Ergonomics Cost-Benefits in a Small Manufacturing Plant

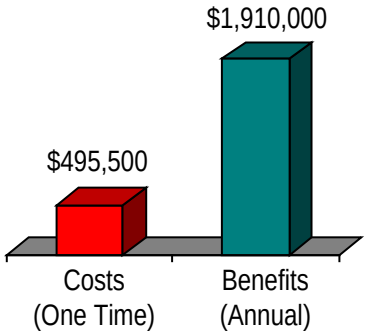
Dan MacLeod CPE
www.danmacleod.com
July 25, 2006

Introduction

This case example is important for several reasons:

1. It is comprehensive — plant-wide over a 10-year period.
2. The ergonomics improvements were far more thorough than most plants.
3. The operation was small in unglamorous basic industry (100 employees in die casting) and there were no professional engineers on staff. The changes were primarily implemented by the maintenance staff. It shows that it is not necessary to be large or especially sophisticated to achieve significant benefits.

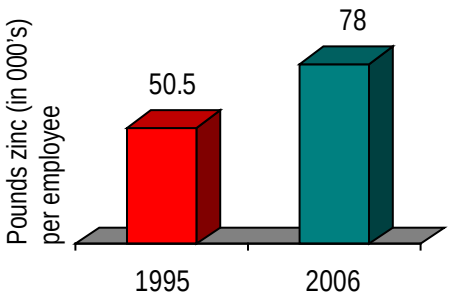
Summary Costs and Benefits



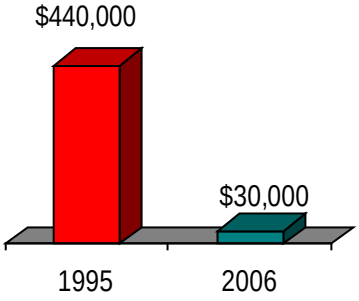
Over a 10-year period, this plant invested about one-half million dollars in making operations more human-compatible. At the time of this analysis, the benefits were about two million dollars *per year*.

Breakdown of Benefits

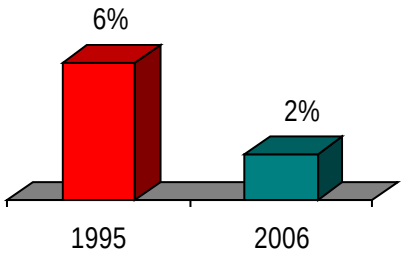
The following graphs were generated from plant records, showing the changes over the 10-year period. Productivity was up about 50% and workers compensation costs, absenteeism, and turnover were down 70–90 %. Converting these changes to dollars yielded the two million dollar annual savings.



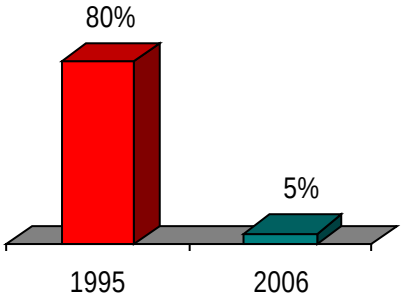
Productivity
Up 54%



Workers' Compensation Costs
Down 93%



Absenteeism
Down 67%



Turnover
Down 94%

Improvements

The equipment changes were a combination of ergonomics, lean manufacturing, and automation. At this level, these strategies are often intertwined. The following are brief descriptions of the most important improvements.

Packing

In the past, packing was done in a different area and the assembled products were brought to that area in bins with a forklift. As part of a lean manufacturing strategy, the plant decided to relocate the packing into the assembly area. To achieve this goal, the plant needed to do two things:

1. Reduce the physical and time demands on the assembly employees by eliminating the manual loading of bins, which was accomplished by using the loading system described above.
2. Raise the completed parts up to an appropriate work height.

Of special note, plant engineering decided that purchasing inclined conveyors was too expensive, so they built their own for roughly $400 using an I-beam, an electric motor, a belt, and a modest amount of steel supports.

Homemade, inexpensive inclined conveyor to bring products up to working height.

Packing station (opposite view of photo at left). Features include automatic counting system, cylinders to push product boxes into position, and a two-tiered packing station to reduce arm motions when loading product boxes into shipping boxes.

Ergonomics made the lean concept feasible

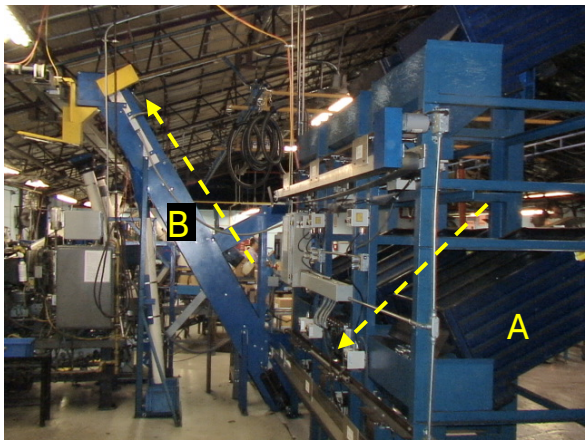
The first attempt to combine packing with assembly caused an "employee rebellion" and failed. The problem was that the initial attempt required employees to bend to floor level repetitively to retrieve the finished products. By adding the inclined conveyor and building a packing station with a variety of ergonomic features, the leaner system became successful.

