NEW YORK CITY

COLLEGE OF TECHNOLOGY

OF THE CITY UNIVERSITY OF NEW YORK

Department of **Mechanical Engineering**

Final Report

Group Project

Professor: Maya
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Simulation and Visualization - IND 3350
Student: Shaul Ranglin
Jude Francis
Kyant Chow

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Background

UPS is a package delivery company that started in 1907. As of 2009, it has grown into a $45.3 billion industry. There approximately 330,600 employees in the US and 70,000 internationally. UPS ships and delivers about 19.3 million packages and documents worldwide on daily basis.

UPS has taken the responsibility of being one of the top leaders in logistics and distribution. Logistics is the procurement, distribution, maintenance, and replacement of resources. The fulfillments that UPS has taken in logistics are:

- cross-docking
- pick and pack
- kitting
- final-stage assembly, configuration and programming
- store ready services
- order management
- vendor-managed inventory
- critical order fulfillment

Order fulfillment the important task of taking a customer's package into a warehouse facility and into the distribution network. This includes carrying out activities that are direct or indirect. These include stocking, receiving, processing, and shipping orders and customer support. UPS has also taking into account their system metrics. Warehousing and inventory management are part of utilization of personnel and queue levels.

UPS has recognized that there are three main factors that are driving new changes in the way companies view their supply chains and distribution centers: new technologies that are available, new transportation services, and customer demands. The pressure to reduce cost expenses are lead to believe that it will preserve "shrinking margins" and to respond to growth and competition that is happening worldwide. The need to provide higher level of customer service is also in demand. Customers want to know more about the system metrics (e.g. value-added services, delivery time, transactions) of the warehousing and distribution. Another demand is to enhance the responsiveness and reduce assets and costs.

Objectives

The simulation that is being studied is a local UPS facility. The facility is a warehouse distribution center used to receive all packages from local UPS stores, separate packages, and ship to their right destination. Simulation software was used to simulate the locations, entities, resources, and paths of the facility. It also was used to describe the structural data, operational data and numerical data. The simulation was scheduled based on a week day to obtain the productivities and output statics. The main purpose of evaluating the local facility is to improve the work flow planning, and product scheduling, processing time and the number of entities that process through the facility. In order for it to be considered successful, the simulation needs to be able to meet specific terms in these general categories:

- Identify the layout information about the facility.
- Identify the sequence of processing activities such as receiving area, cargo area and shipping areas and find the best layout based on minimizing travel time.
- Describe the data requirement in level of details.
- Determine what kind of machineries and tools are needed to meets the best performance for our objectives and the best speed to operate these machines in effective way.
- Improve the production scheduling and productivity improvement by using an idea of technology perspective views and computerizing.
- Analyze the overall flow of the system that needed to meet required production levels and time consumption.
- Come out with two different variations of the original configuration in order to improve the processing time of the entities.
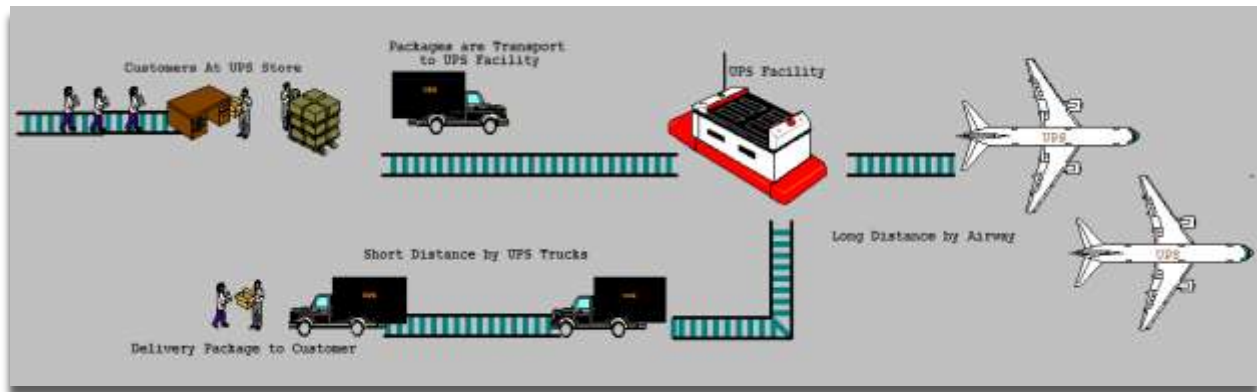
Scope

Figure (1): Overall UPS Layout

The general process for domestic and some international packages in UPS first include the customer dropping an item off at a UPS store. The item is packaged, if not already, and an employee puts a smart label on the package. The smart label has barcodes that contain the information of the package and where the destination is. It scanned numerous times during every step of the way to the destination so that a computer can keep track of the package. After the package leaves the store, it travels by truck to a local warehouse facility. At the facility, packages go through sorting for domestic and international destinations. Packages that are travel over 200 miles are transported to regional sites where they are loaded onto planes. (Figure 1)
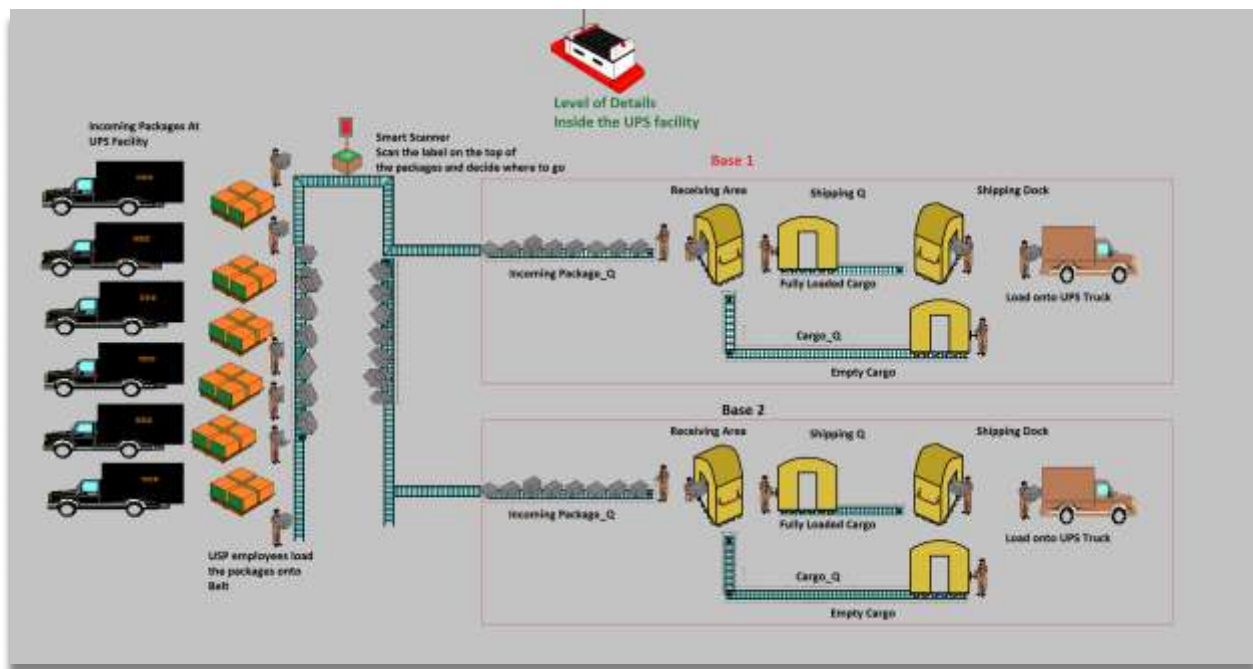

