

INFORMATION MODEL LOGISTICS MINE TRANSPORT SYSTEM OF QUARRY “ERDENET”

LOGISTIČKI MODEL TRANSPORTNOG SISTEMA NA POVRŠINSKOM KOPU “ERDENET”

Ts. NANZAD¹, K. KHAVALBOLOT¹

¹ Mongolian University of Science and Technology, Ulaanbaatar, Mongolia

Abstract: Are considered the order and principle of creation of electronic bases for automation of the information data accompanying cargo flows of mine-transport process of quarry Erdenet, which are one of the most essential technical elements of logistics.

Key words: dynamic model, mine transportation, logistics

Apstrakt: U ovom radu analizirani su način i principi uvođenja automatske obrade podataka vezanih za transport tereta u okviru sistema eksploatacije rude na površinskom kopu Erdenet, što predstavlja jedno od suštinskih tehničkih elemenata logistike.

Ključne reči: dinamički model, rudarski transport, logistika

1 INTRODUCTION

The loading and transporting works represent the basic process of mining industry at transport system of development of deposits of minerals by an open way. The quality of their realization predetermines productivity and economic efficiency of functioning of structures of complex mechanization. On open development of Mongolia and many countries of the world the technology with use single-bucket excavator and wheel types of transport, mainly trucks is applied cycling. In spite of on universal complication of mine technical conditions of developed deposits, growth of depth quarry and increase of individual share of other adverse factors the scales of application single-bucket excavators and trucks are increased.

One of radical ways of increase of efficiency of works of mine-transport systems is technical improvement of the rolling-stock of motor transport and cargo handling means, the

1 UVOD

Utovar i transport mineralnih sirovina predstavljaju veoma važan segment procesa površinske eksploatacije. Dobro organizovan i precizno isplaniran sistem transporta u velikoj meri poboljšava efikasnost i produktivnost opreme i složenih sistema. Na površinskim kopovima u Mongoliji, kao i u mnogim drugim zemljama, koristi se diskontinualni sistem eksploatacije i transporta koji kombinuje otkopavanje pomoću bagera sa jednom kašikom i transport vozilima točkašima, uglavnom kamionima. Pored sve složenijih uslova eksploatacije, povećane dubine kopa i drugih otežavajućih faktora, ovaj metod eksploatacije se sve više primenjuje.

Jedan od načina da se poveća efikasnost sistema transporta sastoji se u uvođenju novih usavršenih tehničkih rešenja kod motornih vozila i uređaja za prenos tereta,

introduction of progressive technology, perfection of organizations of mine-transport works.

Organization of manufacture of loading and transport works understand system of measures directed on achievement to coordination and rhythm of functioning of loading-transport engineering in space and time. Here very important is logistics the approach to organization of motor transportation works of mine transport system. Career therefore is expedient to consider some basic situations logistics and system analysis with reference to mine transport systems.

2 TODAY IS SITUATION OF ERDENET MINING CORPORATION

The Mongolian-Russian joint venture(JV) "Erdenet" mining corporation is (EMC) in territory of Mongolia and is largest in Asia by the enterprise for production and enrichment copper-molybdenum of ores. Our EMCe is 888 of the Mongolian economy and arena of the ĩĩĩĩĩ-Russian equal in rights interaction and cooperation. JV "Erdenet" has huge potential.

The company's units are: open pit mine, mineral processing plant, and valley type tailings impoundment and etc, which are located at 1200-1600 meter above the sea level. The processing plant and the city Erdenet have railway communication to Eastern-Sibirian main line of Russia (through the station Naushki) , and to domestic railway sets through the station Darkhan, and also have automobile transportation between cities Darkhan and Ulaanbaatar. Those transportations run whole year around.

The raw material of Erdenet Mining Corporation is an ore-bearing zone Erdenet, with length of 22 km, and width of 5 km, including several copper-phorpiric type ore deposits. In present, the northwestern region, which is the part of the deposit "Erdenetiin Ovoo" is in use. Calculated ore reserves are about 1300 million tons of ore. (6 million tons of copper, and 170 thousand tons of molybdenum).

Since the time plant began its operation, about 370 million tons of ore was processed, and 2000 thousand-tons of copper, and 35 thousand tons of molybdenum was extracted from copper,

uvođenje novih progresivnih tehnologija i poboljšanje organizacije transporta u rudniku.

