

## CASE STUDY - 7 Drafting (CAD Systems):

### TASK TITLE: CAD Drafting

<b>Task Description:</b>	<p>CAD drafting involves the use of a tablet, keyboard, and standard-shaped mouse. The mouse fits into the palm activated by either a series of two or three buttons. The tablet is used in combination with the mouse and keyboard. The length of time drafting varies significantly for drafting tasks as well as the type of work that is typically performed. Information used for drafting typically comes from a hard copy (paper size varies).</p> <p>Typical jobs in which CAD drafting is performed include:</p> <ul style="list-style-type: none"><li>• engineering</li><li>• drafting</li></ul>
<b>Job Performance Measures Most often impacted by CAD Drafting:</b>	Error rates; number of drawings completed.
<b>Typical Employee Comments about CAD Drafting:</b>	Employees often comment on their concern over the repetitive nature of the mousing task on the tablet. Employees typically complain about discomfort and/or stiffness in the hands/wrists, arms, shoulders/neck, and head/eyes.
<b>Suggested Level II Analysis:</b>	Postural analysis, light level analysis.

**Shoulder/Neck**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Arms held away from body	<ul style="list-style-type: none"> <li>• Tablet positioned too high</li> </ul>  <p><b>Figure 7.1</b></p>	85. Raise chair: <ul style="list-style-type: none"> <li>• set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse;</li> <li>• a footrest may be required to support the person's feet.</li> </ul>	✓		low	low	low
		30. Lower keyboard tray or work surface: <ul style="list-style-type: none"> <li>• set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard.</li> </ul>	✓		low to med	low	med
	<ul style="list-style-type: none"> <li>• Chair positioned too far away</li> </ul>	33. Move chair closer to worksurface.	✓		low	low	low
	<ul style="list-style-type: none"> <li>• Arms of chair interfere with moving chair closer</li> </ul>  <p><b>Figure 7.2</b></p>	90. Remove or lower armrests: <ul style="list-style-type: none"> <li>• remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.</li> </ul>	✓		low to med	low	med
		78. Provide proper chair: <ul style="list-style-type: none"> <li>• provide a chair in which the armrests can be adjusted or removed.</li> </ul>		✓	med to high	med	med

**Shoulder/Neck**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Lack of a place to rest the hands</li> </ul>  <p><b>Figure 7.3</b></p>	<p>36. Move keyboard forward so forearms rest evenly on surface:</p> <ul style="list-style-type: none"> <li>if worksurface is deep enough, this is simply a matter of pushing the keyboard back on the worksurface;</li> <li>if the worksurface depth is restricted, providing this space would require using a different worksurface for computer work.</li> </ul>	✓		low	low	low
	<ul style="list-style-type: none"> <li>Lack of leg clearance under desk</li> </ul>	<p>89. Remove clutter from under work surface.</p>	✓		low	low	med
	<ul style="list-style-type: none"> <li>Mouse positioned too high</li> </ul>  <p><b>Figure 7.4</b></p>	<p>85. Raise chair:</p> <ul style="list-style-type: none"> <li>set the height of the chair so that the person's elbows are at the same height as the mouse;</li> <li>a footrest may be required to support the person's feet.</li> </ul>	✓		low	low	low
		<p>30. Lower keyboard tray or work surface:</p> <ul style="list-style-type: none"> <li>set the height of the mouse support surface so that the person's elbows are at the same height as the mouse.</li> </ul>	✓	✓	low to med	low	med

**Shoulder/Neck**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>• Mouse not positioned next to keyboard</li> </ul>  <p style="text-align: center;"><b>Figure 7.5</b></p>	<p>63. Position mouse next to keyboard:</p> <ul style="list-style-type: none"> <li>• provide a worksurface that allows the mouse and keyboard to be placed side by side and at the same height;</li> <li>• position mouse and keyboard so the forearm can be rested on the worksurface while keying and mousing.</li> </ul>	✓	✓	low to med	low	low
	<ul style="list-style-type: none"> <li>• Keyboard tray used with tablet placed on desk.</li> </ul>  <p style="text-align: center;"><b>Figure 7.6</b></p>	<p>17. Install larger keyboard tray:</p> <ul style="list-style-type: none"> <li>• replace the current keyboard tray with a tray which accommodates a mouse/input device and a keyboard.</li> </ul> <p>49. Place keyboard and mouse on work surface:</p> <ul style="list-style-type: none"> <li>• provide a work surface which is large enough to support a keyboard and mouse.</li> </ul>		✓	med	low	med
	<ul style="list-style-type: none"> <li>• Items used frequently not positioned close to the body</li> </ul>	<p>35. Move item in work zone:</p> <ul style="list-style-type: none"> <li>• frequently used items should be placed close to the body.</li> </ul>	✓		low	low	med

