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Team 13: Michelin Capstone Project

Department of Industrial Engineering

Optimization of Rubber Pallet Transportation

Introduction:

Michelin is the worldwide leading manufacturer of tire in the world and possesses 3 plants in Nova Scotia. However, this project will only focus on the Granton facility.

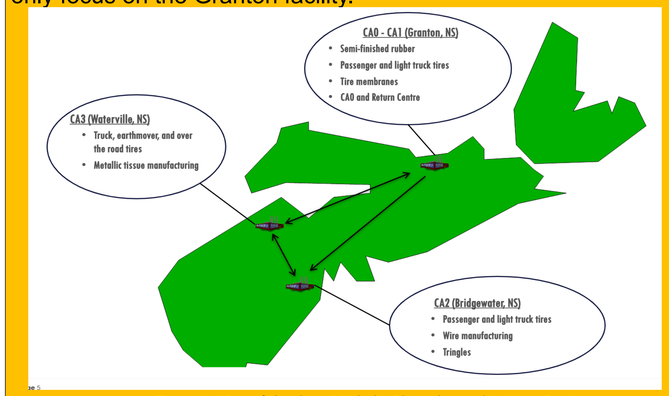


Figure 1: Map of the three Michelin Plants located in Nova Scotia

Project's Objective: The tire company always looks towards innovative solutions to improve sustainable mobility and stay ahead of its competitors. Hence why, In this project, students will focus on improving the transportation process of semi-finished rubber within the Michelin warehouse by trying to implement automated technologies such as AGV or AS/RS system through simulation tests using FlexSim.

Design Process:

- **Step 1:** Analyze current shipping and storing process to identify waste.

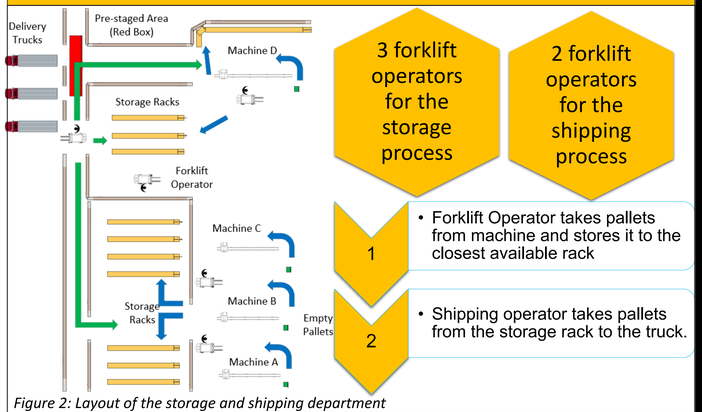


Figure 2: Layout of the storage and shipping department

- **Step 2:** Analyze data of current process to identify queeing time of each item's production.
- **Step 3:** Creation of new storage policy (storage by zone) and removing the current one which is based on first in / first out.
- **Step 4:** Creation of first proposed solution consisting of reallocating resources and implementing new storage policy using FlexSim.
- **Step 5:** Creation of second solution set by implementing AGV's in the system using FlexSim.

Details of the Design:

1) Current System Model

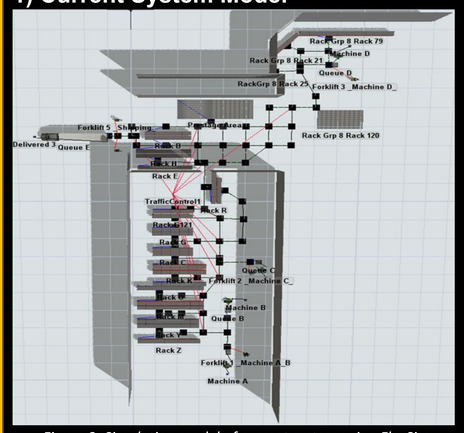


Figure 3: Simulation model of current system using FlexSim

September Production	Time (Days)
Actual Time	30
Simulated Time	23.71

➢ Here are the assumptions made before building the simulation model

- Plant is operating 24/7
- No break time for operators
- No break time between shipping order
- One outflow pathway
- The type of the trailer is neglected
- Neglected machine failure and maintenance (MTTF,MTBF,MTTR)
- Assume pre-stage area as normal rack
- Inter arrival time of each machines are in statistical distribution

