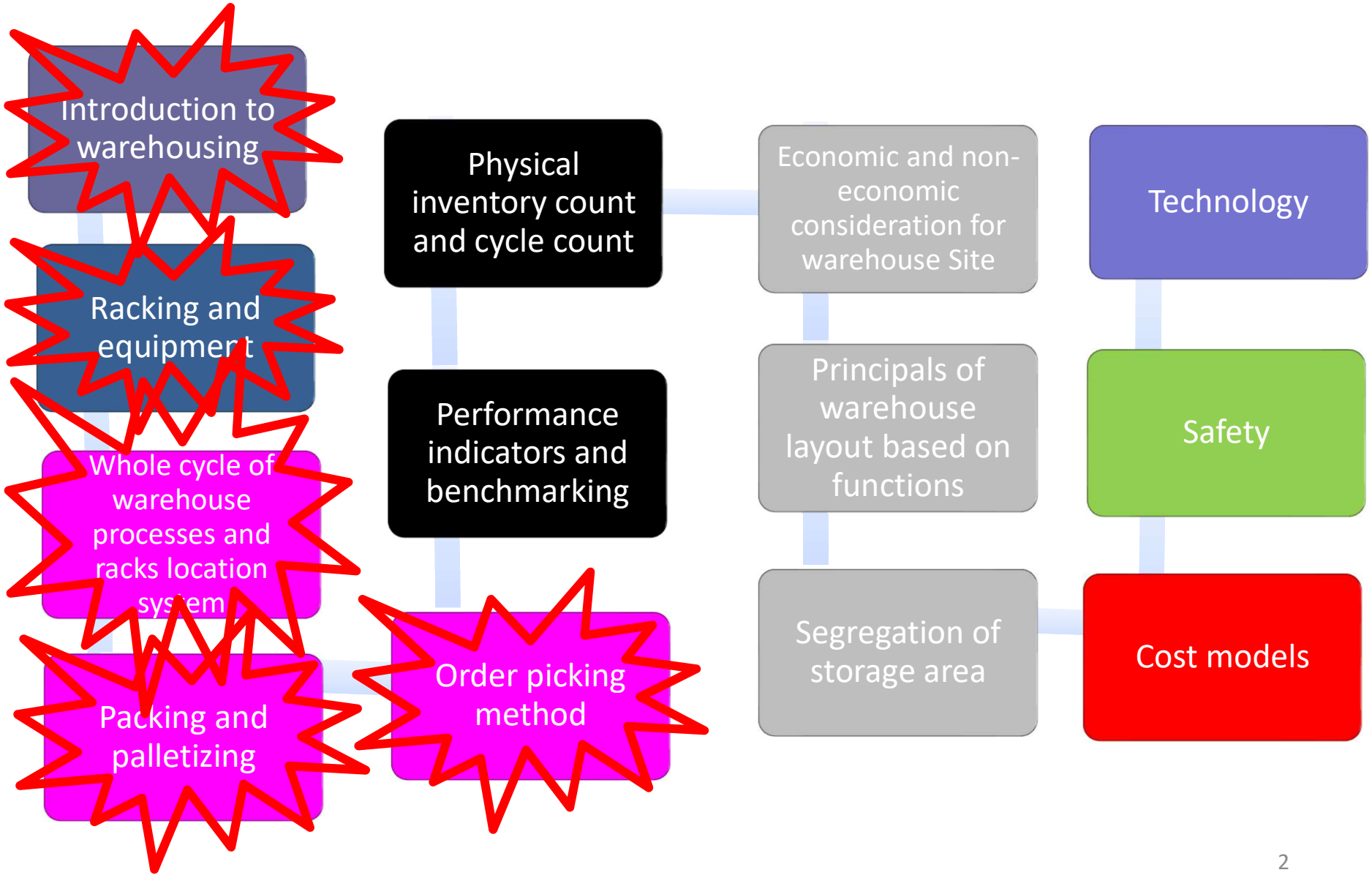
P05

A long walk

E215 – Warehouse and Storage

SCHOOL OF ENGINEERING

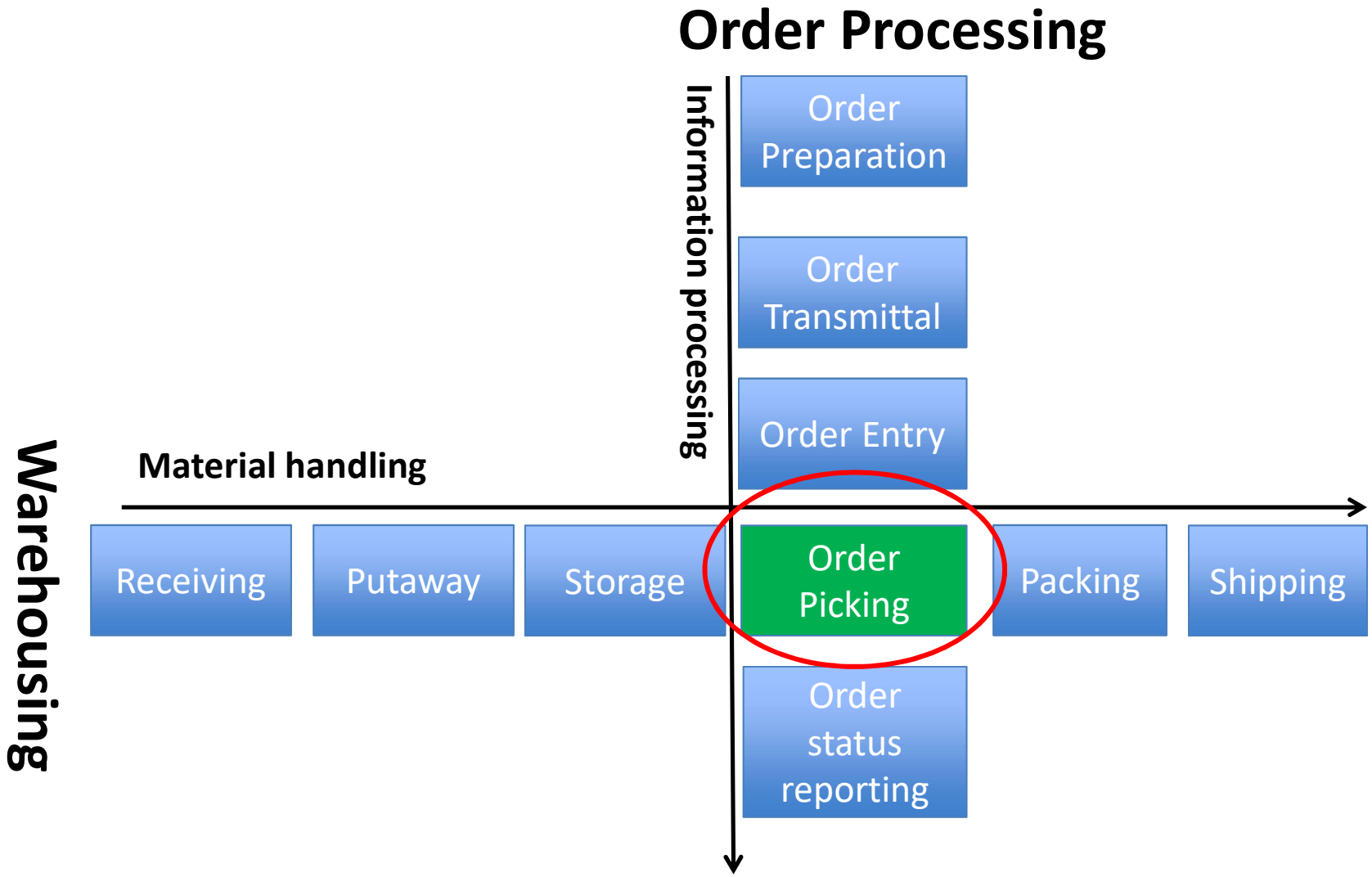
E215 Warehousing and Storage Topic Flow



Learning Objectives

- Apply the order picking principles.
- Elaborate the importance and challenges of order picking
- Explain the various order picking related tasks.
- Apply the various order picking methods.

Recap: Processes in a Warehouse



What is Order Picking?

- Order picking is the selection of items from storage in response to specific customer requests.
- It includes the physical material handling and information processing associated with retrieving (or picking) items efficiently
- Costs include labour, material and information handling systems

