

# MODERN MATERIALS HANDLING®

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Harley-Davidson improves production efficiency with ergonomic handling system



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# Harley-Davidson improves production efficiency with ergonomic handling system

*The motorcycle maker's newest manufacturing plant uses a towline conveyor and height-adjustable carriers to enhance operations on its final vehicle assembly line.*

**A**s Harley-Davidson Motor Company has discovered during its more than 95 years of operation, there are shop floor gains to be found in unexpected places. At the company's new Sportster XL motorcycle assembly plant in Kansas City, Missouri, the productivity engine is powered by one of the most established of all materials handling technologies—towline conveyor—and one that is still emerging—ergonomically designed carriers for work-in-process.

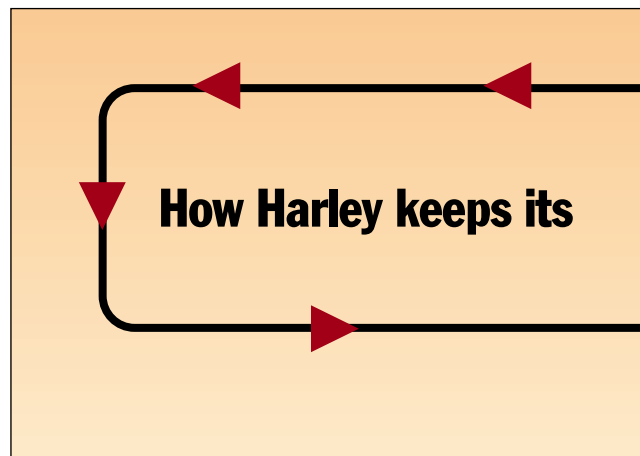
The 346-ft towline conveyor (SI Systems) allows for complete motorcycle assembly, from initial frame placement to final inspection of finished product. Assembly operations are performed at workstations as the towline continually advances at rates that adjust with production requirements. As needed, workers can adjust the height and rotation of the carriers to perform all assembly operations.

The towline conveyor transports motorcycles through many different work

Lisa A. Goetze  
Associate Editor



Workers perform assembly tasks at one of the work stations on the line.



Motorcycles are assembled on ergonomic carriers pulled through work stations by an in-floor towline conveyor. At the final assembly

stations during the final assembly operation. The process is an ergonomic one because the carriers, which support the motorcycles through the various processes, raise and lower, and can rotate 360 deg. to conform to the needs of workers performing particular tasks.

The facility produces and ships over 100 motorcycles a day. Although exact quantities are not available, Michael Arnst, senior manufacturing engineer, reports that this assembly line contributes to the quantities produced

in conjunction with the York, Pa. final vehicle assembly plant.

**A new assembly facility**

Long before the facility in Kansas City produced its first motorcycle, a number of key Harley representatives and outside people met to enumerate the factors important to the company in developing a new assembly plant. These included ergonomics, flexibility, maintainability, reliability, and serviceability.

According to Aaron Jensen, a new products technician with Harley-Davidson, the new plant in Kansas City “is not traditional,” because of the

**Empty carriers (foreground) line up to be loaded with a motorcycle frame to begin assembly. The carriers are delivered to the loading station by the towline recirculation loop.**



*Harley-Davidson combines established towline conveyor technology with ergonomically designed carriers to improve productivity.*

ways in which the company combined “its interest in being more efficient, while cutting costs.”

The facility officially opened in January of 1998. A total of about 100 employees, including management, support the final assembly operation.

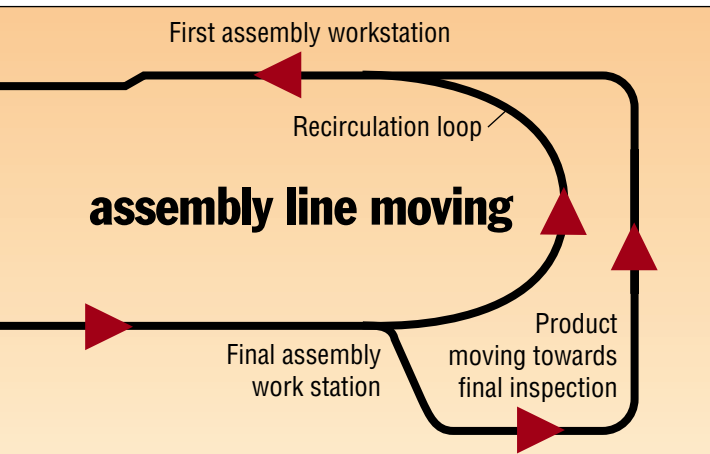
The assembly and paint operations involve one 7:00 am to 3:30 pm shift, five days a week, while the fabrication operation has two shifts.

