AJEMA GLOBAL RESEARCH NETWORK

AMERICAN Journal of Engineering, Mechanics and Architecture
Volume 2, Issue 3, 2024 ISSN (E): 2993-2637

Determining the Efficiency Indicators of Excavators in Open-Pit Mining Processes at Mining Enterprises

Bayramova Minevvar Axmet qizi
Student of Nukus Mining Institute

Abstract: To date, information on calculating the productivity of excavators used in mining and loading processes at mining enterprises in the Republic of Uzbekistan has been provided. To make the process of calculating the efficiency indicators of excavators understandable, we used pictures of the excavator drawing. Minerals can be selected depending on the parameters of the excavators and the geotechnical location of the mine, and the properties of the rocks being mined in open-pit mining enterprises. If the parameters of the excavator are selected correctly in the mining and loading processes in the mines, the duration of the processes and the economic indicators of the mine will increase.

Keywords: Open pit mining, technical parameters, geological conditions, rock properties, excavator efficiency.

Introduction

The fact that the process of open-pit mining of rocks in mining enterprises is carried out with the front shovel of excavators in an open-pit mine, due to the influence of the excavator against its main operation, the efficiency indicators of excavators decrease with the increase in power. Excavator mechanisms (lifting and pushing), their performance parameters should be properly matched during them, and joint actions should be carried out periodically to ensure more efficient digging. We have carried out studies on the calculation of efficiency indicators in mining processes of EKG-5A, EKG-5, Hitachi EX8000-6, Hitachi ZX220LC, Hitachi ZAX850H excavators. In addition, it was determined that power sources depend on the condition of digging capacity of excavators in relation to the working area. We have collected information about which types of excavators we use in mining enterprises to obtain mining economic performance indicators. We carry out performance studies of excavators on the basis of "Traingul Metals Tebin Bulak" iron ore mining enterprise. Excavators used in this mine come from digging, counter-action of main mechanisms and lifting. The power intensity of excavation work is calculated for different areas and is proportional to the working area of the excavator. In order to calculate the power consumption for rock excavation, our proposed method allows us to determine the energy characteristics of the excavator's operational equipment during open-pit mining, and we perform calculations based on the conditions of special mine-technical use of the excavator. Designs of modern electromechanical crawler open excavators (mechanical shovels) used in mines today are technically very unique, but often show many signs of the gap between their technical level and. Due to the complexity of realizing the full technical potential of the excavator and achieving the project, it is necessary to adapt and coordinate the engineering and economic indicators and the actions of its main driving mechanisms (lifting and pushing) in real operating conditions.

Materials and methods

Modeling from the point of view of technology was described, taking into account the dynamics of simultaneous digging and loading of excavators. For this, it is necessary to take into account the mining technical parameters of the mining enterprise where the excavation and loading processes are carried out. Our research shows that the use of hydraulic shovel excavators mainly leads to reduction of losses in coal mining. Comparison of performance with similar rope shovels in the same mine and geological conditions in mining operations. In particular, a strong positive effect on reducing losses is shown when using hydraulic excavators. We compared the effectiveness of open-pit mining in tectonically disturbed zones with a complex geological structure and in the mining of low-thick layers. In addition, the granulometric composition of the blasted rock mass excavated by the mine massif is used to prevent premature wear of the tires of hydraulic shovels, open pit dump trucks, etc. This is due to the requirements of drilling and blasting of relatively harder rock with rope excavators.

