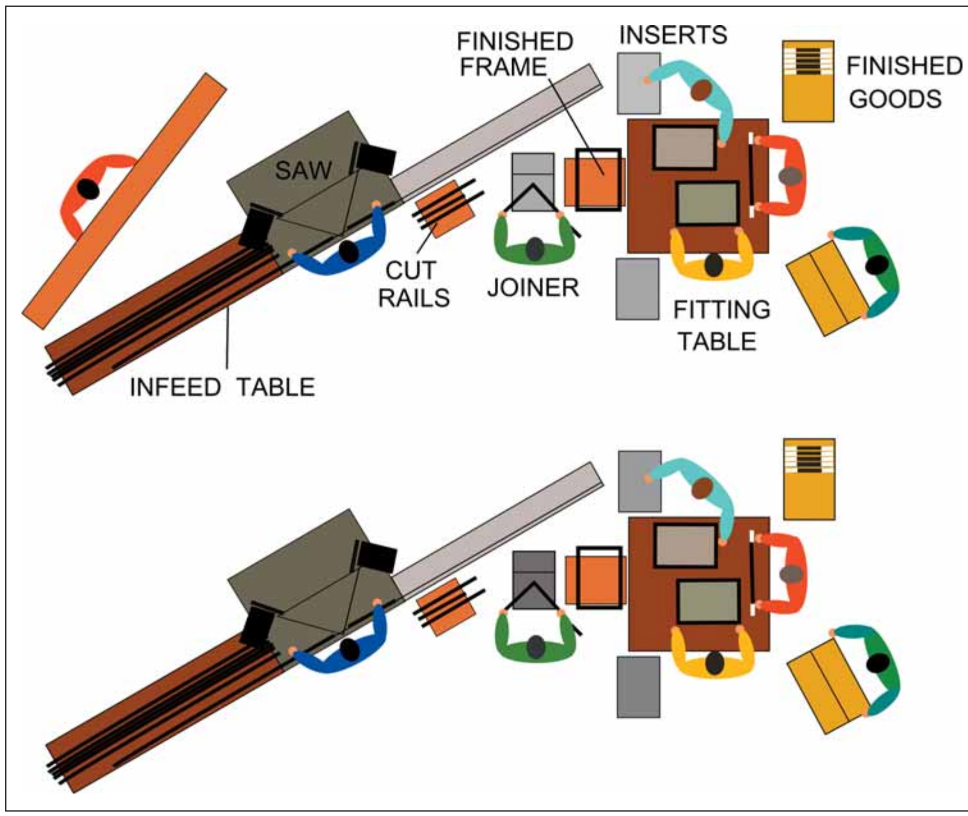
Analyzing Your Production Process

By Jim Burke

Most production framing companies are perennially concerned about their production rates, floor layout, workflow, or the quality of their finished products. Sometimes, you know that you have problems or that you should be more efficient, yet you're not quite sure where to begin.

The answer is to examine your processes, looking for answers to production problems and ways that you can improve your efficiency. In analyzing each part of your operation, it is important to look systematically if you want to make real improvements. The solutions for one company may be entirely different than for another because each company and product is different. You can't rely on solutions that worked somewhere else; you have to investigate your own processes. Once you uncover the sources of your problems, you can develop your own solutions.



