

King Saud University

College of Engineering

IE – 341: “Human Factors Engineering”

Fall – 2016 (1st Sem. 1437-8H)

Manual Materials Handling

(Chapter 8)

part 2 – Case Studies

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Lesson Overview

Part 1:

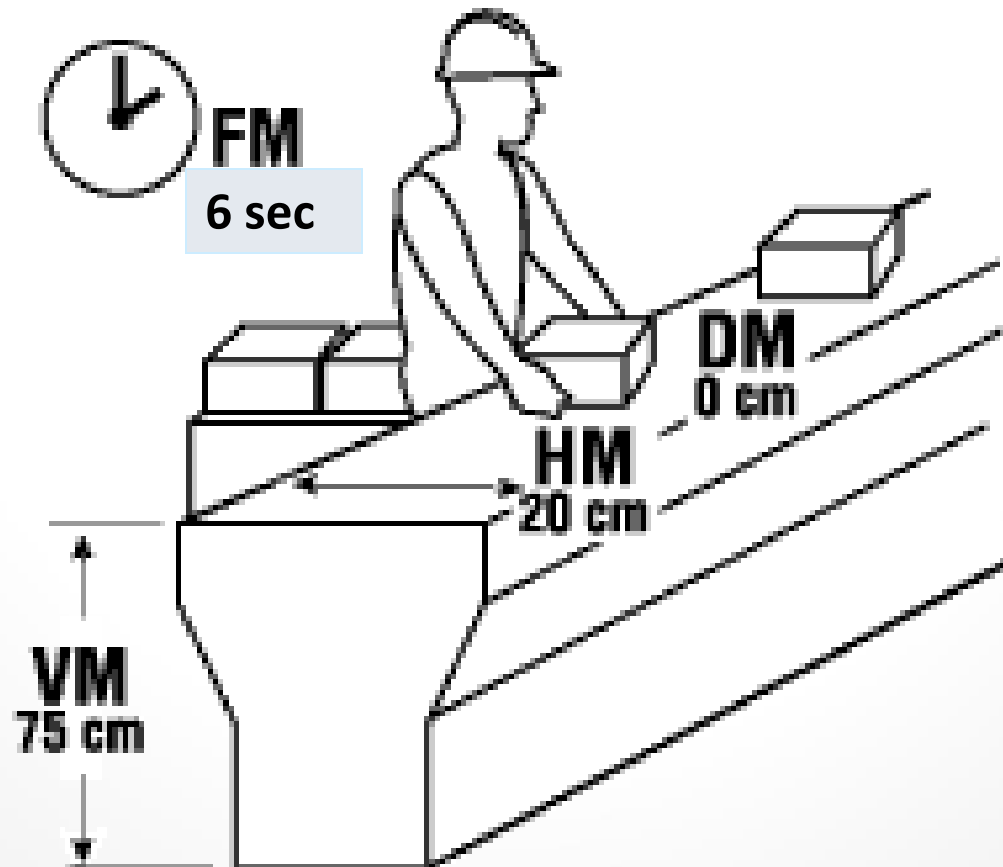
- What is MMH?
- MMH Activities
- MMH Effect on Health
- NIOSH Lifting Equation

Part 2:

- Case Studies
 - Case 1: Effect of Frequency Factor on RWL
 - Case 2: Effect of Horizontal Distance on RWL
 - Case 3: Effect of Vertical Distance on RWL

Case 1: Effect of Frequency Factor on RWL

Problem Statement: Analyze the following work task. A worker lifts 10 kg boxes from the conveyor to the cart, ten times every minute for two-hours.



