

## **Adjustable Tilting Work Table Improves Working Conditions**

Every reputable company looks for ways to keep their employees happy and healthy. In today's society, we are all required to work longer and harder hours. We have a story we would like to tell, which has helped us fix a long standing problem for some of our employees and create a solution to a problem that other companies may want to adopt. We were also fortunate to be able to partner with Oregon OSHA to accomplish it.

Our company, Portland Marble Works, Inc. is a full-scale marble and granite fabrication shop. We work only with quarried natural stone. Our primary market involves high-end residential interiors as well as commercial interior work.

Our marble and granite is quarried all over the world. It is removed from the quarries in block form. The blocks are sent to larger fabrication shops where they are sliced into sheets or slabs. The slabs are then polished on one side and bundled in quantities of 8 to 10. The bundles are then shipped to wholesale suppliers who in turn sell to fabrication shops.

Portland Marble Works Inc. was started in 1983. In the beginning, we were doing primarily installations of marble and granite tile, since the cost of doing business was low. A desire to fabricate slab and the confidence to reach equal or higher quality levels in craftsmanship than those currently in the slab business eventually led to establishing our first 'shop'. We later moved, and are currently occupying a 10,000 sq. foot shop.

The company has always had a need to keep our employees healthy. In a trade such as this, employee turnover becomes a major problem, when much of the technique required to finish these materials, is learned by example at the company. Not everyone has the patience or ability to be a good finisher. Because the equipment involved with finishing our rock products is relatively unsophisticated, consisting primary of a hand held grinder and wood saw horses, it requires a sustained physical exertion over long periods of the day, in awkward postures.

It helps to understand the ergonomic issues of the work, by first understanding the processing required. After cutting a piece of slab material to the required shape, the edges require manual edge finishing. This is normally done by placing the material on a sturdy set of sawhorses, and with the aid of hand held powered grinders, they are shaped and polished to finish. The slabs can weigh up to 500 pounds. Because of their weight and size, sawhorses have been the only practical option to set the slabs on. This requires the average worker, holding a powered grinder, to squat or bend to the edge working height of the slab. They do this for about 7 hours of a normal 10 hour work day. The grinders average 15 pounds in weight. We had not been able to identify any known worktables that could be raised, indexed, and tilted, to allow easy access to the edges and top of these slabs, when working on the material.

After completing the research for an "off the shelf" solution, Mike McCurdy, President of Portland Marble Works eventually contacted Patrick Kraft, Manufacturing Consultant

with the Oregon Manufacturing Extension Partnership (OMEP). Patrick referred us to Oregon OSHA, who also could not locate or recommend any ready made solution to the problem. We were encouraged to apply for an Oregon OSHA Worksite Redesign Grant, which would fund up to 90% of the cost to design, develop and build a prototype solution to address the ergonomic issue. A grant application was written and submitted for processing. It was approved, and OMEP was contracted by Portland Marble Works to project manage the entire project.

A series of about 21 steps were outlined in the original application, that would be followed in the completion of the project. It included a baseline ergonomic evaluation to document the specific pre solution issues that should be addressed with the final device design.

This report, combined with a series of design concept meetings with the employees that actually do the work, resulted in 4 pages of simple drawings that detailed out all the information required to build the prototype. Specifications requested by the employees and incorporated into the design include the ability to support loads to 500 lbs., foot controlled electric lift and tilt functions, simple but consistent slab clamping fixturing, and the ability to have the table top indexed over a 360 degree range to allow for working on the ends of a part. It also needed to withstand a damp, harsh environment.

From this design, the device's framework was fabricated. The electric lift equipment was purchased as specified, and installed in the device. A motor was purchased to make the table top indexable over a 360 degree range and later was determined to be a poor choice due to some unknown characteristics at the time of purchase. A second motor was eventually purchased and fitted to the frame that provided the right mix of functionality. The grant allowed for this experimentation and solution testing.