**Shoulder/Neck**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Multiple input devices used (e.g. keyboard, mouse, digital tablet)</li> <li>Input devices too far away from body</li> </ul>	34. Move items closer to body: <ul style="list-style-type: none"> <li>prioritize the location of input devices based on frequency of use.</li> <li>position the most frequently used input device so that the person does not have to reach or bend the wrist while using it.</li> </ul>	✓		low	med	med
2. Repeated reaching	<ul style="list-style-type: none"> <li>Reaching for items too far from body</li> </ul>  <p><b>Figure 7.7</b></p> <ul style="list-style-type: none"> <li>Multiple input devices used (e.g., keyboard, mouse, digital tablet)</li> <li>Input devices too far away from body</li> </ul>	35. Move items in work zone.	✓		low	low	med
	<ul style="list-style-type: none"> <li>Multiple input devices used (e.g., keyboard, mouse, digital tablet)</li> <li>Input devices too far away from body</li> </ul>	34. Move items closer to body: <ul style="list-style-type: none"> <li>prioritize the location of input devices based on frequency of use;</li> <li>position the most frequently used input device so that the person does not have to reach or bend the wrist while using it.</li> </ul>	✓		low	med	med
3. Shrugging: working with the shoulders shrugged	<ul style="list-style-type: none"> <li>Keyboard too high</li> </ul>	30. Lower keyboard tray or work surface: <ul style="list-style-type: none"> <li>set the height of the work surface so that the person's elbows are at the same height as</li> </ul>	✓	✓	low to med	low	med

**Shoulder/Neck**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		the keyboard.					
	<ul style="list-style-type: none"> <li>Chair positioned too low</li> </ul>	85. Raise chair: <ul style="list-style-type: none"> <li>set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse;</li> <li>a footrest may be required to support the person's feet.</li> </ul>	✓		low	low	low
	<ul style="list-style-type: none"> <li>Drawer under work surface restricts chair height</li> </ul>	71 Provide alternative work surface: <ul style="list-style-type: none"> <li>remove drawer;</li> <li>provide a workstation with no obstructions under the worksurface such as pencil drawers or structural brackets.</li> </ul>	✓		med	low	med
	<ul style="list-style-type: none"> <li>Person has tendency to tense the shoulders while working</li> </ul>	23. Incorporate health comfort strategies: <ul style="list-style-type: none"> <li>encourage the person to relax while working                             <ul style="list-style-type: none"> <li>– breath frequently</li> <li>– alternate tasks</li> <li>– stretch</li> <li>– take rest pauses</li> </ul> </li> </ul>	✓		low	low	med
		95. Train proper body mechanics/posture: <ul style="list-style-type: none"> <li>– encourage the person to let the shoulders drop down and relax while keying.</li> </ul>	✓		low	low	med

**Shoulder/Neck**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
4. Repeated arm forces	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
5. Holding/carrying materials	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
6. Cradling the telephone between the neck and shoulder	<ul style="list-style-type: none"> <li>Talking on the telephone (using a handset) while both hands are occupied (e.g., keying or doing paper work)</li> <li>Monitor positioned too low.</li> </ul>	<p>83. Provide telephone headset:</p> <ul style="list-style-type: none"> <li>provide a selection of head set types to choose from (e.g., over-the-head, over-the-ear).</li> </ul> <p>101. Use an available telephone headset.</p> <p>59. Position monitor just below eye level:</p> <ul style="list-style-type: none"> <li>raise the monitor;</li> <li>monitor should be positioned such that the top of the screen is between 0-4" (0-10.16cm) below eye height;</li> <li>use a monitor riser, CPU/hard drive, or other stable surface to position monitor at the correct height.</li> </ul>		✓	med	med	med
			✓		low	med	med
			✓		low	low	med



