

ERGONOMICS DEMONSTRATION PROJECT

Update

Masonry Industry

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Ergonomic Best Practices / Acceptable Practices in the Masonry, Stonework, Tile Setting Industries

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Table of Contents

Introduction

The Washington State Ergonomics Rule and the Masonry Industry

Work-Related Musculoskeletal Disorders (WMSDs) and the Masonry Industry

The Masonry Industry Ergonomics Demonstration Project

Masonry Industry Use of This Report

Working Group Findings

Hodcarriers (block)

Bricklayers (block)

Hodcarriers (brick)

Bricklayers (brick)

Finishers (tile)

Tile Setters

Retaining Wall (dry stack only)

Conclusions

References

Appendix: Masonry, Stonework, Tile Setting: Possible Hazard Zone Jobs and Risk Reduction Solutions (Tables)

Table 1: Hodcarriers (block)

Table 2: Bricklayers (block)

Table 3: Hodcarriers (brick)

Table 4: Bricklayers (brick)

Table 5: Finishers (tile)

Table 6: Tile Setters

Table 7: Retaining Wall (dry stack only)

Introduction

Washington State Department of Labor and Industries (L&I) has established demonstration projects with business and labor representatives from various industries, to help these industries prepare for the new Ergonomics Rule. This report is a product of a demonstration project in the masonry industry.

Tasks commonly performed by block, brick and tile workers in the masonry industry were reviewed, and those tasks with potential work-related musculoskeletal disorder (WMSD) hazard exposures as described by the Ergonomics Rule. Hazard control examples for reducing these risk factor exposures were identified. The objective of this document is to help employers and workers comply with the new rule by identifying masonry-specific WMSD hazards that may exceed the limits specified in the rule, and to suggest possible controls for those hazards.

The Washington State Ergonomics Rule and the Masonry Industry

On May 26, 2000, L&I adopted the Ergonomics Rule, WAC 296-62-051, to reduce exposures to specific workplace hazards that can cause or aggravate WMSDs. As part of the implementation plan for the Ergonomics Rule, demonstration projects with business and labor representatives from various industries have been established, to help businesses prepare for the new rule.

The Ergonomics Rule requires employers with “Caution Zone Jobs” – jobs where exposures to risk factors exceed the Caution Zone levels of exposure specified in the rule – to provide workers in those jobs, and their supervisors, with ergonomics awareness education. Additionally, employers and workers must further analyze Caution Zone Jobs to see if the rule-defined “Hazard Zone” exposure levels are exceeded. If they are, the employer must reduce the exposures below the “Hazard Zone” level, or to the degree technologically and economically feasible.

The Ergonomics Rule defines a series of compliance start dates for various Washington State industries. Masonry employers with 50 or more full time equivalent workers must meet Caution Zone compliance requirements (ergonomics awareness education, and hazard analysis of Caution Zone jobs) by July 1, 2002. Hazard reduction (for identified “Hazard Zone” jobs) must be implemented by July 1, 2003. For employers with fewer than 50 full time equivalent workers, the compliance dates are one year later.

Work-Related Musculoskeletal Disorders (WMSDs) and the Masonry Industry

Masonry industry workers perform many different jobs and tasks. The work is physically demanding, involving stocking and laying of block and brick, stocking and setting of tile, mixing and stocking of mortar and grout, and assembling scaffolds. Lifting and carrying of materials is common, as well as repetitive motion, high hand force, reaching overhead, and bending of the back or neck, for certain tasks. These exposures can lead to WMSDs.

The Masonry Industry Ergonomics Demonstration Project

The ergonomics demonstration project in the Masonry, Stonework, Tile Setting industries was initiated with the Washington State Conference of Mason Contractors (WSCMC) in September 2000. The working group consisted of members from the WSCMC, business, labor, materials dealers and manufacturers, and L&I. The goal of the project was to identify masonry tasks that may be in the “Hazard Zone” as defined by the Washington State Ergonomics Rule (WAC 296-62-051, Ergonomics), and to identify hazard control examples that can be used by employers to reduce exposures below the Hazard Zone level, or to the extent technologically and economically feasible.

Commonly performed block, brick and tile tasks were reviewed, and tasks were identified that have the potential for exceeding the “Hazard Zone” exposure limits specified in the Ergonomics Rule. The group’s efforts were focused on “hazard” identification, rather than “Caution Zone Job” identification, because “Hazard Zone” jobs are the ones required to be changed by the Ergonomics Rule.

The group used their knowledge of the Ergonomics Rule risk factors, and associated “Hazard Zone” exposure level limits, to create summary tables (by trade) of tasks that have the potential to be in the “Hazard Zone” as defined by the rule. Site visits, still pictures, and video of masonry tasks were used for ergonomics analysis and identification of potentially hazardous exposures. It was acknowledged that differences in these tasks occur over time, between companies, and at different work sites.

The demonstration project group recognized early in the project that many of the masonry trades routinely expose workers to “Caution Zone” levels of Ergonomics Rule-specific risk factors, due to the physical nature of the tasks. The group expects that most, if not all, workers in these trades will require ergonomics awareness education in accordance with the Ergonomics Rule. The group therefore focused their efforts on identifying the potential “Hazard Zone” level tasks that will require hazard reduction in accordance with the Ergonomics Rule, and on identifying hazard control examples.

Masonry Industry Use of This Report

The following section of this report lists the possible masonry industry “Hazard Zone” jobs that were identified by the demonstration project working group. Possible hazards are listed separately for the different masonry trades. This information represents the working group’s determination as to which masonry tasks (as commonly performed today) have significant potential to exceed the exposure limits specified in the Ergonomics Rule. This information is intended as a resource for individual employers to use in identifying Ergonomics Rule-related hazards that may be present in their business. Not all possible masonry tasks were analyzed by the working group. Individual employers will need to include in their analysis any company-specific or site-specific tasks that are not addressed by this document.

Note that the text and tables in this document list potential Hazard Zone jobs on a task-by-task basis, so as to clearly identify the potential WMSD hazards associated with each individual task. The Ergonomics Rule, however, limits a worker’s total exposure to risk factors experienced during the workday. The worker’s “job” may include several different “tasks”, for example, the different tasks of laying and striking that may be performed by a bricklayer, or the different tasks of mixing and stocking that may be performed by a hodcarrier. The Ergonomics Rule exposure limits apply to a worker’s total exposure to risk factors that occur during the workday.

The tables in this report are a resource for employers to use for identifying possible “Hazard Zone” jobs. To assist employers with this analysis, each table first lists tasks where it appears that the task by itself may have “Hazard Zone” exposure levels. Then tasks with lesser exposure levels are listed that appear less likely to have “Hazard Zone” exposures by themselves. Combinations of these lesser hazardous tasks may exceed the hazard exposure limits of the Ergonomics Rule.

This document is meant to be updated as more information becomes available. The primary goal of the demonstration project was to identify possible WMSD hazards as defined by the rule for jobs and tasks performed by the masonry trades, identify possible hazard control examples, and make this information available as a resource for all employers in the block, brick, and tile trades.

The next section presents possible masonry “Hazard Zone” jobs listed by trade and task. Possible methods for reducing these risk factor exposures below the hazard level, or to the degree feasible, are listed. Further refinement and work may be needed to implement interventions in some cases. Development and testing of more innovative ideas may also be necessary before feasibility can be assumed regarding certain issues. The hazards and hazard control methods are by no means all-inclusive. Additional hazards may be present depending on the work conditions at a particular site, and there may be other hazard reduction methods for reducing exposures below the hazard level that are known to the employer. Employers are not limited to the hazard control examples given in this document. If masonry industry or other interested parties identify additional hazard control options for these trades, the working group encourages that these ideas be sent to L&I and/or the working group members for distribution to interested parties.

Working Group Findings

Ideas for reducing hazard zone risk factors were solicited from employers, workers on sites, material manufacturers, and L&I ergonomists. Brainstorming and discussion of possible interventions were conducted at working group meetings for each task and risk factor identified as a possible hazard. Many technically feasible, low-cost risk reduction controls were identified through this process. In most cases, several acceptable control options were identified that could reduce exposures below the “Hazard Zone” level. In these cases, as for any work task, it is the decision of the employer, in consultation with his or her workers, to choose which controls, or set of controls, would work best for their particular situation.

“Hazard Zone” risk factors and associated solutions for block, brick and tile trades are further described in Tables 1-7 (Appendix A). These tables, and the associated discussions in the main body of this report, list possible risk reduction controls, as identified by the working group. Using one, or a combination of the possible controls, as appropriate for a given work situation, will be useful for reducing risk factor exposures below the “Hazard Zone” level. Many of the control examples suggested are methods that are already in use by some employers, but may not be standard procedure by all employers in the state.