Figure (2): Overall system flow inside the local Facility

Figure (2) provides brief information about the UPS warehouse distribution. The warehouse distribution center has different processes and activities. The first area is the receiving area, where packages and envelops of different sizes are unload out trucks and transported to the storage area. Next the packages are loaded onto the conveyor belt that is programmed with cameras and sensors that help to guide the package in the right destination. If the destinations are over 200 miles the packages will be transported by plane, otherwise, they are delivered by UPS trucks. If the destination is less than 200 miles, the packages are sent to Local Receiving Areas which has 19 subdivision areas. These packages are loaded into Cargo Carries in the Cargo Area. Then the workers transport the fully loaded packages to the Shipping Area. Finally, the UPS employees load the packages out of cargo into trucks for shipping.

The system will be narrowed down and scoped so that there will be a concentration on the Local Receiving Areas, Cargo Areas and Shipping Area. There will be 19 subdivision locations in the Receiving Area, and interest will be taken on that one location. Different size packages and envelopes are coming into the system, however only the volume of packages will be considered.

Requirements

The data can be categorized as structural data, operational data, and numerical data:

Structural data involves all the objects in the facility to be modeled. Structural information describes the layout of the local facility as well as identifying the items that are processed. System elements are incoming packages, UPS employees, and locations such as receiving area, cargo area, and shipping dock.

Operational data explains how the warehouse operates and it consists of all the logical information about the system such as routing, schedules, and downtime. Incoming packages are coming into the Receiving areas and employees combine 162 packages to single entities. Employees load onto Empty Cargo and ship to shipping dock.

Numerical data provides quantitative information about the system. The amount of volume of packages that arrive and ship out of the system on a weekday needs to be determined. Also, it requires the arrival rate of incoming package which is done by automatic machines. For example, the packages are coming into Receive Areas every second or 1 minute. Data is needed to define the number of UPS employees are considered necessary to meet the best performance objectives. The number of UPS employees depends on specified location. For example, there will be two employees at receiving area, one employee at Cargo area, and three at the shipping dock.

Other system data has to determine the time and resource requirements for each operation and activity. With this data the amount of time is needed to see how long it takes to combine 162 packages, load packages onto Cargo, cargo travel times, and unload and loading the packages at shipping dock.

Date: Tuesday | W/E 11/13/2010

	Plan	Act
Total Volume	78639	81168
Total S/A	5112	5276
Cargos Vol:	259	258.75
Load Cargo (min)	10.11	10.95
Travel Time (min)	10.28	11.58
Unload Time (min)	5.28	6.28
Load Time (min)	5.30	7.25
Start Time		
Belt Run Time	3.25	3.25
Ground Down Time	4.48	5.00
Total Staffing	7.90	8.25
Total Staffing MSD:	185	
	182	

Plan	Act
1852	
7.90	

AM/Driver	Plan	Act
Ttl Loads:	0.28	0.33
	369	358
Total AM Hours:	103.32	117.69
Belt Stops		
DMS Vol	78246	
%Spa'd	99.5%	0.0%
%DA	5.0%	4.0%

Center	FSP's & PSP's Plan	Report	AM Time Plan	Report	AM Hours Plan	Report	Excess
1122	80	78	0.28	0.35	22.40	27.30	4.90
1123	67	63	0.28	0.31	18.76	19.53	0.77
1124	68	65	0.28	0.26	19.04	16.90	-2.14
1125	78	76	0.28	0.39	21.84	29.64	7.80
1126	76	76	0.28	0.32	21.28	24.32	3.04
Total	**369**	**358**	**0.28**	**0.33**	**103.32**	**117.69**	**14.37**

Summaries	Plan	Act
Primary PPH	173.90	172.02
Belt PPH	160.48	162.70
SL Hours	922.74	950.41
Total w/AM Hours:	1026.06	10.68.10
Building PPH:	76.6	76.6

PRIMARY STATISTICS

FT SUPERVISOR		% Tot Vol	Volume Plan	Act	Staffing MSD	Plan	Act	PPH MSD	Plan	Act	% Effective Plan	Act	Time Plan	Act	Excess	Should Use
	Unload	100%	75250	77670	13	14	15	1287	1171	1158	91	90	64.25	67.08	0.76	66.32
Blount	Sort	127.5%	100265	99029	19	19	18	1194	1198	1196	100	100	83.72	82.81	0.12	82.69
Narain	SPA	72.5%	54556	56311	13	14	15	907	844	837	93	92	64.68	67.29	0.53	66.76
Blount	Total		75250	77670	45	47	48	371	354	358	95	96	212.65	217.18	1.41	215.77

