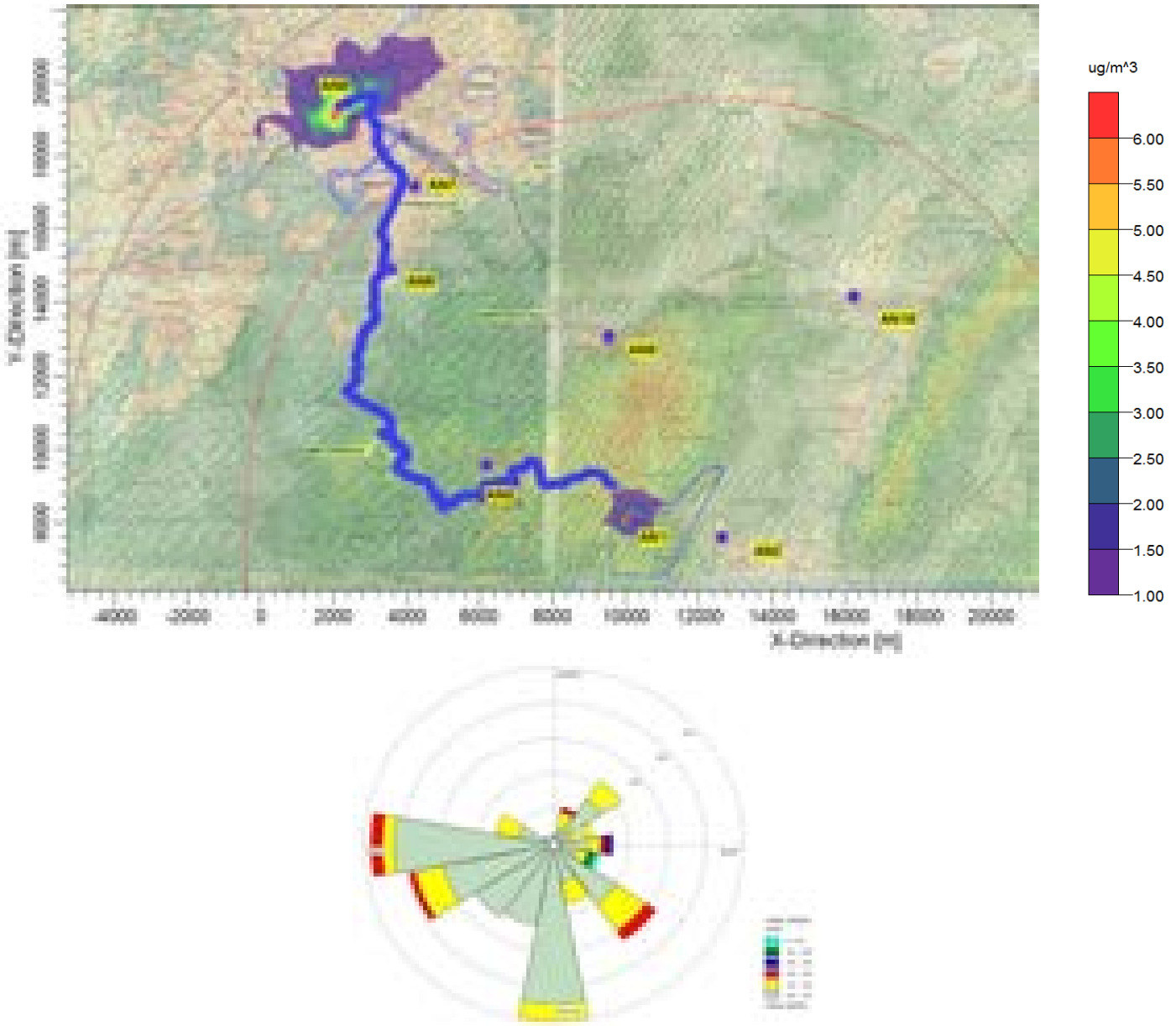


Fig.1.12: Isopleths representing the maximum ground-level concentrations

Table 1.17: Meteorological data used for GLC prediction

Hour	Wind dir. (degree)	Wind speed (m/s)	Temp. (°K)	Stability class	Mixing height (m)
01	225	0.0000	298	6	100
02	194	0.0000	298	6	100
03	239	0.0000	298	6	100
04	237	0.0000	298	6	50
05	243	0.0000	298	5	50
06	241	0.0000	298	4	50
07	344	0.0000	298	3	110
08	1	0.0278	299	3	350
09	17	0.3056	300	2	615
10	27	0.4444	302	2	935
11	32	0.4167	303	1	1300
12	55	0.3333	304	1	1750
13	60	0.5556	305	1	1800

Hour	Wind dir. (degree)	Wind speed (m/s)	Temp. (°K)	Stability class	Mixing height (m)
14	65	0.6944	303	2	2050
15	14	0.6111	303	3	2150
16	55	0.5000	304	3	1700
17	12	0.4167	304	4	1600
18	17	0.4167	303	5	1200
19	203	0.1944	302	6	900
20	201	0.6944	300	6	725
21	270	0.0000	300	6	600
22	233	0.0000	300	6	400
23	225	0.0000	300	6	300
24	270	0.0000	299	6	207

The incremental concentrations of PM_{10} values ($\mu g/m^3$) due transportation by road is given in the following **Table 1.18**. It can be seen that the resultant data are well within the norms.

Table 1.18: Predicted Resultant Air Quality

Sl. No.	Nearest AAQ Location	Station code	Monitored PM_{10} (max) ($\mu g/m^3$)	Expected contribution of Dhobil mine due to addl. handling of 0.2 Mt/yr ROM ($\mu g/m^3$)
1.	Dhobil Mine	AN1	77.1	~2.75
2.	Dhobil Village	AN2	80.7	<1
3.	Hatnaburu	AN3	67.9	<1
4.	Morang	AN4	83.7	<1
5.	Sukri ML	AN5	57.1	<1
6.	Gendung	AN6	72.9	<1
7.	Bachamgutu	AN7	70.8	<1
8.	Manoharpur Railway Station/Siding	AN8	82.0	~6
9.	Chiria Guest House	AN9	86.0	<1
10.	Dhori	AN10	67.7	<1

**without any control measures*

6.2 Impact on Traffic Carrying Capacity

The existing road used for ore-transportation covers nearly a total haulage distance of 31km, which comprises of 26.1km of forest road, 3.7km streach of Rourkela–Manoharpur road and 1.2km is a branch road from Rourkela–Manoharpur road towards railway siding. Traffic monitoring / data collection was conducted for seven consecutive days during October, 2016. The summarised results are presented in **Tables 1.15.1, 1.15.2, 1.15.3 and 1.16.** The detailed traffic monitoring results are given results are given in **Annexure 3**.

For road carrying capacity study the ore transportation route has been divided into different stretches, as follows:

- Stretch 1 : Forest Road from Mine Lease Boundary to Forest Checkpost before joining Rourkela–Manoharpur road.
- Stretch 2 : Rourkela–Manoharpur road from forest road junction to the junction from where road to railway siding branches.
- Stretch 3 : Branch / Approach road from Rourkela–Manoharpur road near Medasai Village / Electric Sub-station to railway siding.

Data of existing road conditions, type of road, width of road and shoulder width and primary traffic survey etc. were conducted during the study period (October, 2016). Photographs of the existing road condition in different stretches is shown in **Fig 1.13.** and the details of road width, type, length etc. are given in **Table 1.19**.

Table 1.19: Details type of road stretches in Ore-transportaion route

S.N	Ore Transportation Route Stretch	Length in Km (Approx)	Type of Road	Existing Carriageway Width, m	Existing Shoulder Width (approx),m	Remarks
1	Stretch 1 : Mine Lease Boundary to Forest Check post	26.1	WBM / Moorum	5.5	0.6	Settlement at last 500mts, before check post
2	Stretch 2 : Rourkela–Manoharpur road from Forest Check post to Sub-station	3.7	Bituminous	7.0	1.2	Major District Road
3	Stretch 3 : Sub Station to Railway Siding	1.2	WBM / Moorum	7.0	0	Dedicated road to Railway siding
	Total Length	**31.0**				

Stretch 1 : Forest Road near Mine Lease Boundary (Start of Ore-transportation Route)

Stretch 1 : Forest Road near Mine Lease Boundary (Start of Ore-transportation Route)

Stretch 1 : Forest Road between ML boundary and Forest Check Post

Stretch 1 : Forest Road between ML boundary and Forest Check Post

Stretch 1 : End of Forest Road near check post (showing road and settlements)

Stretch 2 : Rourkela - Manoharpur Road near forest checkpost

Streach 3 : Approach road to Railway siding from Rourkela–Manoharpur road near sub-station

Manoharpur Railway Siding (End of Transportation Toute)

Fig. 1.13: Photographs of the existing road condition of road in different stretches

6.3 Traffic Load Capacity of Ore Transportation Route

The "IRC: 64.1990: Guidelines for Capacity of Roads in Rural Areas", prescibes the carrying capacity for different road widths in rural areas as given in **Table 1.20**. The road carrying capacity values have been determined as per **Table 1.20**.

