Strategic Solutions for Supply Chain

Applying and Justifying Automated Storage and Retrieval Systems in Logistics and Distribution Applications to gain competitive advantage.

Introduction & Purpose:

This presentation is to help participants:

I. See the link between Supply Chain performance and the Warehouse & Logistics Operations

II. Apply AS/RS systems to logistics and distribution/warehousing problems and

III. Understand economic and strategic returns from such investment.

Supply Chain Relevance

Assumption Statements

(Based on WERC trend reports through 2003)

- Larger Distribution Centers, determined as strategic consolidation decisions will be built and logically located in networks to reduce logistics costs.
- Larger Distribution Centers require significant manpower, management, and time-based coordination to deliver world-class customer service.
- Land and Labor are no longer 'givens' as contention for prime network locations increase in importance.

PART 1

Logistics & Warehousing Issues

Identifying problems:

Because those 2003 strategic Supply Chain assumptions came true in 2004 & 2005, and remain true in some supply chains, the tactics deployed at DCs were & are the 'make/break' factors for meeting successful metrics or KPIs, key performance indicators, in logistics and customer service.

It is important to note that in addition to WERC and CSCMP reported trends cited here, Iowa State University and C.H. Robinson Worldwide, Inc. published reports on distribution problems for temperature-controlled DCs that were used as part of the basis for developing problem statements.

Problems at receiving and shipping docks

35.5% of respondents said on-time delivery means on the same day WERC Watch DC Measures 2006

- Inability to make or keep appointments for pick-up or drop off due to long unload & load wait times cause poor delivery performance.
- Lumper (manual loading) fees incurred during shipping or receiving are high.
- Damage costs from warehousing or transportation are high.
- Failure to reconcile product quantities with the bill of lading causes 'ship shorts' or back charges to occur.
- Congestion in yard management during peak periods prevents trailers from being rapidly serviced.

27.6% (of shippers) delivered 'on the agreed day' WERC Watch DC Measures 2006

Product Loss Issues

- Multiple handling of products by fork trucks results in spearing, crushing, case or box collapse.
- Temperature quality is lost during extended wait times for dock staged goods that are not loaded or put away.
- Crush damage from extended period floor storage of 2-3 high pallet configurations can destroy cases or layers.
- Date code loss from failed FIFO rotation creates unusable product.

Median damage for warehouses is 1%
Only 20% reached best practice .56%
WERC Watch DC Measures 2006

Hidden Costs of Inefficient Warehouse & Logistics Operations

- Quality rejections for entire loads are often due to product appearance or temperature problems discovered when received.
- Missed delivery time rejections that are receiver policy can cause the loss of an entire order value.
- Demand for refrigerated carrier capacity and carrier industry consolidation is driving up logistic costs.
- Direct costs resulting from carrier wait times – such as demurrage, fuel, staffing at operations, lounge requirements, truck lots, larger fleets are on the rise.
- Indirect costs from carrier wait times – such as driver turnover, added safety precautions in operations, claims for injuries or equipment damage are also on the rise.

2005 Logistics costs jumped 15.2% over 2004
CSCMP 17th Annual State of Logistics Report

Future Financial Impact Issues – Not Yet Quantified

- Legislation on driver restrictions for 'hours of (daily) service' may get worse.
- City legislation limiting truck and trailer hours to evening and overnight delivery are more likely due to security & daytime highway congestion; i.e. NYC Port Authority and others.
- Industry issues of diminishing numbers of truck drivers due to worsening conditions will further raise logistic costs.

111,000 drivers short by 2014
CSCMP 17th Annual State of Logistics Report

Problem Summary

- Warehouse, dock, and transportation management are creating both obvious and hidden costs for companies.
- Distribution & Logistics Strategies will be needed that employ solutions for 'future' problems.
- Most distribution and logistics operations today are not meeting the KPIs and metrics that their clients, or even their own management expect.

PART 2

AS/RS based solutions for improving distribution & logistics performance

Why use AS/RS as a solution to these supply chain issues?

Labor, Accuracy, Space

PRODUCTIVITY - AS/RS and associated mechanized peripheral systems can...

