Stone Surface Finish with Process Parameters

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Abstract*— *The experiments were conducted to study and analyze the process of granite machining operations. The machines used for conducting the experiments are 1.35 meter diameter blade machine, 1.20 meter diameter blade machine and 1.00 meter diameter blade machine. Experiments were conducted to find out the power consumed during the granite cutting, time taken to cut the blocks, tool wear, temperature and surface finish by using seven coolants viz., 1) Water 2) Water +Cutting oil 3) Water + SURF1 powder 4) Water + SURF2 powder 5) Water + SURF3 6) Kerosene 7) Diesel, by changing the cutting parameters like speed, feed, depth of cut etc.

In granite machining operation, the machining time, the production efficiency, the tool life, and surface finish are to be improved by using high viscous coolants. Among all the above coolants water + SURF1 washing powder is the best coolant with respect to cost of production.

Keywords*— *Machining, Wear, Tool life, Coolant Granite, Production.

I. INTRODUCTION

Stone was conceptualized to upgrade the technology level of Indian stone industry, develop international market for Indian stones and introduce the state of art mining techniques with low environment pollution. In the present work, different techniques and machines are used to analyze the various parameters and studied how these, parameters can change and behave in granite machining.

II. PROCEDURE

A model is designed to get high quality surface finish by taking the process parameters like cutting speed, feed, depth of cut, coolants etc. As a part of this the power consumption, surface finish, temperature, tool wear are measured.

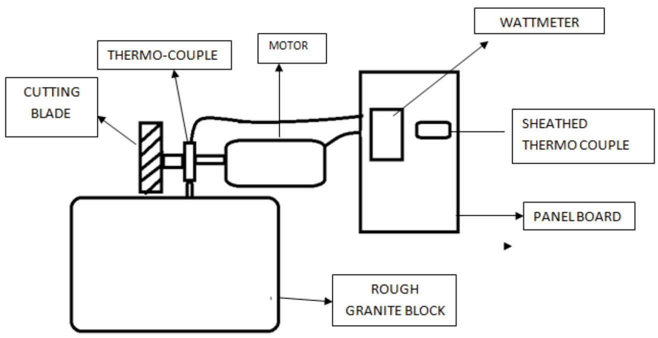

Fig.4.1: Showing Line Diagram of Experimental Set Up

In experimental setup as shown in figure 4.1, the block is placed on the moving trolley which is driven by 15HP motor. The power was displayed in the wattmeter. The temperature at the cutting zone was measured by a sheathed thermo-couple. The thermo-couple of the two wires were arranged in between the two cut strips at the end of the block. Tool wear was measured by Vernier callipers before consumed and after consumed. The surface roughness was measured by portable surface roughness meter individually. The viscosity of the cutting fluids was measured by redwood viscometer.

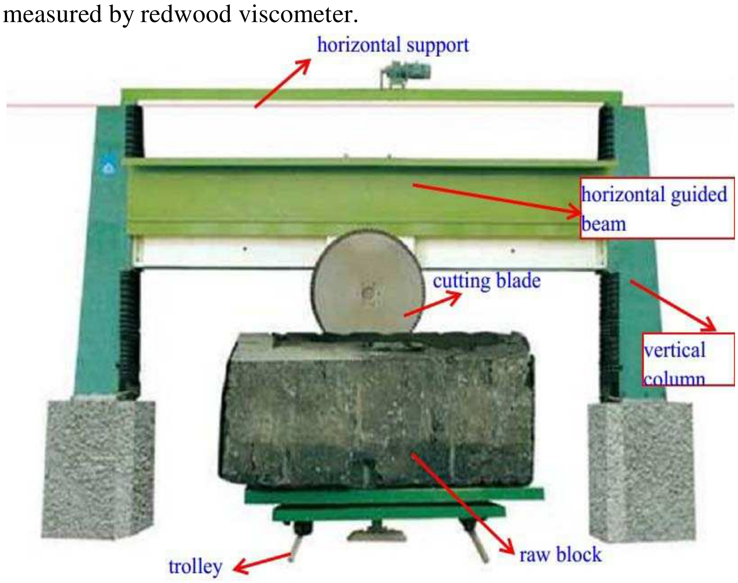

Fig 4.2: Showing Experimental Set Up

Experiments were conducted on 1.4met dia blade machine like:

(a) 1.4 meter diameter blade machine

On each machine, machining of 10 samples of granite of 1m x 0.3m (soft block) machining was done. Initially water is taken as coolant and average values of machining time, surface roughness, tool wear are noted. Experiments were repeated with the following different coolants: 1) water 2) water + cutting oil, 3) Water + SURF1 Washing Powder, 4) water + SURF2 POWDER, 5) water + surf3, 6) kerosene and 7) diesel oil has been used as coolant and the corresponding values are measured.

The coolants are given below in the ascending order of their viscosity

1. Water = 1.0 millipoise
2. Water +Cutting oil =1.35 millipoise
3. Water + SURF3washing powder =1.4 millipoise
4. Water +SURF1 = 1.8 millipoise
5. Water+ Surf3 powder =1.85 millipoise
6. Kerosene = 2.20 millipoise
7. Diesel oil = 2.6 millipoise

More commonly water is used as a coolant. With water as coolant heat is generated more due to friction. As a result surface roughness, temperature, tool wear increases and leads to reduction in tool life.