% Tot Vol	Volume Plan	Act	Staffing MSD	Plan	ACT	PPH MSD	Plan	Act	% Effective Plan	Act	Time Plan	Act	Excess	Should Use
21.7%	17065	17613	4	4	3	1017	1011	1057	99	104	16.88	16.67	-0.75	17.42
1.2%	904	933	10	10	8	20	20	20	99	102	45.49	45.95	-1.00	46.95
40.0%	31456	32467	21	21	17	327	327	339	100	104	96.19	95.83	-3.46	99.29
4.0%	3146	3247	4	5	5	165	145	145	88	88	21.66	22.36	0.00	22.36
11.6%	9122	9415	2	2	2	981	981	939	100	96	9.30	10.03	0.43	9.60
32.9%	25872	26704	1	1	1	5556	5556	5805	100	104	4.66	4.60	-0.21	4.81
6.5%	5112	5276	4	4		300	300	283	100	94	17.04	18.63	1.04	17.59
2.0%	1573	1623	2	2	6	200	178	80	89	40	8.84	20.27	11.15	9.12
94249	**97280**	**48**	**49**	**42**	**444**	**428**	**415**	**97**	**94**	**220.06**	**234.34**	**7.20**	**227.14**	

BELT STATISTICS

	% Tot Vol	Volume Plan	Act	Staffing MSD	Plan	ACT	PPH MSD	Plan	Act	% Effective Plan	Act	Time Plan	Act	Excess	Should Use	Recycle
Belt #1	6.3%	4960	5129	6	6	6	155	154	162	99%	105%	32.01	32.53	-1.75	34.28	
Belt #2	6.4%	5011	5459	6	6	6	168	167	168	99%	100%	30.01	32.56	-0.13	32.69	
Belt #3	6.6%	5155	6053	6	6	7	160	159	164	99%	102%	32.41	37.01	-1.05	38.06	
Belt #4	10.4%	8156	7775	10	10	8	160	159	167	99%	104%	51.28	46.58	-2.31	48.89	
Belt #5	11.9%	9333	9127	11	11	11	165	164	165	99%	100%	56.90	55.44	-0.21	55.65	
Belt #6	7.3%	5733	5715	7	7	7	163	162	158	99%	97%	35.39	36.27	1.00	35.27	
Belt #7	9.3%	7287	7980	9	9	9	158	157	159	99%	100%	46.40	50.29	-0.52	50.81	
Belt #8	11.0%	8664	8903	10	10	10	158	157	150	99%	95%	55.16	59.33	2.64	56.69	
Belt #9	8.2%	6478	6339	7	7	7	168	167	189	99%	112%	38.79	33.56	-4.40	37.96	
Belt #10	8.7%	6853	7967	8	8	9	158	157	160	99%	101%	43.64	49.87	-0.86	50.73	
Belt #11	9.8%	7709	8764	9	9	10	156	155	158	99%	101%	49.72	55.55	-0.97	56.52	
1123 MDC	2.2%	1733	1804	2	2	2	178	179	182	100%	102%	9.69	9.90	-0.19	10.09	
1126 MDC	2.0%	1509		2	2		184	185		100%		8.62		0.00	0.00	
Total	100%	78639	81168	93	93	92	161	160	163	99%	101%	490.03	498.89	-8.74	507.63	**0**

CENTER SUMMARIES

Belt	Center	Volume Plan	Act	Staffing MSD	Plan	Act	Diff	PPH Plan	Act	Diff	Time Plan	Act	Excess	Should Use
4/5	1122	17489	16902	21	21	19	-3.23	134	131	-3.23	130.59	129.32	3.12	126.20
6/6/M	1123	13944	13858	16	16	16	-0.89	26	25	-0.89	535.34	550.78	18.75	532.03
1/2/3	1124	15098	16794	18	18	19	8.07	133	141	8.07	113.47	119.00	-7.22	126.22
7/8	1125	15951	16883	19	19	19	-8.02	129	121	-8.02	123.41	139.26	8.64	130.62
10/11	1126	16157	16731	19	19	19	-2.13	131	129	-2.13	123.26	129.74	2.10	127.64
LVD's		0		0	0	0	0.00	0		0.00	0.00		0.00	0.00
	Total	78639	81168	93	93	92	-0.65	76.6	76	-0.65	1026.06	1068.1	25.39	1042.71

Belt	Term	Volume		Staffing		Time							
4/5			`					Load Trailer		Travel		Unload		Ttl Load
6/6/M		Volume		Staffing		Load Trailer		Travel		Unload		Ttl Load	
1/2/3		Plan	Act	Plan	Act	Plan	Act	Plan	Act	Plan	Act	Plan	Act
7/8	#1	155	163.13	6	6	10	8.91	10	10.88	6	5.23	6	5.27
10/11	#2	155	156.99	6	6	10	8.23	10	10.01	6	6.77	6	5.64
LVD's	#3	155	159.03	6	6	10	10.12	10	8.11	6	6.28	6	5.17
	#4	155	161.02	6	6	10	9.15	10	8.29	6	5.00	6	5.05
	#5	155	162.22	6	6	10	10.21	10	11.57	6	5.45	6	5.71
	#6	155	156.02	6	6	10	10.53	10	11.54	6	5.82	6	5.68
	#7	155	158.98	6	6	10	10.69	10	10.52	6	5.03	6	6.60
	#8	155	160.15	6	6	10	8.36	10	8.19	6	5.94	6	5.02
	#9	155	164.55	6	6	10	10.63	10	8.33	6	6.36	6	6.58
	#10	155	157.92	6	6	10	8.95	10	8.82	6	6.88	6	6.08
	#11	155	160.33	6	6	10	10.60	10	8.98	6	5.97	6	5.33
	#12	155	162.72	6	6	10	8.59	10	8.11	6	6.28	6	6.12
	#13	155	159.41	6	6	10	10.01	10	10.69	6	5.08	6	6.97
	#14	155	160.49	6	6	10	8.54	10	8.68	6	6.70	6	6.01
	#15	155	158.32	6	6	10	8.95	10	9.61	6	5.02	6	6.62
	#16	155	161.38	6	6	10	8.77	10	10.14	6	5.59	6	6.89
	#17	155	164.38	6	6	10	10.07	10	8.58	6	5.54	6	5.03
	#18	155	164.17	6	6	10	10.23	10	10.98	6	5.55	6	5.76
	#19	155	157.58	6	6	10	8.34	10	11.51	6	6.25	6	5.30
	#20	155	161.21	6	6	10	10.22	10	11.96	6	6.76	6	6.69
	#21	155	162.71	6	6	10	8.42	10	8.87	6	6.89	6	5.26
	#22	155	159.41	6	6	10	9.30	10	11.37	6	6.81	6	6.03
	#23	155	156.30	6	6	10	8.53	10	11.07	6	5.26	6	5.04
	#24	155	159.32	6	6	10	10.28	10	11.07	6	5.87	6	6.06
	#25	155	163.57	6	6	10	10.14	10	8.95	6	5.61	6	5.08
	#26	155	159.75	6	6	10	9.17	10	8.07	6	5.69	6	5.62
	#27	155	159.73	6	6	10	8.91	10	10.47	6	6.69	6	5.94
	#28	155	158.14	6	6	10	9.48	10	8.59	6	5.07	6	5.24
	#29	155	157.66	6	6	10	10.79	10	11.23	6	6.66	6	6.83
	#30	155	158.90	6	6	10	9.56	10	10.45	6	6.73	6	5.89
	#31	155	162.85	6	6	10	10.76	10	11.63	6	5.82	6	6.37
	#32	155	162.77	6	6	10	9.41	10	10.39	6	6.02	6	6.03
	Total	4960	5129.42	6	6	10	294.05	10	315.76	6	189.89	6	187.18