Table 1.20: Carrying capacity of different road widths in Rural Areas

Sl. No	Type of road (Carriageway width)	Suggested Design Service Volume in PCU/Day		
		Plain	Rolling	Hilly
1	Single lane road (3.75m)	2000	1800	1600
2	Intermediate lane (5.5m)	6000	5700	5200
3	Two Lane road (7.0m)	15000	11000	7000
Source : IRC: 64-1990 - from Table 2,3 & 4.				

Further, the PCU/day values as given in the IRC : 64 -1990, are subject to reduction / increment based on the type of pavement, shoulder condition and width. In case of 2-lane roads, when the shoulder width is less than 1.8m, various reduction factors as per IRC: 64-1990 are to be considered to arrive at design service volumes.

The type of road, width, shoulder, etc for the three stretches of ore transportation route are given in **Table 1.19**. The design service volume (in PCU's/day) of the three stretches are worked out based on road type / condition (**Table 1.19**), prescribed design service volume (**Table 1.20**) and the reduction factor as given in IRC : 64-1990. The design service volume of ore transportation route in three stretches have been considered as follows

- **Streach 1: From Mine Lease Boundary to Forest Check post**
  As per IRC:64 "Guidelines for Capacity of Roads in Rural Areas", the recommended design service volume for intermediate lane roads with usable sholders on hilly terrain is 5200 Passenger Car Units (PCUs) per day (**Table 1.20**). Additionally, the ore-transportation is restricted between sunset and sunrise, therefore, considering 50% reduction due to restricted hours of ore-transportation, the recommended design service volume comes down to 2600 PCUs/day.
- **Streach 2: From Forest Check post to Power Sub-station**
  As per IRC:64 "Guidelines for Capacity of Roads in Rural Areas", the recommended design service volume for two lane roads on plain terrain is 15000 Passenger Car Units (PCUs) per day (**Table 1.20**) and the reduction factor for shoulder width of 1.2 m is 0.92. Accordingly, the recommended design service volume comes down to 13800 PCUs/day.
- **Streach 3: From Power Sub-Station to Railway Siding**
  As per IRC:64 "Guidelines for Capacity of Roads in Rural Areas", the recommended design service volume for two lane roads on plain terrain is 15000 Passenger Car Units (PCUs) per day (**Table 1.20**) and the reduction factor for road without shoulders is 0.70. Accordingly, the recommended design service volume comes down to 10500 PCUs/day.

The existing maximum traffic volume as per the monitored data at streach 1 (T1) and streach 2 (T3) are 1429 PCUs/day and 2178 PCUs/day, respectively (**Table 1.16 (a) & (c)**).

The ore dispatch data from mines weigh bridge office (T4) were collected (**Table 1.21**) for the same period during which traffic density were monitored at T1, T2 and T3 location.

The ore loaded trucks from mines are destined for railway siding via the approach road originating from Rourkela–Manoharpur road (Stretch 3). The ore loaded trucks and the subsequent returning empty trucks are the only user of Stretch 3. In view of the same the existing traffic load on Stretch 3 is considered as per **Table 1.21.** The maximum existing traffic load on streach 3 comes to about 1236 PCUs/day (**Table 1.21**).

Table 1.21: Existing Traffic Load on Strecth 3 Dedicated Towards Railway siding.

Date	Trucks Dispatched from Mine to Railway Siding (Nos)*	Trucks Plying: considering return after unloading (Nos)	Equivalent Traffic Load in PCUs on Stretch 3
19.10.2016	189	378	1134
20.10.2016	197	394	1182
21.10.2016	195	390	1170
22.10.2016	193	386	1158
23.10.2016	0	0	0
24.10.2016	165	330	990
25.10.2016	206	412	1236
Maximum	**206**	**412**	**1236**

* Data Source : Dhobil Iron Ore Dispatch Register at Mine Gate

A comparison has been made between the existing traffic load on the three stretches (of ore transportation route) and the traffic load which the three stretches can bear according to their road conditions (carrying capacity) and the same has been presented in **Table 1.22**. The additional available traffic load which the three stretches can support have been worked out by taking the difference between the traffic bearing capacity (carrying capacity) and the existing traffic load (**Table 1.22**).

Table 1.22: Existing Capacity and Additional Available Traffic Load Capacity

S.N	Stretch	Estimated Traffic Load (as per road design) (PCUs)	Maximum Existing Traffic Load (with ore transportation by road) - based on Monitored Traffic Density Data (PCU's)	Additional Available Traffic Load Capacity (PCU's)
1	Stretch 1 : Mine Lease Boundary to Forest Check post	2600	1429	1171
2	Stretch 2 : Forest Check post to Sub-station	13800	2178	11622
3	Stretch 3 : Sub Station to Railway Siding	10500	1236	9264

The exisiting time series traffic load during the monitoring period, in Stretch 1, Stretch 2 and Stretch 3 of the ore transportation route along with the respective carrying capacities is depicted in **Figs 1.14.1**, **1.14.2** and **1.14.3**, respectively.

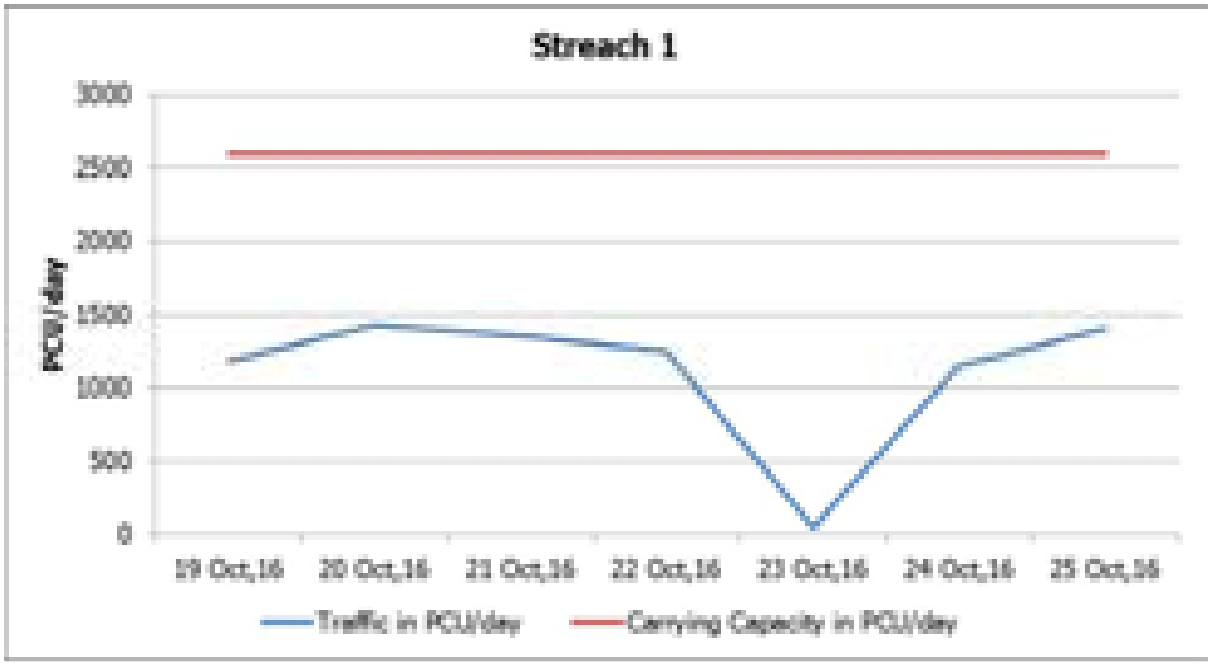


Fig. 1.14.1: Traffic Density on Stretch 1 – Road from ML boundary to Forest check post

