CASE STUDY - Nailing	
TASK TITLE: Nailing	
Task Description:	Nailing involves the use of a hammer or nail gun to drive nails into a variety of materials. The hammering task can be done at a variety of heights and locations. Task duration is dependent on the complexity or nature of the product. Hammers and nail guns vary in size and weight depending on the size nail to be used and the type of material to be nailed. Typical jobs in which nailing is performed include: • carpentry • crating or other wood assembly processes • general maintenance Nailing may take place on bench tops, directly on wood structures, or on the floor.
Job Performance Measures Most Often Impacted by Nailing:	• Quality of the final product (structural integrity, free of defects, appearance) • Speed of completion of task
Typical Employee Comments about Nailing:	Personnel typically report fatigue or discomfort in the hands/wrists/arms, shoulders/neck and lower back. Primary: The primary body regions affected are typically the hands/wrists/arms and shoulders/neck. Secondary: In some cases, the following body regions are also affected: back/torso.
Suggested Level II Analysis:	Postural Analysis, Dynamic Task Analysis, Grip Force Measurement

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Reaching	• Work location is too high	123. Raise the person					
		• use a step stool or ladder	✓	✓	low	med	med
		• provide a fixed platform or scaffolding	✓	✓	med	med	med
		32. Lower the work piece/work surface					
		• modify existing table			med	med	med
		• provide an adjustable height work table	✓	✓ ✓	high	med	high
	• Number of fasteners determines the amount of nailing required	129. Reduce number of fasteners used	✓	✓	low to med	med	med
		140. Use alternative fasteners					
		• Use fasteners (such as screws) that reduce number of fasteners needed		✓	med	med	med

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
2. Arm forces: Repeated contraction of the muscles of the arm or holding/carry-ing materials	• Manual nailing causes high forces	66. Provide a power tool • use a power tool which does not require high force or high speed movements to activate (see Design Criteria section for power tool design criteria)		✓	med	med	med
	• Nail gun is heavy	59. Provide a lighter weight tool • provide lighter weight tool • provide appropriate sized hammer for each task		✓ ✓	med med	med med	med med
	• Carrying pieces of wood over long distances is fatiguing for arms	48. Provide a cart • use an available cart to transport wood	✓		low	med	high

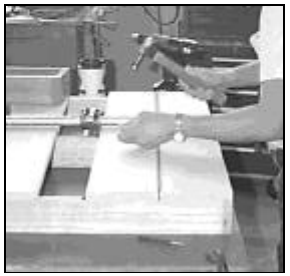
Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
3. High speed, sudden shoulder movements	• Manual nailing causes high speed movements	66. Provide a power tool • use a power tool which does not require high force or high speed movements to activate (see Design Criteria section for power tool design criteria)		✓	med	med	med
		140. Use alternative fasteners • Use fasteners (such as screws) that reduce number of fasteners needed		✓	med	med	med
4. Head/neck bent or twisted	• Rarely occurs to any significant exposure level	N/A					

Hand/Wrist/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
5. Bent wrists/repeated wrist movements or repeated forearm rotation	• Manual nailing causes wrist movements (see Figure 1.1)  **Figure 1.1** • Nailing is performed on flat work piece with a pistol-shaped nail gun.	77. Provide a tool with an appropriate handle angle • use a power tool which does not require awkward wrist movements or postures (see Design Criteria section for power tool design criteria) 136. Rotate the work piece • turn the work piece to an upright position/angle forward	 ✓	 ✓	 med low	 med med	 med med
6. Repeated manipulations with fingers	• Rarely occurs	N/A					
7. Hyper-extension of finger/thumb or repeated single finger activation	• Using nail gun causes repeated single finger trigger activation	62. Provide a multi-finger trigger • provide a tool with a two-finger trigger		✓	med	med	med

Hand/Wrist/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Hand/grip forces	• Tool or work piece must be manually supported, held or steadied (see Figure 1.2)	118. Provide support for the work piece • use clamp to stabilize part		✓	med	med	med
	 **Figure 1.2**	54. Provide a high friction gripping surface • provide a tool handle with a compressible grip surface		✓	med	med	med
		• wrap the hammer handle with friction tape	✓		low	med	med
	• Tool is too heavy	59. Provide a lighter weight tool • provide appropriate sized nail gun for the particular task		✓	med	med	med
	• Force required to activate the nail gun is excessive	34. Maintain hand tools/power tools • repair and lubricate tool to minimize forces required to activate	✓		low to med	med	med
		76. Provide a tool which requires minimal force to use • provide a nail gun with minimal force required to activate		✓	med	med	med

Hand/Wrist/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Force required to pound nails is excessive	140. Use alternative fasteners • Use fasteners (such as screws) that reduce number of fasteners needed and reduce forces required		✓	med	med	med
9. High speed hand/wrist/arm movements or vibration, impact or torque to the hand	• Manual nailing causes high speed movements and impact	66. Provide a power tool • provide a pneumatic nail gun		✓	med	med	med
10. Exposure to hard edges	• Rarely occurs	N/A					
11. Hands and fingers exposed to cold temperatures	• Work area is too cold	93. Provide appropriate gloves • (Caution: gloves of an inappropriate material or size can cause person to increase hand forces to perform task)	✓		med	med	med
		105. Provide portable heaters		✓	med	med	med

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
12. Repeated forward or sideways bending movements	• Rarely occurs (See question 15, static awkward postures)	N/A					
13. Twisting of the lower back	• Work space or access is limited	132. Remove obstructions 63. Provide a padded, compressible surface to lay on • provide a pad/mat	✓ ✓		low med	med med	med med
14. High speed, sudden movements	• Rarely occurs	N/A					

Back/Torso (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Static, awkward back postures	• Work location is too low	124. Raise the work piece/work surface					
		• provide a fixed table to support work piece		✓	med	med	med
		• provide an adjustable table for work piece		✓	med	med	med
		66. Provide a power tool					
		• increase the speed of the task to decrease the time bent forward.		✓	high	med	high
16. Lifting forces	• Rarely occurs (if it occurs, see Lifting case study)	N/A					
17. Pushing or pulling	• Rarely occurs	N/A					
18. Whole body vibration	• Rarely occurs	N/A					

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Fixed position, standing	• Standing on hard surface	96. Provide appropriate shoe inserts	✓		med	med	med
20. Exposure to hard edges on legs, knees, and feet	• Hard edges in work area contact legs/knees • Kneeling required	95. Provide appropriate knee protection	✓		med	med	med
21. Awkward leg postures	• Work location is too low	124. Raise the work piece/work surface • place the work piece on a fixed table • provide a support fixture	✓	✓	low med	med med	med med
22. Standing foot pedal	• Rarely occurs	N/A					

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
23. Difficult to see/light levels too low/too high	• Rarely occurs	N/A					
24. Intensive visual tasks, staring at work objects for long periods	• Rarely occurs	N/A					

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