Costs and Benefits of Ergonomic Interventions for Small Business

Dan MacLeod CPE
www.danmacleod.com

Prevention through Design
Omni Shoreham Hotel in Washington, DC
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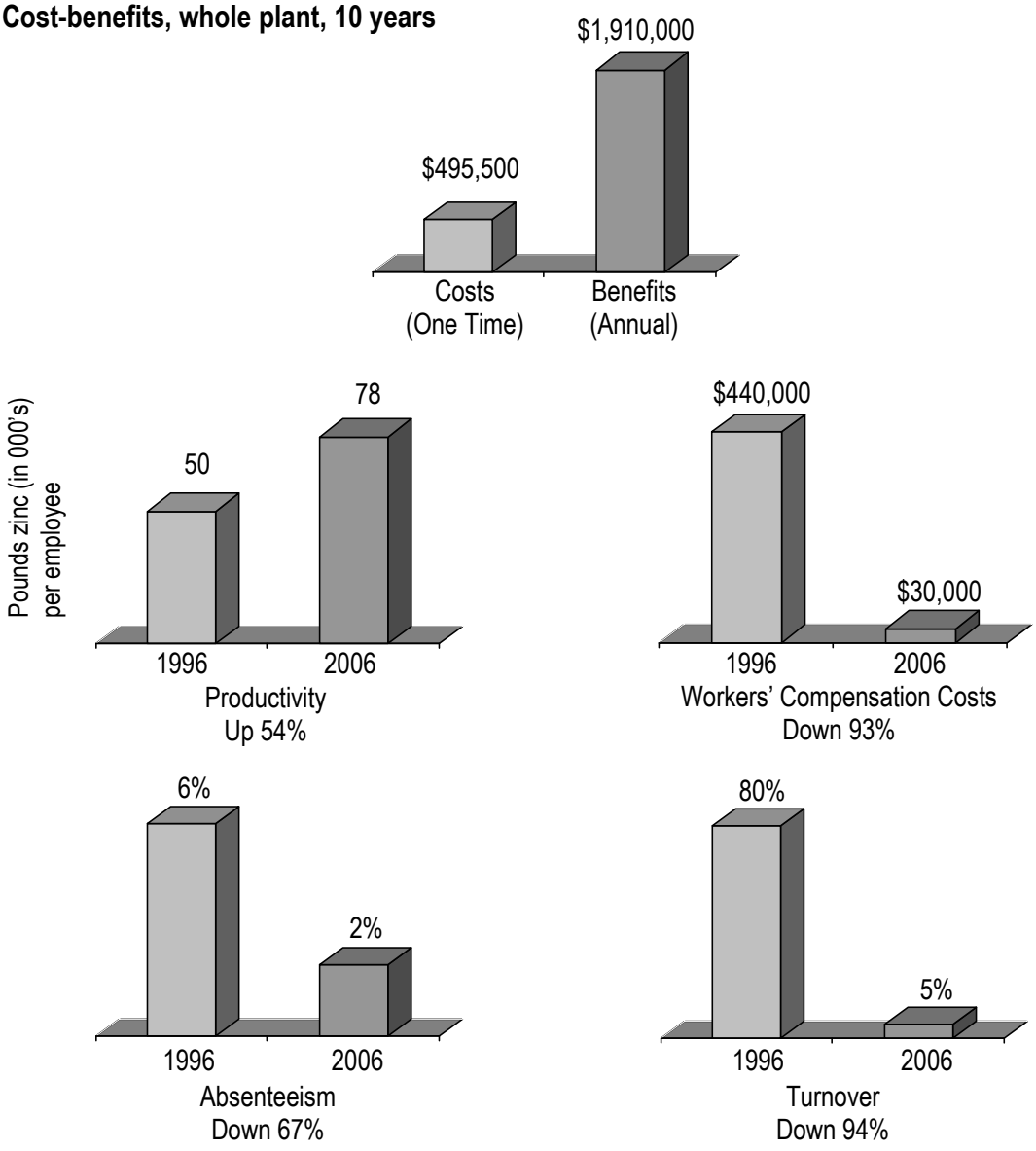
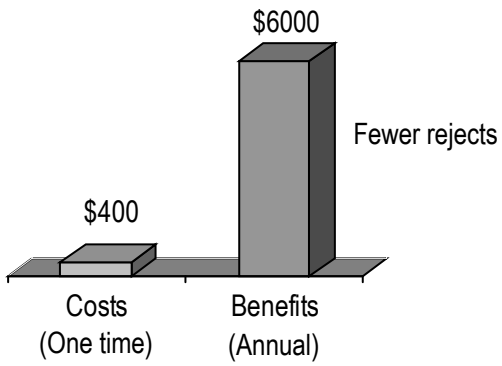
Cost-benefits, whole plant, 10 years



Die cast and assembly operation, 100 unionized employees, initiated formal program in 1995, study conducted in 2006. Improvements included two major capital improvements, but mostly systematic application of "standard" ergonomic improvements.