- receive and put-away product faster, in smaller areas, with less personnel
- retrieve product faster, in smaller areas, with less personnel
- speed pick replenishment and picking productivity
- manage & track orders, product flow, truck load sequencing and staging
- rapidly deploy product to the docks, in smaller areas, with less personnel

Rapid response for today's Supply Chain demands

Technology – Pallet & Unit load AS/RS

- Heights to 100' plus
- Rates equal 2-5 manned vehicles
- Many weights and load variations
- High Reliability

AS/RS optimizes vertical storage space & links to transport & IT Systems.

A Look at Mini-load AS/RS

- Manages cases, totes, and other small material handling load envelopes and weights.
- Heights are to 60'.
- Material movements are very high in very small footprints.

Mini SR Machine moves can be 90-250 plus/hour

A Look at AS/RS Peripheral Systems:
Conveyors for queuing & transporting

Productivity & Safety Gains:

- Less fork trucks
- Faster Receiving
- Faster Shipping
- In smaller areas
- With less dock doors
- Tying in Processes

OSHA estimates there are about 85 forklift fatalities per year, 34,900 serious injuries and 61,800 non-serious injuries.

AS/RS Receiving - what happens?

Inspection and identification processes aside…

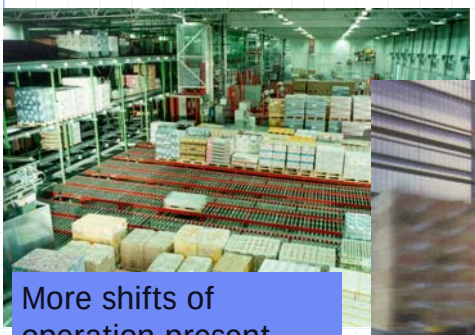
- Pallet handling - a one-level receiving conveyor can take pallets away from the dock into automated storage at 40-60 feet per minute, delivering 100 to 200 plus pallet move operations per hour.
- Case handling - a one-level receiving conveyor can take cases away from the dock into storage at 40-60 cases per minute.

Putaway and Retrieval, Replenishment – what happens?

- Pallet (or unit-load) S/RMs (storage/retrieval machines) deliver double and triple the efficiency of manual fork truck or VNA operations. S/RMs move 40 – 80 pallets per hour.
- Other variants of AS/RS technologies create rates of 200-500 pallet moves an hour.
- Case handling AS/RS can exceed 100 cases per hour per S/RM.

Median pallets shipped per person is 21 (per hr)
WERC Watch DC Measures 2006

AS/RS Provide 7 x 24 Productivity



More shifts of operation present better justification opportunities.

AGV systems deliver to AS/RS around the clock.

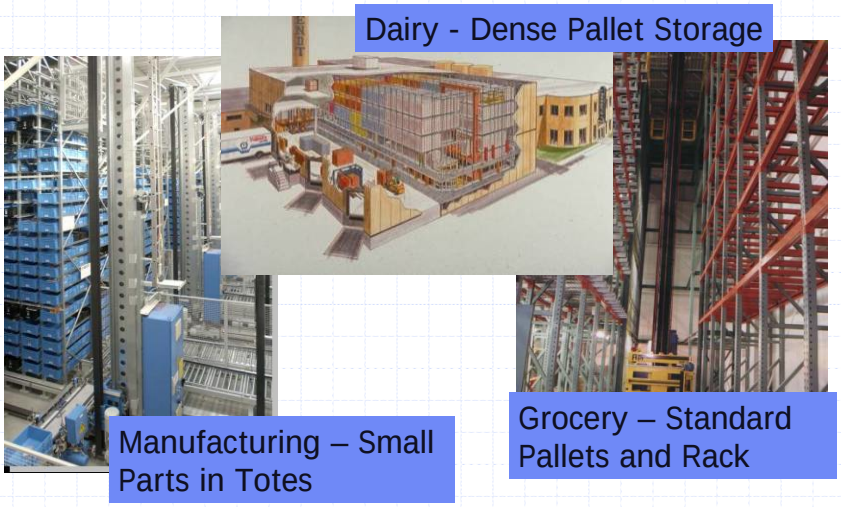
Part 3

Case Studies

"Supply Chain today is seamless, uninterrupted, visible and measurable…." Dick Ward, PHD MHIA

