

Project Report on **Installation of Evacuation Corridor for transportation of Iron ore from Chiria to Patharbasa**



**Steel Authority of India Limited
Raw Materials Division
Manoharpur Ore Mines, Chiria**

CONTENTS

<i>Chapter no.</i>	<i>Topic</i>	<i>Page no.</i>
Chapter 1	Introduction	01
Chapter 2	Description of the Project	04
Chapter 3	Requirement as per Statute	06
Chapter 4	Technological Study for various alternative systems	07
Chapter 5	Selection of the Route	09
Chapter 6	Technical Specifications	11
Chapter 7	Land use details	12
Chapter 8	Summary & Conclusion	13

Chapter 1: Introduction

Steel Authority of India Limited, SAIL, a “Maharatna” Public Sector Undertaking under the Ministry of Steel is the major steel producer of India in the country, contributing to 23.18 Mt hot metal productions after completion of ongoing expansion & modernization plan. In order to meet the national objectives of growth in infrastructure industry, SAIL has also planned for further massive expansion & modernization program with a quantum jump in present hot metal production capacity. Iron ore is a major raw material input required for steel production. In order to cater to the annual hot metal production capacity of 23.18 Mtpa from FY 2015-16 to 35 Mtpa in FY 2020-21 and further to 50.40 Mtpa in FY 2025-26, annual iron ore requirement for different steel plants of SAIL will be around 44.04 Mtpa, 66.50 Mtpa & 95.76 Mtpa respectively. The present leases of SAIL, Chiria in the state of Jharkhand comprises of Budhaburu, Ajitaburu, Dhobil, Sukrilutuburu, Ankua & Tatiburu Mining leases.

Lease	Lease Area (in Ha.)	Present capacity as per EC (in Mtpa)
Budhaburu (Mclellan)	823.617	4.2
Ajitaburu	323.887	2.8
Dhobil	513.036	0.75
Sukri Lutur Buru	609.554	0.75
Ankua	67.178	-
Tatiburu	38.850	-
Total	2376.122	8.5

The present status of available reserves/resources [as on 01.04.2015] in the mining leases of SAIL in Chiria is given as follows:

Name of Leasehold	Total reserves/resources (in Mt)	Reserves (in Mt)	Resources (in Mt)
Chiria Group of Mines	1948.99	992.23	956.76

Source: Mining Plan Reports

Share of Chiria in total resources requirement for existing Steel Plants of SAIL is given as follows:

Name of iron ore cluster	Total reserves/ resources (in Mt)	% age presence
Chiria group of mines	1948.99	58%
Other than Chiria group of mines (Gua, KBR, MBR, Bolani, Barsua, BSP Mines)	1402.08	42%
Total	3351.07	100%

It can be inferred from the above that all leases of SAIL in Jharkhand/ Odisha /Chhattisgarh cluster are not able to meet the requirement of SAIL, unless the resources of Chiria are available with it.

Importance of Chiria cluster for SAIL

SAIL has undertaken massive expansion plan of its units to meet growing needs of infrastructural development of the country. The expansion plan envisages supply of major volume of iron ore from Chiria Iron ore mines. If leases of Chiria mines are not renewed immediately, SAIL will have serious problem in iron ore supply to these units. Hence, any further delay in settling this issue may critically affect SAIL's corporate objective and financial health.

In order to bridge the gap between the iron ore production capacity and its requirement beyond 2025, SAIL has a plan to develop phase wise expansions of Chiria cluster of mines in order i.e 7 MTPA (by 2018-19), 15 MTPA (by 2022), 25 MTPA (by 2027) and 35 MTPA (by 2034). Accordingly a Detailed Project Execution Report (DPER) has been prepared through M/s HATCH Associates Pvt. Ltd., Australia for expansion of mines capacity to 7.0 MTPA in 1st Phase & subsequent expansion to 15.0 MTPA through mechanized means. Production will be met from Budhaburu (MacLellan) & Ajitaburu with capacity of 4.2 MTPA & 2.8 MTPA respectively.