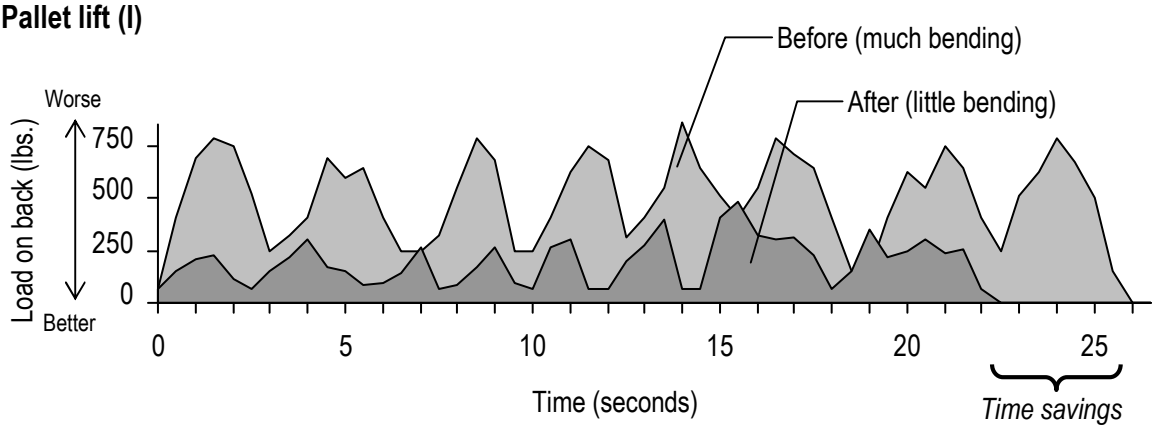
Quality Improvement



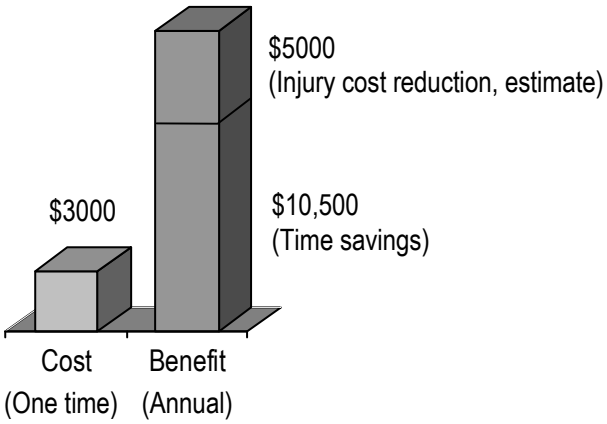
An employee reported shoulder pain from manually agitate parts in a dip tank, and as a result, a mechanical device was fabricated. Unexpectedly, the number of rejects dropped dramatically. It retrospect, the manual task was too fatiguing to do properly.

Plant size: 150 employees.

