

Comprehensive Analysis To Enhance The Overall Cutting Efficiency Of Diamond Wire Saw Machine In Granite Stone

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ABSTRACT

The diamond wire saw cutting machine is utilized for extracting marble and dimensional stones. This study seeks to enhance cutting efficiency and cost-effectiveness in marble extraction through controlled field experiments with fixed and variable-speed saws. Key factors influencing performance include the peripheral speed of the wire, applied thrust, water flow rate, and the type of bench cuts, measured in terms of cutting rate and diamond bead wear. Optimal water flow is crucial to prevent overheating and aquaplaning, while ideal peripheral speeds were determined for varying marble hardness. The research found that both cutting rate and bead wear increase with higher speeds and thrust, with multivariate regression models predicting performance based on shear strength and operational parameters. Additionally, the study examined how bench cut size and cutting styles affect machine efficiency, highlighting the relationship between cutting rate and bead wear during operations while considering stress concentration at the rock-tool interface.

Keywords: Cutting Efficiency, Diamond Wire Saw, Granite

INTRODUCTION

1.1. General

The global demand for natural stone products has led to the opening of numerous stone quarries worldwide. Stone is often extracted in large blocks and subsequently cut to precise dimensions for use in construction, monuments, and other architectural applications. Countries such as China, Brazil, India, the USA, Italy, Spain, South Africa, Argentina, Greece, France, and Australia are among the major producers of a wide variety of natural stones—including marble, granite, sandstone, limestone, slate, and quartzite. Among these, marble remains the most produced stone globally, followed by granite. In many nations, the dimensional stone industry contributes significantly to foreign exchange earnings and regional economic development.

In India, the marble sector has been growing steadily.

While traditional methods of quarrying still persist, modern, mechanised technologies are increasingly being adopted. Cutting technologies such as diamond wire saws, diamond belt saws, and chain saws are now more widely used in marble quarries in India, improving production efficiency and reducing waste. (aggbusiness.com) Scientific investigations into optimizing these parameters can potentially reduce block-extraction costs, increase cutting rates, and decrease wear of diamond beads or wires, thereby raising overall productivity.

The diamond wire saw technique is widely used for bench cutting and squaring operations in granite due to its flexibility, efficiency, and environmentally friendly nature. The performance of a diamond wire saw machine in granite quarries is influenced by both uncontrollable rock-related factors—such as strength, texture, and mineral composition—and controllable machine parameters, including electric motor power, peripheral speed of the diamond wire, applied thrust, and operational aspects such as bench cut size and type of cut (vertical, vertical strand, horizontal, or blind/channel). Water is used as a cooling medium during the cutting process.

The cutting performance of a diamond wire saw is typically evaluated through the cutting rate (m^2/h) and the wear rate of diamond beads (mm/m), both of which are critical indicators for determining the economic feasibility of quarry operations. Among these, bead wear significantly impacts the overall cost due to the high price of diamond beads. To enhance cutting efficiency and reduce operational costs, a detailed investigation has been conducted on granite stones.

In marble and granite quarries, various types of cuts are performed during bench cutting operations, depending on spatial constraints and production requirements. A vertical cut—where the machine is placed at the base of the bench and commonly used in most quarries—is employed to separate a large block from two sides when two free faces are available. A horizontal cut is carried out to detach the block from the bottom of the bench. The blind (channel) or reverse catenary cut is mainly utilized for creating openings (gallis) or for developing new benches. The vertical strand cut, which is an ascending vertical cut, is applied in areas with limited space, particularly during face advancement after a new bench has been opened.