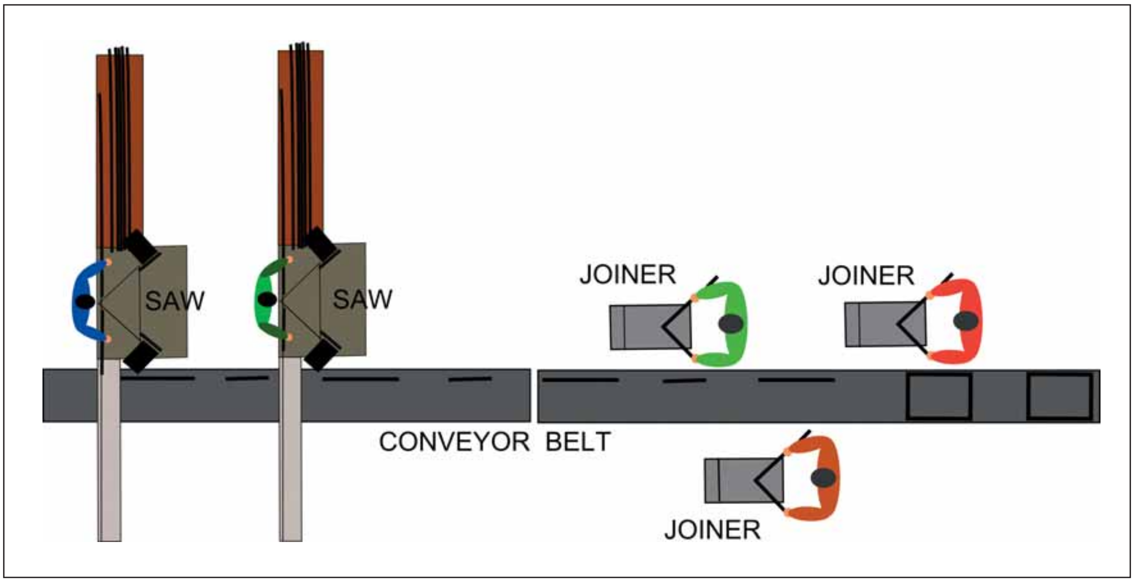
Example 1 represents an in-line production cell replicated two times. It includes cutting, joining, fitting, and packaging in one compact area. The saw requires flip stops or a jogging stop to produce short-rail, long-rail sequences. It also requires a good dust collection system to remove most of the sawdust and some type of chip removal system that doesn't interfere with the ongoing production. To keep the joining area compact, the joining machine should be set up in a near vertical position so that side tables aren't required to support larger frames. The frame faces downward when joined, not upward as normally expected. Conventional machines that are on stands and able to pivot need to be raised on a platform by 20" to 24" for correct working height. Up to three people can be positioned around the fitting tables. An additional two or three people are required to feed moulding to the saw, supply bundled inserts for fitting, and remove the finished goods in boxes. Each cell requires seven to eight people and can produce up to 2,000 poster-sized finished pieces a day. With eight people, that represents 64 man-hours, or .032 man-hours/piece, or 1.92 minutes per piece in an eight-hour shift.

Analyzing Frame Manufacturing

Let's start by looking at the frame manufacturing process. It has three main parts: storing moulding, cutting moulding into rails, and joining the rails into finished frames. Start your systematic look by examining the following points.

By using a systematic approach to analyzing your production problems, you can eliminate those problems and become more efficient

5. A system should be in place so that any moulding number can be found easily at any time. A system needs to be developed by you and your staff to suit your needs. Point 1 suggests three possible ways to segregate storage. Using a rack numbering system may prove helpful. When moulding is received, the rack number can be entered into your inventory system.
6. Storage can be vertical or horizontal or a combination of each. Horizontal storage is good for long-term items or for job lots. If you have standard frame jobs that need to be accessed every day, a vertical bin system can prove useful. Replenish the vertical bins from your horizontal long-term rack storage.



Example 2 represents an in-line flow using conveyor belts to deliver cut rails to joiners and finished frames to the fitting area. It can stop there or continue all the way to fitting, boxing, and shipping finished goods. These systems are best adapted to frames that are smaller than 16" x 20" and are ideal for photo frame sizes. Conveyor systems have an advantage for overall efficiency in production because operators of saws and joiners are constantly aware of the moving belt and the need to maintain speed. This is not meant to be a detriment. Operators can get into a rhythm that makes the time (and the product) go faster. When conveyor speeds are set properly, everyone benefits.

Storage

1. Is your moulding stored in short- or long-term areas or in one large inventory? Is storage for future jobs separate from daily jobs when space is available? Is moulding stored by job numbers, by moulding number, or by a bin location?
2. Moulding inventory should be accessible at all times so you can remove boxes from a stack or sticks from a box. Haphazard placement of incoming moulding in front of stored boxes will create hours of wasted time in moving everything from place to place. This can also cause employee frustration when trying to find a particular moulding. Plan out moulding storage carefully.
3. Moulding should be located near the cutting area (saws) or near the entry point (truck dock).
4. If boxes can't be stored near the point of entry (for less handling), they should be near the saws and cutting area for easier access.