Hodcarriers (block)

Table 1. Hodcarriers (block): Tasks, Hazard Zone Risk Factors, Control Examples
(See Appendix – Table 1. Hodcarriers (block))

Summary of Hazardous Exposures

Hodcarriers (block) potential hazards are primarily due to:

- a) Lifting heavy frames, planks, scaffolding – while assembling scaffolds
(control ideas: use forklifts, more than one worker per lift, lift single items)
- b) Lifting heavy mortar bags, lifting heavy buckets -- while mixing mortar and stocking
(control ideas: use smaller (lighter) bags, distribute mortar by forklift/tub)
- c) Lifting heavy block – while stocking
(control ideas: use block buggies, hand trucks; rotate to other tasks)

Details

Some hodcarrier (block) tasks performed alone result in hazard level exposures. Other hodcarrier (block) tasks are not likely to be hazardous on their own, but can be hazardous when combined with similar tasks performed during the same day.

The following 5 tasks (as commonly performed) are possible stand-alone hazard zone tasks:

1) Lifting Scaffolding Frames

Hazardous Activity: Heavy ladder frames and walk-through frames (45 lbs each) are lifted two at a time for offloading, erecting, moving, dismantling, loading scaffolding.

Control Examples: Using forklifts, or limiting manual lifting to one frame per worker, would remove the lifting hazard due to lifting over 45 lbs.

Basis of 45 lbs: (frame lifted from ground level, approximately 1 lift per minute, between 1-2 hrs per day) ($50 \times .9 = 45 \text{ lb}$)

Controls Summary: * Use forklifts
* Lift one frame at a time (one worker – one frame)

Optional Good Ideas: * Stack frames standing up for manual lifting
(start lifting from between knee and waist level rather than from ground level)
* Tip a flat lying frame upright before lifting it
* Consider using continuous scaffolding
(using mechanical lifts or multiple workers to erect scaffold components)

2) Lifting Scaffolding Planks

Hazardous Activity: Heavy planks 9' (35 lb.), 12' (45 lbs.) 16' (60 lb.) are lifted for offloading, erecting, moving, dismantling, loading scaffolding.

Control Examples: Using forklifts, or limiting manual lifting to one plank per worker, would remove the lifting hazard due to lifting over 45 lbs.

Basis of 45 lbs: (frame lifted from ground level, approximately 1 lift per min, between 1-2 hrs per day) ($50 \times .9 = 45$ lbs)

- Controls Summary:
- * Use forklifts
 - * Lift/carry one plank at a time
 - * Use additional worker(s) for lifting wet or otherwise heavy planks
 - * Lift one end of a plank at a time (wherever possible) (1/2 the weight)

Optional Good Ideas: * Scrape and clean planks after each use

3) Lifting Continuous Scaffolding

Hazardous Activity: Heavy sections of scaffolding (> 90 lb) are lifted for offloading, erecting, moving, dismantling, and loading scaffolding.

Control Examples: Using forklifts, and/or using enough workers to reduce the weight lifted per worker to non-hazardous levels, would remove the hazard of lifting over 90 lbs (from the knee to waist level) or 70 lbs. from ground level (from below the knees).

- Controls Summary:
- * Use forklifts
 - * Use enough workers for non-hazardous manual lifting

4) Mixing, Stocking Mortar

Hazardous Activity: Heavy bags of cement (94 lbs) are lifted for mixing.

Control Examples: Use of a silo for mixing large volumes, or for the use of smaller bags (50 lbs max), and placing the bags up off the ground (for example, on pallets) would remove the hazard of lifting over 50 lbs from ground level (from below the knees).

- Controls Summary:
- * Use a silo for large projects
 - * Use smaller bags (50 lbs max), or cut large bags in half
 - * Place bags up off ground (for example, on pallets), and lift bags close to body

Hazardous Activity: Lifting/gripping a heavy (filled) wheelbarrow while stocking mortar.

(Lifting: > 90 lbs, from between knee and waist level)

(Gripping: > 10 lbs per hand, for > 4 hrs per day) (> 3 hrs per day with bent wrist)

Control Examples: Distributing mortar by forklift/tub, or limiting the wheelbarrow lifting load on the hands (to 90 lbs max), would remove the hazard of heavy lifting and high hand force (gripping).

Controls Summary: * Distribute mortar by forklift/tub or wheelbarrow
 * Limit wheelbarrow lifting load on hands (to 90 lbs max)
 * Rotate to other tasks

Optional Good Idea: * Use wheelbarrow with 3 or 4 wheels
 (where wheelbarrow used)

5) Stocking Block

Hazardous Activity: Heavy blocks 8" (~30-35 lb.), 12" (~50 lb.) are stocked (distributed) two at a time by hand (one in each hand). Workers can be exposed to lifting too much weight, too many hours per day, as well as too many hours of gripping blocks:

(Lifting: The once per day hazardous lifting weight is > 55 lbs (lifting from between the knee and waist)

(Gripping: > 10 lbs per hand for over 4 hrs per day)

Control Examples: Job rotation (for example, mixing mortar, stocking mortar, site cleanup, scaffold/plank moving, using grout hose, other miscellaneous hodcarrier tasks) would reduce the lifting hazard. Job rotation, use of a hand truck with cubing/banding, or block buggy distribution of block, would reduce the gripping hazard.

While stocking block: Job rotation would reduce the hazard of lifting over 36 lbs, and reduce the gripping hazards, associated with stocking 35-50 lb. blocks.

(Two blocks = 70-100 lbs.)

Basis of 36 lbs: (blocks lifted from between knee and waist level, approximately 2-3 lifts per min, for 2+ hrs per day) ($55 \times .65 = 36$ lbs)

Controls Summary:

(Lifting) * Rotate to other tasks
 (for example, mixing mortar, stocking mortar, site cleanup, scaffold/plank moving, using grout hose, other miscellaneous hodcarrier tasks)

(Gripping) * Pallets loaded with block right side up
 (gripping flange on top) -- to reduce grip force required
 * Rotate to other tasks
 * Hand truck distribution of block (w/cubing/banding)
 * Use block buggies

Optional Good Ideas: * Place pallets as close to masons' required location as possible, using forklifts
 (lifting and gripping) * Lift blocks close to the body
 (step close to blocks or slide blocks close to body before lifting, where possible)
 * Hand truck distribution of block (w/cubing/banding)
 * Use block buggies

The following 2 tasks (as commonly performed) are unlikely to be stand-alone hazard zone tasks:

(Unless performed for uncommonly long amounts of time without rotation to other tasks)

Note: Tasks with similar risk factors may combine to reach hazard zone exposure levels.

6) Using Grout Hose

Activity: Workers drag the heavy grout hose to the grout location, and use high grip force to hold the hose.

Control Examples: Rotating workers between the different hose positions, rotating workers to other tasks, and possibly modifying the hose for better gripping, would remove the gripping hazards of using the hose.

Controls Summary: * Rotate worker positions on hose
* Rotate workers to other tasks (for example, stocking)
* Use other procedures (grout hog)

Optional Good Ideas: * Modify hose for better gripping
(for example, use rope or auto fan belt for better grip,
attach non-slip tape or handles)

7) Consolidation

Activity: Workers are exposed to hand-arm vibration from consolidation.

Control Examples: The use of low vibration vibrators (low vibration on the worker) and rotation to other tasks, would remove the vibration hazards of consolidation.

Controls Summary: * Use low vibration vibrators (low vibration on the worker)
* Rotate to other tasks

Optional Good Ideas: * Maintain/repair vibrators to minimize vibration
on worker
* Use anti-vibration gloves and/or anti-vibration
materials on vibrator
(isolation pads between power head and hand)

Bricklayers (block)**Table 2. Bricklayers (block): Tasks, Hazard Zone Risk Factors, Control Examples**
(See Appendix – Table 2. Bricklayers (block))*Summary of Hazardous Exposures*

Bricklayers (block) potential hazards are primarily due to:

- a) Saw cutting of block
(control ideas: adjust saw height, rotate to other tasks)

Details

Some bricklayer (block) tasks performed alone result in hazard level exposures. Other bricklayer (block) tasks are not likely to be hazardous on their own, but can be hazardous when combined with similar tasks performed during the same day.

The following task (as commonly performed) is a possible stand-alone hazard zone task:

1) Saw Cutting of Block

Hazardous Activity: Workers doing extensive amounts of cutting can be exposed to too many hours of back and/or neck bending forward:

(Back bent: > 30 degrees for over 4 hrs per day; or > 45 degrees for over 2 hrs per day)

(Neck bent: > 45 degrees for over 4 hrs per day)

Control Example: Adjusting the saw height to better accommodate the workers' heights would reduce the bending below the hazardous level.