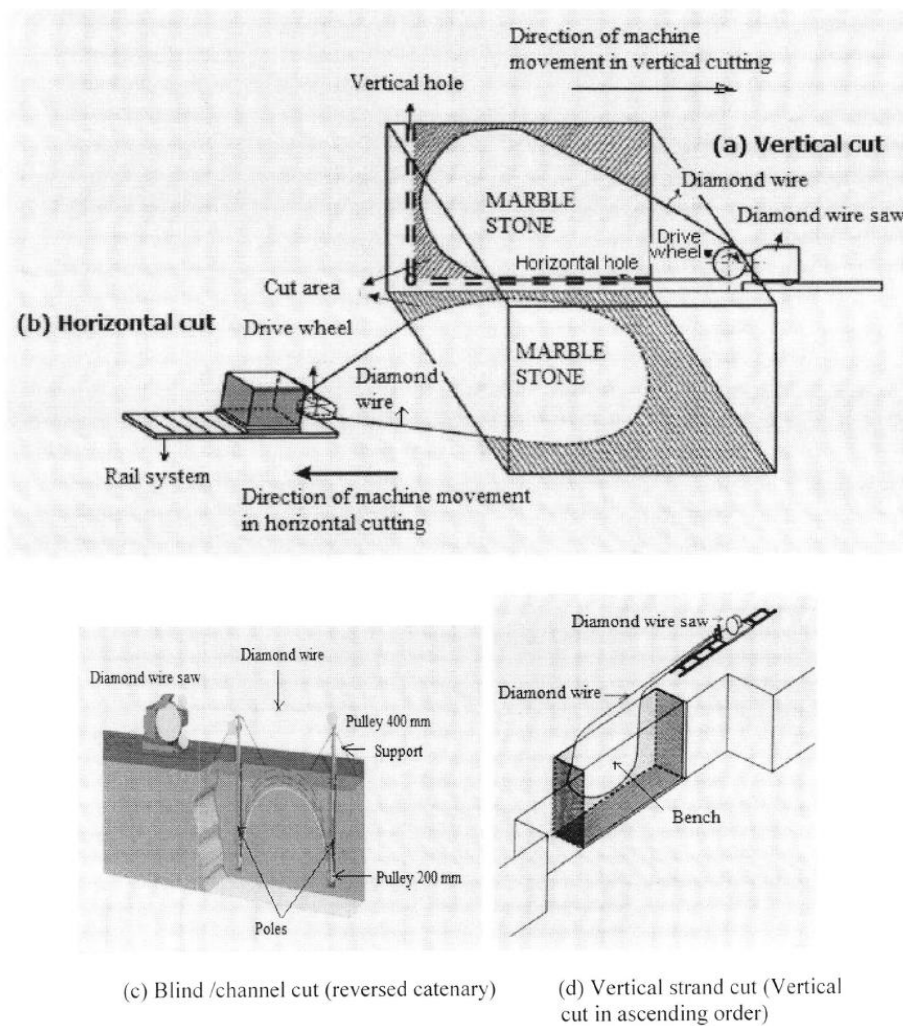


Figure 1 Different types of cut with diamond wire saw machine

1.2. Objectives

Diamond wire saw cutting has become a widely adopted technique in dimension stone mining due to its precision, reduced waste generation, and ability to produce high-quality granite blocks. However, the cutting performance of diamond wire saws is highly dependent on operational parameters such as wire speed, cutting orientation, and cooling conditions. Suboptimal selection of these parameters can adversely affect cutting efficiency, increase tool wear, elevate energy consumption, and reduce overall productivity.

To achieve efficient and sustainable granite extraction, it is essential to quantitatively assess the influence of these parameters on cutting performance. A systematic evaluation enables the identification of optimal operating conditions that maximize cutting efficiency while minimizing equipment wear and operational costs. In this context, the present study focuses on analyzing the effect of diamond wire saw speed, type of cut, and cooling media on the cutting performance of granite stone, with the objective of optimizing the diamond wire saw cutting process for improved efficiency and equipment longevity.

- Evaluate the impact of diamond wire saw speed on the cutting performance and to determine the optimal diamond wire saw speed to maximize granite block to cutting efficiency
- Analyse the effect of type of cut on the cutting performance in granite stone.
- Optimize the use of cooling media, particularly water, to enhance the cutting performance and prevent equipment wear in granite stone mining.

1.3. Methodology

Achieving the research objectives requires a well-structured and carefully planned methodology. Every research process starts with collecting relevant information about the issue under investigation. An initial review of the site and the problem is followed by comprehensive fieldwork to expand the dataset, which will serve as the foundation—and also the limitations—for developing an effective solution to the identified challenge. In this

study, the focus will be on evaluating the technical aspects of deposit mining. Based on these assessments, appropriate and stable stope geometries along with suitable pillar dimensions will be recommended.

1.3.1. Field work

- Data related to drilling of diamond wire saw and cutting dimension stone will be collected through field observations
Variable speed diamond wire saw - Study the effect of peripheral speed and thrust of diamond wire machine on cutting efficiency and obtain optimum speed while other parameters are constant.
- Water quantity was optimisation for dimension stone quarry vertical cut, vertical strand cut, horizontal cut and blind (channel) cut.
- Slurry deposition observation will take at a fix time interval by reducing water quantity and beads temperature will measure with infrared thermometer.
- -The dimension of cut to be made will measure by steel tape. Find out optimum height and length of bench for vertical cut, horizontal cut and blind cut at constant speed and thrust.

REVIEW OF LITERATURE

Smithetal.,(1999) carried out a single bead test for assessing diamond wire performance and revealed that the cutting performance and wear of diamond wire is related to parameters such as cutting rate, wire velocity, the type of work piece material and the length of cut. Diamond bead wear is sensitive to apply load or wire tension. characterise by accelerated wear as the load is increased. Cutting rate has a distinct effect on wire life. Wire life reduces with an increasing cutting rate. The choice of diamond grit type has an influence on bead wear rate, with higher quality diamond significantly reducing bead wear.

