

# Motion is Money<sup>®</sup>

Helping increase productivity and reduce risk.

MANUFACTURING



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Wasted motion decreases your workers' production and increases their risk of injury. This booklet will give you strategies, methods and ideas to enhance your workers' productivity and reduce risk factors. For every one percent reduction in risk, you can gain one percent improvement in productivity.

- Spend 30 to 60 minutes observing your workers walking, bending, reaching and carrying.
- Remember, unnecessary movement affects productivity and efficiency.
- Don't criticize during this time, but learn and then coach.

## Key Questions to Ask Yourself

- How much walking do you see?
- How many bends are occurring?
- How much reaching is occurring?
- How many employees are walking to get parts and tools?
- What are the distances employees are walking?
- What percentage of parts/tools can be staged off the floor or ground?
- How do we get parts/tools off the floor or ground?
- Are the right type and orientation of hand tools used? (e.g., pistol grip vs. in-line)
- What is the distance from point of installation to the tool crib or inventory?
- Was the best type of material handling equipment used?

## Observations

### Key factors:

Number of trips, number of minutes, per observation.

### Annualize all measurements:

- Treasure hunting (look for tools and materials)
- Distance walked (to and from tool room, inventory, staging point, warehouse and component bins)
- Frequency of trips
- Reaching into bins
- Carrying parts and sub-assemblies to production lines
- Bending over to the floor or ground, and lifting
- Working overhead, reaching
- Body posture while palletizing and depalletizing

### Typical times it takes to:

Bend to the floor – **3 seconds**

Walk 50 paces – **30 seconds**

Put down and pick up tools – **5 seconds**

## Example #1

### Bending Observation on Typical Job

#### Bending:

Number of workdays per year = 250

Number of bends performed in one hour = 50

50 bends x 3 seconds = 150 seconds

150 seconds x 8 hours = 1,200 seconds

= 20 labor minutes

20 labor minutes x 250 days = 5,000 labor minutes

5,000 / 60 minutes = 83 labor hours

Total number of employees on the job = 100

83 hours x 100 employees

= 8,300 labor hours per year

Hourly rate = \$ 20

8,300 labor hours x \$ 20 hourly rate

= \$ 166,000 cost of bending

## Worksheet #1

### Bending Observation on Typical Job

#### Bending:

Number of workdays per year =

Number of bends performed in one hour =

bends x 3 seconds =  seconds

seconds x 8 hours =  seconds

=  **labor minutes**

labor minutes x  days =  labor minutes

/60 minutes =  **labor hours**

Total number of employees on the job =

hours x  employees  
=  **labor hours per year**

Hourly rate = \$

labor hours x \$  hourly rate  
= \$  **cost of bending**

## Example #2

### Walking Observation on Typical Job

#### Walking:

Number of workdays per year = 250

Number of minutes walking = 10

$$\begin{aligned} 10 \text{ labor minutes} \times 250 \text{ workdays} &= 2,500 \text{ minutes}/60 \\ &= 42 \text{ labor hours} \end{aligned}$$

Total number of employees performing job = 100

$$\begin{aligned} 42 \text{ labor hours} \times 100 \text{ employees} &= 4,200 \text{ labor hours per year} \end{aligned}$$

Hourly rate = \$ 20

$$\begin{aligned} 4,200 \text{ labor hours} \times \$ 20 \text{ hourly rate} &= \$ 84,000 \text{ cost of walking} \end{aligned}$$

## Worksheet #2

### Walking Observation on Typical Job

#### Walking:

Number of workdays per year =

Number of minutes walking =

$$\begin{aligned} & \text{ labor minutes} \times \text{ workdays} \\ & = \text{ minutes}/60 \\ & = \text{ labor hours} \end{aligned}$$

Total number of employees performing job =

$$\begin{aligned} & \text{ labor hours} \times \text{ employees} \\ & = \text{ labor hours per year} \end{aligned}$$

