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MICHELIN
A BETTER WAY FORWARD

Department of Industrial Engineering

Scheduling And Standardization Of Michelin Quality Control Testing

Process Background and Context

- Before tire production, Michelin manufactures and mixes rubber into sheets
- Sheets are then used to manufacture tires
- Rubber sheets must be sampled and tested for quality to ensure tire quality
- Failure to pass quality control test will lead to halt in tire production and potential recall

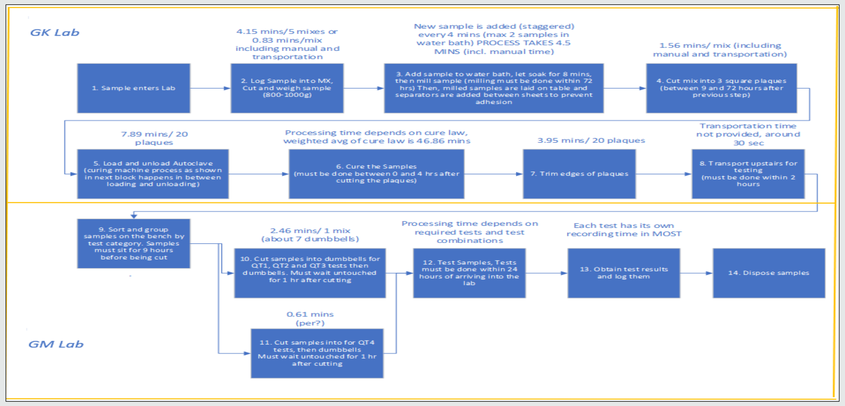
Problem Definition

- There are many potential quality tests that vary
- Tests are conducted in an arbitrary fashion with no order and no standardization
- Lab Technicians do not have labour requirements or assignments per shift.
- This leads to excessive autonomy for the technicians
- Autonomy may cause workers to delay the work and leave it for others
- Such autonomy and delays lead to excessive variability in test lead times.

Project Scope

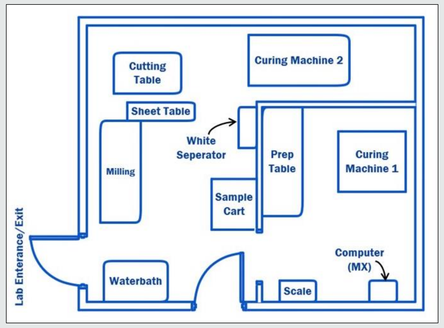
- 2 Testing Labs (GK & GM)
- Preparation Tasks (Cutting, weighing, milling)
- Curing (Based on distinct Cure Laws)
- 4 Quality Tests (QT1, QT2, QT3, QT4)
- Numerous Test variations (QT1A, QT1B, QT1C, etc.)
- Over 100 possible test combinations
- 4 Full-Time Lab Technicians

Solution Methodology – Scheduling App



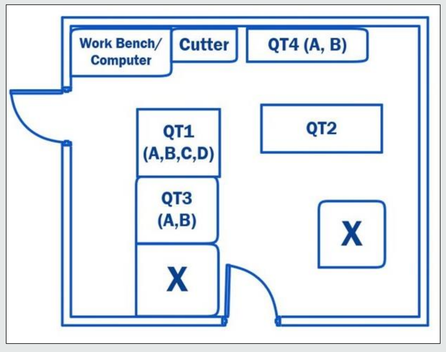
GK Lab:

- Flow shop with linear process
- Conducted BASIC MOST to determine bottleneck of the system , which was the curing machine.
- Distinct Cure Laws dictate Processing Times

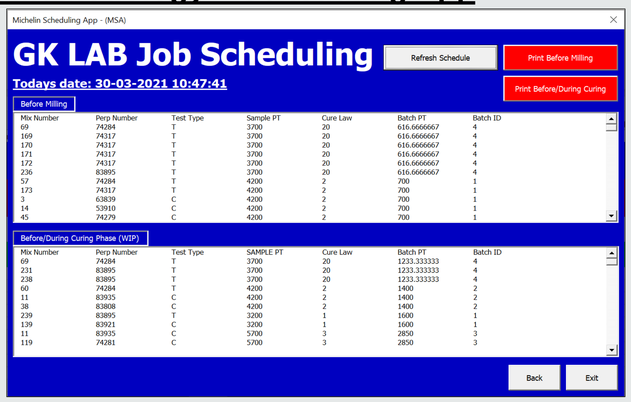


GM Lab:

- Open shop with parallel process
- Minimum 9 hour wait prior to testing
- 1 hour wait after cutting test pieces (Dumbbell shaped)



Solution Methodology – Scheduling App



- Milling and Curing schedules utilize Shortest Processing Time Algorithm on Weighted Batch Processing Times.
- Based on a 4-hour shift length , SPT resulted in a 14.9% increase in throughput in comparison to current operations
- The test schedule utilizes Shortest Processing Time Algorithm on Test Combinations at a refresh rate of 4 hours.
- This is to maximize machine utilization in the lab.

Solution Methodology – Worker Shift Reassignment

Time in System	Hours	Days
Baseline	88.823	3.7009
After Improvement	32.29	1.3453
Percentage of Improvement	63.65%	

- 4 Lab Technicians, two 8.5 hour shifts, and two 12 hour shifts
- Worker – Machine activity chart constructed to study system behaviour
- Chart showed idle time and machine utilization over shift
- Two consecutive 12 hour shifts in GK would lead to greatest throughput in the system according to chart
- GM lab is open for 8.5 hours, two workers in parallel, GK worker can work in GM lab as needed

Conclusion and Recommendations

- SPT algorithm helps standardize and track work by graphically informing the lab technician on the jobs to work on, and resulted in a throughput increase of 14.9%.
- Machine worker chart showed that by altering worker shifts, average time in the system decreased by 63.65%, in worst case scenario conditions with highest ever recorded number of daily samples according to historic data
- Future PII students may want to build a more complex simulation to attempt more shift variations and test other possible improvements (different scheduling algorithms on individual machines, an additional autoclave)
- It may be worthwhile for future PII students to look at the throughput through each testing machine individually since upstairs lab has different machines that work in parallel, and therefore can be scheduled individually