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<u>Client:</u> The University of Pittsburgh Logistics and Printing Department

Mentor: Dr. Vidic

Summary: Company Background, Current Condition, & Problem Statement

- Background of The Logistics and Printing Department (LPD)
 - O Receives, sorts, stores, and delivers packages for University of Pittsburgh departmental buildings
 - o In 2020, the University of Pittsburgh started Ship2Pitt.
 - Direct-to-dorm shipping service
 - Provides on-campus students 5 pre-paid shipping labels to send packages from current residence to their residential hall.



Current Condition

- A "Blank Slate"
- O Mostly manual material handling equipment

Problem Statement

- O Current conditions limit the warehouse operations.
- O Warehouse operations cannot handle demands of both departmental buildings and residential halls
- O Storage space is limited so material flow and organization is compromised.

Summary: Project Goals and Deliverables

- Forecast of departmental and Ship2Pitt demand given:
 - o 2020 Ship2Pitt label creation data
 - O Departmental receival data from last several months
- Sensitivity analysis of demand:
 - o Increase demand by 25%, 50%, 75% and 100%.
- Model the current system and two alternative solutions.
- Propose an optimal layout.
 - Provide flexibility for different forecasts and budgets.
 - O Identify and resolve inefficiencies in flow, material handling, and storage.



Summary:

Metrics

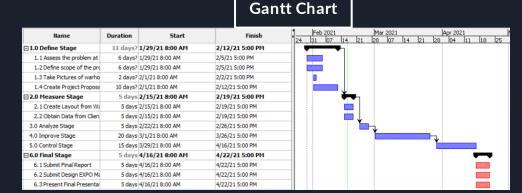
- Storage Capacity Optimization
 - Maximize utilization of warehouse floor (vertically & horizontally)
- Overflow Reduction
 - Reduce inventory outside of designated storage space
- Cost of Alternatives
 - Minimize cost to purchase new equipment/tools
- Cost Variance
 - The cost difference between alternative solutions

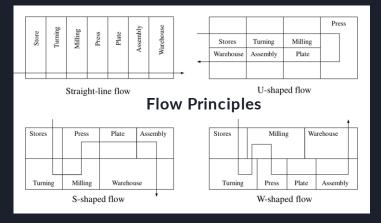
Measures of Success

- Personnel:
 - Minimize manual handling
- Cost Efficient:
 - O Clear cost analysis
 - O Justify cost / Minimize cost
- Quality:
 - Validated proposal, forecasting and alternative solution models
 - O Layout solutions can accommodate forecasts of demand
- Duration of Project:
 - Deliverables are on time
 - Weekly Client, Mentor, and Team meetings for updates of the status of the project
- Client Satisfaction
 - O Of project proposals and deliverables

Summary: Project Management Tools, Methodology & Courses Relevant To Methodology

- 1) Project Management
 - Plan, Organize, Lead, and Control
 - Gantt Chart, WBS, LRC
- 1) Supply Chain Analysis & Engineering Economics
 - Forecasting of Demand
 - Sensitivity Analysis of Demand
- 1) Facility Layout And Material Handling
- Flow Principles
- Warehousing
 - Functions & Factors, Receiving and Shipping, Storage
- Material Handling
 - Personnel and Equipment





Summary: Risks, Barriers, & Realistic Constraints

- Forecasting Constraints
 - Only one year of label-creation data for Ship2Pitt
 - Receiving and delivery data was estimated
 - Only a few months of scanning data of departmental packages
 - Uncertainty of demand is expected to increase after campus reopening
- Warehouse Constraints
 - O Official blueprint of the warehouse is not available
 - Measurement taken during onsite inspections
 - Error in measurements considered
 - Ease of access to parts of the warehouse is limited
 - Proposal of removing a wall
- Storage Space Constraints
 - O Low ceiling limits vertical storage space
 - Areas of warehouse are currently occupied with materials and equipment.
 - O Height of pallets will be disciplined by the degree to which the packages are full
- No Budget Given
 - O Costs analysis required for each alternative solution..

Summary: Data Gathering

- Ship2Pitt Data
 - Label-creation data
 - Analysis of number of students using the service, number of labels created per student and per residential hall, etc..
 - Residential hall statistics
 - Student capacity of each residential hall
 - Student type of each residential hall
 - Locations of Residential Halls
 - In order to improve efficiency by grouping neighboring halls
 - Facility Material Handling System: Storage capacity and cost utilizing pallets
- Central Receiving Data
 - O Analysis of number of packages received per day
 - O Facility Material Handling System: Storage capacity and cost utilizing hampers



Results: Forecasts

- Ship2Pitt
 - No receiving data.
 - Label creation data and student capacity data.
 - O Packages projected for a 3 week receiving period.
 - O Using student capacity data, we were able to find the amount of students from each hall that used Ship2Pitt in 2020.
 - Forecast was created where residential halls moved towards 55% usage.
 - O Placed into groups based on delivery location.
 - O Pallets allocated based off number of the packages for each building.
 - O Forecast accounts for both layout solutions.
- Department Packages
 - O Data ranged from Jan 19,2021 to Mar 5,2021.
 - O Exponential Smoothing (a = 0.25).
 - O Sensitivity Analysis increase packages by 25% to 100%.