VISCOSITY MEASUREMENT

- Viscosity can be measured with instrument redwood viscometer.
- Viscosity can be compared with water as a standard fluid.

Fig.4.3: Red wood viscometer

TEMPERATURE MEASUREMENT

- Temperature can be measured by sheath thermo couple. Two wires of thermo couple are inserted in between parallel ends of the pieces of the block surface.

Fig.4.4 : Sheathed thermocouple

SURFACE ROUGHNESS MEASUREMENT

- Roughness can be measured by digital portable surface meter TR100. Instrument is kept on the work piece and the button is pressed to get the value of surface roughness in micrometer.

Fig.4.5: Portable Surface Meter TR100

POWER MEASUREMENT

- Power (in kW) can be measured by wattmeter.

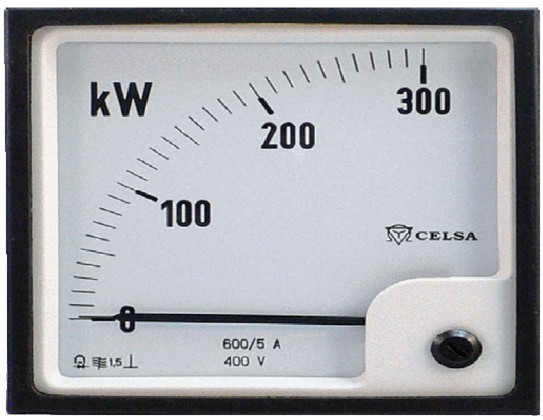

Fig.4.6: wattmeter

TOOL WEAR MEASUREMENT

- Tool wear in mm measured by Digital Vernier calipers with Least count of 0.01mm

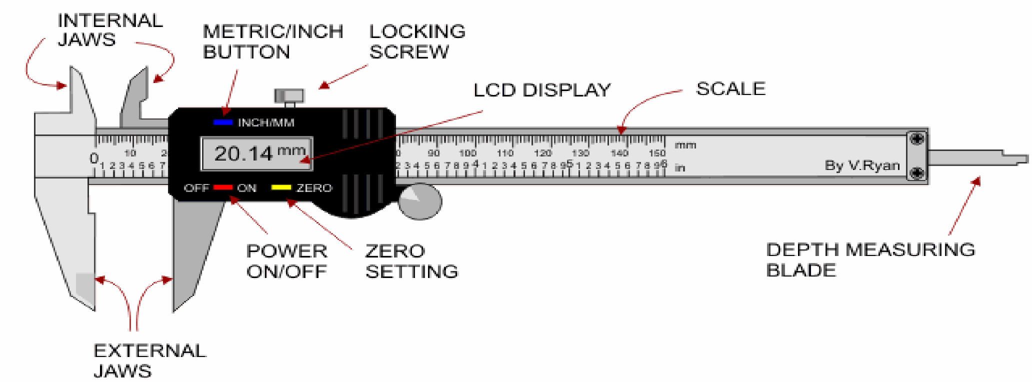

Fig.4.7 : Digital Vernier calipers

In existing system water as coolant obeys Taylor's equation to find tool life, machining time, surface roughness, temperature, tool wear.

$$(V \times d \times f \times T^{n}) = C$$

But in the proposed system Taylor equation is modified

$$(V \times d \times f \times T^{n})/R = C$$

Where,
R (viscosity ratio) = viscosity of fluid/viscosity of water V =Blade speed (m/min)
d = depth of cut (m) f = feed (m/min)
n = index depends on material, machine, cutting tool and cutting conditions. Average process parameters

III. EXPERIMENTAL ANALYSIS

AVERAGE PROCESS PARAMETERS

S. No	Viscosity of coolant	Length of piece (m)	Machining time (min)	Depth of cut (m)	Feed rate (m/mi n)	Power (kW)	temperature (ºC)	Surface roughness (µm)	Tool wear (mm)	Tool life Experimental (min)	Tool life predicted (min)
1	Water (1.00)	1.06	12.85	0.30	0.0824	1.86	437	6.20	0.029	8862	8862
2	Water + Oil (1.35)	1.08	12.10	0.30	0.0892	1.86	421	5.10	0.023	11051	10521
3	Water + Nirma (1.80)	1.10	10.15	0.30	0.1084	1.78	417	4.15	0.017	12125	11941
4	Water + ETA (1.40)	1.08	11.95	0.30	0.0903	1.74	420	5.14	0.021	11380	11321

5	Water +surf excel (1.85)	1.10	10.05	0.3 0	0.109 4	1.6 0	416	4.10	0.016	12563	12348
6	Kerose ne (2.20)	1.10	9.25	0.30	0.1189	1.44	416	4.10	0.014	13214	13511
7	Diesel (2.60)	1.06	9.15	0.30	0.1158	1.33	402	4.05	0.012	15250	16395

IV. CONCLUSION

It is observed that machining time decreases, temperature, surface finish increases, tool wear decreases cutting speed increases, feed increases and the depth of cut also increases while working with viscous coolants.

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