

CHAPTER-4

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FIELD STUDY AND DATA COLLECTION

4.1 FIELD STUDY

For fulfilling the research objectives field studies were done in two large surface mining projects of Northern Coal Field Limited (NCL) and Bharat Coking Coal Limited (BCCL). This research has studied operation of 35 numbers of dump trucks from NCL including 5 number of 85 T and 30 number of 100 T dump trucks. The study period extends from January, 2015 to December, 2019. This research has also used operational data of 5 numbers of 85 T dump trucks operating in Block-II project of BCCL.

The area of NCL is about 2202 square Km. The coalfield can be divided into two basins, viz. Moher sub-basin (312 Square Km.) and Singrauli Main basin (1890 Square Km.). Major part of the Moher sub-basin lies in the Singrauli district of Madhya Pradesh and a small part lies in the Sonebhadra district of Uttar Pradesh. Singrauli main basin lies in the western part of the coalfield and is largely unexplored. The present coal mining activities and future blocks are concentrated in Moher sub-basin.

All the coal mining operations of NCL are at present concentrated in Moher sub-basin through 10 numbers of highly mechanized open cast mines. Nearly 500 dump trucks are operational in these mines. This research has collected operational data of dump trucks from 3 opencast mines, namely Jayant, Khadia and Amlohri projects as shown in Figure 4.1. In these three projects, 157 dump trucks are operating.

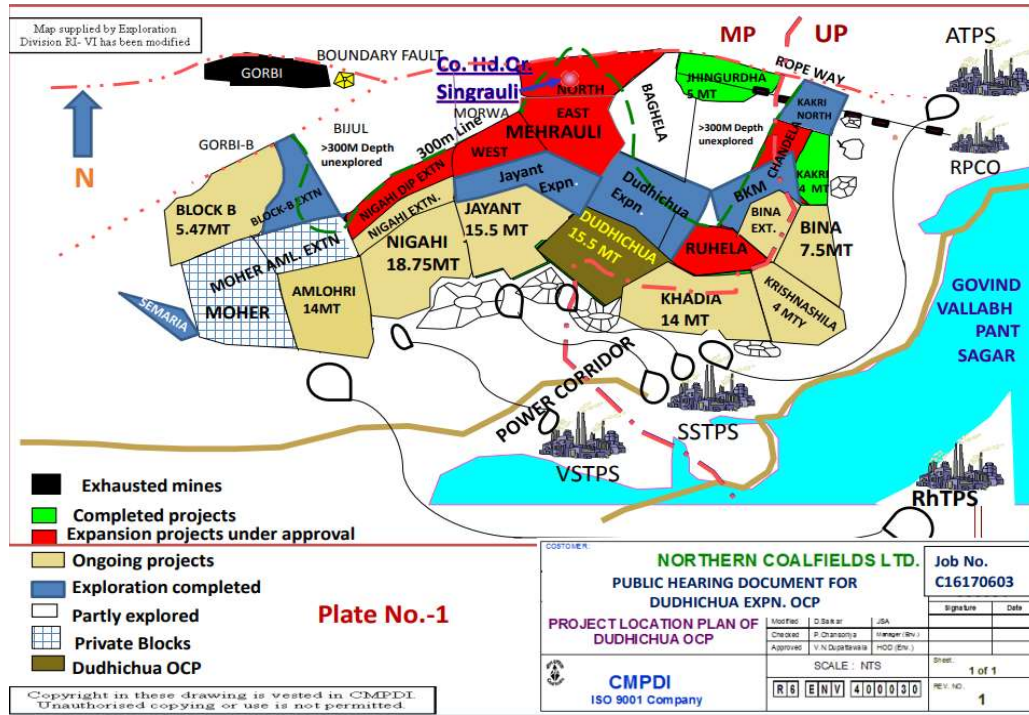


Figure 4.1 Location of various mining projects in NCL Coalfields

4.2 JAYANT PROJECT

Jayant Open Cast Project (a 10 MTY Project) of NCL is one of the oldest mine of Singrauli area in which the excavation started in the year 1976-77 and approximate depth of the mine is now approaching 180 m. The project has an environmental clearance of 15.5 MTY. An expansion project report of Jayant OCP for 20 MYTPA is under consideration before CIL board. It has achieved a peak production level of 15.50 MT in the year 2010-2011.