Ship2Pitt Package Forecast

	2021: Expected		Pallets	Pallets		
	at 55% Student			allocated (114	Package	Package
Building	Usage	Weight	pallets)	pallets)	capacity(112)	capacity(112)
Amos	321	0.01796407186	2	2	20	20
Holland	1423	0.07963512228	9	9	90	90
Brackenridge	487	0.02725390341	3	3	30	30
Bruce	457	0.02557501819	3	3	30	30
McCormick	314	0.01757233197				20
Panther	1214	0.06793888858			70	70
Irvis	997	0.05579495215	5	5	50	50
Lothrop	1716	0.0960322346	11	11	110	110
The Bridge	53	0.002966030556	1	1	10	10
Forbes Pavillion	551	0.03083552521	3	4	30	40
Wyndham Gardens	35	0.001958699424	1	1	10	10
Wyndham University Center	1011	0.05657843192	6	6	60	60
Nordenberg	1327	0.07426268957	8	8	80	80
Forbes Craig	244	0.01365493312	2	2	20	20
Ruskin Hall	988	0.05529128659	6	6	60	60
Sutherland East	1757	0.09832671106	11	11	110	110
Sutherland West	2917	0.1632436062	16	17	160	170
Frats	43	0.002406402149	1	1	10	10
Bouquet Gardens	1545	0.08646258884	12	12	120	120
Centre Plaza	469	0.02624657228	3	3	30	30
Tower	4430	STORED IN CONTAINER	30	30	300	300
Total	17869	1	112	114	1120	1140
	Amos Holland Brackenridge Bruce McCormick Panther Itvis Lothrop The Bridge Forbes Pavillion Wyndham Gardens Wyndham Gardens Wyndham Lesser Kordenberg Ruskin Hall Sutherland East Sutherland East Sutherland West Frats Bouquet Gardens Centre Plaza Tower	Building	Building	Building	Building	Building Building

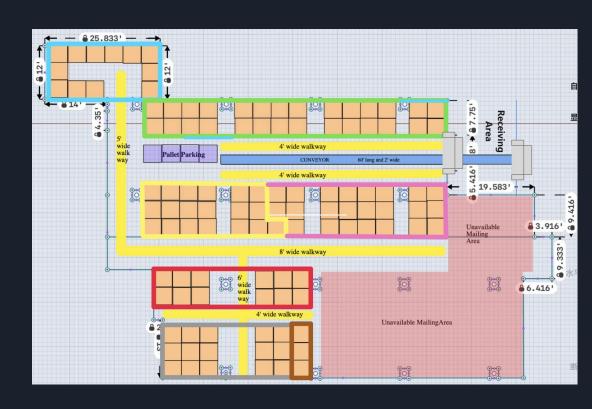
Department Package Forecast

				Exponential Smoothing (alpha = 0.25)		Sensitivity Analysis				
Date		Weekday			F(t-1,t)	Error	F(t-1,t)*1.25	F(t-1,t)*1.5	F(t-1,t)*1.75	F(t-1,t)*2
1/19/2021		Tue	292	292						
1/20/2021	Week 1	Wed	159	259	292		365	438	511	584
1/21/2021	Week 1	Thu	219	249	259	40	323	388	453	518
1/22/2021		Fri	313	265	249	64	311	373	435	498
1/25/2021		Mon	187	245	265	78	331	397	464	530
1/26/2021		Tue	185	230	245	60	307	368		
1/27/2021	Week 2	Wed	202	223	230	28	288	345	403	461
1/28/2021		Thu	252	230	223	29	279	335	391	446
1/29/2021		Fri	198	222	230	32	288	346	403	461
2/1/2021		Mon	201	217	222	21	278	333		
2/2/2021		Tue	196	212	217	21	271	325	380	434
2/3/2021	Week 3	Wed	185	205	212	27	265	318		
2/4/2021		Thu	238	213	205	33	256	308	359	410
2/5/2021		Fri	217	214	213	4	267	320	373	427
2/8/2021		Mon	256	225	214	42	268	321	375	428
2/9/2021		Tue	217	223	225	8	281	337	393	449
2/10/2021	Week 4	Wed	255	231	223	32	278	334	390	445
2/11/2021		Thu	177	217	231	54	289	346	404	462
2/12/2021		Fri	241	223	217	24	272	326	380	435
2/15/2021		Mon	253	231	223	30	279	335	391	447
2/16/2021		Tue	103	199	231	128	288	346	404	461
2/17/2021	Week 5	Wed	183	195	199	16	248	298	348	398
2/18/2021		Thu	173	189	195	22	244	292	341	390
2/19/2021		Fri	190	190	189	1	237	284	331	379
2/22/2021		Mon	260	207	190	70	237	284	332	379
2/23/2021		Tue	156	194	207	51	259	311	363	414
2/24/2021	Week 6	Wed	198	195	194	4	243	292	340	389
2/25/2021		Thu	230	204	195	35	244	293	342	391
2/26/2021		Fri	217	207	204	13	255	306	357	408
3/1/2021		Mon	197	205	207	10	259	311	363	414
3/2/2021		Tue	223	209	205	18	256	307	358	409
3/3/2021	Week 7	Wed	251	220	209	42	262	314	366	418
3/4/2021		Thu	205	216	220	15	275	330	384	439
3/5/2021		Fri	234	221	216	18	270	324	378	432
						33.38	365	438	511	

