Assignment 1

Material Handling System Costing

Adapted from material prepared by
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RETAIL DISTRIBUTION CENTER

- **Semi-automated facility**
- 40 acre complex
- Facility:
  - 148,000 sq. ft. (~100 yards by 100 yards)
  - Max # of SKUs 24,000
  - Max Throughput 98,600 units picked/shift

LAYOUT

1

RECEIVING

2

STAGING

3

BULK STORAGE (Pallet Racks)

4

SURGE STORAGE (High Density Racks)

5

LONG TERM STORAGE (Narrow Aisle Racks)

6

7

REPLENISHMENT STORAGE (High Density Pallet Racks)

8

sortation conveyor

9

PICKING AREA(Floor Level)

10

PICKING AREA

REPLENISHMENT STORAGE (High Density Racks)

PICKING (Carousel Area & High Value Items)

PICKING (Slow Movers)

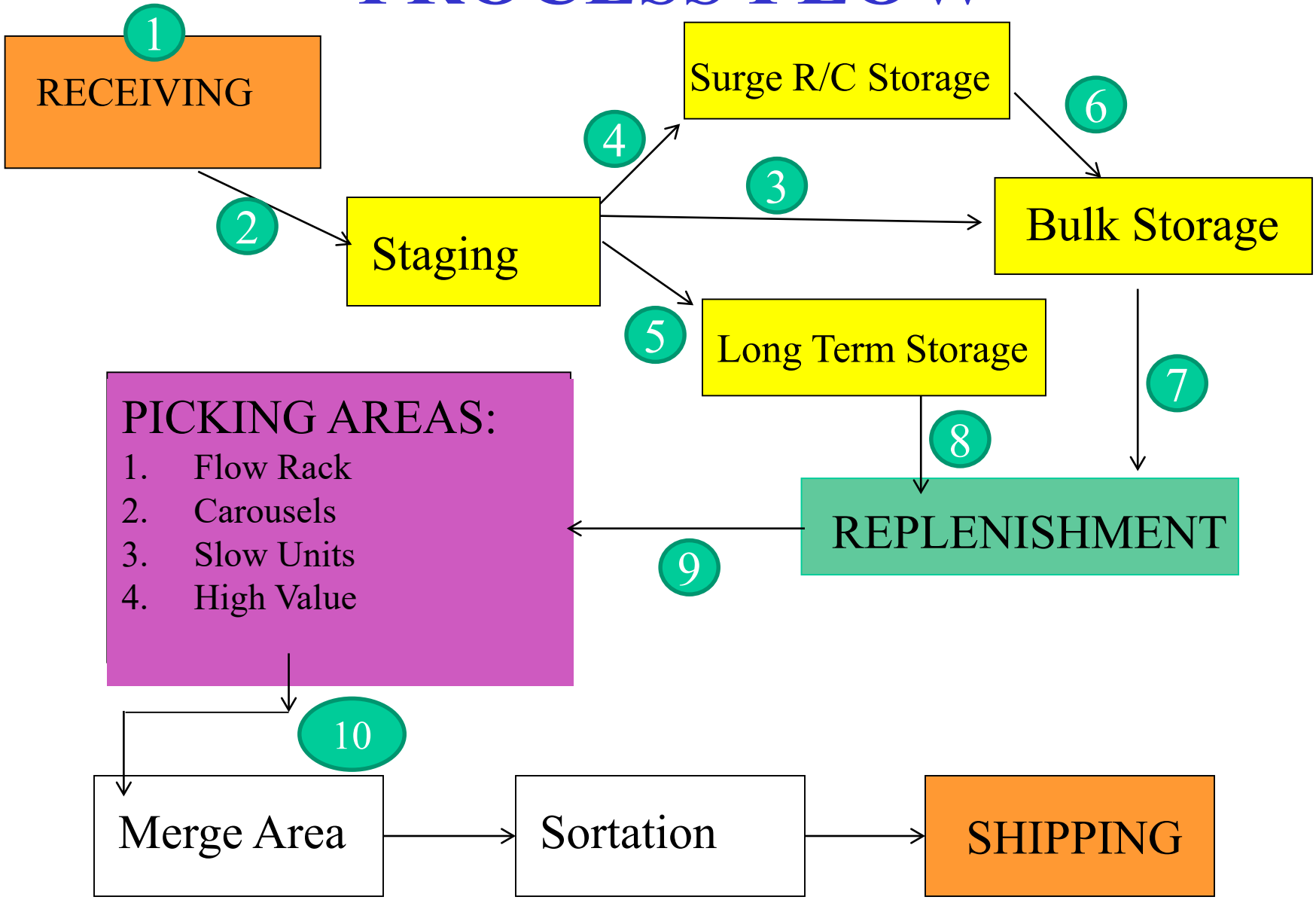
SORTATION

SHIPPING

100 yards

100 yards

PROCESS FLOW



MATERIAL HANDLING EQUIPMENT (MHE) USED IN THIS WAREHOUSE

1. Pallet Jacks
2. Walkie Stackers
3. CB Lift Trucks
4. NA Trucks
5. Rider OP Trucks
6. Picking Carts
7. Conveyors
8. Pallet Rack
9. Picking Racks & Carousels