Case 1: Effect of Frequency Factor on RWL

Solution: First, calculate the recommended weight limit (RWL) for the task

1. Determine the weight of the load.
Weight = 10 kg
2. Assess the six components of lifting task.

H (Horizontal Distance)	20 cm
V (Vertical Distance)	75 cm
D (Lifting/ carrying Distance)	0 cm
A (Angle)	90°
F (Frequency)	6 sec
C (Coupling/quality of grip)	fair

Case 1: Effect of Frequency Factor on RWL

3. Select appropriate multiplier factors for each lifting component from the appropriate tables

H (Horizontal Distance)	20 cm	HM	1
V (Vertical Distance)	75 cm	VM	0.99
D (Lifting/ carrying Distance)	0 cm	DM	1
A (Angle)	90°	AM	0.71
F (Frequency)	6 sec	FM	0.26
C (Coupling/quality of grip)	fair	CM	1

Case 1: Effect of Frequency Factor on RWL

4. Determine the Recommended Weight Limit for the task:

$$\begin{aligned}\text{RWL} &= 23 \text{ kg} * 1 * .99 * 1 * 0.71 * 0.26 * 1 \\ &= 4.2 \text{ kg}\end{aligned}$$

5. Compare weight of the load against determined weight limit for the task:

weight of load (10 kg) > RWL (4.2 kg)

6. Conclusion: **Task is Dangerous**

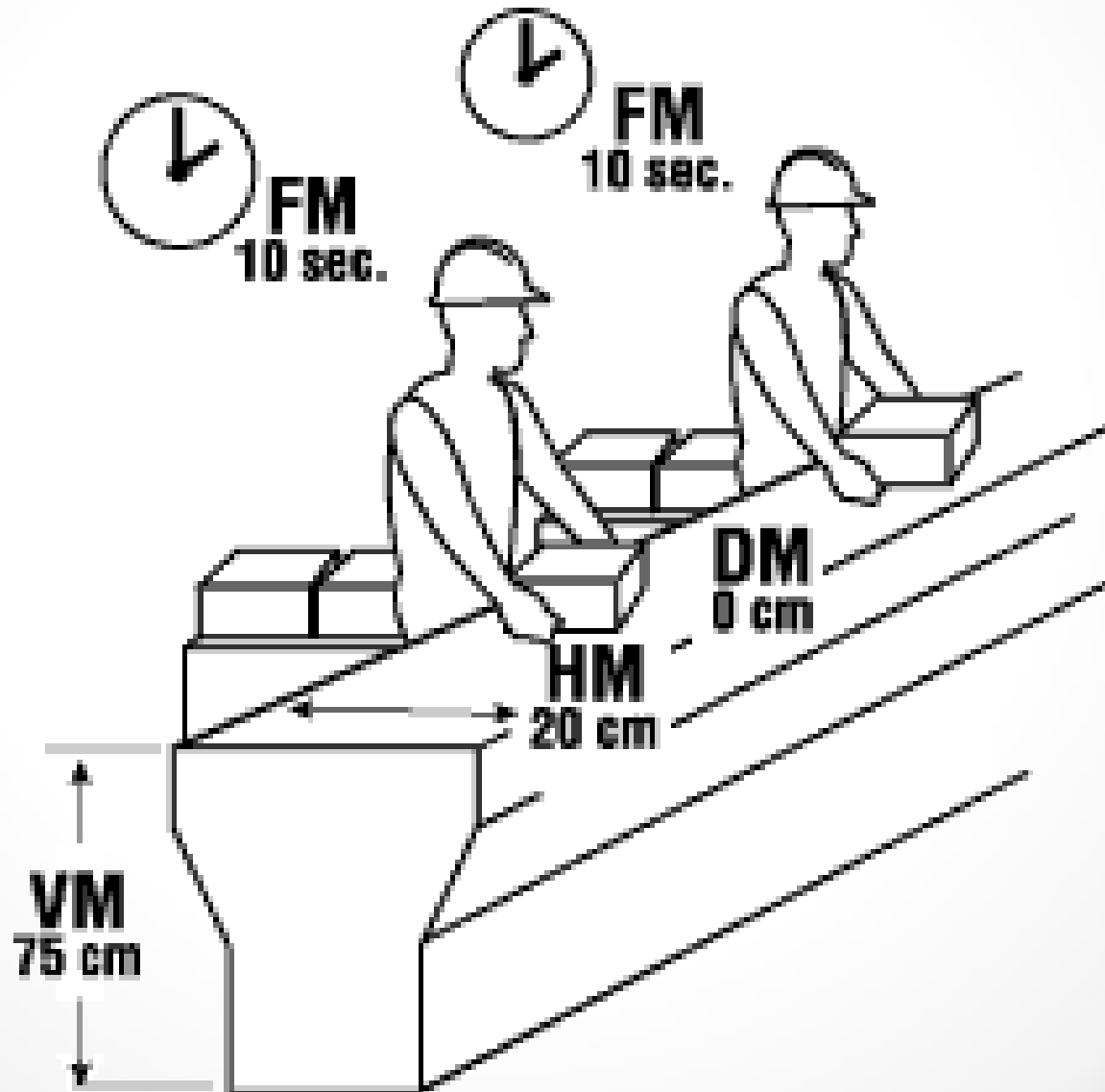
Case 1: Effect of Frequency Factor on RWL