- Controls Summary:
- * Adjust saw height
(for example, place pallet under saw table)
 - * Stock blocks up off the ground
(for example, place a pallet, or extra material, under block stock at the saw)
 - * Rotate to other tasks

The following 3 tasks (as commonly performed) are unlikely to be stand-alone hazard zone tasks:

(Unless performed for uncommonly long amounts of time without rotation to other tasks)

Note: Tasks with similar risk factors may combine to reach hazard zone exposure levels.

2) Laying 8" Block

Activity: Heavy blocks (35 lb) are routinely lifted, held, and placed with a one-hand pinch grip.

Control Examples: Placing blocks with two hands (above waist height), buttering the block on leg or mud board, and job rotation to non-laying tasks, would reduce the duration of grip force to lower levels.

(Note: Routine block laying does not typically require a hazardous duration of grip force (> 3hrs per day), yet this task is recognized as a source of injury. These controls are therefore recommendations only, except in extreme duration of pinch grip situations.)

- Controls Summary:
- * Place blocks with two hands for courses above waist height, or lifting over vertical rebar
 - * Butter block on leg, mudboard, or block stack (to reduce time of high grip force)
 - * Rotate between laying, striking, cleaning

- Optional Good Ideas:
- * Set mortar on trowel by tapping trowel (not by flicking trowel in the air)

3) Laying 12" Block

Activity: Heavy blocks (50 lb) are routinely lifted, held, and placed by a single worker with one hand pinch grip.

Control Examples: Placing blocks with two workers, using two hands (above waist height), buttering the block on leg or mud board, and job rotation to non-laying tasks, would reduce the duration of grip force to lower levels.

(Note: Routine block laying does not typically require a hazardous duration of grip force (> 3hrs per day), yet this task is recognized as a source of injury. These controls are therefore recommendations only, except in extreme duration of pinch grip situations.)

- Controls Summary:
- * Use two workers to place 12" block on wall
 - * Place blocks with two hands for courses above waist height, or lifting over vertical rebar
 - * Rotate between laying, striking, cleaning

- Optional Good Ideas:
- * Set mortar on trowel by tapping trowel (not by flicking trowel in the air)
 - * Timing: Helper should rest block on leg – while waiting for mason to set prior unit (minimize time held against leg by not lifting block until mason is ready)
(Or do other tasks – for example, striking)

Pick the unit over the rebar

(incorporated into the Laying 8" Block and Laying 12" Block tasks)

Hazardous Activity: Heavy blocks are routinely lifted over the top of vertical rebar.

Control Example: Using two hands to support the block would reduce the hazardous exposure.

(Note: Routine block laying does not typically require a hazardous duration of grip force (> 3hrs per day), yet this task is recognized as a source of injury. These controls are therefore recommendations only, except in extreme duration of pinch grip situations.)

Controls Summary: * Use two hands to support block

Optional Good Ideas: * Use open end units
* Use continuous scaffolding
(to reduce the need to lift over the rebar)

4) Striking, Cleaning, Wiping

Activity: Workers performing routine striking/jointing, cleaning, wiping, tasks can be exposed to too many hours per day of highly repetitive wrist motions of the tool hand:

(> 6 hrs per day with bent wrist only) (no high hand force)

(> 2 hrs per day with bent wrist and high hand force (> 10 lbs per hand))

Control Example: Rotating between laying, striking/jointing, cleaning, wiping, (as is often done) would reduce the repetitive motion duration for the striking, cleaning, wiping, activities below the hazardous level:

Controls Summary: * Rotate between laying, striking/jointing, cleaning, wiping
(routinely do other tasks (for example, laying)
that are not rapidly repetitive wrist tasks)

Optional Good Ideas: * Teach/use low strain tool handling techniques
(low force, where possible)
(wrist relatively straight, where possible)
* Use tools with other hand part of the time

Hodcarriers (brick)

Table 3. Hodcarriers (brick): Tasks, Hazard Zone Risk Factors, Control Examples
(See Appendix – Table 3. Hodcarriers (brick))

Summary of Hazardous Exposures

Hodcarriers (brick) potential hazards are primarily due to:

- a) Lifting heavy frames, planks, scaffolding – while assembling scaffolds
(control ideas: use forklifts, more than one worker per lift, lift single items)
- b) Lifting heavy mortar bags, lifting heavy buckets -- while mixing mortar and stocking
(control ideas: use smaller (lighter) bags, distribute mortar by forklift/tub)
- c) Lifting heavy brick – while stocking
(control ideas: use block buggies, hand trucks; rotate to other tasks)

Details

Some hodcarrier (brick) tasks performed alone result in hazard level exposures. Other hodcarrier (brick) tasks are not likely to be hazardous on their own, but can be hazardous when combined with similar tasks performed during the same day.

The following 5 tasks (as commonly performed) are possible stand-alone hazard zone tasks:

1) Lifting Scaffolding Frames

Hazardous Activity: Heavy ladder frames and walk-through frames (45 lbs each) are lifted two at a time for offloading, erecting, moving, dismantling, loading scaffolding.

Control Examples: Using forklifts, or limiting manual lifting to one frame per worker, would remove the lifting hazard due to lifting over 45 lbs.

Basis of 45 lbs: (frame lifted from ground level, approximately 1 lift per min, between 1-2 hrs per day) ($50 \times .9 = 45$ lbs).

Controls Summary: * Use forklifts
* Lift one frame at a time (one worker – one frame)

Optional Good Ideas: * Stack frames standing up for manual lifting
(start lifting from between knee and waist level rather than from ground level)
* Tip a flat lying frame upright before lifting it
* Consider using continuous scaffolding
(using mechanical lifts or multiple workers to erect scaffold components)

2) Lifting Scaffolding Planks

Hazardous Activity: Heavy planks 9'(35 lb.), 12'(45 lbs.) 16'(60 lb.) are lifted for offloading, erecting, moving, dismantling, loading scaffolding.

Control Examples: Using forklifts, or limiting manual lifting to one plank per worker, would remove the lifting hazard due to lifting over 45 lbs.

Basis of 45 lbs: (frame lifted from ground level, approximately 1 lift per minute, between 1-2 hrs per day) ($50 \times .9 = 45$ lbs)

- Controls Summary:
- * Use forklifts
 - * Lift/carry one plank at a time
 - * Use additional worker(s) for lifting wet or otherwise heavy planks
 - * Lift one end of a plank at a time (wherever possible) (1/2 the weight)

Optional Good Ideas: * Scrape and clean planks after each use

3) Lifting Continuous Scaffolding

Hazardous Activity: Heavy sections of scaffolding (> 90 lbs) are lifted for offloading, erecting, moving, dismantling, and loading scaffolding.

Control Examples: Using forklifts, and/or using enough workers to reduce the weight lifted per worker to non-hazardous levels, would remove the hazard of lifting over 90 lbs (from the knee to waist level) or 70 lbs. from ground level (from below the knees).

- Controls Summary:
- * Use forklifts
 - * Use enough workers for non-hazardous manual lifting

4) Mixing, Stocking Mortar

Hazardous Activity: Heavy bags of cement (94 lbs) are lifted for mixing.

Control Examples: Use of a silo for mixing large volumes, or for the use of smaller bags (50 lbs max), and placing the bags up off the ground (for example, on pallets) would remove the hazard of lifting over 50 lbs from ground level (from below the knees).

- Controls Summary:
- * Use a silo for large projects
 - * Use smaller bags (50 lbs max), or cut large bags in half
 - * Place bags up off ground (for example, on pallets), and lift bags close to body

Hazardous Activity: Lifting/gripping a heavy (filled) wheelbarrow while stocking mortar.

(Lifting: > 90 lbs, from between knee and waist level)

(Gripping: > 10 lbs per hand, for > 4 hrs per day) (> 3 hrs per day with bent wrist)

Control Examples: Distributing mortar by forklift/tub, or limiting the wheelbarrow lifting load on the hands (to 90 lbs max), would remove the hazard of heavy lifting and high hand force (gripping).

Controls Summary:

- * Distribute mortar by forklift/tub or wheelbarrow
- * Limit wheelbarrow lifting load on hands (to 90 lbs max)
- * Rotate to other tasks

Optional Good Idea: * Use wheelbarrow with 3 or 4 wheels
(where wheelbarrow used)

5) Stocking Brick

Hazardous Activity: Heavy brick sets (tongs with 7 bricks) (28-35 lbs each set) are stocked (distributed) two tongs at a time by hand (one in each hand). Workers can be exposed to too much weight, too many hours per day, as well as too many hours of gripping brick tongs:

(Lifting: The once per day hazardous lifting weight is > 55 lbs (lifting from between the knee and waist)

(Gripping: > 10 lbs per hand for over 4 hrs per day)

Control Examples: Job rotation (for example, mixing mortar, stocking mortar, site cleanup, scaffold/plank moving, other miscellaneous hodcarrier tasks) would reduce the lifting hazard. Job rotation, use of a hand truck with cubing/banding, or brick buggy distribution of brick, would reduce the gripping hazard.