ESTIMATE MHE COSTS FOR (those marked with green)

1. Pallet Jacks
2. Walkie Stackers
3. CB Lift Trucks
4. NA Trucks
5. Rider OP Trucks
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MHE 1. Pallet Jack

- Pallet + walk + no stack
- Front wheels are mounted inside the end of the forks and extend to the floor as the pallet is only lifted enough to clear the floor for subsequent travel
- Pallet restrictions: reversible pallets cannot be used, double-faced non reversible pallets cannot have deck boards where the front wheels extend to the floor, and enables only two-way entry into a four-way notched-stringer pallet because the forks cannot be inserted into the notches

2(a) Manual Pallet Jack

- Pallet + walk + no stack + manual
- Manual lifting and/or travel

2(b) Powered Pallet Jack

- Pallet + walk + no stack + powered
- Powered lifting and/or travel

MHE3. Sit-Down Counterbalanced Lift Truck

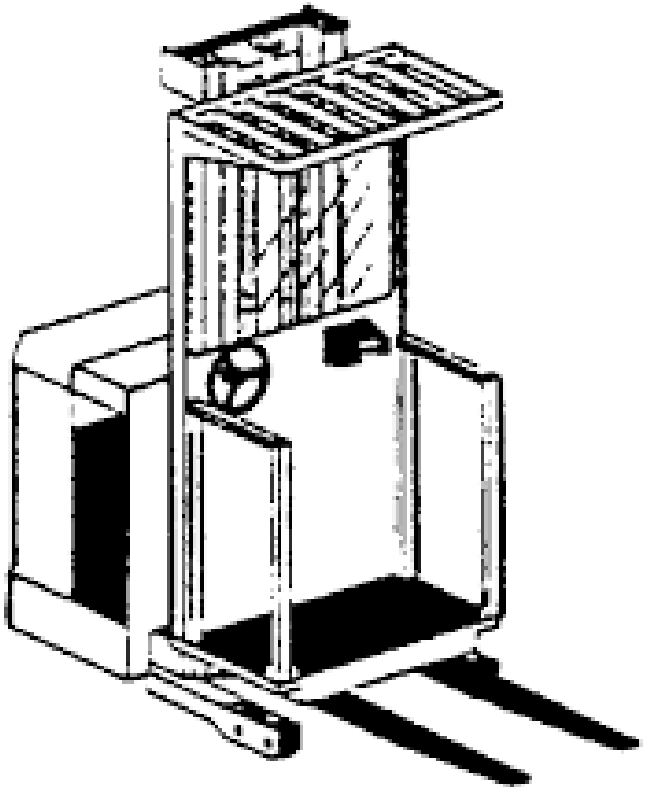
- Operator sits down
- 12-13 ft. minimum aisle width requirement

