12

Setup Improvements Based on Shop Circle Activities

Toyota Auto Body Co., Ltd.

THE COMPANY

Toyota Auto Body Co., Ltd. is located in the city of Kariya in Aichi Prefecture, where its specialized plant produces bodies for passenger cars, trucks, and commercial vehicles by means of pressing, plate-work, painting, and assembly processes.

Numerous body types are produced — four passenger car types, five truck body types, and three commercial vehicle body types — and each production line is a mixed, multi-body line. In numbers of auto bodies, the firm is responsible for over 10% of total Toyota production.

APPLICATIONS OF SMED

Simplifying Materials Setting Changes

As shown in *Figure 12-1 (left)*, although the press line was a single line from machines 1–6, intermediate processes fed into the line according to the shapes of the parts involved. When this happened, a materials rack was placed between machines 1 and 2 to feed into the main line. Each time this took place, considerable setup time was required to set up the materials rack with a crane and to put the material in place.

To improve this process, rather than use a crane with a high operating load, we arranged to move the operation to external setup (*Figure 12-1, right*). We made the materials racks so they could slide up and down and, with a conveyor running underneath a materials rack between machines 1–6, materials could be delivered by sliding up the rack.

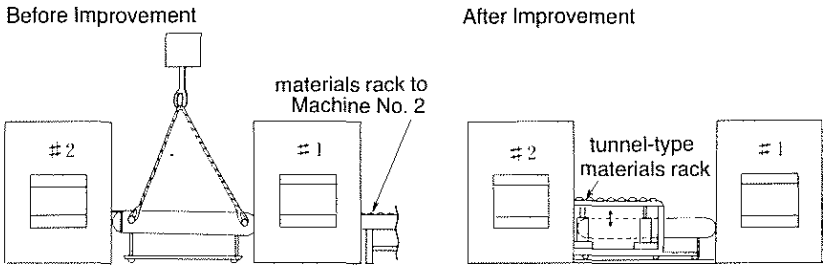

FIGURE 12-1. Simplification of Materials Setting Changes

Improved Setup for Accessory Transfer Die Equipment

Because the number of transfer-die processes varied, setups for installing a conveyor to remove and then move products took considerable time, as shown in *Figure 12-2 (left)*.

To improve this setup, a stage was attached to the transfer die (*Figure 12-2, right*). Products could then be moved by mechanical fingers, thereby eliminating conveyor equipment.

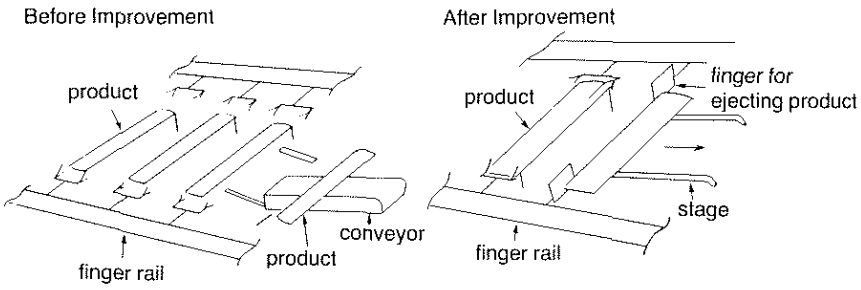

FIGURE 12-2. Improved Setup for Accessory Transfer Die Equipment

Improved Setting of Dies on a Fixed Bolster

Previously, a hoist crane had been used to transport dies for insertion into and removal from a small press (*Figure 12-3, left*).

To simplify the die placement, we set a roller conveyor into the bolster so that dies could be inserted and removed without using machines (*Figure 12-3, right*).