*iSpa staffing should only be counted once in primary

Average			
Volume		Time	
Plan	Act	Plan	Act
155	162.77	32	32.53

Belt	Center	Volume		Staffing				PPH			Time			
4/5		Plan	Act	MSD	Plan	Act	Diff	Plan	Act	Diff	Plan	Act	Excess	Should Use
6/6/M	1122	17489	16902	21	21	19	-3.23	134	131	-3.23	130.59	129.32	3.12	126.20
1/2/3	1123	13944	13858	16	16	16	-0.89	26	25	-0.89	535.34	550.78	18.75	532.03
7/8	1124	15098	16794	18	18	19	8.07	133	141	8.07	113.47	119.00	-7.22	126.22
10/11	1125	15951	16883	19	19	19	-8.02	129	121	-8.02	123.41	139.26	8.64	130.62
LVD's	1126	16157	16731	19	19	19	-2.13	131	129	-2.13	123.26	129.74	2.10	127.64
		0		0	0		0.00	0		0.00	0.00		0.00	0.00
	Total	78639	81168	93	93	92	-0.65	76.6	76	-0.65	1026.06	1068.1	25.39	1042.71

	MSD	Plan	Act
Total Staffing	182	185	182

Staffing		
	Plan	Act
Assigned	250	
Planned Absent	20	
Unplanned Absent	25	
Available	215	
Average		

Collect and Analyze Data

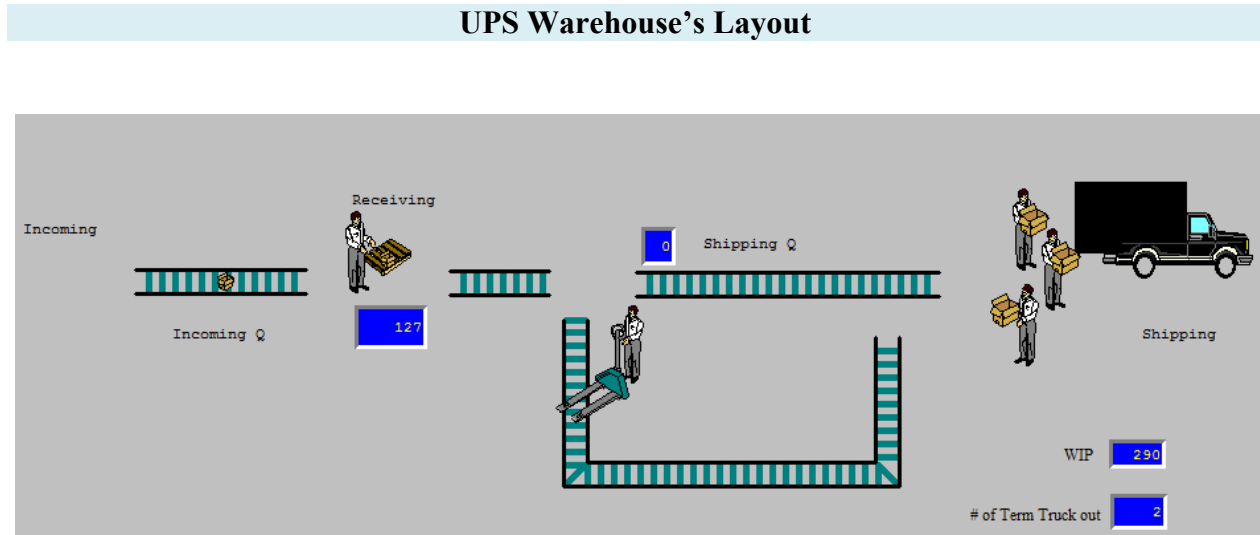*Structural Data*

UPS Warehouse's Layout

Figure 3

In the simulation the packages will be the entities and incoming quantities represent the volumes. The total volume will be 78,639 and distribute to 19 bases according to their destinations. Our group will focus only base 1 and it has Initial Volume of 5129. Time is based on 16 hours consumptions which is two shifts. There will be five locations such as Incoming Package_Q, Receiving Area, Shipping_Q, Shipping Dock and Cargo_Q. Resources are UPS employers who will perform the task in the system. The total staffing in base one is six employees. Two employers in Receiving Areas are loading packages into Cargo container, and one worker will move the full loaded cargo to shipping dock. Three employers are in Shipping Dock, 2 are unloading and 1 is loading packages into UPS truck. The same person who brings the full load cargo to shipping dock will bring back empty cargo back to receiving area.

