

### **3. EXAMPLE PROBLEMS**

#### **3.1. How to Use the Example Problems**

There are several approaches for controlling the stressors related to manual lifting. One approach is to eliminate the manual requirements of the job by using hoists, cranes, manipulators, chutes, conveyors, or lift trucks, or through mechanization or automation. If the manual requirements of the job cannot be eliminated, then the demands of the job should be reduced through ergonomic design/redesign (e.g., modify the physical layout of the job or reduce the frequency or duration of lifting). As a last resort, and if redesign is not feasible, the stress on the worker should be reduced by distributing the stress between two or more workers (e.g., team lifting).

In many cases elimination of manual lifting is not feasible or practical. Thus, ergonomic design/redesign is the best available control strategy. The goal of such a strategy is to reduce the demands of the job by reducing exposure to dangerous loading conditions and stressful body movements.

Ergonomic design/redesign includes: (1) physical changes in the layout of the job, (2) reductions in the lifting frequency rate and/or the duration of the work period, and (3) modifications of the physical properties of the object lifted, such as type, size, or weight and/or improvement of hand-to-object coupling.

The lifting equation and procedures presented in this document were designed to identify ergonomic problems, and evaluate ergonomic design/redesign solutions. By examining the value of each task multiplier, the penalties associated with each job-related risk factor can be evaluated, thereby determining their relative importance in consideration of alternate workplace designs. The task factors that cause the greatest reduction in the load constant should be considered as the first priority for job redesign.

Ten examples are provided to demonstrate the proper application of the lifting equation and procedures. The procedures provide a method for determining the level of physical stress associated with a specific set of lifting conditions, and assist in identifying the contribution of each job-related factor. The examples also provide guidance in developing an ergonomic redesign strategy. Specifically, for each example, a job description, job analysis, hazard assessment, redesign suggestion, illustration, and completed worksheet are provided. The ten examples were chosen to provide a representative sample of lifting jobs for which the application of this equation was suitable.

Note, you might obtain slightly different values from those displayed in the worksheet examples due to differences in rounding, especially when these values are compared to those determined from computerized versions of the equation. These differences should not be significant. Also, for these examples, multipliers are rounded to two places to the right of the decimal and weight limit (RWL, FIRWL, and STRWL) and lifting index values (LI, FILI, STLI, and CLI) are rounded to one place to the right of the decimal.

The examples are organized as follows:

- A. Single Task, Performed a Few Times Per Shift
  - Loading Punch Press Stock, Example 1
  - Loading Supply Rolls, Example 2
  - Loading Bags Into A Hopper, Example 3
- B. Single Task, Performed Repetitively
  - Package Inspection, Example 4
  - Dish-Washing Machine Unloading, Example 5
  - Product Packaging I, Example 6
- C. Multi-Task, Short Duration (1 hr or less)
  - Depalletizing Operation, Example 7
  - Handling Cans of Liquid, Example 8

**D. Multi-Task, Long Duration (more than 2 hours but less than 8)  
Product Packaging II, Example 9  
Warehouse Order Filling, Example 10**

To help clarify the discussion of the 10 example problems, and to provide a useful reference for determining the multiplier values, each of the six multipliers used in the equation have been reprinted in tabular form in Tables 1 through 5 and Table 7 on the following page.

**Table 1**  
Horizontal Multiplier

H	HM	H	HM
	in	cm	
≤10	1.00	≤25	1.00
11	.91	28	.89
12	.83	30	.83
13	.77	32	.78
14	.71	34	.74
15	.67	36	.69
16	.63	38	.66
17	.59	40	.63
18	.56	42	.60
19	.53	44	.57
20	.50	46	.54
21	.48	48	.52
22	.46	50	.50
23	.44	52	.48
24	.42	54	.46
25	.40	56	.45
>25	.00	58	.43
		60	.42
		63	.40
		>63	.00

**Table 3**  
Distance Multiplier

D	DM	D	DM
in		cm	
≤10	1.00	≤25	1.00
15	.94	40	.93
20	.91	55	.90
25	.89	70	.88
30	.88	85	.87
35	.87	100	.87
40	.87	115	.86
45	.86	130	.86
50	.86	145	.85
55	.85	160	.85
60	.85	175	.85
70	.85	>175	.00
>70	.00		

