

An Efficient Truck Dock Allocation Algorithm

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1. Objective

In Supply chain industry, movement of the cargo on the roadside is an integral segment of the business. The cargo moves between the cities and sometimes across the countries by the Trucks. Timely delivery of the Cargo to the end consignee depends on various factors. One of them is the inefficient truck dock allocation mechanism; which contributes the major tangible delays in the whole process. The inefficiency of the Truck Docks Management inside the warehouse represents the significant financial burdens on the trucking and warehouse management companies. Based on the internal performance tracking data, on an average, a truck wastes roughly 20-25 minutes after arrival inside the warehouse to get the correct truck dock allocated for loading and unloading of the Cargo. Considering the movement of 100-200 truck on an average in a warehouse per day contributes to 35 to 40 wasted person-hours in a single warehouse, this results in \$800 per day or \$292,000 per annum, which is a significant amount to lose, the influence may higher be considering all the warehouse across the network.

This white paper highlights the effective algorithm for the truck dock management, their allocations, timely availability, the service requirement inside the Air Cargo terminal/warehouse.

2. Methods Procedures

This white paper deals with the algorithmic aspects of Truck Dock allocation within the Air cargo warehouse terminal. Truck dock algorithm process allocates truck to available docks. Truck dock allocation operates in two phases.

In the first phase of Truck dock allocation, a reservation for time is requested. This is called time allocation. In the second phase, the actual truck dock is allocated. This allocation is done only when there is confirmation of the truck being available at the terminal entrance or available at Truck Park.

Therefore, having a time allocation only prevents over reservation rather than guaranteed truck dock availability. This is because the actual availability of truck dock is based on the arrival of trucks on time (as per reservation time), completion of load/unload operation by the estimated time and possible exceptions, like a requirement for follow-on trucks.

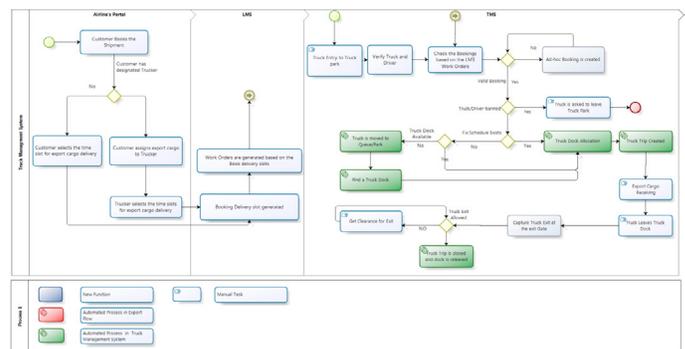
3. Definitions, Acronyms, and Abbreviations

3.1 Functional Terms

Term	Description
TMS	Truck Management system
BPM	Business Process model
SLA	System Level Agreements.
TCO	Truck Controlling Office
DG	Dangerous Goods
IMP GEN	Import General
AVI	Live Animal
CR	Cool Room

4. Truck Dock Allocation Concepts

4.1 Business Process Model- High-Level Process Flow



4.2 Truck Dock purpose

'Purpose' is a generic categorization used to define the capability of a Truck dock, Nature of cargo and so on. 'Purpose' is used to define attributes of a Cargo Reservations, Truck, and Truck Docks. Each truck dock is associated with one or more purpose. The 'Purpose' of a truck dock indicates the kinds of truck/cargo

it can handle. Similarly, every pickup/drop of a Truck would also have a 'Purpose' associated. This 'Purpose' is either declared/derived while Cargo reservation or at the Terminal Entrance or at the Truck Controlling Office (TCO).

Truck Dock Purpose includes:

- Import Bulk
- Import Pre-pack
- Imp Perishable
- Imp Cool Room
- Imp Dangerous Goods
- Export Bulk
- Export Pre-Pack
- Export Dangerous Goods
- Export Perishable
- Export Cool Room
- Valuable

- Odd Size

4.3 Managing Dock Purpose

Each truck dock has defined purpose. Each Truck dock is associated with primary purpose, second/third/fourth/fifth purposes. For example, Truck Dock TD101 may have a primary purpose of DG (Dangerous Goods), and the second purpose of IMP GEN (Import General), third as AVI (Live animal). This means that TD101 is primary to be allocated for DG, but then it can also handle IMP GEN or AVI Shipments.