Design Variations Solve Different Business Issues

Widely varying speeds, feeds, with high reliability & maintainability



Dairy - Dense Pallet Storage

Manufacturing – Small Parts in Totes

Grocery – Standard Pallets and Rack

ASRS Case Studies

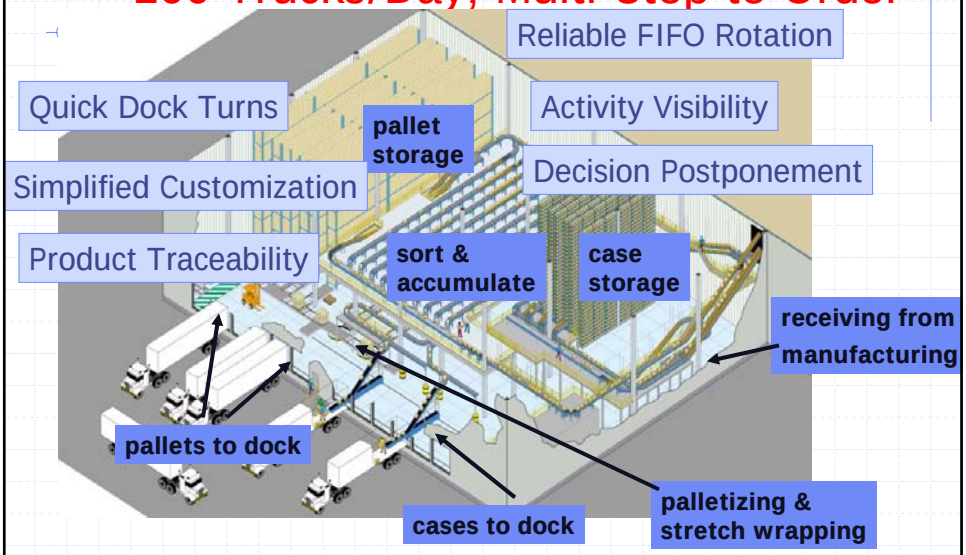
Case A – Manufacturing Distribution for Refrigerated Fresh Foods (dwell time 0-3 days typical)

Fully Automated Case Order Fulfillment including...

- software visibility of information and material flow,
- transportation & absolute tracking of cases and pallets,
- buffering of products (storage & retrieval),
- order management and release,
- single SKU & mixed box palletizing,
- stretch wrapping, and
- Shipping platform customization (pallet, slip sheet, floor)

Order Fulfillment

100 Trucks/Day, Multi-Stop to Order



System Details

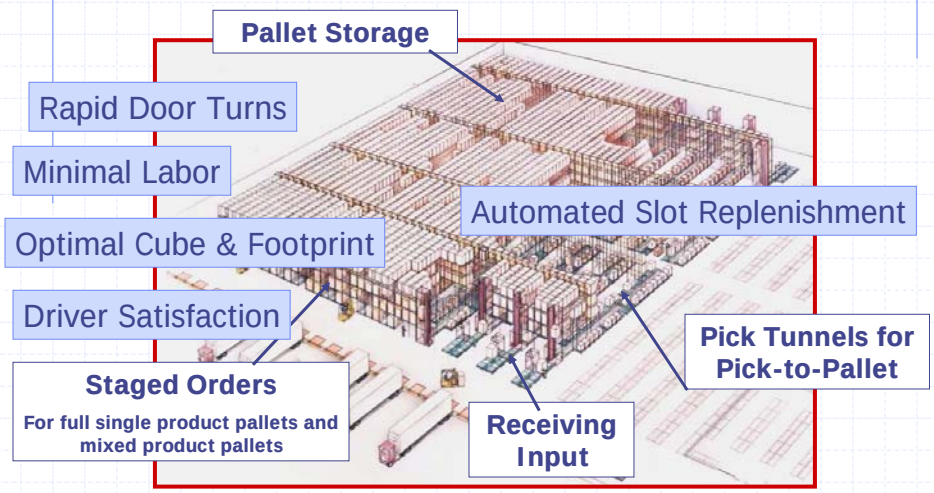
Product:	Boxed Beef
Building Type:	Free Standing
Capacity:	1,000 pallets 30,000 boxes total
Footprint:	30,000 ft.²
Height:	45 Feet
Equipment:	3 Unitload / 3 Miniload
Daily Throughput:	60,000 boxes
Special Features:	- Postponing release of orders to optimize dock turns. - Visibility of orders and inventory at one look.

