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Human Factors and Work Measurement Lab

A case study on using the NIOSH lifting equation (RWL)

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Introduction

The most frequent medical condition that most individuals experience at work or in daily life is low back discomfort, which often affects the third to fifth lumber and causes disability as a result of repetition. From this point on, it is important to realize that the NOISH lifting equation is used to ascertain how hard labor contributes to the growth of this significant issue and to pinpoint methods to make all activities safer.

Acute pain is caused by overusing the muscle, whereas cumulative discomfort, such as Carpal Tunnel Syndrome, results from overexcretion of the muscle. On average, 29 days are lost per 100 employees owing to LBP (Lower Back Pain).

In order to determine the lifting index based on the required weight limit of 23 kg, we used the NOISH equation to a constructions worker moving a block weights 10 kg from the ground to 1-meter heigh, with a frequency of 0.5 lift/min.

Review of basic theory

The **NIOSH Lifting Equation** is a tool used by occupational health and safety professionals to assess the manual material handling risks of low-back disorder associated with repeated lifting and lowering tasks in the workplace. This equation considers job task variables to determine safe lifting practices and guidelines. it consists of two primary products:

Recommended Weight Limit (RWL)

The weight of the load that nearly all healthy workers could perform over a substantial period of time without an increased risk of developing lifting-related low back pain.

Lifting Index (LI)

A term that provides a relative estimate of the level of physical stress associated with a particular manual lifting task. LI = Weight of Load Lifted / RWL

Technical Requirements for Using the Revised NIOSH Equation:

- Smooth Lift (no jerking)
- Two Handed Lift
- Moderate Width of Load (75 cm max)
- Unrestricted Posture
- Good Foot Traction
- Optimal Environment (Low humidity and temperature, good lighting, quiet).

Procedure

- Observe the Task selected and determine the assessment approach.
- Note the position of feet, location of hands and coupling classification
- Mark mid-point between ankles
- Mark the midpoint between the hand grasps
- Specify the asymmetry angle at both origin and destination
- We must adjust the weight of the box by filling it with the load appropriate.
- Take the measurements of the horizontal H distance and the vertical distance V, at both the origin and the destination.
- Specify the frequency of lift assume applying an 8 hours standard industrial shift in your case study.
- Apply the RWL using the NAIOSH equation and calculate the maximum weight limit for your case study.
- Set your ergonomic design priorities and alternative design -if necessary- for your case study by calculating the lifting index LI.

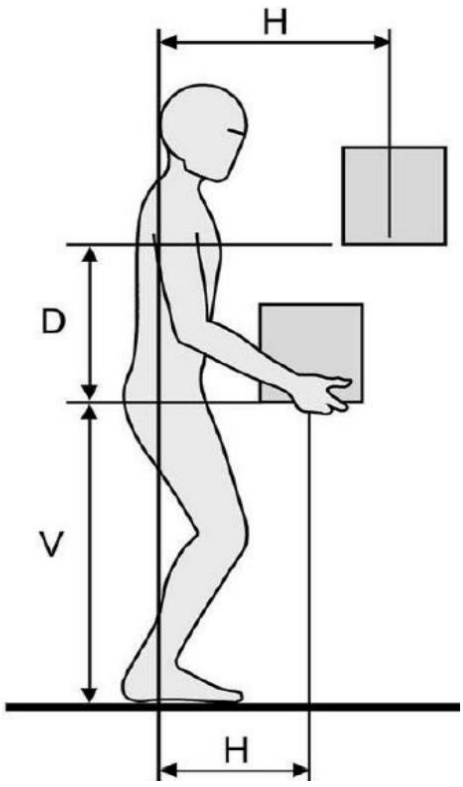

Figure 1

RWL = LC x HM x VM x DM x AM x FM xCM

Load Constant	LC	23 kg	51 lb
Horizontal Multiplier	HM	(25/H)	(10/H)
Vertical Multiplier	VM	1-(.003|V-75|)	1-(.0075|V-30|)
Distance Multiplier	DM	.82 + (4.5/D)	.82 + (1.8/D)
Asymmetric Multiplier	AM	1-(.0032A)	1-(.0032A)
Frequency Multiplier	FM	From FM Table	From FM Table
Coupling Multiplier	CM	From CM Table	From CM Table

