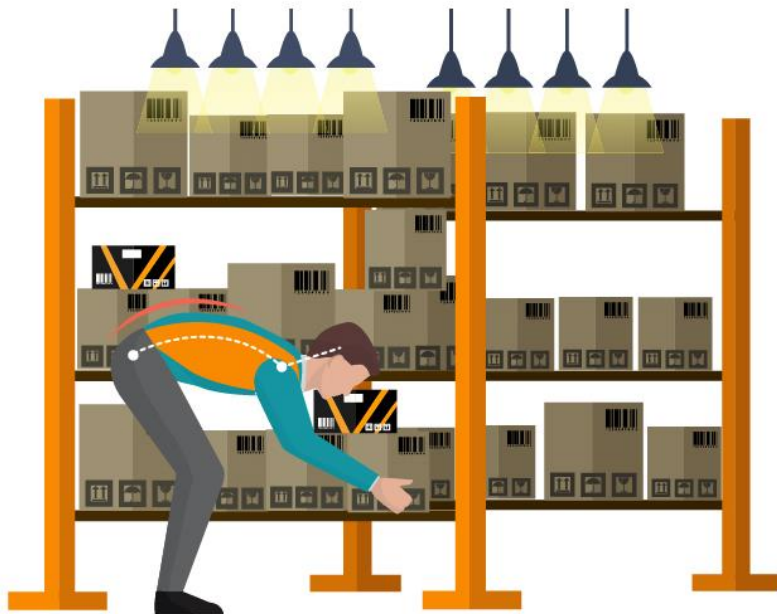


Positioning Your Order Picking Team For Success

White Paper

How automated goods-to-person storage and retrieval systems deliver ergonomic benefits that yield higher productivity, better accuracy and reduced operational costs.



Introduction

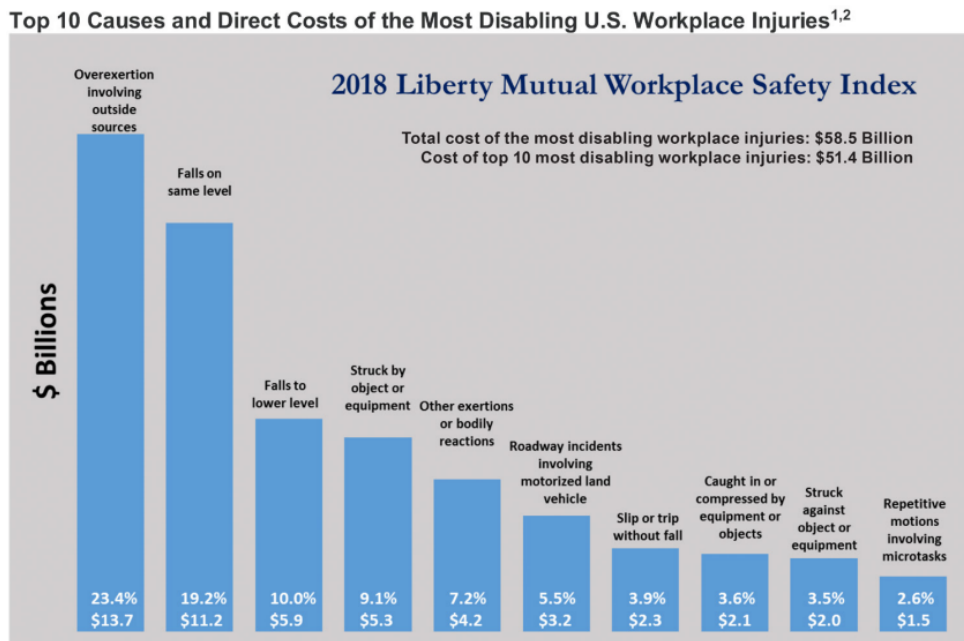
Every sport — from cycling to soccer, golf to ice hockey — requires safety equipment to minimize the risk of injury to athletes. Whether it’s special shoes with cleats or spikes for better grip on the ground, pads and helmets that deflect impacts, or guards that shield the face, using the right gear keeps both amateur and professionals safe. Without it, an injury could result not only in pain for the athlete, but in the case of professional sports, negatively impact a team’s performance.

Likewise, when it comes to warehouse and distribution employees, more organizations are deploying ergonomically designed automation systems. These ergonomic solutions help workers complete picking and order fulfillment tasks while simultaneously eliminating the risk of injury. In addition to enhancing safety, the devices can boost productivity and reduce a variety of costs — positioning both workers and companies for operational success.

