

Design Project - Dragon Duds Distribution

The management of Dragon Duds has charged you with the responsibility of solving their operational problems by designing a more space efficient and productive layout that will accommodate their warehousing and distribution requirements for the next five (5) years.

Company Profile and Project Background Information:

1. Dragon Duds is a retailer operating 500 stores, primarily located in strip malls and shopping centers.
2. DRAGON DUDS leases 160,000 square feet in a 320,000 square foot facility in New Bern, North Carolina. (See Figure 2.) The facility features 32'-0" of available clear stacking height (including clearances required for overhead sprinklers). The columns in the building are spaced out 40'-0" by 50'-0", with dimensions of 12" x 12". Five (5) years remain on the lease. The facility lease cost is \$7.50/square foot/year net.
3. Product is stored in (and picked from) double deep pallet racks and bulk floor stacks.
4. Stores are being added at the rate of 50 per year. A supply chain optimization program is being undertaken; the company expects average inventory turns to increase from the current level of 3.5 turns to 7.0 turns within 5 years. The number of SKUs being stored and carried by the facility is not expected to increase. Sales per store are expected to increase by 5% per year.
5. The tenant in the adjacent 160,000 square feet is moving out in 4 months. The building owner has offered to lease DRAGON DUDS either all or half of this space at \$7.50/square foot/year, with a lease that expires at the same time as the lease on their existing space. DRAGON DUDS would then have an option for 5 more years at the same lease rate.

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An initial audit has determined the following:

- 1.) With most of the items manufactured in the Orient, cartons of merchandise are received floorloaded in ocean containers that measure 40' L x 8' W x 8'-6" H. The cartons range in size from 16" x 12" x 8" (48 cartons/pallet) to 28" x 18" x 12" (16 cartons/pallet). Inventory is currently tracked in terms of the number of cartons. To convert to pallets, the average pallet is assumed to contain 24 cartons and is about 50 cubic feet in volume.
- 2.) Pallets are stored 4 high in the racks. Pallets that are stored on the floor are stacked 2 high.
- 3.) Orders consist of two types; initial and store replenishment
 - Initial orders are "pushed;" full carton quantities are shipped to the stores when a new item is received. These orders are picked from the racks and floor stacks onto manual pallet jacks, average 4.3 lines and 20.2 cubic feet, and are shipped LTL. Each store averages 2 "push" orders per week.
 - Store replenishment orders are "pulled" and are generally in piece pick quantities. These orders are picked from the racks and floor stocks into a rolling basket, average 7.5 lines and 2.3 cubic feet, and shipped via parcel carriers. Each store averages 5 "pull" orders per week.
 - A peak picking day consists of 350 "push" orders and 1,400 "pull" orders.
 - Daily picking activity averages 11 lines/day/store or 5,500 lines/day.
- 4.) Picking productivity is low for the replenishment orders. Excessive walking has been identified as the culprit. Moving one item to access another behind it hurts replenishment productivity.
- 5.) On peak receiving days, an insufficiently sized receiving area results in received product being staged in the aisles, hampering the ability of picking and replenishing personnel to access product. The average inbound ocean container contains 16 SKUs.
- 6.) Product damage is a problem. A frequent complaint is crushed cartons, particularly in the summer.
- 7.) There is currently no Warehouse Management System (WMS) in place; however, management recognizes that one will be needed. An overview of how the new WMS can manage and track the activity of products, equipment, and people in the proposed design will be necessary.
- 8.) The fully loaded cost for warehouse workers is \$15/hour.

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Description of Current Product Flow:

1. A one-shift operation is now in place from 8:00 am – 5:00 pm.
2. Receiving occurs between 8:00am and 11:30am. Empty pallets are brought into the ocean containers; cartons are loaded onto the pallets, and removed with pallet jacks. These pallets are brought to the receiving dock and sorted to pallets by SKU.
3. Large inventory items are stored in bulk floor lanes (products can stack an average of 2 pallets high); lower inventory items are stored in double deep pallet racks.
4. Each SKU has a floor picking location, either in the racks or the floor lanes. (The aisle-facing pallet in the floor lanes is one high). When the floor location is empty, it is replenished with another pallet.
5. Initial orders are single-order picked to a manual pallet jack and taken to the dock area, where they are checked and staged for shipment on the floor.
6. Store replenishment orders are single-order picked into a rolling basket, and taken to the packing area, where the packer removes the items from the basket, checks the order, packs it, and places it on the appropriate pallet (sorted by carrier). Currently there are 5 carriers. The packers use 4 carton sizes, and on a peak day consume 10 pallets of corrugated.
7. When a carrier pallet is full, a material handler replaces it with an empty pallet and takes it to the shipping staging area.
8. Carriers arrive between 2pm and 4:30pm. On an average day approximately one third (1/3) of the staged product is picked up by the carrier. The average carton sits in the shipping staging area approximately 2.3 days