Hourly rate = \$

$$\begin{aligned} & \text{ labor hours} \times \$ \text{ hourly rate} \\ & = \$ \text{ cost of walking} \end{aligned}$$

## Example #3

### Reaching in a Sitting Position

#### Reaching with Arm Extended to 15":

Number of workdays per year = 280

Number of reaches performed in one hour = 125

$$\begin{aligned}
 125 \times .66 \text{ of a second} &= 82.5 \text{ seconds} \times 8 \text{ hours} \\
 &= 660 \text{ seconds}/60 \\
 &= 11 \text{ labor minutes}
 \end{aligned}$$

$$\begin{aligned}
 11 \text{ labor minutes} \times 280 \text{ work days} &= 3,080 \text{ labor minutes}/60 \\
 &= 51.3 \text{ labor hours}
 \end{aligned}$$

Total number of employees reaching = 50

$$\begin{aligned}
 51.3 \text{ labor hours} \times 50 \text{ employees} &= 2,565 \text{ labor hours per year}
 \end{aligned}$$

Hourly rate = \$25 per/hour

2,565 labor hours x \$25 hourly rate

= \$64,125 cost of reaching in a sitting position

## Worksheet #3

### Reaching in a Sitting Position

#### Reaching with Arm Extended to 15":

Number of workdays per year =

Number of reaches performed in one hour =

$$\begin{aligned}
 \text{[ ]} \times .66 \text{ of a second} &= \text{[ ]} \text{ seconds} \times 8 \text{ hours} \\
 &= \text{[ ]} \text{ seconds}/60 \\
 &= \text{[ ]} \text{ labor minutes}
 \end{aligned}$$

$$\begin{aligned}
 \text{[ ]} \text{ labor minutes} \times \text{[ ]} \text{ work days} \\
 &= \text{[ ]} \text{ labor minutes}/60 \\
 &= \text{[ ]} \text{ labor hours}
 \end{aligned}$$

Total number of employees reaching =

$$\begin{aligned}
 \text{[ ]} \text{ labor hours} \times \text{[ ]} \text{ employees} \\
 &= \text{[ ]} \text{ labor hours per year}
 \end{aligned}$$

Hourly rate = \$  per/hour

$$\begin{aligned}
 \text{[ ]} \text{ labor hours} \times \$ \text{[ ]} \text{ hourly rate} \\
 = \$ \text{[ ]} \text{ cost of reaching in a sitting position}
 \end{aligned}$$

## Example #4

### Reaching in a Standing Position

#### Reaching with Arm Extended to 20":

Number of workdays per year = 280

Number of reaches performed in one hour = 100

$$\begin{aligned}
 100 \times .78 \text{ of a second} &= 78 \text{ seconds} \times 8 \text{ hours} \\
 &= 624 \text{ seconds}/60 \\
 &= 10.4 \text{ labor minutes}
 \end{aligned}$$

$$\begin{aligned}
 10.4 \text{ labor minutes} \times 280 \text{ work days} &= 2,912 \text{ labor minutes}/60 \\
 &= 48.5 \text{ labor hours}
 \end{aligned}$$

Total number of employees reaching = 50

$$\begin{aligned}
 48.5 \text{ labor hours} \times 50 \text{ employees} &= 2,425 \text{ labor hours per year}
 \end{aligned}$$

Hourly rate = \$25 per/hour

$$\begin{aligned}
 2,425 \text{ labor hours} \times \$25 \text{ hourly rate} &= \$60,625 \text{ cost of reaching in a standing position}
 \end{aligned}$$

## Worksheet #4

### Reaching in a Standing Position

#### Reaching with Arm Extended to 20":

Number of workdays per year =

Number of reaches performed in one hour =

$$\begin{aligned} \text{[ ]} \times .78 \text{ of a second} &= \text{[ ]} \text{ seconds} \times 8 \text{ hours} \\ &= \text{[ ]} \text{ seconds}/60 \\ &= \text{[ ]} \text{ labor minutes} \end{aligned}$$

$$\begin{aligned} \text{[ ]} \text{ labor minutes} \times \text{[ ]} \text{ work days} \\ &= \text{[ ]} \text{ labor minutes}/60 \\ &= \text{[ ]} \text{ labor hours} \end{aligned}$$