So far as statutory clearances are concerned, Mining leases have been granted extension vide latest ordinance promulgated under MMDR Act, 2015. Environmental Clearances have been granted for four leases with total capacity of 8.5 MTPA as state above. Mining Plans have also

been approved by IBM. Stage- I Forestry Clearance have been granted by MoEF &CC, GOI vide letter dated 07.03.2011 for total area of 595.075 Ha. However, as per Stage-I condition no. 14 & 15 of the above in-principle approval the mining of ore and crushing upto two stages is to be carried out within the reserve forest area and processing of the ore should be carried out in a non-forest area by transporting the same through Closed Conveyor system.

To comply the statutory requirement the instant proposal is initiated for installation of a most efficient, environment friendly and world class technology of material conveying system from Ajitaburu mining lease to nearest non-forest area available at Patharbasa village for an approximate length of 6.3 km.

Chapter 2: Description of the project

The Manoharpur Ore Mines, Chiria is situated in West Singhbhum district of Jharkhand state in India. It is one of the largest known iron ore deposits in the world, located in the Saranda Reserve Forest. The location of Chiria deposit is at 22°17' latitude and 85°16' longitude. The nearest railway station is at Manoharpur through which Howrah – Mumbai broad gauge line is passing and Chiria is situated at 22 km away from Manoharpur and connected by a state highway. The Chiria mine comprises six leases Ajitaburu, Budhaburu (MacLellan), Dhobil, Sukri luturburu, Ankua & Tatiburu and collectively contains a reserve of 1.9 billion tonnes averaging 62% Fe. Since Chiria can provide the raw material security for the steel plants of SAIL in future years and thus a DPER for 7.0 MTPA capacity expansion plan has been prepared. Fully mechanized mining will be carried out from Ajitaburu & Budhaburu (MacLellan) mining leases with the ROM capacity of 2.8 MTPA & 4.2 MTPA respectively in the Ist Phase. As per Stage-I FC granted by MoEF, GOI the mining and crushing of ores is to be carried out within the mining leases as these are in the reserve forest area and processing will be done outside the reserve forest area i.e on non-forest area near Patharbasa in which the final stage crushing, segregation of ore, beneficiation and loading will be taken up.

For transportation of ore from mines to Patharbasa has been explored by M/s HATCH considering different modes like Railway, road and conveyor system. Because of certain constraints like availability of land, forest area and distant location and moreover involvement of lot of R&R issues, it is proposed for the installation of conveyor system. They suggested for a patented Ropecon Conveyor system of Doppelmayr, Austria, which can provide the better solution in ore transportation system. The RopeCon is a conveyor system supported by suspension ropes with support trestles spaced up to 800 metres apart. The main features of this system are its ability to span large distances and convey material up and down inclines unachievable by conventional belt conveyors. This feature enables its installation in areas of rough terrain with a minimal footprint. This will not only minimize the requirement of forest land but also reduces the environmental impacts.

RopeCon conveys bulk materials continuously using a flat belt with flexible corrugated sidewalls. The belt is supported by axles and wheels sets, fastened to the top of the belt at around 4m to 5m spacing. The wheels then run on wire track ropes much the same as a cable car does. Similar to a conventional conveyor, it is driven by drive pulley in the head and/or tail station. Roof cover is supported separately by two ropes; the roof can in turn support HV power /communication cables, pipe, etc. A separate pair of ropes supports a maintenance carriage that can run along over the conveyor. All ropes are tied together with frames at around 6m spacing in order to stabilize them. The towers that support the ropes can be spaced as much as 800 m apart, depending upon the terrain. RopeCon is serviced from head and tail end of the conveyor and has no walkway structure alongside.

Chapter 3: Requirement as per Statute

As stated earlier, the Stage-I Forestry Clearance has been granted by MoEF, GOI, New Delhi vide order no. 8-70/2009-FC dated 07.03.2011 for the diversion of 595.075 Ha of forest land in that in-principle approval the following conditions have been imposed:

1. **Condition – 14** states that “Only mining and primary and secondary crushing would take place in the forest area. Processing, beneficiation, blending, stockpiling, railway sidings, infrastructure and all township facilities will be 15 km away in non-forest land”
2. **Condition – 15** states that “Only closed conveyer systems will be used for transportation of ore”.

In compliance to the condition no. 14, the location of beneficiation plant has been selected in the non-forest land at Patharbasa at a distance of about 15 km away by road from Manoharpur Ore Mines i.e. Chiria Deposit.