This white paper reviews the costs of injuries associated with overexertion and explores three ways automated storage systems improve worker ergonomics and productivity. It also shares an overview of two different operations that implemented such a system and their results.

Common Ergonomic Injuries and Their Costs

Serious, non-fatal workplace injuries cost U.S. businesses nearly \$60 billion in non-fatal worker compensation injury claims in 2017, according to a 2017 Workplace Safety Index study compiled by insurer Liberty Mutual’s Research Institute.¹ Within the Index’s top 10 ranking of the most frequent causes of those injuries, two of the top five are associated with the physical exertion most frequently seen in retrieval of stored items. They are:



¹ 2018 Liberty Mutual Workplace Safety Index. Accessed May 30, 2019. <https://business.libertymutualgroup.com/business-insurance/Documents/Services/Workplace%20Safety%20Index.pdf>

1: Overexertion injuries, involving “lifting, pushing, pulling, holding, carrying or throwing, cost businesses \$13.8 billion in direct costs and accounted for nearly one quarter of the overall national burden.”²

5: Exertion/reaction injuries resulting from tasks such as bending, crawling, reaching, twisting, climbing, stepping, kneeling, sitting, standing or walking, were responsible for 6.5% of the overall injury burden, costing U.S. businesses \$3.9 billion.³

Workers’ compensation insurance covers the direct costs of occupational injury and illness, such as medical costs and wage replacement (indemnity). How much might an ergonomic injury cost?

*The average cost of a back injury related workers comp claim can be **\$40,000 - \$80,000 per employee**. The direct employee costs include musculoskeletal injuries, cost of turnover (hire and train replacement employees), over-time and temporary help, days away from work, transition duty days, sick days used, and administrative costs of handling compensation claims.⁴*

Employers, however, also experience significant indirect costs associated with a worker injured on the job — from **two to 20 times**⁵ higher than direct costs. That’s because there are so many hidden or unanticipated expenses resulting from an employee injury. According to Occupational Safety and Health Administration (OSHA), possible indirect costs can include (but aren’t limited to):

- *Any wages paid to injured workers for absences not covered by workers’ compensation;*
- *The wage costs related to time lost through work stoppage;*
- *Administrative time spent by supervisors following injuries;*
- *Employee training and replacement costs;*
- *Lost productivity related to new employee learning curves and accommodation of injured employees; and*
- *Replacement costs of damaged material, machinery and property.⁶*

Clearly, the costs of an ergonomic injury can add up.

Regulations and Recommendations

Although the OSHA has not established a maximum limit on how much weight a person may lift or carry,⁷ it does offer recommendations for the prevention of musculoskeletal disorders — including muscle strains and lower back injuries. The agency also notes, the Bureau of Labor Statistics (BLS) found warehousing to be one of four industries

² Ibid.

³ Ibid.

⁴ Encompass Group. “The Direct and Indirect Costs of Workplace Injuries, 2010.” Accessed June 4, 2019.

http://www.encompassgroup.net/content/pdf/safe_patient_handling/Cost%20of%20Workplace%20Injuries.pdf

⁵ QBE Holdings Inc. “Direct and Indirect Accidents Costs.” Presentation by QBE Loss Control Services. Accessed June 4, 2019.

<http://qbena.com/media/20161/accident%20costs%20qbe.ppt>

⁶ United States Department of Labor. “Injury and Illness Prevention Programs White Paper, January 2012.” Occupational Safety & Health Administration. Accessed June 4, 2019. <https://www.osha.gov/dsg/InjuryIllnessPreventionProgramsWhitePaper.html>

⁷ United States Department of Labor. “Standard Interpretations.” Occupational Safety & Health Administration. March 29, 2004. Accessed September 16, 2015. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=24876

with the highest rate of musculoskeletal disorders related to lifting heavy items, bending, reaching overhead, or pushing and pulling heavy loads.⁸



Taking the establishment of guidelines a step further, the National Institute of Occupational Safety and Health (NIOSH) has developed a mathematical calculation to evaluate risk factors for manual material handling tasks, such as lifting and lowering. According to NIOSH, the maximum recommended load weight that a healthy worker can lift under ideal conditions is 51 pounds. When six other variables are multiplied into the equation (horizontal location of the load; vertical location of the load; distance the load is moved; degree of twisting required; frequency and length of lifting activity; and the worker’s grip on the load), that maximum weight decreases.⁹

Companies that are well versed in these ergonomic issues often have dedicated Health, Safety and the Environment (HSE) teams to ensure workers are safe on the job. They have already established safe handling practices, such as blocking warehouse aisles when forklifts are retrieving or placing items stored at heights and using spotters to warn pedestrians and other workers in the area of activity overhead. Others have begun lowering the maximum load weight they will allow an employee to lift unassisted to 35 pounds — a full 16 pounds less than the NIOSH recommendations — as an aggressive measure to further prevent musculoskeletal disorders.

