

ASSISTANCE IN THE CLEAVAGE AND GRADING OF STONE MATERIAL

Organisation

The Joint Health and Environment Committee of the porphyry sector in the province of Trento, Italy

Introduction

Porphyry is a stone material, volcanic in origin, characterised by its development along parallel planes.



Figure 1 Pieces of porphyry



Figure 2 Pieces of porphyry showing parallel planes

This characteristic allows it to be used as a semi-finished product as well as after “splitting”. Porphyry’s considerable resistance to wear and tear due to atmospheric agents, is the feature that has led to its widespread use in street furniture but also in the home.

Porphyry is initially extracted using explosives. The material is then placed on the ground in the open where the workers perform two operations, in bent-trunk postures:

- splitting, with a sledge hammer, or hand-held hammer, along the parallel planes, typical to porphyry;
- grading (study, evaluation of its workability), lifting and transportation of the material, prior to later processes.



Figure 3 Splitting porphyry



Figure 4 Grading porphyry

The material to be moved usually weighs between 7 and 30 kg, but, occasionally, it can be as much as 50 kg. During a working day, a worker moves more than two hundred hundredweight (200 x 50kg). In addition to the risks of moving this weight, the risk to the low back is further increased by the weather conditions (temperature, humidity), the irregular terrain and the dimensions of the blocks.



Figure 5 Stacking split porphyry on a pallet

Until a few years ago, the initial porphyry working processes exposed an individual to a high back-lumbar risk, due not only to the lifting and transportation of loads, but also to the particularly adverse conditions associated with work on the land. The risk, evaluated using the NIOSH (The National Institute for Occupational Safety and Health) Lifting Index, was higher than 4.0. This problem involved about 400 workers.

Aims

The aim was to find a new system of work in order to reduce the risk to the low back for workers.

What was done, and how

The Joint Health and Environment Committee of the porphyry sector believed that the initial working process was a priority to be addressed.

Further to the involvement of a specific working group made up of the workers' trade union representatives, the supervisory authorities (Health and Safety in the Workplace Operative Unit belonging to the Provincial Health Care Services – the Autonomous Province of Trento's Mineral Service), the employers' representatives and INAIL (the National Insurance Institute for Industrial Accidents), a system was designed and implemented to feed the material which allows the initial working process to be carried out in an upright posture.

This system foresaw that the material coming from the quarry face was unloaded using a hopper's mechanical loader.



Figure 6 Use of a mechanical loader to move material to the hopper



Figure 7 Automatic feed from the hopper to the conveyor



Figure 8 The shed where splitting now occurs

A hydraulic extractor fed a reinforced conveyor belt that was 90 cm high. The workers were then able to work on the material to be processed or graded whilst standing in an upright position. The operator controlled the belt's progress. The waste material that was not removed by the worker was dumped at the end of the belt. The introduction of this system necessarily led to an automated line being implemented in the working area, whereas previously the working processes had been purely manual.



Figure 9 Use of a pallet lifter

This was followed by a suitable experimentation period, when the prototype was tested by a number of companies. The experiment was monitored by gathering the opinions of the employers and the workers on the level of productivity as well as the reduction in fatigue and the overloading of the lumbar spine.

After the publication of the working group's final report, in March 2006, the companies began introducing the system into the production process.

At the same time the Quarry Management Consortium (SO.GE.CA.) conducted some research in all the quarries in order to evaluate the possibilities concerning the introduction of the experimental system, on the basis of the type of material extracted, in as much as the new system's production yield may vary

further to the unrefined product's dimensions. The research showed that the quarries, where the new system cannot be introduced, are extremely few.

In some cases, individual companies have created customised solutions that, whilst satisfying the guidelines expressed by the working group, represented an evolution of the original idea. Some other accessories have been added to this system (suction cups, mobile platforms and lifting equipment) that allows the risk to be reduced considerably.

What was achieved

The use of this system has led to a considerable reduction (nearly 50%) in the workers' risk of musculoskeletal disorders (MSDs), as can be seen from the two research projects carried out by the public authorities (Verona University and INAIL).

The benefits are the reduction in fatigue (according to the feedback from the workers), reduction in low-back disorders with the consequent reduction in absenteeism, probable reduction in the cases of total or partial disability in moving loads and better placement possibilities for employees with slight/moderate disabilities.

Further information

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Transferability

The system presented in this case can be used in other countries where porphyry or similar stone is being extracted.

The factors of success are a strong commitment of all parties involved in this activity, a careful examination of how the work is performed, and gathering the employers' and workers' opinions.