Complexities of Order Picking

Picking complexities increases

Pallet (Unit Load) Picking

Retrieval of full-pallet quantities from storage

Case/Carton Picking

Retrieval of full cartons from storage

Split Case Picking

Retrieval of inner packs from storage

Piece (Broken Case) Picking

Retrieval of individual items from storage

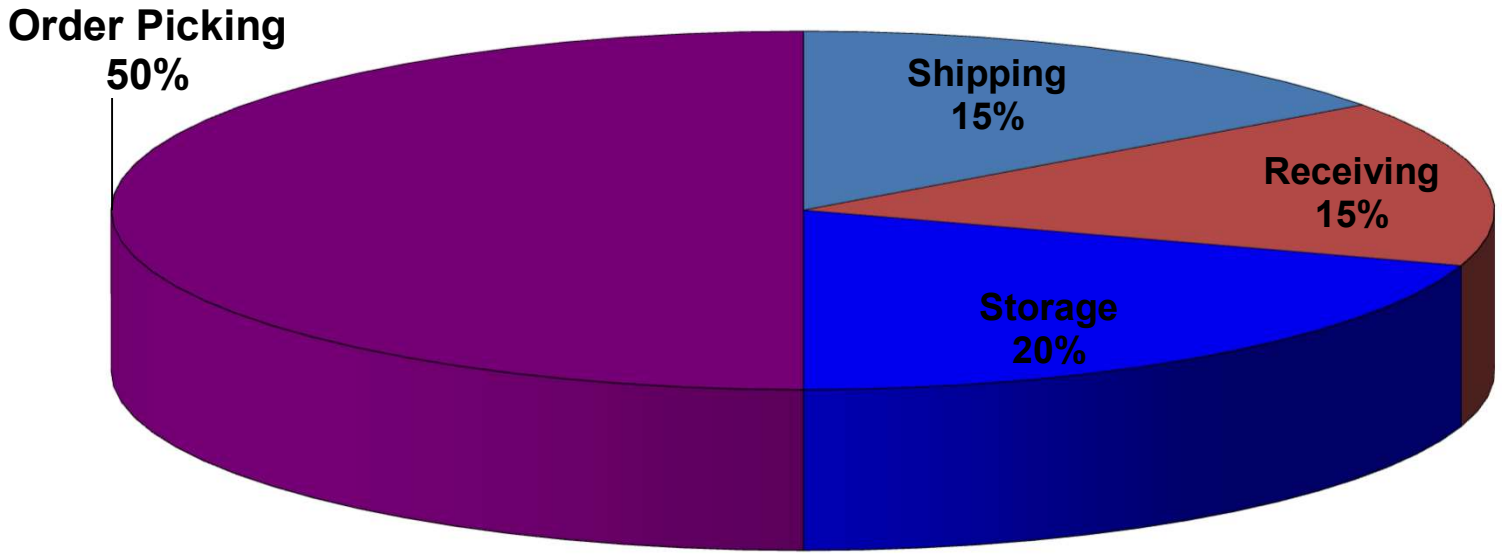
Importance of Order Picking

- For the purpose of order fulfillment
- Impact customer service level
  - Picking done wrongly will translate into
    - Shipment errors
    - Loss of sales
    - Loss of profit
    - Loss of customers
- High opportunity for quality improvement
  - Elimination of pick errors
  - Reduction of pick time, etc