While stocking brick: Job rotation would reduce the hazard of lifting over 36 lbs, and remove the gripping hazards, associated with stocking 28-35 lb. brick sets).

(Two brick sets = 56-70 lbs)

Basis of 36 lbs: (brick sets lifted from between knee and waist level, approximately 2-3 lifts per minute, for 2+ hours per day) ($55 \times .65 = 36$ lbs)

Controls Summary:

(Lifting)

- * Rotate to other tasks
(for example, mixing mortar, stocking mortar, site cleanup, scaffold/plank moving, other misc. hodcarrier tasks)

(Gripping)

- * Rotate to other tasks
- * Hand truck distribution of brick (w/cubing/banding)
- * Use brick buggies

Optional Good Ideas: * Place pallets as close to masons' required location as possible, using forklifts

- * Lift brick sets close to the body
(step close to bricks sets or slide brick sets close to body before lifting, where possible)
- * Hand truck distribution of brick (w/cubing/banding)
- * Use brick buggies

Bricklayers (brick)

Table 4. Bricklayers (brick): Tasks, Hazard Zone Risk Factors, Control Examples
(See Appendix – Table 4. Bricklayers (brick))

Summary of Hazardous Exposures

Bricklayers (brick) potential hazards are primarily due to:

- a) Saw cutting of brick
(control ideas: adjust saw height, rotate to other tasks)

Details

Some bricklayer (brick) tasks performed alone result in hazard level exposures. Other bricklayer (brick) tasks are not likely to be hazardous on their own, but can be hazardous when combined with similar tasks performed during the same day.

The following task (as commonly performed) is a possible stand-alone hazard zone task:

1) Saw Cutting of Brick

Hazardous Activity: Workers doing extensive amounts of cutting can be exposed to too many hours of back and/or neck bending forward:

(Back bent: > 30 degrees for over 4 hrs per day; or > 45 degrees for over 2 hrs per day)

(Neck bent: > 45 degrees for over 4 hrs per day)

Control Examples: Adjusting the saw height to better accommodate the workers' heights, and stocking bricks up off the ground, would reduce the bending below the hazardous level.

- Controls Summary:
- * Adjust saw height
(for example, place pallet under saw table)
 - * Stock bricks up off the ground
(for example, place a pallet, or extra material, under brick stock at the saw)
 - * Rotate to other tasks

The following 2 tasks (as commonly performed) are unlikely to be stand-alone hazard zone tasks:

(Unless performed for uncommonly long amounts of time without rotation to other tasks)

Note: Tasks with similar risk factors may combine to reach hazard zone exposure levels.

2) Repetitive Brick Laying

Activity: A trowel is routinely used in a highly repetitive manner to butter bricks while brick laying. Highly repetitive motion time for the trowel hand can exceed 6 hrs per day.

Control Example: Rotating between laying, striking/jointing, cleaning, wiping, would reduce the repetitive motion below the hazard level.

Controls Summary: * Rotate between laying, striking/jointing, cleaning, wiping

Optional Good Ideas: * Set mortar on trowel by tapping trowel (not by flicking trowel in the air)

3) Striking, Cleaning, Wiping

Activity: Workers performing routine striking/jointing, cleaning, wiping tasks can be exposed to too many hours per day of highly repetitive motions of the tool hand:

(> 6 hrs per day with bent wrist only) (no high hand force)

(> 2 hrs per day with bent wrist and high hand force (> 10 lbs per hand))

Control Example: Rotating between laying, striking/jointing, cleaning, wiping, (as is often done) would reduce the repetitive motion below the hazard level.

Controls Summary: * Rotate between laying, striking/jointing, cleaning, wiping
(routinely do other tasks (for example, laying)
that are not rapidly repetitive wrist tasks)

Optional Good Ideas: * Teach/use low strain tool handling techniques
(low force, where possible)
(wrist relatively straight, where possible)
* Use tools with other hand part of the time

Finishers (tile)

Table 5. Finishers (tile): Tasks, Hazard Zone Risk Factors, Control Examples
(See Appendix – Table 5. Finishers (tile))

Summary of Hazardous Exposures

Finishers (tile) potential hazards are primarily due to:

- a) Lifting heavy tile boxes – while stocking
(*control ideas: distribute pallet loads with forklift, distribute boxes with hand truck, carry single boxes (where required); store boxes up off floor*)
- b) Lifting heavy thinset bags, lifting heavy thinset buckets -- while mixing thinset and stocking
(*control ideas: use smaller (lighter) bags (50 lb max); distribute thinset in partially filled 5 gal buckets, or smaller buckets*))
- c) Highly repetitive grouting
(*control ideas: rotate to other tasks*)

Details

Some finisher (tile) tasks performed alone result in hazard level exposures.

Other finisher (tile) tasks are not likely to be hazardous on their own, but can be hazardous when combined with similar tasks performed during the same day.

The following 3 tasks (as commonly performed) are possible stand-alone hazard zone tasks:

1) Stocking of Tile

Hazardous Activity: Heavy boxes of tile (50 lbs) are routinely lifted by finishers.

Control Examples: Distribution of pallet loads of boxes with forklifts (where appropriate), distribution of boxes with hand trucks, storing boxes up off the floor, and lift/carrying single boxes (where required) would remove the hazard of lifting over 50 lbs from floor level (from below the knees).

- Controls Summary:
- * Distribute pallet loads with forklift
 - * Distribute boxes with hand truck
 - * Store boxes up off floor (on pallets)
(between approximately knee and waist height)
 - * Lift/carry single boxes (where lifting is req'd)

2) Mixing, Stocking Thinset

Hazardous Activities: Heavy bags (50 –55 lbs) and buckets (5 gal of thinset may be > 50 lbs, 5 gal of water = 42 lbs) are lifted from floor level (from below the knees) while mixing and distributing thinset.

Control Examples: Use of smaller bags and buckets of material (50 lbs max), storing smaller bags up off the floor (above knee level), and distribution of material using hand trucks, would remove the hazard of lifting over 50 lbs from floor level (from below the knees).

- Controls Summary:
- * Use smaller bags and buckets of material to be mixed (50 lbs max)
 - * Use hand trucks where required to distribute material to be mixed
 - * Store bags up off floor (on pallets)
 - * Distribute mixed thinset in partially filled 5 gal buckets, smaller filled buckets, or use a hand truck

3) Grouting

Hazardous Activities: Workers performing routine trowel and/or sponge motions of the trowel hand while grouting can be exposed to too many hours per day of highly repetitive motion of the trowel hand:

(> 6 hrs per day with bent wrist only) (no high hand force)

(> 2 hrs per day with bent wrist and high hand force (> 10 lbs per hand))

Control Example: Rotating to other tasks (for example, scraping (floor/wall prep), wiping, stocking) would reduce the repetitive motion below the hazard level.

- Controls Summary:
- * Rotate to other tasks, where possible (for example, scraping (floor/wall prep), wiping, stocking, etc.)
 - * Rotate tasks with tile setter

- Optional Good Ideas:
- * Use high quality trowels, with easy to grip handles
 - * Wiping -- Use adequate amounts of clean water and sponges (reduce hand force by frequently cleaning sponges)
 - * Use tools (especially sponge) with other hand part of the time

Tile Setters

Table 6. Tile Setters: Tasks, Hazard Zone Risk Factors, Control Examples

(See Appendix – Table 6. Tile Setters)

Summary of Hazardous Exposures

Tile Setters potential hazards are primarily due to:

- a) Awkward postures (kneeling, hands over head, back bent) – while setting tile
(*control ideas: rotate to setting tile at different heights; rotate between kneeling and squatting, rotate to other tasks, rotate floor tile kneeling task with finisher*)
- b) Highly repetitive motion – while setting smaller tile (for example, 4” tile)
(*control ideas: rotate to installing larger tiles as well (less highly repetitive))*)
- c) Repeated impact (using the hand as a hammer while setting tile)
(*control ideas: use a wooden board and hammer, use a rubber mallet*)
- d) Lifting and repetitive motion for installing pavers
(*control ideas: rotate to non-installation tasks, use mechanical lifters/positioners*)

Details

Some tile setter tasks performed alone result in hazard level exposures.

Other tile setter tasks are not likely to be hazardous on their own, but can be hazardous when combined with similar tasks performed during the same day.

The following 4 tasks (as commonly performed) are possible stand-alone hazard zone tasks:

1) Installing Floor Tile

Hazardous Activity: Workers doing extensive amounts of floor tile installation can be exposed to more than 4 hours per day of kneeling.