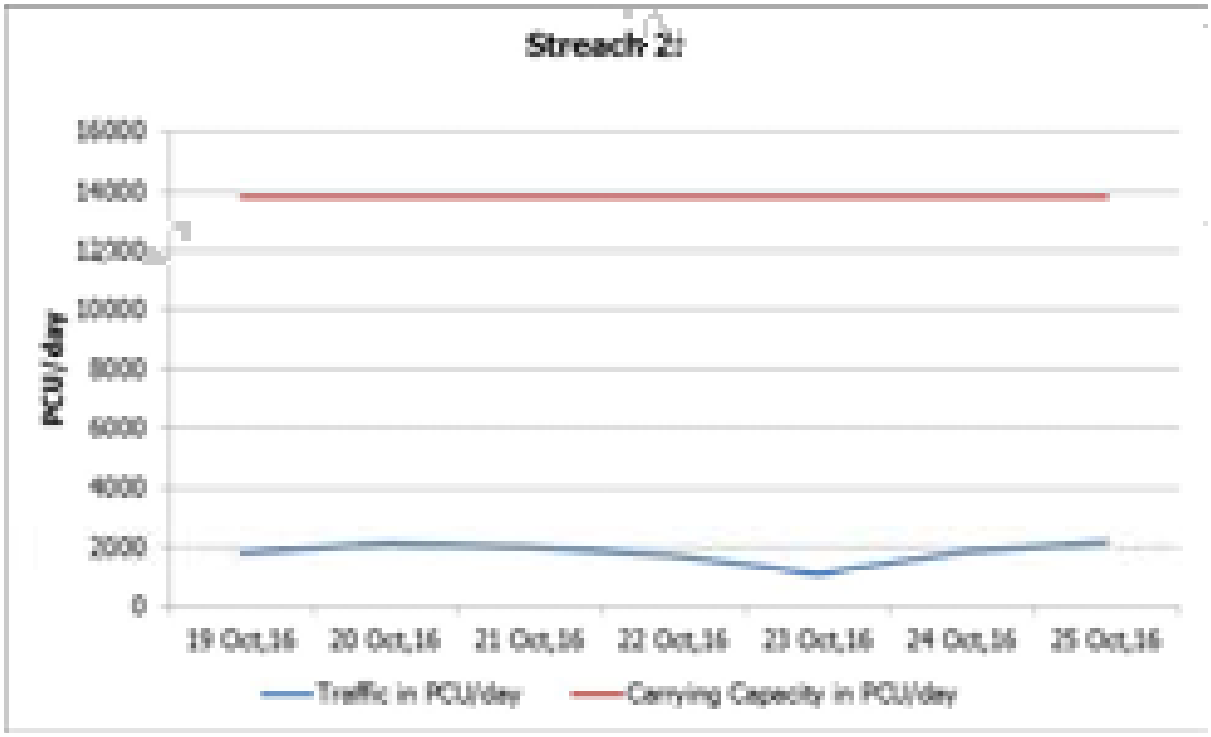


Fig. 1.14.2: Traffic Density on Stretch 2 – Road from Forest check post to Sub-station

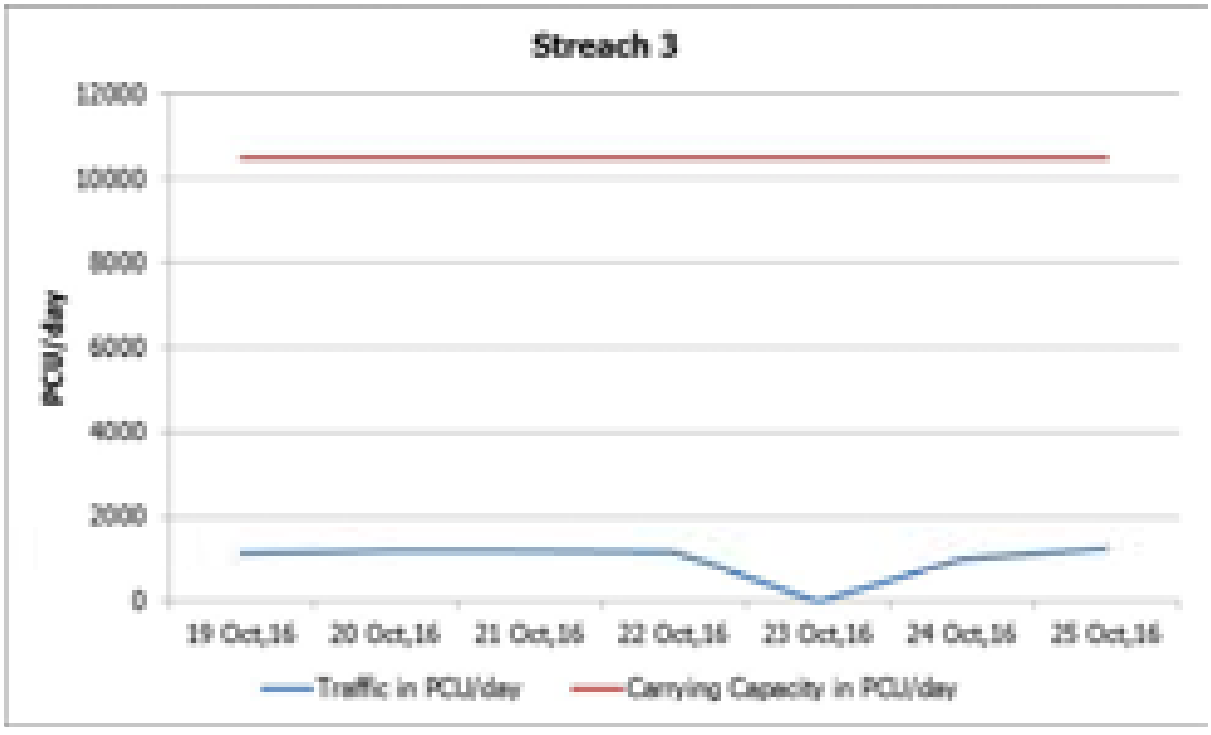


Fig. 1.14.3: Traffic Density on Stretch 3 – Road from Sub-station to Railway siding

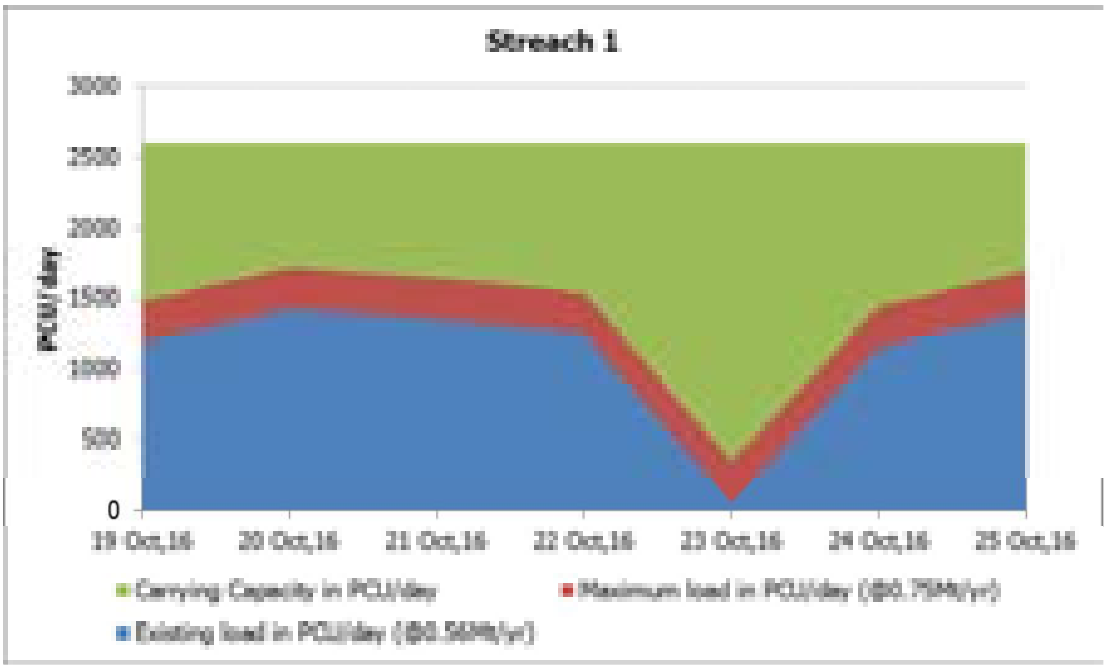
It can be observed from the **Figs 1.14.1**, **1.14.2** and **1.14.3**, that the ore-transportation with present production rate of 0.56 Mt/yr (estimated from dispatch of 46602.55t in October, 2016) maximum PCU's is well below the estimated carrying capacity of the three stretches of ore transportation route.