Importance of Order Picking

- Labour intensive
  - Consumes large proportion of manpower cost

Operating cost distribution in a typical warehouse

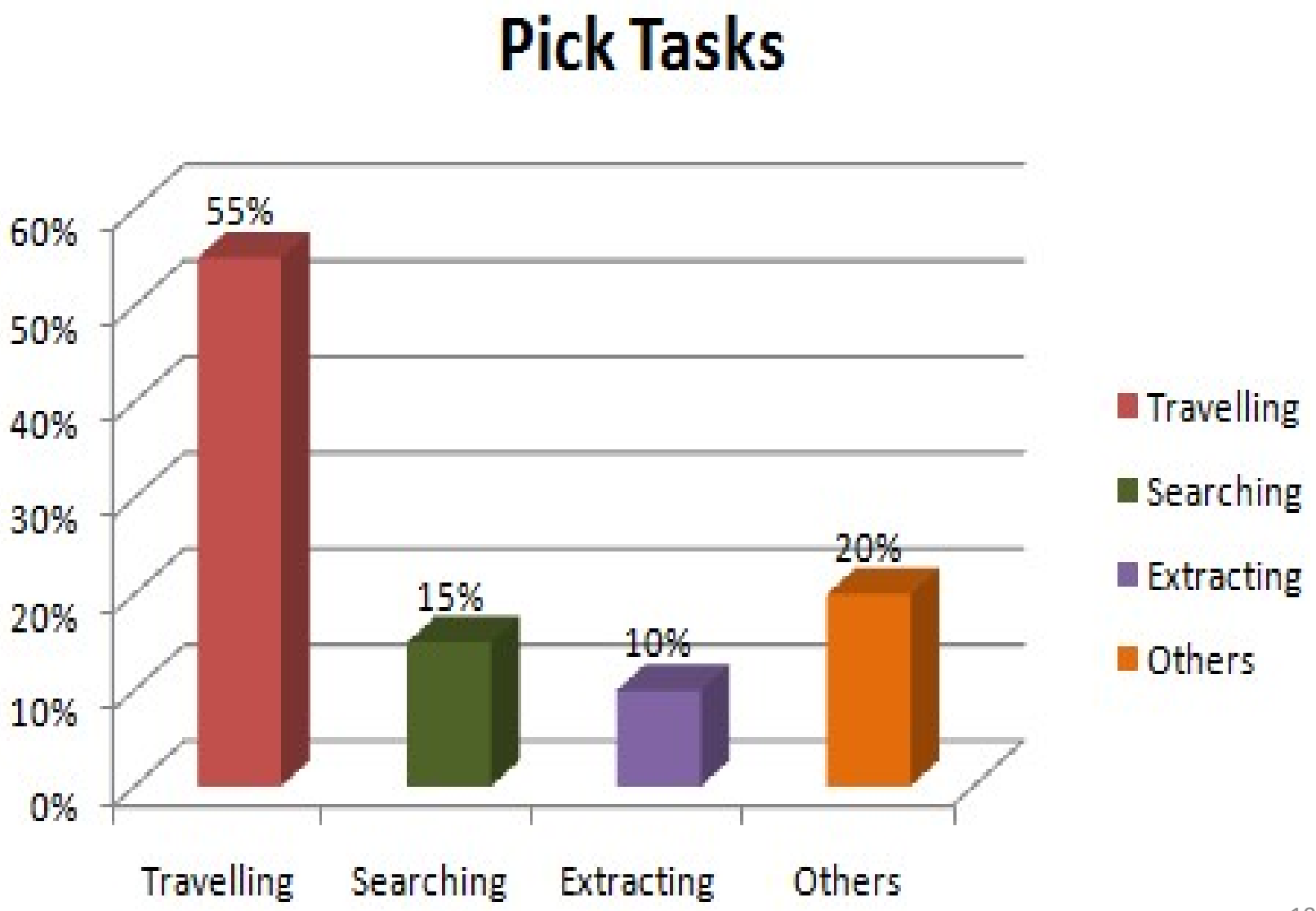


Source: Frazelle (2002)

Order Picking Related Tasks

- Travelling
  - Getting to the rack/location to pick
- Searching
  - Finding the item/carton/pallet in the rack
- Extracting
  - Taking the carton or pallet from the rack
- Picking (from carton or pallet)
  - Selecting the items
- Documenting
  - Checking and updating picking information in the WMS
- Sorting
  - Sort the items picked for the individual orders
- Packing
  - Putting individual pieces into case and cartons

Average Time Taken by Order Picking Tasks



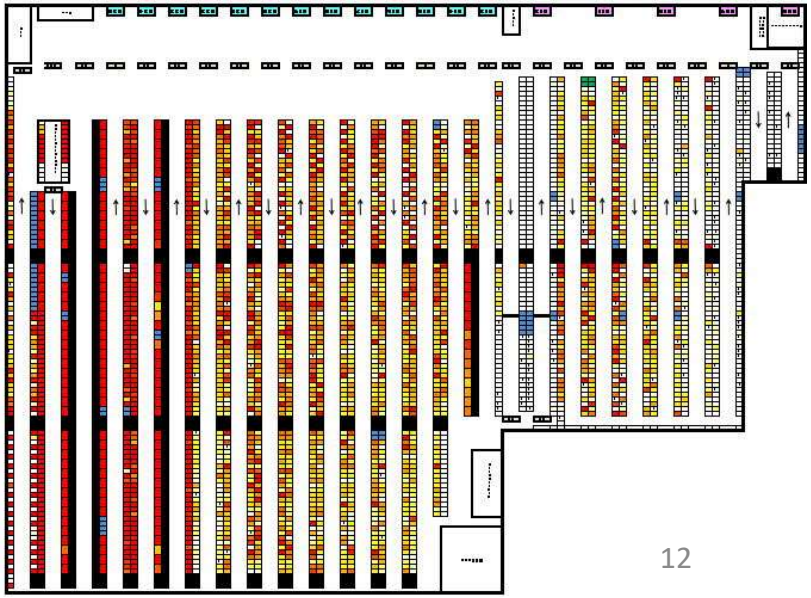
Challenges of Order Picking

Order picking has become increasingly difficult to manage:

- Customers demand:
  - Smaller and more frequent shipments
  - Faster delivery times with 100% shipment accuracy
- Cost
  - Increasing labour cost
- Highly dependent on other warehouse processes
  - Receiving, putaway and storage: if all are done correctly, the picking productivity can be improved.
  - Layout of the warehouse: if there are sufficient aisle space and appropriate use of storage system and MHE, picking efficiency will also improve.