Control Examples: Rotate between kneeling and squatting; rotating kneeling tasks with apprentice (finisher); and rotating to non-floor tile installation (wall tile, ceiling tile, other activities); would reduce kneeling below the hazard level.

- Controls Summary:
- * Rotate to installation at different levels
(rotate away from installing floor tiles)
 - * Rotate between kneeling and squatting
 - * Rotate kneeling tasks with apprentice (finisher)

- Optional Good Ideas:
- * Stand up as a break from kneeling – whenever possible
 - * Use high quality kneepads
(Note: Kneepads are not considered PPE for ergonomics. Kneepads distribute force on the knee’s surface, but don’t reduce the internal force on the knee joint.)

2) Installing Wall Tile

Hazardous Activity: Workers doing extensive amounts of wall tile installation can be exposed to too many hours of working with their hands above their head, with their backs bent, or kneeling:

(Hands over the head, or elbows over the shoulders: > 4 hrs per day)

(Back bent: > 30 degrees for more than 4 hrs per day, or > 45 degrees for more than 2 hrs per day)

(Kneeling: > 4 hrs per day)

Control Examples: Rotating to wall tile installation at different levels (lower and higher), or possibly floor tile installation, would reduce the hands above the head and back bent postures, and kneeling, below hazard levels. Kneeling can also be rotated with squatting and sitting. Rotating to floor tile installation would reduce exposure to hands above the head and back bent postures, but add too much kneeling if the wall tile installation task required extensive kneeling.

Hazardous Activity: Workers use their hand as a hammer for setting wall tiles.

(> once per minute for more than 2 hrs per day)

Control Examples: Use of a wooden board and hammer, a rubber mallet, or using press force only (no hard impact of hand) to set tiles, would reduce the repeated impact hazard below hazard levels.

Hazardous Activity: Workers doing extensive installation of small tiles (for example, 4”) can be exposed to highly repetitive motion of the tile-applying hand:

(> 6 hrs per day with bent wrist only) (no high hand force)

(> 2 hrs per day with bent wrist and high hand force (> 10 lbs per hand))

Control Example: Rotation away from application of many small tiles would reduce the repetitive motion below hazard levels.

Controls Summary:

(Hands above the Head) * Rotate to installation at different levels
 (lower and higher levels)
 or possibly floor tile installation

Optional Good Idea: * Stand on a stable non-slip platform for reaching
 higher wall areas

(Back Bent) * Sit on bucket/stool, or short rolling cart,
 for low wall work
 * Rotate to tile installation at lower or higher levels

(Kneeling) * Rotate between kneeling, squatting, and sitting
 * Rotate to tile installation at higher levels

(Repeated Impact) * Use wooden board and hammer
 * Use rubber mallet
 * Press force only (no hard impact on hand)

(Highly Repetitive Motion) * Rotate away from highly repetitive application of smaller tiles
(to installation of larger tiles, or to non-installation tasks)

Optional Good Idea: * Apply tiles with the other hand part of the time

3) Installing Tile Ceilings (tile overhead)

Hazardous Activity: Workers doing extensive amounts of tile ceiling installation can be exposed to more than 4 hours per day of working with their hands above their head.

Control Example: Rotation away from too many hours of overhead installation (for example, rotate to wall or floor tile) would reduce the hands above the head time below hazardous levels.

Hazardous Activity: Workers doing extensive installation of small tiles (for example, 4") can be exposed to highly repetitive motion of the tile applying hand:

(> 6 hrs per day with bent wrist only) (no high hand force)

(> 2 hrs per day with bent wrist and high hand force (> 10 lbs per hand))

Control Example: Rotation away from application of many small tiles would reduce the highly repetitive motion below hazard levels.

Controls Summary:

(Hands above the Head) * Rotate to installation at different levels
(rotate away from application of overhead tiles)

(Highly Repetitive Motion) * Rotate away from highly repetitive application of smaller tiles
(to installation of larger tiles, or to non-installation tasks)

Optional Good Idea: * Apply tiles with the other hand part of the time

4) Installing Pavers

Hazardous Activities: Workers doing extensive amounts of paver installation can be exposed to too many hours of kneeling, highly repetitive motion, and lifting:

(Kneeling: > 4 hrs per day)

Highly Repetitive Motion:

(> 6 hrs per day with bent wrist only) (no high hand force)

(> 2 hrs per day with bent wrist and high hand force (> 10 lbs per hand))

Control Examples: Rotating between kneeling, squatting, and sitting, where possible; rotation to non-installation tasks (for example, finishing tasks); and using mechanical lifters/positioners, where possible, to reduce the hazard of lifting 13-23 lb from ground level; would reduce the hazards below the hazard levels.

Basis of 23 lbs: (pavers lifted from ground level, 4-5 lifts per min, for 2+ hrs per day)

(50 x .45 = 23 lbs)

Basis of 13 lbs: (pavers lifted from ground level, 6-7 lifts per minute, for 2+ hrs per day)

(50 x .25 = 13 lbs)

Note: It is uncertain whether the lifting rate for paver installation is closer to 4-5 lifts per min or 6-7 lifts per min, so both calculations are shown.

Controls Summary:

- (Kneeling) * Rotate between kneeling, squatting, and sitting
-- where possible
 - (Highly Repetitive Motion) * Rotate to non-installation tasks (for example, finishing)
 - (Lifting) * Rotate to non-installation tasks (for example, finishing)
* Use mechanical lifters/positioners
(for example, devices that lift and place multiple pavers at once)
- Optional Good Ideas:
- * Stand up as a break from kneeling – whenever possible
 - * Use high quality kneepads
(Note: Kneepads are not considered PPE for ergonomics. Kneepads distribute force on the knee's surface, but don't reduce the internal force on the knee joint.)

Retaining Wall (dry stack only)**Table 7. Retaining Wall (dry stack only): Tasks, Hazard Zone Risk Factors, Control Examples**

(See Appendix – Table 7. Retaining Wall (dry stack only))

Summary of Hazardous Exposures

Retaining Wall potential hazards are primarily due to:

- a) Lifting heavy retaining wall blocks – while stocking, or positioning blocks on wall

(control ideas: use mechanical lifting aids, or two or more workers, to lift blocks; rotate workers to non-heavy lifting tasks)

Details

Some retaining wall tasks performed alone result in hazard level exposures.

Other retaining wall tasks are not likely to be hazardous on their own, but can be hazardous when combined with similar tasks performed during the same day.

The following 3 tasks (as commonly performed) are possible stand-alone hazard zone tasks:

1) Loading Block on Truck, or Directly from Stocking Truck to Wall Locations

Hazardous Activity: Heavy retaining wall blocks (60-120 lbs) are routinely loaded/unloaded by a single worker

Control Examples: Using mechanical lifting aids, or two or more workers, to lift the blocks, would remove the hazard of lifting over 47 lbs per worker.

Basis of 47 lbs: (blocks lifted from between knee and waist level, approximately 4-5 lifts per min, for < 1 hr per day) ($55 \times .85 = 47$ lbs)

Controls Summary: * Use mechanical lifting of pallet loads/blocks
 * Use two workers to lift blocks (< 94 lb block max)
 (2 x 47 = 94 lbs)

2) Unloading Block from Truck Bed, from Trailer, or from Pallet on Ground Carrying Block to Wall

Hazardous Activity: Heavy retaining wall blocks (60-120 lb) are routinely unloaded, lifted, held, and placed by a single worker

Control Examples: Using mechanical lifting aids, or two or more workers, to lift the blocks, would remove the hazard of lifting over 38 lbs per worker.

Basis of 38 lbs: (blocks lifted from between waist and shoulder level, approximately 1 lift per min, for 2+ hrs per day) ($50 \times .75 = 38$ lbs)

- Controls Summary:
- * Use mechanical lifting of blocks
(for example, distribute pallets along wall with forklift,
distribute blocks along wall with hand truck)
 - * Use two workers to lift blocks (< 76 lb block max)
(2 x 38 = 76 lbs)

3) Lift Block onto Wall and Position Block on Wall

Hazardous Activity: Heavy retaining wall blocks (60-120 lbs) are routinely lifted, held, and placed by a single worker. Workers are exposed to heavy lifting, and can be exposed to too many hours of back bending:

(Back bent: > 30 degrees for more than 4 hrs/day, or > 45 degrees for more than 2 hrs/day)

Control Examples: Using mechanical lifting aids, or two or more workers, to lift the blocks, would remove the hazard of lifting over 42 lbs per worker.