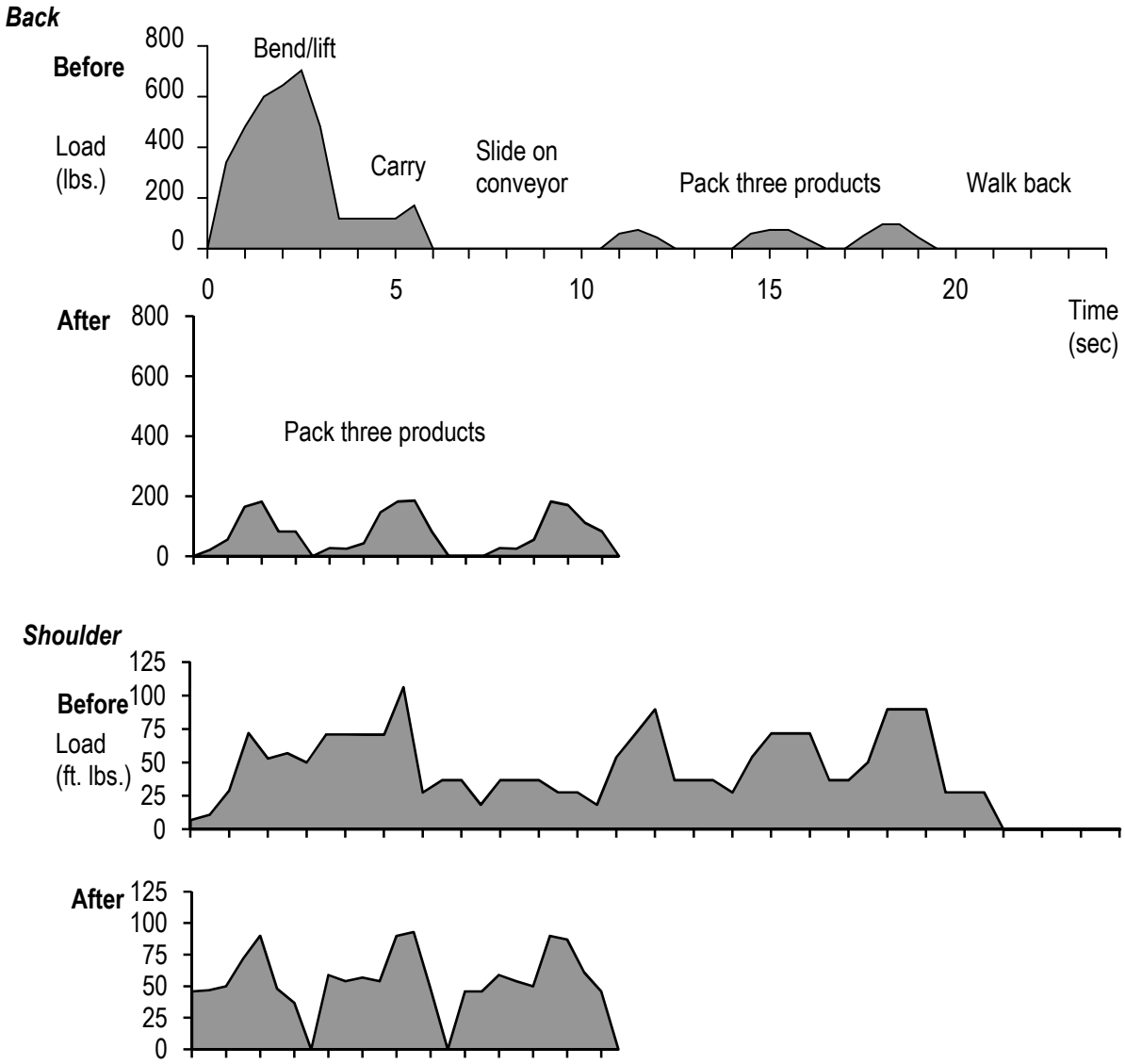
Pallet lift (I)



Before-and-after reductions:
Peak load on lower back — 43%
Average load on back — 60%
Time-Weighted Load — 66%
Time savings — 15%



Pallet Lift (II)

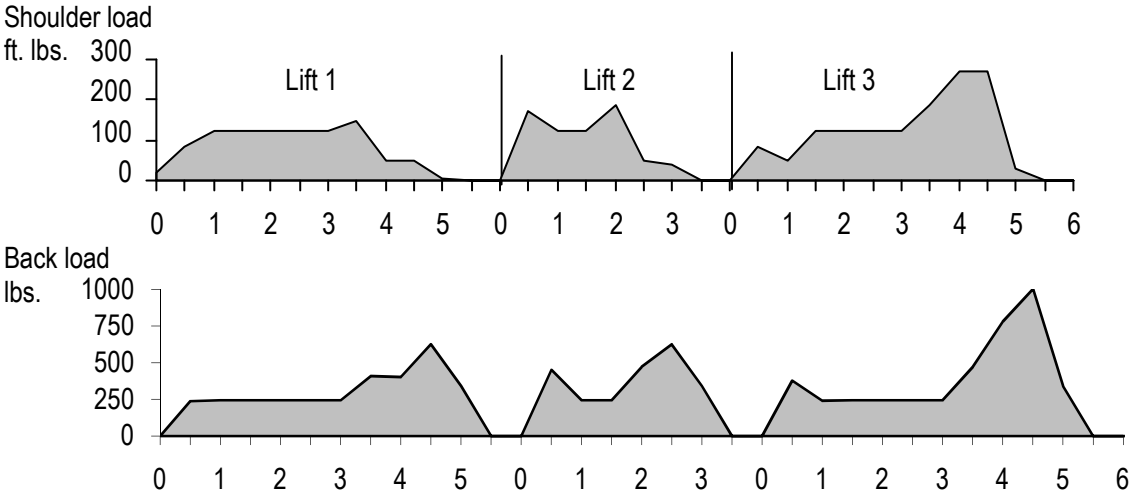


Before-and-after reductions:

Back	Peak	74%
	Average	23%
	Time-Weighted	58%
	Time	15%
Shoulder		
	Peak	13%
	Average	*+21%*
	Time-Weighted	33%

Results whole plant
Before: 125 units/hour
After: 250 units/hour

Comparison of lift method and layout



Lift 3 (worst) to Lift 1 (best) comparison:

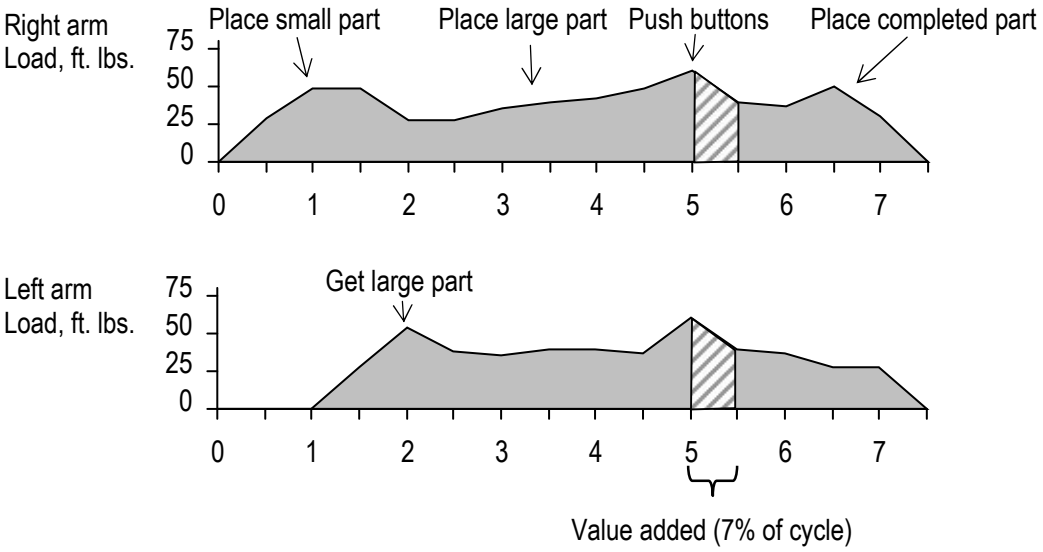
Back

Peak	38%
TWL	43%
Time	40%

Shoulder

Peak	32%
TWL	50%

Operate Small Press, work cycle analysis



Wasted time is 93% of cycle, due to reaching

Time and Physical Demands Analysis (TAPDA)

Method

- Videotape the task
- Review the video, pausing at regular intervals, e.g. each 0.5 second
- Calculate the physical demands for each frame, e.g. biomechanical model.
- Graph the results
- Summarize statistical results

Advantages

- It shows the physical demands for each step of a job, enabling analysts to identify more clearly the specific portion of a task where problems lie.

- It includes *time*, which most other methods do not, enabling decision makers to better understand how physically demanding tasks often reduce efficiency.

- The method incorporates most of the key variables of concern in a single graph:
  - Posture
  - Force
  - Motions (each motion is separately observable on the graph)
  - Magnitude of the load on the body
  - Duration of the load on the body

- Using biomechanics as the foundation of the method makes the results more scientifically accurate than other common scoring systems and bypasses questions on how to combine effects of different risk factors.

- The results are intuitive, i.e., the load on the back and shoulder measured in pounds/foot pounds (or kilograms/newton-meters) rather than a number on a scale that few people are familiar with.

- The graphs are easily understandable by managers and decision-makers, providing a good format around which to base reports and presentations.

Best Uses

- Comparison of time and physical demands
  - before-and-after changes
  - within a single task
  - between similar tasks or methods
- Relate MSD risk factors to non-value-added activities

Future

- Perhaps with further development this method provides a universal task quantification system useful for epidemiology, i.e., measurement of the "dose" to compare with injury rates.
  - Add factors for static load, vibration, etc.
  - Develop wrist model

"5000 Ergonomics Solutions"
On-Line Knowledgebase

Background

The website is funded by NIOSH Small Business Innovation Research Grant (SBIRG) as a commercial product and is hosted by www.ergoweb.com.

Phase I — Complete with 1000+ solutions for Material Handling and Workstations
Phase II — 4000 more solutions planned for Handtools, Maintenance, Warehousing, Machine Operation, and more

Completed

Tutorials
How to design a workstation
Ways to improve material handling
Setting up a production line

Material Handling Categories	**Workstation Design Categories**
Pallet and container lifts	Fixtures: bench top
Conveyors	Fixtures: free-standing
Slides	Height adjustment
Conveyor gates	Visual Access
Carts	Lighting
Lifter-Transporter	Magnification
Wheels	Parts handling
Air casters	Storage
Tuggers/pushers	Surface dimensions
Large containers	Surface material
Hand held totes	Slanted surface
Tilters	Standing platforms
Dumpers	Arm supports
Pallets	Clearance
Hoists	Sit-stand
Manipulator arms	Seating
	Flooring
	Footrests

Each category provides a range of options from low-cost to high-end solutions, each illustrated with photos from actual workplaces. Many show good ideas that were fabricated in house. Links to vendors of commercial products are provided. Each category includes background on problems, the ergonomics principles affected, and the underlying design objectives. Cautions about common pitfalls are included.