**Figure 7.8**

**Shoulder/Neck**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
7. Head Bent down, up, or neck twisted	<ul style="list-style-type: none"> <li>• Monitor and keyboard not aligned</li> </ul>  <p style="text-align: center;"><b>Figure 7.10</b></p> <ul style="list-style-type: none"> <li>• Monitor greater than 30" inches from eye causes the person to lean forward to read monitor</li> </ul>	<p>61. Position monitor in front of body:</p> <ul style="list-style-type: none"> <li>• position monitor so that it is directly behind the keyboard;</li> <li>• this allows the body to be in alignment and prevents twisting of the neck;</li> <li>• provide a worksurface that is deep enough to support the keyboard and the monitor screen. For large monitors, this indicates a worksurface which is at least 30" (76.2 cm) deep;</li> <li>• provide a worksurface that is large enough for computer and paper tasks;</li> <li>• use of keyboard trays and monitor support arms may be used in some situations, however, they often have unwanted side effects.</li> </ul> <p>34. Move items closer to body:</p> <ul style="list-style-type: none"> <li>• position monitor between 18" and 30" (45.72-76.2 cm ) from eyes;</li> <li>• 22"-24" (55.88-60.96 cm) is a good distance for many people.</li> </ul>	✓	✓	low	med	med
			✓		med to high	med	med
			✓		low	med to high	med

**Shoulder/Neck**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Uncorrected visual disorders cause the person to lean forward to read monitor or documents</li> <li>Individual wears bifocals</li> </ul>	<p>6. Check eyes and correct for visual disorders:</p> <ul style="list-style-type: none"> <li>encourage person to have visual disorders corrected.</li> </ul> <p>6. Check eyes and correct for visual disorders:</p> <ul style="list-style-type: none"> <li>provide monofocal or tri-focal computer glasses.</li> </ul> <p>59. Position monitor directly on the work surface:</p> <ul style="list-style-type: none"> <li>for bifocal users, place monitor directly on the work surface or a bit higher so that the head is upright not tilted ensure that this does not cause glare problems. If it does, computer glasses are a better solution).</li> </ul>	✓		med to high	med to high	high
				✓	med to high	med	med
			✓		low	low	med

**Shoulder/Neck**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Working with large documents (e.g., large drawings and CAD print-outs).</li> </ul>	4. Angle work surface to bring work closer to the body and the eye: <ul style="list-style-type: none"> <li>provide worksurfaces to support large documents;</li> <li>drawings that are frequently moved or written on should be placed on an angled worksurface (like a drawing board);</li> <li>drawings that are used for reference can be hung vertically;</li> <li>the goal is to position the document in a more upright position and close to the monitor screen if it is used in conjunction with computer tasks.</li> </ul>	✓		low	med	med
				✓	med	med	med

**Hands/Wrists/Arms**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Bent wrists	<ul style="list-style-type: none"> <li>• Keyboard/typewriter too high</li> <li>• Worksurface too high</li> <li>• Keyboard is above elbow height</li> </ul>	30. Lower work surface/keyboard tray: <ul style="list-style-type: none"> <li>• if the worksurface/keyboard tray is adjustable in height, set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard/mouse;</li> <li>• this is the preferred strategy because it doesn't require a foot rest.</li> </ul>	✓	✓	low to high	low	med
		85. Raise chair: <ul style="list-style-type: none"> <li>• set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse;</li> <li>• This strategy is best when the worksurface is not easily adjustable in height;</li> <li>• a footrest may be required to support the person's feet.</li> </ul>	✓		low	low	low

**Hands/Wrists/Arms**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Multiple input devices used (e.g. keyboard, mouse, digital tablet)</li> <li>Input devices too far away from body</li> </ul>	34. Move items closer to body: <ul style="list-style-type: none"> <li>prioritize the location of input devices based on frequency of use.</li> <li>position the most frequently used input device so that the person does not have to reach or bend the wrist while using it.</li> </ul>	✓		low	med	med
	<ul style="list-style-type: none"> <li>Keyboard/typewriter too low</li> <li>Keyboard is below elbow height when chair height is adjusted so that the person's feet are flat on the floor</li> </ul>	87. Raise keyboard or work surface: <ul style="list-style-type: none"> <li>if the worksurface/keyboard tray is adjustable in height, set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard/mouse;</li> <li>if the worksurface is not adjustable in height, try raising the entire workstation with risers. This works best for free standing furniture but often does not work for modular furniture;</li> <li>this is the preferred strategy because it doesn't require a foot rest.</li> </ul>	✓	✓	low	low	med