Basis of 42 lbs: (blocks lifted from between knee and waist level, approximately 1 lift per min, for 2+ hrs per day) ($55 \times .75 = 42$ lbs)

Controls Summary:

- (Lifting)
- * Use mechanical lifting of blocks
(for example, truck mounted or portable crane)
 - * Use two workers to lift blocks (< 84 lb block max)
(2 x 42 = 84 lbs)

Optional Good Idea: * Store blocks up off ground (on pallets)
(to lift blocks from above knee height)

- (Back Bent) * Rotate to other non-bending tasks

Conclusions

Possible “Hazard Zone” jobs in the masonry industry have been identified for workers in the block, brick and tile trades, based on a review of commonly performed masonry tasks, as defined by the working group. Hazard control examples for reducing these hazardous exposures have been identified.

This document is intended for use as a resource by masonry industry employers and workers preparing for the new ergonomics rule. It identifies tasks that may exceed the risk factor exposure limits specified by the rule, and lists possible hazard control examples for reducing hazard levels below the limits specified in the rule.

Caution Zone and Hazard Zone masonry tasks that are not addressed by this document must be addressed as well. This document has attempted to address the most common masonry tasks performed in these trades, and may not cover all possible hazardous tasks.

Employers are not limited to using only the hazard control examples given in this document when determining how to reduce hazardous exposures. If masonry industry or other interested parties identify additional hazard control options for these trades, the working group requests that these ideas be sent to L&I and/or the working group members for distribution to interested parties.

References

Everett, J. (1977), *Ergonomic Analysis of Constriction Tasks for Risk Factors of Overexertion Injuries*, final report for NIOSH grant #5 R03 OH03154-02, University of Michigan Center for Construction Engineering and Management Technical Report 96-27, Ann Arbor, MI: University of Michigan.

Kicklighter, C. (1997), *Modern Masonry: Brick, Block, Stone*, Goodheart-Willcox, Illinois.

Appendix: Masonry, Stonework, Tile Setting: Possible Hazard Zone Jobs and Risk Reduction Solutions (Tables)

- Table 1: Hodcarriers (block)
- Table 2: Bricklayers (block)
- Table 3: Hodcarriers (brick)
- Table 4: Bricklayers (brick)
- Table 5: Finishers (tile)
- Table 6: Tile Setters
- Table 7: Retaining Wall (dry stack only)

These tables list possible hazard zone jobs identified by the working group. For each task, the ergonomics rule hazard level exposure limits, hazard control examples, and optional good ideas for risk reduction, are shown.

* * * * *

Table 1. Hodcarriers (block)

Possible Hazard Zone Job (Individually hazardous tasks)	Hazards (Ergo Rule hazard levels listed)	Hazard Control examples (Safe Harbors)	Optional Good Ideas
Lifting Scaffolding Frames (offloading, erecting, moving, dismantling, loading) 1 frame: ~45 lbs 2 frames: ~90 lbs (exceeds manual lifting limits)	Lifting > 45 lbs (example calc.) (from ground level) (1 lift/min, for 1-2 hrs/day) (50 x .9 = 45 lbs)	* Use forklifts * Lift/carry one frame at a time (manually) (one worker -- one frame)	* Teach/use proper lifting techniques (individual worker lifting) (team lifting) * Stack frames standing up for manual lifting * Tip a flat lying frame upright before lifting it * Consider use of Continuous Scaffolding
Lifting Scaffolding Planks (offloading, erecting, moving, dismantling, loading) 9' = ~35 lbs, 12' = ~45 lbs 16' = ~60 lbs	Lifting > 45 lbs (example calc.) (from ground/floor level) (2-3 lifts/min, for < 1 hr/day) (50 x .9 = 45 lbs)	* Use forklifts * Lift/carry one plank at a time (manually) * Use additional worker(s) for lifting wet or otherwise heavy planks * Lift one end of a plank at a time wherever possible (1/2 the weight)	* Teach/use proper lifting techniques (individual worker lifting, team lifting) * Keep planks clean (eliminate mortar buildup)
Lifting Continuous Scaffolding (offloading, erecting, moving, dismantling, loading) Some sections > 90 lbs	Lifting > 90 lbs (example calc.) (from knee to waist level) Lifting > 70 lbs (example calc.) (from ground/floor level)	* Use forklifts * Use enough workers to reduce weight lifted per worker to non-hazardous levels	* Teach/use proper lifting techniques (individual worker lifting, team lifting)
Mixing, Stocking Mortar Mixing: (lifting bags, shoveling) bags: ~50 lbs, 94 lbs	Lifting > 50 lbs (from below knee level) Gripping > 10 lbs per hand > 4 hrs/day (> 3 hrs/day with bent wrist)	* Use a silo for large projects * Use small bags (50 lbs max), or cut large bags in half * Place bags up off ground (e.g., on pallets), and lift bags close to body * Rotate to other tasks	

Table 1. Hodcarriers (block) Cont.

<p>Stocking: (wheelbarrow use) lifting load on hands > 90 lbs?</p>	<p>Lifting > 90 lbs (from knee to waist level)</p> <p>Gripping > 10 lbs per hand > 4 hrs/day (> 3 hrs/day with bent wrist)</p>	<p>* Distribute mortar by forklift/tub</p> <p>* Limit wheelbarrow lifting load on hands (to 90 lbs max)</p> <p>* Rotate to other tasks</p>	<p>* Use wheelbarrow with 3 or 4 wheels (where wheelbarrow used)</p>
<p>Stocking Block 8" block: ~30-35 lbs (x2 = 70) 12" block: ~50 lbs (x2 = 100) (Note: two blocks lifted (one per hand) counts as one lift) (Note: putting blocks down at the final location doesn't count as a second "lift")</p>	<p>Lifting > 36 lbs (example calc.) (from knee to waist level) (~2-3 lifts/min, for 2+ hrs/day) (55 x .65 = 36 lbs)</p> <p>Gripping > 10 lbs per hand > 4 hrs/day</p>	<p>* Rotate to other tasks (e.g., mixing mortar, stocking mortar, site cleanup, scaffold/plank moving, using grout hose, other miscellaneous hodcarrier tasks)</p> <p>* Pallets loaded with block right side up (gripping flange on top)</p> <p>* Rotate to other tasks (e.g., grout hose)</p> <p>* Hand truck distribution of block (w/cubing/banding)</p> <p>* Use block buggies</p>	<p>* Place pallets as close to required location as possible (w/forklift) (string out materials along scaffold) (consider using 1/2 pallets of block)</p> <p>* Lift blocks close to the body (step close to blocks or slide blocks close to body before lifting, where possible)</p> <p>* Hand truck distribution of block (w/cubing/banding)</p> <p>* Use block buggies (Note: Further analysis is necessary to determine whether use of hand trucks/cubing/banding, or block buggies, would result in significant reduction in the lifting hazard for stocking block)</p>

Possible Hazard Zone Job

(Not individually hazardous tasks) (as typically performed)

The following tasks are not likely to result in hazardous exposures, unless performed for uncommonly long amounts of time, without rotation to other tasks. It is possible that these tasks may combine with other tasks to result in Hazard Zone exposure levels.

Table 1. Hodcarriers (block) cont.

Using Grout Hose (dragging, holding)	Gripping > 10 lbs per hand > 4 hrs/day	<ul style="list-style-type: none"> * Rotate worker positions on hose * Rotate to other tasks (e.g., stocking) * Use other procedures (grout hog) 	<ul style="list-style-type: none"> * Use hose designed for easy gripping * Modify hose for easier gripping (e.g., use rope or auto fan belt for better grip, attach non-slip tape or handles)
Consolidation	Gripping > 10 lbs per hand > 4 hrs/day	<ul style="list-style-type: none"> * Use low vibration vibrators (low vibration on worker) * Rotate to other tasks 	<ul style="list-style-type: none"> * Maintain/repair vibrators to minimize vibration on worker
	High Hand-Arm Vibration		<ul style="list-style-type: none"> * Use anti-vibration gloves and/or anti-vibration materials on vibrator (isolation pads between power head and hand)

Other Risk Factors

(Not covered by Ergonomics Rule) (risk reduction recommended, but not required by the rule)

None

Table 2. Bricklayers (block)

Possible Hazard Zone Job (Individually hazardous tasks)	Hazards (Ergo Rule hazard levels listed)	Hazard Control examples (Safe Harbors)	Optional Good Ideas
Saw Cutting of Block	Back bent > 30 deg, > 4 hrs/day, or > 45 deg, > 2 hrs/day Neck bent forward > 45 deg, > 4 hrs/day	* Adjust saw table height (e.g., place pallet under saw table) * Stock blocks up off ground (e.g., place pallet, or extra material, under block stack at the saw) * Rotate to other tasks	

Possible Hazard Zone Job
(Not individually hazardous tasks) (as typically performed)

The following tasks are not likely to result in hazardous exposures, unless performed for uncommonly long amounts of time, without rotation to other tasks. It is possible that these tasks may combine with other tasks to result in Hazard Zone exposure levels.