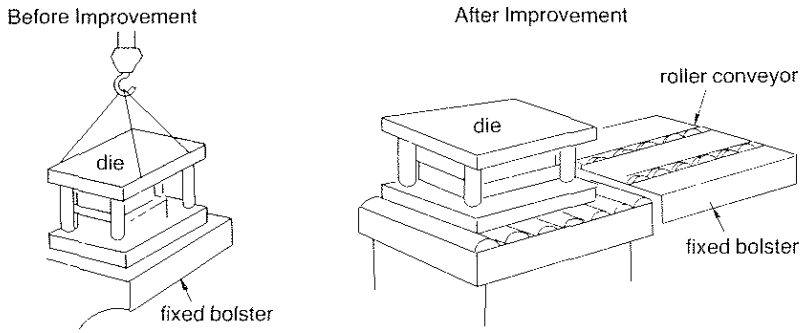

FIGURE 12-3. Improved Setting of Dies on a Fixed Bolster

Improvement in the Attachment and Removal of Air Hoses for Automation

Air hoses had been used for automation, but setups took time because hoses were manually attached to and removed from dies in the course of internal setup (*Figure 12-4, left*).

The improvement was to attach and remove air hoses during external setup. A packing-type quick joint was mounted on the bolster, so that air would be automatically fed in or cut off as the press moved up and down (*Figure 12-4, right*).

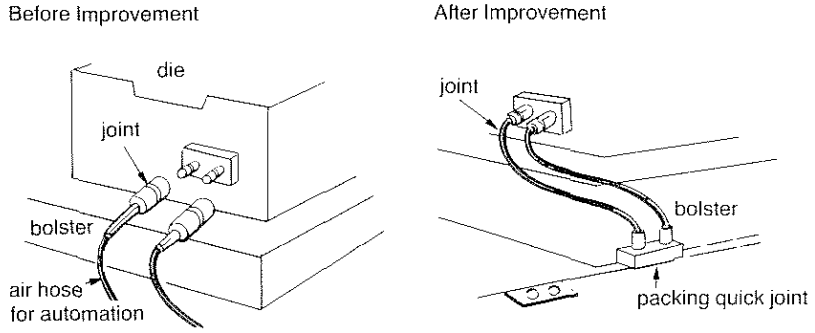

FIGURE 12-4. Improvement in the Attachment and Removal of Air Hoses for Automation

Die Positioning

Dies were set in place by fitting die-locating jigs into slots on the bolster and on the bottom of the die (*Figure 12-5, left*). The fine ad-

justments involved, however, took a great deal of time.

To improve the positioning of dies, locating stoppers were mounted on a moving bolster and corresponding sections cut out of the lower press die (*Figure 12-5, right*). When these came into contact as the crane was lowered, the die was set in place without fine adjustments.

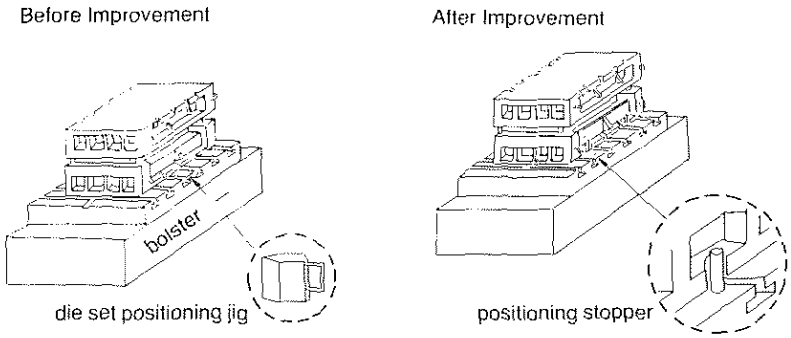

FIGURE 12-5. Die Positioning

Setting Coil Sheet Feed Volume

Coil sheet feed adjustments needed for particular types of products used to be made by combining four cylindrical spacers and using adjustment screws (*Figure 12-6, left*). These feed volume adjustments, however, took a long time.

For each product type, a special arch-shaped stroke gauge was made so that one-touch adjustment settings became possible (*Figure 12-6, right*).

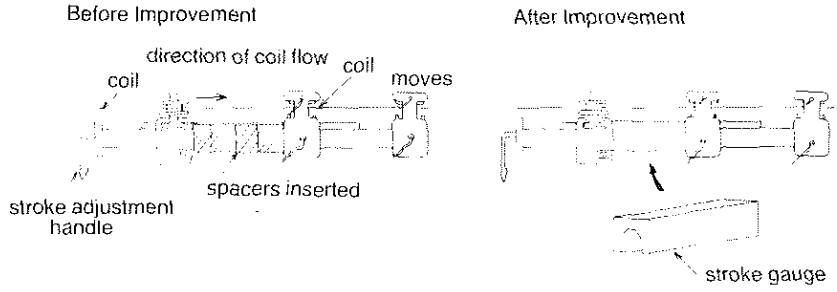

FIGURE 12-6. Setting Coil Sheet Feed Volume

Simplified Die Positioning

Center keys, located at the front and back and left and right, made positioning difficult and time-consuming when attaching or removing a die on a bolster, since it had to take place at four locations simultaneously (*Figure 12-7, left*).