ASRS Case Studies

Case B - High Turn ASRS Buffer

Consolidated Distribution in Refrigerated Food Services – Multiple manufacturing facilities provide products for downstream DCs and retail clients through a 'mixing' center.

Refrigerated Food Services
180 Trucks / day



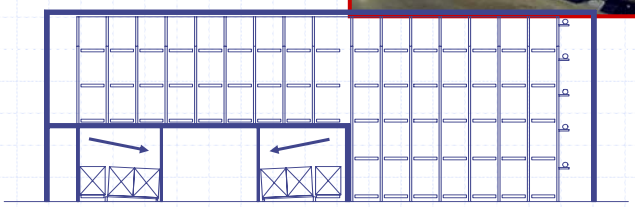
System Details

Product:	Refrigerated Food
Building Type:	Free Standing
Capacity:	8,000 pallets
Footprint:	65,000 ft.²
Height:	35 Feet (4 Levels)
Daily Throughput:	5,500 Pallets In/Out 1,000 Pallets to Replenishment
Special Feature	Truck Loads sequenced & staged internal to the rack

Refrigerated Pick Tunnel

for pick to pallet operations

Pick Tunnels Automatically Replenish & Re-slot Pick-From Locations



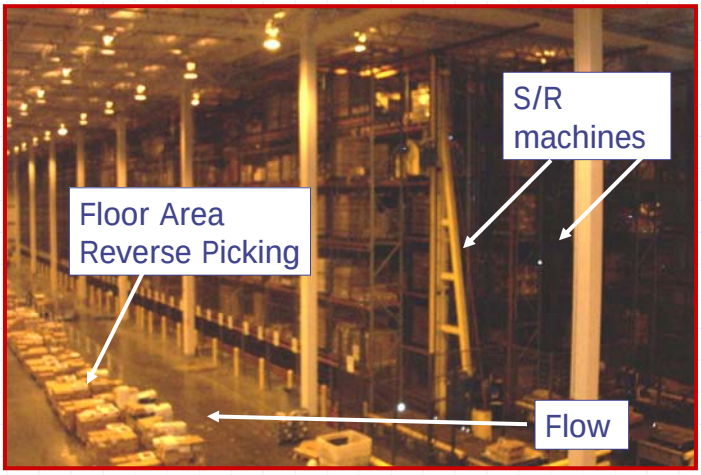
Pallet Truck Tunnel

ASRS Case Studies

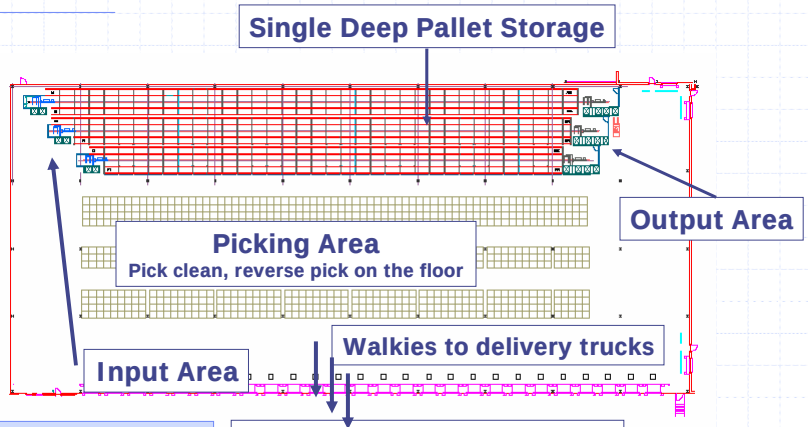
Case C

Grocery Product Replenishment – AS/RS buffer for aged beef products holds & replenishes age-ready beef and value-added meat products to support reverse picking operations (cross dock) of multi-product fresh meats category to stores.

Facility & System View



Product Replenishment
Support of Daily Crossdock Operations



Supports replenishment requests

Eliminates pallet quality issues

System Details

Product:	Meat Products
Building Type:	Free Standing
Capacity:	4,500 pallets
Footprint:	12,000 ft.²
Height:	40 Feet (6 Levels)
Equipment:	3 Cranes
Aisle:	3 Aisles
Daily Throughput:	1,000 Pallets
Special Feature:	Use of street pallets. Use of standard rack.