**Table 2**  
Vertical Multiplier

V	VM	V	VM
in		cm	
0	.78	0	.78
5	.81	10	.81
10	.85	20	.84
15	.89	30	.87
20	.93	40	.90
25	.96	50	.93
30	1.00	60	.96
35	.96	70	.99
40	.93	80	.99
45	.89	90	.96
50	.85	100	.93
55	.81	110	.90
60	.78	120	.87
65	.74	130	.84
70	.70	140	.81
>70	.00	150	.78
		160	.75
		170	.72
		175	.70
		>175	.00

**Table 4**  
Asymmetric Multiplier

A	AM
deg	
0	1.00
15	.95
30	.90
45	.86
60	.81
75	.76
90	.71
105	.66
120	.62
135	.57
>135	.00

**Table 5**  
Frequency Multiplier

F MHz/ min	DURATION					
	< 1 hour		1-2 hours		2-8 hours	
	V< 30 in	V≥ 30 in	V< 30 in	V≥ 30 in	V< 30 in	V≥ 30 in
≤2	1.00	1.00	.95	.95	.85	.85
.5	.97	.97	.92	.92	.81	.81
1	.94	.94	.88	.88	.75	.75
2	.91	.91	.84	.84	.65	.65
3	.88	.88	.79	.79	.55	.55
4	.84	.84	.72	.72	.45	.45
5	.80	.80	.60	.60	.35	.35
6	.75	.75	.50	.50	.27	.27
7	.70	.70	.42	.42	.22	.22
8	.60	.60	.35	.35	.18	.18
9	.52	.52	.30	.30	.00	.15
10	.45	.45	.26	.26	.00	.13
11	.41	.41	.00	.23	.00	.00
12	.37	.37	.00	.21	.00	.00
13	.00	.34	.00	.00	.00	.00
14	.00	.31	.00	.00	.00	.00
15	.00	.28	.00	.00	.00	.00
>15	.00	.00	.00	.00	.00	.00

**Table 7**  
Coupling Multiplier

COUPLING TYPE	CM	
	V < 30 in	V ≥ 30 in
GOOD	1.00	1.00
FAIR	.95	1.00
POOR	.90	.90

A series of general design/redesign suggestions for each job-related risk factor are provided in Table 8. These suggestions can be used to develop a practical ergonomic design/redesign strategy.

**Table 8**  
**General Design/Redesign Suggestions**

If HM is less than 1.0	Bring the load closer to the worker by removing any horizontal barriers or reducing the size of the object. Lifts near the floor should be avoided; if unavoidable, the object should fit easily between the legs.
If VM is less than 1.0	Raise/lower the origin/destination of the lift. Avoid lifting near the floor or above the shoulders.
If DM is less than 1.0	Reduce the vertical distance between the origin and the destination of the lift.
If AM is less than 1.0	Move the origin and destination of the lift closer together to reduce the angle of twist, or move the origin and destination further apart to force the worker to turn the feet and step, rather than twist the body.
If FM is less than 1.0	Reduce the lifting frequency rate, reduce the lifting duration, or provide longer recovery periods (i.e., light work period).
If CM is less than 1.0	Improve the hand-to-object coupling by providing optimal containers with handles or handhold cutouts, or improve the handholds for irregular objects.
If the RWL at the destination is less than at the origin	Eliminate the need for significant control of the object at the destination by redesigning the job or modifying the container/object characteristics. (See requirements for significant control, p. 36, 43.)