The truck dock purpose can change over time and may also be different for different times of the day or different days of the week. To manage these settings for a truck a truck dock properties template is used along with a schedule that indicates applicable times when the template is applicable.

Dock No →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
↓Purpose																				
Primary	DG	DG	DG	DG	DG	AV I	AV I	AV I	GE N	CR	CR	CR	CR							
2ND	GE N	GE N	GE N	AV I	AV I	GE N	GE N	GE N									GE N	GE N		
3RD				GE N	GE N															
4TH																				
5TH																				

Template 1

Dock No →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
↓Purpose																				
Primary	DG	DG	DG	DG	DG	AV I	AV I	AV I	GE N	CR	CR	CR	CR							
2 ND	GE N	GE N	GE N	AV I	AV I	GE N	GE N	GE N									GE N	GE N		
3 RD				GE N	GE N															
4 TH																				
5 TH																				

Template 2

Dock No →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
↓Purpose																				
Primary	DG	DG	DG	GE N	GE N	AV I	AV I	GE N	CR	CR	CR	CR	CR	CR						
2 ND	GE N	GE N	GE N			GE N	GE N													
3 RD																				
4 TH																				
5 TH																				

4.4 Truck Dock Properties Template

A truck dock properties template is used to configure the primary purpose and subsequent purposes of all the truck docks in the terminal and save it as one reference-able set.

4.5 Truck Dock Template

Template ID	Dock No	primary Purpose	Sec 1 Purpose	Sec 2 Purpose	Sec 3 Purpose
1	1	DG	GEN		
1	2	DG	GEN		
1	3	DG	GEN		
1	4	DG	AVI	GEN	
1	5	DG	AVI	GEN	
1	6	AVI	GEN		
1	7	DG	AVI	GEN	
1	8	AVI	GEN		
1	9	GEN			
1	10	GEN			
....					
2	1	DG	GEN		
2	2	DG	GEN		
2	3	DG	GEN		
2	4	GEN			
2	5	GEN			
2	6	AVI	GEN		

2	7	AVI	GEN
2	8	GEN	
2	9	GEN	
2	10	GEN	
....			

4.6 Template Schedule

Once the template is ready, the template is made applicable using a schedule. A Schedule indicates the time of the day and the days of the week when the template is applicable. Based on the schedule and the template the system generates the truck dock properties for a given day. The Schedule should be such that there is some or other template applicable for all hours of the day.

4.7 Truck Dock Zone

A truck dock zone is a group of truck docks that are physically close to each other and is served by one set of resources. The truck zone is are source grouping of docks and has significance in the way resource handles delivery of cargo to be available at a truck dock.

The concept will have an impact only when the truck has a reservation and the cargo will be pre-staged at buffer area of the booked zone and any truck dock for that purpose is not available in that zone during allocation.

4.8 Truck Dock pool

Since actual truck, docks are not allocated when Cargo reservation, it is sufficient to maintain the count of available truck docks

Truck Dock Template Schedule

Schedule ID	Template ID	From	To	SU	MO	TU	WE	TH	FR	SA
1	1	06:00	09:59		Y	Y	Y	Y	Y	
2	1	06:00	14:59	Y						Y
3	2	10:00	23:59		Y	Y	Y	Y	Y	
4	2	00:00	05:99	Y	Y	Y	Y	Y	Y	Y
5	2	15:00	23:59	Y						Y

4.9 Dock properties (purpose)

Zone	Zone 1										Zone 2									
Dock No →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
↓Purpose																				
Primary	DG	DG	DG	DG	DG	AV	AV	AV	GE	GE	GE	GE	GE	GE	GE	GE	CR	CR	CR	CR
						I	I	I	N	N	N	N	N	N	N	N				
Secondary 1	GE	GE	GEN	AV	AV	GE	GE	GE									GE	GE		
	N	N		I	I	N	N	N									N	N		
Secondary 2				GE	GE															
				N	N															
Secondary 3																				
Pools....																				