S/R Machines Using Standard Racking and GMA Pallets

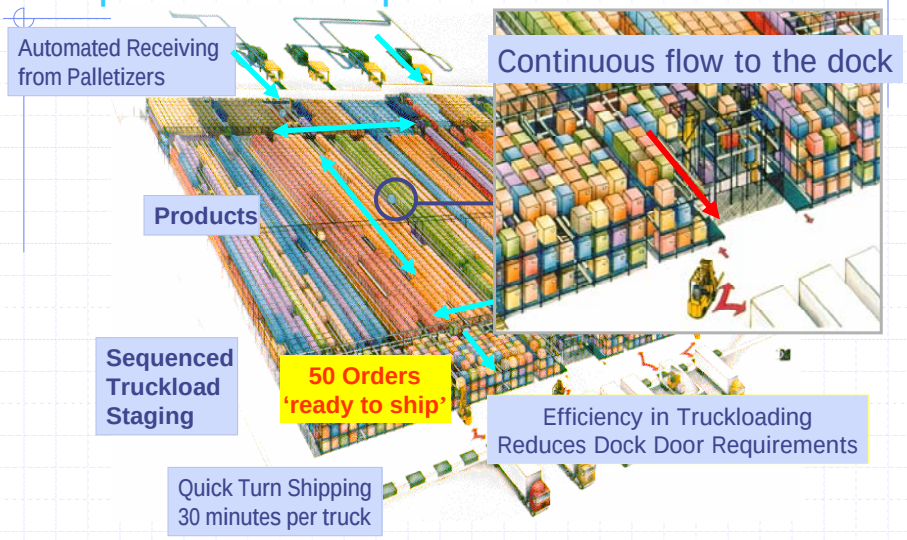
ASRS Case Studies

Case D

Flow-through Manufacturing Pallet Distribution Buffer operations support Pull Strategies in Supply Chain

Manufacturing DC Productivity

No personnel except at the dock



System Details

Product:	Household CLeaners
Building Type:	Free Standing (2)
Capacity:	10,000 pallets
Footprint:	50,000 sq. ft.
Height:	32-40 Feet (3 & 4 level)
Equipment:	Deep Lane ASRS
Aisle:	N/A
Daily Throughput:	4800 peak
Special Feature:	Use of CHEP pallets. Existing Building & Greenfield

Part 4

AS/RS
Cost Savings & Value

Justification Thinking

- The paradigm shift from conventional, manual warehousing and logistics requires re-evaluating how many functional areas & processes will be able to be mechanically automated.
- The space and labor efficiency of mechanized warehousing changes many processes and eliminates many costs of an operation. Processes and layouts are often dramatically different and require thorough evaluation.
- The useful life of ASRS systems is considered to be an average of 10 years, with many existing systems providing 20 or more years.

Conventional Warehousing Requires Lots of Real Estate & Equipment

Building design calculations using four high standard rack can require 7-10 square foot per pallet stored.

Employing many dock doors to accommodate typical slow turn rates drives up building costs.

Networks are requiring more inventory to meet more frequent deliveries.

Delivery times (failed)… (are causing) planning changes from mega-DCs to (constructing more) smaller DCs (in distribution networks to improve delivery times)
CSCMP 17th Annual State of Logistics Report

AS/RS - smaller warehouse footprints

ProLogis (a 4PL & property sales/management firm) reported a tight leasing market, higher rents. CSCMP 17th Annual State of Logistics Report

AS/RS designs:

- Reduce aisle space
- Provide vertical storage capacity that is 2 to 4 times greater than conventional.

AS/RS benefit:

- Provide direct 'one-time' savings in construction by eliminating 35-70% of square footage.

New Warehouse construction has risen
CSCMP 17th Annual State of Logistics Report

More Storage, Smaller Footprint

2006 WERC Watch
Best Practice Measure
Honeycomb – (only) 20.8% of DCs Get >90% storage utilization vs 75% (current median)

Maximum Pallets per Square Foot

- **Comparison in square feet per pallet at 40' building height**
  - ✓ **Narrow Aisle: 5–6***
  - ✓ **VNA: 4–5***
  - ✓ **Stacker Crane/ASRS: 4–5***
  - ✓ **High Density AS/RS: 3–4'**

Example: High Density requires a 3000 sq. ft. warehouse for 1000 pallets stored.