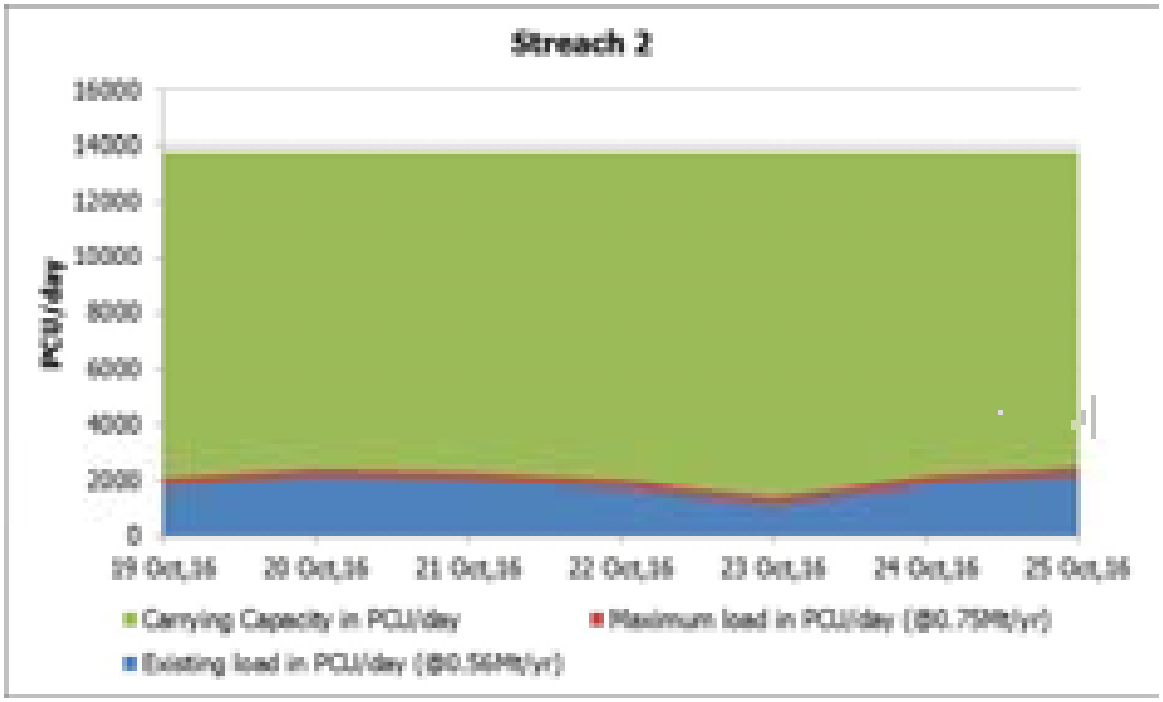
Additionally, even considering the maximum truck's despatch at production rate of 0.75Mt/yr, the increase in traffic load will be 294 PCUs/day. It can be seen that even at mine production at 0.75 Mt/yr, the additional increase in traffic load due to ore transportation by trucks (294 PCUs/day), there is still substantial cushion available in terms of traffic load in the three stretches of Ore transportation route as shown in **Fig.1.15**. The traffic load cushion available in the three stretches may accomodate the future increase in traffic load of the region in the coming five years (for which the present study report has been made).

Table 1.23: Estimated Additianal Load on Ore Transportation Route at 0.75 Mt/yr Ore Production

Present Ore Production	559231	tonnes/yr
Maximum Production (EC @0.75Mt/yr)	750000	tonnes/yr
Additional Transport Required at 0.75 Mt/yr Ore Production	190769	Tonnes
Number of Trucks per year Required for Transportation [Considering Truck Capacity Avg. 13t (10t-16t trucks)]	14675	trucks/yr
Number of Trucks per day Required for Transportation (Considering 300 days of working)	49	trucks/day
Equivalent PCUs / day	147	PCU/day
Taking to-fro Movement of Trucks Number of PCUs / day	294	PCU load/day
Extra PCU's calculated	**294**	**PCU/day**

Fig. 1.15 shows present PCU Load, additional PCU's at maximum production and total carrying capacity of different road streaches used.





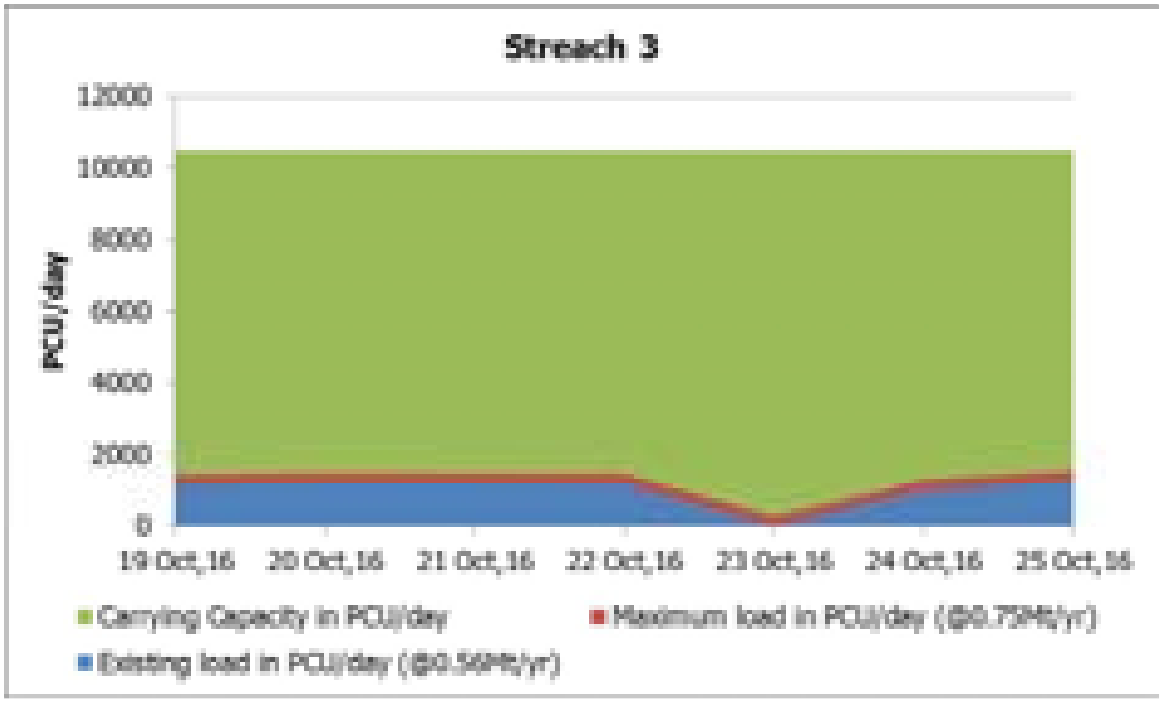


Fig. 1.15: Existing PCU Load, additional PCU's at maximum production and total carrying capacity of different road streaches of ore transportation route.

Ore from Dhobil mines is transported by road to the railway siding situated at Manoharpur and loaded into railway wagons for dispatch. The ore transportation stretch is the only route for ore transportation from the mine lease (ML). Ore from the mine to the railway siding is transported by trucks through

forest road, Rourkela-Manoharpur road and the connecting road from Rourkela-Manoharpur road to railway siding covering over a total distance of 31 km. Out of the total transportation distance of 31 km, the public transport road i.e. Rourkela-Manoharpur road is only ~3.7km, out of the remaining, forest road consists of 26.1km and SAIL private road of 1.2 km.

The traffic studies revealed that the entire ore transport road covering three stretches from the mines to Manoharpur Railway Siding with total length of 31 km is capable of handling the ore transport from Dhobil Iron ore mine with adequate buffer capacity.

7.0 CONCLUSION

The following conclusion can be drawn from the study:

- The proposal is only continuation of existing ore transportation by road upto railway siding for further period of 5 years without involving change in production capacity or change in broken area as envisaged during grant of Environmental Clearance for the project. Hence, no change in pollution load on the region is expected.
- The baseline studies revealed that the air, noise and water quality in and around the mines are well within the respective standards.
- The existing road transport infrastructure is capable of handling the ore-transportation load from Dhobil Mines through the designated existing transport route road with adequate margin.
- The predicted PM_{10} level shows that the additional contribution due to the operation/ of mines at the rated capacity of 0.75Mt/yr shall be very less with no appreciable repercussions. The value is/may further be minimized with proper management measures.

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ANNEXURES

Annexure 1

Detail AAQ Monitored Data during October, 2016

Table 1: Detail Ambient Air Quality results for Dhobil Mine (AN1)

Sample No.	Date	Results in µg/m³			
		$PM_{2.5}$	PM_{10}	SO_2	NOx
1	03.10.2016	26.7	55.6	6.7	14.9
2	06.10.2016	35.4	49.2	7.2	15.3
3	09.10.2016	17.9	49.8	6.0	13.7
4	14.10.2016	24.4	69.7	5.0	13.8
5	17.10.2016	31.0	69.5	5.7	11.4
6	20.10.2016	35.8	67.3	4.9	12.3
7	24.10.2016	29.7	77.1	5.0	12.9
8	27.10.2016	32.7	64.5	6.4	14.3

Table 2: Detail Ambient Air Quality results for Dhobil village (AN2)

Sample No.	Date	Results in µg/m³			
		$PM_{2.5}$	PM_{10}	SO_2	NOx
1	03.10.2016	24.3	58.1	6.0	13.7
2	06.10.2016	32.2	73.9	5.7	13.5
3	09.10.2016	38.6	80.7	5.3	12.9
4	14.10.2016	26.5	57.9	4.8	10.7
5	17.10.2016	24.9	66.7	4.1	11.4
6	20.10.2016	27.4	55.8	<4	12.0
7	24.10.2016	24.7	59.6	4.9	13.7
8	27.10.2016	22.3	50.7	5.5	16.4

Table 3: Detail Ambient Air Quality results for Hatnaburu (AN3)

Sample No.	Date	Results in µg/m³			
		$PM_{2.5}$	PM_{10}	SO_2	NOx
1	03.10.2016	29.8	60.2	6.9	11.8
2	06.10.2016	33.6	67.9	5.4	12.6
3	09.10.2016	29.2	52.5	7.1	10.3
4	14.10.2016	21.0	42.9	4.8	11.4
5	17.10.2016	23.0	57.9	5.5	<10
6	20.10.2016	23.3	55.9	6.3	14.1
7	24.10.2016	24.9	50.8	5.9	11.3
8	27.10.2016	21.6	45.2	5.1	13.8

Table 4: Detail Ambient Air Quality results for Morang (AN4)

