AI Warehouse Assessment

ABC Company

Sample AI Optimization Analysis (1,000 Items)

Warehouse Overview

This report offers a thorough summary of warehouse metrics, activities, and cost analyses based on an AI-driven warehouse analysis. It emphasizes actionable recommendations designed to enhance warehouse performance and efficiency. Moreover, it provides detailed specifications to support the effective implementation and management of these recommendations.

Warehouse Management Summary

The following metrics provide a range of estimates related to warehouse performance, fulfillment, and costs, based on the recommendations generated by the AI warehouse analysis.

Cost & Performance Metrics

Total warehouse operating cost per day	$1,230.19
Total warehouse operating hours per day	60.7
Total warehouse cost per hour	$20.27
Total units fulfilled per day	4,960.0
Total warehouse cost per unit	$0.25
Total units fulfilled per operating hour	81.73

Order & Unit Fulfillment Metrics

Total customer orders fulfilled per day	2,000.0
Total product orders fulfilled per day	3,968.0
Total units fulfilled per day	4,960.0
Avg products per customer order	1.98
Avg units per customer order	2.48

Operating Cost Ratios

Avg warehouse cost per hour	$20.27
Avg warehouse cost per customer order	$0.62
Avg warehouse cost per product order	$0.31
Avg warehouse cost per unit	$0.25

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Operating Hours and Workload Planning

Total warehouse hours per customer order	0.030
Total warehouse hours per product order	0.015
Total warehouse hours per unit	0.012
Customer orders fulfilled per warehouse hour	32.96
Product orders fulfilled per warehouse hour	65.38
Units fulfilled per warehouse hour	130.89

Warehouse Section Summary

The following table lists the structures selected by the optimization assessment, along with their overall warehouse statistics.

Structure Name	Layout Area (sq ft)	Daily Operating Cost	Daily Operating Hours
Picking Area	3,600.0	$1,230.19	60.7

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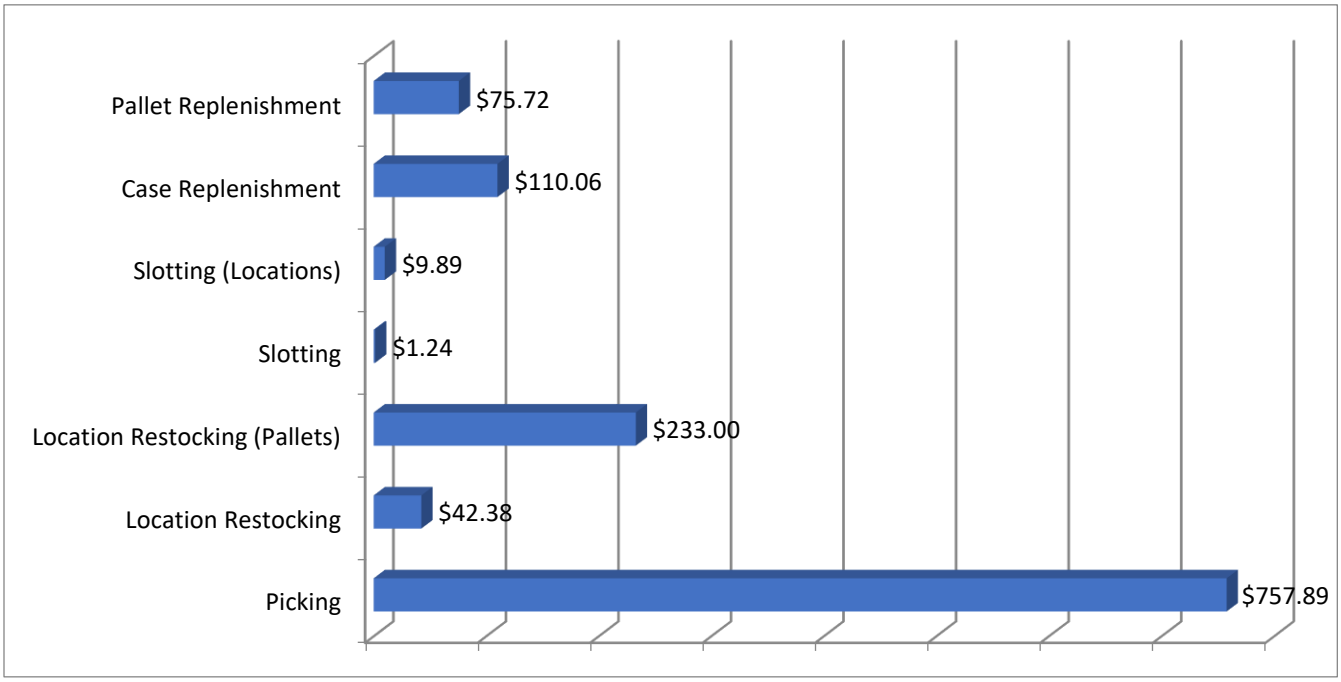
Warehouse Activity and Cost Summary