Prikryt (2001) highlighted that variations in measured mechanical strength cannot be attributed to a single factor, but rather to the combined effect of several rock properties and testing conditions. These include mineralogical composition, which governs the bonding and hardness of constituent minerals, as well as density and porosity, which significantly affect the rock's resistance to applied loads. Additionally, textural characteristics such as grain size, shape, and orientation play an important role in determining strength values. External factors, including moisture content, sample dimensions, and laboratory testing procedures, were also reported to cause noticeable differences in strength results. As a consequence, Prikryt emphasized the importance of carefully controlling testing conditions and thoroughly characterizing rock samples to ensure reliable and comparable mechanical strength data.

Ciccu et al. (2001) examined the influence of wire sawing configurations on operational performance. Their study demonstrated that reversing the direction of wire rotation, combined with the incorporation of an idle pulley, leads to a more favorable alignment of the wire's leading edge. This configuration reduces wire curvature and minimizes the length of the contact zone between the wire and the rock. As a result, more stable and uniform cutting conditions are achieved throughout the operation. The authors reported that these improvements contribute to enhanced operational safety, a reduction in tool wear, and improved cutting efficiency. Overall, their findings suggest that optimizing mechanical configuration and maintaining constant operational parameters can significantly improve the effectiveness and longevity of wire cutting systems

Deliormanli and Pamrrkcu, (2003) observed that in stone sawing processes, the cutting performance is primarily governed by the forces generated by individual diamond grains acting on the beads. Among the parameters influencing the mechanical behaviour of the cutting operation, chip thickness plays a dominant role. The average chip thickness is therefore commonly employed as a quantitative measure to characterize the cutting process and to evaluate its mechanical efficiency.

Dwan (2003) in his study revealed that as the diamond size increases the impact properties decreases, and as the diamond concentration increases the impact properties decreases. Fine diamonds may be used in hard rock cutting and coarse diamonds for soft rock to achieve maximum efficiency. Diamond grits may be distributed homogeneously. When there is no diamond around the bead, wear rate in matrix will increase, simultaneously decreasing the cutting efficiency

FIELD STUDY

3.1. Study Area-

Area located in Deogarh tehsil of Rajsamand district in Rajasthan, India. It is situated 22km away from sub-district headquarter Deogarh (tehsildar office) and 87 km away from district headquarter Rajsamand

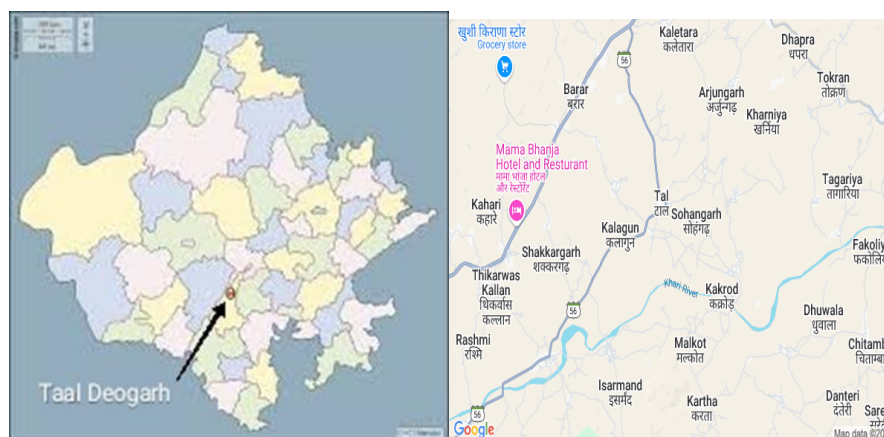


Figure 2: Location Map of Mine in Rajsmand Deogarh region

Geology of area

The Deogarh area in Rajasthan's Rajsmand district features complex geological characteristics due to multiple magmatic intrusions and high-grade metamorphism. Notable for extensive granitic intrusions within the pre-Aravalli basement, these bodies interact with older metamorphic units from the Bhilwara Supergroup, particularly within the Mangalwar and Sandmata complexes. The interaction between granitic magmas and surrounding high-grade metamorphic rocks results in partial melting and the formation of composite gneissic rocks that exhibit igneous and metamorphic features.

Granites in the region are coarse-grained, suggesting slow cooling, often accompanied by pegmatitic intrusions that foster the growth of large crystals. Both granite and pegmatite share a mineralogical composition rich in quartz and feldspar, with pegmatites showing localized element enrichment. Regional studies indicate these granitic bodies are part of a larger suite of intrusions that modify the structural features of host rocks, disrupting primary metamorphic characteristics and preserving enclaves of amphibolites and schists. Contact zones reveal signs of metamorphic overprinting, highlighting the effects of magmatic fluids during granite emplacement. The orientations of these intrusions are influenced by the pre-existing structural framework, contributing to complex geological formations in the region.