for each ‘Purpose’. Truck docks are grouped into pools based on unique combination of primary and secondary ‘Purpose’. Additionally, the Truck Dock pool is segregated based on the Truck dock zone. Truck dock pools are derived from the actual truck dock properties defined for each truck dock. The following table indicates the Truck Dock pools that are derived from a typical configuration of Truck dock zone and truck dock purpose.

4.10 Truck Dock Pools

Pool ID	Zone	Dock Count	primary Purpose	Sec 1 Purpose	Sec 2 Purpose	Sec 3 Purpose
1	901	3	DG	GEN		
2	901	2	DG	AVI	GEN	
3	901	3	AVI	GEN		
4	901	6	GEN			
5	902	2	GEN			
6	902	2		GEN		
7	902	2				
		20	Total			

The above chart shows the total dock count is 20, the number of docks that can handle GEN is 18 (3 + 2 + 3 + 6 + 2 + 2), DG is 5 (3 + 2), AVI is 5 (2 + 3) and CR is 4 (2+ 2).

The docks associated within a Pool are also maintained.

Dock in Pool

Pool ID	Dock ID	Pool ID	Dock ID	Pool ID	Dock ID
1	1	4	9	6	17
1	2	4	10	6	18
1	3	4	11	7	19
2	4	4	12	7	20
2	5	4	13		
3	6	4	14		
3	7	5	15		
3	8	5	16		

4.11 Truck Dock Reservation

The reservation of truck dock is done by the Agent in advance before truck arriving at the Warehouse terminal. The reservation of truck dock requires incoming purpose (import/export), the type of cargo, tonnage and other parameters that help decide the appropriate truck dock for that truck.

4.12 Identifying ‘Purpose’ of a Reservation

Reservation starts with the process of identifying the cargo to be picked-up (import) or delivered (export). Cargo that is in a reservation can be of one or more types, with each type being of

different quantity. To identify a matching truck dock, the cargo type needs to be considered. If a cargo is of only one type (say DG), then it obviously requires a DG compliant Truck dock. However, if the cargo is a combination of DG and General Cargo, the tonnage of DG Cargo being booked decides whether a DG dock is required or a General Doc is sufficient. Further, they are other factors that overrule the cargo type for Dock selection. If a cargo is identified as Customs controlled, it is required to be at a Dock close to Customs detention area. Therefore, to enable identification of the ‘Purpose’ of a reservation, it requires measuring multiple factors to arrive at the possible ‘Truck Dock Purpose’.

The purpose of the reservation is the primary cargo type of the reservation.

The primary cargo type of the reservation is identified. For this, the identification of cargo type for each shipment will be done. Cargo type will be same as truck dock purpose as stated in the truck dock purpose identification table. After this, the primary cargo type will be identified as below.

$$\{Cp, p\} = \max (\{Cn, (Wn \times Tn/T)\})$$

n – The nth cargo in the list of different cargo types in the reservation

Cp – Primary cargo type of reservation

Cn – Cargo type of n

Wn – Weight factor for the Cargo type n (used to apply weight for a cargo type)

Tn – Tonnage of this type of cargo

T – Total tonnage

Examples

Purpose: Gen, DG, Custom Controlled

Weight factor for Cargo type: GEN - 1, DG - 2, Custom Controlled - 4

	Description	Calculation as per formula	Primary Cargo type (Max)
1	1.2 Tons Dangerous Goods, 3.5 Tons General Cargo, total 4.7 Tons	GEN = 1 x 3.5/4.7 = 0.745 DG = 2 x 1.2/4.7 = 0.511	GEN
2	1.5 Tons Dangerous Goods, 2.5 Tons General Cargo, total 4 Tons, Custom controlled 0.5 Tons	GEN = 1 x 2.5/4 = 0.745 DG = 2 x 1.5/4 = 0.75 Custom = 3 x 0.5/4 = 0.5	DG
3	3.5 Tons General Cargo, total 3.5 Tons, Custom controlled 1.5 Tons	GEN = 1 x 3.5/3.5 = 1 Custom = 3 x 1.5/3.5 = 1.28	CC