Sample No.	Date	Results in µg/m³			
		$PM_{2.5}$	PM_{10}	SO_2	NOx
1	03.10.2016	33.6	71.7	6.4	12.9
2	06.10.2016	37.8	83.7	4.7	11.8
3	09.10.2016	35.6	75.3	7.8	17.6
4	14.10.2016	30.0	65.4	4.2	11.6
5	17.10.2016	24.4	57.9	6.6	13.2
6	20.10.2016	32.8	71.5	5.2	11.1
7	24.10.2016	21.8	56.8	4.6	10.6
8	27.10.2016	27.8	61.1	6.1	14.1

Table 5: Detail Ambient Air Quality results for Sukri ML (AN5)

Sample No.	Date	Results in µg/m³			
		$PM_{2.5}$	PM_{10}	SO_2	NOx
1	03.10.2016	26.5	52.7	6.9	11.4
2	06.10.2016	18.1	43.6	7.3	13.3
3	09.10.2016	19.2	35.8	5.7	12.7
4	14.10.2016	14.8	50.9	6.5	13.6
5	17.10.2016	13.5	55.4	6.9	12.5
6	20.10.2016	31.4	57.1	6.1	17.9
7	24.10.2016	31.8	54.6	5.9	14.2
8	27.10.2016	30.6	53.6	<4	12.3

Table 6: Detail Ambient Air Quality results for Gendung (AN6)

Sample No.	Date	Results in µg/m³			
		$PM_{2.5}$	PM_{10}	SO_2	NOx
1	03.10.2016	28.7	67.2	4.1	<10
2	06.10.2016	29.8	72.9	6.0	10.3
3	09.10.2016	24.6	58.4	5.3	12.6
4	14.10.2016	16.3	45.8	4.5	14.1
5	17.10.2016	14.2	41.4	5.6	13.0
6	20.10.2016	25.9	61.0	4.3	10.6
7	24.10.2016	23.8	56.5	7.1	16.4
8	27.10.2016	31.7	69.0	6.7	<10

Table 7: Detail Ambient Air Quality results for Bachamgutu (AN7)

Sample No.	Date	Results in µg/m³			
		$PM_{2.5}$	PM_{10}	SO_2	NOx
1	03.10.2016	22.8	42.7	5.3	11.9
2	06.10.2016	24.6	49.3	4.2	13.0
3	09.10.2016	19.8	41.6	5.5	10.7
4	14.10.2016	29.8	51.8	4.7	<10
5	17.10.2016	24.7	47.5	5.8	14.5
6	20.10.2016	34.6	70.8	4.9	10.6
7	24.10.2016	24.3	47.4	4.1	<10
8	27.10.2016	33.0	68.3	7.2	13.6

Table 8: Detail Ambient Air Quality results for Manoharpur Railway Siding (AN8)

Sample No.	Date	Results in µg/m³			
		$PM_{2.5}$	PM_{10}	SO_2	NOx
1	03.10.2016	20.8	45.8	6.1	13.4
2	06.10.2016	42.0	61.8	4.6	10.6
3	09.10.2016	19.7	41.8	5.3	15.9
4	14.10.2016	47.0	82.0	7.2	15.3
5	17.10.2016	37.4	68.4	5.0	10.1
6	20.10.2016	29.4	67.7	6.2	14.8
7	24.10.2016	25.3	50.8	7.8	16.5
8	27.10.2016	23.8	56.1	8.5	13.2

Table 9: Detail Ambient Air Quality results for Chiria Guest House (AN9)

Sample No.	Date	Results in µg/m^3			
		$PM_{2.5}$	PM_{10}	SO_2	NOx
1	05.10.2016	23.4	49.3	5.5	11.4
2	07.10.2016	24.4	51.1	4.2	12.7
3	13.10.2016	28.5	79.0	4.6	13.2
4	15.10.2016	23.5	59.2	5.7	<10
5	18. 19.2016	29.4	71.0	<4	<10
6	21.10.2016	22.2	51.1	5.1	12.2
7	23.10.2016	31.2	86.0	4.4	14.0
8	26.10.2016	29.9	75.8	4.7	13.2

Table 10: Detail Ambient Air Quality results for Dhori (AN10)

Sample No.	Date	Results in µg/m^3			
		$PM_{2.5}$	PM_{10}	SO_2	NOx
1	05.10.2016	21.9	47.6	4.5	<10
2	07.10.2016	26.3	58.0	7.6	15.2
3	13.10.2016	22.8	48.1	5.2	14.4
4	15.10.2016	29.2	64.3	7.5	12.7
5	18. 19.2016	19.9	49.2	6.4	15.3
6	21.10.2016	27.0	53.8	6.7	11.4
7	23.10.2016	28.9	67.7	4.4	<10
8	26.10.2016	19.6	40.4	<4	10.1

Annexure 2

Detail Ambient Noise Monitoring Data during October, 2016

Sl. No.	Time (Hrs.)	AN-1	AN-2	AN-3	AN-4	AN-5	AN-6	AN-7	AN-8	AN-9	AN-10
1	6	47.6	34.9	37.3	39.7	35.8	34.6	54.3	43.3	37.3	36.4
2	7	48.7	37.2	39.1	41.2	39.6	43.3	56.6	48.5	39.5	40.2
3	8	55.4	40.5	42.4	43.5	41.3	46.5	56.8	51.7	41.2	43.8
4	9	63.4	44.8	43.5	45.1	43.4	48.7	56.8	52.1	44.3	45.3
5	10	62.6	43.2	42.6	47.2	44.5	48.3	58.3	50.4	46.2	42.4
6	11	58.4	43.5	44.3	46.3	43.8	49.5	60.5	53.2	45.5	43.5
7	12	59.7	41.2	40.5	42.5	31.4	47.6	57.3	54.8	41.2	40.6
8	13	56.4	40.5	41.3	44.3	40.7	44.3	52.4	52.4	42.7	39.2
9	14	57.8	41.3	42.7	43.5	42.3	46.5	48.3	50.2	43.8	38.5
10	15	63.4	39.5	40.6	46.5	40.2	49.4	52.5	48.7	44.5	42.7
11	16	61.2	40.2	43.8	43.2	43.8	48.7	54.6	53.2	43.7	45.8
12	17	63.5	42.7	44.5	48.5	44.6	47.9	59.7	56.4	45.2	46.4
13	18	56.2	43.1	45.8	49.7	42.8	48.6	60.5	51.2	39.2	45.3
14	19	48.7	40.7	44.3	48.3	40.4	41.4	52.4	53.7	38.7	44.3
15	20	40.3	37.2	41.2	45.2	38.3	37.5	44.7	44.2	39.8	40.1
16	21	36.2	35.1	37.3	41.5	34.6	32.2	36.5	40.7	34.7	35.6
17	22	35.1	31.9	34.2	39.4	33.2	29.5	39.2	41.6	35.3	33.8
18	23	33.4	32.5	33.7	36.3	32.6	28.3	32.5	43.8	34.2	31.4
19	24	33.1	31.4	32.6	37.1	32.8	30.2	31.2	40.3	33.7	30.6
20	1	32.2	31.2	32.1	35.2	30.6	28.6	30.8	38.2	32.2	32.8
21	2	33.7	29.5	30.2	35.1	30.8	29.1	31.2	37.5	34.7	31.4
22	3	32.6	28.6	31.3	34.2	31.2	28.5	29.6	41.2	33.6	30.8
23	4	31.5	29.2	30.3	33.5	30.6	30.2	28.4	40.3	34.2	32.1
24	5	33.4	31.4	32.4	36.2	32.3	29.7	37.7	42.7	33.7	33.2

All Values in dB (A)

Annexure 3

Detail Traffic Density Data during October, 2016

Table 1: Traffic Density Survey on T1, T2 and T3 (from 0000 hrs on 19-10-2016 to 2300 hrs on 19-10-2016)