Figure 3- Quarry of Granite stone mines

The study aimed to evaluate the cutting performance of diamond wire saw machines in granite processing and explore ways to enhance their efficiency. It differentiates between non-controllable parameters, inherent to the granite (such as mineral composition and hardness), and controllable parameters linked to machine design and operating conditions. Optimizing these controllable factors is vital for improving cutting efficiency and productivity, reducing diamond bead wear, and minimizing costs. Performance was measured via cutting rate (m^2/h) and wire life (m^2/m), both crucial for assessing effectiveness. The research highlighted the importance of peripheral wire speed, cutting geometry, and adequate cooling water supply in achieving optimal results. A field-based approach allowed for real-time data collection, facilitating the development of strategies to improve cutting performance, enhance tool life, and reduce operational costs in granite applications.

Experimental Setup and Conditions

To assess the impact of peripheral wire speed on cutting performance, **vertical cuts** were made into **granite stone benches** using the variable-speed machine at the a forementioned speeds. Each condition was tested through **three similar cuts** on identical granite sections to ensure consistency and reliability of results.

The wire construction remained consistent across both machines, featuring:

- **30 diamond beads per meter,**
- Locking after every **three beads,**
- Use of **sintered diamond beads** from the same manufacturer.

The machine was initially positioned **4.0 meters away** from the bench face before each cut. Water usage during cutting was optimized based on the actual cutting length for each trial. The data collected included measurements of peripheral speed and thrust, monitored via the operating panel (see Figure 3.7).



Figure 4 -Fixed speed diamond wire saw machine cutting vertical cut

Understanding these technical aspects of the diamond bead wire rope and their interplay with operational parameters such as peripheral speed provides valuable insights for optimizing wire saw machine performance, reducing operational costs, and improving the quality of stone blocks extracted in granite quarrying.

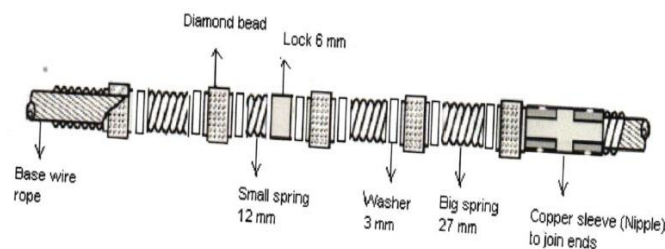


Figure 5– Construction of Diamond wire



Figure 6- Diamond wire rope

3.1.1. Table for effect of peripheral speed of diamond wire on cutting performance of diamond wire saw machine in granite stone

Table

Cut no	Cut area in m (Cut length. x Cut height in m)	Diamond wire peripheral speed in (m/s)	Machine run (hours)	Cutting rate (m ² /hr.)	Diamond beads dia. (mm) Avg.		Beads wear rate
					Before starting of cut	After end of the cut	
1	27.78(9.14x3.04)	26	9.03	3.087	11.25	11.10	0.00195
2	24.521 (7.91x3.1)	26	8.11	3.023			
3	24.429 (7.83x3.12)	26	8.00	3.050			
4	27.648 (8.64x3.2)	27	8.04	3.438	11.10	10.95	0.00205
5	22.185 (8.45x2.7)	27	6.90	3.300			
6	24.83 (8.01x3.1)	27	7.42	3.340			
7	33.852(8.68x3.9)	28	9.50	3.563	10.95	10.72	0.00218
8	39.354(9.37x4.2)	28	10.78	3.650			
9	32.375(9.25x3.5)	28	8.90	3.637			
10	33.497(8.19x4.09)	29	10.22	3.277	10.72	10.51	0.00224
11	30.495(7.88x3.87)	29	9.43	3.233			
12	30.109(9.38x3.21)	29	9.35	3.220			

The average cutting rate of granite using a variable-speed diamond saw machine at a peripheral speed of 27 m/s was recorded at 3.05 m²/h. At this speed, the bead wear rate was measured at 0.00195 mm/m². Both cutting rate and bead wear rate demonstrated a similar trend of increasing values as the peripheral speed increased to , 28,29 and 30 m/s. The highest cutting rate was observed at 27 m/s. Additionally, the bead wear rate continued to rise with increasing peripheral speed, reaching a maximum value of 0.00224 mm/m² at 30 m/s.