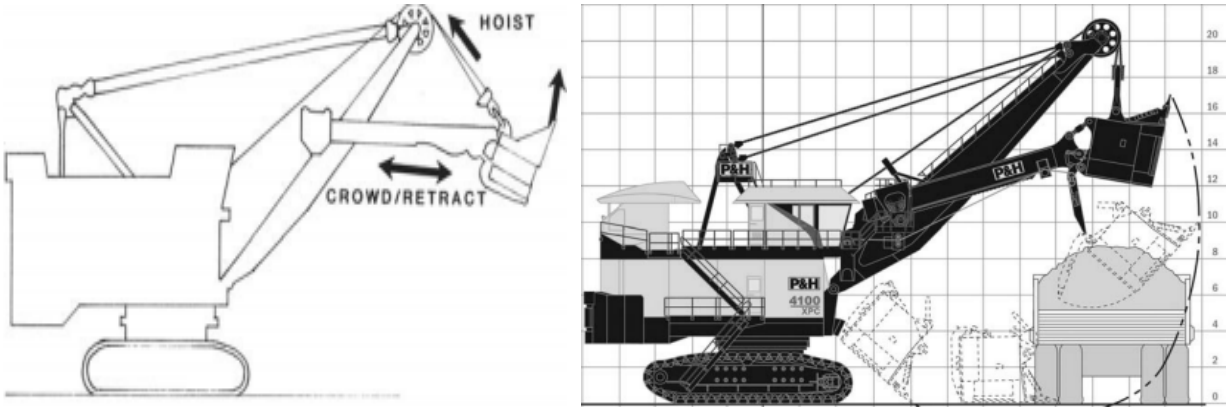

Figure 1: The kinematic diagram of the excavator digging system and the loading system.

Mining enterprises have a lot of experience in using electric shovels operations. Common practices can be briefly summarized as follows: Strongly consolidated materials should be drilled and blasted prior to excavation. The shovel should work on a flat, level excavation floor as much as possible. Digging down allows for higher drag forces because it increases drag resists movement of the machine away from the digging face. Generally, the digging face should not be higher than the tire of the lever (fixed to one axle). Handles should be perpendicular to the face to minimize possible damage materials slide down the face and facilitate positioning maneuvers. Frequent short strokes are recommended to keep the paddle close to the face efficiency of crowding and lifting forces. The movement of the lifter and the crowd must be coordinated for effective brush uplift. Surface penetration should be uniform, depth should be sufficient to fill 2 or 3 dipper lengths. Then it should be cleaned from the face to minimize the dipper. Engines should not be idled for long periods of time during excavation to optimize engine life. Excessive build-up will shorten the life of the suspension cable. Top must be dug out for ease of lifting in harsh conditions through the bottom. Rocks or ice caps are dug out and then lifted out. If the excavator has a rigid rotary clutch, the machine should be moved as close as possible it is necessary to improve the direction of the tooth for maximum benefit from its forces and penetration. Designing exploitation schemes is a complex activity involving depth knowing the parameters that govern the operation. Experience and the creativity of the mine planner is key to creating schemes that solve problems the ultimate goal of value creation and respect for constraints operation. This paper explored the concept of exploitation scheme, proposed a discussion of the formal definition and relevant considerations design. Support for complex scenarios with multiple shovels in a reduced area Mathematical and optimization tools can be useful for dealing with circuit design. However, optimization models must be able to represent the design purpose and operational constraints. Further research may be warranted search for existing and new mathematical methods that can be useful for optimization design schemes for use in open pit mining. As a result, our method allows not only analysis optimal route for trucks traveling along the existing road in open pit mines during the production phase their life cycle as well as the design of the haulage route for the open pit mine which is still being planned and the project step and the path for it do not exist. Open mines have many obstacles such

as trees, rocks or other equipment. reduces the visibility of drivers. Reduced visibility often creates dangerous situations for the truck drivers. Therefore, it will be interesting to develop an extended method to consider in future work stopping and sight distances when designing the radius of curvature.

Discussion

Geometries are critical to a safe and efficient shovel-loading operation participants are well adapted. Some design guidelines are provided with rules, some of which are expressed below: Standards for the safe management of pit walls, including the general slope of the pit wall. must be set and executed by the operator. Such standards should be consistent with reasonable engineering design, the nature of the ground and the type of material and extraction of minerals and ensuring safe working conditions according to the level from the slope. Mining methods should be chosen that ensure the stability of the wall and the embankment; including tools necessary for safe general slope. To ensure safe operation, the width and height of benches should be determined according to the type the equipment used and the operation to be performed. Safe means of scaling pit banks should be provided. Risky banks must scale before doing any other work in a dangerous banking area. Men should not work near or under dangerous banks. Hanging banks are taken subsidence and other hazardous ground conditions must be promptly corrected, or areas should be barricaded and installed. Fences or guards should be installed on the outer edge of the elevated roads. Do not overturn buckets, buckets, lifting booms or heavy hanging loads vehicle cabins until the drivers leave the cabin and in safe places. Unless trucks are specifically designed to protect drivers from falling material. Cargo equipment should be loaded in such a way as to minimize spillage during transport. The choice is influenced by the requirement to provide safe means of measuring peaks equipment and bench heights. Although there are some special equipment and techniques there are and are used to scale pit walls, it is most common to do this with primary excavator. For a loading shovel, this means the bench height must be at or below equal to the maximum cutting height of the shovel. A complex system with a mining excavator can reach up to 20% of the working time fund. The technical condition and service life of these machines directly depends on the operation the influence of conditions and external factors. Many failures occur due to man-made causes. technical and ethical factors, first of all, it is necessary to implement related processes determining exposure response. external influences, propulsion and control systems, the drive itself and the structure of the excavator and its high-rigidity operating equipment, which causing the mining machine to respond as and when it interacts with the surface rock continuous control of the bucket movement during the operation of the excavator and related controls will cause errors. All the different factors affecting its intensity for damage processes during the operation of the excavator used in mining enterprises many reasons can be divided into two large groups: male. due to human intervention, natural events without direct human influence and man-made factors, or it is minimized. Firstly the group of factors includes the driver's control of the excavator, its nature and level mining operations, their organization in the introduction of mining technology, as well as nature and extent of maintenance during excavator maintenance and repair. Natural and man-made influence factors include: geological and climatic conditions, surface quality and stone preparation mass, selected maintenance and repair strategy and natural equipment aging factor. Provided the machine continues to operate nominal (passport) working conditions, the last factor exists here as a kind of ideal natural aging process during the life of the excavator. Factors of these groups intensity and does not have the same effect on degradation processes, as a result of which degradation processes can increase true aging, a process that reduces this intensity when the nominal operating parameters are exceeded or not working more favorable terms than nominal.

