OPERATIONS SCHEDULING PROBLEM AT LOBLAW DISTRIBUTION CENTRE

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Problem Definition

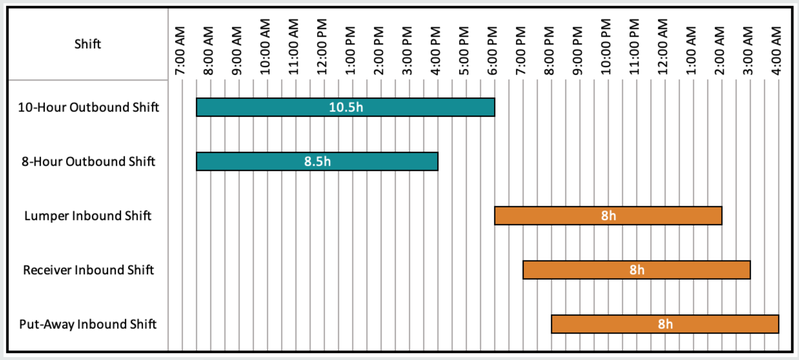
The Loblaw's Distribution Centre (DC) has outdated operations with ineffective downtime and an inflexible scheduling of labour. Loblaw's is also seeking to build a business case for expanding capacity.

Project Objectives

- Determine the labour hours required to meet retailer demand.
- Design potential shift configuration schedules.
- Discover a better way to redistribute volume across the week.
- Determine which dock doors the trailers should be assigned to.

Initial Conditions

Shift Configuration



Outbound: Monday - Saturday *Inbound: Monday - Friday*

Current Employee Schedule

Summary of Current Employee Schedule in March 2022

Day		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday	
Shift Duration		8 Hour	10 Hour	8 Hour	10 Hour	8 Hour	10 Hour	8 Hour	10 Hour	8 Hour	10 Hour	8 Hour	10 Hour
Number of Workers	Receiver	2	0	2	0	2	0	2	0	2	0	0	0
	Put Away	9	0	9	0	9	0	9	0	9	0	0	0
	Total IB	11	0	11	0	11	0	11	0	11	0	0	0
Total Hours	Total IB	82.5		82.5		82.5		82.5		82.5		0	
Number of Workers	FPP/Replen.	0	6	0	6	0	6	0	6	0	5	0	3
	Assembly	19	14	16	13	21	12	21	13	16	15	12	13
	Shipping	1	2	1	1	1	1	1	2	1	2	0	0
	Total OB	42		37		41		43		39		28	
Total Hours	Total OB	359		317.5		345.5		364.5		336.5		242	
Total Daily Hours		441.5		400		428		447		419		242	

Summary

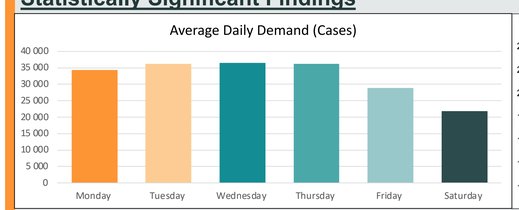
Number of 8-Hour IB Workers	11	Number of 8-Hour OB Workers	22
Number of 10-Hour IB Workers	0	Number of 10-Hour OB Worker	30
Total Number of IB Workers	11	Total Number of OB Workers	52
Total Weekly IB Hours	412.5	Total Weekly OB Hours	1965

63 Total Workers | 2377.5 Scheduled Hours | 1968.2 Actual Hours

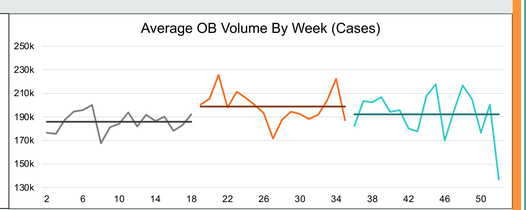
Methods & Analysis

Data Analysis

Statistically Significant Findings



Volume Differs by Weekday



Volume Differs by Quadrimester (4 Months)

Linear Programming

Constraints

- Schedule must satisfy demand
- Full-time employees only
- Employees can only work one shift per day
- Employees must get two consecutive days off

Objective Function

$$\text{Minimize } Labour = \sum_{i=1}^{E} \sum_{j=1}^{D} \left(x_{i,j,1} + (3 * x_{i,j,2}) \right)$$

8-hour shifts *10-hour shifts*

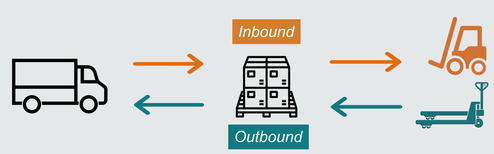
Simulation

Purpose
Evaluate worker schedules and dock door assignment plans.