## **3.2. Jobs Performed a Few Times Per Shift**

### **3.2.1. Loading Punch Press Stock, Example 1**

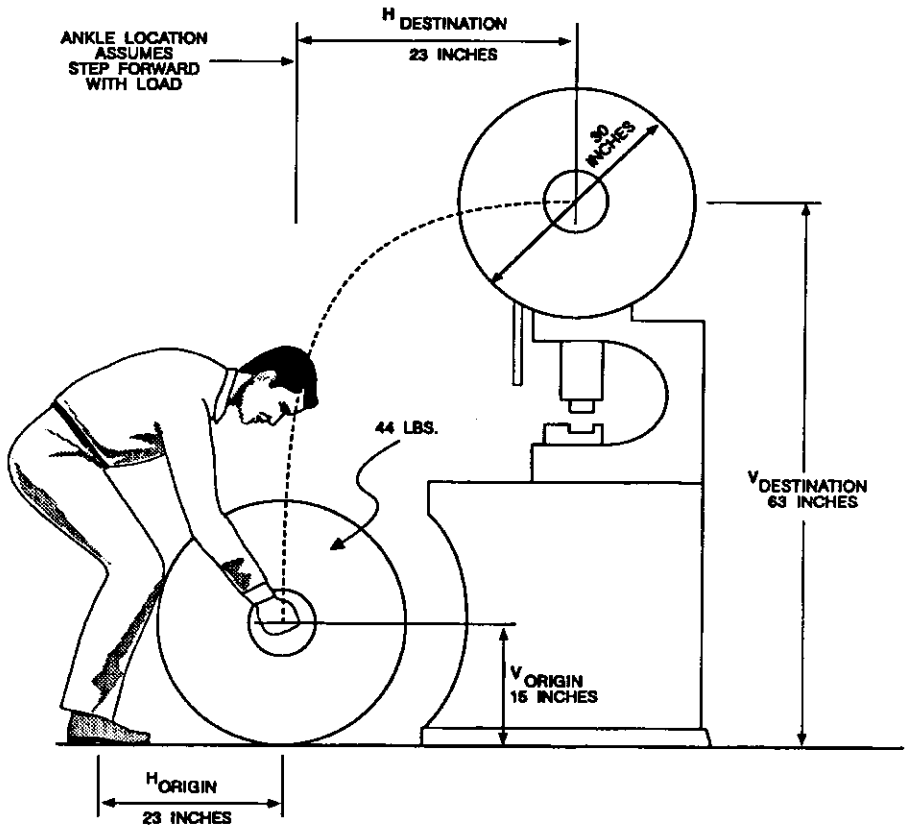
#### **3.2.1.1. Job Description**

Figure 5 illustrates a common oversight in physically stressful jobs. A punch press operator routinely handles small parts, feeding them into a press and removing them. A cursory view of this task may overlook the fact that once per shift the operator must load a heavy reel of supply stock (illustrated at floor height) from the floor onto the machine. The diameter of the reel is 30 inches, the width of the reel between the worker's hands is 12 inches, and the reel weighs 44 lbs. Significant control of the load is required at the destination of the lift due to the design of the machine. Also, the worker cannot get closer to the roll (i.e., between the legs) because the roll is too awkward.

#### **3.2.1.2. Job Analysis**

The task variable data are measured and recorded on the job analysis worksheet (Figure 6). Assuming the operator lifts the reel in the plane shown, rather than on the side of the machine, the vertical height (V) at the origin is 15 inches, the vertical height (V) at the destination is 63 inches, and the horizontal distance (H) is 23 inches at both the origin and the destination of the lift. The activity occurs only once per shift, so F is assumed to be < 0.2 (see Table 5), and duration is assumed to be less than 1 hour.

No asymmetric lifting is involved (i.e.,  $A = 0$ ), and according to Table 6, the couplings are classified as fair because the object is irregular and the fingers can be flexed about 90 degrees. Since significant control is required at the destination, the RWL must be computed at both the origin and the destination of the lift.



**Figure 5** Loading Punch Press Stock, Example 1

The multipliers are determined from the lifting equation or from tables (Tables 1 to 5, and Table 7). The CM is .95 at the origin and 1.0 at the destination, due to the difference in the vertical height at the origin and destination. As shown in Figure 6, the RWL for this activity is 16.3 lbs at the origin and 14.5 lbs at the destination.

### **3.2.1.3. Hazard Assessment**

The weight to be lifted (44 lbs) is greater than the RWL at both the origin and the destination of the lift (16.3 lbs and 14.5 lbs, respectively). The LI at the origin is  $44/16.3$  or 2.7, and the LI at the destination is  $44/14.5$  or 3.0. These values indicate that this lift would be hazardous for a majority of healthy industrial workers.