**Hands/Wrists/Arms**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Keyboard is sloped towards the person</li> </ul>	49. Place keyboard and mouse on worksurface: <ul style="list-style-type: none"> <li>lower the feet on the back of the keyboard;</li> <li>adjust the keyboard support surface so the keyboard is flat and level.</li> </ul>	✓		low	low	med
	<ul style="list-style-type: none"> <li>Person rests wrists on front edge of the keyboard or the work surface immediately in front of the keyboard</li> </ul>	96. Train proper keying style: <ul style="list-style-type: none"> <li>encourage person to maintain straight wrists while keying;</li> <li>encourage person to keep wrists free while keying ;</li> <li>encourage person to avoid bending the wrists while resting the hands when not keying.</li> </ul>	✓		low	med	med
		18. Install palm rest: <ul style="list-style-type: none"> <li>a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture;</li> </ul>	✓		low	med	med

**Hands/Wrists/Arms**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Leaning forward while keying or using the mouse</li> </ul>	95. Train proper body mechanics: <ul style="list-style-type: none"> <li>encourage person to rest the back against the back rest while keying or using the mouse; this reduces the tendency to bend the wrists back while keying or using the mouse.</li> </ul>	✓		low	med	med
	<ul style="list-style-type: none"> <li>Position of mouse in relation to keyboard</li> </ul>	107. Use keyboard tray that accommodates mouse, keyboard, and palm support.		✓	low to med	med	med
	<ul style="list-style-type: none"> <li>Mouse is too far away from body</li> </ul>	63. Position mouse next to keyboard: <ul style="list-style-type: none"> <li>position the mouse directly adjacent to the keyboard and at approximately the same height as the keyboard;</li> <li>position mouse and keyboard so the forearm can be rested on the worksurface while keying and mousing.</li> </ul>	✓		low	low	low
	 <p><b>Figure 7.11</b></p> <ul style="list-style-type: none"> <li>Using wrist movement to move mouse rather than arm movement</li> </ul>	95. Train proper body mechanics posture: encourage person to use a forearm movement to move the mouse rather than a wrist movement.	✓		low	low	low

**Hands/Wrists/Arms**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
9. Repeated wrist movements	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
10. Repeated finger movements	<ul style="list-style-type: none"> <li>Mousing speed and length of task</li> <li>Length of task without a work break</li> </ul>	67. Program macro keys to reduce keying: <ul style="list-style-type: none"> <li>macros are small programs that can be useful for highly repetitive keying or mousing actions.</li> </ul>	✓		low	high	high
		95. Train proper body mechanics posture: <ul style="list-style-type: none"> <li>Encourage the person to avoid rushing.</li> </ul>	✓		low	low	low
		13. Incorporate health comfort strategies: <ul style="list-style-type: none"> <li>- breath frequently</li> <li>- alternate tasks;</li> <li>- stretch;</li> <li>- take rest pauses.</li> </ul>	✓		low	med	med
11. Hyper-extension of finger/thumb	<ul style="list-style-type: none"> <li>Small input device (e.g., track ball, glide point) requires single finger activation.</li> </ul>	15. Install alternative mouse <ul style="list-style-type: none"> <li>provide a full-size input device such as a mouse or large track-ball.</li> </ul>		✓	low to high	low	med

Case Study 7 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Person has tendency to hyperextend fingers or thumbs while keying</li> </ul>	98. Train proper mousing style: <ul style="list-style-type: none"> <li>encourage person to avoid extending fingers while mousing or keying;</li> <li>encourage person to keep all of the fingers curled under and together.</li> </ul>	✓		low	low	low
12. Hand forces	<ul style="list-style-type: none"> <li>Person tends to hit keys hard</li> </ul>	96. Train proper keying style: encourage person to practice using as light a touch as possible on keys and buttons.	✓		low	low	low
	<ul style="list-style-type: none"> <li>Person tends to place a heavy grip on mouse or click mouse buttons hard</li> </ul>	98. Train proper mousing style: <ul style="list-style-type: none"> <li>encourage person to practice keeping a light grip on the mouse.</li> </ul>	✓		low	low	low
	<ul style="list-style-type: none"> <li>Keys are stiff</li> </ul>	22. Investigate use of alternative keyboard: <ul style="list-style-type: none"> <li>provide a keyboard with keys which do not require excessive forces to actuate; keys should provide adequate auditory and tactile feedback when actuated.</li> </ul>		✓	med to high	med	med

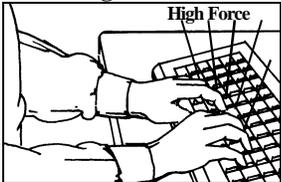
Case Study 7 (continued)