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Supplied Materials:

- Receipts by Day for 3 weeks
- Movement Analysis
- Peak Inventory Analysis
- Current Staffing and Mobile Equipment
- Figure 1. Typical Pallet Rack Section – Front Elevation View
- Figure 2. Existing Layout
- Figure 3. Available Space Including Possible Expansion
- Material Handling and Storage Equipment Menu
- “Rules of Thumb” for Warehouse Equipment Costs (may be accessed via the web at www.grossassociates.com)

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Receipts By Day For 3 Peak Weeks

Date	# of Containers	Pallets
15-Aug-05	8	256
16-Aug-05	7	224
17-Aug-05	7	224
18-Aug-05	5	160
19-Aug-05	6	192
22-Aug-05	11	352
23-Aug-05	8	256
24-Aug-05	9	288
25-Aug-05	6	192
26-Aug-05	5	160
29-Aug-05	9	288
30-Aug-05	7	224
31-Aug-05	8	256
1-Sep-05	7	224
2-Sep-05	4	128
Total	107	3,424
Average	7	228
Max	11	352

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MOVEMENT ANALYSIS MONTHLY MOVEMENT

Range (Pallets)	PEAK SHIPPING MONTH					
	# of SKUs	% of SKUs	Cumul %	Total Pallets	% of Pallets	Cumul %
0	118	12.8%	12.8%	0	0.0%	0.0%
0 - 0.25	99	10.7%	23.5%	12	0.3%	0.3%
0.25 - 0.50	144	15.6%	39.0%	50	1.2%	1.5%
0.50 - 1	202	21.8%	60.9%	162	3.9%	5.4%
1-2	129	13.9%	74.8%	194	4.6%	10.0%
2-5	102	11.0%	85.8%	357	8.5%	18.5%
5-10	71	7.7%	93.5%	568	13.5%	32.0%
10-50	33	3.6%	97.1%	825	19.7%	51.7%
>50	27	2.9%	100.0%	2,025	48.3%	100.0%
	925	100%		4,193	100%	

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PEAK INVENTORY ANALYSIS

Average Inventory is about 7,800 pallets.

Range (Pallets in Inventory)	# of SKUs	% of Total SKUs	Cumulative %	Total Pallets	% of Total Pallets	Cumulative %
0-0.25	307	33.2%	33.2%	31	0.3%	0.3%
0.25-1	180	19.5%	52.6%	180	2.0%	2.3%
1-4	120	13.0%	65.6%	300	3.3%	5.6%
5-10	105	11.4%	77.0%	735	8.0%	13.6%
11-20	82	8.9%	85.8%	1,230	13.4%	27.0%
21-40	71	7.7%	93.5%	2,130	23.2%	50.2%
41-100	44	4.8%	98.3%	2,640	28.8%	79.1%
over 100	16	1.7%	100.0%	1,920	20.9%	100.0%
	925	100.0%		9,166	100.0%	

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Current Staffing and Mobile Equipment