The first-hired assembly workers in the Kansas City plant were trained in the York, Pa. facility. Before the new facility opened, the York plant had been the only final vehicle assembly plant for the company.

Parts required for assembly are delivered to the appropriate assembly line work station. Because the plant operates on a

just-in-time basis, the plant receives new parts on every day of operation.

The towline system consists of two variable-speed towline



**station, motorcycles are removed from the carriers, which then return to the first work station by the recirculation towline.**



**A nearly completed motorcycle receives final components before being unloaded from the carrier.**

**MANUFACTURING**

loops. One loop is the assembly line while the other is a recirculating and accumulation line for carriers being readied to re-enter the assembly loop (see drawing).

At the first work station, the motorcycle frame is mounted on the ergonomic carrier. The assembly loop of the towline then proceeds to join the work-in-process through each of the assembly line's work stations. Carriers are about 12 ft apart to give workers at each station sufficient time to complete the required assembly operations.

According to Arnst, the carriers were designed to meet Harley's specific requirements. Inside a rubber bellows at the center of the carrier (see photograph at right), a battery-powered scissor lift raises and lowers the work deck as needed for each assembly operation. Meanwhile, the deck is mounted on a turntable with a 360-deg turning radius providing an efficient and ergonomic approach to assembly.

The control system of the conveyor is PLC-based, and uses operator interface terminals for monitoring the status of both conveyors and materials. An overhead message display provides quick status evaluation from any position on the assembly line floor.

In addition, a PC provides for the generation of a full range of production reports, and has access to all time-stamped system status events.

When the assembly process is complete, the motorcycles are low-

ered to ground level while still in the carriers. Empty carriers are switched over to the recirculation loop for their return to the first assembly work station. Accumulation stops on this transfer conveyor create buffer queues both before and after the unload station for balancing the operation. Assembly workers manipulate the product manually as they are readied for shipment.

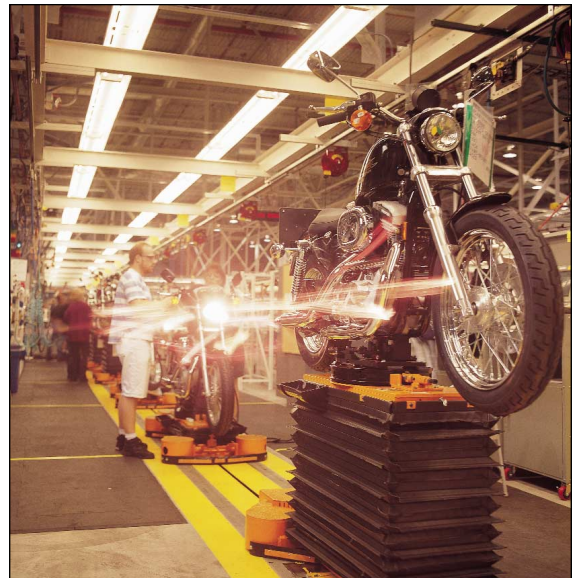
Every motorcycle goes through rigorous testing after assembly. In the roll test booth, the engine and transmission must demonstrate conformance with design criteria.

After testing, the motorcycles travel only about 40 ft to the crating area, and another 20 ft for placement in a cardboard/ wooden box for shipping. All motorcycles are shipped to retailers via truck.

**Planning the system**

Arnst reports that the project of opening a new manufacturing assembly line occupied less than a year from concept to installation. The design team included assembly workers, safety representatives, a maintenance representative, a design consultant, Harley-Davidson engineers, and a process lead.

The members of the design team naturally each had their own ideas about the vital elements of an assembly line. One common goal,



**Custom-designed ergonomic carriers on the towline conveyor transport motorcycles through the ergonomic assembly process. Carriers are height-adjustable and can rotate 360 deg, thereby easing processes for workers.**

however, was to create an ergonomic environment for assembly operations. The other objectives for the new assembly line included reliability, maneuverability, flexibility, and serviceability. Arnst comments that the company wanted an integrator (SI Systems) that would work with the company in designing the assembly system.

Both Arnst and Jensen report that the Sportster's assembly line is designed ergonomically to improve worker efficiency and satisfaction. They also state that workers have given the system high marks. Arnst also says that integration of the system has been successful, almost transparent to workers on the line. □



*The line is designed ergonomically, and assembly workers give the system high marks.*