The potential impact of the AI's warehouse recommendations is assessed below by examining their effect on specific warehouse activities, along with their associated costs, workloads, and productivity levels.



Cost and Workload Summary

Department	Activity	Daily Cost	Daily Hours
Picking	Picking	$757.89	37.9
Materials	Location Restocking	$42.38	2.1
Materials	Location Restocking (Pallets)	$233.00	11.6
Inventory	Reslotting	$1.24	0.1
Inventory	Reslotting (Locations)	$9.89	0.5
Materials	Case Replenishment	$110.06	5.0
Materials	Pallet Replenishment	$75.72	3.4

Productivity Summary

Department	Productivity Measure	Average
Picking	Picks per hour	104.61
Picking	Product orders picked per hour	104.71
Picking	Units picked per hour	130.89

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Materials	Restocks per hour	12.50
Materials	Restocks per hour (Pallets)	12.50
Inventory	Reslots per hour	50.00
Inventory	Reslots per hour (Locations)	12.50
Materials	Items replenished per hour (Case)	4.19
Materials	Items replenished per hour (Pallet)	30.00

Activity Summary

Department	Activity	Daily Totals
Picking	Picks	3,964.34
Materials	Location Restocks	26.49
Materials	Location Restocks (Pallets)	145.62
Inventory	Reslots	3.09
Inventory	Reslots (Locations)	6.18
Materials	Item Replenishments (Case)	21.04
Materials	Item Replenishments (Pallet)	103.28

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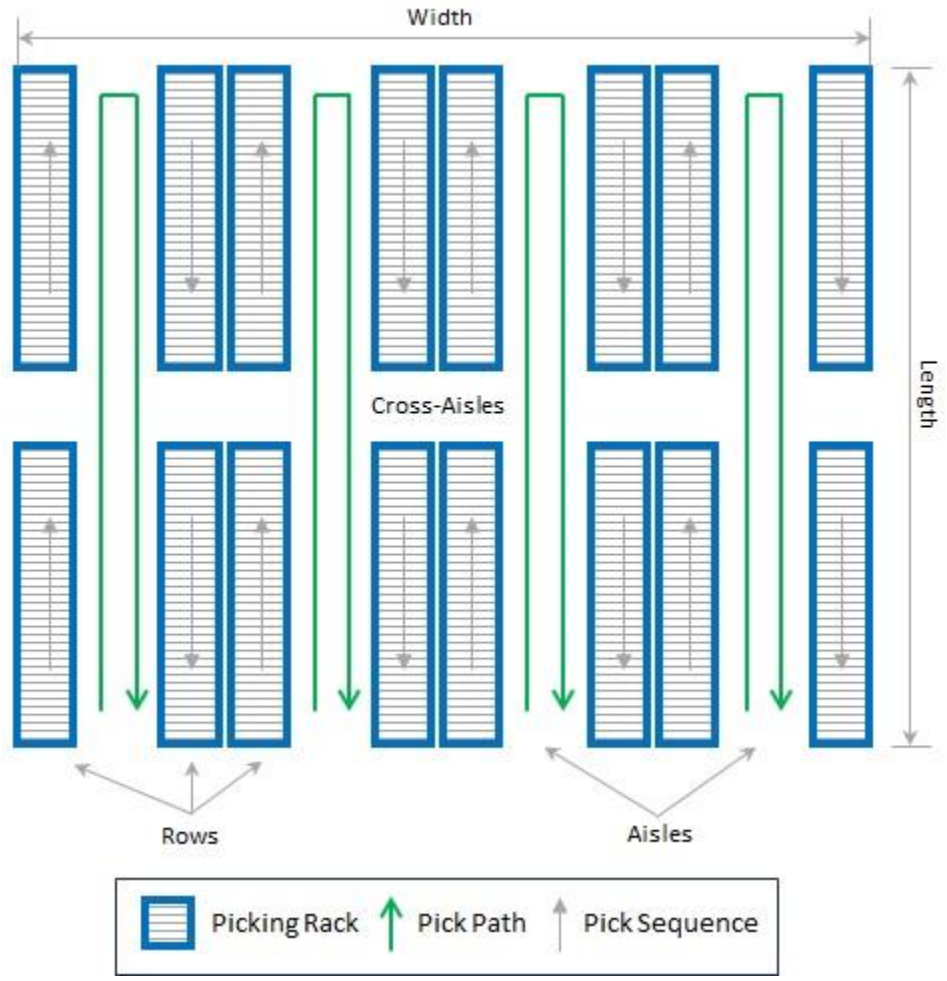
Warehouse Recommendations