Figure 7-Diamond wire saw cutting blind cut

3.1.2. Table -Cutting rates for blind (channel) cuts in granite stones

Cut No.	Dimensions of cut LxB (m)	Cutting area (m ²)	Machine run(hours)	Cutting rate m ² /hr
1	4.64x8.19	38.00	8.89	4.27
2	5.58x7.21	40.23	8.67	4.64
3	4.82x8.79	42.36	10.56	4.01
4	5.37x8.78	47.14	11.63	4.05
5	5.42x8.91	48.29	12.54	3.85
6	5.31x9.53	50.60	13.42	3.77
7	4.78x6.32	30.20	7.34	4.11
8	5.73x10.24	58.67	17.99	3.26
Weighted mean cutting rate				3.94

In blind (channel) cutting of granite, the cutting rate achieved using a fixed-speed diamond wire saw ranged from 3.26 to 4.64 m²/h, with an average cutting rate of 3.94 m²/h

3.1.3. Table cutting rates for vertical cuts in granite stone

Cut No.	Dimensions of cut LxB (m)	Cutting area (m ²)	Machine run(hours)	Cutting rate m ² /hr
1	8.27x2.52	20.84	4.98	4.18
2	10.21x3.32	33.89	7.89	4.29
3	9.42x6.75	63.58	13.79	4.61
4	9.41x6.79	63.89	14.22	4.49
5	11.98x5.32	63.73	13.79	4.62
6	11.95x6.53	78.03	16.08	4.85
7	10.25x8.97	91.94	19.77	4.65
8	14.82x7.92	117.37	20.95	5.60
Weighted mean cutting rate				4.819

In blind (channel) cutting of granite, the cutting rate achieved using a fixed-speed diamond wire saw ranged from 3.46 to 5.05 m²/h, with an average cutting rate of 4.2 m²/hr.

3.2. Water optimisation in wire saw cutting

S.No.	Duration of cut (minutes)	Water Quantity (l/min.)	Bead temp (°C)	Remark
1	30	26	31	No slurry on beads and wire
2	30	25.5	31.5	No slurry on beads and wire
3	30	25	32	No slurry on beads and wire
4	30	24.5	32.4	No slurry on beads and wire
5	30	24	33	slurry observed on wire
6	30	23.5	33.6	slurry observed on wire
7	30	23	34.2	slurry observed on wire
8	30	22.5	34.8	slurry observed on wire

A water usage optimization study was conducted during vertical cutting of granite using a diamond wire saw machine, for a cut size of 10.23m × 5.76 m. The findings of this study are presented in Table 3.2. The actual contact cutting length of the diamond beads in all cuts was observed to be 14 meters. Based on the study results, an optimal water flow rate of 124.50 liters per hour of actual cutting length was determined for granite.

RESULTS AND DISCUSSION

1.1. Results of Analysis

1.1.1. A comprehensive study was conducted to identify and optimize the key parameters influencing the cutting performance of diamond wire saw machines used on granite stones. During the investigation, various cutting parameters were optimized to enhance efficiency. The physico-mechanical, chemical, mineralogical, and textural characteristics of the granite stones were analyzed in laboratory settings and are presented in Chapter 3. Additionally, the optimal water usage for different types of cuts was determined. Field experiments involving variable parameters were carried out in the granite stone quarries located in the Morwad area. Two primary indicators of cutting performance—cutting rate and the lifespan of the diamond wire—were evaluated during the study.

1.1.3 EVALUATION OF CUTTING PERFORMANCE IN DIFFERENT TYPES OF CUTS

The cutting performance of a fixed-speed diamond wire saw machine was evaluated under field conditions, and the cutting rates for various types of cuts are presented in Table 4.1. The results indicate a clear trend: cutting rates decrease as the hardness of granite increases, from soft to hard varieties. Among the different types of cuts, vertical cuts in soft granite showed the highest cutting rates, while the lowest cutting rates were recorded in vertical strand cuts of hard granite marble.

Figure 4.1 illustrates the relationship between the type of cut, and the corresponding cutting rates. Based on these findings, it is recommended that vertical cuts be prioritized wherever feasible during bench cutting operations using diamond wire saw machines, to achieve better cutting performance.

Table 4.1 Cutting rates observed with fixed speed diamond wire saw machine

S.no	Type of cut	Cutting rate observed
1	Vertical Cut	4.81
2	Horizontal Cut	4.13
3	Blind Cut	3.94