### **3.2.1.4. Redesign Suggestions**

The worksheet shown in Figure 6 indicates that the smallest multipliers (i.e., the greatest penalties) are .44 for the HM, .75 for the VM at the destination, and .86 for the DM. Using Table 8, the following job modifications are suggested:

1. Bring the object closer to the worker at the destination to increase the HM value.
2. Lower the destination of the lift to increase the VM value.
3. Reduce the vertical travel distance between the origin and the destination of the lift to increase the DM value.
4. Modify the job so that significant control of the object at the destination is not required. This will eliminate the need to use the lower RWL value at the destination.

If the operator could load the machine from the side, rather than the from the front, the reel could be turned 90° which would reduce the horizontal location of the hands at the origin.



## JOB ANALYSIS WORKSHEET

<b>DEPARTMENT</b>	Manufacturing	<b>JOB DESCRIPTION</b>	Loading supply stock onto
<b>JOB TITLE</b>	Punch Press Operator		punch press machine
<b>ANALYST'S NAME</b>			Example 1
<b>DATE</b>			

### STEP 1. Measure and record task variables

Object Weight (lbs)	Hand Location (in)		Vertical Distance (in)	Asymmetric Angle (degrees)		Frequency Rate (Hz/min)	Duration (HRS)	Object Coupling
	Origin	Dest.		Origin	Destination			
44	H	V	D	A	A	F	<.2	C
44	23	15	23	63	48	0	0	<1
								Fair

### STEP 2. Determine the multipliers and compute the RWL's

**RWL = LC × HM × VM × DM × AM × FM × CM**

**ORIGIN**      **RWL =**  $51 \times .44 \times .89 \times .86 \times 1.0 \times 1.0 \times .95 =$  16.3 Lbs

**DESTINATION**      **RWL =**  $51 \times .44 \times .75 \times .86 \times 1.0 \times 1.0 \times 1.0 =$  14.5 Lbs

### STEP 3. Compute the LIFTING INDEX

**ORIGIN**      **LIFTING INDEX =**  $\frac{\text{OBJECT WEIGHT (L)}}{\text{RWL}} = \frac{44}{16.3} =$  2.7

**DESTINATION**      **LIFTING INDEX =**  $\frac{\text{OBJECT WEIGHT (L)}}{\text{RWL}} = \frac{44}{14.5} =$  3.0

**Figure 6: Example 1, Job Analysis Worksheet**

(i.e., H = 10 inches) and destination of the lift (i.e., H = 12 inches). The grip, however, would be poor because the object is bulky and hard to handle and the fingers could not be flexed near 90° when picking up the reel (see Table 6, Note 4).

The RWL and corresponding LI values for this preferred combination of task variables (i.e., loading the machine from the side) are shown on the modified job analysis sheet (Figure 7). At the origin, the RWL is 35.1 lbs and the LI is 1.3. At the destination, the RWL is 24.6 lbs and the LI is 1.8. Since the LI is still greater than 1.0, however, a more comprehensive solution may be needed. This could include: (1) lowering the vertical height of the destination, which would increase the VM and the DM at both the origin and the destination of the lift; (2) reducing the size and/or weight of the supply reel; or, (3) transferring the supply reel from the storage area on a mobile, mechanical lifting device or jack that could be moved near the machine to eliminate the need for manual lifting. If it is not feasible to eliminate or redesign the job, then other measures, such as assigning two or more workers, could be considered as an interim control procedure.

#### **3.2.1.5. Comments**

Although ergonomic redesign is preferred, this example demonstrates how a change in work practices (i.e., insuring that the operator can load the reel from the side) can reduce the magnitude of physical stress associated with a manual lifting task. This approach, however, relies more on worker compliance than on physical job modifications.