To simplify this procedure, the left-to-right position on the bolster is determined first. Setup time is reduced by providing a spring-action bobbing center key, since centering can be divided between the two surfaces (*Figure 12-7, right*).

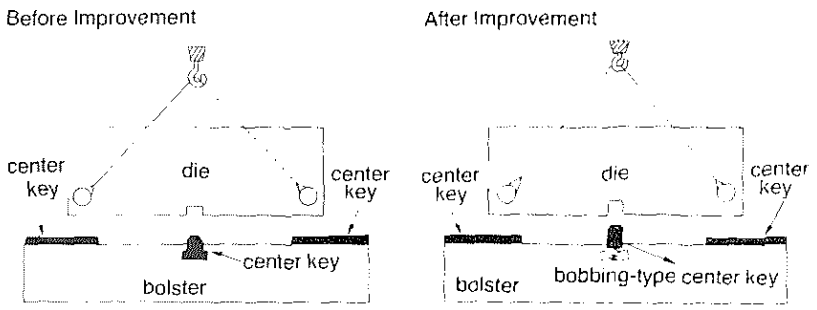

FIGURE 12-7. Simplified Die Positioning

Microshear Piling Setup Improvement

Pilings made of material cut to planks on a microshear were secured by fitting the piling stopper to the cut dimension of the raw material (*Figure 12-8, left*).

Now, by linking the microshear adjustment stopper and the piling stopper, piling stopper adjustments have been eliminated and setup time reduced (*Figure 12-8, right*).

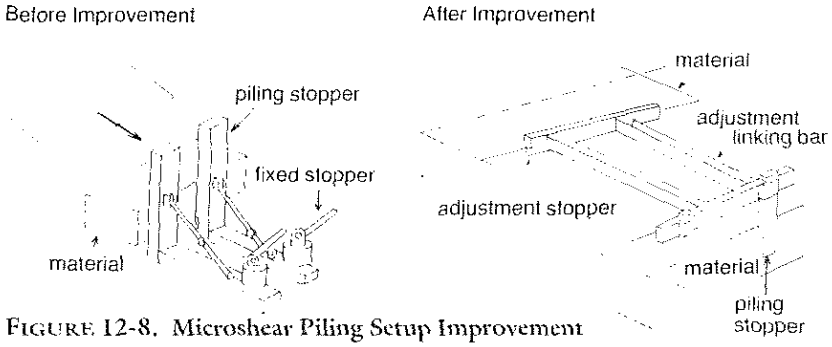

FIGURE 12-8. Microshear Piling Setup Improvement

Improving Setup by Means of a Feed Line Blanking Die Strike Die

For a spring stock blanking die with few processing strokes, a surface plate was used, and setup took a long time because bolts were used for attachment (*Figure 12-9, left*).

After improvement, a gap is preserved between the upper and lower dies with urethane stock so that the die can be struck directly (*Figure 12-9, right*). The surface plate is abandoned and bolts are eliminated from both the upper and lower dies.

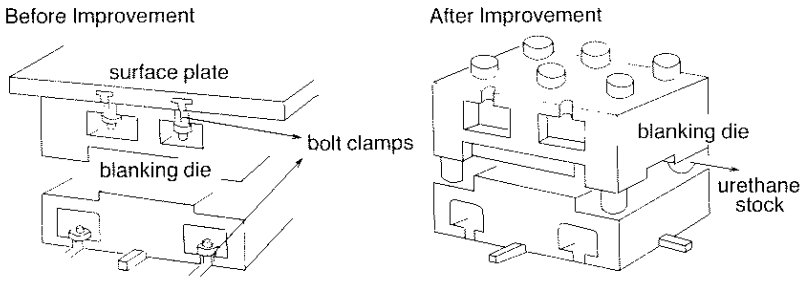

FIGURE 12-9. Improved Setup by Means of a Feed Line Blank Die Strike Die

Automating Deck Front Guard Frame Spot-Welding

Decks (the loading areas on trucks) are put together on two lines, and to spot-weld front guard frames on each of them, workers would choose either RX-34, C-157 or C-030 spot-welding guns and then do the welding (*Figure 12-10, left*). With the integration of