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>• Mouse buttons are stiff</li> <li>• Lack of appropriate tactile feedback (e.g., a “click”)</li> </ul>	15. Install alternative mouse: <ul style="list-style-type: none"> <li>• provide a mouse with buttons which do not require excessive forces to actuate.</li> </ul> 22. Investigate use of alternative keyboard: <ul style="list-style-type: none"> <li>• keys should provide adequate auditory and tactile feedback when actuated.</li> </ul> 15. Install alternative mouse: <ul style="list-style-type: none"> <li>• mouse buttons should provide adequate auditory and tactile feedback when actuated.</li> </ul>		✓ ✓ ✓	med to high low to high med to high	med med med	med med med

Case Study 7 (continued)

**Hands/Wrists/Arms**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
13. Hard edges	<ul style="list-style-type: none"> <li>• Wrists rest on edge of work surface (See Figures 7.12 and 7.13)</li> </ul> <p style="text-align: center;"><b>Figure 7.12</b></p>  <p style="text-align: center;"><b>Figure 7.13</b></p> 	<p>85. Raise chair:</p> <ul style="list-style-type: none"> <li>• set the height of the chair so that the person's elbows are at the same height as the keyboard or mouse;</li> <li>• Note: in some cases, a footrest will be required in order to support the person's feet .</li> </ul>	✓		low	low	low
		<p>30. Lower keyboard tray or work surface:</p> <ul style="list-style-type: none"> <li>• set the height of the keyboard/mouse support surface so that the person's elbows are at the same height as the keyboard.</li> </ul>	✓		low to med	low	med
		<p>36. Move keyboard forward so forearms rest evenly on surface:</p> <ul style="list-style-type: none"> <li>• this reduces the tendency to rest the wrists/forearms on the hard edge;</li> <li>• if the work surface depth is restricted, providing this space would require using a different work surface for computer work.</li> </ul>	✓		low	low	low
						✓	med

Case Study 7 (continued)

**Hands/Wrists/Arms**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		18. Install palm rest: <ul style="list-style-type: none"> <li>the hard edge can be eliminated by attaching a rounded edge to the front edge of the work surface. This option is generally preferred over the use of a palmrest;</li> <li>a palm rest can provide a comfortable place to rest when not keying and encourages neutral wrist posture;</li> <li>a palm rest is only necessary if there is not another comfortable place to rest the hands without having to bend the wrists;</li> <li>a palm rest is not recommended for a mouse because it results in awkward wrist movements.</li> </ul>	✓		low	med	med
	<ul style="list-style-type: none"> <li>Work surface is not deep enough to provide a place to rest the hands in front of the keyboard</li> </ul>	107. Utilize keyboard tray that accommodates mouse, keyboard, and palm support.		✓	high	med	med
	<ul style="list-style-type: none"> <li>Hard arm rests</li> </ul>	77. Provide larger work surface.		✓	med	med	med
		94. Train worker to properly adjust chair: <ul style="list-style-type: none"> <li>attach padding to the armrests to eliminate exposure to hard edges.</li> </ul>	✓		low	low	low

Case Study 7 (continued)

**Hands/Wrists/Arms**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		78. Provide proper chair • provide a chair with padded armrests		✓	med	low	low
14. Repeated forearm motion	Rarely occurs	N/A					

Case Study 7 (continued)

**Back/Torso**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
15. Leaning forward or poor lower back posture	• Monitor too far from eyes	58. Position monitor 18" - 30" (45.72-76.2 cm) from the eyes: <ul style="list-style-type: none"> <li>• 22"-24" (55.88-60.96 cm) is a good distance for many people.</li> </ul>	✓		low	med	med
	• Text is difficult to read	12. Improve character size and style on document and monitor: <ul style="list-style-type: none"> <li>• increase font size of text;</li> <li>• font size of at least 12 point is recommended for screen distances of 18"-30" (45.72-76.2 cm);</li> <li>• font sizes of greater than 12 point are recommended for screen distances of greater than 30" (76.2 cm).</li> </ul>	✓		low	med	med
	• Person has the unconscious habit of leaning forward while working	95. Train proper body mechanics: <ul style="list-style-type: none"> <li>• encourage person to rest the back against back rest and sit back and relax while working;</li> <li>• encourage person to push his or her chair toward the workstation in order to reduce the tendency to lean forward.</li> </ul>	✓		low	med	med

Case Study 7 (continued)