## JOB ANALYSIS WORKSHEET

**DEPARTMENT** Manufacturing **JOB DESCRIPTION** Loading supply stock onto  
**JOB TITLE** Punch Press Operator **Destination** punch\_press\_machine  
**ANALYST'S NAME** \_\_\_\_\_ **Modified Example 1**  
**DATE** \_\_\_\_\_

### STEP 1. Measure and record task variables

Object Weight (lbs)	Hand Location (in)			Vertical Distance (in)	Asymmetric Angle (degrees)		Frequency Rate (Hz/min)	Duration (HRS)	Object Coupling
	Origin	Dest.	V		Origin	Destination			
L (AVG)   L (Max)	H   V	H   V	V	D	A	A	P		C
44	10	15	12	63	48	0	<.2	<.1	Poor

### STEP 2. Determine the multipliers and compute the RWL's

$RWL = LC \times HM \times VM \times DM \times AM \times FM \times CM$   
**ORIGIN**  $RWL = 51 \times 1.0 \times .89 \times 1.0 \times 1.0 \times .90 = 36.1 \text{ Lbs}$   
**DESTINATION**  $RWL = 81 \times .83 \times .75 \times 1.0 \times 1.0 \times .90 = 24.6 \text{ Lbs}$

### STEP 3. Compute the LIFTING INDEX

**ORIGIN**  $LIFTING INDEX = \frac{OBJECT WEIGHT (L)}{RWL} = \frac{44}{36.1} = 1.3$   
**DESTINATION**  $LIFTING INDEX = \frac{OBJECT WEIGHT (L)}{RWL} = \frac{44}{24.6} = 1.8$

**Figure 7: Modified Example 1, Job Analysis Worksheet**

## **3.2.2. Loading Supply Rolls, Example 2**

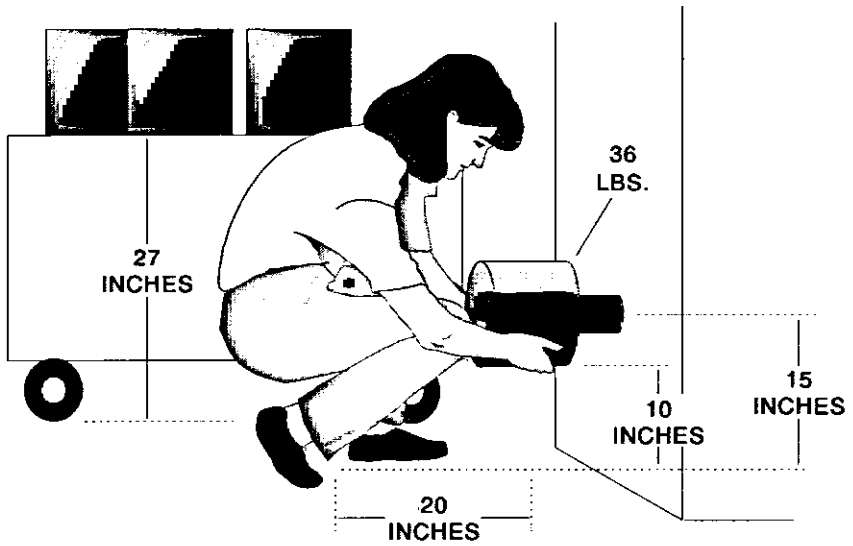
### **3.2.2.1. Job Description**

With both hands directly in front of the body, a worker lifts the core of a 35-lb roll of paper from a cart, and then shifts the roll in the hands and holds it by the sides to position it on a machine, as shown in Figure 8. Significant control of the roll is required at the destination of the lift. Also, the worker must crouch at the destination of the lift to support the roll in front of the body, but does not have to twist.

### **3.2.2.2. Job Analysis**

The task variable data are measured and recorded on the job analysis worksheet (Figure 9). The vertical location of the hands is 27 inches at the origin and 10 inches at the destination. The horizontal location of the hands is 15 inches at the origin and 20 inches at the destination. The asymmetric angle is 0 degrees at both the origin and the destination, and the frequency is 4 lifts/shift (i.e., less than .2 lifts/min for less than 1 hour - see Table 5).

Using Table 6, the coupling is classified as poor because the worker must reposition the hands at the destination of the lift and they can not flex the fingers to the desired 90° angle (e.g., hook grip). No asymmetric lifting is involved (i.e.,  $A = 0$ ), and significant control of the object is required at the destination of the lift. Thus, the RWL should be computed at both the origin and the destination of the lift. The multipliers are computed from the lifting equation or determined from the multiplier tables (Tables 1 to 5, and Table 7). As shown in Figure 9, the RWL for this activity is 28.0 lbs at the origin and 18.1 lbs at the destination.



