- What is Material Handling?
 - It is handling material!
- · Right Definition
 - Material handling uses the right method to provide the right amount of the right <u>material</u> at the right place, at the right time, in the right sequence, in the right position, in the right condition, and at the right cost.
 - » This is a relatively broad definition of material.
- · Material handling ...
 - involves handling, storing, and controlling material
 - adds value through time and place utility
 - impacts space requirement, profits, quality, safety, and productivity

INEN 416

Material Handling

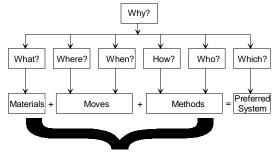
- Checklists
 - Provide a check of new designs
- Principles
 - Provide "rules-of-thumb"
 - » Planning
 - » Standardization
 - » Work
 - » Ergonomic
 - » Unit Load
 - » Space Utilization
 - » System
 - » Automation
 - » Environmental
 - » Life Cycle Cost

- Material Handling System Design Process
 - Define the objectives and scope of the mhs
 - Analyze the requirements for handling, storing, and controlling material
 - Generate alternative designs for meeting mhs requirements
 - Evaluate alternative mhs designs
 - Select the preferred design for handling, storing, and controlling material
 - Implement the preferred design
 - » Selection of suppliers
 - » Training
 - » Installation, debug, and start-up
 - » Performance audits

INEN 416

Material Handling

- Questioning Attitude: Why, what, where, when, how, who, and which?
 - Why is handling required?



Material Handling System Alternatives

Factors

- Type of materials
- Physical characteristics
- Quantities to be moved
- Sources and destinations for each move
- Frequency or rate of each move
- Equipment alternatives
- Units to be handled
- Material Flow → Method of handling, storing, and controlling → Material Handling

 $\sum_{moves} [Why (Where + What + When)]$

INEN 416

Material Handling

- Study each move
 - Can the move be eliminated?
 - Can the move be combined with another or with an in-transit operation?
 - Can the move be simplified?
 - Is resequencing the moves possible? Is it advantageous?
 - If the move <u>must</u> take place, then determine the best method.

- Unit Load Principle
 - Unit load is the unit to be moved or handled at one time
 - Advantage: handle multiple items -- reduce the number of trips
 - Unit loads can be contained in totes, cartons, pallets, pallet boxes, etc.
 - Enclosure and stabilization is provided by strapping, shrinkwrapping, and stretchwrapping
- Unit load specification is an integral part of material handling and storage system design

INEN 416

Material Handling

- Pallets
 - Style and Size based on:
 - » Shipping and receiving restrictions
 - » Size and weight of items on the pallet
 - » Space restrictions
 - » Equipment used to move the pallet
 - » Slave versus non-slave considerations
 - » Cost, supply, and maintenance
 - » Aisle widths, door sizes, stacking heights

Material Handling Performance

- "Support efficient production operations"
- Throughput
- Response time
- Cost
- · Space and cube utilization
- Flexibility
- Expandability

INEN 416

Material Handling Costs

- Total Cost of Ownership
 - Initial purchase price
 - Operating expenses (fuel, disposables, etc.)
 - Maintenance costs
 - Direct and indirect labor costs
 - Miscellaneous associated costs
 - » Training
 - » Insurance
 - » Damage
 - » Environmental impacts

- Equipment Classifications
 - Conveyors
 - Monorails
 - Hoists and Cranes
 - Automated Storage and Retrieval Systems
 - Industrial trucks
 - » Pallet jack
 - » Fork lift
 - » Automated guided vehicle system
 - Containers and supports
 - Auxiliary Equipment
- Picture Bank

INEN 416

AGV Classification

- Introduction
- Guidepath Determination
 - Static path
 - » Unidirectional
 - » Bidirectional
 - Dynamic path
- Vehicle Capacity
 - Single unit load
 - Multiple loads
- Vehicle Addressing Mechanism
 - Direct address
 - Indirect address