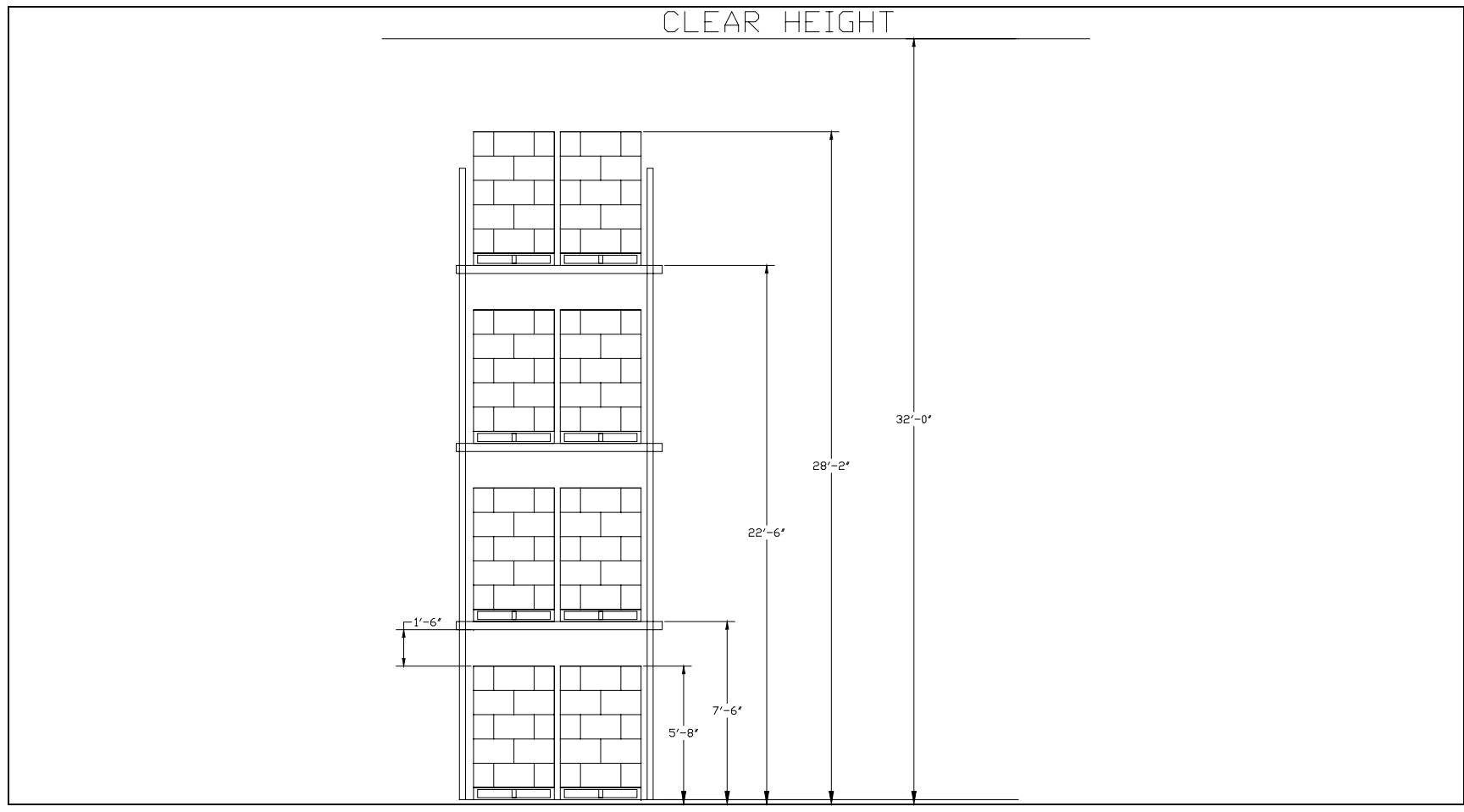
CURRENT HOURLY STAFFING (fully loaded wage rate: \$15/hr)

Area	# of Employees
Receiving and palletizing	10
Shipping	5
Picking	20
Packing	5
Lift truck drivers - pallet handling (putaway, replenishment)	4

CURRENT MATERIAL HANDLING EQUIPMENT	
Counterbalanced Trucks	6
Deep Reach Trucks	3
Manual Pallet Jacks	10