NIOSH and OSHA recommend that workers use powered equipment — such as automated storage and retrieval equipment (like horizontal carousels, vertical carousels and vertical lift modules)¹⁰ and cranes outfitted with an electric hoist¹¹ — as an alternative to lifting loads manually. Here, a look at three ways these automated storage systems improve worker ergonomics and reduce the potential for costly injuries.

⁸ United States Department of Labor. “Safety and Health Topics: Ergonomics - Prevention of Musculoskeletal Disorders in the Workplace.” Occupational Safety & Health Administration. Accessed June 4, 2019. <https://www.osha.gov/SLTC/ergonomics/index.html>

⁹ Centers for Disease Control and Prevention. “Applications Manual for the Revised NIOSH Lifting Equation.” The National Institute for Occupational Safety and Health (NIOSH). Accessed June 4, 2019. <http://www.cdc.gov/niosh/docs/94-110/pdfs/94-110.pdf>

¹⁰ Ibid. 47.

¹¹ National Institute for Occupational Safety and Health (NIOSH). “Ergonomic Guidelines for Manual Material Handling.” DHHS (NIOSH) Publication No. 2007-131. 45. Accessed June 4, 2019. <http://www.cdc.gov/niosh/docs/2007-131/pdfs/2007-131.pdf>

Solution: Automated Storage Systems to Minimize Exertion

To minimize the exertion injuries associated with manual material handling processes (including lifting, reaching, walking, stretching, bending, stooping, pulling, pushing, twisting, gripping and climbing), a variety of automated goods-to-person storage and retrieval systems exist. These include:

- **Horizontal Carousels** – Bins mounted on an oval track that rotate horizontally to deliver storage locations to an operator.
- **Vertical Carousels** – Comprised of a series of shelves that rotate around a track—similar to a Ferris wheel—these systems deliver stored items safely and quickly to an ergonomically positioned work counter.
- **Vertical Lift Modules (VLMs)** – A vertical lift module (VLM) consists of two columns of trays holding items. An automatic inserter/extractor device between the columns stores and retrieves a tray when required by an operator.
- **Vertical Buffer Modules (VBMs)** – In the middle of a multi-segment shelving system is an aisle, where a moveable mast with a telescopic gripper operates. The control unit sets the gripper in motion picking a bin and transporting it to a picking station.

Minimize Fatigue, Improve Accuracy

All three of these automated storage and retrieval systems eliminate unproductive and physically tiring travel and search time by delivering required items directly to the operator on command. Workers in conventional warehouses spend as much as 60% of their time walking to product,¹² searching for it on a shelf, and climbing on a ladder to reach items stored high or kneeling down to access items stored low. With an automated storage system, a worker no longer has to spend as much time on travel or retrieval of items. Not only does limiting an operator to just a few steps to complete picking tasks dramatically reduce fatigue, it also boosts picking rates by as much as 600%.

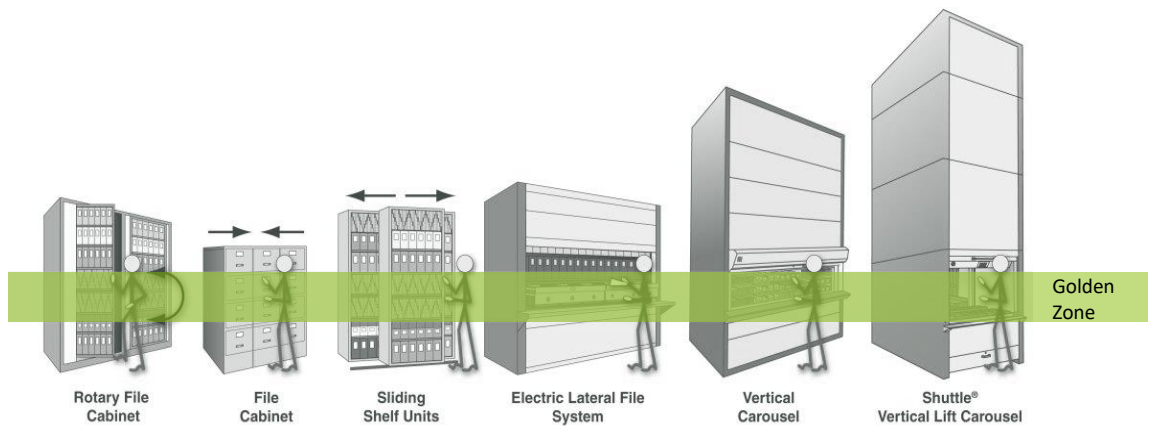
Further, a less-fatigued worker is a more accurate one. Tired operators are more likely to make mistakes. In addition to minimizing fatigue caused by exertion, these automated goods-to-person systems can prevent errors when equipped with a variety of supporting technologies. Additions such as light-directed picking systems and monitors that display images of the items to be picked further errors, resulting in up to 99.9%+ picking accuracy.