4.3 KHADIA PROJECT

Khadia project is located in the Singrauli area of Northern Coalfields Limited between latitude 24°7'26" and 24°8'47" and between longitude 82°41'40" and 82°44'47" has been named after Khadia village located in the south of the block. Khadia

is second highest coal producer project in NCL among all projects. It has an environmental clearance of 8.5 MTY.

4.4 AMLOHRI PROJECT

Amlohri block is located in the south western part of moher basin of Singrauli coalfields. Moher block lies on its west and Nigahi block in east. The feasibility study prepared by CMPDI with participation of Russian experts in 1974 had identified Amlohri open cast mine with rated capacity of 10 MT/year of coal. The report was based on the available geological information in April 1982 for an initial capital investment of Rs.323.32 crores and was sanctioned by the government of India on 25 June 1982.

4.5 BCCL BLOCK-II AREA

Block-II Area came into existence in the year 1983-84 primarily for the production of Coking Coal with the inclusion of the Nudkharkee OCP, Benedih OCP, Jamunia OCP and the opening of Block-II Project. The Block-II Project was funded by World Bank. The project was envisaged to improve the financial position of BCCL and to meet the growing demand of Coking Coal in the country.

In the year 2002-03 Benedih OCP, Nudkharkee OCP and Block-II OCP (Coking coal) were amalgamated and Block-II OCP (Non-coking) Project came into existence. In 2003-04 Madhuban Coal Washery also came under the administrative control of Block-II Area.

4.6 METHODS OF DATA COLLECTION FOR RESEARCH

Data collection is a process of collecting information from all the relevant sources to find answers to the research problem, test the hypothesis and evaluate the

outcomes. Data collection methods can be divided into two categories: primary methods of data collection and secondary methods of data collection.

Primary data collection methods can be divided into two groups i.e. qualitative and quantitative methods. Qualitative methods do not involve numbers or mathematical calculations. These are closely associated with words, sounds, feeling, emotions, colors and other elements that are non-quantifiable. Qualitative data collection methods include interviews, questionnaires with open-ended questions, focus groups, observation, game or role-playing, case studies, etc.

On the other hand, quantitative data collection methods are based in mathematical calculations in various formats. It includes questionnaires with closed-ended questions, methods of correlation and regression, mean, mode and median and others. This method is cheaper to apply and they can be applied within shorter duration of time compared to qualitative methods.

Secondary data collection methods are used to collect the data that has already been published in books, newspapers, magazines, journals, online portals, etc. There is an abundance of data available in these sources about a research area, almost regardless of the nature of the research area. The choice of quantitative or qualitative methods of data collection depends on the area of the research and the nature of research aims and objectives.

4.7 DATA COLLECTION FOR THE PRESENT RESEARCH

The various operational data like maintenance hours, breakdown hours, idle hours, operating hours and other relevant information have been collected through field study, from the machinery logbook as well as from the NCL server. All the case study

mines maintained a record of these data (Figure 4.2). These data have been primarily used for computation of time losses. These mines do not record information of various capacity losses of the dump trucks. This information has been ascertained through discussion and collecting the opinion of the crew members involved in the dump truck operation. The crew members marked their response on a structured tailored questionnaire. Collected data has been analysed to compute various capacity losses.