The subsequent sections of this report will outline the specific details needed to define and implement the warehouse recommendations. Additionally, they will provide specific operating statistics associated with the warehouse activities supporting these recommendations.

Picking Area

General Layout

The image illustrates the proposed layout for the warehouse racking, focusing on the grouping of racks, sequencing of picks, and general travel patterns. While it provides an overview, it does not capture all the specifics of the final design, such as the exact number of racks, aisles, and cross aisles. That specific information of the layout is listed in the following 'Dimensions' section of the report.



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Dimensions

Section Width

Total rows of racking: 8
Rack depth: 4.00 ft
Aisle width: 10.00 ft
Total aisles: 4
Total structure width: 72.00 ft

Section Length

Linear feet of racking per aisle: 40.00 ft
Total cross-aisles: 1
Cross-aisle width: 10.00 ft
Total structure length: 50.00 ft

Travel Pattern

Total pick paths: 8
Pick facing: Double (picks are on both sides of each picking aisle)
Pick path sequencing: The pick paths within each picking aisle are sequenced in alternating directions.

Section Height

Total height: 10.00 ft
Picking height (Maximum): 10.00 ft
Picking height (Minimum): 0.00 ft

Section Area & Volume

Total area: 3,600.00 sq ft
Total volume available for pick locations: 12,800.00 cu ft

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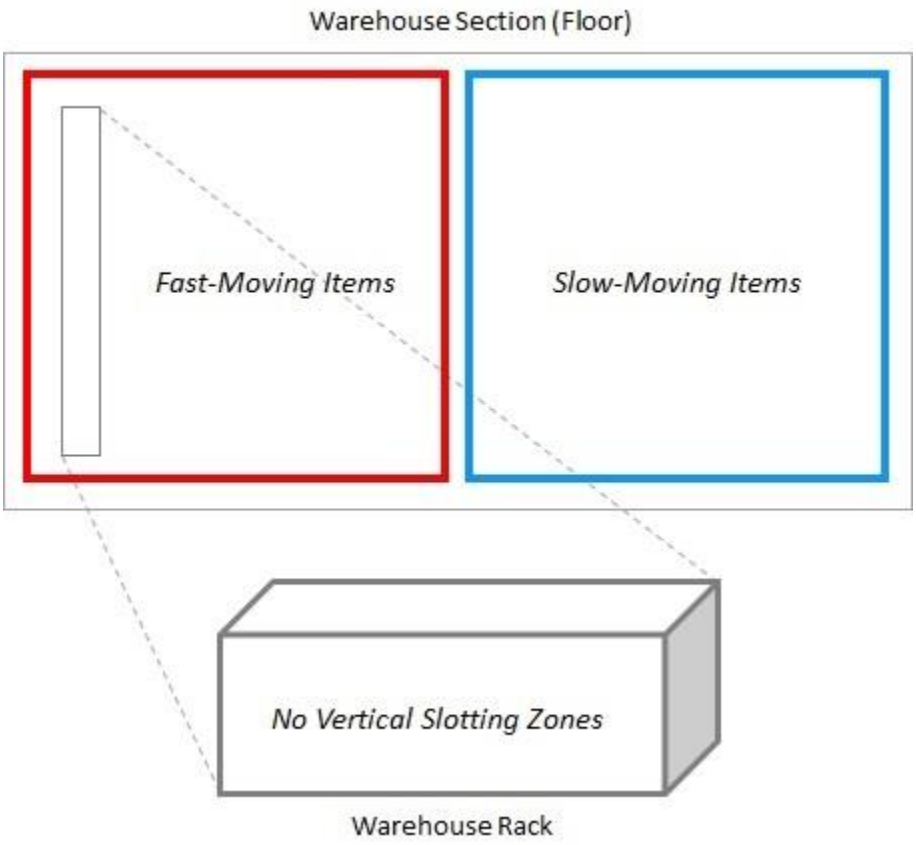
Slotting Strategy