S.No.	Incoming Purpose	Reservation	Shipment Type	Controlled	IMR	Special handling Code	ULD	Derived Purpose	Truck Dock Purpose
	Imp Cool Room								Imp Cool Room
	Imp Bulk / Pre-Pack					PER			Imp Cool Room
		Imp				PER		Imp Cool Room	Imp Cool Room
	Imp PER								Imp PER
	Imp Bulk / PPK				Y	PER			Imp PER
		Imp			Y	PER		Imp PER	Imp PER
	Imp Bulk / PPK					Odd Size			Odd Size
		Imp				Odd Size		Imp Bulk	Odd Size
	Imp PPK		PPK				20 Ft		20 feet Container
		Imp	PPK				20 Ft	Imp PPK	20 feet Container
	Imp Bulk		Bulk						Imp Bulk
		Imp	Bulk					Imp Bulk	Imp Bulk
	Imp PPK		PPK						Imp PPK
		Imp	PPK					Imp PPK	Imp PPK
	Imp PER			Y					C&E PER
	Imp Bulk / PPK			Y					C&E
	Imp Bulk / PPK					DG			Imp DG
	Imp DG								Imp DG
		Imp				DG		Imp DG	Imp DG
	Export Bulk								Export Bulk
		Export	Bulk					Export Bulk	Export Bulk
	Export PPK & Bulk								Export PPK
	Export PPK								Export PPK
		Export	PPK					Export PPK	Export PPK
	Export DG								Export DG
		Export				DG		Export DG	Export DG
	Export PER								Export PER
		Export				PER		Export PER	Export PER
	Export Cool Room								Export Cool Room

Note: Controlled here means the content of the shipments

Below is the table that will map the shipment type, other factors to the truck dock purpose. Also in case the reservation exist the system will put the purpose as specified in 'Derived Purpose' is controlled by Customs and in Customs Status is 'On Hold'.

4.13 Maintaining Timeslot Allocations for Reservation

The availability status of truck docks is maintained on the timeline by tracking the availability of truck docks for each time slots over time. The time slots are of 15 minutes' interval. For each time slot, the list of Truck dock pools and for each pool, the dock availability is maintained. Each time slot – pool has the following attributes:

- Dock count – the total docks in the pool for this timeslot
- Reservation Quota – the number of docks available for reservation
- WI Quota – the dock available for Walk-in
- Reservation Allocated – the number of docks booked
- Reservation Unallocated – the number of bookable docks still remaining.

It should be noted that the all the counts are maintained for each time 15 minutes' timeslot.

4.15 Find Possible Reservation Timing

When a dock is required for reservation, the attributes of the shipment (including the Special Handling Code, Weight) are considered. Based on this information the system will

- Determine whether these shipments can be handled at a given truck dock: This is to eliminate cases of a combination of shipments that cannot be clubbed together in one reservation because the dock required for some shipments are different from the others. The system will have a configuration that lists the combination of cargo types that will not be allowed in a single reservation. If such a combination is found on the reservation, the reservation is rejected.
- Estimate the time required: The estimation duration of occupying the truck dock will be calculated based on the tonnage of the shipments selected. This calculation will be based on the formula. This will be $x \text{ Kg/min}$ where x is