Total number of employees reaching =

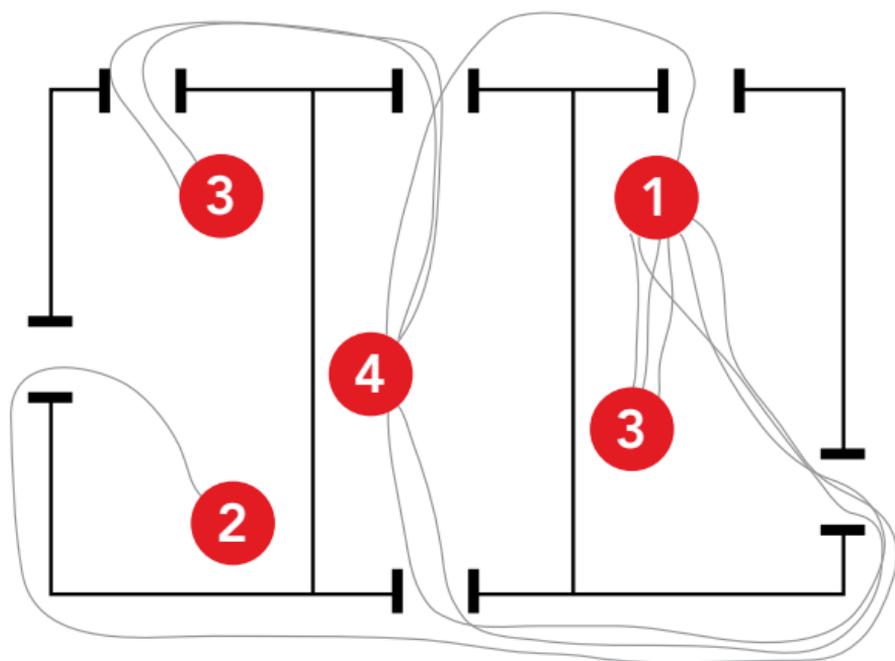
$$\begin{aligned} \text{[ ]} \text{ labor hours} \times \text{[ ]} \text{ employees} \\ &= \text{[ ]} \text{ labor hours per year} \end{aligned}$$

Hourly rate = \$  per/hour

$$\begin{aligned} \text{[ ]} \text{ labor hours} \times \$ \text{[ ]} \text{ hourly rate} \\ = \$ \text{[ ]} \text{ cost of reaching in a standing position} \end{aligned}$$