In compliance to the condition no. 15, various alternative routes have been studied for ore transportation from Chiria to Patharbasa by closed conveyer system. The alignment of proposed conveyer route has been described in chapter 2 above.

Chapter 4: Technological Study for various alternative systems

Following factors are attributed to locating the project in Forest area:

1. All the Mining leases of Manoharpur Ore Mines, Chiria are in reserved forest area.
2. For installation of beneficiation & loading plant requires about 100 ha of land.
3. Condition no 14 of Stage-1 Forest Clearance states as that's "Only mining and primary and secondary crushing would take place in the forest area. Processing, beneficiation, blending, stockpiling, railway sidings, infrastructure and all township facilities will be 15 km away in non-forest land"
4. Nearest available 100 ha of Non-forest area at Patharbasa was selected for setting up of beneficiation & Loading plant. (As per DPER prepared by M/s Hatch).
5. The different options for the transportation of crushed ROM ore from the Chiria mine site to the beneficiation plant site at Patharbasa was studied by engaging reputed Global consultant.
6. Studies were conducted on Rail, Trucks Conveyor systems. Various options for the transport of crushed ore from crushing plant to the beneficiation plant site have been considered. As per M/s Hatch Associates (A reputed Global consultant) study, the only practicable solution is a conveyor system.

Selection of Ore Transport System

A study is undertaken to evaluate the various options for transportation of crushed ROM ore from the Chiria mine site to the beneficiation plant site at Patharbasa. Based on the study, a conveyor belt system is proposed for the Chiria project.

Routes for Overland Conveyor System

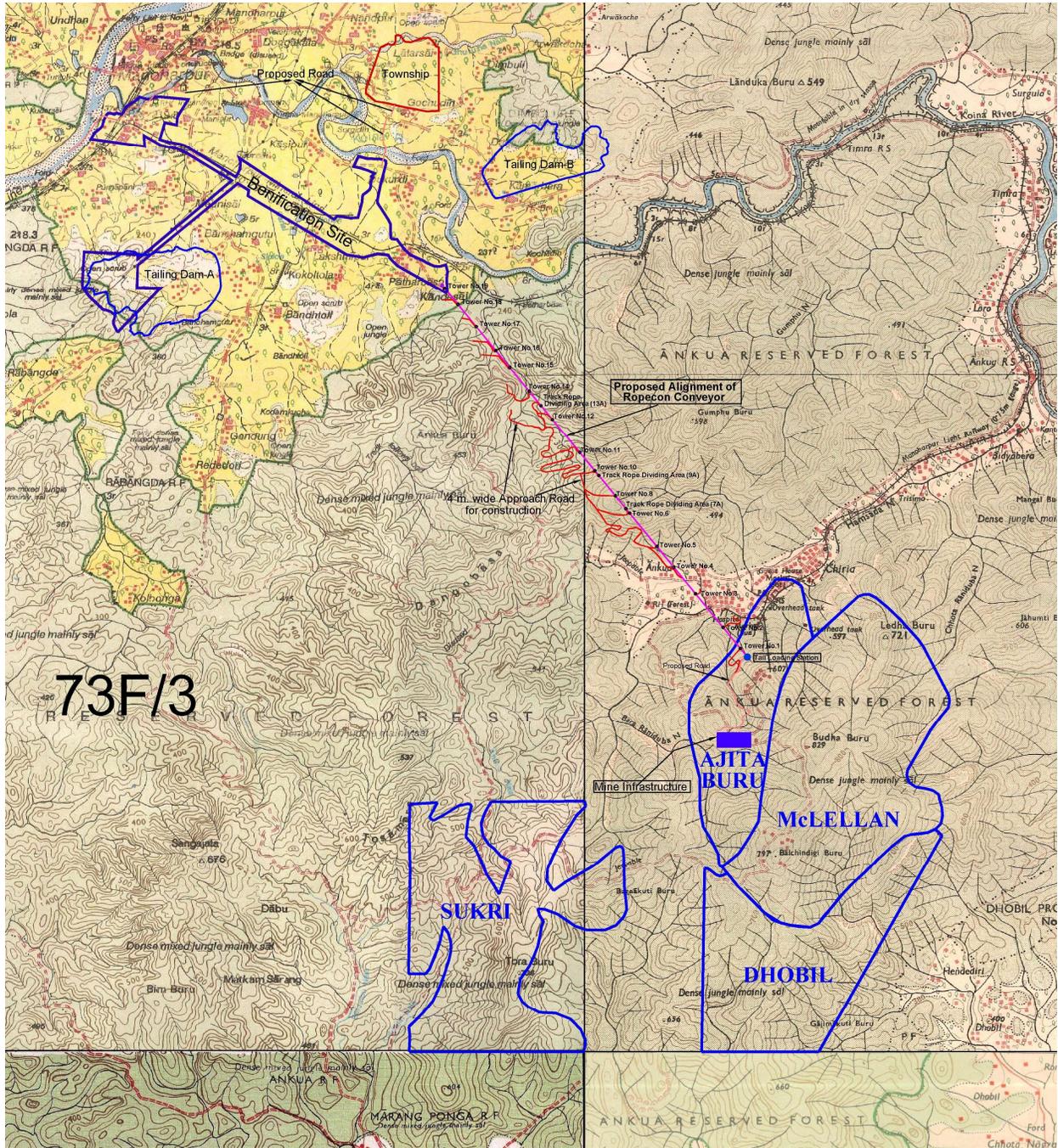
Various options for the transport of crushed ore from crushing plant to the beneficiation plant site have been considered. The only practicable solution is a conveyor system. Two possible routes have been identified for the transportation of crushed ore by an overland conveyor system.