Date: 19/10/2016	T1- Near Forest Check post on end of forest road before joining Rourkela-Manoharpur road (Mines to Railway Siding-R.S)						T2- Near Meena Bazar on Rourkela - Manoharpur road before Forest Check post.(Rourkela-ROU to Manoharpur-MHP)						T3- Near Medasai village on Rourkela-Manoharpur road before joining approach road towards Railway siding (Rourkela-ROU to Manoharpur-MHP)					
Time	2 wheelers		LMV		HMV		2 wheelers		LMV		HMV		2 wheelers		LMV		HMV	
	To R.S	To Mines	To R.S	To Mines	To R.S	To Mines	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU
0000 – 0100 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0100 – 0200 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0200 – 0300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0300 – 0400 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0400 – 0500 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0500 – 0600 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0600 – 0700 hrs.	4	1	1	1	17	66	2	1	2	4	2	3	8	2	6	4	7	16
0700 – 0800 hrs.	-	2	-	-	2	12	12	9	12	6	1	2	19	13	9	7	4	16
0800 – 0900 hrs.	5	6	-	1	2	7	12	10	16	7	-	8	16	21	16	7	2	13
0900 – 1000 hrs.	2	4	1	1	18	11	20	25	9	15	3	2	24	27	9	17	22	14
1000 – 1100 hrs.	6	3	1	-	23	19	11	18	16	14	2	4	16	22	19	15	27	16
1100 – 1200 hrs.	4	2	2	2	18	20	19	19	14	19	7	2	23	21	17	21	28	25
1200 – 1300 hrs.	4	5	1	2	17	16	9	13	7	9	-	1	20	18	14	16	22	23
1300 – 1400 hrs.	1	2	-	-	5	20	16	7	13	11	-	-	15	11	9	6	10	9
1400 – 1500 hrs.	2	2	1	-	12	8	22	19	16	13	1	2	22	25	16	13	13	6
1500 – 1600 hrs.	1	2	-	-	11	6	26	16	8	17	2	3	23	21	9	17	12	11
1600 – 1700 hrs.	5	3	1	1	25	6	24	27	13	10	-	3	24	27	16	14	25	11
1700 – 1800 hrs.	2	4	-	-	21	16	23	24	15	16	3	3	23	25	12	19	39	19
1800 – 1900 hrs.	-	-	-	-	-	-	5	3	3	2	-	2	7	3	7	5	-	8
1900 – 2000 hrs.	-	-	-	-	-	-	2	1	1	4	-	-	4	5	2	6	-	6
2000 – 2100 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2100 – 2200 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2200 – 2300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2300 – 0000 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**36**	**36**	**8**	**8**	**171**	**207**	**203**	**192**	**145**	**147**	**21**	**35**	**244**	**241**	**161**	**167**	**211**	**193**

Table 2: Traffic Density Survey on T1, T2 and T3 (from 0000 hrs. on 20-10-2016 to 2300 hrs on 20-10-2016)

Date: 20/10/2016	T1- Near Forest Check post on end of forest road before joining Rourkela-Manoharpur road (Mines to Railway Siding-R.S)						T2- Near Meena Bazar on Rourkela - Manoharpur road before Forest Check post.(Rourkela-ROU to Manoharpur-MHP)						T3- Near Medasai village on Rourkela-Manoharpur road before joining approach road towards Railway siding (Rourkela-ROU to Manoharpur-MHP)					
Time	2 wheelers		LMV		HMV		2 wheelers		LMV		HMV		2 wheelers		LMV		HMV	
	To R.S	To Mines	To R.S	To Mines	To R.S	To Mines	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU
0000 – 0100 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0100 – 0200 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0200 – 0300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0300 – 0400 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0400 – 0500 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0500 – 0600 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0600 – 0700 hrs.	3	-	1	-	25	56	5	4	6	4	4	2	12	6	10	5	24	41
0700 – 0800 hrs.	3	3	1	1	2	12	10	4	3	4	2	4	24	14	7	6	6	16
0800 – 0900 hrs.	2	4	1	1	5	12	14	14	7	8	1	6	14	18	14	15	8	13
0900 – 1000 hrs.	2	1	-	-	26	12	14	13	17	13	3	7	24	14	17	15	28	16
1000 – 1100 hrs.	1	2	-	-	20	18	21	22	15	17	-	7	24	24	13	17	20	24
1100 – 1200 hrs.	3	1	3	4	35	34	14	19	15	16	4	1	17	22	18	17	30	36
1200 – 1300 hrs.	2	2	-	-	18	27	18	18	7	9	-	-	21	30	8	15	24	25
1300 – 1400 hrs.	2	2	-	-	9	8	16	13	17	11	3	2	13	15	12	9	8	13
1400 – 1500 hrs.	4	-	1	1	17	5	12	20	12	14	2	3	15	26	15	17	20	6
1500 – 1600 hrs.	2	8	-	-	33	9	13	17	15	10	3	2	21	13	15	15	34	15
1600 – 1700 hrs.	5	6	-	-	17	10	20	8	13	16	3	3	24	15	14	12	15	11
1700 – 1800 hrs.	5	7	-	1	26	12	21	20	10	12	2	5	27	34	17	20	34	24
1800 – 1900 hrs.	3	4	-	1	9	1	17	4	11	1	2	6	15	13	8	10	5	15
1900 – 2000 hrs.	-	-	-	-	-	-	1	3	12	4	1	2	-	-	-	-	-	-
2000 – 2100 hrs.	-	-	-	-	-	-	2	3	5	6	1	-	-	-	-	-	-	-
2100 – 2200 hrs.	-	-	-	-	-	-	3	2	4	3	2	1	-	-	-	-	-	-
2200 – 2300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2300 – 0000 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**37**	**40**	**7**	**9**	**242**	**216**	**201**	**184**	**169**	**148**	**33**	**51**	**251**	**244**	**168**	**173**	**256**	**255**

Table 3: Traffic Density Survey on T1, T2 and T3 (from 0000 hrs. on 21-10-2016 to 2300 hrs on 21-10-2016)

Date: 21/10/2016	T1- Near Forest Check post on end of forest road before joining Rourkela-Manoharpur road (Mines to Railway Siding-R.S)						T2- Near Meena Bazar on Rourkela - Manoharpur road before Forest Check post.(Rourkela-ROU to Manoharpur-MHP)						T3- Near Medasai village on Rourkela-Manoharpur road before joining approach road towards Railway siding (Rourkela-ROU to Manoharpur-MHP)					
Time	**2 wheelers**		**LMV**		**HMV**		**2 wheelers**		**LMV**		**HMV**		**2 wheelers**		**LMV**		**HMV**	
	To R.S	**To Mines**	**To R.S**	**To Mines**	**To R.S**	**To Mines**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**
0000 – 0100 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0100 – 0200 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0200 – 0300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0300 – 0400 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0400 – 0500 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0500 – 0600 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0600 – 0700 hrs.	1	-	2	1	9	9	5	5	6	2	3	2	12	7	6	2	2	60
0700 – 0800 hrs.	1	1	-	-	5	49	8	7	6	5	-	-	16	14	9	9	12	3
0800 – 0900 hrs.	3	3	-	-	4	-	10	11	11	10	6	2	17	20	13	12	11	4
0900 – 1000 hrs.	3	2	2	1	22	11	17	8	14	14	3	1	21	13	14	17	28	17
1000 – 1100 hrs.	4	3	1	3	23	31	17	22	6	12	2	3	23	27	8	12	23	24
1100 – 1200 hrs.	5	6	2	1	28	27	21	18	15	14	4	4	21	18	17	32	28	32
1200 – 1300 hrs.	6	6	1	-	11	14	15	20	9	12	1	2	22	22	14	16	18	17
1300 – 1400 hrs.	4	1	-	-	11	11	15	18	9	11	-	4	21	18	11	14	14	11
1400 – 1500 hrs.	4	3	-	-	24	9	11	14	7	14	-	1	18	20	6	24	12	11
1500 – 1600 hrs.	3	8	1	1	15	5	15	13	16	9	3	-	18	21	18	10	21	3
1600 – 1700 hrs.	4	7	-	1	33	3	16	19	8	14	-	3	24	30	11	12	36	6
1700 – 1800 hrs.	1	2	1	1	21	13	13	23	12	10	1	2	13	15	15	13	20	19
1800 – 1900 hrs.	-	-	-	-	13	12	11	13	7	15	3	3	11	16	8	13	10	6
1900 – 2000 hrs.	1	2	1	1	16	1	9	5	7	5	2	-	3	8	2	6	1	17
2000 – 2100 hrs.	-	-	-	-	-	-	10	2	8	7	-	-	-	-	-	-	-	-
2100 – 2200 hrs.	-	-	-	-	-	-	6	0	3	7	2	1	-	-	-	-	-	-
2200 – 2300 hrs.	-	-	-	-	-	-	3	1	1	2	-	-	-	-	-	-	-	-
2300 – 0000 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**40**	**44**	**11**	**10**	**235**	**195**	**202**	**199**	**145**	**163**	**30**	**28**	**240**	**249**	**152**	**192**	**236**	**230**

Table 4: Traffic Density Survey on T1, T2 and T3 (from 0000 hrs. on 22-10-2016 to 2300 hrs on 22-10-2016)