ID	DESCRIPTION	CIL NO	MANUF DATE OF SRL NO COMM	PRICE	SFT	WEEK	MT	BDN	EDL	AVL	AVL74	UTL	ISTD	Specific Consumption	Tires	Mileage	MPH	Problem Observed	
257	257 Caterpillar 777D	D-10647	257 05/11/07	32,995.00	720	300.00	40.00	226.00	254.00	454.00	63.06	27.78	11051	55.26				0.0	
259	259 Caterpillar 777D	D-9926	259 03/12/07	31,896.00	720	0.00	0.00	720.00	0.00	0.00	0.00	0.00		#Error#				0.0 maj 26/06/2017	
260	260 Caterpillar 777D	D-9924	260 08/12/07	28,054.00	720	337.00	37.00	139.00	207.00	544.00	75.56	46.81	15676	46.57				0.0	
261	261 Caterpillar 777D	D-9921	261 26/11/07	32,330.00	720	138.00	24.00	445.00	113.00	191.00	34.86	19.17	7342	53.20				0.0	
262	262 Caterpillar 777D	D-9923	262 30/11/07	30,829.00	720	323.00	48.00	154.00	195.00	518.00	71.94	44.86	16669	51.61				0.0 maj 23/07/2017	
268	268 Caterpillar 777D	D-10048	268 01/03/08	34,698.00	720	350.00	33.00	48.00	290.00	639.00	88.75	48.61	17017	48.02				0.0	
269	269 Caterpillar 777D	D-10049	269 21/03/08	33,038.00	720	186.00	29.00	267.00	258.00	474.00	58.89	25.83	8879	47.74				0.0	
270	270 Caterpillar 777D	D-10053	270 12/03/08	27,711.00	720	407.00	48.00	55.00	210.00	617.00	85.69	56.53	20633	50.76				0.0	
271	271 Caterpillar 777D	D-10144	271 12/03/08	25,635.00	720	0.00	0.00	720.00	0.00	0.00	0.00	0.00		#Error#				0.0 maj 26/06/2017	
272	272 Caterpillar 777D	D-10052	272 12/03/08	31,987.00	720	215.00	13.00	308.00	94.00	309.00	42.92	29.86	11813	54.94				0.0 maj 11/07/2017	
273	273 Caterpillar 777D	D-10050	273 21/03/08	37,292.00	720	347.00	111.00	29.00	233.00	490.00	80.56	48.19	15996	46.10				0.0	
MODEL WISE TOTAL FOR :				1673	18,504.00	5,721.00	329.00	8,216.00	8,821.00	40,528	30.03	26,403							
1137	1137 BH 100 Dumper	D-10749	1137 31/01/10	15,500.00	720	219.00	49.00	193.00	208.00	497.00	67.64	30.42	10897	49.76				0.0	
1138	1138 BH 100 Dumper	D-10750	1138 16/01/10	11,032.00	720	0.00	0.00	720.00	0.00	0.00	0.00	0.00		#Error#				0.0 maj 26/06/2017	
1140	1140 BH 100 Dumper	D-10458	1140 14/12/09	15,788.00	720	182.00	26.00	364.00	148.00	130.00	45.83	23.26	10142	55.73				0.0	
1141	1141 BH 100 Dumper	D-10751	1141 16/01/10	13,942.00	720	125.00	30.00	385.00	180.00	305.00	42.36	17.36	7208	58.14				0.0	
1252	1252 BH 100 Dumper	D-11223	1252 15/12/11	14,112.00	720	0.00	0.00	720.00	0.00	0.00	0.00	0.00		#Error#				0.0 maj 26/06/2017	
1275	1275 BH 100 Dumper	D-11224	1275 15/12/11	12,559.00	720	171.00	16.00	363.00	170.00	341.00	47.36	23.75	9094	53.18				0.0	
MODEL WISE TOTAL FOR :				1677	4,320.00	697.00	112.00	2,743.00	796.00	33,27	16.13	27401							
275	275 HD785-7, 100T DUMPER	D-10890	275 23/10/10	27,777.00	720	228.00	120.00	59.00	313.00	541.00	75.14	31.67	12315	54.01				0.0	
276	276 HD785-7, 100T DUMPER	D-10891	276 23/10/10	19,250.00	720	119.00	11.00	474.00	116.00	235.00	32.64	16.53	6491	54.56				0.0	
277	277 HD785-7, 100T DUMPER	D-10892	277 23/10/10	28,893.00	720	377.00	97.00	21.00	295.00	642.00	89.17	52.36	23377	62.01				0.0	
278	278 HD785-7, 100T DUMPER	D-10893	278 23/10/10	25,650.00	720	0.00	0.00	720.00	0.00	0.00	0.00	0.00		#Error#				0.0 maj 26/06/2017	
279	279 HD785-7, 100T DUMPER	D-10894	279 23/10/10	29,122.00	720	272.00	97.00	141.00	210.00	482.00	66.94	37.78	14373	52.84				0.0	
280	280 HD785-7, 100T DUMPER	D-10895	280 23/10/10	28,290.00	720	342.00	46.00	67.00	265.00	607.00	84.31	47.50	17482	51.12				0.0	

Figure 4.2 Sample of collected raw data

The questionnaire was distributed to 100 personnel of different designations including field manager, mining engineer, transport in charge, dump truck operator, shovel operator, quality inspector, and other related personnel and 75 responses were received. The personal information like, name, age, designation, educational qualification, experience, habit, of these respondents was also collected.