Cutting

1. Moving moulding to saws should be straightforward and easy. Carts, wagons, or forklifts might be used depending on the quantity needed for each job. Whose responsibility is it for bringing moulding to the saw—the saw operator or a designated employee? Can that person locate the moulding easily and identify the profile needed for a specific job? Wasting a saw operator's time means fewer frames will be cut that shift.
2. The in-feed system for a saw should include space for at least one box of moulding to feed the saw. A table or supports should be used in place of or in addition to the standard in-feed arm for a saw. For crated moulding in bulk, space needs to be allocated at the in-feed side of the in-feed arm to pull mouldings from the crate onto the saw's in-feed arm.
3. The responsibilities and duties of a saw operator will affect your total output. If an operator has to move, load, and cut every box of moulding that is to be mitered as well as discard the used box, the frame cutting time is diminished greatly. In addition, an operator probably discards cut scraps and cleans up every day, further diminishing productivity.

Vertical moulding storage

Horizontal moulding storage

Joining

1. Once the rails are cut, they have to be moved to the joining area. What person does this—the saw operator, the joiner operator, or a designated employee? What method is used to transport the cut rails—a hand cart modified for this use or some form of wagon with trays? (This assumes a cell or batch mode operation, not in-line production, is being used.) Is there enough storage area to hold the cut rails waiting to be joined?
2. What is the proximity of the joiners to the saws? Are they near each other for convenience or are they somewhere across the room for separation and/or dust considerations? Is there enough storage space around the joiners for rails waiting to be joined into frames?
3. Whose responsibility is it to move the carts or stored rails to the joiners—the joiner operator, the saw operator, or a designated employee? The size of your company usually dictates this. For a large-scale operation where the quantity per day is most important, a designated employee usually moves items, not the operators. Once a frame is joined, who moves the finished stack of frames to the fitting area? Again, look at all duties of each operator.
4. Who manages the scrap or determines what happens to junk frames? Is there a central place where frames that didn't make the finished pile are stored? What do you do with badly joined frames or scrap rails? Do you recycle them as smaller frames after re-cutting the rails, or do you simply throw every piece away? (On some jobs it could be cheaper to throw them away rather than spend more labor to re-cut and re-join.) You have to make that decision based on moulding cost.

Benchmarks

To analyze a problem you may be having in your production system accurately, it is helpful to know what your equipment is capable of producing in a given period, such as per hour or per shift. Not all equipment is rated by manufacturers for expected performance ratings. If a rate is provided, consider that it might be for maximum production for an in-line production system, not for batch-mode production.

Let's clarify the terms “in-line” and “batch-mode” production.

- For “in-line cutting,” assume that the saws are cutting short-rail, long-rail sequences and passing the cut pieces to either a conveyor belt or a joiner table located beside the saw and next to the joiner. There could also be two saws, one cutting the short rails and the other cutting the long rails. These are placed on a conveyor belt, which then feeds the joiners downstream. For the first example, the saws would be equipped with flip stops or jog stops to produce short-rail, long-rail sequences. Also assume that the saw operator does not supply the moulding to the saw.
- For “in-line joining” assume that a joiner operator is presented with four rails to be assembled, two long and two short. After the rails are joined, the finished frame is passed to a conveyor belt or to a table for fitting. The finished frames are not stacked.
- In “batch-mode cutting,” a saw operator cuts a tray or rack of long rails and then an equal number of short rails in batches. These trays are then moved to the joiners for finishing at some future time. A short-term inventory of cut pieces is created.
- “Batch-mode joining,” rails are presented in batches using some type of tray. Long rails are in one tray and short rails are in another. After joining, finished frames are stacked in batches for transport to another station. An inventory of frames is created.

