

Ergonomic Risk Reduction and Labor Savings Involved with Manual Material Handling Reduction: A Case Study

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Abstract: The financial justification of ergonomics is lacking in the literature, and there is a need for more examples and case studies of successful projects that have resulted in excellent financial justification. This paper describes a mechanical material-handling case study that addresses injury risk, labor savings and a description of the project parameters. The financial justification for the purchase of conveyor systems is addressed through return-on-investment financial techniques.

Keywords: ROI, Ergonomic Risk Reduction, Project Justification

1. Introduction

Ergonomics and specifically “the financial benefits of ergonomics” continues to be a topic of discussion among ergonomists, and within the business community. The main intent of this paper is to present one case study of a successful project and outline the approach and results of the project.

On the internet, there are several approaches to justifying ergonomics. For example, one paper titled “Cost Justification for Ergonomics Program” by Darren Van Winckle, Carrie Taylor Van Velzer, and Anjie Davis outlines a systems approach to determine whether an ergonomics program within an organization is cost beneficial. An excerpt from the paper that is worth noting is repeated here.

Part of the challenge of cost-benefit analysis for an existing program is that, if the program is perceived to be successful, little justification exists for spending the time to prove its success; resources are better utilized to continue to make improvements to other jobs. If the program is not perceived to be successful, little justification exists for spending time on the program at all; it is abandoned without objective evaluation.

The authors' insight is well taken, as successful projects can drive additional projects within the same organization. A recent presentation at The Applied Ergonomics Conference suggested using both financial as well as risk modeling techniques to determine the overall effectiveness of the ergonomics risk reduction project. (<https://www.iise.org/details.aspx?id=45628>) Several case studies are presented using both financial methods and risk measurement tools.

One of the best collections of successful ergonomic projects comes from the Washington State Department of Labor and industries and the Puget Sound Human Factors and Ergonomics Society and contains 60 pages and over 300 case studies in various industries. This collection of case studies can be downloaded from:

http://odm.ergotron.com/Portals/0/literature/whitePapers/english/Ergonomics_cost_benefit_case_study_collection.pdf.

This paper presents another case study involving manual material handling reduction and the financial aspects of the change. Both financial models and ergonomic risk reduction is presented. The financial model used is Net Present Value analysis and the NIOSH lift equation is used for the risk-reduction approach.

2. Description of the Task

In this example case study, product was processed and placed into boxes. Employees approximate the weight so the product is within $\frac{1}{2}$ pound of the actual weight. An employee grabs the box and places it on a pallet (denoted by orange square in Figure 1). Once a pallet load of product is completed, a powered pallet jack moves the pallet to a packing station and the boxes are placed on another conveyor (denoted by blue square below). Each box is lifted from the pallet, rolled to a scale, weighed, then closed for packing. Once the final weight is established, a bar code is applied to the box, each box is moved to a pallet, and another pallet jack moves the pallet to a freezer. The black square below denotes the completed pallet of product that is ready for storage.



Figure 1. Existing handling method

For the material flow shown in Figure 1 above, an employee moves a 40-pound box of material from a conveyor to a pallet and stacks it to mid-chest height. Once the pallet is filled, the entire pallet is moved to another part of the manufacturing floor for packaging. The boxes are lifted to another conveyor, weighed, labeled and restacked for shipment to the customer. In this scenario, two (2) employees are needed to keep the process flowing and each box must be lifted three (3) times. Each of the material handling steps has the associated ergonomics risks of lifting, bending, and reaching and can be analyzed using a number of tools. In this case, the NIOSH Lift Equation could be useful to determine the relative risk of back injury.

Within this situation, a lean approach was used, and the team examined the repetitive nature of the lifting with a goal of eliminating the manual material handling. Instead of loading the pallet and moving it with a pallet jack, a conveyor was installed to eliminate two (2) of the three (3) manual lifts. This change resulted in the elimination of one (1) position with a resultant cost savings of \$597,671. For the details of using the Net Present Value financial method, interested readers should reference Stevens (1983). The project has been implemented and the cost savings have been realized. In the Future State, the boxes flow directed to the scale, are weighed and labeled and moved to a conveyor. One person has been removed from the process and the associated material handling risk have been eliminated.

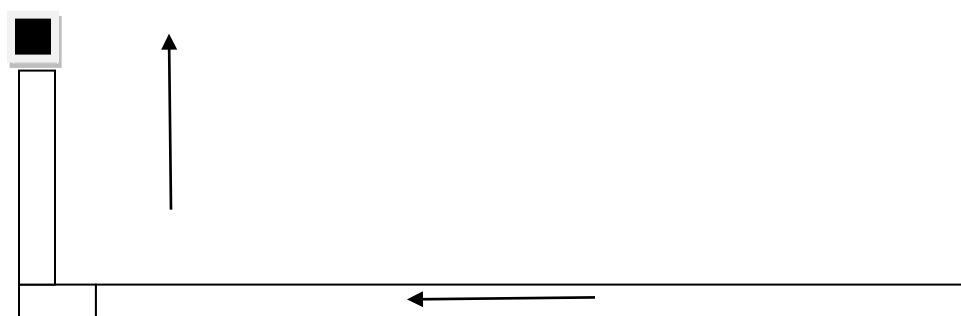


Figure 2. Future State handling method

In Figure 2, two (2) lifting positions have been eliminated, resulting in the financial savings. An additional take-away conveyor was added so the boxes, once filled, are carried 10 feet and placed on the take away conveyor. This is an added improvement, as the scale employee do not have to bend to place the boxes on a pallet.

Since employees only lift the box once and move the box at waist level, the ergonomics of the process are improved. The question that must be raised is “is there additional improvements that can be made?” Subsequent observations of the process resulted in the qualitative approach that is presented here. Employees were observed lifting the same 40-pound box at 32-inches above the floor and transferring the box to another conveyor that is 30-inches above the floor. The lifting frequency, and other posture data variables used to compute the NIOSH Lifting Index are summarized in Table 1.

Table 1. NIOSH Lift Equation Data

NIOSH Variables	Present State
Weight	40 pounds
Horizontal Reach	12 inches
Starting Load Height	32 inches
Travel Distance	2 inches
Lifting Frequency	1 box/minute
Twisting	0
Coupling	Good
Recommended Weight Limit (RWL)	31.4 pounds
Lifting Index (LI)	1.3

Although the Lifting Index is not below 1.0, it is close and some organizations might stop there and proceed to another area of need. In this case, the team is interested in installing a short bridge conveyor that allows the employees to slide the box from the scale to the take-away conveyor, eliminating the lifting and carrying involved in the now “New Present State”. The most important point here is that this additional recommendation does not have the acceptable financial justification that the previous conveyor improvement had and is an incremental improvement to reduce the risk of injury. It does, however, have a qualitative benefit, and can have a reduction in fatigue as well.

3. Conclusions

It is suggested that a combination of both financial and qualitative models, like the NIOSH lift equation, be employed when examining ergonomic improvement projects. Hard financial cost savings on one project can help drive incremental improvements that do not have the same financial impact. This is the case within the project described here.

4. References

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