MHE4. Narrow-Aisle (NA) Straddle Truck

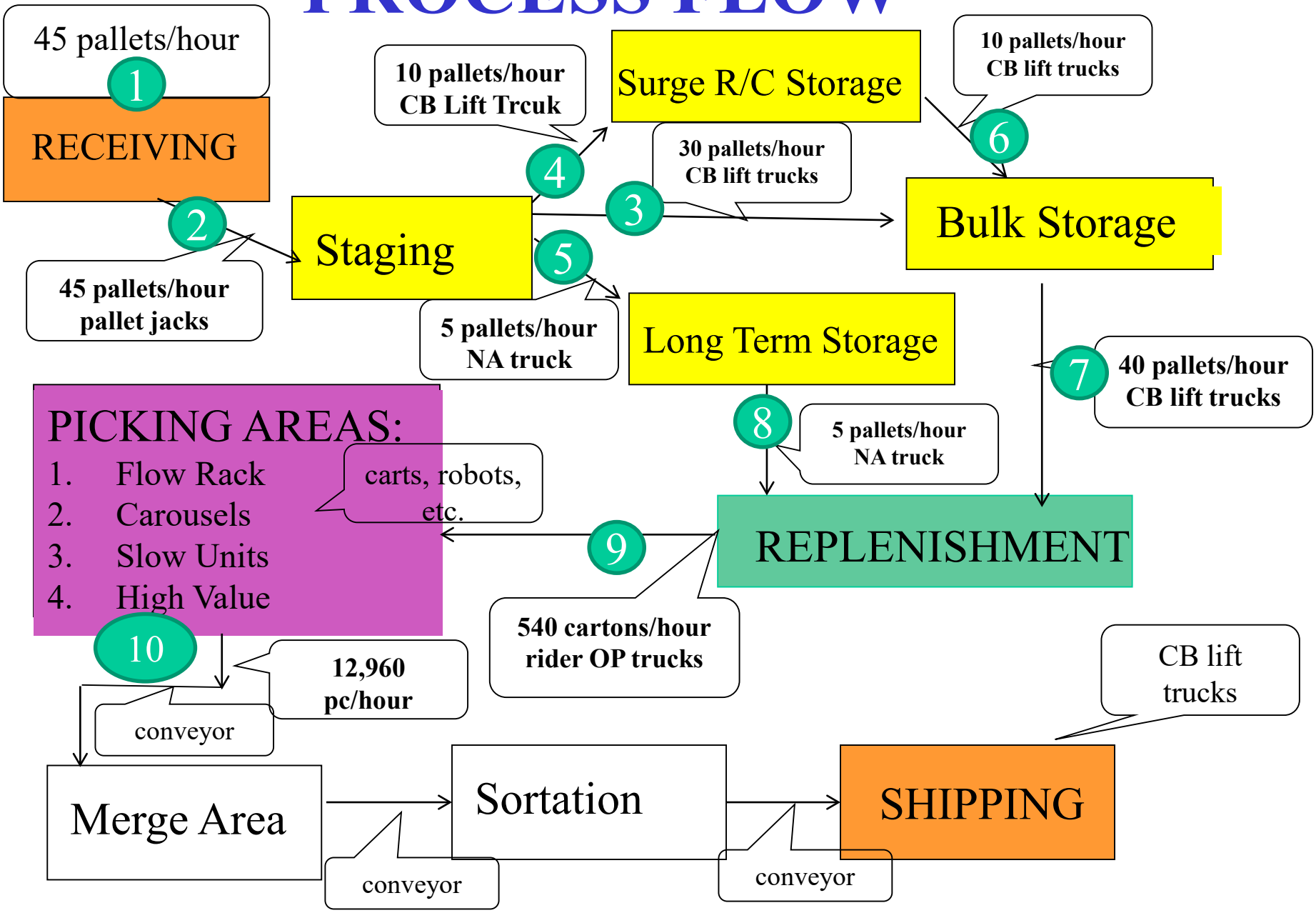
- Similar to stand-up CB lift truck, except outrigger arms straddle a load and are used to support the load instead of the counterbalance of the truck
- 7-8 ft. minimum aisle width requirement
- Less expensive than stand-up CB lift truck and NA reach truck
- Since the load is straddled during stacking, clearance between loads must be provided for the outrigger arms
- Arm clearance typically provided through the use of load-on-beam rack storage or single-wing pallets for load-on-floor storage

MHE5. Order Picker Truck

- Similar to NA straddle truck, except operator lifted with the load to allow for less-than-unit-load picking
- Typically has forks to allow the truck to be used for pallet stacking and to support a pallet during less-than-pallet-load picking
- "Belly switch" used for operator safety during picking



PROCESS FLOW



UNIT CONVERSIONS FOR ESTIMATION

98,600 units per shift

= 12,960 pc/hour (≈7.61 hr/shift)

= 540 cartons/hour @ 24 items/carton

= 45 pallets/hour @ 12 cartons/pallet

PERFORMANCE "STANDARDS"

FORKLIFT TIME STUDY DATA:

- Pickup and deposit load 0.00300 hrs./occurrence (CB LT)
- 0.00600 hrs/occurrence (NA LT)
- Travel time 0.00013 hrs./ft./round trip

PALLET JACKS:

- 20 pallets/hr in shipping and receiving

ORDER PICK TRUCKS:

- 50 cartons/hour

PICKING CARTS

- 40 lines per hour
- 2.5 pieces/line
- 25% of volume handled by carts

DETERMINE

- How many trips
- How far each trip (assume layout is to the scale)
- How many vehicles
- Cost of MHEs (Use Rules of Thumb provided by TransSystem for equipment cost)

Travel time

- estimate unloaded
- total distance
- speed

Allowances

- pick up & put down
- utilization

(Total time required)/(time available) = Vehicles required

Make suitable assumptions providing justification.

WHAT'S HARD ABOUT THIS?

- Estimating distance traveled loaded/unloaded travel
- Estimating effective travel speed
- Estimating utilization
- Estimating surge capacity of MHEs

Make suitable assumptions providing justification.

Thanks