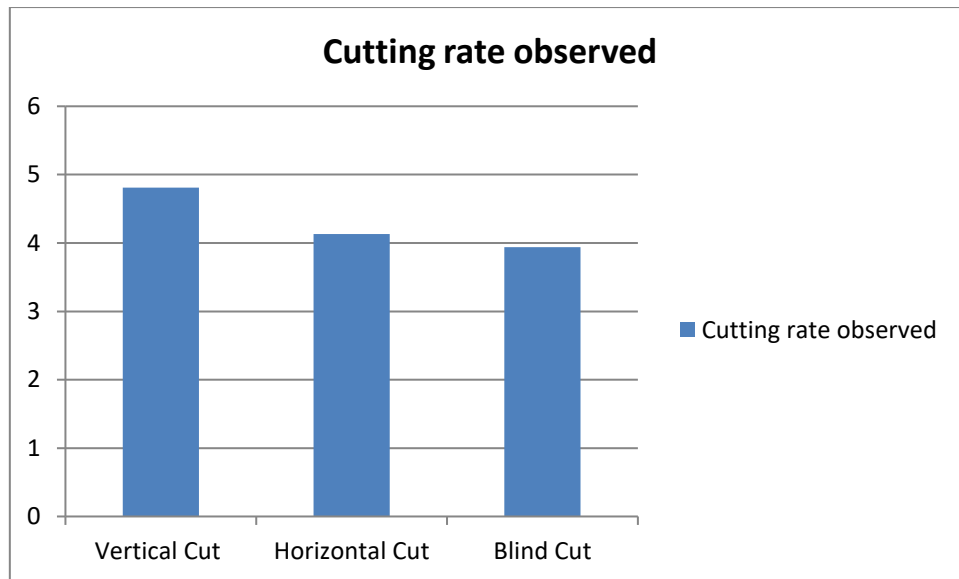


Figure 8 Relationship between types of cuts and cutting rate in granite stones

The wear rate results of diamond beads across various cutting types are presented in Table 3.1. The wear trend of the beads is highest in granite. Among all categories of granite, the minimum wear rate occurs in vertical cuts, while the maximum wear rate is observed in vertical strand cuts. Cut size of a bench is one of the operational controllable parameters that has important role on cutting performance of diamond wire saw machine (DWS). Cutting performance was measured for different types of cuts with fixed speed diamond wire saw machine by varying the size of cuts in granite stone. Beads wear rate shows increasing trend from small cut size area to large cut size area. Regression polynomial curve lines show the significant relationship between cut size area and cutting rate.

Relationship between cut size area and cutting rate for horizontal cuts made during bench cutting operations in granite stones are shown in Figure 4.2

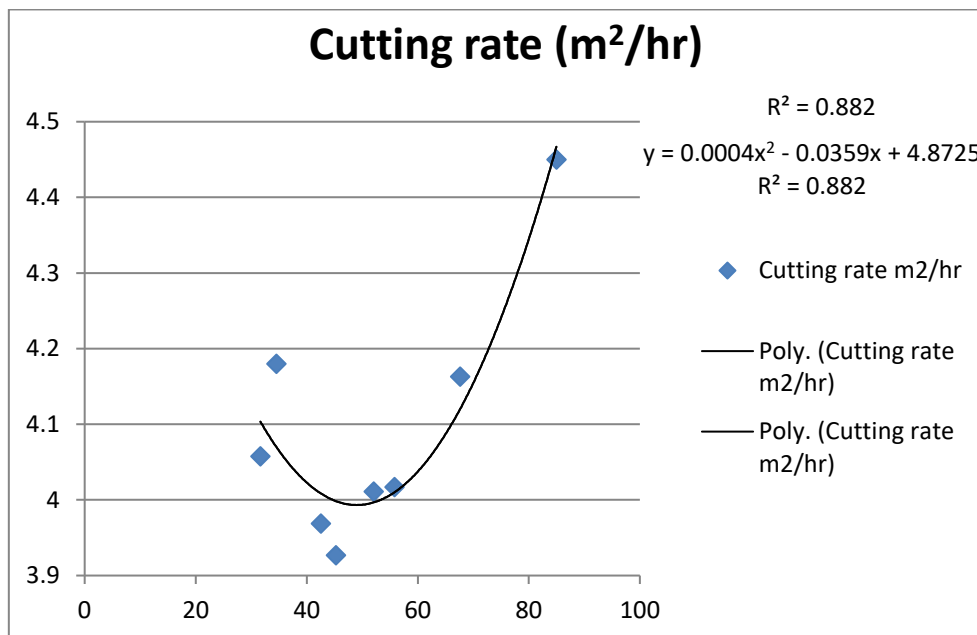


Figure 9 Relationship between cut size area and cutting rate with diamond wire saw machine in horizontal cuts.

Figure 4.3 shows the relationship between cut size area and cutting rate for vertical cuts in granite stones. Cutting rate observed in granite stones was higher in bench cut size area between 100 to 120 m². Beads wear rate in vertical cut shows increasing trend from small cut size area to large cut size area.

Regression polynomial curve line shows the significant relationship between cut size area and cutting rate for vertical strand cuts

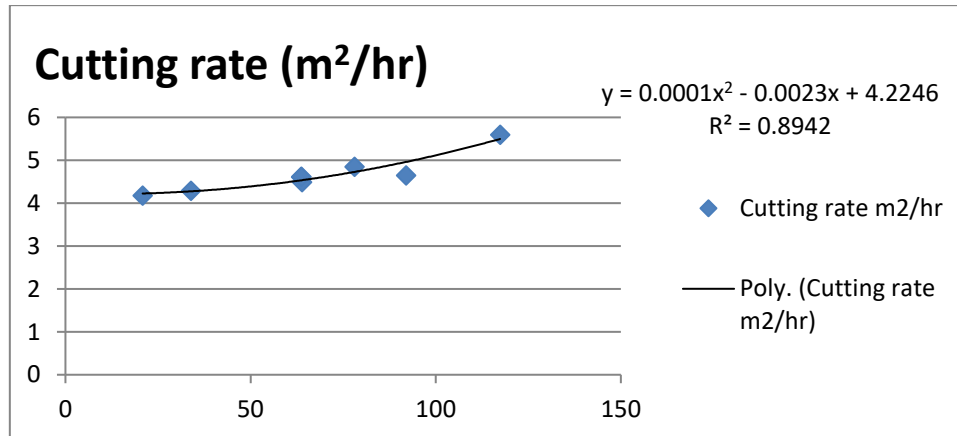


Figure 10 Relationship between cut size area and cutting rate with diamond wire saw machine in vertical cuts