Organizacija proizvodnje, utovara i transporta podrazumeva sistem mera čije uvođenje treba da obezbedi koordinaciju i usklađivanje utovara i transporta u vremenu i prostoru. Ovde je od velikog značaja logistika, odnosno organizacija motornog transporta u okviru sistema rudničkog transporta, zbog čega će se ovde razmatrati neke osnovne logističke situacije i analize vezane za sistem transporta u rudniku.

2 TRENUTNA SITUACIJA U RUDARKOJ KORPORACIJI ERDENET

Zajedničko mongolsko-rusko rudarsko preduzeće "Erdenet" (EMC) nalazi se na teritoriji Mongolije i predstavlja najveće preduzeće u Aziji za proizvodnju i preradu rude bakra i molibdena. EMC ima veliki značaj za mongolsku privredu i u kooperaciji sa ruskim partnerom predstavlja izuzetan privredni potencijal.

Korporacija se sastoji iz sledećih delova: površinski kop, postrojenje za pripremu mineralnih sirovina, odlagalište flotacijske jalovine itd. Pomenuti objekti nalaze se na nadmorskoj visini od 1200 do 1600 m. Postrojenje za preradu mineralnih sirovina i grad Erdenet povezani su železnicom sa istočno Sibirskom prugom, preko stanice Nauški i sa lokalnom železničkom mrežom preko stanice Darkan. Gradovi Darkan i Ulanbator povezani su autoputem i pomenute saobraćajnice su u funkciji u toku cele godine.

Rudonosna zona je dugačka 22 km, a široka 5 km, uključujući i nekoliko bakarno-porfirnih slojeva. Trenutno je u eksploataciji severozapadna oblast koja predstavlja deo ležišta "Erdenetin Ovo". Proračunate rezerve iznose oko 1300 miliona tona (6 miliona tona bakra i 170 hiljada tona molibdena).

Od kada je postrojenje pušteno u pogon prerađeno je oko 370 miliona tona rude, od čeka 2 000 000 tona bakra i 35 000 tona molibdena koji je dobijen iz bakra i koncentrata molibdena.

molybdenum concentrates, respectively. According to project capacity, number of mined ore is increased from 20 million tons in 1991 to 24 million tons in the half of 2001. On the table 1 is shown main activity indicators of EMC.

Prema projektovanim kapacitetima obim proizvodnje od 20 miliona tona u 1991. godini povećan je na 24 miliona tona do polovine 2001. godine. Tabela 1 prikazuje pokazatelje osnovne aktivnosti koje se odvijaju u EMC-u.

Table 1 Main activity indicators of EMC

tabela 1 Pokazatelji osnovnih aktivnosti EMC-a

	Indicators	Unit of measurement	2001	2002
1	Ore mass	Thousand cubic meter	15889	15865
2	Freight turnover	Thousand ton km	91904	94464
3	Ore processing	Thousand ton	23807	24455
8	Total sales income	Million \$ US	139.6	148.8
9	Profit	Million \$ US	5.6	21.10
10	Cost of output	Million \$ US	117.7	119.1
11	Cost of:	\$ US		
	extracting per ton of ore		0.95	0.87
	transportation (10 ton/km)		1.33	1.15
	processing per ton of ore		2.88	2.96

General Direction of Activities

Projected measurements of mine surface:

- Length 2500m
- Width 1150m
- Maximum depth 270 m

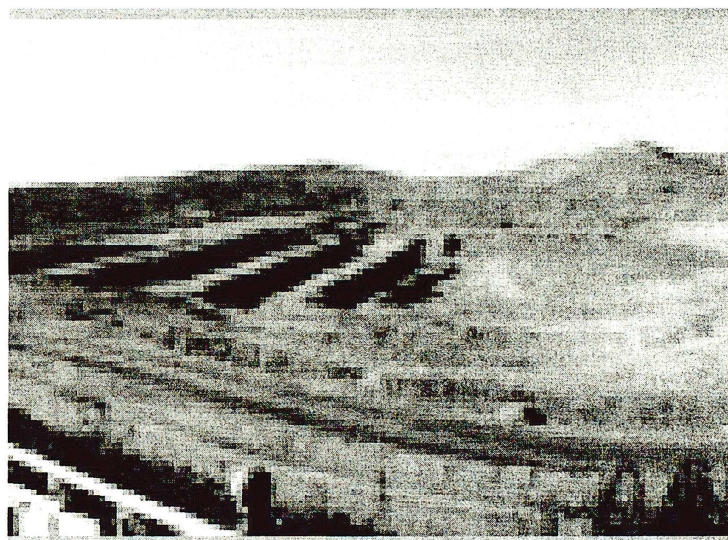
Opšte karakteristike

Projektovane dimenzije rudnika:

- Dužina 2500m
- Širina 1150m
- Maksimalna dubina 270 m

Processing system is transportation of ore to outside dumps. Height of ledge is 15m, minimum width of working space is 50m, and minimum field of operations for one excavator is 100m. The general view of quarry is shown on a Picture 1.

Ruda se transportuje na spoljašnju deponiju. Visina nasipa je 15 m, maksimalna širina je 50 m, a minimalni otkopni front jednog bagera je 100 m. Prikaz površinskog kopa dat je na slici 1.



Picture 1 General view of quarry of EMC

slika 1 Prikaz površinskog kopa EMC

Main technological equipment of quarry : Excavator EKG-10 and EKD-8, wells drilling equipment SBSH-250 MNA, bulldozers CAT, D8, 9, and 10, and motorgraders 16G.

The park of an engineering vehicle includes 20 dump trucks BelAZ-7512 by load capacity of 120 tons, 2 dump trucks "CAT-785B" by load capacity of 136 tons and 3 dump trucks ND-785 "Komatsu" by load capacity of 78 tons.

Factor of engineering readiness on technological transport in 2000 has made 0,81, capacity factor of park in time 65%.

At the enterprise are introduced technique of restoring of large-sized auto buses "Tip-Top", diagnostic center for dump trucks BelAZ-7512, spectral analysis of motor oils. In motor transportation enterprise by forces of a creative brigade manufactured the stand for drives BelAZ.

The park of transport contains 253 mobile units and includes all aspects of automobiles for service of daily needs of manufacture, passenger carriages (buses) managing and operating personal. Means of mechanization of repair work (cranes, trailers, lifts etc.), road-building engineering here are concentrated.

3. THE BASIC TASKS OF INFORMATION SYSTEM

Now on a section the reconstruction and modernization of manufacture is carried out on the basis of the newest domestic and foreign achievement in engineering and technology. Perfection of technological processes, rational uses of the mine-transport equipment, optimization transportations of cargo, authentic system of the account of the executed jobs - are bases of organization of economically effective manufacture by open development of deposits. One of ways assisting to carry out given measure, is the automation of a control system of manufacture.

Basis automation of a control system of mine-transport process are, information maintenance

Osnovna tehnološka oprema na površinskom kopu je: bager EKG-10 i EKD-8, oprema za bušenje SBSH-250 MNA, buldozeri CAT, D8, 9, i 10 i grejderi 16G.

Vozni park se sastoji od 20 dampera BelAZ-7512, čiji utovarni kapacitet iznosi 120 tona, 2 dampera CAT-785B utovarnog kapaciteta od 136 tona i 3 dampera ND-785 "Komatsu", čiji je utovarni kapacitet 78 tona.

Faktor tehničke spremnosti tehnološkog transporta 2000-te godine dostigao je 0,81, a faktor utovarnog kapaciteta 65%.

Uvedene su nove tehnologije za rekonstrukciju velikih autobusa tipa "Tip-Top", za dijagnostiku kvarova na damperima BelAZ-7512, spektralna analiza motornog ulja, kao i izrada posebnih nosećih konstrukcija za BelAZ.

Transportna oprema ima 253 mobilnih jedinica i raspolaže svim tipovima automobila koji podmiruju potrebe proizvodnje, kao što su putnička vozila i autobusi za potrebe uprave i operativnog osoblja. Postoji mehanizacija koja je potrebna za remont opreme kao što su kranovi, prikolice, dizalice itd. U ovu grupu svrstana je i oprema za izgradnju puteva.