Conclusion

During these studies, we used various types of excavators in mines with different capacities and learned how to determine the most effective option. We have come to the conclusion that this will

further increase the periodicity of processes in the mine and the economically effective indicators of the mine. In this study, we found out that depending on the technical parameters of the excavator used in the mine, it cannot be loaded more than the average impact value and load carrying capacity limit. The research paper has a new solution to a recent scientific problem about parameters optimization for open pit shovel excavators in order to select and create machines the high level of engineering required to develop mining machines theory and practice of design and operation. Recommended methodology for optimal selection and parameter optimization excavator models of open pit shovels allow a scientifically based choice excavators with optimal parameters for the specified conditions are also implemented their parameters can be set and optimally coordinated according to the criteria defined in design stage. A comprehensive assessment of the engineering level of the open pit mine was carried out hydraulic front shovel type excavators use the software package in the existing fleet. The engineering level of the existing fleet of open excavators, roads was evaluated was to increase the level of engineering and methods of their implementation at the design stage. Optimal values of composite quality indicators, their main parameters technical characteristics of open pit excavators were analyzed.

References

1. Jumabayeva, G., B. Allanazarov, and A. Joldasbayeva. "STAGES OF OPEN PIT MINING. MINING METHODS AND THEIR PROCESSES." Science and innovation 2.A1 (2023): 236-240.
2. Allanazarov, Bayrambay. "GEODETIC DIMENSIONING STUDIES AND POINT-DIMENSION LOCATION COORDINATE SCHEME CREATION PROCESSES." Евразийский журнал академических исследований 3.4 Part 2 (2023): 21-25.
3. Yeshmuratova, Amangul. "TECHNOLOGICAL METHODS OF ENSURING INFORMATION SECURITY IN TECHNICAL SYSTEMS." Евразийский журнал академических исследований 3.4 (2023): 188-192.
4. Саидова, Л. Ш., et al. "АНАЛИЗ ИССЛЕДОВАНИЙ ПО ПОДЪЕМУ ГОРНОЙ МАССЫ ИЗ ГЛУБОКИХ КАРЬЕРОВ И ВЫБОР ГОРНОТРАНСПОРТНОГО ОБОРУДОВАНИЯ ДЛЯ ОТКРЫТЫХ ГОРНЫХ РАБОТ." Евразийский журнал академических исследований 2.11 (2022): 811-816.
5. Хайруллоев, Шахзод, and Мухаммедали Сметуллаев. "ПЕРЕРАБОТКА КВАРЦЕВОЙ ПЫЛИ ДЛЯ УМЕНЬШЕНИЕ КОНЦЕТРАЦИИ ПЫЛИ ПРИ РАЗРАБОТКЕ МЕСТОРОЖДЕНИЙ ПОЛЕЗНЫХ ИСКОПАЕМЫХ ОТКРЫТЫМ СПОСОБОМ." Interpretation and researches (2024).
6. Суйунов, Аброр Салохиддинович, and Учкунжон Мардонович Мирзаев. "ОСОБЕННОСТИ ВЛИЯНИЕ НА ОКРУЖАЮЩУЮ СРЕДУ ОТКРЫТЫХ ГОРНЫХ РАБОТ FEATURES ENVIRONMENTAL IMPACT OF OPEN-PIT MINING." Scientific Impulse 1.8 (2023): 9-12.
7. Ravshanov, Z., et al. "Determination of mineral location coordinates in geotechnology and mining enterprises." Scienceweb academic papers collection.–2023 (2023).
8. Djaksimuratov, K., et al. "Comprehensive monitoring of surface deformation in underground mining, prevention of mining damage." Modern technologies and their role in mining (2021).
9. Мислибаев, Илхом Туйчибаевич, et al. "Уменьшение пылегазового загрязнения атмосферы при производстве массовых взрывов на карьерах." Известия вузов. Горный журнал 2 (2017): 39-43.
10. Заиров, Шерзод Шарипович, and Муборак Жабборовна Норматова. "Разработка конструкции и параметров скважинных зарядов взрывчатых веществ при контурном взрывании для получения устойчивых откосов уступов." Ãîðíûé æóðíàë (2017): 102868.