Date: 22/10/2016	T1- Near Forest Check post on end of forest road before joining Rourkela-Manoharpur road (Mines to Railway Siding-R.S)						T2- Near Meena Bazar on Rourkela - Manoharpur road before Forest Check post.(Rourkela-ROU to Manoharpur-MHP)						T3- Near Medasai village on Rourkela-Manoharpur road before joining approach road towards Railway siding (Rourkela-ROU to Manoharpur-MHP)					
Time	2 wheelers		LMV		HMV		2 wheelers		LMV		HMV		2 wheelers		LMV		HMV	
	To R.S	To Mines	To R.S	To Mines	To R.S	To Mines	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU	To MHP	To ROU
0000 – 0100 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0100 – 0200 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0200 – 0300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0300 – 0400 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0400 – 0500 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0500 – 0600 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0600 – 0700 hrs.	6	4	1	2	4	42	3	1	10	3	-	-	9	8	8	5	2	30
0700 – 0800 hrs.	5	3	-	-	1	7	4	12	10	7	-	1	7	11	14	10	1	1
0800 – 0900 hrs.	5	5	1	1	13	1	7	17	10	10	1	1	11	27	13	10	13	2
0900 – 1000 hrs.	2	1	1	1	23	22	14	19	9	12	3	3	13	20	13	11	24	25
1000 – 1100 hrs.	4	4	-	2	28	11	24	15	9	11	2	2	30	22	11	14	24	15
1100 – 1200 hrs.	5	6	2	-	25	31	21	13	10	19	-	1	19	30	11	17	29	28
1200 – 1300 hrs.	2	3	1	1	11	20	13	13	11	16	-	1	18	27	13	13	19	22
1300 – 1400 hrs.	4	4	-	-	10	15	9	9	12	9	1	3	13	9	14	7	13	9
1400 – 1500 hrs.	7	5	-	-	17	5	16	17	10	9	3	1	16	11	14	11	13	7
1500 – 1600 hrs.	4	4	-	2	22	4	19	12	18	16	2	1	23	19	18	19	21	10
1600 – 1700 hrs.	4	5	2	1	19	6	20	17	9	14	1	2	30	18	11	18	27	10
1700 – 1800 hrs.	2	6	-	-	35	12	9	14	10	15	-	5	13	20	12	12	30	16
1800 – 1900 hrs.	1	4	-	-	5	4	10	15	9	10	3	3	3	13	3	5	5	6
1900 – 2000 hrs.	-	-	-	-	-	-	4	8	11	9	3	1	-	-	-	-	-	-
2000 – 2100 hrs.	-	-	-	-	-	-	6	4	7	6	2	4	-	-	-	-	-	-
2100 – 2200 hrs.	-	-	-	-	-	-	4	6	5	4	2	2	-	-	-	-	-	-
2200 – 2300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2300 – 0000 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**51**	**54**	**8**	**10**	**213**	**180**	**183**	**192**	**160**	**170**	**23**	**31**	**205**	**235**	**155**	**152**	**221**	**181**

Table 5 : Traffic Density Survey on T1, T2 and T3 (from 0000 hrs. on 23-10-2016 to 2300 hrs on 23-10-2016)

Date: 23/10/2016	T1- Near Forest Check post on end of forest road before joining Rourkela-Manoharpur road (Mines to Railway Siding-R.S)						T2- Near Meena Bazar on Rourkela - Manoharpur road before Forest Check post.(Rourkela-ROU to Manoharpur-MHP)						T3- Near Medasai village on Rourkela-Manoharpur road before joining approach road towards Railway siding (Rourkela-ROU to Manoharpur-MHP)					
Time	**2 wheelers**		**LMV**		**HMV**		**2 wheelers**		**LMV**		**HMV**		**2 wheelers**		**LMV**		**HMV**	
	To R.S	**To Mines**	**To R.S**	**To Mines**	**To R.S**	**To Mines**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**
0000 – 0100 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0100 – 0200 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0200 – 0300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0300 – 0400 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0400 – 0500 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0500 – 0600 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0600 – 0700 hrs.	1	2	-	-	-	-	12	13	6	9	2	3	11	15	6	10	2	3
0700 – 0800 hrs.	4	3	2	1	-	-	5	8	3	7	-	1	8	13	4	11	-	1
0800 – 0900 hrs.	4	9	1	2	-	-	20	15	16	10	2	7	28	20	18	12	2	7
0900 – 1000 hrs.	3	5	2	1	-	-	18	16	17	17	4	5	25	19	22	21	5	5
1000 – 1100 hrs.	5	2	-	-	-	-	27	22	20	25	7	9	26	27	21	23	9	9
1100 – 1200 hrs.	2	3	1	-	-	-	21	28	16	19	1	5	25	26	17	20	1	5
1200 – 1300 hrs.	4	2	-	-	-	-	24	22	21	20	-	3	27	28	23	21	-	3
1300 – 1400 hrs.	3	1	1	2	-	-	7	7	7	2	-	-	9	13	8	2	-	-
1400 – 1500 hrs.	3	-	-	1	-	-	10	28	19	10	-	-	13	31	20	10	-	-
1500 – 1600 hrs.	4	2	-	-	-	-	19	19	17	24	8	3	22	21	17	24	8	3
1600 – 1700 hrs.	1	1	-	1	-	-	8	10	6	14	9	1	9	11	7	14	9	1
1700 – 1800 hrs.	1	3	-	-	-	-	27	25	18	7	10	4	30	26	18	10	10	4
1800 – 1900 hrs.	-	2	-	-	-	-	11	12	16	15	4	-	13	13	17	17	4	-
1900 – 2000 hrs.	-	2	-	-	-	-	15	13	15	10	4	14	18	13	15	10	4	14
2000 – 2100 hrs.	-	1	-	-	-	-	10	15	10	6	5	7	11	15	10	6	5	7
2100 – 2200 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	6	10	2	5	-	2
2200 – 2300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	2	4	2	3	-	-
2300 – 0000 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**35**	**38**	**7**	**8**	**0**	**0**	**234**	**253**	**207**	**195**	**56**	**62**	**283**	**305**	**227**	**219**	**59**	**64**

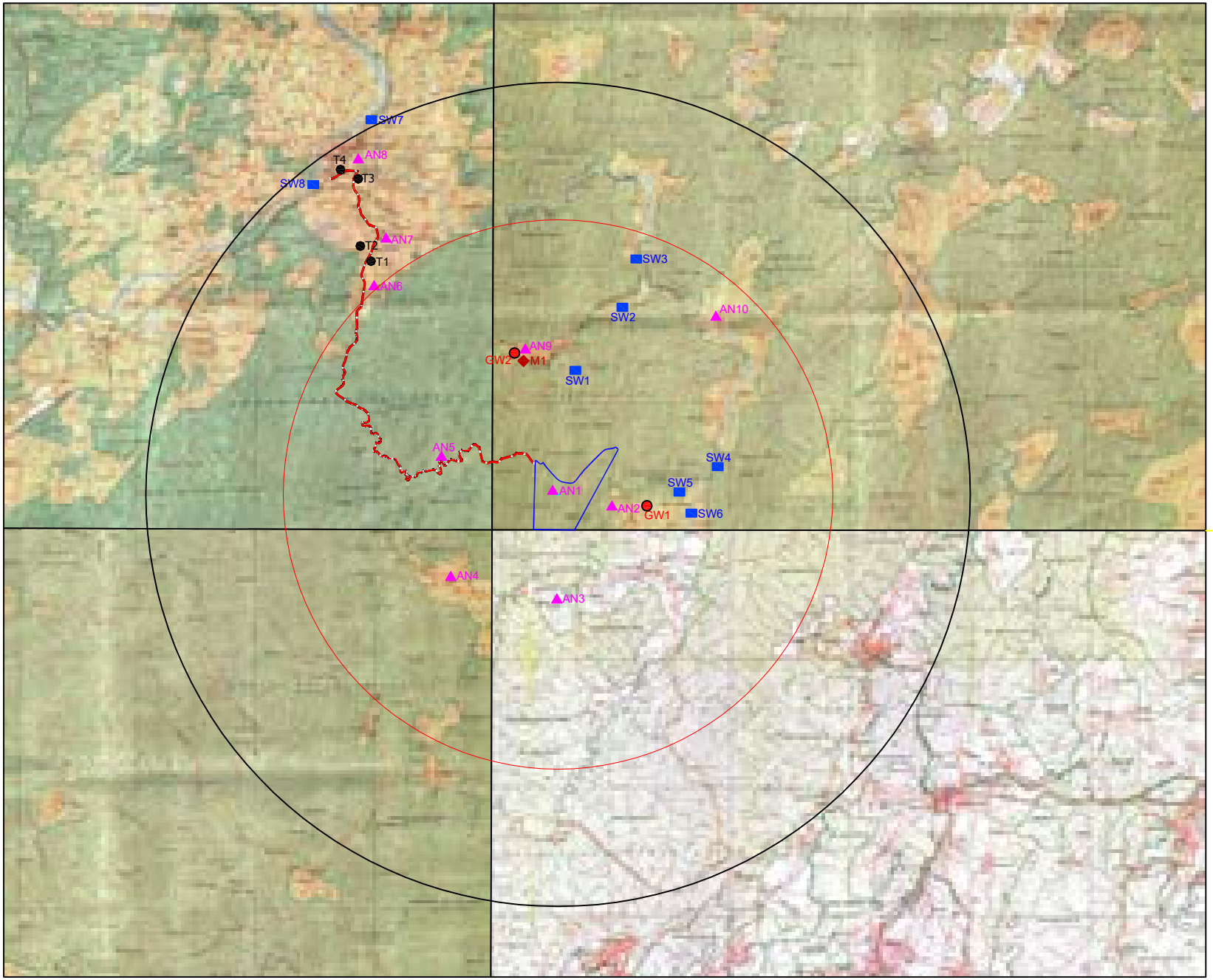
Table 6 : Traffic Density Survey on T1, T2 and T3 (from 0000 hrs. on 24-10-2016 to 2300 hrs on 24-10-2016)