Results: Ship2Pitt

Layout Alternative 1

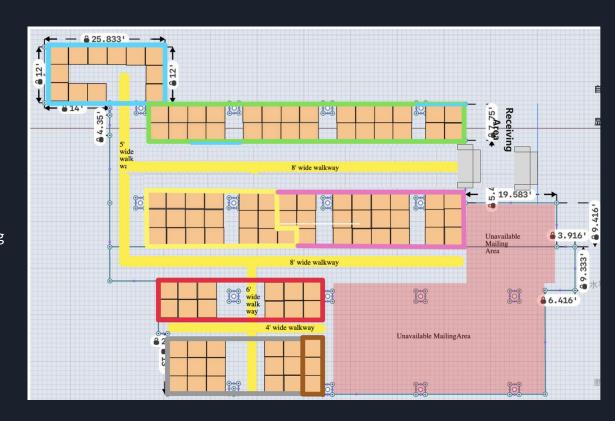
- Storage space designated by delivery group.
- Safety Considerations
 - O 4' wide walkways
 - O No shelving / reaching required
- Pallets vs shelving
 - Vertical storage space constraint
- Addition of conveyor
 - Reduces manual material handling
 - O Faster material handling
 - Multi-functional
- One storage container (not picture)



Results: Ship2Pitt

Layout Alternative 2

- Storage space designated by delivery group.
- Material handling tools
 - o Pallets
 - o Pallet jacks
- No conveyor
 - More manual material handling
 - Less efficient process
- Two additional employees required
- Same safety considerations
- One storage container (not picture)



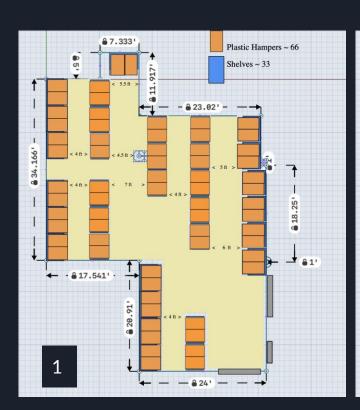
Results: Departmental Receiving

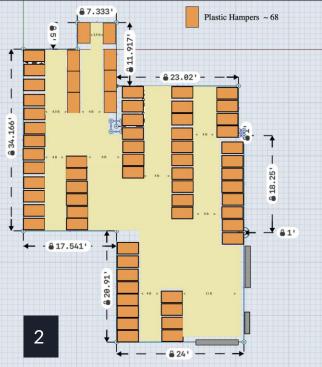
Layout Alternative 1

- 66 hampers
- 33 shelving units
- Additional costs required for tools and labor for installation

Layout Alternative 2

68 hampers





Conclusions

• Compared three factors of the alternatives... cost, storage capacity, and labor requirements.

Concluded...

- Cost of the conveyor is justifiable
 - O Mobile, can benefit functions throughout the warehouse
 - O Greatly increases efficiency in material flow \rightarrow requires less storage
 - Requires less labor
- Cost of shelving is not justifiable
 - Only a slight increase in storage capacity of facility with shelving vs without
 - o Requires installation costs

Summary								
	Cost (\$)		Capacity (boxes)		Labor Requirements			
Alt 1 Room A	3088	55938	2320-3220	1 2980-3880 I	9			
Alt 1 Room B	52850	33330	660					
Alt 2 Room A	0	28868	2340-3240	2884-3784	11			
Alt 2 Room B	28868		544					

Conclusions of Alternative Solutions

Recommendations & Recommended Implementation Plan

Recommendations

- Ship2Pitt Room A Alt. 1
 - O Purchase conveyor to reduce labor and increase material flow.
 - O Rent one storage container to increase storage space.
- Departmental Receiving Room B -Alt. 2
 - Remove portion of wall and install garage door to improve material flow from docking area to room.
 - Use current material handling tools hampers to reduce costs.

Recommended Implementation Plan

- Implementation plan assumed to begin with a blank slate.
- Contact external companies (wall removal, PMF rentals, conveyor supplier)
- Storage categorization of pallets with labeling (signs, tape).
- Gather hampers and implement flow recommendation.

Questions?