Process Description for UPS Warehouse Distribution

The total initial volumes at Receiving Area are 5129, and 2 employees start to load the average of 162 packages onto empty Cargos and it takes about 10 minutes, and when the full

Location	Activity Time	Activity Resource	Next Location	Move Resource
Incoming Packages	0.185 Volume of packages occur every minute	Machinery	Incoming	None
Receiving Area Loading	Uniform distribution U(9.55,1.2)	**2** Employee	Shipping_Q	None
Shipping_Q	Uniform Distribution U(9.92,1.85)	**1** Employee	Shipping Dock	Employee
Shipping Dock Unloading packages	Uniform Distribution U (5.95,0.95)	**2** Employee	Empty Cargos Travel back to Receiving Area	Employee
Shipping Dock Loading onto UPS Trucks	Exponential Distribution E(5.84)	**1** Employee	UPS Truck	None

loaded cargo departure to shipping_Q, the workers continue to load the packages into another empty cargo. One worker beings to move the full loaded Cargo to Shipping Dock and the travel time is about the average of 10 minutes. After the Cargo is dropped, the extra empty cargo is returned to the receiving area. Two employees at Shipping Dock are unloading the packages from the Cargos and it takes about the average of 6 minutes. One employee starts to load the packages onto a waiting truck and its loading time is about the average of six minutes.

Using **StarFit** to analyze Raw Data

1. **Statistical Analysis of Numerical Data**
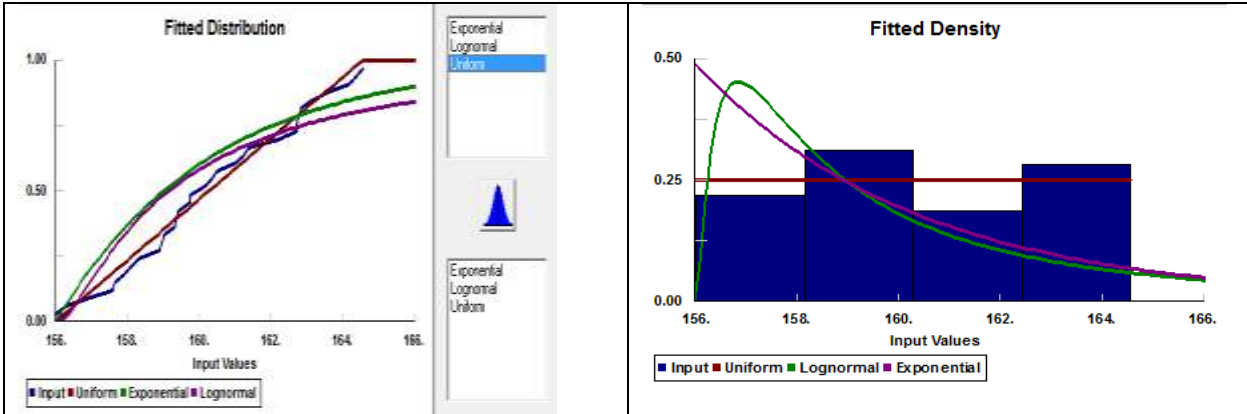   I.   *Receiving Area has (19 Bases)*
          Base 1
          Employers load the incoming packages (average of 162 volumes) onto empty
          Cargos and observed loading packages volume

32 Observed loading Volume package onto Cargo		
163.13	160.33	156.30
156.99	162.72	159.32
159.03	159.41	163.57
161.02	160.49	159.75
162.22	158.32	159.73
156.02	161.38	158.14
158.98	164.38	157.66
160.15	164.17	158.90
164.55	157.58	157.66
157.92	161.21	158.90
	159.41	162.77

Auto::Fit of Distributions

distribution	rank	acceptance
Uniform(156, 165)	100	do not reject
Lognormal(156, 1.15, 1.15)	0.424	reject
Exponential(156, 4.35)	0.287	reject

descriptive statistics

data points	32
minimum	156.02
maximum	164.55
mean	160.347
median	159.95
mode	159.525
standard deviation	2.41783
variance	5.84591
coefficient of variation	1.50787
skewness	0.111003
kurtosis	-1.05714

method of moments estimates

Exponential
  minimum = 156. [fixed]
  beta   = 4.34719

Lognormal
  minimum = 156. [fixed]
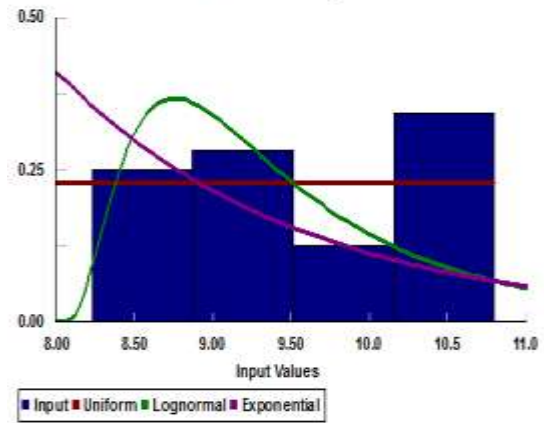 mu   = 1.33477
  sigma   = 0.519156

Uniform
  minimum = 156. [fixed]
  maximum = 164.55

II. Receiving Area

Employers load the incoming packages (average of 162 volumes) onto empty Cargos and observed loading time in minutes

32 Observed loading package onto Cargo Time in Minutes		
8.91	10.60	9.30
8.23	8.59	8.53
10.12	10.01	10.28
9.15	8.54	10.14
10.21	8.95	9.17
10.53	8.77	8.91
10.69	10.07	9.48
8.36	10.23	10.79
10.63	8.34	9.56
8.95	10.22	10.76
	8.42	9.41