Considering the variation in product velocities, wave patterns, and overall warehouse characteristics, the recommended strategy is 'Dynamic Slotting.' This approach involves relocating products to faster or slower zones based on their current order volumes and lifecycle stages. Travel distance will be minimized by creating a total of 2 slotting zones. The warehouse is divided into 2 sections according to the diagram below, with no vertical slotting required within each section.



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Slotting Rules

The table below outlines the management rules for maintaining the recommended slotting zones. Each zone is assigned minimum and maximum values based on the average daily order volume to ensure optimal organization and efficiency.

Slotting Section	Slotting Level	Avg Orders/Day (Max)	Avg Orders/Day (Min)
Fastest Zone (1)	N/A	Max (15.00)	7.51
Slowest Zone (2)	N/A	7.51	Min (0.02)

Location Sizes & Mix

Optimal location sizes and the accurate mix of these locations are critical factors in determining the overall efficiency of the stocking and replenishment process. The table below presents the recommended location sizes and their ideal distribution for achieving maximum efficiency.

Location Assignment Rules

After determining the optimal location sizes and mix, the next critical factor in maximizing stocking and replenishment efficiency is ensuring proper management of item assignments to their respective locations. The management rules for this process are outlined in the (Min) and (Max) columns of the table below. These values define the range for assigning and reassigning items to a specific location size, based on a metric called 'Demand-Volume (DV).' This metric is calculated by multiplying an item's average daily demand (in units) by its volume. Overlap in the assignment ranges is common and intentional, as it prevents reslotting costs from outweighing the efficiency gains achieved by the optimal location sizes and mix.

Location Volume (cu ft)	Items	Avg DV/Day (Max)	Avg DV/Day (Min)
9.22	472	1.09	0.00
16.00	356	4.83	1.10
16.00	172	18.25	4.88

Utilization

Total items assigned to this structure: 1,000
Percentage of all items assigned to this structure: 100.0%
Total product orders picked from this structure per day: 3,968.0

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Total units picked from this structure per day: 4,960.0

Item Assignment Rule

Items are assigned to this structure based on 'Order Volume' and the assignment range is between 0.0 and 15.0 average orders per day.

Picking Area (Operational Statistics)

Picking

Average percentage of time (days) that section contains picks: 100.00%
Average number of waves per day: 981.13
Total picks per day: 3,964.34
Average picks per wave: 4.04

Total product orders picked per day: 3,968.0
Total units picked per day: 4,960.0
Average product orders per pick: 1.00
Average units per pick: 1.25

Hourly cost: $20.00 / hour
Total time required per wave: 0.04 hours
Total cost per wave: $0.77
Total time required for picking per day (daily average): 37.89 hours
Total cost of picking per day (daily average): $757.89

Picks per hour: 104.61
Product orders picked per hour: 104.71
Units picked per hour: 130.89

Floor Travel

Total pick paths: 8
Average pick paths required (per wave): 3.01
Average picks per pick path: 1.34

Hourly cost: $20.00 / hour
Average travel speed: 10,560.00 ft / hour
Total travel distance required for all picks (per wave): 140.09 ft
Total time needed to travel required distance (per wave): 0.01 hours
Total cost of travel (per wave): $0.27