Date: 24/10/2016	T1- Near Forest Check post on end of forest road before joining Rourkela-Manoharpur road (Mines to Railway Siding-R.S)						T2- Near Meena Bazar on Rourkela - Manoharpur road before Forest Check post.(Rourkela-ROU to Manoharpur-MHP)						T3- Near Medasai village on Rourkela-Manoharpur road before joining approach road towards Railway siding (Rourkela-ROU to Manoharpur-MHP)					
Time	**2 wheelers**		**LMV**		**HMV**		**2 wheelers**		**LMV**		**HMV**		**2 wheelers**		**LMV**		**HMV**	
	To R.S	**To Mines**	**To R.S**	**To Mines**	**To R.S**	**To Mines**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**
0000 – 0100 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0100 – 0200 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0200 – 0300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0300 – 0400 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0400 – 0500 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0500 – 0600 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0600 – 0700 hrs.	4	5	-	-	-	40	10	1	10	7	2	5	10	4	7	7	2	31
0700 – 0800 hrs.	5	3	-	-	-	31	27	8	4	3	-	2	53	26	10	13	4	24
0800 – 0900 hrs.	6	5	-	-	13	10	26	8	8	10	-	-	22	15	7	9	10	5
0900 – 1000 hrs.	3	6	-	-	15	12	14	19	7	10	7	-	28	27	7	12	25	17
1000 – 1100 hrs.	8	6	-	1	23	21	10	15	10	11	2	7	20	22	12	12	23	25
1100 – 1200 hrs.	8	3	1	-	20	11	26	19	15	13	2	3	31	26	12	14	18	19
1200 – 1300 hrs.	2	1	-	1	17	18	15	17	13	13	1	4	28	23	12	13	22	16
1300 – 1400 hrs.	-	3	1	-	15	5	18	15	8	11	5	1	19	20	8	13	17	11
1400 – 1500 hrs.	4	4	-	-	37	10	17	17	11	12	4	4	26	24	12	13	32	13
1500 – 1600 hrs.	3	1	1	-	9	6	22	24	8	10	2	1	23	25	9	10	17	10
1600 – 1700 hrs.	6	6	-	-	31	11	15	24	16	9	4	5	22	21	15	15	36	16
1700 – 1800 hrs.	4	3	1	1	4	5	21	20	15	14	-	6	30	28	22	15	9	16
1800 – 1900 hrs.	2	4	-	-	-	-	12	7	5	11	4	-	12	8	9	7	4	-
1900 – 2000 hrs.	-	-	-	-	-	-	4	9	7	1	3	1	-	-	-	-	-	-
2000 – 2100 hrs.	-	-	-	-	-	-	2	3	5	1	-	2	-	-	-	-	-	-
2100 – 2200 hrs.	-	-	-	-	-	-	3	2	6	1	1	-	-	-	-	-	-	-
2200 – 2300 hrs.	-	-	-	-	-	-	1	1	3	-	-	-	-	-	-	-	-	-
2300 – 0000 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**55**	**50**	**4**	**3**	**184**	**180**	**243**	**209**	**151**	**137**	**37**	**41**	**324**	**269**	**142**	**153**	**219**	**203**

Table 7 : Traffic Density Survey on T1, T2 and T3 (from 0000 hrs. on 25-10-2016 to 2300 hrs on 25-10-2016)

Date: 25/10/2016	T1- Near Forest Check post on end of forest road before joining Rourkela-Manoharpur road (Mines to Railway Siding-R.S)						T2- Near Meena Bazar on Rourkela - Manoharpur road before Forest Check post.(Rourkela-ROU to Manoharpur-MHP)						T3- Near Medasai village on Rourkela-Manoharpur road before joining approach road towards Railway siding (Rourkela-ROU to Manoharpur-MHP)					
Time	**2 wheelers**		**LMV**		**HMV**		**2 wheelers**		**LMV**		**HMV**		**2 wheelers**		**LMV**		**HMV**	
	To R.S	**To Mines**	**To R.S**	**To Mines**	**To R.S**	**To Mines**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**	**To MHP**	**To ROU**
0000 – 0100 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0100 – 0200 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0200 – 0300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0300 – 0400 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0400 – 0500 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0500 – 0600 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0600 – 0700 hrs.	5	3	1	1	-	45	10	3	6	5	1	6	13	2	6	9	-	51
0700 – 0800 hrs.	3	5	-	-	2	19	11	5	9	8	1	1	21	9	8	10	2	4
0800 – 0900 hrs.	6	7	1	-	7	3	20	14	13	11	3	11	23	22	20	9	27	16
0900 – 1000 hrs.	5	4	-	-	25	15	20	19	24	7	2	3	20	22	24	10	27	22
1000 – 1100 hrs.	7	6	-	1	37	32	17	23	17	13	4	5	23	30	17	13	36	35
1100 – 1200 hrs.	4	6	1	-	27	24	8	15	13	13	7	4	13	21	14	13	34	28
1200 – 1300 hrs.	3	4	2	2	11	20	17	13	15	10	6	3	16	15	14	10	15	21
1300 – 1400 hrs.	6	6	1	1	17	10	15	14	12	11	3	30	22	20	12	12	22	10
1400 – 1500 hrs.	1	1	2	1	18	9	14	20	9	11	2	4	16	22	8	12	26	17
1500 – 1600 hrs.	3	3	-	-	27	5	14	20	10	12	4	5	23	19	13	14	30	10
1600 – 1700 hrs.	6	7	-	-	25	15	21	13	9	14	4	3	15	15	7	15	42	15
1700 – 1800 hrs.	7	7	1	1	20	10	20	21	21	25	4	6	22	34	19	14	26	22
1800 – 1900 hrs.	6	4	1	2	6	12	14	14	9	15	4	3	5	12	4	10	1	2
1900 – 2000 hrs.	-	-	-	-	-	-	6	7	7	8	9	5	-	-	-	-	-	-
2000 – 2100 hrs.	-	-	-	-	-	-	4	4	4	4	4	4	-	-	-	-	-	-
2100 – 2200 hrs.	-	-	-	-	-	-	3	2	4	5	3	2	-	-	-	-	-	-
2200 – 2300 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2300 – 0000 hrs.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**62**	**63**	**10**	**9**	**222**	**219**	**214**	**207**	**182**	**172**	**61**	**95**	**232**	**243**	**166**	**151**	**288**	**253**

DRG.No.MEC/G24Z/11/S2/01



N
W E
S

LEGEND

MONITORING STATION

M METEROLOGICAL MONITORING M1

M1 - Chiria Mine Office

AN AMBIENT AIR QUALITY & NOISE LEVEL (AN1 TO AN10)

AN1 - Dhobil Mine
AN2 - Dhobil Village
AN3 - Hatnaburu
AN4 - Morang
AN5 - Sukri ML
AN6 - Gendung
AN7 - Bachamgutu
AN8 - Manoharpur Railway Station / Siding
AN9 - Chiria Guest House
AN10 - Dhori

SW SURFACE WATER (SW1 TO SW8)

SW1 - Chiria Spring
SW2 - Hamsada Nala
SW3 - Koina river downstream w.r.t. Hamsad Nala
SW4 - Koina River downstream w.r.t. Dhobil ML stream
SW5 - Dhobil ML stream going toward Koina river
SW6 - Koina river upstream w.r.t. Dhobil ML stream
SW7 - Koel river upstream w.r.t. Manoharpur Railway siding
SW8 - Koel river downstream w.r.t. Manoharpur Railway siding

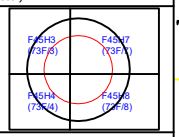
GW GROUND WATER (GW1 TO GW2)

GW1 - Dhobil village
GW2 - Chiria Township / Guest House

T TRAFFIC DENSITY (T1 TO T4)

T1 - Forest Road - Near Forest Check post at the end of forest road before joining Rourkela - Manoharpur road
T2 - Rourkela - Manoharpur road - Near Meena Bazar on Rourkela - Manoharpur road (100 m towards Rourkela before forest road junction)
T3 - Rourkela - Manoharpur road - Near Medasai village on Rourkela - Manoharpur road before joining approach road towards Railway siding (On Rourkela - Manoharpur and, 50 m before turning to branch road going towards railway siding, before power sub-station)
T4 - Branch road from Rourkela - Manoharpur road, after turning from power sub-station, going towards railway siding (From Secondary data collected from mine dispatch register)

Dhobil ML
15 km Buffer
10 km Buffer
Ore Transportation Route



STEEL AUTHORITY OF INDIA LIMITED

MECON LIMITED

SECTION	ENV. ENGG.	DHOBIL IRON ORE MINING PROJECT
LOCATION	RANCHI	
DESIGNED	S.B	MAP SHOWING DHOBIL MINE LEASE, TRANSPORTATION ROUTE AND MONITORING LOCATION
DRAWN	M.P	
CHECKED AND VERIFIED	V.S	
APPROVED	S.K.S	SCALE – AS SHOWN / SHEET / REV
DATE	05.10.2016	DRG.No.MEC/G24Z/11/S2/01 / 1 OF 1 / 0