Principles of Order Picking

- Pareto's Law:
  - 20% of items will account for 80% of the picking activities
  - Faster moving items should be placed at lower level for easier access
- Establish separate forward and reserve picking areas
  - A condensed picking area containing some of the inventory of popular items
- Assign items that are likely to be requested together to the same or nearby locations
  - Creating families of products
- Pickers must be accountable for his pick

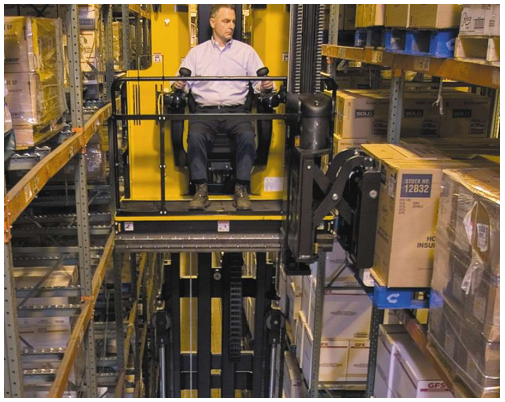


Principles of Order Picking

- Picking instruction is clear, easy to read and pre-routed
  - Picking information is presented in order that is required, i.e. location, SKU no, unit of measure and quantity required
  - The items to be picked are arranged in order of picking to minimize travelling time.
- Balance picking activity across picking locations to reduce congestion
- Batch orders to reduce total travel time
  - Increase the number of orders picked by each picker during a picking tour.

Principles of Order Picking

- Eliminate and combine order picking tasks if possible. Some examples:
  - Travelling and documenting
    - A person-aboard storage/retrieval machines transport pickers to locations while documenting the transactions.
  - Travelling and extracting
    - Stock-to-picker MHE such as carousels or ASRS
  - Design picking vehicles to combined Picking, sorting and packing (small items, small orders)
    - E.g. using dividers, bins or toteson picking carts



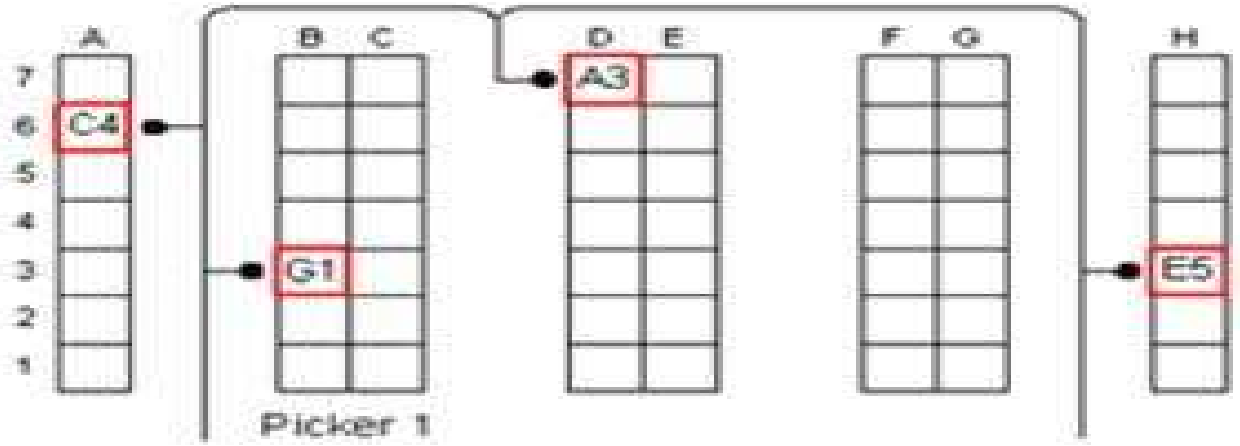
Principles of Order Picking

- Encourage and design for full-pallet or full carton box picking
  - Encourage customers to order in full pallet/box quantity or create ¼ or ½ pallet loads. This will minimize handling and counting of the goods which in turn will save time, reduce errors, and the likelihood of damaging the goods.
- Organize picking documents and displays to minimize search time and errors
- Where possible, technologies can be used to eliminate paperwork
  - E.g. barcode scanner

Picking Method: Discrete Picking

- Each order picker completes one order at a time
- No sorting required
- Order integrity is kept, thus reduce the risk of picking errors.
- Suitable for urgent customer request.
- Accountability of pick accuracy is clear
- Disadvantage:
  - Pickers have to travel over a large portion of the warehouse, thus time is wasted. This is the least productive picking method.

Discrete Picking



PICKER	ORDER	SKU	QTY	LOC
1	1	G	1	B3
		C	4	A6
		A	3	D7
		E	5	H3
	2	G	1	B3
		C	3	A6
		D	5	C5
		F	2	G6
		E	3	H3
		B	4	E1

Picking Method: Batch Picking

- Multiple orders for the same items are batched together.
- Order picker is responsible for retrieving a batch of orders together on the same picking tour.
- Very effective for small orders (1 to 5 line items)
- Order can be sorted in the following ways:
  - Use separate containers to sort the items of different orders while picking (applicable for small items with small order quantity).
  - Orders can be picked and taken to a staging area where they are sorted and combined to make a complete order.

