

Carlex Glass Laminated Side Glass Process Optimization

Team 2018

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Under the direction of Mike Mund, Project Manager





The Original System

- Inconsistent cycle times across machines
 - Lamination room was 17.8 seconds, bag furnace was 15 seconds, other systems were 18 or 17 seconds
- No set value of autoclave batch size
 - Operators ran the autoclave whenever they decided to do so, usually for arbitrary reasons
- Two teams of two workers each per shift
 - Resource utilization was noticeably low; these workers were often idle



System Overview and Objectives

Lamination

Remove inconsistencies with specifications given by Mike Mund

Ensure process flow is balanced with the same cycle time for every component

Autoclave

Determine optimal number of racks of glass (within the constraint of a maximum of 12 racks) to be inserted per cycle.

Ensure autoclave staging area is not overflowing

Finishing

Keep resource utilization of human labor close to 100%

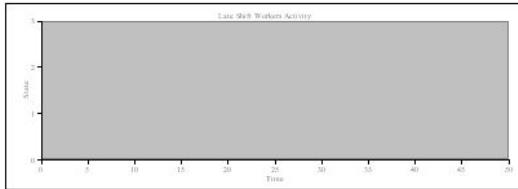
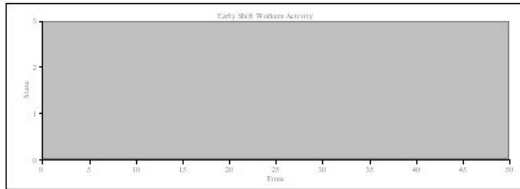
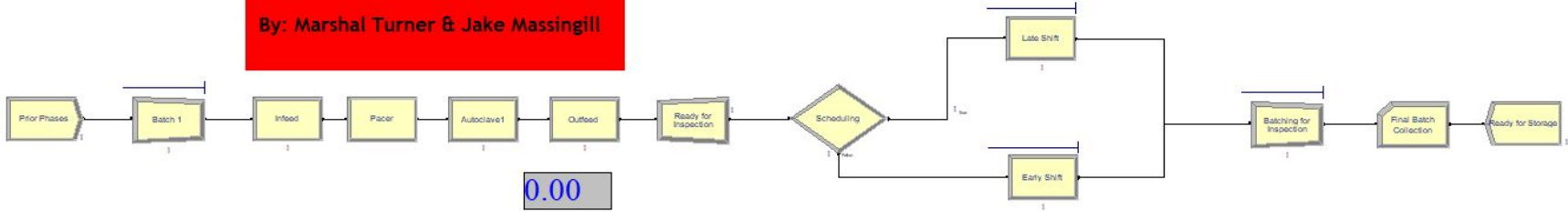
Reduce the number of human workers necessary at this stage (reassigned per assignment problem)

Carlex Simulation Model

Operating Time
12:00:00

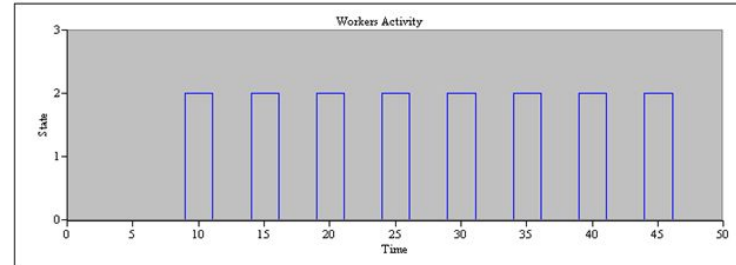
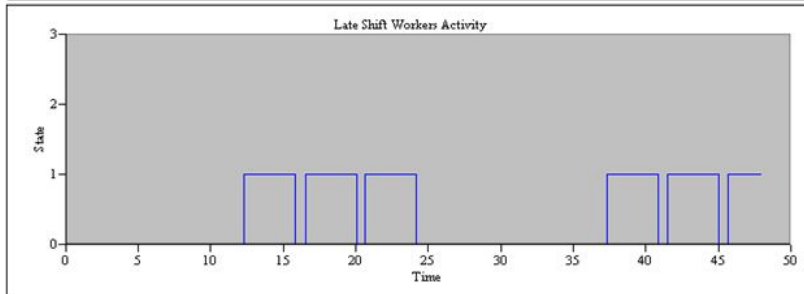
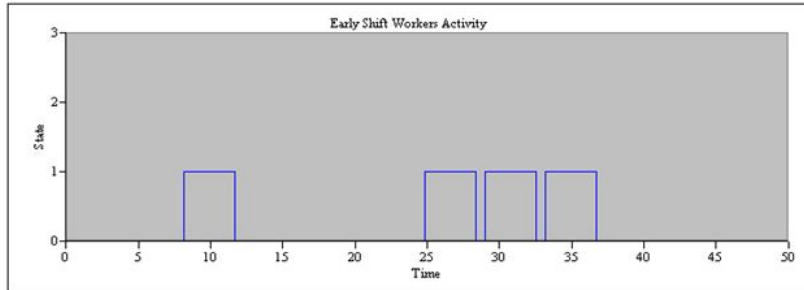
AUTOCLAVE SIMULATION MODEL
By: Marshal Turner & Jake Massingill