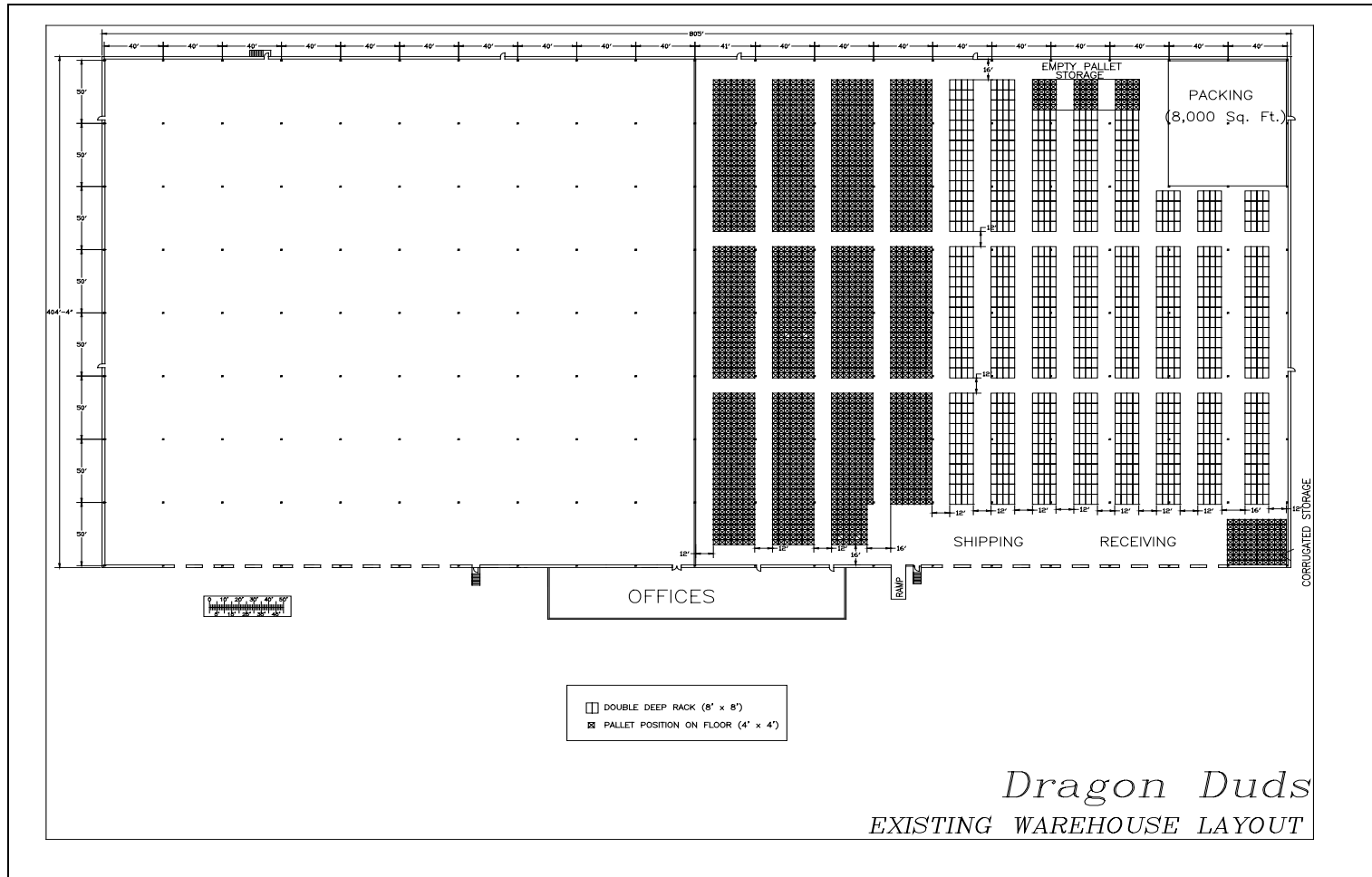
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Figure 1: Typical Pallet Rack Section – Front Elevation View