7. Recommendations:

- Assess which component(s) contribute(s) most to the risk
 - the critical factor is FM \Rightarrow it is required to reconsider the frequency of lifting and/or duration of task
- Shorten the frequency of lifting by:
 - a. reducing the frequency of incoming boxes (i.e. increasing F) and/or
 - b. assigning additional workers to task, and/or
 - c. shortening the time of the task to 1 hour

Case 1: Effect of Frequency Factor on RWL

7. Recommendations (Cont.):



Case 1: Effect of Frequency Factor on RWL

8. Redesign the Task

- Assess the six components in the redesigned task
- Determine new RWL:

$$\text{RWL} = 23 \text{ kg} * 1 * .99 * 1 * 0.71 * 0.75 * 1$$
$$= 12.1 \text{ kg}$$

- Compare weight of the box against determined weight limit for redesigned task:
weight of load (10 kg): now < RWL (12.1 kg)
- Conclusion:
most workers can perform the task safely (why *most*?)

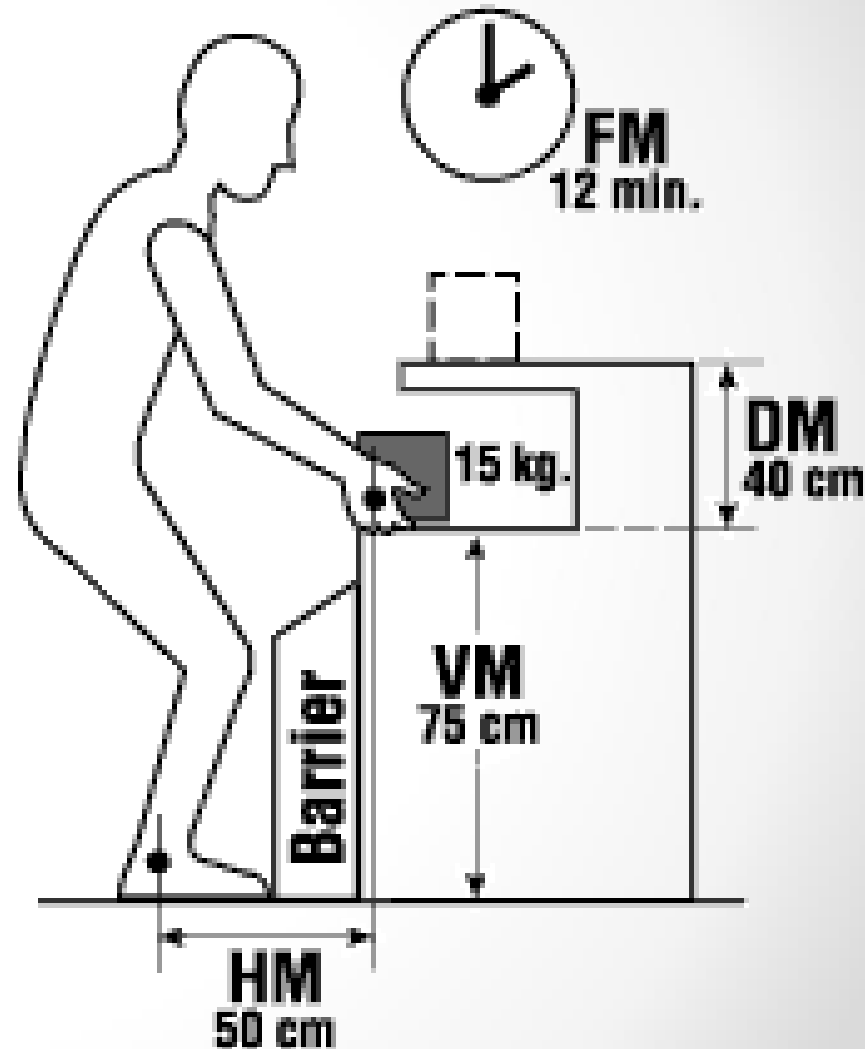
Case 2: Effect of Horizontal Dist. on RWL