Figure 4.4 shows the relationship between cut size area and cutting rate for blind cuts in granite stones. Cutting rate observed in granite stones was higher in bench cut size area between 40 to 50 m². Beads wear rate in vertical cut shows increasing trend from small cut size area to large cut size area.

Regression polynomial curve line shows the significant relationship between cut size area and cutting rate for vertical strand cuts

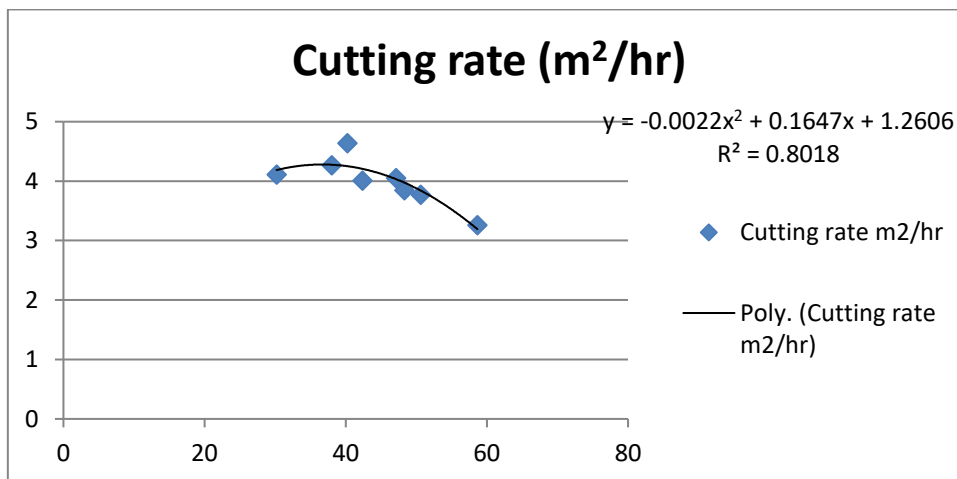


Figure 11 Relationship between cut size area and cutting rate with diamond wire saw machine in blind cuts

Regression Models and Optimum Bench Cut Size for Granite Stones

Regression models and the corresponding optimum bench cut sizes for various types of cuts in granite stones are presented in Table 4.2. These models indicate that the bench cut size significantly influences the cutting performance of the diamond wire saw machine. The optimum bench cut size varies depending on the type of cut, primarily due to the geometric characteristics of the granite blocks.

For horizontal, vertical, and blind cuts, the regression models were developed to predict cutting performance as a function of bench cut area. Analysis of these models identified the optimum bench cut size ranges as follows:

80–90 m² for horizontal cuts, 100–120 m² for vertical cuts, and 40–50 m² for blind cuts. These optimum sizes are particularly suitable for diamond wire saw machines equipped with a 45.6 kW motor, ensuring efficient cutting while minimizing wire wear and energy consumption.

Table 4.2 Regression models and optimum bench cut size for various cuts in granite stones with diamond wire saw machine.

S.no	Type of cut	Regression model	optimum bench cut size in m ²
1	Horizontal cut	$y = 0.0004x^2 - 0.0359x + 4.8725$	80-90
2	Vertical cut	$y = 0.0001x^2 - 0.0023x + 4.2246$	100-120
3	Blind cut	$y = -0.0022x^2 + 0.1647x + 1.2606$	40-50

1.1.4 Impact of Peripheral Speed on Cutting Performance

Machine-related parameters, such as the peripheral speed of the diamond wire play a significant role in the cutting performance of a diamond wire saw. Field experiments were conducted to evaluate the effect of these parameters on the cutting performance of the diamond wire saw in quarries containing granite. The results of cutting rates under varying peripheral speeds using a diamond wire with 2,000 beads and a total length of 66.66 m are presented in Table 3.1.1. It was observed that the cutting rate increased with an increase in the applied thrust on the diamond wire. The maximum cutting rates recorded were 6.20 m²/h for granite stone .