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Total travel distance required per day (daily average): 137,445.57 ft
Total travel time required per day (daily average): 13.02 hours
Total travel cost per day (daily average): $260.31

Vertical Travel

Total sections: 40.00
Average picks per section: 1.04
Total sections that contain picks (per wave): 3.89

Starting pick height: 0.00 ft
Average distance between starting height and highest pick (per section): 2.52 ft
Average distance between starting height and lowest pick (per section): 0.00 ft

Hourly cost: $20.00 / hour
Average vertical speed: 10,560.00 ft / hour
Total vertical distance required for all picks (per wave): 0.85 ft
Total time needed to travel required vertical distance (per wave): 0.00 hours
Total cost of vertical travel (per wave): $0.00

Total vertical distance required per day (daily average): 833.67 ft
Total vertical travel time required per day (daily average): 0.08 hours
Total vertical travel cost per day (daily average): $1.58

Reach

Starting pick height: 0.00 ft
Average reach distance between starting height and highest pick: 4.79 ft
Average reach distance between starting height and lowest pick: 0.00 ft
Total units (per wave): 5.06
Average units per reach: 2.00
Total reaches (per wave): 2.53

Hourly cost: $20.00 / hour
Total time spent reaching for all picks (per wave): 0.03 hours
Total cost of reaching for all picks (per wave): $0.51

Total time spent reaching for all picks per day (daily average): 24.80 hours
Total cost of reaching for all picks per day (daily average): $496.00

Location Restocking

Restocking

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Average restocks per day: 26.49
Average restocking units per location: 37.12
Cost per hour: $20.00
Time to complete a location restock: 0.08 hours
Restocks per hour: 12.50

Total time spent restocking locations per day (daily average): 2.12 hours
Total cost of restocking locations per day (daily average): $42.38

Restocking (Pallets)

Average pallet restocks per day: 145.62
Average pallet restocking units per location: 37.12
Cost per hour: $20.00
Time to complete a pallet location restock: 0.08 hours
Pallet restocks per hour: 12.50

Total time spent restocking locations with pallets per day (daily average): 11.65 hours
Total cost of restocking locations with pallets per day (daily average): $233.00

Reslotting

Average reslots per day: 3.09
Average days item stays in slotting zone: 323.56 days

Cost per hour: $20.00
Total time spent reslotting products per day (daily average): 0.06
Total cost of reslotting products per day (daily average): $1.24

Reslotting (Locations)

Average location reslots per day: 6.18
Average days item stays in location: 161.78 days

Cost per hour: $20.00
Total time spent reslotting products to other location sizes per day (daily average): 0.49
Total cost of reslotting products to other location sizes per day (daily average): $9.89

Case Replenishment (from Reserve)

Average percentage of time (days) that section requires case replenishments: 100.0%
Average items requiring case replenishment per day: 21.04
Average replenishment waves per day: 1.00

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Average units per replenishment item: 46.73

Hourly cost: $22.00 / hour
Total time required to complete a replenishment wave: 5.03 hours
Total cost per replenishment wave: $110.06

Total time required for case replenishments per day (daily average): 5.03 hours
Total cost of case replenishments per day (daily average): $110.06
Case replenishments per hour: 4.19

Floor Travel (Case Replenishment - Reserve)

Average replenishment items per pick path (per replenishment wave): 2.05
Average number of pick paths required per replenishment wave: 10.28

Hourly cost: $22.00 / hour
Average travel speed: 26,400.00 ft / hour
Total travel distance required per replenishment wave: 1,854.41 ft
Total time needed to travel required distance (per replenishment wave): 0.07 hours
Total cost of travel (per replenishment wave): $1.55

Total travel distance required per day (daily average): 1,854.41 ft
Total travel time required per day (daily average): 0.07 hours
Total travel cost per day (daily average): $1.55

Vertical Travel (Case Replenishment - Reserve)

Average replenishment picks per section: 1.02
Total sections containing replenishment picks (per replenishment wave): 20.69

Starting pick height: 0.00 ft
Average distance between starting height and highest replenishment (per section): 10.08 ft
Average distance between starting height and lowest replenishment (per section): 0.00 ft