Problem Statement:

Analyze the following work task.

A worker lifts 15 kg boxes from the table to the shelf, five times an hour.

Notice that there is a barrier between the worker and the box.

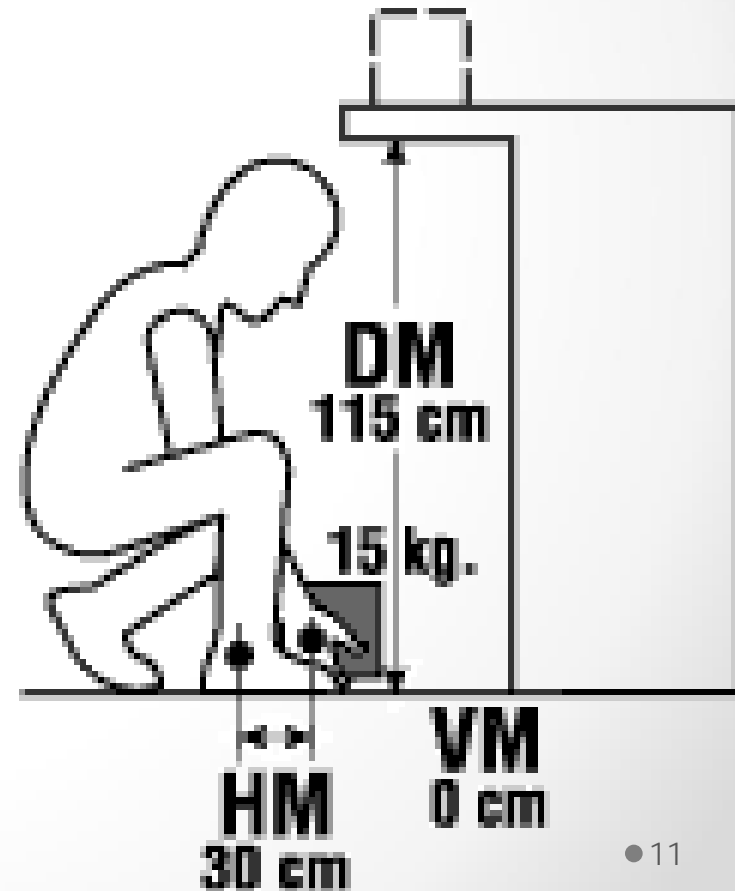


Case 3: Effect of Vertical Distance on RWL

Problem Statement:

Analyze the following work task.

A worker lifts a 15 kg load of loosely-piled pieces of metal from the floor to the table, five times an hour.



References

1. Slides by: *Dr. Khaled Al-Saleh*; online at: <http://faculty.ksu.edu.sa/alsaleh/default.aspx>
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3. ***Revised NIOSH Equation for the Design and Evaluation of Manual Lifting Tasks.*** Thomas R. Walters et al. *Ergonomics* 36(7): 749-776,1993.
4. ***Applications Manual for the Revised NIOSH Lifting Equation.*** Thomas R. Walters, Vern Putz-Anderson, Arun Garg. US Department of Health and Human Services: Public Health Services. Cincinnati, OH, 1994.
5. ***OSHA Technical Manual. Section VII: Chapter 1: Back Disorders and Injuries.*** Online at:
• www.osha.gov/dts/osta/otm/otm_vii/otm_vii_1.html