The following benchmark list is based on production double miter saws that are air-operated and designed for a total stroke time of two to four seconds per cut (up and down motion). The benchmarks for joiners include any automated computerized machines that are designed for continuous production, regardless of brand. The more recent machines with multiple nail channels or memory capabilities to store programs offer extra value but aren't necessarily faster than machines with just computer operation and manually set nail positions. The overall joining speed is a combination of machine speed, operator speed and process efficiency. Keep in mind that each number represents one hour of production. For example, to get the production number for an eight-hour shift, just multiply the number by eight.

You can use benchmarks in the following way: Say you need to produce 1,000 frames a day that are 11"x14" and use 1" wide poly moulding. You have two saws and two joiners and can barely keep up with quantities needed. From the benchmark for batch-mode cutting and using the first example of 190 frames per hour, you can see that one saw should be able to cut 1,140 frames in six hours. Try using one saw and let the other saw operator supply moulding to that saw and also move cut rails from the saw. With one saw operator just cutting, see if your production increases. The first operator's job is to cut and nothing else. If the workers get bored, let them switch between breaks.

The production rates shown in the benchmark examples should not be used to measure a machine operator but rather to evaluate the system they work in. The volumes suggested are for maximum efficiency and are supported by past or present factories that achieved these rates. ■

Jim Burke owns Machines Etc., a sales and consulting company based in New Bedford, MA. He started in the picture framing industry with Arquati Moulding in Cleveland as general manager. For the past 25 years he has sold and serviced all types of machinery for cutting and joining frames and cutting mats. He has also sold web control machinery to paper mills, tire cord manufacturing, textiles, plastic film extrusion, and paper converting companies throughout the Midwest.

SAWS ***(Maximum Per Hour)***

In-Line Mode (½"-1½" wide x 20" or less)
250 - 310 frames (1,000-1,240 rails)
(3.6 - 2.9 seconds per rail avg.)

In-Line Mode (2"-4" wide x 24" or less)
200 - 225 frames (800-900 rails)
(4.5 - 4.0 seconds per rail avg.)

In-Line Mode (2"-4" wide x 26" or more)
150 - 180 frames (600-720 rails)
(6.0 - 5.0 seconds per rail avg.)

Batch-Mode (½" - 1½" wide x 20" or less)
190 - 250 frames (760 - 1,000 rails)
(4.75 - 3.6 seconds per rail avg.)

Batch-Mode (2" - 4" wide x 24" or less)
150 - 180 frames (600 - 720 rails)
(6.0 - 5.0 seconds per rail avg.)

Batch-Mode (2" - 4" wide x 26" or more)
100 - 125 frames (400-500 rails)
(9.0 - 7.2 seconds per rail avg.)

Batch-mode saw rates can be almost equal to in-line production rates if a designated employee moves all moulding to the saw and all cut rails away from the saw when trays are filled.

JOINERS ***(Maximum Per Hour)***

In-Line (½" - 1½" wide)
250 - 310 frames (up to 16"x20") No Glue
(14.4 - 11.6 seconds per frame)

In-Line (2"-4" wide)
175 - 200 frames (up to 16"x20") No Glue
(20.5 - 18.0 seconds per frame)

In-Line (2"-4" wide)
125 - 175 frames (over 16"x20") No Glue
(28.8 - 20.5 seconds per frame)

Batch-Mode (½" - 1½" wide)
150-250 frames (up to 16"x 20") No Glue
(24.0-14.4 seconds per frame)

Batch-Mode (2" - 4" wide)
90-150 frames (up to 16"x20") No Glue
(40.0-24.0 seconds per frame)

Batch-Mode (2" - 4" wide)
60 - 100 frames (over 16"x20") No Glue
(60.0 - 36.0 seconds per frame)

Joining rates are generally affected more by rail lengths than by moulding width. A 24"x30" frame, regardless of moulding width, requires more time and space to maneuver. When glue is added to the equation and is applied by a joiner operator, production drops by 40 to 50 percent. Production can be the same as with no-glue if the glue person is not the machine operator. Wide mouldings with added bulk in height, such as a 5" wide x 2½" tall moulding, will slow down saw and joiner rates by about 30 to 40 percent in the examples above.