4.14 Timeslot wise Pool Allocation

Time Slot	Truck Pool ID	Dock Count	Reservation Quota	Walk-In Quota	Reservation Allocated	Reservation Unallocated	Reservation Adjusted	Walk-In Adjusted Unallocated	WI Adjusted Allocated
10:00	1	3	2	1	1	1	0	1	0
10:00	2	2	1	1		1	0	1	0
10:00	3	3	2	1		2	0	1	0
10:00	4	6	4	2	1	3	0	2	0
10:00	5	2	1	1		1	0	1	0
10:00	6	2	2	0		2	0	0	0
10:00	7	2	0	2		0	0	2	0
10:15	1	3	2	1	1	1	0	1	0
10:15	2	2	1	1		1	0	1	0
10:15	3	3	2	1		2	0	1	0
10:15	4	6	4	2	1	3	0	2	0
10:15	5	2	1	1		1	0	1	0
10:15	6	2	2	0		2	0	0	0
10:15	7	2	0	2		0	0	2	0
10:30	1	3	2	1	1	1	0	1	0
10:30	2	2	1	1		1	0	1	0
10:30	3	3	2	1		2	0	1	0
10:30	4	6	4	2	1	3	0	2	0
10:30	5	2	1	1		1	0	1	0
10:30	6	2	2	0		2	0	0	0
10:30	7	2	0	2		0	0	2	0

the parameter different for different cargo type. The user will be able to specify the additional time to be added for certain special cargo like controlled or DG. For Export Pre-Pack/ Mix Pre-Pack, it will be a fixed time period (configurable). In case the reservation has both bulk and Pre-Pack than the time for each will be added together.

- Identify the truck docks purpose of the reservation as detailed above and then identify truck dock pools that match the 'truck dock purpose' identified for the reservation.
- identify the time slots available (as detailed bellow), which can be recommended to the agent

Based on the above considerations, information is displayed to the user who is performing the reservation. The user has advised the time slot from the proposed list.

To find the possible time slot, two pieces of information is required

- The purpose of the reservation and
- The duration of the reservation.

The purpose of the reservation will be derived as mentioned above. The duration of reservation (Estimated duration) is calculated. The estimated duration is divided by the slot time (15 minutes) to find the total number of slots (Allocation Slots) required. In case 2 docks are required for the cargo collection then the estimated duration for each dock will be half of the calculated duration.

To find the available time when the reservation can be made, the 'Time Slot Wise Pool Allocation' is queried to find the time when the required number of contiguous slots are available in pools that can handle the purpose indicated in the reservation. The pools are queried first by primary purpose of the pool and then by secondary purpose, and so on. In a given time, first, the primary purpose pools are chosen rather than the secondary pools. The availability of docks in a slot is known by the 'Reservation Unallocated' for that pool in that time slot. If the shipments are stored in 'Floor goods', then the pool on the floor goods level will be chosen. If the shipment is stored at 'Floor Goods' on multiple levels, then the level having the maximum storage weight will be considered and if the shipment is stored at 'Floor Goods' on the single level then that level will be considered. The possible time when a reservation can be known is provided to the user to choose from.

Reservation Summary

Reservation ID	Truck No	Truck Pool ID	Purpose	Time Slot From	Time Slot To	Allocation Duration	Estimated Duration
1	US 2003	1	DG	10:00	10:30	45	42
2	US 2004	2	GEN	10:00	10:45	60	49

5. Reservation

When a reservation is made against a time slot, the slots which contribute to the reservation has one count reduced from the reservation Unallocated for each time slot for which the reservation is made, thereby reducing the available truck docks. 'Purpose' of a reservation is calculated at based attributes of reservation which includes the Cargo types, Tonnage of each cargo type etc. For example, if a reservation is made for Truck pool id 1 from 10:00 to 10:30, two slots of 10:00 and 10:15 for truck pool id 1 will be booked (as indicated above).

5.1 Truck Dock Allocation

5.1.1 Maintaining Timeslot allocations for Walk-in

The availability status of truck docks for Walk-in has also maintained time slot wise along with the reservation. The walk-in quota available at a given timeslot; called 'Walk-in Adjusted'; is the sum of specified Walk-in quota and any docks in the reservation quota that have lapsed because of no reservation, or cancellation or no-show cases. The Walk-in Adjusted is the total docks available for allocation that have no reservation.

To begin with, Walk-in Adjusted is the same as Walk-in Quota. But after the reservation time for a slot (30 minutes before the slot time) expires, the docks that are not booked ('Reservation Unallocated') are added to the 'WI Adjusted Unallocated'.