3 OSNOVNI ZADATAK INFORMACIONOG SISTEMA

Modernizacija i revitalizacija proizvodnje izvršena je uz primenu najsavremenijih domaćih i stranih tehnoloških i tehničkih dostignuća. Usavršavanje tehnološkog procesa, racionalizacija i optimizacija transportnih sistema i opreme, kao i nova sistematizacija i restrukturiranje radnih mesta predstavljaju osnov za ostvarivanje profitabilne proizvodnje mineralnih sirovina površinskom metodom. Jedan od načina da se realizuju pomenute mere je automatizacija sistema proizvodnje.

Uspostavljanje informacionog sistema predstavlja osnov za automatizaciju sistema transporta u rudniku.

The information maintenance of logisticson mine process represents activity under the forecast, processing, to the account and analysis of the information and is the tool of integration of elements of system logistics of management.

The basic tasks of information system:

- Continuous maintenance of managing bodies logistics of system by the authentic, urgent and adequate information on movement of the order (about course of functional and information processes);
- Continuous maintenance of the employees of functional divisions of the enterprise by the adequate information on movement of production on a circuit of deliveries in a mode of real time;
- Realization of system of operative operation of business on key parameters (cost price, structure of expenses);
- Maintenance of a transparency of the information about use of the invested capital for a management(manual);
- Granting the information for strategic planning;
- Granting to a management(manual) of the information about structure of general(common) expenses and charges;
- Possibility of duly revealing of "bottlenecks";
- Possibility of redistribution of resources of the enterprise

3.1 INFORMATION MODEL OF MINE TRANSPORT LOGISTICS

The automation of information flows accompanying cargo flows of mine-transport process is one of the most essential technical components of logistics. The modern lines of management of information flows consist in replacement of the paper transportation documents of electronics.

At with out documents of technology traditional methods of performance of cargo operations at stations of departure, arrival and in transits of steel anachronism - they are a barrier on ways of creation of essentially new technologies of mine-transport process.

Uspostavljanje informacionog sistema nad logistikom procesa, koji se odvijaju u rudniku podrazumeva predviđanje, obradu i analizu informacija i predstavlja sredstvo za integraciju svih elemenata sistema logističkog upravljanja.

Osnovni zadaci informacionog sistema su:

- kontinualno praćenje upravljačkih celina logističkog sistema primenjujući brzo, neposredno i verodostojno informisanje o kretanju i redosledu procesa (tok operativnih i informativnih procesa),
- kontinualno praćenje zaposlenih u operativnim delovima preduzeća putem odgovarajućeg informisanja o proizvodnim procesima i ciklusima u realnom vremenu,
- realizacija operativnih procesa u funkciji ključnih parametara (cena koštanja, struktura troškova),
- transparentnost informacija vezano za upotrebu uloženog kapitala,
- obezbeđivanje informacija za strateško planiranje,
- obezbeđivanje obrada informacija o strukturi opštih troškova,
- mogućnost pravovremenog otkrivanja "uskih grla" u procesu i
- mogućnost redistribucije resursa preduzeća.

3.1 LOGISTIČKI MODEL TRANSPORTNOG SISTEMA

Suštinska tehnička komponenta logistike je automatizacija informacionog toka koji prati tok transportnih procesa na rudniku. Savremen način upravljanja informacionim tokovima sastoji se u kompjuterskoj obradi podataka koji su do sada beleženi na konvencionalni način.

Tradicionalni metodi kojima je praćen učinak transportnih sistema od početne do krajnje tačke su zastareli i predstavljaju prepreku za uvođenje novih tehnologija u ovoj oblasti.

The attempts of simplification of the transportation documents of loading and transport processes, system of mutual accounts for transportations between the senders, addressees and transport organizations are undertaken.

Naturally, by development of new technology it is necessary to be guided not only by existing means of automation, but also to take into account the further prospects of their development. By technical base of creation of progressive technologies and the constructions logistics of mine-transport system are:

- multiprocessor COMPUTERS, mini and macro personal computers of the fifth generation;
- channels of communication(connection);
- equipment by personal computers of the officials of cargo stations.

Besides application of progressive technical base, at creation of essentially new technology it is necessary to carry out a complex of the following organizational-technological measures:

- to develop the system, unified for all types of transport, of coding of cargoes, vehicles, and also ports, auto stations.
- to construct databanks of the help and operative information in computing station (CS), information center (IC) and main computer center (MCC), which to contain the information necessary for the decision of tasks for automation jobs of mine transport process.