## Spaghetti Chart

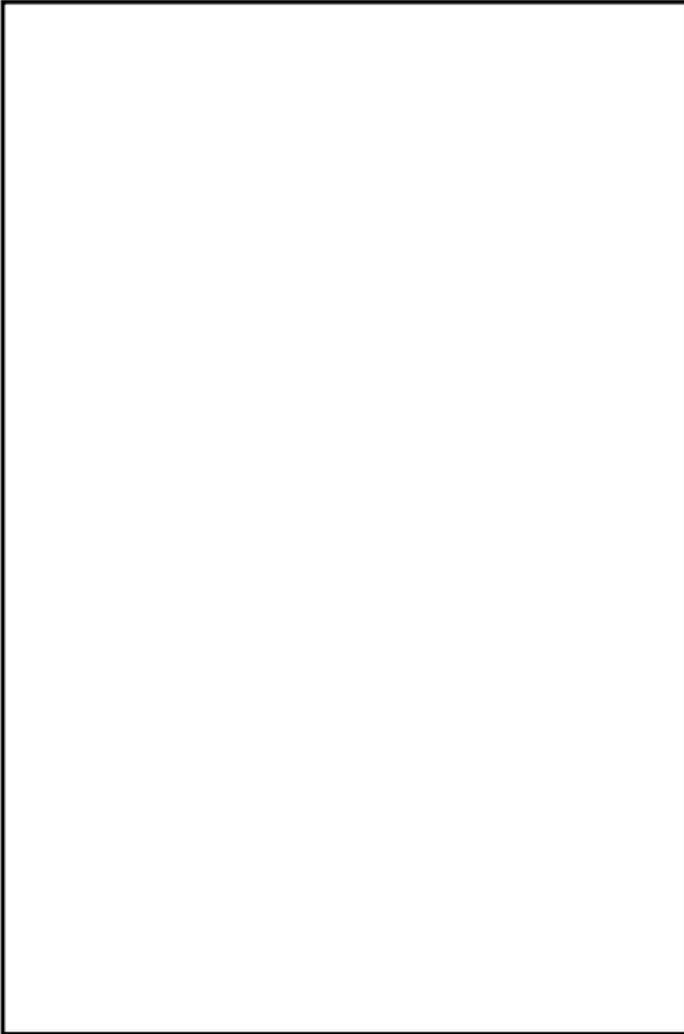
A Spaghetti Chart is a method of focusing on the movement of your employees and determining if there is excess walking or movement. This is a visual method of showing wasted motion.



- ① Assembly or Installation
- ② Tool Crib
- ③ Inventory
- ④ Finished Goods

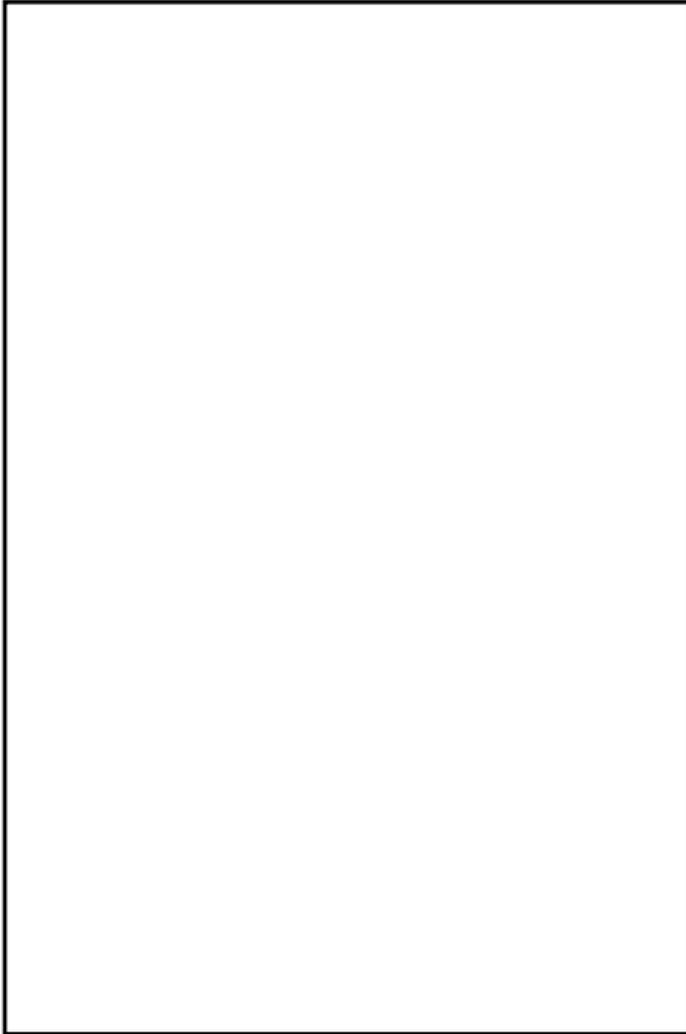
## Spaghetti Chart

Use this space to observe workplace movement.