Auto::Fit of Distributions

distribution	rank	acceptance
Uniform(8., 10.8)	100	do not reject
Lognormal(8., 0.227, 0.711)	42.7	do not reject
Exponential(8., 1.55)	5.19	reject

descriptive statistics		method of moments estimates	
data points	32	**Exponential**	
minimum	8.23	minimum = 8. [fixed]	
maximum	10.79	beta = 1.54625	
mean	9.54625		
median	9.445	**Lognormal**	
mode	10.455	minimum = 8. [fixed]	
standard deviation	0.862063	mu = 0.300503	
variance	0.743153	sigma = 0.520248	
coefficient of variation	9.03039		
skewness	1.79213e-002	**Uniform**	
kurtosis	-1.56086	minimum = 8. [fixed]	
		maximum = 10.79	

Fitted Distribution

Input Values

Input ■ Uniform ■ Lognormal ■ Exponential

Fitted Density
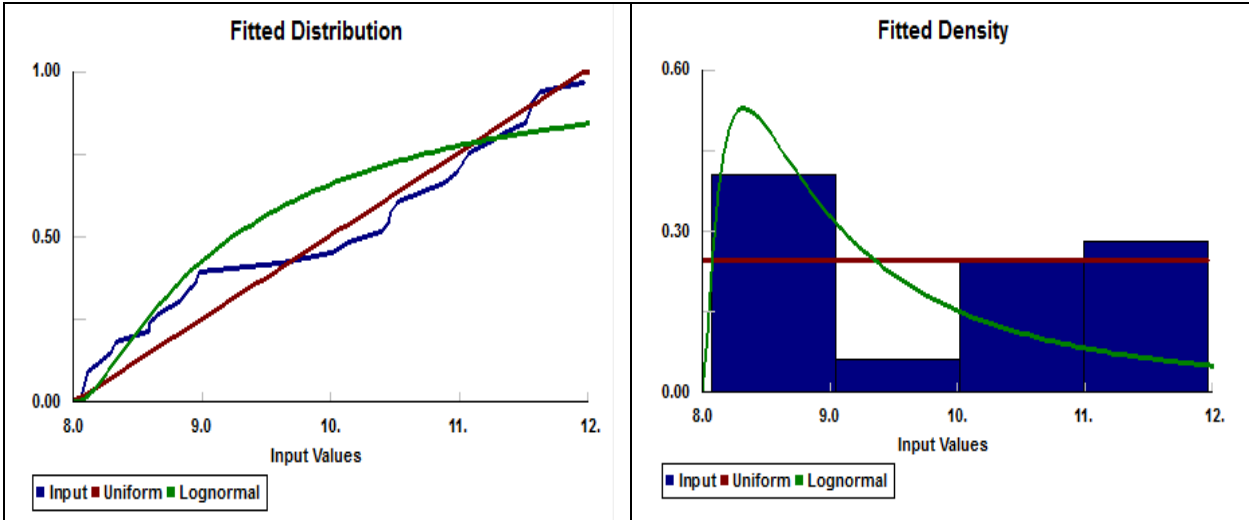
Input Values

Input ■ Uniform ■ Lognormal ■ Exponential
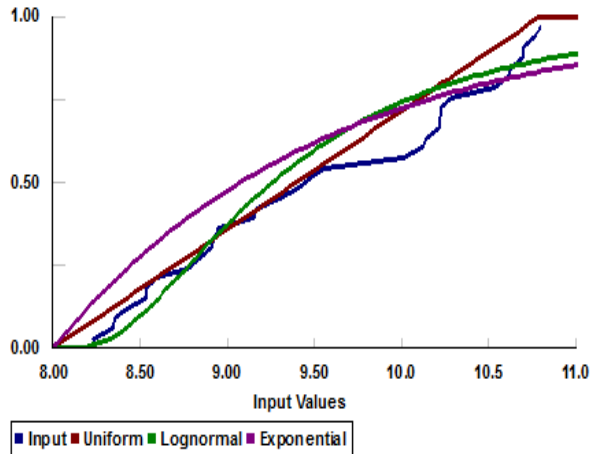
Shipping

Fully loads of packages are moving to Shipping Docks and observed traveling time in minutes.

32 Observed Shipping Time in Minutes		
10.88	8.98	11.37
10.01	8.11	11.07
8.11	10.69	11.07
8.29	8.68	8.95
11.57	9.61	8.07
11.54	10.14	10.47
10.52	8.58	8.59
8.19	10.98	11.23
8.33	11.51	10.45
8.82	11.96	11.63
	8.87	10.39

Auto::Fit of Distributions

distribution	rank	acceptance
Uniform(8., 12.)	100	do not reject
Lognormal(8., 0.213, 1.16)	5.25	reject

descriptive statistics

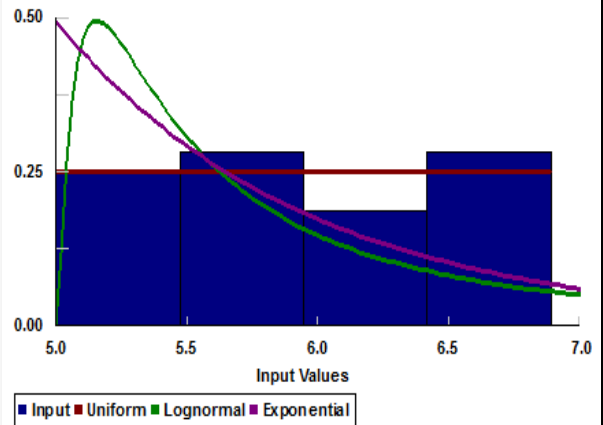|	
data points	32
minimum	8.07
maximum	11.96
mean	9.92687
median	10.265
mode	8.07
standard deviation	1.3047
variance	1.70224
coefficient of variation	13.1431
skewness	-9.24042e-002
kurtosis	-1.61358

method of moments estimates

Lognormal
minimum = 8. [fixed]
mu = 0.467204
sigma = 0.614321

Uniform
minimum = 8. [fixed]
maximum = 11.96

Fitted Distribution / **Fitted Density**

III.   *Unload Packages from Cargo Time in Minutes*

32 Observed Unload Time in Minutes		
5.23	5.97	6.81
6.77	6.28	5.26
6.28	5.08	5.87
5.00	6.70	5.61
5.45	5.02	5.69
5.82	5.59	6.69
5.03	5.54	5.07
5.94	5.55	6.66
6.36	6.25	6.73
6.88	6.76	5.82
	6.89	6.02