**Back/Torso**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Inappropriate chair adjustment</li> </ul>	94. Train worker to properly adjust chair: <ul style="list-style-type: none"> <li>adjust back rest to support lower back;</li> <li>pull chair forward and lean back while working;</li> <li>attach a small pillow to back rest to support lower back.</li> </ul>	✓		low	med	med
	<ul style="list-style-type: none"> <li>Inadequate chair</li> </ul>	78. Provide proper chair: <ul style="list-style-type: none"> <li>provide a chair with a back rest;</li> <li>provide a chair with adequate lower back support.</li> </ul>		✓	med to high	med	med
	<ul style="list-style-type: none"> <li>Chair arms interfere with moving chair closer</li> </ul>	90. Remove or lower armrests: <ul style="list-style-type: none"> <li>remove or adjust armrests, pencil drawers or other obstructions if they prevent the person from moving close enough to the workstation.</li> </ul>	✓		low to med	med	med
		78. Provide proper chair: <ul style="list-style-type: none"> <li>provide a chair in which the armrests can be adjusted or removed.</li> </ul>		✓	med to high	med	med

Case Study 7 (continued)

**Back/Torso**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>• Seat pan on chair is too deep</li> </ul>	<p>75. Provide back support:</p> <ul style="list-style-type: none"> <li>• attach a pillow to back rest to decrease the seat pan depth and support the lower back;</li> <li>• provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.</li> </ul>	✓		low to med	med	med
	<ul style="list-style-type: none"> <li>• Inadequate foot support causes person to not lean against back rest</li> <li>• Chair too high causes person not lean against back rest</li> </ul>	<p>76. Provide footrest:</p> <ul style="list-style-type: none"> <li>• provide a footrest which allows both the heels and toes to be supported;</li> <li>• a footrest can be a purchased item ;</li> <li>• a box or several ring binders taped securely together can also be used;</li> <li>• a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within several heights or are adjustable in height are preferred);</li> <li>• a footrest should be large enough to allow the feet to move freely (a size of 16" x 20" (40.64 cm X 50.8 cm) is recommended).</li> </ul>	✓	✓	med to high	med	med
					low to med	low	low

Case Study 7 (continued)

**Back/Torso**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
			✓		low	low	low
	<ul style="list-style-type: none"> <li>Working with large documents (e.g., large drawings and CAD print-outs)</li> </ul>	<p>28 Lower chair:</p> <ul style="list-style-type: none"> <li>adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest;</li> <li>care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.</li> </ul> <p>4. Angle work surface to bring work closer to the body and the eye:</p> <ul style="list-style-type: none"> <li>provide work surfaces to support large documents;</li> <li>drawings that are frequently moved or written on should be placed on an angled work surface (like a drawing board);</li> <li>drawings that are used for reference can be hung vertically;</li> <li>the goal is to position the document in a more upright position and close to the monitor screen if it is used in conjunction with computer tasks.</li> </ul>	✓		low to med	med	med

Case Study 7 (continued)

**Back/Torso**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
16. Repeated bending	<ul style="list-style-type: none"> <li>Reaching for items too far from body</li> </ul>  <p><b>Figure 7.14</b></p>	35. Move items in work zone.	✓		low	med	med
	<ul style="list-style-type: none"> <li>Working with large documents (e.g., large drawings and CAD print-outs)</li> </ul>	4. Angle work surface to bring work closer to the body and the eye: <ul style="list-style-type: none"> <li>provide work surfaces to support large documents;</li> <li>drawings that are frequently moved or written on should be placed on an angled work surface (like a drawing board);</li> <li>drawings that are used for reference can be hung vertically;</li> <li>the goal is to position the document in a more upright position and close to the monitor screen if it is used in conjunction with computer tasks.</li> </ul>	✓		low to med	med	med

Case Study 7 (continued)

**Back/Torso**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
17. Lifting forces	<ul style="list-style-type: none"> <li>Rarely occurs</li> </ul>	N/A					
18. No foot support	<ul style="list-style-type: none"> <li>Chair too high</li> </ul>	28. Lower chair: <ul style="list-style-type: none"> <li>adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest;</li> <li>care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.</li> </ul>	✓		low	low	low
	<ul style="list-style-type: none"> <li>Feet are unsupported</li> </ul>	76. Provide footrest: <ul style="list-style-type: none"> <li>provide a footrest which allows both the heels and toes to be supported;</li> <li>a footrest can be a purchased item or a box or several ring binders taped securely together;</li> <li>a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within several heights or are adjustable in height are preferred);</li> <li>a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64 cm X 50.8 cm) is recommended).</li> </ul>	✓		low to med	low	low

Case Study 7 (continued)