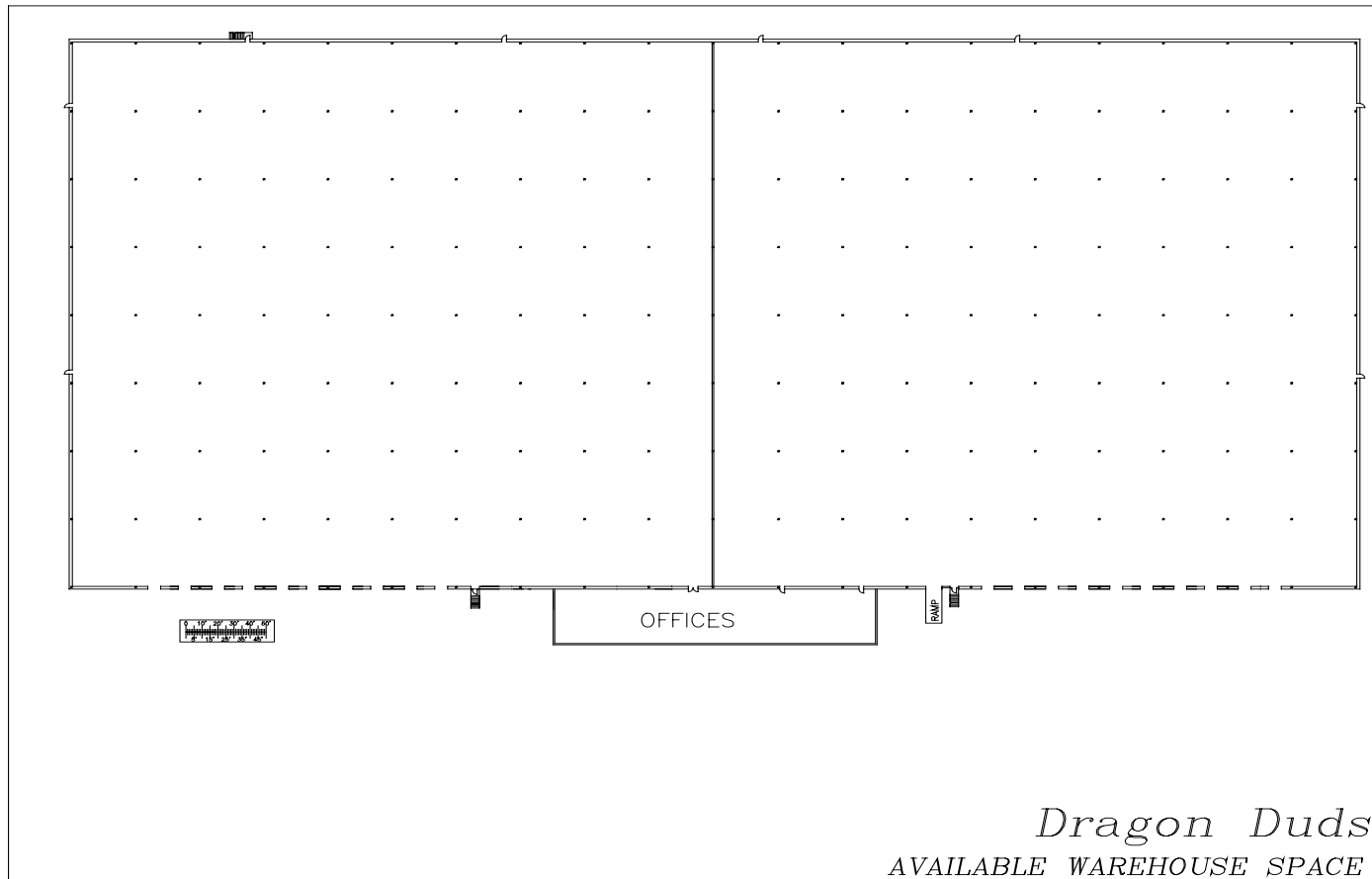
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Figure 2: Existing Layout



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Figure 3: Available Space Including Possible Expansion



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Material Handling & Storage Equipment Menu

The following storage/picking modules and material handling equipment are just a sampling of options that can be used to configure your system. In some cases, module sizes have been rounded to the nearest foot for convenience.

- A.) Pallet rack (selective): Each bay is 8 feet or 12 feet in length and 4 feet deep. Two or three (in the case of 12 foot lengths) pallets on each level x the number of levels (including floor positions) will yield the total facings/capacity per section of selective pallet rack.
- B.) Pallet rack (double deep): Each bay is 8 feet or 12 feet in length and 8 feet deep. Two or three (in the case of 12 foot lengths) pallets on each level x 2 pallets deep x the number of levels will yield the total capacity per section.
- C.) Push-back rack (2 to 5 deep). Each bay is 8 feet length; the depth is 4 feet x the number of pallets deep. Two pallets on each level x the number of pallets deep x the number of levels will yield the total capacity per section.
- D.) Pallet flow rack (4 to 10 deep). Each bay is 8 feet length; the depth is 4 feet x the number of pallets deep. Two pallets on each level x the number of pallets deep x the number of levels will yield the total capacity per section.
- E.) Drive-in racks (3 to 5 deep). Each section is 4 feet wide; the depth is 4 feet x the number of pallets deep. The number of pallets deep x the number of levels will yield the total capacity per section.
- F.) Floor storage (2 to 5 deep). Each floor position is 4 feet x 4 feet.
- G.) Carton flow rack: Each module of flow rack is 8 feet wide x 8 feet deep x 6 feet high. 3 pick levels (shelves) with 5 carton facings per shelf are provided. The inventory depth of each facing is 4 cases.
- H.) Static shelving: Each shelving module is 4 feet wide x 2 feet deep x 8 feet high. Each unit has 5 useable shelf levels and each shelf level accommodates 3 carton facings, each of them 1 carton deep.
- I.) Conveyor: All conveyors may be drawn as 2 feet wide. No details need be included with regard to gravity, power, accumulation, sortation etc. The object is to define flow rather than prescribe functionality. Simply draw the conveyor paths and illustrate with arrows to denote flow direction.
- J.) Lift trucks and miscellaneous equipment (hand trucks, pallet jacks, carts, etc.) may be used as you see fit.