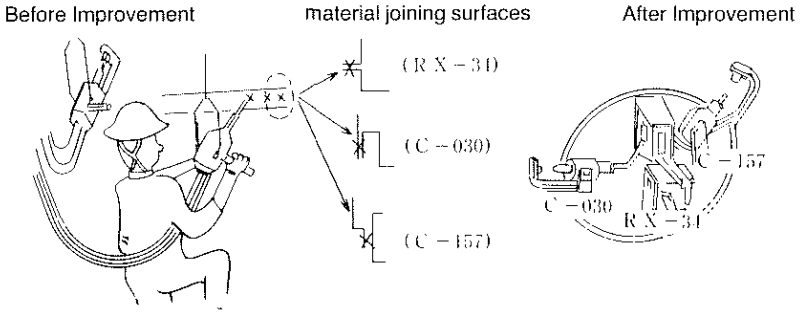

FIGURE 12-10. Elimination of Gun Selection Time Through the Automation of Deck Front Guard Frame Spot-Welding

decks, selection changes become more frequent, requiring more time and increasing worker fatigue.

To eliminate the increased time and fatigue that result from these gun selection changes, the three types of spot-welding gun are now set on a round plate (*Figure 12-10, right*). Rotating the plate automates the gun selection process.

Eliminating Setup Operations for Urethane Bumper Loading Pallets

When a loading pallet for urethane bumper products was full, a preparatory operation was needed in which that pallet was shunted aside and the next loading pallet was moved into loading position. Positioning pallets required repeated adjustments and production had to wait until all the preparations were completed (*Figure 12-11, left*).

A positioning guide to control the pallet was then installed and a feed mechanism and loading pallet were linked and automated. By this means, pallet-moving preparations were reduced by half and positioning adjustment operations and waiting were eliminated (*Figure 12-11, right*).

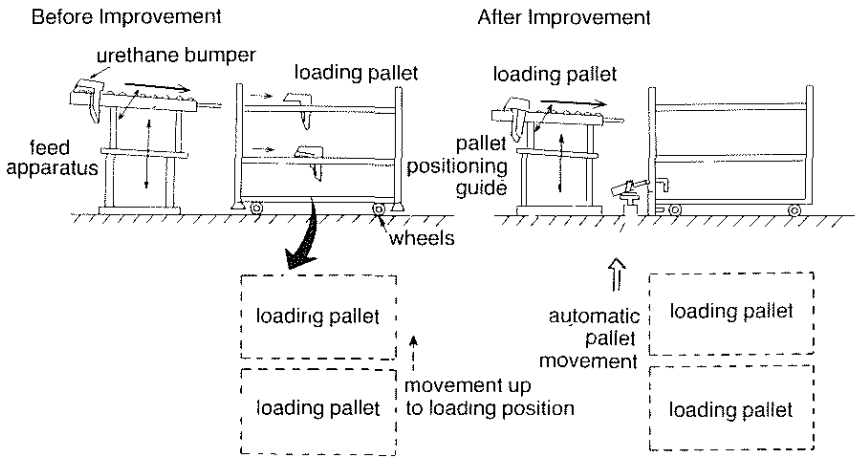

FIGURE 12-11. Elimination of Setup Operations for Urethane Bumper Loading Pallets

Improved Separation of a Hat-Shaped Cutting Die

Formerly, two types of die were used for hat-shaped cutting, making it necessary to set the dies in place for each separation (*Figure 12-12, left*).

Now, two types of hat shapes are incorporated in a single die, which can be separated by changing the length of the strike block (*Figure 12-12, right*).