0.00



Simulation of Original System: Finishing Phase

Original: Batch Size 750/ 2 Teams/ Early and Late Shift Workers



$$\left[\frac{24 - (0.8528 * 24)}{5} \right] * 60 = 42.39 \text{ minutes or } 42:23$$



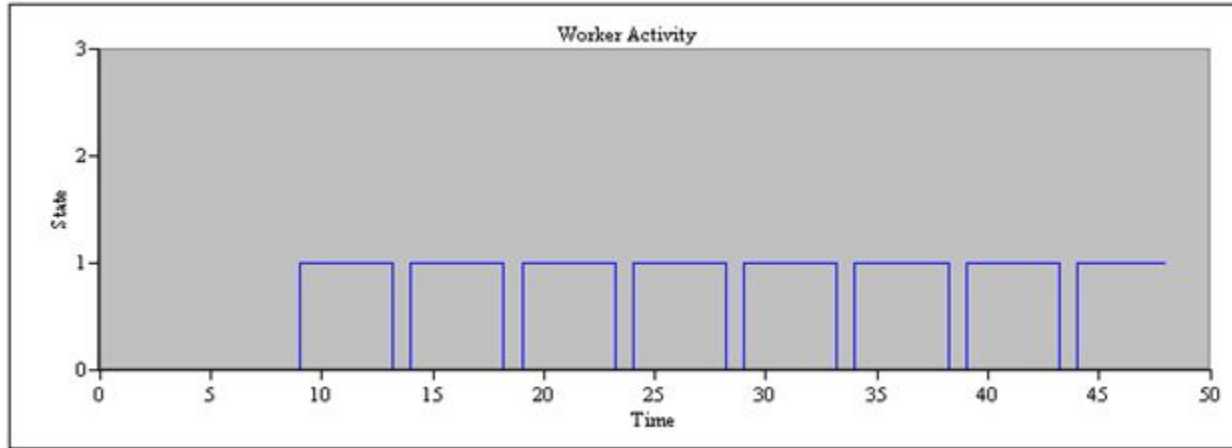
The Improved System

- More consistent cycle times across machines
 - All systems except bag furnace were set to approximately 18 seconds
- Set and optimized autoclave batch size of 900
 - This is the maximum possible batch size, which means minimum number of cycles per day and maximum savings
- One team of two workers each per shift
 - Resource utilization was nearly at the target of 90%



Simulation of Improved System: Finishing Phase

Improved: Batch Size 900/ 1 Team/ Simplified Worker Model



The gaps where the workers are idle are becoming more narrow



The Optimized System

- Consistent cycle times across machines
 - All systems have a cycle time of 18 seconds
- Set and optimized autoclave batch size of 900
 - This is the maximum possible batch size, which means minimum number of cycles per day and maximum savings
- One team of two workers each per shift
 - Resource utilization was now 93%

These changes can be implemented as early as next week, with no cost to Carlex!



Results and Conclusions

- Four workers were relocated from Finishing, reducing costs for this line by \$16,000 per month
- The Autoclave and Finishing workers now operate and idle at consistent intervals
- Reduced Autoclave usage reduces energy and maintenance costs



Questions and Answers

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