Laying 8" Block	Gripping > 10 lbs per hand > 3 total hrs/day	* Place block with two hands above the 4th course (above waist height), or lifting over vertical rebar * Butter block on leg, mud board, or block stack (to reduce time in hand) (i.e. to reduce grip force required) * Rotate between laying, striking, cleaning, wiping (routinely do tasks other than laying) * Don't limit tasks performed to just buttering or just picking	* Use open end units * Use continuous scaffolding (to reduce the need for lifting as high up over rebar)
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Table 2. Bricklayers (block) cont.

Setting mortar on trowel (same for 8", 12" block)	High Hand Force with bent wrist > 3 hrs/day (Note: This is a significant risk factor, but total time for the set motion is probably not > 3 hrs/day)		* Set mortar on trowel by tapping trowel (not by flicking trowel in the air)
Laying 12" Block	Gripping > 10 lbs per hand > 3 total hrs/day	<ul style="list-style-type: none"> * Use two workers to place 12" block on wall * Place block with two hands above the 4th course (above waist height), or lifting over vertical rebar * Rotate between laying, striking/jointing, wiping (routinely do tasks other than laying) * Don't limit tasks performed to just buttering or just picking 	<ul style="list-style-type: none"> * Timing: Helper should rest block on leg -- while waiting for mason to set prior unit (Note: minimize time held against leg by not lifting next block until mason is ready) (Or do other tasks (e.g., striking))
Striking, Cleaning, Wiping, (repetitive wrist tasks)	Highly Repetitive Wrist motions with bent wrist > 6 hrs/day, or with bent wrist and high hand force > 2 hrs/day High Hand Force (striking?) (Probably not > 10 lbs grip force)	<ul style="list-style-type: none"> * Rotate between laying, striking/jointing, cleaning, wiping (routinely do other tasks (e.g., laying) that are not rapidly repetitive wrist tasks) 	<ul style="list-style-type: none"> * Teach/use low strain tool handling techniques (low force, where possible) (wrist relatively straight, where possible) * Use tools with other hand part of the time

Other Risk Factors

(Not covered by Ergonomics Rule) (risk reduction recommended, but not required by the rule)

None

Table 3. Hodcarriers (brick)

Possible Hazard Zone Job (Individually hazardous tasks)	Hazards (Ergo Rule hazard levels listed)	Hazard Control examples (Safe Harbors)	Optional Good Ideas
Lifting Scaffolding Frames (offloading, erecting, moving, dismantling, loading) 1 frame: ~45 lbs 2 frames: ~90 lbs (exceeds manual lifting limits)	Lifting > 45 lbs (example calc.) (from ground level) (1 lift/min, for 1-2 hrs/day) (50 x .9 = 45 lbs)	* Use forklifts * Lift/carry one frame at a time (manually) (one worker -- one frame)	* Teach/use proper lifting techniques (individual worker lifting) (team lifting) * Stack frames standing up for manual lifting (lifting limit is greater above ground level) * Tip a flat lying frame upright before lifting it (tip-up is 1/2 the weight, then a better lift)
Lifting Scaffolding Planks (offloading, erecting, moving, dismantling, loading) 9' = ~35 lbs, 12' = ~45 lbs 16' = ~60 lbs	Lifting > 45 lbs (example calc.) (from ground/floor level) (2-3 lifts/min, for < 1 hr/day) (50 x .9 = 45 lbs)	* Use forklifts * Lift/carry one plank at a time * Use additional worker(s) for lifting wet or otherwise heavy planks) * Lift one end of a plank at a time wherever possible (1/2 the weight)	* Teach/use proper lifting techniques (individual worker lifting, team lifting) * Keep planks clean (eliminate mortar buildup to reduce weight)
Lifting Continuous Scaffolding (offloading, erecting, moving, dismantling, loading) Some sections > 90 lbs	Lifting > 90 lbs (example calc.) (from knee to waist level) Lifting > 70 lbs (example calc.) (from ground/floor level)	* Use forklifts * Use enough workers to reduce weight lifted per worker to non-hazardous levels	* Teach/use proper lifting techniques (individual worker lifting, team lifting)
Mixing, Stocking Mortar Mixing: (lifting bags, shoveling) bags: ~50 lbs, 94 lbs	Lifting > 50 lbs (from below knee level) Gripping > 10 lbs per hand > 4 hrs/day (> 3 hrs/day with bent wrist)	* Use a silo for large projects * Use small bags (50 lbs max) or cut large bags in half * Place bags up off ground (e.g., on pallets), and lift bags close to body * Rotate to other tasks	

Table 3. Hodcarriers (brick) cont.

<p>Stocking: (wheelbarrow use) lifting load on hands > 90 lbs?</p>	<p>Lifting > 90 lbs (from knee to waist level)</p> <p>Gripping > 10 lbs per hand > 4 hrs/day (> 3 hrs/day with bent wrist)</p>	<p>* Distribute mortar by forklift/tub * Limit wheelbarrow lifting load on hands (to 90 lbs max) * Rotate to other tasks</p>	<p>* Use wheelbarrow with 3 or 4 wheels (where wheelbarrow used)</p>
<p>Stocking Brick Lifting brick sets with tongs Brick sets: 4 lbs x 7 bricks = 28 lbs (x2 tongs = 56 lbs) 5 lbs x 7 bricks = 35 lbs (x2 tongs = 70 lbs) (Note: two tongs lifted (one per hand) counts as one lift) (Note: putting bricks down at the final location doesn't count as a second "lift")</p>	<p>Lifting > 36 lbs (example calc.) (from knee to waist level) (2-3 lifts/min, for 2+ hrs/day) (55 x .65 = 36 lbs)</p> <p>Gripping > 10 lbs per hand > 4 hrs/day</p>	<p>* Rotate to other tasks (e.g., mixing mortar, stocking mortar, site cleanup, scaffold/plank moving, other misc. hodcarrier tasks)</p> <p>* Rotate to other tasks * Hand truck distribution of brick (w/cubing/ banding) * Use brick buggies</p>	<p>* Place pallets as close to required location as possible (w/forklift) (string out materials along scaffold) (consider using 1/2 pallets of brick)</p> <p>* Lift brick sets close to the body (step close to brick sets or slide brick sets close to body before lifting, where possible)</p> <p>* Hand truck distribution of brick (w/cubing/ banding) * Use brick buggies (Note: Further analysis is necessary to determine whether use of hand trucks/ cubing/banding, or brick buggies, would result in significant reduction in the lifting hazard for stocking brick)</p>

Possible Hazard Zone Job

(Not individually hazardous tasks) (as commonly performed)

The following tasks are not likely to result in hazardous exposures, unless performed for uncommonly long amounts of time, without rotation to other tasks. It is possible that these tasks may combine with other tasks to result in Hazard Zone exposure levels.

None

Other Risk Factors

(Not covered by Ergonomics Rule) (risk reduction recommended, but not required by the rule)

None

Table 4. Bricklayers (brick)

Possible Hazard Zone Job (Individually hazardous tasks)	Hazards (Ergo Rule hazard levels listed)	Hazard Control examples (Safe Harbors)	Optional Good Ideas
Saw Cutting of Brick	Back bent > 30 deg, > 4 hrs/day, or > 45 deg , > 2 hrs/day Neck bent forward > 45 deg, > 4 hrs/day	* Adjust saw table height (e.g., place pallet under saw table) * Stock bricks up off ground (e.g., place pallet, or extra material, under brick stack at the saw) * Rotate to other tasks	
Possible Hazard Zone Job			
(Not individually hazardous tasks) (as commonly performed)			

The following tasks are not likely to result in hazardous exposures, unless performed for uncommonly long amounts of time, without rotation to other tasks. It is possible that these tasks may combine with other tasks to result in Hazard Zone exposure levels.

Repetitive Brick Laying	Highly Repetitive Motion of trowel hand > 6 hrs/day	* Rotate between laying, striking/jointing, cleaning, wiping (routinely do tasks other than laying) (e.g., striking/jointing, cleaning, wiping)	* Teach/use low strain trowel handling (apply mortar with low force)
Setting mortar on trowel	High Hand Force with bent wrist > 3 hrs/day (Note: This is a significant risk factor, but total time for the set motion is probably not > 3 hrs/day)		* Set mortar on trowel by tapping trowel (not by flicking trowel in the air)

Table 4. Bricklayers (brick) cont.