**Legs/Feet**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
19. Edge of seat or work surface presses into legs	<ul style="list-style-type: none"> <li>• Feet are not supported</li> </ul>	<p>76. Provide footrest:</p> <ul style="list-style-type: none"> <li>• a footrest can support the feet and simultaneously reduce pressure on the back of the leg;</li> <li>• a footrest can be a purchased item or a box or several ring binders taped securely together;</li> <li>• a footrest of one height may not be appropriate for all sized individuals or workstations (footrests within several heights or are adjustable in height are preferred);</li> <li>• a footrest should be large enough to allow the feet to move freely (a size of at least 16" x 20" (40.64 cm X 50.8 cm) is recommended).</li> </ul>	✓		low to med	low	low



**Figure 7.15**

Case Study 7 (continued)

**Legs/Feet**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		28. Lower chair: <ul style="list-style-type: none"> <li>adjust the chair height so that the person's heels and toes can both rest comfortably on the floor or other foot rest;</li> <li>care must be given to insure that adjusting the chair for the feet does not cause problems for the hands, wrists, and arms.</li> </ul>	✓		low	low	low
	• Seat pan has a hard front edge	94. Train worker to properly adjust chair: <ul style="list-style-type: none"> <li>provide a cushion for the seat pan to prevent contact with hard edge.</li> </ul>	✓		med	low	low
		78. Provide proper chair: <ul style="list-style-type: none"> <li>provide a chair with a rounded front edge on the seat pan.</li> </ul>		✓	med to high	low	low
	• Seat pan too long	75. Provide back support: <ul style="list-style-type: none"> <li>attach a pillow to back rest to decrease the seat pan depth and support the lower back;</li> <li>provide a chair with an adequate/adjustable seat pan depth and adequate lower back support.</li> </ul>	✓		med	low	low
				✓	med to high	med	med

Case Study 7 (continued)

**Legs/Feet**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>• Obstructions under work surface interfere with leg clearance and expose person to hard edges:                             <ul style="list-style-type: none"> <li>– pencil drawers;</li> <li>– keyboard trays;</li> <li>– or structural supports.</li> </ul> </li> </ul>	89. Remove clutter from under work surface: <ul style="list-style-type: none"> <li>• eliminate obstructions;</li> <li>• remove pencil drawers;</li> <li>• replace problem keyboard trays with trays that do not expose person to hard edges.</li> </ul>		✓	low to high	med	med
20. Hard floor surfaces	<ul style="list-style-type: none"> <li>• Rarely occurs</li> </ul>	N/A					
21. Kneeling/squatting	<ul style="list-style-type: none"> <li>• Rarely occurs</li> </ul>	N/A					

Case Study 7 (continued)

**Head/Eyes**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
22. Staring at screen or document	<ul style="list-style-type: none"> <li>Length of work task without a change of position for the eyes</li> </ul>	46. Periodically look away from screen.	✓		low	low	low
		13. Incorporate health comfort strategies: <ul style="list-style-type: none"> <li>encourage the person to relax while working               <ul style="list-style-type: none"> <li>– breath frequently</li> <li>– alternate tasks;</li> <li>– stretch;</li> <li>– take rest pause.</li> </ul> </li> </ul>	✓		low	low	low
23. Glare	<ul style="list-style-type: none"> <li>Glare directly from a light source: looking towards an uncovered window</li> <li>Glare from an uncovered window reflected off monitor or other shiny surfaces</li> </ul>  <p style="text-align: center;"><b>Figure 7.16</b></p>	53. Place the monitor perpendicular to the window.	✓		low to med	med	med
		8. Close blinds or curtains: <ul style="list-style-type: none"> <li>provide window coverings if not available.</li> </ul>	✓		low	med	med
	<ul style="list-style-type: none"> <li>Glare directly from a light</li> </ul>	60. Position the monitor between					

Case Study 7 (continued)

**Head/Eyes**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<p>source: looking towards an overhead light</p> <ul style="list-style-type: none"> <li>• Glare from an overhead or task light reflected off monitor or other shiny surfaces</li> </ul>	<p>rows of overhead lights:</p> <ul style="list-style-type: none"> <li>• position monitor so that no overhead lights are visible directly above the monitor when looking at the screen;</li> <li>• place the workstation so that it faces a wall or partition.</li> </ul>		✓	low to med	med	med
	 <p><b>Figure 7.17</b></p>	<p>31. Lower light levels:</p> <ul style="list-style-type: none"> <li>• remove pairs of fluorescent light bulbs from overhead fixtures. Note: this should be done with the assistance of appropriate technical assistance and the agreement of co-workers in the area.</li> </ul>		✓	low to med	med	med
		<p>20. Install parabolic louvers to direct light down on the surface:</p> <ul style="list-style-type: none"> <li>• provide alternative light fixtures for overhead lights (parabolic louver fixtures are recommended when computer work is the predominant activity.) Note: this should be performed by the appropriate personnel.</li> </ul>		✓	high	med	med
		<p>79. Provide screen hood/visor.</p>	✓		low	med	med
		<p>93. Tilt monitor down so that the screen is vertical.</p>	✓		low	med	med