1. A rail route along the existing 24 km long narrow gauge old light railway track from skipway bottom bunker to Patharbasa has been examined. It was not found suitable due to want of space at Chiria valley for stock piling and siding development due to existence of colony as well as forest cover. Moreover, the light loco route is having lot of encroachments as on today.
2. Long distance conveyor on the same route is also not found suitable for installation and maintenance because of two/three turning points and crossing of the conveyor across Koina river at no. of places.
3. Road transportation was also examined and found that it would not be suitable for handling huge volume of ore at plying of the transportation vehicles on public road as well as in the forest area.
4. **Direct route from Chiria mining lease to Patharbasa:**
 - a. The direct patented route of Ropecon Conveyor system of Doppelmayr, Austria proposed by M/s HATCH Associates, Australia envisages transportation of the crushed ore straight from the intermediate silo at Chiria mine to Patharbasa site over a distance of 6.3 km. This route passes through a forest and approval is required for ground corridor for the conveyor from the Forest Department. An examination of the topographical features for the direct route indicates that it is technically feasible to install a conveyor system running above the canopy of the forest.
 - b. Long Distance Belt Conveyor system along / adjacent to the Light Loco Route with the provision of one transfer point: Conveyer length in the route is 14.32 km involving total land of 39.37 ha, out of which 25.242ha is forest land and 14.028 ha is non-forest land. Out of the total forest land of 25.242 ha, 1.719ha falls under mining lease and the remaining is forest land outside the lease.
 - c. Long Distance Belt Conveyor system adjacent to the Light Loco Route without the provision of transfer points in between: Conveyer length in the route is 12.255 km involving total land of 33.165 ha, out of which 29.645 ha is forest land and 3.52 ha is non-forest land. Out of the forest land of 29.645 ha, 1.719ha falls under mining lease and the remaining is forest land outside the lease.

Chapter 5: Selection of the Route

Out of the two routes proposed in the chapter no. 4 under “Direct route Chiria mining lease to Patharbasa”, the Ropecon Conveyor system of Doppelmayr, Austria proposed by M/s HATCH Associates as captioned (a) is considered as Route no. 1 and captioned (b) as Route no. 2 in the proposal. The Direct Route has added advantages for minimum length of 6.314 km as well as it is a close conveyor system. The Conveyor trusses spacing is about 300-400 m and hence only 19 numbers of trusses are required. Also, the Trusses height will be about 22 m and thus it will not obstruct movement of wild life. Spillage as well as dust / noise generation will be less because it is a closed conveyor system and there is no provision of transfer points. Less noise generation, zero spillage and less dust generation will lead to the least disturbance of flora and fauna of the area. RopeCon Conveyor system of Doppelmayr, Austria has been considered as base for alignment of the route and proposed for the following advantages:

- a) High capacity material transport in difficult, steep, hilly terrain;
- b) RopeCon combines the benefits of ropeway technology with those of a conventional conveyor belt;
- c) Can be installed across buildings, roads, rivers and other obstacles;
- d) Can withstand wind speeds of 210 - 250 km/hr (as per vendor data);
- e) Minimal spillage;
- f) Relatively small footprints due to larger spacing of support trestles;
- g) Less chance of pilfering or vandalism as the system can be more than 22m high above the ground;
- h) Less environmental impact.
- i) Narrow line corridor
- j) Straight conveying line
- k) Easy crossing of buildings, railway lines, rivers or other obstacles
- l) Lower running/rolling resistance than on conventional conveyors
- m) Low energy consumption
- n) Very low noise emission (About 50 dB(A) at a distance of 1 m)
- o) Minimum line structures required
- p) Lower belt is turned soiled side up again
- q) No maintenance platform along the line
- r) No belt skewing.



Chapter 6: Technical Specifications

SAIL RMD sought the opinion of reputed technology vendors like M/s HATCH Associates Pvt. Ltd. to explore other viable options. Experience profile of Doppelmayr, Austria proposed by M/s HATCH Associates in the related field is attached at the end of long distance conveying options in India.

Technical Data	Description
Horizontal conveying length	6,300 m
Vertical conveying height	363 m
Maximum inclination	26 degree
Hourly capacity	3,000 t/h (rated)
Maximum lump size	100 mm
Bulk density	2.10 – 2.80 t/m ³
Belt speed	5 m/sec
Location of drive unit	Loading station
Power required, continuously (regenerative)	1,916 kW
Belt Data	
Belt type	ST 6030 11T/9T-Y
Belt width	1,050 mm
Belt utilization width	900 mm
Side wall height	200 mm
Endless belt length	13000
Track Rope Data	
Track rope diameter	2 X 67 mm, 2 X 67 mm, 2 X 67 mm
Pretension force	9260 kN
Rope length	6 X 6480
Tower Details	
Total number of towers	19
Track rope anchoring towers	7th, 9th and 13th tower
Unloading station (At the end of RopeCon)	1
Loading station (At the start of RopeCon)	1

Chapter 7: Land use details

For the installation of 6.37 km long conveyor from Chiria mining lease to Patharbasa, DGPS survey has been conducted and tentative Land use for different installations like starting point i.e. material loading arrangement, erection of tower/trestles as conveyor support, laying of Conveyor, transfer points, civil structures for monitoring and control, end point discharge arrangement, approach road etc. have been calculated as under:

SN.	Purpose	Forest land (in ha)	Revenue land (in ha)	Total area (in ha)
1	Approach road for towers	8.7565	0.0905	8.847
2	Area for towers	1.2600	0.1805	1.4400
3	Area for tack driving	0.0600	0.0000	0.0600
4	Area for end station	4.5000	0.0000	4.5000
5	Area for laydown	1.0000	0.0000	1.0000
6	Area for RopeCon alignment	1.6680	4.2430	5.9130
	Total	17.24	4.514	21.7540

The area mentioned in the table might get changed during installation, however, total area would be adjusted within the diverted area. The proposed alignment may also deviate during actual installation, however, care would be taken such that in all circumstances the diverted area remains same.

Chapter 8: Summary & Conclusion

The proposal of installation of Conveyor system along 6.3 km is most essential for evacuation of the ore from the mines to Patharbasa so that final processing and beneficiation of the ore can be taken up in the non-forest area. The present expansion plan is for 7 MTPA which may extend upto 15 MTPA after stabilization. The DPER prepared by HATCH has kept the provision of installation of some additional units on the side of the other installations so that further expansion upto 15 MTPA would not be affected. The process of land acquisition in the non-forest area and development of siding near Manoharpur are in the process. The tentative estimate of the cost of 7 MTPA expansion plan would be approximately Rs. 5400 Crores and the installation of Conveyor system would be approximately Rs. 410 Crores. The technology for such installation would be world class with minimum environmental degradation and provide sufficient space for movement of Wildlife.

The RopeCon conveyor system would be the linkage between mining and processing of ore and then it would be dispatched to various steel plants of SAIL as per linkages so that raw material requirement is met with in future. Chiria has positional advantage over the other mines for supplying the substantial quantity of raw material at the lowest cost.