## Spaghetti Chart

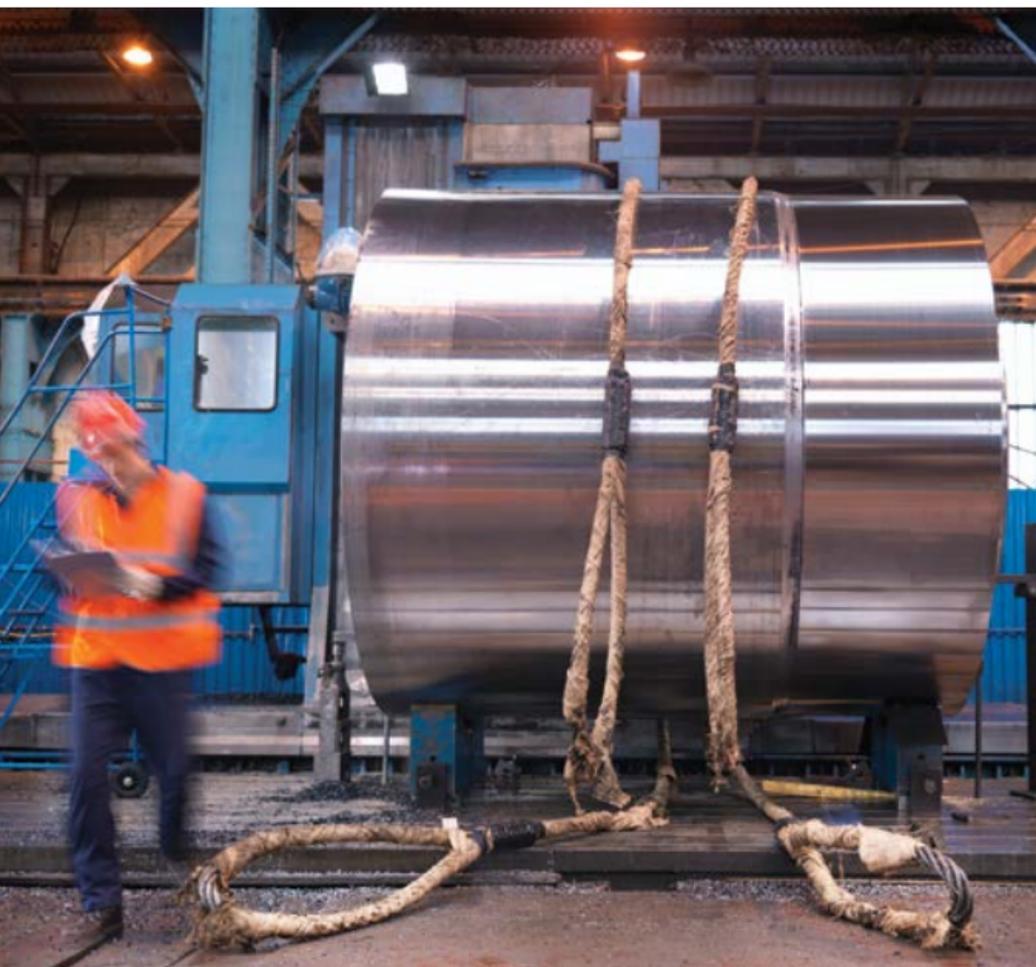
Use this space to observe workplace movement.





## Key Points to Remember

- Remember to annualize all numbers.
- Pre-planning must include the human interface.
- Keep parts, materials, work in process a minimum of 18 inches off floor to reduce bending, reaching and awkward postures.



## Common Conversions

60 seconds = 1 minute

3,600 seconds = 1 hour

28,800 seconds = 8-hour day

60 minutes = 1 hour

480 minutes = 8-hour day

19,200 minutes = 40-hour week

10 bends = 30 seconds

50 paces walking = 30 seconds





For more information,  
visit [www.cna.com/riskcontrol](http://www.cna.com/riskcontrol).



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