

# **Rob Strickland, OTR**

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### **Post Project Ergonomic Evaluation**

**Portland Marble, Inc.  
Adjustable Tilt Table  
September 2001  
Rob Strickland, OTR**

An on-site ergonomic evaluation of the tasks involving the use of the new adjustable tilt table was completed at Portland Marble on September 28, 2001 at the request of Pat Kraft, Manufacturing Consultant and Project Manager. A video tape and digital still photos were taken during the evaluation and are available for review. Employee discomfort surveys were completed.

#### **Purpose/Background:**

The purpose of this evaluation is to provide an assessment and documentation of the improvements in the musculoskeletal disorder (MSD) risk factors associated with the use of the new adjustable tilt table while finishing (grinding and smoothing) the edges of marble slabs. This is being done as part of the Oregon OSHA Worksite Redesign Grant Program which has been awarded to Portland Marble Works Inc. The intended goal of this project is to make engineering improvements to reduce the identified risk factors in order to prevent work injury.

#### **General Description:**

The over-all work task has not changed as a result of this project. However, rather than placing a marble slab on saw horse supports, it is now placed on the new tilt table and clamped into position. It is then adjusted to an optimal height and angle so that the worker can complete the finishing work while standing in an upright posture. The employee begins the process by measuring, marking and taping) the edges for grinding and smoothing to obtain a rounded edge. He then selects the appropriate air powered grinder to grind and smooth the edges, grasping the tool with un-gloved hands. There are four grinders used, graded from rough to smooth, which vary in weight measured at 18 lb., 16.4 lb., 11 lb. and 8.4 lb. The grinders use a stream of water to keep the grinding wheel and surface cool from the effects of friction.

The worker may use a variety of movements to guide the grinder back and forth along the edge of the slab but most often uses long sweeping side to side movements in order to obtain a uniform edge. The old method often involved squatting partially or bending forward at the trunk to lower one's body to a functional position to view the edge and skillfully operate the grinder. Now, using the tilt table, the employee can quickly adjust the height of the slab or tilt it upward (to grind the lower edge) to eliminate the need for sustained squatting or bending in order to obtain a favorable position. On average it takes one hour or more to finish a slab in this manner. This activity takes place for approximately 6 to 7 hours out of a 10 hour work day (60%-70%) for each of three employees involved.

**Device description/ relevant dimensions:**

Tilt table top- 39" diameter (round)

Adjustable work height (floor to top of rails holding marble slab) = 40.5" to 52.5" (12" range)

Fixture holding clamps- quickly adjust to accommodate different slab dimensions

Foot control for height adjustments (motorized), 12" range in 35 seconds

Foot control for tilt adjustment (motorized), lifts leading edge of slab from horizontal position to an angle up to approximately 40 degrees in 15 seconds

Hand control pendant for rotation of platform to 360 degrees in either direction (motorized) in 16 seconds. (Note the tilt table is going to be retrofitted with a mechanical lock system to eliminate play in the rotational movement of the table)

Reach distance- worker can get as close to the slab as needed, reducing reach distance to under 14"

**Musculo-skeletal disorder (MSD) risk factor assessment:**

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.

### Employee Discomfort Survey Results

**Pre-project:** Job Title- Stone Fabricator    Number of surveys completed= **3**

Discomfort Area	Number of employees with discomfort	Percentage of the total (n= 3)	Average Rating (0-10 scale)
Neck	1	33%	4
Shoulder	1	33%	4
Upper back	1	33%	4
Lower back	3	100%	4
Elbow/forearm	1	33%	5
Hand/wrist	1	33%	4
Hip/thigh	1	33%	5
Knee	1	33%	3
Lower leg	0	0%	0
Ankle/foot	2	66%	2

**Post-project:** Job Title- Stone Fabricator    Number of surveys completed= **2**

Both surveys that were completed post project (related to the use of the new adjustable tilt table) indicated no discomfort during or after the task.

### Employee Discomfort Survey Summary

Although the sample size 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.

### Worksite Re-design Project Completion Summary

The reduction in MSD 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.

**Additional Recommendations:  
Engineering controls**

1. Consider feasibility of an over head, track mounted lifting device to lift and position marble slabs on the support table, thus eliminating manually lifting the material.
2. Explore availability of and conduct trials with suitable vibration dampening gloves which would reduce worker exposure to hand/arm vibration.

**Administrative controls**

Explore alternative staffing patterns if needed, to rotate employees out of the grinding tasks as a means of limiting worker exposure to the MSD risk factors (vibration, cold temperatures and contact pressure) inherent in this task.



**Figure 1**

**Height adjustable, tilting, rotating table operates quickly and easily with foot or hand controls. Fixture clamps adjust to various slab dimensions and quickly secure slab in place.**



**Figure 2**

**Worker can easily adjust the marble slab to the optimal work position and thus maintain upright standing posture and more neutral joint positions.**



**Figure 3**

**Table tilts upward if needed to allow finishing of lower edge of marble slab while maintaining good body mechanics.**

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For further assistance or questions regarding this report please contact Rob Strickland  
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Respectfully,

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