Auto::Fit of Distributions

distribution	rank	acceptance
Uniform(5., 6.89)	100	do not reject
Exponential(5., 0.957)	12.5	do not reject
Lognormal(5., -0.429, 1.2)	5.96	reject

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descriptive statistics		method of moments estimates	
data points	32	**Exponential**	
minimum	5.	minimum = 5. [fixed]	
maximum	6.89	beta = 0.956875	
mean	5.95688		
median	5.905	**Lognormal**	
mode	6.89	minimum = 5. [fixed]	
standard deviation	0.637275	mu = -0.227635	
variance	0.406119	sigma = 0.605892	
coefficient of variation	10.6981		
skewness	9.74857e-003	**Uniform**	
kurtosis	-1.39562	minimum = 5. [fixed]	
		maximum = 6.89	

Fitted Distribution

Input Values

■ Input ■ Uniform ■ Lognormal ■ Exponential

Fitted Density

Input Values

■ Input ■ Uniform ■ Lognormal ■ Exponential

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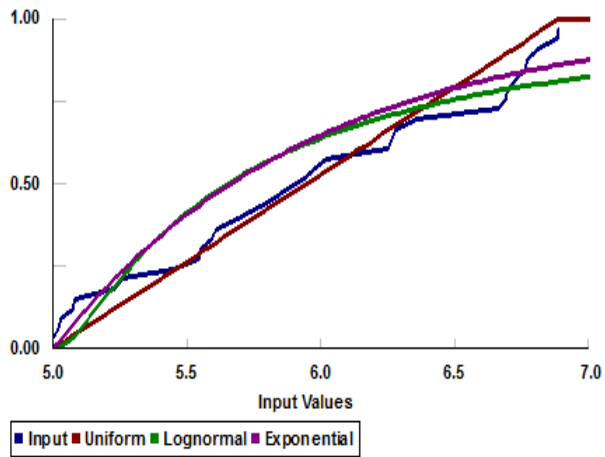
I. *Load Packages into Waiting UPS Truck Time in Minutes*

32 Observed Unload Time in Minutes		
5.27	5.33	6.03
5.64	6.12	5.04
5.17	6.97	6.06
5.05	6.01	5.08
5.71	6.62	5.62
5.68	6.89	5.94
6.60	5.03	5.24
5.02	5.76	6.83
6.58	5.30	5.89
6.08	6.69	6.37
	5.26	6.03

Auto::Fit of Distributions

distribution	rank	acceptance
Exponential(5., 0.841)	100	do not reject
Uniform(5., 6.97)	19.5	do not reject
Lognormal(5., -0.686, 1.28)	11.	do not reject

descriptive statistics		descriptive statistics	
data points	32	data points	32
minimum	5.02	minimum	5.02
maximum	6.97	maximum	6.97
mean	5.84094	mean	5.84094
median	5.825	median	5.825
mode	5.02	mode	5.02
standard deviation	0.614971	standard deviation	0.614971
variance	0.378189	variance	0.378189
coefficient of variation	10.5286	coefficient of variation	10.5286
skewness	0.28795	skewness	0.28795
kurtosis	-1.17118	kurtosis	-1.17118
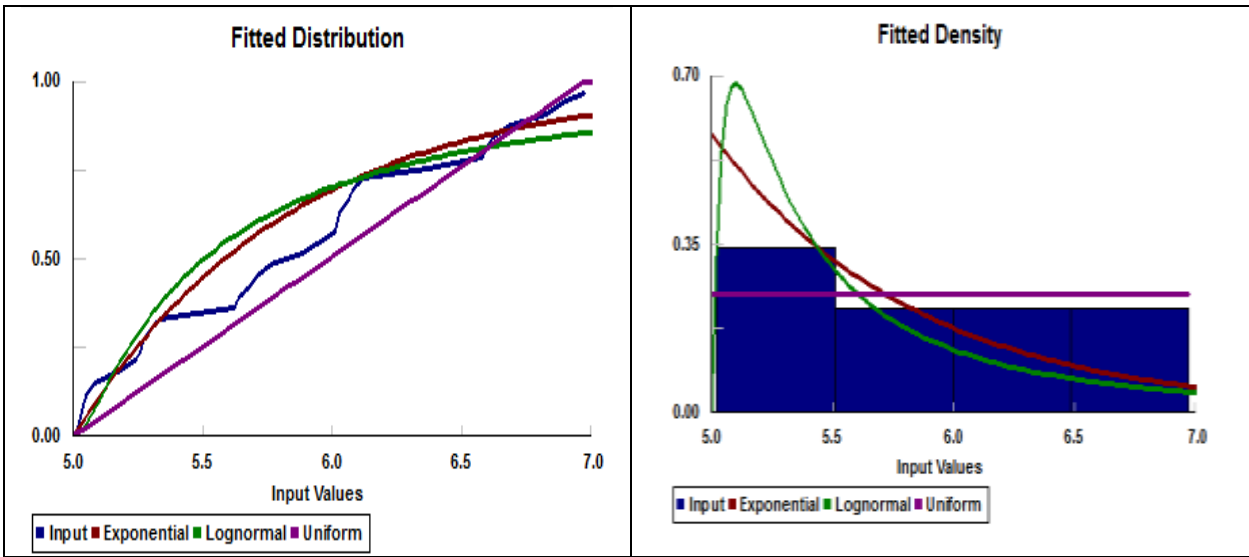
Validate the Model

Compare the ProModel Against original raw data

	Time (hour)	Original Raw Data	ProModel Output Data	% Difference
Total Entities	1	324	325.22	0.37%
	16	5129	5189	1.17%
# No Trucks	1	2	2	
	16	32	32	

According to the software result, 5189 packages are processed through the system within 16 hours and 32 trucks had left the warehouse. The original raw data has 5129 packages and 32 trucks had left the warehouse. The difference between the two results for total entities is 0.37% for 1 hour and 1.17% for 16 hours.

Conduct Experiments

Create two different variations of the original configuration in order to improve the processing time of the entities. Improvements do not include the number of employees. Our changes will be the overall flow of the system.