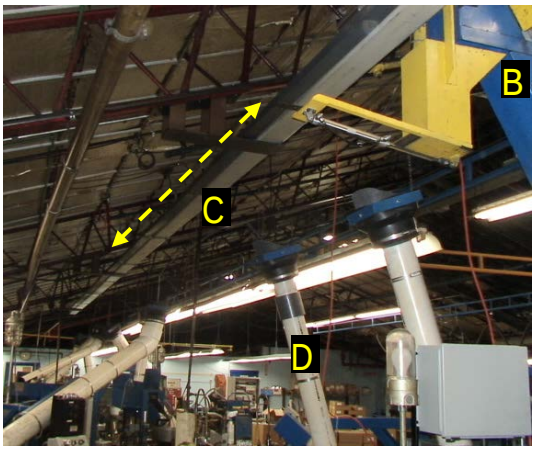
Hopper Loader

The most unique innovation at this site is an automatic hopper loading system. The tasks it replaced were the common ones of manually loading a hopper, as shown in the following photos, with strain on the arm and back.

Before: Bending low into a bin to scoop out parts and then reaching high to dump them into a hopper.

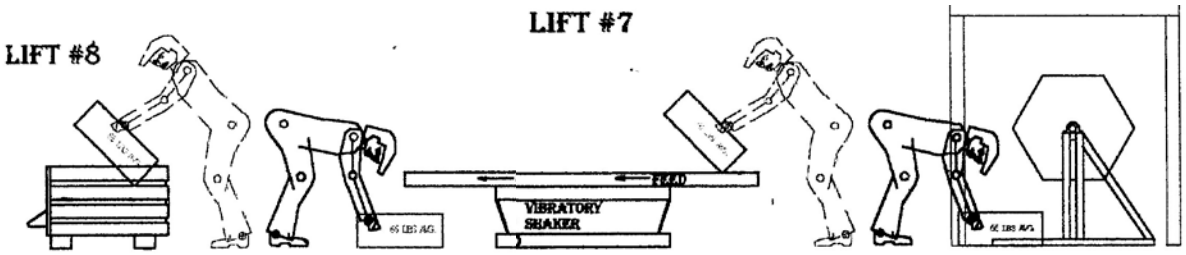
This hopper loading system was conceived and built by plant personnel. In addition to saving wear and tear on employees, it saved 5000 sq. ft. of floor space, which enabled assembly cells to be placed in a room that was otherwise too small. Moreover, eliminating the need to load hoppers enabled efficient packing of the product in these cells.





After: Parts from bins in a racking system (A) drop as needed into a conveying system (B) to a loader. The loader runs almost instantaneously along a monorail (C) to fill the various chutes leading to machines (D).

Tumbling Automation
The final major improvement was in the tumbling portion of the die cast area. Previously, each load of cast parts had to be lifted 12 times in the process of being tumbled. Sketches of those lifts are shown below. This area especially was a source of injuries, high workers' compensation claims, absenteeism, and turnover.



Before: Multiple lifts of materials throughout production process.

These tasks were essentially automated. Part of the system is shown in the photo below. This system was the most expensive investment of those described here, and also yielded the highest return in savings.

After: Automated sorting and handling system

Other improvements
Variety of other standard ergonomics improvements, including lift tables, turntables, anti-fatigue matting, etc.

Synergy

"We tend now to look at ergonomics as more a part of a systems approach to continuous improvement than just a tool to improve safety. We didn't start out that way, but rather we morphed to that realization.

"The lean concepts of waste and flow, the quality concept of continuous improvement, and the ergonomics concept of wasted motion/poor motions as part of the same drive for competitive advantage in cost and service excellence. These tools and their applications are synergistic, not independent strategies!"

— Plant Manager

Comments

Standard accounting systems often have a hard time taking into account longer term perspectives as well as cost avoidance factors such as workers' compensation costs. Consequently, it can be helpful occasionally to take a step back and make additional calculations such as those here.

Probably most plants that have implemented similar improvements have achieved the same types of positive results. The difference in this case is that the plant is small and the effects of process improvements more measurable. In large operations, there are often so many variables that it can be difficult to sort out which changes are related to which financial savings. Additionally, in this case, virtually all of jobs in this facility have been affected, not just single work cells or departments. So again, measurements are more meaningful than usual.

A few other positive aspects of this facility are:

- Senior management is especially skilled in good communications with the workforce and in promoting change.
- The engineering/maintenance team is unusually creative.
- The unionized workforce is involved.