11. Заиров, Ш. Ш., М. Ж. Норматова, and З. С. Шарипов. "Расчет параметров пылегазового загрязнения атмосферы при производстве массовых взрывов на карьерах." Горный вестник Узбекистана 1 (2017): 33-35.
12. Заиров, Ш. Ш., et al. "Исследование влияния забойки скважинного заряда на эффективность разрушения и пылеподавления." ТОШКЕНТ-2021 (2016): 59.
13. Саидова, Л. Ш., М. Норматова, and М. Равшанова. "АНАЛИЗ УПРАВЛЕНИЯ ТРАНСПОРТНЫМИ ПОТОКАМИ В РАЗЛИЧНЫХ ГОРНО-ГЕОЛОГИЧЕСКИХ УСЛОВИЯХ." ЁШ ОЛИМЛАР АХБОРОТНОМАСИ.
14. Норматова, Муборак Жабборовна, and Самандар Шодмонович Абруйев. "КАРЬЕРЛАРДА ОММАВИЙ ПОРТЛАТИШЛАРДА ЧАНГ-ГАЗ ҲОСИЛ БЎЛИШИНИ КАМАЙТИРИШ." Innovative Development in Educational Activities 2.8 (2023): 425-428.
15. Заиров, Ш. Ш., М. Ж. Норматова, and Ш. З. Худойназаров. "ПОВЫШЕНИЕ ЭФФЕКТИВНОСТИ ПЫЛЕПОДАВЛЕНИЯ ПРИ МАССОВЫХ ВЗРЫВАХ НА КАРЬЕРАХ." Экономика и социум 3-1 (82) (2021): 556-559.
16. Заиров, Шерзод Шарипович, Муборак Жабборовна Норматова, and Сарвинос Ботир Қизи Пардаева. "КАРЬЕРЛАРДА ЯЛПИ ПОРТЛАТИШ ИШЛАРИНИ ОЛИБ БОРИШДА АТРОФ МУҲИТГА НЕГАТИВ ТАЪСИРИНИ КАМАЙТИРИШ." Academic research in educational sciences 2.3 (2021): 305-311.
17. Заиров, Шерзод Шарипович, et al. "Разработка способов управления пылегазовым режимом при взрывании высоких уступов в глубоких карьерах." Известия высших учебных заведений. Горный журнал 4 (2020): 113-121.
18. ЗАИРОВ, ШШ, МЖ НОРМАТОВА, and МХ РАВШАНОВА. "Определение оптимальных параметров подпорной стенки при массовых взрывах на карьерах." Ãîðíûé æóðíàë (2017): 102872.
19. Karamov, Alisher, et al. "IN MINING ENTERPRISES RESEARCH ON THE STUDY OF GEOTECHNOLOGICAL PROCESSES." International Bulletin of Engineering and Technology 3.5 (2023): 120-124.
20. Zykov, Pyotr, et al. "Enhancement of open-pit mining efficiency by means of quality improvement of open-pit excavators design and operating in specified conditions." E3S Web of Conferences. Vol. 134. EDP Sciences, 2019.
21. Manyele, Samwel Victor. "Investigation of excavator performance factors in an open-pit mine using loading cycle time." Engineering 9.7 (2017): 599-624.
22. Tyurin, Alexey, and Ildar Kuvataev. "Improving the Efficiency of a Mining Enterprise by Coordinating Production Processes." E3S Web of Conferences. Vol. 174. EDP Sciences, 2020.