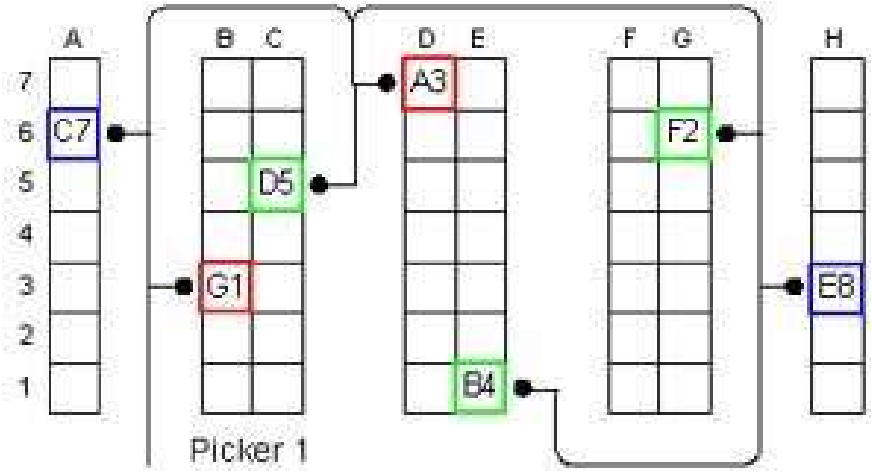
Batch Picking

- Advantage:
  - Increase productivity significantly by reducing the travel time of the picker.
  - Travelling time per line item pick will be reduced by almost x times, where x is the number of orders per batch.
  - Effective for scheduled picking

- Disadvantage:
  - Need a WMS that can support this process, if not the batching of items on the pick list will be very difficult to do manually.
  - Usually sorting is required after picking and this increase the risk of errors.
  - Not suitable for urgent customer request.
  - Not suitable for large orders

Batch Picking

In the illustration to the right, the single picker will pick two orders (Order 1 & 2) at the common locations A6 and H3 for SKUs C and E.



Picking trolley

PICKER	SKU	QTY	LOC	ORDER
1	G	1	B3	1
	C	7	A6	1,2
	A	3	D7	1
	D	5	C5	2
	F	2	G6	2
	E	8	H3	1,2
	B	4	E1	2

Picking Method: Zone Picking

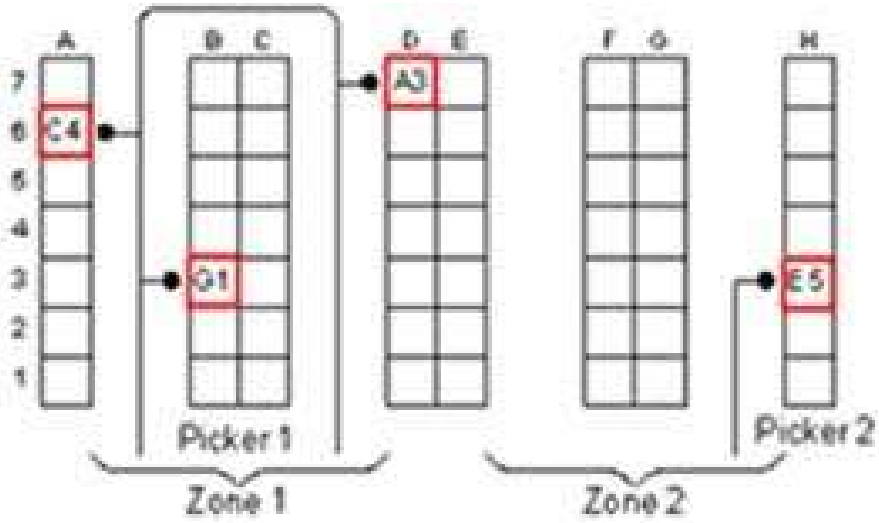
- Pick areas are organized into zones
  - Pickers will only pick in their assigned zone.
- A zone is defined by:
  - A portion of an aisle
  - Multiple aisles
  - Machines assigned to operator for picking.
    - E.g. Fork lift, manual picking and carousels
- Pick can be done:
  1. Sequentially
     - Pick and pass (more details later)
  2. Simultaneously
     - Pickers pick at the same time for the same order

Zone Picking

- Advantage:
  - Reduction in travel time
  - Increase order picker's familiarity with the product in the zone
  - Reduced interaction with other order pickers
    - Reduce time spent unproductively (any examples?)
  - Increased accountability for productivity and housekeeping within the zone
- Disadvantage:
  - Costs of downstream sortation system
  - Higher risk of having order fulfillment errors
  - Lack of order accountability
    - Same order picked by many pickers
  - Difficulty in balancing the amount of work in each zone

Zone Picking

There may be multiple pickers per order. Each picker picks only the items that are located in his/her assigned zone



PICKER	ORDER	SKU	QTY	LOC
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2	1	E	5	H3
	2	F	2	G6
		E	3	H3
		B	4	E1

Sortation in Zone Picking

- Progressive Order Assembly

  Each zone will pick and pass the container (e.g. cart, tote box) to the next zone. The order is then assembled progressively during the process.