**Figure 8 Loading Supply Rolls, Example 2**

## JOB ANALYSIS WORKSHEET

**DEPARTMENT** Shipping      **JOB DESCRIPTION** Loading paper supply rolls  
**JOB TITLE** Packager  
**ANALYST'S NAME** \_\_\_\_\_  
**DATE** \_\_\_\_\_      Example 2

**STEP 1. Measure and record task variables**

Object Weight (lbs)	Hand Location (in)		Vertical Distance (in)	Asymmetric Angle (degrees)		Frequency Rate (lifts/min)	Duration (HRS)	Object Coupling
	Origin	Dest.		Origin	Destination			
35	H	V	D	A	A	F	<.2	C
35	15	27	10	17	0	0	<.2	<1
								Poor

**STEP 2. Determine the multipliers and compute the RWL's**

$RWL = LC \times HM \times VM \times DM \times AM \times FM \times CM$   
**ORIGIN**       $RWL = [51] \times [67] \times [98] \times [93] \times [1.0] \times [1.0] \times [90] = 28.0 \text{ Lbs}$   
**DESTINATION**       $RWL = [51] \times [50] \times [85] \times [93] \times [1.0] \times [1.0] \times [90] = 18.1 \text{ Lbs}$

**STEP 3. Compute the LIFTING INDEX**

**ORIGIN**       $LIFTING INDEX = \frac{OBJECT WEIGHT (L)}{RWL} = \frac{35}{28.0} = 1.3$   
**DESTINATION**       $LIFTING INDEX = \frac{OBJECT WEIGHT (L)}{RWL} = \frac{35}{18.1} = 1.9$

**Figure 9: Example 2, Job Analysis Worksheet**

### **3.2.2.3. Hazard Assessment**

The weight to be lifted (35 lb) is greater than the RWL at both the origin and destination of the lift (28.0 lb and 18.1 lb, respectively). The LI at the origin is 35 lbs/28.0 lbs or 1.3, and the LI at the destination is 35 lbs/18.1 lbs or 1.9. These values indicate that this job is only slightly stressful at the origin, but moderately stressful at the destination of the lift.

### **3.2.2.4. Redesign Suggestions**

The first choice for reducing the risk of injury for workers performing this task would be to adapt the cart so that the paper rolls could be easily pushed into position on the machine, without manually lifting them.

If the cart cannot be modified, then the results of the equation may be used to suggest task modifications. The worksheet displayed in Figure 9 indicates that the multipliers with the smallest magnitude (i.e., those providing the greatest penalties) are .50 for the HM at the destination, .67 for the HM at the origin, .85 for the VM at the destination, and .90 for the CM value. Using Table 8, the following job modifications are suggested:

1. Bring the load closer to the worker by making the roll smaller so that the roll can be lifted from between the worker's legs. This will decrease the H value, which in turn will increase the HM value.
2. Raise the height of the destination to increase the VM.
3. Improve the coupling to increase the CM.

If the size of the roll can not be reduced, then the vertical height (V) of the destination should be increased. Figure 10 shows that if V was increased to about 30 inches, then VM would be increased from .85 to 1.0; the H value would be decreased from 20 inches to 15 inches, which would increase HM from .50 to .67.; the DM

would be increased from .93 to 1.0. Thus, the final RWL would be increased from 18.1 lbs to 30.8 lbs, and the LI at the destination would decrease from 1.9 to 1.1.

In some cases, redesign may not be feasible. In these cases, use of a mechanical lift may be more suitable. As an interim control strategy, two or more workers may be assigned to lift the supply roll.

#### **3.2.2.5. Comments**

The horizontal distance (H) is a significant factor that may be difficult to reduce because the size of the paper rolls may be fixed. Moreover, redesign of the machine may not be practical. Therefore, elimination of the manual lifting component of the job may be more appropriate than job redesign.



