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Virtual Ergonomics in Prevention through Design (PtD) Example of a Value Added Proposition

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Author Note: More information and demonstrations can be provided by the author upon request.

Extended Abstract: Work-related musculoskeletal disorders (MSDs) are a leading cause of pain, suffering, and disability in our workplaces. OSHA estimates that work-related MSDs in the United States account for 34 percent of all lost work days reported to the Bureau of Labor Statistics (BLS) and one out of every three dollars spent on workers' compensation. An example of the cost of injuries can be found in OSHA Cost Calculator in the link below.

https://www.osha.gov/dcsp/smallbusiness/safetypays/estimator.html

Estimated Total Cost

The extent to which the employer pays the direct costs depends on the nature of the employer's workers' compensation insurance policy.

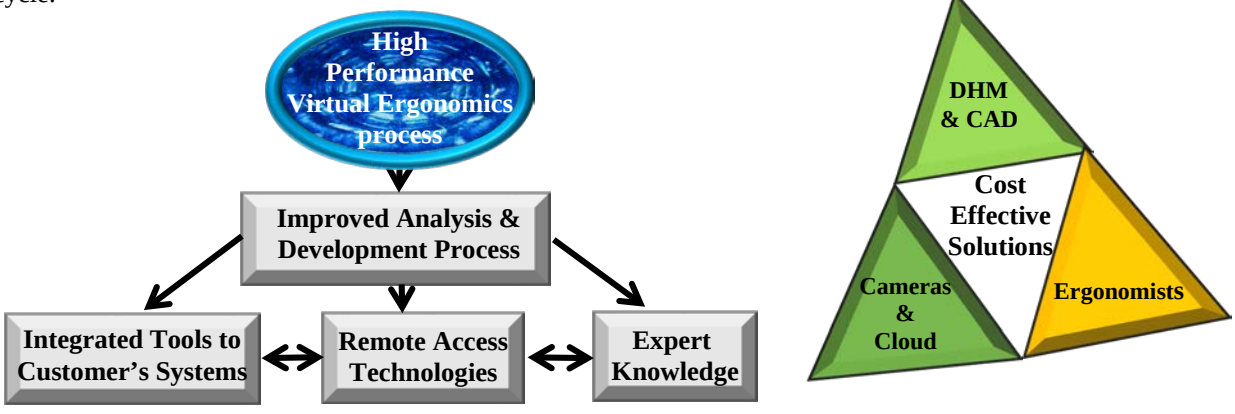
The employer always pays the indirec costs.

Injury Type	Instances	Direct Cost	Indirect Cost	Total Cost
Carpal Tunnel Syndrome	1	$ 30,509	$ 33,559	$ 64,068
Strain	1	$ 33,140	$ 36,454	$ 69,594

In addition to the cost of injuries, the manufacturing burden of rework, from missing ergonomics inputs at the beginning of a project can be significant when adding the costs of downtime related to machine, purchasing-receiving material, the cost of labor (management, design, manufacturing and operation), decommissioning and recycling, not to mention the effects on overall quality and customer satisfaction.

The most effective way to reduce the incidence and control of MSD-related and manufacturing rework costs is to include ergonomic considerations into the design life cycle. The Prevention through Design ANSI-ASSE Z590_3_2011 Standard incites the prevention of risks in any occupational setting.

The complexity and integration of the technologies at all levels in the current design/manufacturing system, lead to a redefinition of the ergonomics' methods. A high performance ergonomics method, aligned with the customer's systems should be applied to insure a lean and efficient process to integrate the ergonomics aspects as early as possible in the project`s life cycle.