Variation I

Brief Description

Incoming packages will be directly sent to shipping dock. As a result, there will be reduced amount of the locations such as Receiving Area, Cargo_Q, Shipping_Q, and Cargo Area. There will be five new locations such as incoming package, incoming_Q, loading area, and shipping. Three employees will unload incoming packages from belt and other three employees will load onto UPS truck.
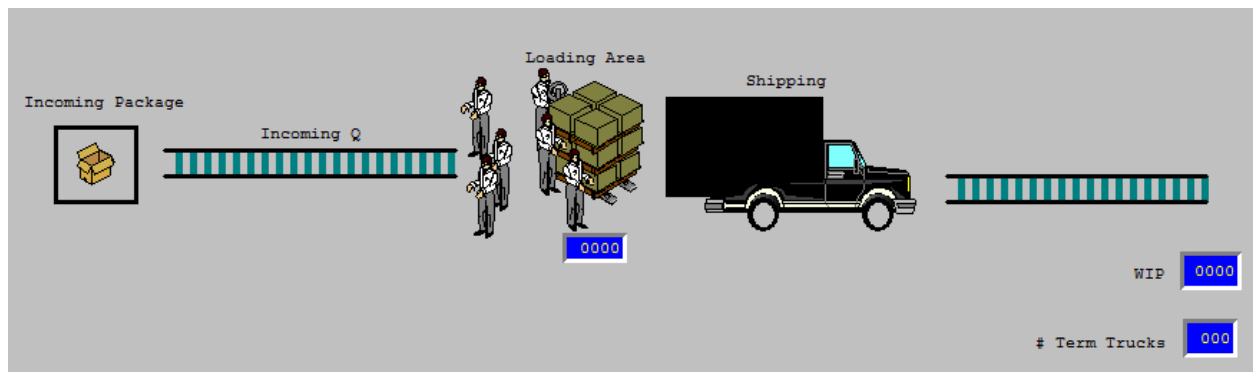

Figure (4): Variation I

	Time in hour	Variation **I** output
Total Entities (Packages)	1	500
	16	8000
# No Trucks	1	4
	16	48

Variation II

Brief Description

In variation II, more paths will be added in the overall flow of the entities. Incoming packages will be directly sent to the shipping dock and instead of having six employees loading for one truck, there will be three UPS trucks at Shipping docks, and two employees for each trucks.
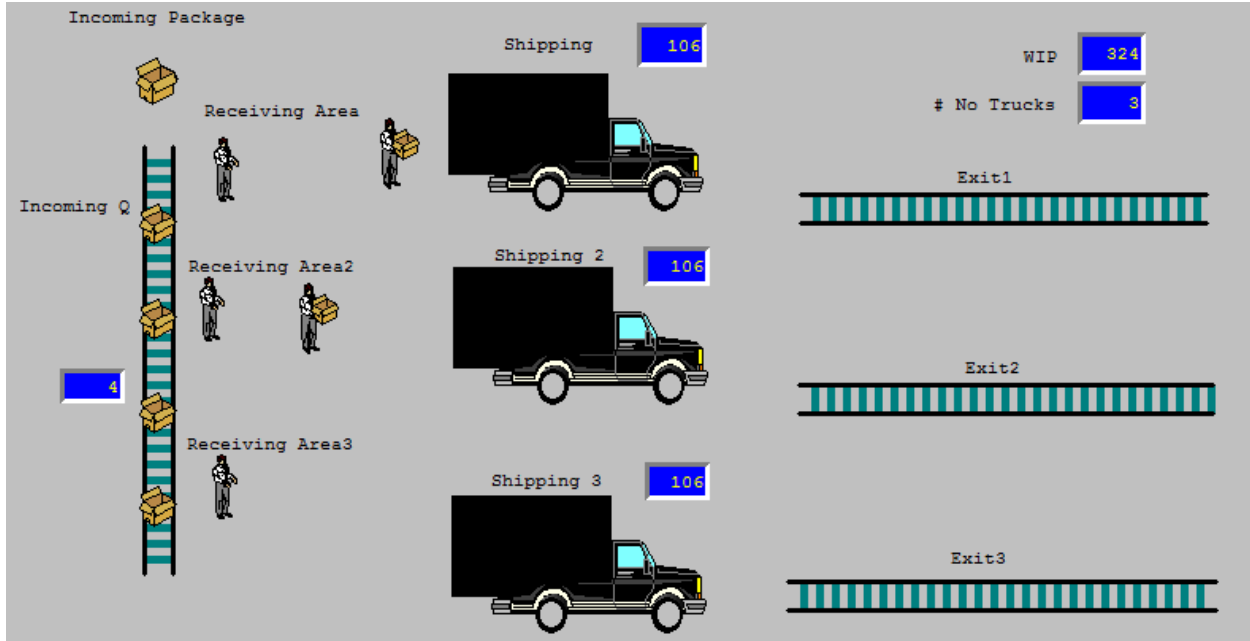
20

Figure (5): Variation II

	Time in hour	Variation **II** output
Total Entities (Packages)	1	967
	16	15,483
# No Trucks	1	6
	16	96

Data Comparison

	Time in hour	Original Configuration	ProModel Simulation From Original	Variation I	Variation **II**
Total Entities (Packages)	1	324	325.22	500	967
	16	5129	5189	8000	15,483
# No Trucks	1	2	2	4	6
	16	32	32	48	96

According to our Data Comparison table the changes in overall flow of the system will improve the processing time of the entities.

Conclusion

Simulation involves frame work, collecting and analyzing data. Simulation models are usually done using computer software to imitate the dynamic system of how elements in practical condition and how they interact each other. From this software a conceptual model was converted into a simulation model. The software ProModel was used to simulate the UPS local facility in order to improve the work flow planning and product scheduling. This project applies to a highly technology world because the whole universal creates as a system which how collection of elements work together. For example, UPS local facility has so many elements that work together. The activities and processing are interdependencies and variability makes up the system complexity. In order to control the cost reduction, software like ProModel improve the overall system. Data is very important when the system is being model because it is a main input resource, and invariable data makes the model a failure.

References

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