Go for the Gold(en Zone)

Every item stored in a vertical carousel and VLM is delivered to the operator at the optimal ergonomic work height, called the “Golden Zone,” or waist-high. (In the case of a horizontal carousel, the addition of a lift table — coupled with proper slotting to ensure the most-frequently-picked items are at waist height — achieves the same ergonomic benefit.) Shelves, trays or bins of products presented in easy reach eliminates bending down to retrieve an item stored low or stretching up to grab an item stored high.

¹² Ruriani, Deborah Catalano. “Improving Picking Practices.” Inbound Logistics. September 2006. Accessed June 4, 2019. <http://www.inboundlogistics.com/cms/article/improving-picking-practices/>

The machines also minimize unnecessary or excessive motions required for retrieval of items from drawers or shelves, such as reaching, stretching, bending, pushing, pulling, or stooping. Likewise, ladders, climbing and forklifts are not needed to place or retrieve items.



Further, VLMs can be equipped with a manual or automatic tray extractor for even easier load handling. With a manual extraction device, the operator can easily glide the tray completely out of the VLM and onto a cart or trolley. The tray of items can then be rolled to any destination within the facility, such as a workstation for parts kitting or a work cell that requires tooling stored within the VLM. Upon its return, the extraction device accepts the tray with minimal operator effort. Ideal for heavier loads (such as dense, heavy parts, tooling, dies, molds and other components used in manufacturing or field service and support operations), the automatic tray extractor mechanically slides the tray out of the machine. This ergonomic assist function prevents a worker from having to reach inside the system to pull the tray or item out.



Manual Tray Extraction



Automatic Tray Extraction

Need a Lift? Add a Hoist

As the most rugged of the three automated storage and retrieval systems, VLMs can be engineered to hold a range of different load capacities per tray, including 4-foot-wide goods weighing more than 2,200 pounds up to 13-foot-wide items weighing more than 1,700 pounds. Loads that heavy are impossible for an operator to lift. For such situations, a VLM can be equipped with an integrated, overhead crane and electric hoist to provide further ergonomic handling assistance.

With a hoist rated for loads more than the 2,200-pound VLM tray limit, an operator using a hand held, wired control pendant can safely and confidently direct the lifting of the load from the tray, then position it as needed. To accommodate different load types, the hoist can be outfitted with a variety of customized below-the-hook

attachments, end effectors or specialized tooling. For safety and control, the hoist maneuvers the load to its destination precisely, at a fraction of the rated speed.

The hoist takes the strain of lifting the load off the worker, further reducing fatigue and lowering injury risk. It also handles products gently to minimize damage and waste. Unlike forklifts, which are involved in 20,000 serious injury accidents and 100 deaths annually¹³ and can be costly to own and maintain, the integrated crane and hoist operate only with the VLM. This ensures the device is always readily available when needed to transfer a heavy item into or out of the storage machine, unlike overhead warehouse cranes engineered to maneuver large loads throughout a facility.



Shuttle XP VLM Fitted with Crane Handling



Shuttle XP VLM with Crane Handling in Action

Working together, a VLM with an integrated crane and hoist ensures safe, ergonomic handling of heavy loads by a single operator — no spotter required. Whether deployed as a stand-alone solution or in combination with other machinery, the system can be used as a production buffer, to supply assembly lines, as a tool store or to distribute spare parts.

Other Benefits

Not only do horizontal carousels, vertical carousels and VLMs eliminate the fatigue and errors associated with walk and search time and substantially decrease the risk of worker injury, adding these ergonomic systems positions an operation to significantly reduce absenteeism, insurance premiums and claims for worker's compensation. Additional benefits include highly dense storage, reducing floor space requirements by as much as 80%; fast access times; computerized inventory control for simplified warehouse management; and interface modules that communicate with other warehouse management systems (WMS) and enterprise resource planning (ERP) systems.