- Downstream Sorting

  Order pickers work in parallel i.e. simultaneously. All the products picked are transferred (manually or by conveyor) to sorting system. They are sorted into different orders and packed afterwards.

Picking Method: Wave Picking

- Orders are scheduled to be picked during a specific planning period (wave).
- Usually used when there are a lot of orders.
- As much as possible, the orders scheduled in a wave must be completed within the time frame of the wave.
- Can have more than one wave during each operations shift.
- This method allows the warehouse to coordinate and maximized downward operation, to better manage the manpower and resources.
- Can be combined with batch, discrete, and zone pickings.

Wave Picking

- Categorize the orders into different waves. For example:

  Waves are batched by carrier (flight number)

  - Wave 1: 13:00~13:50pm (all shipments to TYO by JL700)
  - Wave 2: 14:00~14:50pm (all shipments to LAX by SQ021)
  - Wave 3: 15:00~15:50pm (all shipments to HKG by CX450)

- Time fence can be dynamic.
  - E.g. if there are many orders at a certain time frame, the time fence for the wave can be longer. To overcome it, more staffs can be assigned for picking during the period or start the wave earlier

Combination of Picking Methods

- In practice, warehouses may use a combination of picking methods to meet their customers' requirements

- Some examples of combination:
  - Batch and zone
  - Wave and discrete

Performance indicator for order picking operations

- **Productivity**
- **Cycle Time**
- **Accuracy**

Performance indicator for order picking operations

- Productivity

Productivity in order picking is measured by the pick rate. Piece pick operations usually measure the pick rate in line items picked per hour while case pick operations may measure cases per hour and line items per hour. Productivity gains are usually achieved via reduction of travelling time.

- Cycle Time

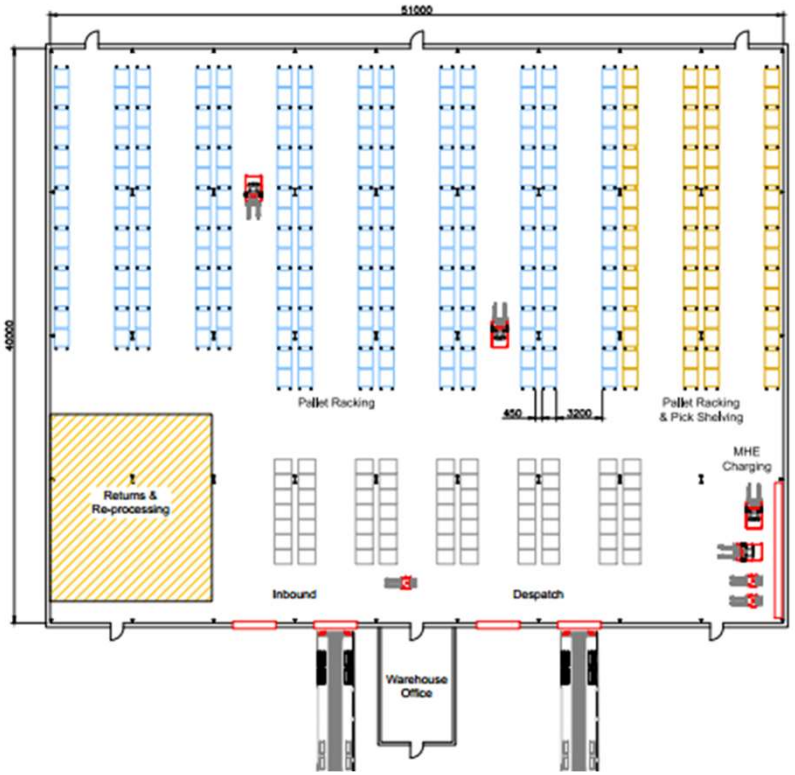
Cycle time is the amount of time it takes to get an order from order entry to the shipping dock. Immediate release of orders to the warehouse for picking and methods that provide concurrent picking of items within large orders are ways to reduce cycle time.

- Accuracy

Accuracy is another key objective in order picking. Technologies that aide in picking accuracy include pick-to-light systems and bar code scanners. Beyond the design aspects of an order picking operation, employee training, accuracy tracking, and accountability are essential to achieving high levels of accuracy.