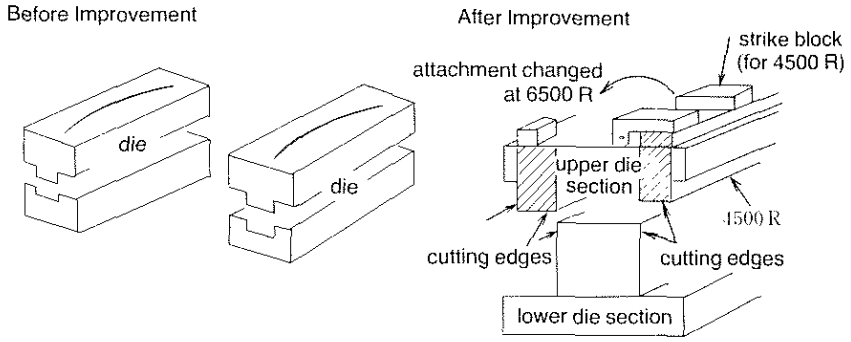

FIGURE 12-12. Improved Separation of a Hat-Shaped Cutting Die

Reducing Setup Times for Changing Automatic Patch Machine Attachments

On automatic patch machines for a deck sheet metal shearcross process, two types of gusset shearcross are spot-welded with an automatic machine. Since gusset shearcross dimensions vary, there was a special attachment for each. According to the order of assembly, they were changed by loosening two bolts per side with a wrench (*Figure 12-13, left*).

After improvement, it was possible to change attachments by a one-touch plug-in method (*Figure 12-13, right*).

Reducing Loading Process Setup Times by Using a Tunnel Conveyor

Before improvement, the press line consisted of a single line from machines 1–6 (*Figure 12-14, upper*), but depending on fluctua-

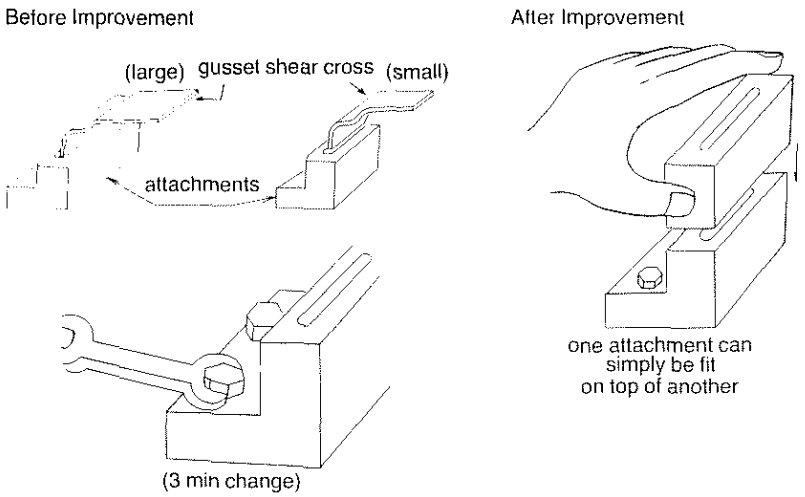

FIGURE 12-13. A Deck Sheet Metal Shearcross Process

tions in the number of processes for the parts involved, the loading position would shift either to behind machine 5 or to behind machine 6. Each change took considerable time.

After improvement, goods were loaded at a fixed location (*Figure 12-14, lower*). A turntable was attached to the conveyor, which could then be rotated for loading and unloading, and storage facilities could be set up at the next location after the halted process.

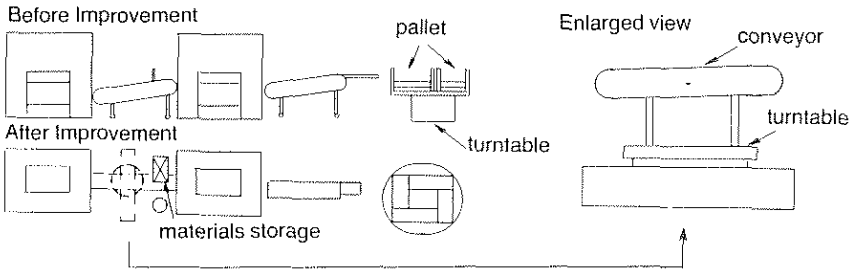

FIGURE 12-14. Reductions in Loading Process Setup Times Through the Use of a Tunnel Conveyor