Hourly cost: $22.00 / hour
Average vertical speed: 26,400.00 ft / hour
Total vertical distance required per replenishment wave: 417.37 ft
Total time needed to travel required vertical distance (per replenishment wave): 0.04 hours
Total cost of vertical travel (per replenishment wave): $0.35

Total vertical travel distance required per day (daily average): 417.37 ft
Total vertical travel time required per day (daily average): 0.04 hours
Total vertical travel cost per day (daily average): $0.35

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Reach (Case Replenishment - Reserve)

Starting pick height: 0.00 ft
Average reach distance between starting height and highest replenishment: 0.00 ft
Average reach distance between starting height and lowest replenishment: 0.00 ft
Total units (per replenishment wave): 983.31
Average units per replenishment reach: 2.00
Total reaches (per replenishment wave): 491.66

Hourly cost: $22.00 / hour
Total time spent reaching for product (per replenishment wave): 4.92 hours
Total cost of reaching for product (per replenishment wave): $108.16

Total time spent reaching for product per day (daily average): 4.92 hours
Total cost of reaching for product per day (daily average): $108.16

Pallet Replenishment (from Reserve)

Average percentage of time (days) that section requires pallet replenishments: 100.00%
Average items requiring pallet replenishment per day: 103.28
Average replenishment pallets per item: 1.41
Total replenishment pallets per day: 145.62

Hourly cost: $22.00 / hour
Total time required to complete a pallet replenishment: 0.02 hours
Total cost per pallet replenishment: $0.52
Pallet replenishments per hour: 42.31

Total time required for pallet replenishments per day (daily average): 3.44 hours
Total cost of replenishments per day (daily average): $75.72

Floor Travel (Pallet Replenishment - Reserve)

Hourly cost: $22.00 / hour
Average travel speed: 26,400.00 ft / hour
Total travel distance required per replenishment pallet: 340.00 ft
Total time needed to travel required distance (per replenishment pallet): 0.01 hours
Total cost of travel (per replenishment pallet): $0.28 ft

Total travel distance required per day (daily average): 49,512.28 ft
Total travel time required per day (daily average): 1.88 hours
Total travel cost per day (daily average): $41.26

Vertical Travel (Pallet Replenishment - Reserve)

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Starting pick height: 0.00 ft
Average distance between starting height and highest replenishment (per section): 10.00 ft
Average distance between starting height and lowest replenishment (per section): 0.00 ft

Hourly cost: $22.00 / hour
Average vertical speed: 26,400.00 ft / hour
Total vertical travel distance required per replenishment pallet: 20.00 ft
Total time needed to travel required vertical distance (per replenishment pallet): 0.00 hours
Total cost of vertical travel (per replenishment pallet): $0.02

Total vertical travel distance required per day (daily average): 2,912.49 ft
Total vertical travel time required per day (daily average): 0.11 hours
Total vertical travel cost per day (daily average): $2.43

Reach (Pallet Replenishment - Reserve)

Starting pick height: 0.00 ft
Average reach distance between starting height and highest replenishment: 0.00 ft
Average reach distance between starting height and lowest replenishment: 0.00 ft
Total pallet reaches per day: 145.62

Hourly cost: $22.00 / hour
Total time spent reaching for pallet (per replenishment pallet): 0.01 hours
Total cost of reaching for pallet (per replenishment pallet): $0.22

Total time spent reaching for pallets per day (daily average): 1.46 hours
Total cost of reaching for pallets per day (daily average): $32.04

Picking Area (Cost Component Summary)

Structure Cost Component	Cost (Daily Average)
Picking Travel (Low Wave)	$260.31
Picking Vertical (Low Wave)	$1.58
Picking Reach (Low Wave)	$496.00
Location Restocking	$42.38
Location Restocking (Pallets)	$233.00
Reslotting	$1.24
Reslotting (Locations)	$9.89
Case Replenishment Travel (Reserve)	$1.55

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Case Replenishment Vertical (Reserve)	$0.35
Case Replenishment Reach (Reserve)	$108.16
Pallet Replenishment Travel (Reserve)	$41.26
Pallet Replenishment Vertical (Reserve)	$2.43
Pallet Replenishment Reach (Reserve)	$32.04

Total Cost (Daily Average): $1,230.19
Unit Cost (Daily Average): $0.25