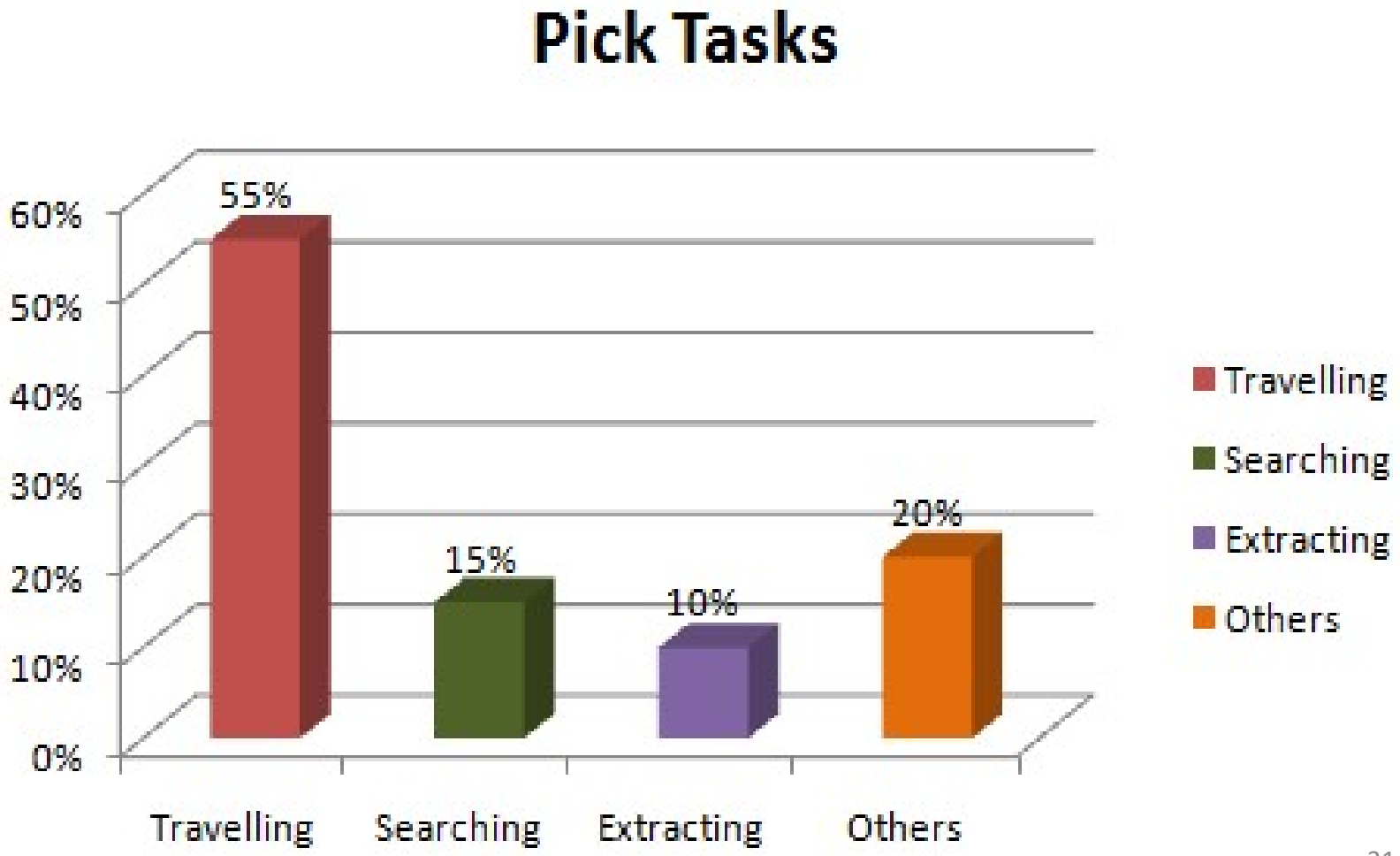
Recap of Today's Problem

- The warehouse is medium in size (approximately 2,000m^2).
- There are on average 1,000 orders to be dispatched daily. Each order usually consists of 1 to 5 order lines to pick.



Recommendations

- We note that travelling takes the most time, thus we must minimize the travelling time.



Recommendations

Recommendation to Shirley based on the following information:

Scale of Operation (No. of SKUs)	Low
Size of warehouse	Med
Total no. of orders handled daily	High
No. of picks per order	Low

Employ batch picking

- Saves travelling time
- Picked up to 3 orders in a pick-tour
- Downstream sortation required

Other Recommendations

- Popular items are placed together near the dock, which will reduce travelling time.
- Sequence pick location visits to reduce travel time
- Organize picking documents and displays to minimize search time and errors

Learning Outcome

- Apply the order picking principles.
- Elaborate the importance and challenges of order picking
- Explain the various order picking related tasks.
- Apply the various order picking methods.