Production Analysis in Car Manufacturing Industry - Case Study

Summary

Client Organization is a global automotive industry leader specializing in the production of body-in-white closures, exhaust systems, and closure manufacturing equipment.

They provide a complete turn-key solution, offer a fully integrated production system that supports customers from product design, tool development, through mass production. The flawless execution of their Full Vertical Approach enables them to achieve short vehicle development timeframes with exceptional quality.

To quickly understand their design, a simulation study is done to ascertain the required operating parameters.

Aims/Objectives

- Understand system throughput.
- Identify Bottlenecks
- Impact of Downtime Zones.
- Buffer requirement between downtime zones

Key Points

- Current Facility can achieve required throughput.
- Material Handling robot 5C-010 is the bottleneck.
- Several Stations are close to the bottleneck station, so many improvements would be needed to continue improving throughput.
- The planned 3 buffers between downtime zones is sufficient.
- Overall line efficiency is 93.4%.

Client's Challenge

- Sealer Purge operation on Sealer robots
- Factoring effect of Tip change and Tip Dress of welding robots on the entire system due to the unsynchronized behaviour.
- Effect of weld take out for inspection.
- Interaction of Downtime zones.

PMI's Approach.

The study was organized in a 6-stage process:

1. Data Verification and Static analysis
2. Conceptualization
3. Model Building and verification.
4. Testing Scenario's
5. Results and Conclusion

Data Verification and Static analysis – Check data provided by client, analyse information and theoretically estimate the possible utilization and output from the system.

Conceptualization – Understand all parameters, rules and possible changes in the manufacturing system. Come up with a flexible model building method to quickly accommodate possible changes.

Model Building and Verification – Using Simulation software, build and check behaviour of model against static analysis.

Testing Scenario's – Tweak parameters and analyse the model to bring value to current facility.

Results and Conclusion – Throughput target is achieved. Optimization of skid, trolley and MHE counts. Tabulate all scenario's tested for client reference.

Involvement of Associates –

- PMI – 1 Project Manager, 1 Engineer.
- Client – 2 Project coordinators.

Static Analysis -

- Summarize the large input data from robotic timing analysis to event based activity cycle time data.
- Estimate approximate combined downtimes for each station area and zone.
- Machines Utilization factoring in changeovers, forced delays and downtimes.

Station Name	Cumulative MTBF (min)	Cumulative MTTR (min)	Availability	Zone
5C010	188.67	5.22	97.31%	1
5C020	177.17	5.26	97.12%	1
5C030	187.68	5.08	97.36%	1
5C040	1304.72	6.84	99.48%	1
5C050	1240.98	6.49	99.48%	2
5C200	1094.27	4.61	99.58%	2
5C210	1240.98	6.49	99.48%	2
5C220	16500.00	4.00	99.98%	2
5C300	2566.55	6.15	99.76%	2
5C310	1306.92	21.13	98.41%	2
5C320	856.72	5.87	99.32%	2

Stations	Total(s)	Utilisation
OP010	52.65	75.27%
TT010	69.75	99.72%
WR010	50.25	71.84%
MH1_010	66.45	95.00%
BS010	37.50	53.61%
MH2_020	25.95	37.10%
OP020	20.55	29.38%
TT020	60.75	86.85%
WR020	29.25	41.82%
MH3_020	63.45	90.71%
BS020	18.00	25.73%
MH4_030	24.45	34.96%
OP030	34.50	49.32%
TT030	66.00	94.36%
WR030	34.50	49.32%
MH5_030	22.95	32.81%
BS030	18.00	25.73%
MH6_040	61.95	88.57%
BS040	18.00	25.73%
MH7_050	59.76	85.44%
M050	48.06	68.71%
OP200	24.30	34.74%
ST200	69.95	100.00%
SR200	60.65	86.70%
MH8_210	52.40	74.91%
SR210	39.95	57.11%
BS220	38.25	54.69%
MH9_300	44.70	63.91%
Hem310	42.75	61.12%
BS320	18.00	25.73%
MH10_320	39.45	56.40%
Conveyor	36.00	51.47%
OP5	56.55	80.85%
OP6	50.25	71.84%
OP7	63.00	90.07%

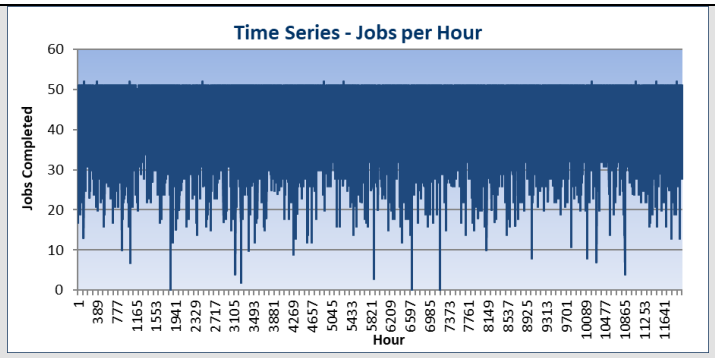
- Expected Bottlenecks –

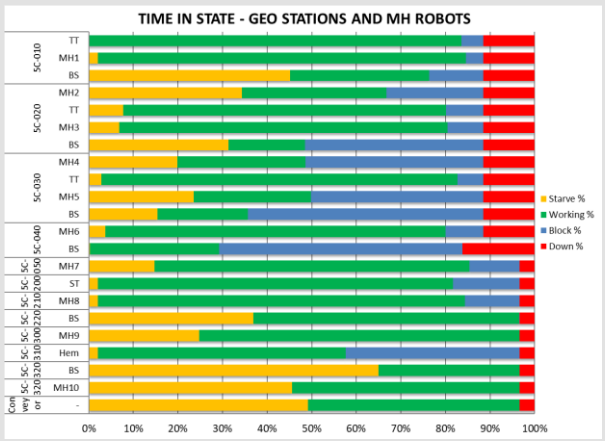
Safety Zone	Max. Cycle (s)	Bottleneck stations	Gross JPH	Net JPH
1	69.8	5C - 010 (Turntable)	51.6	47.4
2	69.9	5C - 200 (Station)	51.5	49.5

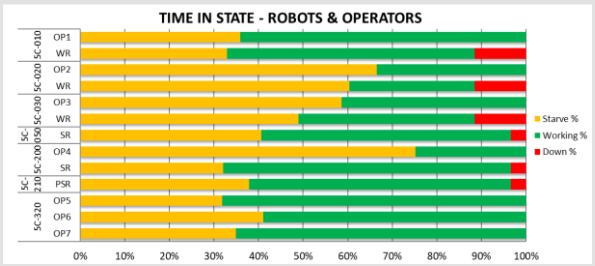
Finding & Recommendations

After doing analysis and evaluation following results were obtained –

1. Throughput analysis – 4.5% more production than target is possible.
2. Machine and operator Utilizations studied







3. Shown below are the top 5 bottlenecks.

BottleNecks	Zone
5C - 010 (Turntable)	1
5C - 010 (MH1)	1
5C - 200 (Station)	2
5C - 030 (Turntable)	1
5C - 030 (MH3)	1

4. Model is flexible to add more stations, update cycle times and downtimes zones.

Contact Details

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