<p>Striking, Cleaning, Wiping, (repetitive wrist tasks)</p>	<p>Highly Repetitive Wrist motions with bent wrist > 6 hrs/day, or with bent wrist and high hand force > 2 hrs/day</p>	<p>* Rotate between laying, striking/jointing, cleaning, wiping (routinely do other tasks (e.g., laying) that are not rapidly repetitive wrist tasks)</p>	<p>* Teach/use low strain tool handling techniques (low force, where possible) (wrist relatively straight, where possible) * Use tools with other hand part of the time</p>
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Other Risk Factors

(Not covered by Ergonomics Rule) (risk reduction recommended, but not required by the rule)

None

Table 5. Finishers (tile)

Possible Hazard Zone Job (Individually hazardous tasks)	Hazards (Ergo Rule hazard levels listed)	Hazard Control examples (Safe Harbors)	Optional Good Ideas
Stocking of Tile (moving heavy boxes of tile) 1 box: ~50 lbs 2 boxes: ~100 lbs (exceeds manual lifting limits)	Lifting > 50 lbs (from floor level)	<ul style="list-style-type: none"> * Distribute pallet loads with forklift * Distribute boxes with handtruck * Store boxes up off floor (on pallets) * Lift/carry single boxes (where lifting req'd) 	
Mixing, Stocking Thinset Mixing: bags: 50-55 lbs buckets (bucketfulls): 5 gal thinset may be > 55 lbs 5 gal water = 42 lbs	Lifting > 50 lbs (from floor level) Lifting > 55 lbs (from between knee and waist level)	<ul style="list-style-type: none"> * Use small bags and buckets of material to be mixed and distributed (50 lbs max) * Use hand trucks where it is required to distribute material to be mixed, or lift/carry single bags * Store bags up off ground (on pallets) 	
Stocking: buckets (bucketfulls): > 50 lbs	Lifting > 50 lbs (from floor level)	<ul style="list-style-type: none"> * Distribute mixed thinset in partially filled 5 gal buckets, smaller filled buckets, or use a hand truck 	
Grouting	Highly Repetitive Motion of trowel hand(s), with high hand force > 2 hrs/day, or with low hand force > 6 hrs/day	<ul style="list-style-type: none"> * Rotate to other tasks, where possible (e.g., scraping (floor/wall prep), wiping, stocking, etc.) * Rotate tasks with tile setter 	<ul style="list-style-type: none"> * Teach/use low strain trowel handling (apply/spread thinset with low force) * Use high quality trowels, with easy to grip handles * Wiping -- Use adequate amounts of clean water and sponges (reduce hand force by (frequently cleaning sponges) * Use tools (especially sponge) with other hand part of the time

Table 5. Finishers (tile) cont.**Possible Hazard Zone Tasks**

(Not individually hazardous tasks) (as commonly performed)

The following tasks are not likely to result in hazardous exposures, unless performed for uncommonly long amounts of time, without rotation to other tasks. It is possible that these tasks may combine with other tasks to result in Hazard Zone exposure levels.

None

Other Risk Factors

(Not covered by Ergonomics Rule) (risk reduction recommended, but not required by the rule)

None

Table 6. Tile Setters

Possible Hazard Zone Job (Individually hazardous tasks)	Hazards (Ergo Rule hazard levels)	Hazard Control examples (Safe Harbors)	Optional Good Ideas
Installing Floor Tile	Kneeling > 4 hrs/day	<ul style="list-style-type: none"> * Rotate kneeling tasks with apprentice (finisher) * Rotate between kneeling and squatting * Rotate to non-floor tile installation -- where possible (wall tile, ceiling tile, other activities) 	<ul style="list-style-type: none"> * Stand up as a break from kneeling -- whenever possible * Use high quality kneepads (Note: Kneepads distribute force over a larger area of the knee's surface, but don't reduce the forces on the knee joint itself)
Installing Wall Tile	<p>Hands above the Head, or Elbows above the Shoulder, > 4 hrs/day</p> <p>Back Bent > 30 deg, > 4 hrs/day, or Back Bent > 45 deg, > 2 hrs/day</p> <p>Kneeling > 4 hrs/day</p> <p>Repeated Impact (using the hand as a hammer) (> once/min, > 2 hrs/day)</p> <p>Highly Repetitive Motion > 6 hrs/day or Highly Repetitive Motion, with wrist bent and high hand force,</p>	<ul style="list-style-type: none"> * Rotate to tile installation at lower levels (below shoulder level) or possibly floor tile installation * Sit on bucket/stool, or short rolling cart for low wall work * Rotate to tile installation at lower or higher levels * Rotate between kneeling, squatting and sitting * Rotate to tile installation at higher levels * Use wooden board and hammer * Use rubber mallet * Press force only (no hard impact on hand) 	<ul style="list-style-type: none"> * Stand on stable, non-slip step/platform for reaching higher wall areas
		<ul style="list-style-type: none"> * Rotate away from highly repetitive application of smaller tiles 	<ul style="list-style-type: none"> * Apply tiles with other hand part of the time

Table 6. Tile Setters cont.

	> 2 hrs/day		
	Pushing (not covered by Ergo Rule)	* Use wooden board and hammer * Use rubber mallet	
Installing Tile Ceilings (tile overhead)	Hands above the Head > 4 hrs/day	* Rotate between tile ceiling and wall or floor tile (rotate away from application of overhead tiles)	
	Highly Repetitive Motion > 6 hrs/day or Highly Repetitive Motion, with wrist bent and high hand force, > 2 hrs/day	* Rotate away from highly repetitive application of smaller tiles	* Apply tiles with other hand part of the time
Installing Pavers	Kneeling > 4 hrs/day	* Alternate between kneeling, squatting, and sitting -- where possible * Rotate to non-installation tasks -- where possible (example finishing)	* Stand up as a break from kneeling -- whenever possible * Use high quality kneepads (Note: Kneepads distribute force over a larger area of the knee's surface, but don't reduce the forces on the knee joint itself)
	Highly Repetitive Motion > 6 hrs/day or Highly Repetitive Motion, with wrist bent and high hand force, > 2 hrs/day	* Rotate to non-installation tasks -- where possible (example finishing)	
	Lifting > 23 lbs (example calc.) (from ground level) (~4-5 lifts/min, for 2+ hrs/day) (50 x .45 = 23 lbs) or Lifting > 13 lbs (example calc.) (from ground level)	* Rotate to non-installation tasks -- where possible (example finishing) * Use mechanical lifter/positioners (e.g., devices that lift and place multiple pavers at once)	

Table 6. Tile Setters cont.

(~6-7 lifts/min, for 2+ hrs/day)
 (50 x .25 = 13 lbs)

Possible Hazard Zone Tasks

(Not individually hazardous tasks) (as commonly performed)

The following tasks are not likely to result in hazardous exposures, unless performed for uncommonly long amounts of time, without rotation to other tasks. It is possible that these tasks may combine with other tasks to result in Hazard Zone exposure levels.

None

Other Risk Factors

(Not covered by Ergonomics Rule) (risk reduction recommended, but not required by the rule)

None

Table 7. Retaining Wall (dry stack only)

Possible Hazard Zone Job (Individually hazardous tasks)	Hazards (Ergo Rule hazard levels listed)	Hazard Control examples (Safe Harbors)	Optional Good Ideas
Loading Block on Truck, or Directly from Stocking Truck to Wall Locations Full size blocks: 60-90 lbs Largest blocks: 110-120 lbs?	Lifting > 47 lbs (example calc.) (from knee to waist level) (~4-5 lifts/min, for < 1 hr/day) (55 x .85 = 47 lbs) (Note: risk doesn't exist if blocks are not loaded/unloaded by hand)	* Use mechanical lifting of pallet loads * Use two workers to lift blocks (< 94 lbs)	
Unloading Block from Truck Bed, from Trailer, or from Pallet on Ground Carrying Block to Wall	Lifting > 38 lbs (example calc.) (from waist to shoulder level) (~1 lift/min, for 2+ hrs/day) (50 x .75 = 38 lbs)	* Distribute pallets along wall with forklift * Distribute blocks along wall with handtruck * Use two workers to lift blocks (< 76 lbs)	
Lifting Block onto Wall and Positioning Block on Wall	Lifting > 42 lbs (example calc.) (from knee to waist level) (~1 lift/min, for 2+ hrs/day) (55 x .75 = 42 lbs) Back Bent > 30 deg, > 4 hrs/day, or Back Bent > 45 deg, > 2 hrs/day	* Use two workers to lift blocks (< 84 lbs) * Use truck-mounted or portable crane to lift blocks onto wall and position block on wall * Rotate to other non-bending tasks	* Store blocks up off ground (on pallets)
<hr/> Possible Hazard Zone Job (Not individually hazardous tasks) (as commonly performed)			

The following tasks are not likely to result in hazardous exposures, unless performed for uncommonly long amounts of time, without rotation to other tasks. It is possible that these tasks may combine with other tasks to result in Hazard Zone exposure levels.

Table 7. Retaining Wall (dry stack only) **cont.**

None

Other Risk Factors

(Not covered by Ergonomics Rule) (risk reduction recommended, but not required by the rule)

None

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