The Adjustable Tilting Work Table was eventually completed for installation and testing. Our employees at Portland Marble Works began using the device that they had helped design, and have fully integrated its use into the processing of the slabs.

The device's design was documented, along with all vendors who worked on the project, so that others may eventually be able to review, adopt, and construct similar devices to improve the working conditions in their shops, for their employees.

After installation and testing of the solution, a post ergonomic evaluation was completed, which evaluated the ergonomic conditions of the work being performed while using the new adjustable table. The post ergonomic report stated " Although the sample size (number of employees surveyed) for both surveys was small, the results do indicate that at least for these employees, a substantial benefit has been realized by the elimination of all task related discomfort. This benefit is directly attributable to the ergonomic improvements that have occurred with the introduction of the new adjustable tilt table. The reduction in MSD (musculoskeletal disorder) risk factors as discussed above, combined with the extremely favorable discomfort survey results, indicate that the engineering controls involving the adjustable height tilt table have been very

successful. The device has met all of the original goals for the project. It is efficient, simple to operate and has not created any additional MSD risk factors. The employees who have used the device report high satisfaction in the over-all outcome of the engineering improvements. Productivity levels remain essentially unchanged".

The specific MSD risk factors that were evaluated, along with their outcomes, are as follows:

1. Awkward/static postures- have been significantly reduced particularly related to forward flexion of the spine (lumbar, thoracic and cervical) and partial squatting postures given that the marble slab can be quickly and easily re-positioned to obtain the best working location.
2. Forces and Loads- related to muscle loading of the trunk extensors and quadriceps have been greatly reduced by making it possible for the worker to remain in an upright, more neutral posture resulting in much less muscle fatigue and adequate muscle recovery time.
3. Repetition- moderately high rate of repetitive movements to draw the grinder side to side across the edge of the marble slab, may include transfer of body weight from one leg to the other in a side to side motion. These movements however, as discussed above, are performed in much more advantageous (more neutral) postures and with less muscle loading than before. Movements of the upper extremities are still involved (as before) in shoulder internal/external rotation and wrist flexion/extension while holding and manipulating the grinders.
4. Contact pressure - hard grinder handle against soft tissues of hand (no change)
5. Vibration- moderate exposure to vibration using the grinder (no change). Vibration is a factor primarily with the rough grinders which makes up approximately 25% of the grinding time.
6. Exposure to cold temperatures on hands from tap water spraying from grinders (no change).
7. Posture and Body Mechanics- workers are now generally able to maintain good body mechanics technique because of the adjustability of the new table.

Overall, the company is very happy with the solution, and in having the ability to be involved with creating the operating specifications of the device. It is believed that this device will improve the long term ergonomic issues, over the original saw horse support system previously used.

Oregon OSHA's (OR-OSHA) Worksite Redesign Grant program provided up to \$30,000 in grant monies for this project. This covered the costs of design, development and evaluation of the prototype table, as well as the documentation of the results, so that

others could benefit from the research. Portland Marble Works Inc. contributed our required 10% match in the form of meeting involvement, installation, testing, and reporting on the project outcomes. This product was designed for the special needs of Marble and granite polishing, but our employees believe it could be invaluable to any company with manual material manipulation tasks. It would make an excellent maintenance work bench.

All products developed through this program are public property. The design is complete, and will be freely available to anyone wishing to duplicate or further develop the mobile lift. A web based project archive is in the process of being constructed, that will provide details on this and many of the 35 to 40 grants being completed by other companies. It will be linked from the main Oregon OSHA website and will provide information such as project overviews, ergonomic reports on the projects, as well design and vendor information so that anyone may research the results and adopt the technologies.

*Information from Portland Marble Works Inc. may be obtained from Mike McCurdy, President*

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Information about developments and the status of this program can be obtained from Oregon OSHA ([www.orosha.org](http://www.orosha.org)).

Phone: 509/453-7690.

Phone: 503/947-7448.

<http://www.cbs.state.or.us/osha/grants/worksitere redesign.htm>

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