Environmental performance is assessed from the percentage of CO₂ in the exhaust. UNIPHOS CO₂ gas analyser (i.e., Air Sampling Pump ASP-40 P/N CF000769)

was used to measure the CO₂ percentage in the dump trucks engine exhaust. While measuring the carbon dioxide, the colour of the tube changes from blue to white and the length of the colour change depend on the percentage of CO₂ in the exhaust. For the measurement of percentage of CO₂ in the exhaust, 30 dump trucks of 100 T capacities were selected. These dump trucks were divided into two groups based on their date of deployment in the mines and manufacturer. During my 3 years of study time each dump truck was studied twice in a year at six months interval. My study results 180 sets of reading. Each sets of reading consists of 3 readings; (a) empty dump truck travelling on level road (b) loaded dump truck travelling on level road and (c) loaded dump truck travelling uphill.

The average of these three readings was calculated and represents the percentage of CO₂ in the exhaust at the study time (Figure 4.3).



Figure 4.3 CO₂ measurement of dump truck by UNIPHOS gas detector tube and pump

4.8 Issues and Challenges of Data Collection

Data used in this research was collected through the following three sources

- (i) Source-I: Mine's authority maintains record of operational and performance data of various equipment including dump trucks. Various type of time- performance data like, available hours, breakdown hours, maintenance hours, idle hours, etc. were collected from the performance & maintenance log book of dump trucks.
- (ii) Source-II: Capacity loss data of dump truck was collected through questionnaire survey.
- (iii) Source-III: Data used for calculating the environmental performance of dump trucks was collected during field study. Uniphos gas detector tubes were used to measure the percentage of CO₂ in the exhaust gases of dump trucks..

Performance & maintenance data of dump trucks was available in the logbooks as well as in the company's server. These data include shift-wise routine maintenance time, breakdown time but idle time is not clearly mentioned because these data are maintained by different person in different shift without maintaining much uniformity and details break up of time. Some data were collected from the Excavation department in the dump truck workshop while others were collected from the Mine Planning department at the GM Office. Collecting capacity losses data through the questionnaire survey is a challenge to this study. For this, one has to select a group of respondents with different designation and associated with work elements of dump truck operation. Simply distribution of questionnaire and asking response do not work. One has to pursue it and sometimes circumstances may warrant a meeting with the respondent for

collecting his/her response. This is a time-consuming assignment as to get some free time of a busy employee is a challenge.

Data used for calculating environmental performance of dump trucks was collected by measuring the percentage of CO₂ in the engine exhaust using UNIPHOS gas detector tube and pump. Collecting sample of hot engine exhaust when the loaded dump trucks are in motion is the most difficult part of gathering data for environmental performance measurement. For measuring CO₂ percentage in the engine exhaust, we do a makeshift arrangement by connecting a hose with the instrument which helps to measure the CO₂ percentage while dump truck is being operated.

4.9 Sample Questionnaire

Sticky Material: Some times, there may leave some sticky materials inside the dump truck which may reduce the capacity of the dump truck.

(1) How much it reduces the capacity of the dump truck?

- (a) 0-20 Kg (b) 21-50 Kg (c) 51-80 Kg (d) 81-100 Kg

Under-loading: Many times, there may be capacity losses due to under-loading of dump trucks.

(2) How much capacity losses can occur due to under-loading of dump trucks?

- (a) 0-40 Kg (b) 41-80 Kg (c) 81-125 Kg (d) 126-200 Kg

Loss of Coal during Transportation: In coal mines, the haul roads are not properly level and maintained, so there are chances of transportation losses (spillages) during transportation.

(3) How much coal losses may occur during transportation?

- (a) 0-30 Kg (b) 31-60 Kg (c) 61-125 Kg (d) 126-200 Kg

Quality losses: Materials other than coal like shale, Overburden (OB), stones, soils, etc. are mixed with coal in a loaded dump truck which will reduce its coal carrying capacity due to quality losses.

(4) What could be the amount of materials other than coal present in the a loaded dump truck

- (a) 100-250 Kg (b) 251-500 Kg (c) 501-800 Kg (d) 801-1000 Kg

(1) The above questionnaire was used to collect responses for the Dump truck operators, Shovel Operators, Overmans (Supervisors), Field managers, Workshop engineers and Members of the blasting team. Information like Name of the mine, Name of the employee, Age, Designation, Educational qualification, Experience, etc.