5.1.2 Maintaining Dock Allocation in the Pool Allocation

When a dock is allocated for a period of time, one count is reduced from the available count (Reservation Unallocated / WI Adjusted Unallocated) and one count increased in the allocated count (Reservation Allocated /WI Adjusted Allocated) for each of the timeslots for which the dock is allocated.

6. Dock Allocation

At reservation, a truck dock is blocked in a given truck dock pool. However, the actual allocation of a Truck dock happens only when the truck arrives at the terminal. Some trucks arrive without a reservation, in which case a truck dock needs to be allocated from the Walk in quota.

Timeslot wise Pool Allocation

Time Slot	Truck Pool ID	Dock Count	Reser- vation Quota	WI Quota	Reser- -vation Unall- -ocated	Reservation Allocated	Reservation Adjusted	WI Adjusted Unall- -ocated	WI Adjusted Allocated	Remarks
10:00	1	3	2	1	0	1	1	2	0	
10:00	2	2	1	1	0		1	2	0	
10:00	3	3	2	1	0		2	3	0	All 'Reservation Unallocated' have been set to zero for time slot 10:00 and 10:15, the number moved to 'Reservation Adjusted' and added to the 'WI Adjusted Unallocated'*
10:00	4	6	4	2	0	1	3	5	0	
10:00	5	2	1	1	0		1	2	0	
10:00	6	2	2	0	0		2	2	0	
10:00	7	2	0	2	0		0	2	0	
10:15	1	3	2	1	0	1	1	2	0	
10:15	2	2	1	1	0		1	2	0	
10:15	3	3	2	1	0		2	3	0	
10:15	4	6	4	2	0	1	3	5	0	
10:15	5	2	1	1	0		1	2	0	
10:15	6	2	2	0	0		2	2	0	
10:15	7	2	0	2	0		0	2	0	
10:30	1	3	2	1	1	1	0	1	0	
10:30	2	2	1	1	1		0	1	0	
10:30	3	3	2	1	2		0	1	0	
10:30	4	6	4	2	4	1	0	2	0	
10:30	5	2	1	1	1		0	1	0	
10:30	6	2	2	0	2		0	0	0	
10:30	7	2	0	2	0		0	2	0	

* Considering time 09:50

7. Dock Status

At reservation, a truck dock is blocked in a given truck dock pool. However, the actual allocation of a Truck dock happens only when the truck arrives at the terminal. Some trucks arrive without a reservation, in which case a truck dock needs to be allocated from the Walk in quota.

The dock status is maintained and reflects the current occupancy state of the dock. Typically, a Dock is 'occupied' or 'free' or

'reserved' or 'unavailable'. If a dock has been allocated, the truck number and the allocation from and to are indicated. Current status of the dock is the actual status as detected by the truck monitoring system. A Truck dock is considered for allocation only if the current status is free. If the dock is 'occupied' even after the Allocation time ('Allocation to') the truck is overstaying, but still, cannot be considered for allocation. Therefore, a dock is available for allocation only if it is 'free' and has does not have an active allocation against it.

Dock ID	Current Status	Truck No.	Allocation From	Allocation To	Remarks
1	Free				Dock is free for allocation
2	Occupied	BA 4522	10:00	10:45	Dock is occupied, work in progress
4	Occupied	BC 2932	09:30	10:15	Dock is occupied, even though allocation expired at 10:15, the truck is overstaying *
5	Allocated	AR 9726	10:30	11:15	Dock is free but it is already allocated and is awaiting the arrival of the truck, allocation starts at 10:30 *

* Current time being 10:25

8. Truck with Reservation

If a truck has a reservation, the pool id against which it is booked and Truck docks for that pool id are retrieved. The Truck docks of that pool are checked for availability (using the Dock status info); if any of the truck docks in the pool is 'free' it is allocated.