Input
Worker schedules, job process durations, routing heuristics, vehicle speeds, and warehouse dimensions.

Output
Traffic percentage, number of cases worked, time completed, and worker productivity.

Benefit
Validate proposed solutions (schedules, dock door plan).



Results & Implementation

Workload Calculator

Purpose → An Excel tool to calculate labour hours for building employee schedules.

Input → Department volumes, production rates, significance level, and shift duration.

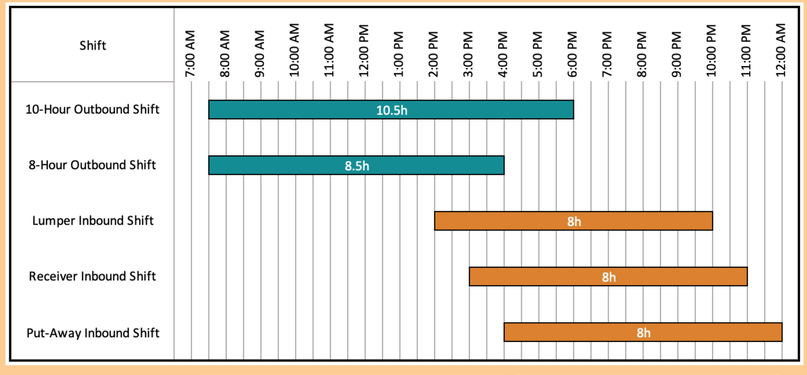
Output → Required labour hours, and number of full-time employees.

Benefit → Easy to use, functional for future use, and scalable to other sites.

Summary of Workload Calculator Results

Path	Metric	Hours Required By Day					
		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Assembly	Average	176.6	150.7	162.2	182.2	147.1	114.1
FPP	Average	1.4	8.2	6.3	2.2	1.5	0.5
Shipping	Average	16.8	17.7	17.8	17.7	14.1	10.6
Replenishment	Average	40.3	34.4	37.0	41.5	33.5	26.0
Total OB	**Average**	**235.0**	**211.0**	**223.3**	**243.6**	**196.2**	**151.3**
Receiving	Average	14.6	14.6	14.6	14.6	14.6	0.0
Putaway	Average	28.0	28.0	28.0	28.0	28.0	0.0
Total IB	**Average**	**42.6**	**42.6**	**42.6**	**42.6**	**42.6**	**0.0**

Shift Reconfiguration



Outbound: Monday - Saturday *Inbound: Monday - Friday*

Dock Door Assignment Plan

Time	Dock Set 1	Dock Set 2	Dock Set 3	Dock Set 4	Dock Set 5	Dunnage
7:30am	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉
12:30pm	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉
4:00pm (A)	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉
4:00pm (B)	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉
6:00pm	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉	◉◉◉◉◉

◉ *Dock Door* ◉ *Outbound* ◉ *Inbound* (A) *1-15 Assembly Workers* (B) *16-30 Assembly Workers*

Employee Schedules

Purpose → Generate employee schedule prototypes using a linear program.

Input → Required labour by day, shift duration, scheduling constraints.

Output → Number of daily workers, schedule and shift duration for each worker.

Benefit → Create flexible schedules that can respond to demand.

Summary of Worker Schedule - Quadrimester 3 (Outbound Workers)

Day	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday	
Shift	8 Hour	10 Hour	8 Hour	10 Hour	8 Hour	10 Hour	8 Hour	10 Hour	8 Hour	10 Hour	8 Hour	10 Hour
Working	21	13	27	7	27	3	27	6	27	10	6	13
Total workers	34		34		30		33		37		19	
Hours Scheduled	281		269		231		259.5		297.5		168.5	
Hours Demanded	241.6		215.9		225.7		239.8		195.2		137.6	

Summary

Number of 8-Hour Workers	27
Number of 10-Hour Workers	13
Total Number of OB Workers	40

Labour & Cost Savings

Quadrimesters	Current State (Hours per week)	Proposed Solution (Hours per week)	Improvement (Hours per week)	Estimated Savings (Per Quadrimester)
1	1968.2	1878.0	90.2	$27,601
2	1968.2	1807.0	161.2	$49,327
3	1968.2	1731.5	236.7	$72,430
			Total Annual Savings:	**$149,358**