¹³ National Institute for Occupational Safety and Health (NIOSH). "Preventing Injuries and Deaths of Workers Who Operate or Work Near Forklifts." DHHS (NIOSH) Publication No. 2001-109. Accessed June 4, 2019. <http://www.cdc.gov/niosh/docs/2001-109/>

Automated Storage Systems with Integrated Lift-Assist in Action...

Zimbrick European Consolidates Parts into VLM, Eliminating Employee Travel Up and Down Stairs

When Zimbrick European — an automotive dealer serving Mercedes-Benz, Porche and Audi vehicle owners with parts and service — moved into a new facility, the service parts department area dropped from 2,300 square feet to 400 square feet. Further, the majority of the parts storage was located upstairs, on a second floor mezzanine area.

"We [had no] means to move parts between the first floor and the second floor, short of running up and down the stairs every time we needed to store a part or remove a part from inventory in order to sell it," says Steve Stepnock, Zimbrick European's Parts and Service Director.

To solve both the space and ergonomic problems, the business implemented a dual-access Shuttle VLM from Kardex Remstar. The dual access model is equipped for access to parts at both the first and second floor work areas. The VLM access opening on the first floor is located in the parts department, directly behind the retail customer counter. The opening on the second floor is located near the freight elevator for convenient receiving and storage operations.

"The Shuttle VLM reduced labor costs, increased productivity and reduced the risk of potential injury from using the staircase," Stepnock explains. In addition to reducing parts employee fatigue, the VLM accommodated the 84% reduction in storage space while still supporting 23 service technicians servicing three different car lines within the facility. Productivity has increased by 70% without adding more staff.

Further, the fast-moving, smaller parts stored in the VLM can be quickly and easily accessed automatically. "It's absolutely seamless. With just a push of a button, the part is delivered to the first floor," says Stepnock. "We also use the VLM to transfer [larger and slower-moving] parts from second floor bin storage to the first floor. We've saved ourselves two full-time positions that would have otherwise been required, simply to have people moving those parts between the floors manually."

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Shuttle XP VLMs Help Christie Lift Heavy Projector Components

Projection technology manufacturer Christie custom-builds systems for cinemas, education, media, government and more. When the company sought to double its inventory of sub-assembled projectors, it switched from a cart-based storage system to two Shuttle VLMs from Kardex Remstar.

The VLMs each hold 100 sub-assembled projectors with room for more. Each VLM occupies only 180 square feet, compared to the 600 square feet occupied by the previous cart system, providing 70% floor space savings. In addition to these benefits, the company has improved both ergonomics and safety — thanks to the VLMs' integrated, ergonomic tray extractor and lift-assist hoist.

With each projector weighing approximately 52 pounds, "the projectors are very heavy and lifting them puts the employee at risk of injury and the projector at risk of damage," explains Philip Hibberd, Senior Manufacturing Engineer at Christie.

When the projectors were stored on carts, employees had to push and pull them around, contributing to fatigue. Once a cart reached its designated production station, hoists were available to transfer the projector — but not all employees utilized the hoists, putting some at risk for back injuries.

Alternately, the new Shuttle VLMs are equipped with automatic tray extraction and a hoist mounted at the operator access point. The operator processes the order with the click of a button, and the VLM retrieves the tray with the required projector. Once the tray arrives at the opening, it is automatically pushed out onto an extraction table for easy access. A software screen identifies the projector's storage position in the tray.

Because up to five sub-assembled projectors rest closely together on the trays for maximum storage density, workers must use the ergonomic hoist to easily access them. To pick, the operator uses hand held controls to position the hoist over the item, hooks the two together, and again uses the controls to lift the load. With the controls the operator guides the hoist to move and lower the projector onto a transfer cart, where the two are disconnected. After pushing a button to confirm the pick, the tray automatically retracts into the VLM.



In addition to introducing a safer, more ergonomic process by deploying the hoist-supported VLMs, projectors are retrieved 90% faster with half the number of employees previously required.

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To learn more about how automated, goods-to-person storage and retrieval systems can improve your operation's safety and ergonomics — as well as space utilization and efficiency — contact your Kardex Remstar representative today.

About Kardex Remstar

Kardex Remstar, LLC, a company of the Kardex Group, is a leading provider of automated storage and retrieval systems for manufacturing, distribution, warehousing, offices and institutions. For information about the company's dynamic storage solutions visit www.kardexremstar.com.