Figure 2

Figure 3. Lifting to the destination

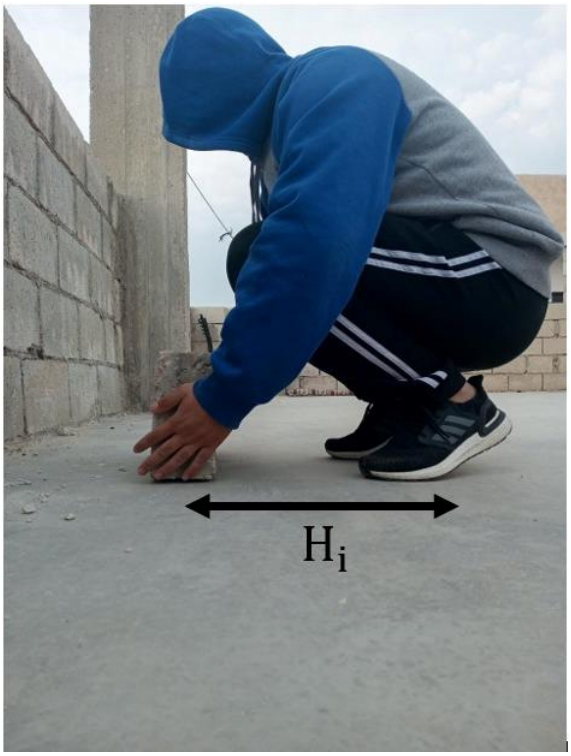

Figure 4. Lifting from the origin

Before improvement:

Load=10 kg

H_i=42 cm

H_f= 45 cm

V_i=0 cm

V_f= 100 cm

D=100 cm

Angle=0 degrees

Discussion and analysis and results

	H	V	D	A
At origin	42	0	0	0
At destination	50	100	100	0

**All values are calculated using equations in figure 2.*

Before improvement:

At origin

	H	V	D	A		
	42	0	0	0		
Factor	HM	VM	DM	AM	FM	CM
Multiplier	0.6	0.775	1	1	0.81	0.9

*RWL = 23*0.6*0.775*1*1*0.81*0.9 = 7.80 kg*

L.I= Weight lifted/RWL = 10/7.79 = ***1.28***

L.I > 1, so we need an **alternative design.**

At destination

	H	V	D	A		
	45	100	100	0		
Factor	HM	VM	DM	AM	FM	CM
Multiplier	0.56	0.925	0.865	1	0.81	0.9

*RWL = 23*0.56*0.925*0.865*1*0.81*0.9 = 7.51 kg*

L.I= Weight lifted/RWL = 10/8.69 = ***1.15***

L.I > 1, so we need an **alternative design.**

Before improvement:

- We can use a pallet that heights 50 cm as an origin position.
- Teach the worker that minimizing the horizontal distance to Hi of 30cm and Hf of 35 cm between him and the block will reduce pain problems.

At origin

	H	V	D	A		
	30	50	0	0		
Factor	HM	VM	DM	AM	FM	CM
Multiplier	0.83	0.925	1	1	0.81	0.9

*RWL = 23*0.83*0.925*1*1*0.81*0.9 = 12.87 kg*

L.I= Weight lifted/RWL = 10/12.87 = ***0.777***
L.I < 1, so **principle achieved.**

At destination

	H	V	D	A		
	35	100	50	0		
Factor	HM	VM	DM	AM	FM	CM
Multiplier	0.71	0.925	0.91	1	0.81	0.9

*RWL = 23*0.71*0.925*0.91*1*0.81*0.9 = 10.02 kg*

L.I= Weight lifted/RWL = 10/10.02 = ***0.998***
L.I < 1, so **principle achieved.**

Conclusion

Now that the work is safer, performing it will cause less low back pain difficulties. From the foregoing, it can be inferred that occupational health and safety employ the NIOSH Raising Equation as a tool to avoid low back discomfort at work that is brought on by frequent lifting and lowering tasks. Many conditions that affect the lower abdomen, pelvis, soft tissues, and spine joints can cause low back stiffness and pain. You may utilize multipliers to identify certain workplace problems. Establish the maximum weight limit or desired weight limit for the design, evaluate work designs, and give ergonomic design the highest priority using the RWL and LI to Guide Ergonomic Design. There are several causes of low back discomfort and disability at work, including lifting.

The NIOSH lifting equation does not account for other factors that influence and contribute to LPD, such as the work environment, temperature, psychological concerns, and walking while lifting; as a result, its value is likely to be affected.

References

1- Human factors Lab- Experiment 5: A case study on using the NIOSH lifting equation (RWL).

2- A How-To Guide: The NIOSH Lifting Equation - VelocityEHS