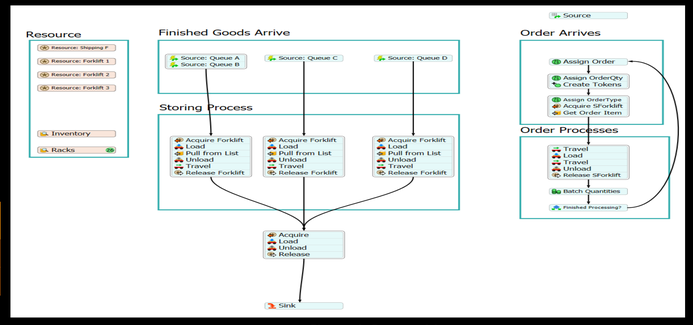
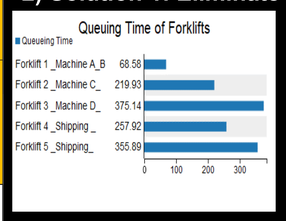
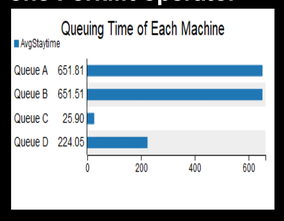
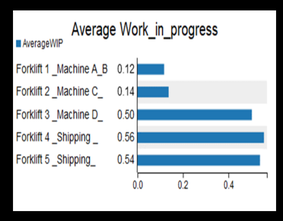


Figure 4: Process Map

2) Solution 1: Eliminate one Forklift operator







Result	
Shipping Efficiency	-0.836%
Storing Efficiency	-8.174%
Total Process Efficiency	**-0.836%**
Cost Efficiency	**23.161%**

3) Solution 2: Zoning Method

Result: Zoning System with Current System	
Shipping Efficiency	3.416%
Storing Efficiency	-0.073%
Total Process Efficiency	**3.537%**

Result: Zoning system with New System	
Shipping Efficiency	0.633%
Storing Efficiency	-7.580%
Total Process Efficiency	**0.633%**
Cost Efficiency	**23.161%**

Zone	Capacity
1	360
2	320
3	564

Machine	Daily Production
A & B	135
C	56
D	116

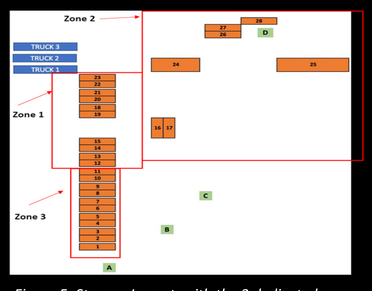
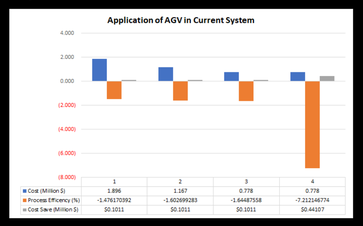
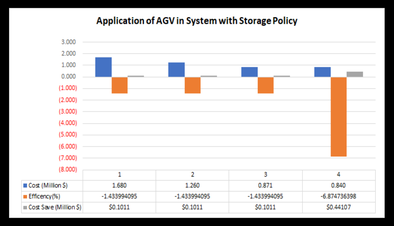


Figure 5: Storage Layout with the 3 dedicated zones

4) Solution 3: Implementation of 2 AGV's and 2 General Workers





	# of AGV	Num. of Workers
Case 1	4	4
Case 2	3	3
Case 3	2	3
Case 4	2	2

➢ For Case 4, one worker is using a Segway

Recommendations

1) First Recommendation:

➢ Use only 4 forklift and new storage policy policy

Cost of Current System	
Machinery Cost	
Forklift Lease	CAD 66,000.00
Maintenance	CAD 102,454.00
Labor Cost	
Employee Wages	CAD 1,445,000.00
Total Cost	CAD 1,613,454.00
Cost of New system	
Machinery Cost	
Forklift Lease	CAD 52,800.00
Maintenance	CAD 81,963.20
Labor Cost	
Employee Wages	CAD 1,105,000.00
Total Cost	CAD 1,239,763.20
Cost Saving for First Solution	**CAD 373,690.80**

2) Second Recommendation:

➢ Use 2 AGVs , 2 shipping operators, 2 general operators

Discount Rate of Capital	5.61%
Cost of Capital	CAD 778,000
Inflows	
Savings per year from reduction of employees	CAD 340,000
Savings per year from reduction of forklifts	CAD 101,70
Outflows	
AGV Maintenance cost per Year	CAD 50,457
Segway initial cost	CAD 11,000
Results	
NPV (Net Present Value)	CAD 1,461,866
IRR (Internal Rate of Return)	48.8%
ROE (Return on Investment)	125.29%
Payback Period (years)	2.21

Conclusion:

Based on the results from the different simulation models, the best option that will optimize the transportation process at a high efficiency would be using 2 AGVs and 2 general workers including the new storage policy of the zoning method. Despite case 1,2,3 having a better process efficiency rate, case 4 has more significant improvement on cost saving.