## JOB ANALYSIS WORKSHEET

**DEPARTMENT** Shipping      **JOB DESCRIPTION** Loading paper supply rolls  
**JOB TITLE** Packager  
**ANALYST'S NAME** \_\_\_\_\_  
**DATE** \_\_\_\_\_  
Modified Example 2

**STEP 1. Measure and record task variables**

Object Weight (lbs)	Hand Location (in)			Vertical Distance (in)	Asymmetric Angle (degrees)		Frequency Rate (lifts/min)	Duration (HRS)	Object Coupling
	Origin	Dest.	Dist.		Origin	Destination			
L (AVG.)	H	V	H	V	D	A	F		C
35	15	27	15	30	3	0	<.2	<.1	Poor

**STEP 2. Determine the multipliers and compute the RWL's**

**RWL = LC × HM × VM × DM × AM × FM × CM**  
**ORIGIN**    **RWL =**  $51 \times .67 \times .98 \times 1.0 \times 1.0 \times 1.0 \times .90 = 30.1 \text{ Lbs}$   
**DESTINATION**    **RWL =**  $51 \times .67 \times 1.0 \times 1.0 \times 1.0 \times 1.0 \times .90 = 30.8 \text{ Lbs}$

**STEP 3. Compute the LIFTING INDEX**

**ORIGIN**      **LIFTING INDEX =**  $\frac{\text{OBJECT WEIGHT (L)}}{\text{RWL}} = \frac{35}{30.1} = 1.2$   
**DESTINATION**      **LIFTING INDEX =**  $\frac{\text{OBJECT WEIGHT (L)}}{\text{RWL}} = \frac{35}{30.8} = 1.1$

**Figure 10: Example 2, Modified Job Analysis Worksheet**

### **3.2.3. Loading Bags Into A Hopper, Example 3**

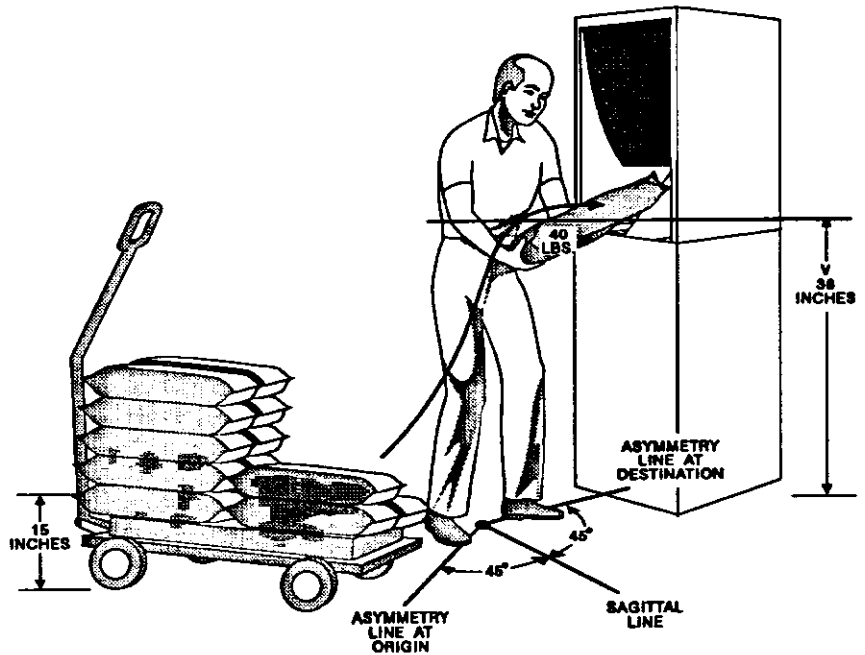
#### **3.2.3.1. Job Description**

The worker positions himself midway between the handtruck and the mixing hopper, as illustrated in Figure 11. Without moving his feet, he twists to the right and picks up a bag off the handtruck. In one continuous motion he then twists to his left to place the bag on the rim of the hopper. A sharp edged blade within the hopper cuts open the bag to allow the contents to fall into the hopper. This task is done infrequently (i.e., 1-12 times per shift) with large recovery periods between lifts (i.e., > 1.2 Recovery Time/Work Time ratio). In observing the worker perform the job, it was determined that the non-lifting activities could be disregarded because they require minimal force and energy expenditure.