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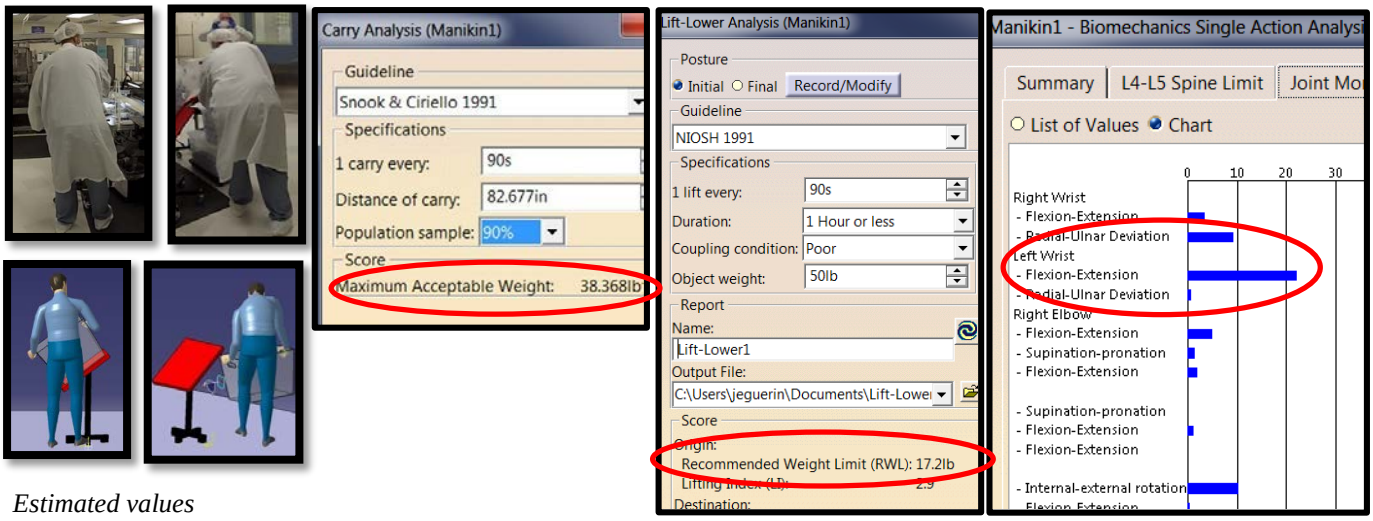
A comprehensive tool like the Digital Human Model can be used directly in a Computer Aided Design system (3D modeling) at the beginning or at any phase of a project life cycle to help Design-Out Ergonomics Risk Factors by simulating the impact of proposed designs. Using Human Factors and Ergonomics (HF&E) Digital Human Modeling software, rather than implementing the design and then tracking the results, costs associated with retrofit, rework and injuries is a value added proposition, even when considering the cost and complexity of the tool itself.

The following example explains the added value of HF&E human modeling in the design of equipment and tools.

In addition to the Biomechanical Single Action analysis, the Snook and Ciriello guideline for carrying and NIOSH tables for lifting were used to analyze the situation. A video was taken of the task from which the most critical postures were modeled using the digital human. The results helped the development of a guideline and of a potential solution:

- Not to exceed weight to place in the bins
- Design of a different handle system on the bins
- Eliminate the final postural risk by placing the bin on a platform as opposed to the floor
- **Eliminate the risks for the initial, final postures as well as the carrying by providing a rolling table**



Estimated values

Task, including manual lifting time per box: 90 secs. (1 shift =7 hours or 25,200 secs.)	25,200 secs/ 90 seconds per box= 280 boxes a day
Rolling table: Time saving: 10 seconds per box x 4 boxes=40 secs – 10 seconds to move the table containing 4 boxes=30 seconds	90 secs-30 secs=60 secs per task 25,200 secs/60 seconds = 420 boxes processed per day
Time saved per shift	33% more boxes a day = 2.3 hours a day
Employee hourly rate with benefits	$50 / hour
Dollars saved	2.3 hours x $50 = $115 / day x 261 manufacturing days=$30,015 yearly
Cost of rolling table	$3,000
Payback period	$3,000 ÷ $115/day = 26 days
Cost of Digital Human Modeling Evaluation	$25,000 (varies)
Cost of a back strain injury (Cost avoidance)	$36,000 (per employee x # of employees x # shifts)
Cost of a carpal tunnel injury (Cost avoidance)	$34,000 (per employee x # of employees x # shifts)
Total costs	$3,000+$25,000 =$ 28,000
Total cost savings	$30,015+$36,000+$34,000=$100,015
Value added proposition	$100,015-28,000=**$72,015**

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