

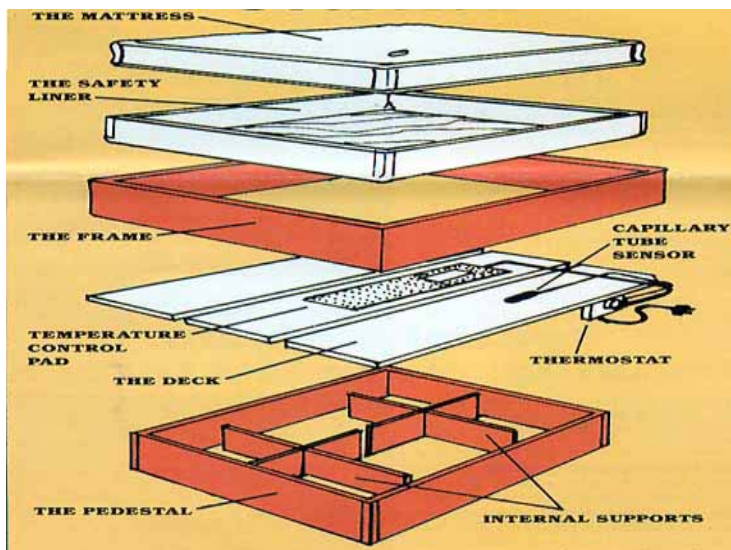
Waterbeds East

Waterbeds East designed, manufactured, sold, and installed a variety of waterbeds out of its “hole-in-the-wall” store on the outskirts of Brunswick, Maine’s shopping district looking towards the Androscoggin River. The showroom was just large enough to display 3 beds and accessories, and there was a small office in the back. The workshop was located in the basement below the showroom and office. Space was at a premium, especially in the workshop. The total square footage was 800 square feet each for the showroom/office and workshop below. The store operated from Tuesday through Saturday each week. On average during the past year the store sold 10 beds per week.

The store competed in the marketplace on several fronts. First, the store’s prices were lower than the competition. Second, since it made its own beds, Waterbeds East could deliver a customized bed to a customer’s specifications within 3 days of an order. Customization related to the color stain for the wooden frame. If a customer wanted a headboard, then the order might take longer. When a customer ordered a bed, a 50% deposit was required to supply working capital. (The store also had a credit line with a local bank with an interest rate of 15% per year.) Third, the in-house manufacturing provided for distinct branding with a “Made in Maine” label, which appealed to many “Mainiacs.” Waterbeds East’s competitors bought beds from manufacturers in the South.

A waterbed consisted of a number of separate parts (see Figure 1):

1. The wooden frame that provided structural support for the water mattress.
2. A wooden pedestal that raised the frame and mattress to a comfortable height – pedestals could ordered with draws or a space to store skis.
3. A deck or platform that sat on the pedestal and supported the mattress.
4. An optional headboard,
5. The water mattress itself, which was a “bag” of plastic 22 mils thick that held 180-220 gallons of water in a queen and king mattress, respectively,



6. A plastic safety liner in which the mattress sat to catch – hopefully! – any leaks. The liner was attached to the frame during installation using narrow wooden strips.
7. A heater, composed of a temperature control pad, thermostat, and sensor, that maintained a constant water temperature.

The mattress, liner, and heater were all bought from distributors, but the frames, pedestals, and optional headboards were all built by Waterbeds East in the downstairs workshop. 95% of bed sales were for king (6 feet wide) and queen (5 feet wide) size beds. The remaining sales were for double (4.5 feet wide), super single (4 feet wide), and single (3.5 feet wide). Occasionally, customers bought baby water cribs, which were supposed to reduce the incidence of Sudden Infant Death Syndrome (SIDS)!

During the store's early years when the sales volume was low, the carpenter built each bed to order. As sales volume grew, delays in bed delivery occurred. The staff began experimenting with making some of the standard parts in batches. They found they could make a mixed batch of king and queen with no added confusion. Storage space in the cramped workshop was limited, though. Only about 15 frames could easily be stored at a time. They had considered renting a trailer for additional space.

Frame Materials and Construction Process

Bed frames were built out of 2" x 10" lumber bought in 14' lengths, which would allow for the ends of the boards to be trimmed. An order for lumber was placed once a week.

One frame consisted of four boards:

- ◆ Two, 7' 3" side pieces regardless of the size of the bed
- ◆ Two, end pieces, which would be 5' 0" (Queen), 6' 0" (King) or other widths if a special order arrived for a double, super single or single bed.

All the work done on the frame pieces was performed on the one work bench in the workshop by one carpenter, who was paid \$10/hour. The workbench had special marks and "jigs" to hold the boards in proper position for each operation. Frames could be built in batches up to the point of customizing the frame with a customer's choice of stain color.

The following table shows the 6 steps necessary to prepare the frame boards for staining. The run time is the time required to process all four boards that comprise one frame. The table also shows the time for customization. *For the customization process, the Run Time for the two drying processes represents the elapsed time for the boards to dry. No labor was consumed for these two steps.

<u>Step</u>	<u>Construction Process</u>	<u>Set Up Time</u>	<u>Run Time</u>
1	Cut boards to length with circular saw	5 min.	4 min.
2	Rough sand boards	4 min.	12 min.
3	Round top edges of boards with a router	2 min.	8 min.
4	Finish sand boards	4 min.	20 min.
5	Drill holes for lag bolt (side pieces only)	3 min.	4 min.
6	Stack boards to await custom finishing	0 min.	2 min.
<u>Customization Process</u>			
7	Apply stain & stack to dry	5 min	15 min.
8	Dry boards		24 hours*
9	Apply polyurethane & stack to dry	5 min	20 min.
10	Dry boards		24 hours*

When assembling the bed in the customer's home, the side pieces would be attached to the end pieces using 8 lag bolts, two for each corner. The frame was then supported by the pedestal and its deck. Angle brackets were used to attach the frame to the deck.

Questions

1. If they make the frames individually to order, how much carpenter's capacity is needed to make 50 frames?
2. If they make the frames in batches of 10 sets, how much carpenter's capacity is needed to make 50 frames?
3. If they make the frames in batches of 25 sets, how much carpenter's capacity is needed to make 50 frames?
4. In addition to storage limitations, what other factors might affect the choice of batch size?
5. Would a line flow process design make sense for this operation? That is, what would happen to cost per frame if six people were hired with one person performing each of the operations? If you wanted to use an assembly line process, what process redesigns would you want to make?
6. If they were to move the business to a much larger facility, and they wanted to be able to handle custom frame requests in this process, would you advocate having a line flow process? For example, some customers want double or super-single size bed frames or they may want a different type of edge done by the router in Step 3. How long would it take for one of these custom beds to be completed if you made frames in batches of 10 sets? In batches of 25 sets?