If none of the docks in the booked pool are 'free', then an alternative dock could be found in another pool. This requires careful examination because there should be no effect on future reservations in the other pool because of this movement. The alternative pool that would be found should preferably be in the same Truck dock zone. This is because retrieval orders from Shipment Storage would have already been sent to Shipment Storage to retrieve the cargo to the buffer area of that zone, and Shipment Storage would have moved the goods to the buffer area of the Zone associated with the reservation pool. Movement of goods to another zone would result; on an average; 20 minutes. Hence shifting of reservation to another zone is not preferred.

The order of preference for alternate pools is (a) pools in the same Zone with pool's primary purpose matching; (b) pools in same Zone with pool's subsequent purposes match; the pool having more number of available truck docks will be preferred (c) pools in adjoining zone with pool's primary purpose / subsequent purposes matching. If no matching pool is found the truck is expected to wait for an allocation in the Truck park and the truck is put in the wait queue.

Once an alternate pool is identified, check if a truck dock is free in any of the identified pools, if a truck dock is free in any of the identified pools, try to allocate by:

- 1. Allocating in Walk-in Quota:** Check if the walk-in quota (WI Adjusted Unallocated) is more than one for all the timeslots required for the duration of this reservation and if yes allocate the dock.
- 2. Swap equal Reservation:** Check reservation against the identified pool and to find reservation records that can be swapped. The swap requires the reservation duration and the start time of reservation to be same. Swapping requires no change expect the swap of the pool id for the identified reservations.

Once the pool with a match is identified and the quota is available either in the walk-in or by swapping of reservation, the free dock identified is marked as allocated and the truck number and 'from and to' time of the allocation is updated in the Dock status.

If no matching pool or no sufficient quota is found, or not the swappable reservation is found or no free dock is found, the truck is put in the waiting queue.

9. Truck without Reservation

If a truck has no reservation, a free dock has to be identified from the Walk-in quota. First based on the identified Truck dock pur-

pose (as indicated in the Table in the previous section), Pools with the primary purpose matching the identified Truck dock purpose and then pools with matching subsequent purpose are examined. If the shipments are stored in 'Floor goods', then the pool on the floor goods level will be chosen. If the shipment is stored at 'Floor Goods' on multiple levels, then the level having the maximum storage weight will be considered and if the shipment is stored at 'Floor Goods' on the single level then that level will be considered. In the identified pools, first check if there are unallocated docks in the walk in quota (WI Adjusted Unallocated), if yes, check the physical status of the Dock status, if they are free, if yes allocate, if not the truck transferred in the wait queue.

10. Conclusions

The proposed algorithm is proved to be a workable solution and more feasible for the truck dock allocations within the Air cargo warehouses. This provides the overall visibility on the availability of the truck docks, timely allocations, better monitoring and optimized dwell time for the trucks. It processes the lesser time in assigning the available trucks-dock to each truck entered in the terminal and guides the truck from the shortest(predefined) route towards the allocated dock. This help to optimize the dwell time of the truck in truck park or moving around in the terminal.

Since this algorithm also captures the information for the required time for loading /unloading of the cargo as per the characteristics like X minutes requires to load/unload the XYZ category of cargo with y tonnage, hence in addition to this, it also help in measuring the service level agreements(SLAs) defined for the trucks for the specific services. This help to optimize the resource availability and performance at the truck docks.

At last, once the truck is loaded/unloaded at the truck dock, the truck dock is marked as vacant for the subsequent truck to be parked so it can be assigned to the subsequent truck entered in the Air cargo warehouse terminal.

As the issues highlighted in the problem statement, the truck dock are allocations are optimized, dwell time at the truck park and truck docks are optimized, resources are monitored, SLAs are monitored in the effective ways. This will help in reducing the stated losses the particular area of the supply-chain business.

A vice thought to the observed problem may lead to the terrific solution which can help in saving the time, cost energy and social life of many persons. This white paper is based on the real problems observed during the early days of the professional life. However, the complete solution took the time to evolve and sketched on the paper. Now, this needs to be designed and convert to the system. This is the ultimate goal of writing the white paper.

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