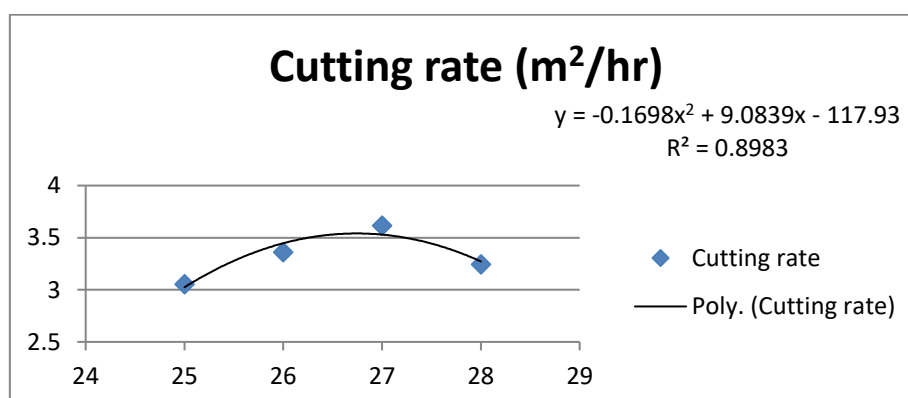


Figure 12 illustrates the cutting rates at different peripheral speeds and applied thrust values during granite cutting.

Through these observations, the optimum peripheral speed for granite cutting was identified as 27 m/s. This optimum speed is attributed to the unique physico-mechanical, textural, and mineralogical characteristics of the granite. The variations in these properties directly affect the wire's interaction with the stone, thereby influencing the cutting efficiency.

1.1.2 WATER QUANTITY OPTIMISATION

Water plays a critical role in cooling the diamond beads and flushing out the slurry generated during the cutting of marble and granite stones. Currently, water is used at a rate of 35 to 45 liters per minute across all types of cuts in granite quarries, regardless of the stone's size, hardness, or the specific cutting operation. However, optimizing water usage is essential to enhance the performance of the diamond wire saw machine. Excessive water leads to aquaplaning on the diamond beads, which reduces cutting efficiency, while insufficient water results in overheating and

Table 4.3 Saving in water quantity after optimization

S.no	water quantity used in granite stone cutting		Saving %
	Earlier (l/min)	After optimization (l/min)	
1	35-45	24.5	38.75

Table 4.3 details a water optimization study focusing on cutting premature wear of bead types, revealing that optimal water quantity differs with the cut type. A trend shows decreasing water volume from soft to hard granite, with the vertical cut in a descending loop requiring the most water, while an ascending loop cut uses the least. Post-optimization, ideal consumption for vertical granite cuts is 1.85 liters per minute per meter, significantly improving efficiency from 2.50–3.21 l/min/m to 1.43–2.25 l/min/m. This represents a 38.75% reduction in water use for vertical cuts, with a notable 68.8% savings in harder granite. For example, a 15 m × 10 m vertical cut saved approximately 15,300 liters, leading to an estimated total daily savings of 270,000 liters in the Deogarh mining area, thereby enhancing environmental management through reduced slurry generation.

CONCLUSION

Diamond wire saw machines are widely used for cutting and squaring granite blocks in stone quarries. Although these machines are commonly employed, significant scope remains for scientific investigation to enhance their cutting efficiency. Therefore, this study was undertaken to assess and improve the cutting performance of diamond wire saw machines in granite quarries.

The research involved optimizing the quantity of water required for different types of cuts to ensure adequate cooling of the beads and effective removal of slurry. The influence of peripheral speed—ranging from 27 m/s to 30 m/s—on cutting performance was also examined. In addition, the study evaluated the impact of varying bench cut sizes, from small to large, as well as different cutting orientations including vertical, vertical-strand, horizontal, and blind (channel) cuts.

Based on the research findings, the following conclusions and recommendations were made:

1. The required water quantity varies considerably with the type of cut. By optimizing water usage through observations of slurry deposition on the beads and base wire, daily water consumption in the study area was reduced by 270,000 liters.
2. The optimum peripheral speed for cutting granite was found to be 27 m/s. Existing machines in the study area can achieve this speed by installing a multistage pulley system.
3. An increase in thrust results in higher cutting rates but also accelerates diamond bead wear.
4. Bench cut size has a significant effect on cutting performance. The optimal bench cut area differs depending on the type of cut in granite and marble stones.
5. Cutting orientation strongly influences machine performance, with vertical cuts exhibiting the highest cutting efficiency.
6. Variable-speed diamond wire saw machines demonstrated a 3.1% improvement in cutting performance for granite compared to fixed-speed machines.
7. Accurate prediction of cutting performance enables mine operators to plan quarrying activities more efficiently.

Scope for Future Work

1. The predictive models developed in this study may be applied to other dimensional stones, such as sandstone and Kota stone, to enhance diamond wire saw performance.
2. Water quantity optimization may be further explored for various types of cuts in granite and sandstone quarries, focusing on effective bead cooling and slurry removal.
3. The findings can contribute to the design and further development of improved diamond wire saw machines.