Significant control is not required at the destination, but the worker twists at the origin and destination of the lift. Although several bags are stacked on the hand truck, the highest risk of overexertion injury is associated with the bag on the bottom of the stack; therefore, only the lifting of the bottom bag will be examined. Note, however, that the frequency multiplier is based on the overall frequency of lifting for all of the bags.

#### **3.2.3.2. Job Analysis**

The task variable data are measured and recorded on the job analysis worksheet (Figure 12). The vertical location of the hands is 15 inches at the origin and 36 inches at the destination. The horizontal location of the hands is 18 inches at the origin and 10 inches at the destination. The asymmetric angle is 45° at the origin and 45° at the destination of the lift, and the frequency is less than .2 lifts/min for less than 1 hour (see Table 5).



**Figure 11 Loading Bags Into Hopper, Example 3**

Using Table 6, the coupling is classified as fair because the worker can flex the fingers about  $90^\circ$  and the bags are semi-rigid (i.e., they do not sag in the middle). Significant control of the object is not required at the destination of the lift so the RWL is computed only at the origin. The multipliers are computed from the lifting equation or determined from the multiplier tables (Tables 1 to 5, and Table 7). As shown in Figure 12, the RWL for this activity is 18.9 lbs.

### **3.2.3.3. Hazard Assessment**

The weight to be lifted (40 lbs) is greater than the RWL (18.9 lbs). Therefore, the LI is  $40/18.9$  or 2.1. This job would be physically stressful for many industrial workers.

### **3.2.3.4. Redesign Suggestions**

The worksheet shows that the smallest multipliers (i.e., the greatest penalties) are .56 for the HM, .86 for the AM, and .89 for the VM. Using Table 8, the following job modifications are suggested:

1. Bringing the load closer to the worker to increase the HM.
2. Reducing the angle of asymmetry to increase AM. This could be accomplished either by moving the origin and destination points closer together or further apart.
3. Raising the height at the origin to increase the VM.

If the worker could get closer to the bag before lifting, the H value could be decreased to 10 inches, which would increase the HM to 1.0, the RWL would be increased to 33.7 lbs, and the LI would be decreased to 1.2 (i.e.,  $40/33.7$ ).

# JOB ANALYSIS WORKSHEET

**DEPARTMENT** Manufacturing **JOB DESCRIPTION** Dumping bags into mixing  
**JOB TITLE** Batch Processor **hopper**  
**ANALYST'S NAME** Example 3  
**DATE** \_\_\_\_\_

### STEP 1. Measure and record task variables

Object Weight (lbs)	Hand Location (in)			Vertical Distance (in)	Asymmetric Angle (degrees)		Frequency Rate (lifts/min)	Duration (hrs)	Object Coupling	
	Origin	Dest.			Origin	Destination				
L (AVG.)	H	V	H	V	A	A	F		C	
40	18	15	10	36	21	45	45	<.2	<.1	Fair

### STEP 2. Determine the multipliers and compute the RWL's

$$RWL = LC \times HM \times VM \times DM \times AM \times FM \times CM$$

**ORIGIN**  $RWL = 51 \times .56 \times .89 \times .91 \times .86 \times 1.0 \times .95 = 18.9 \text{ Lbs}$

**DESTINATION**  $RWL = 51 \times \square \times \square \times \square \times \square \times \square \times \square = \square \text{ Lbs}$

### STEP 3. Compute the LIFTING INDEX

**ORIGIN**      LIFTING INDEX =  $\frac{OBJECT \text{ WEIGHT (L)}}{RWL} = \frac{40}{18.9} = 2.1$

**DESTINATION**      LIFTING INDEX =  $\frac{OBJECT \text{ WEIGHT (L)}}{RWL} = \frac{\square}{\square} = \square$

**Figure 12: Example 3, Job Analysis Worksheet**

### **3.2.3.5. Comments**

This example demonstrates that certain lifting jobs may be evaluated as a single-task or multi-task job. In this case, only the most stressful component of the job was evaluated. For repetitive lifting jobs, the multi-task approach may be more appropriate. (See Examples 7-10).