The basic purpose of development of perspective essentially new technology: completely to automate processes of reception, search and account of cargoes, tracking their movement at all stages of process of transportations, including on phases of service of material flows of cargo station practically without the paper documents.

The main principle technology of with out document of loading and transport job at realization of mine-transport process is, that from the moment of receipt of cargoes on a motorway up to the moment of unloading on dump and warehouse all necessary information is in a computer memory.

Preduzete su mere u cilju pojednostavljivanja pomenutog sistema evidentiranja i dokumentovanja procesa utovara i transporta i usklađivanja evidencija između pošiljaoca, primaoca i transportnih organizacija.

Uvođenje novih tehnologija podrazumeva razmatranje i implementiranje postojećih tehnika, kao i mogućnost njihovog budućeg razvoja. Tehnička osnova za uvođenje novih progresivnih tehnologija i uspostavljanje logističkog modela sistema transporta u rudniku podrazumeva sledeće komponente:

- multiprocesorski kompjuteri, mini i makro personalni kompjuteri pete generacije,
- komunikacioni kanali (konekcije),
- personalni kompjuteri i oprema rukovodioca na utovaru.

Osim primene unapredene tehničke baze, uspostavljanje suštinski nove tehnologije zahteva sprovođenje sledećih složenih organizaciono-tehnoloških mera:

- razvoj sistema koji objedinjava sve tipove transporta, kodiranje tereta, vozila i transportne punktove,
- stvaranje banke podataka operativnih i pomoćnih informacija u kompjuterskim stanicama (CS) informacionim centrima (IC) i u glavnom kompjuterskom centru (MCC) u kome su sadržane sve informacije neophodne za automatizaciju pojedinih segmenta transportnog procesa.

Osnovni cilj uvođenja nove tehnologije sastoji se u potpunoj automatizaciji procesa prijema, lociranja i evidentiranja tereta, praćenja njegovog kretanja u svim fazama procesa transporta, uključujući servisiranje i materijalne tokove u pojedinim punktovima, bez potrebe za papirnom dokumentacijom.

Osnovni princip uvođenja nove tehnologije praćenja utovara i transporta sastoji se u pohranjivanju svih neophodnih informacija u kompjutersku memoriju, od trenutka pihvatanja tereta na utovarnom punktu do momenta istovara na odlagalištu ili na deponiji.

The process transport of cargoes is simulated by movement of the data on files of memory at stations of departure, appointment, sorting stations in IC and MCC i.e. the global dynamic model of movement of a material flow is under construction.

The dynamic information model in the beginning is under construction at station of departure with transfer given in IC of a road of departure. By transfer of a cargo on station of appointment the information model of his processing in a financial settlements center of station on elements of technological process is formed. Besides it, in MCC the dynamic information model on elements of a transport network for roads, sorting and cargo stations is under construction.

4 CONCLUSION

Proceeding from this, the idea technology with out document consists in maintenance of synchronization of processes of moving of cargoes on a transport network and data on a cargo in dynamic information model, that answers ideas of logistic.

Proces transporta tereta se kompjuterski simulira od otpreme preko distribucije do sortiranja u informacionim centrima i u glavnom kompjuterskom centru, t.j globalni dinamički model simulira kretanje materijalnog toka.

Dinamički informacioni model prenosi informaciju o transportu tereta u IC od momenta otpreme, sledeći njegovu putanju po odabranoj trasi do konačnog odredišta. Informacioni model obrađuje pomenute podatke i prenosi ih do centra za finansijski obračun i analizu, čime je praktično pokriven čitav tehnološki proces. Osim tog planira se i izrada kompletnog dinamičkog modela koji bi pratio čitavu mrežu transportnih puteva, proces distribucije, sortiranja i utovarne stanice.

4 ZAKLJUČAK

Suštinski cilj ove tehnologije sastoji se u sinhronizaciji procesa transporta tereta u okviru transportne mreže i prenosa podataka u dinamički informacioni model kako bi se udovoljilo zahtevima logistike.

REFERENCES / LITERATURA

- [1] Миротина В.И., и другие Транспортная логистика. М.: Экзамен, 2003. – 510 с.
 [2] Nanzad Ts., Purevtogtokh B., Khavalbolot K. Modeling a choice of an optimum combination of a loading and transport complex in conditions quarry "Erdenet", 2002.

Reviewal / Recenzija: prof. dr Dragan Ignjatović