Case Study 7 (continued)

**Head/Eyes**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Task light shines into eyes</li> </ul>  <p><b>Figure 7.18</b></p>	9. Cover or turn out under-cabinet lighting: <ul style="list-style-type: none"> <li>cover the task light to prevent it from shining into eyes.</li> </ul> 40. Move monitor out from under-cabinet lighting.  10. Direct task light away from screen and eyes: <ul style="list-style-type: none"> <li>if necessary, provide a more easily adjustable task light.</li> </ul>	✓		low	low	low
			✓		low	low	low
			✓		low	med	med
					low	low	low

Case Study 7 (continued)

**Head/Eyes**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
24. Light levels	<ul style="list-style-type: none"> <li>Light levels too high around monitor</li> <li>Light level too low to read document</li> </ul>	31. Lower light levels: <ul style="list-style-type: none"> <li>turn off task light;</li> <li>20-50 fc is an appropriate range of light levels for computer tasks;</li> <li>remove pairs of fluorescent light bulbs from overhead fixtures. Note: this should be done with the assistance of appropriate technical assistance and the agreement of co-workers in the area;</li> <li>provide alternative light fixtures for overhead lights (parabolic louvre fixtures are recommended when computer work is the predominant activity.) Note: this should also be performed by the appropriate personnel;</li> <li>if light levels for the monitor are adjusted appropriately, it may still be necessary to increase light levels for paper tasks using a task light/desk lamp.</li> </ul>	✓	✓	med to high	med	med

Case Study 7 (continued)

**Head/Eyes**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		82. Provide task light: <ul style="list-style-type: none"> <li>• provide task light (50-100 fc is an appropriate range of light levels for reading tasks);</li> <li>• increase overall light levels to meet the lighting needs of computer and paper tasks (50 fc is an appropriate light level where both computer and paper tasks are performed).</li> </ul>		✓	low to med	med	med
25. Screen Distance	<ul style="list-style-type: none"> <li>• Monitor positioned too close to eyes</li> <li>• Not enough work surface space to position monitor far enough away from person</li> <li>• Monitor positioned too far from eyes</li> </ul>	58. Position monitor 18" -30" (45.72-76.2 cm) from the eyes: <ul style="list-style-type: none"> <li>• 22"-24" (55.88 - 60.96 cm) is a good distance for many people.</li> </ul>	✓		low	med	med
		52. Place monitor on alternative work surface.		✓	med	med	med
		58. Position monitor 18" -30" (45.72-76.2 cm) from the eyes: <ul style="list-style-type: none"> <li>• 22"-24" (55.88 - 60.96 cm) is a good distance for many people.</li> </ul>	✓		low	med	med

Case Study 7 (continued)

**Head/Eyes**

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> <li>Uncorrected visual disorders</li> </ul>	6. Check eyes and correct for visual disorders: <ul style="list-style-type: none"> <li>provide computer glasses for person's who need bifocals, provide monofocal or tri-focal computer glasses.</li> </ul>		✓	med to high	med	med
26. Difficult to read	<ul style="list-style-type: none"> <li>Font/character size too small to read on computer screen</li> </ul>	12. Improve character size and style on document and monitor: <ul style="list-style-type: none"> <li>increase font size of text;</li> <li>font size of at least 12 point is recommended for screen distances of 18"-30" (45.72-76.2 cm);</li> <li>font sizes of greater than 12 point are recommended for screen distances of greater than 30".</li> </ul>	✓		low	med	med
	<ul style="list-style-type: none"> <li>Document text too small</li> </ul>	12. Improve character size and style on document and monitor: <ul style="list-style-type: none"> <li>increase character size.</li> </ul>	✓		low	med	med
	<ul style="list-style-type: none"> <li>Document text is hand written or hard to ready</li> </ul>	12. Improve character size and style on document and monitor: <ul style="list-style-type: none"> <li>increase character size.</li> </ul>		✓	low to high	med	med
	<ul style="list-style-type: none"> <li>VDT screen dirty.</li> </ul>	7. Clean screen regularly.	✓		low	med	med