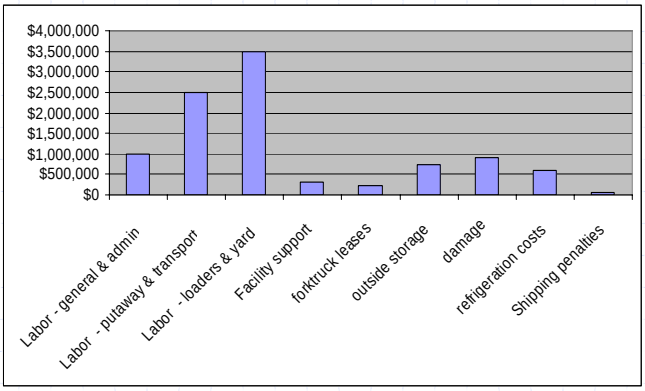
* Data courtesy of Gross Associates

Capital & Expense Offsets

Justification Areas to examine for one-time capital savings & on-going expense reduction.

Manual Operations

1.8 MM Pallet Manufacturing Distribution



One-time Savings Potential in Construction Costs via AS/RS

Refrigerated Buildings

- $85 - $170 per square foot plus land and development costs

Non-Refrigerated Buildings

- $40-$75 per square foot plus land and development costs

Inventories have slowly crept up.....reversing the trend
(for smaller, leaner inventories and smaller buildings)
CSCMP 17th Annual State of Logistics Report

Equipment Savings via AS/RS

Reduction for one-time purchases and associated expenses

Fork trucks (including fueling systems / charging equipment, batteries), dock levelers, dock doors, RF and associated systems can be reduced or eliminated creating savings via:

- Capital recovery by reducing fleet size
- Capital savings on future replacements
- Repair costs on-going
- Energy cost reduction (fuel)

Equipment-Based Savings

Re-claiming Capital using ASRS

- $15,000 to $20,000 per dock door
- $25,000 to $90,000 per lift truck depending on class by height, weight, speed and reach
- $50-$200 per rack location based on standard to push back ranges

Equipment/forklifts capacity used (only) 62.5% (of total fleet working capacity)
WERC Watch DC Measures 2006

DC & Logistic Savings

One-time & Recurring

Faster dock turns, less personnel

- Eliminate outside storage and all associated expenses by consolidating product storage on site.
- Reduce detention and/or freight costs (by quick dock turnaround) for customer trucks with appointments.
- Reduce dedicated fleet size by increasing truck turns for route deliveries.
- Eliminate or reduce the size of drop lots by meeting appointment times.
- Reduce penalties and related expenses associated with “problem freight” and customer returns.

Although purchases of new equipment (truck fleet) are on the rise, most of the purchases are for replacement….
CSCMP 17th Annual State of Logistics Report

DC Operational Savings via AS/RS

On-Going Expenses that can be captured

- $.50 - $1.00 per square foot in facility maintenance/year.
- $.005 to $.02 per cubic foot per month in cooling & refrigeration costs.
- $10-$15 per hour plus benefits, related expenses and supplies per man hour.
- $.02 to $.10 per case through depending on pick type – pallet, case, each or mix.

Less People, More Work via AS/RS

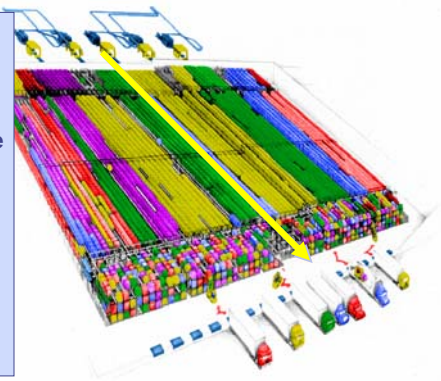
Consumer Goods DC - 200 pallets/hour in and out, Staffing is (4) Loaders in shipping, fully automated input.

Quote from WERCwatch October 2006; Transportation Capacity Issues:

"Unitized Loads (Pallets/Slipsheets)

Programs were set up to facilitate more rapid loading and unloading

Often customer order sizes do not permit unit-loading, but where changes can be made, shipping on pallets or slipsheets reduces loading and unloading times dramatically. At minimum, firms should set up unitized shiping programs on intra-company movements wherever possible."



Direct Savings in Labor via AS/RS

Total Wage Elimination Areas

- High cost on-going benefits, especially medical, sick leave, vacation
- Employer paid taxes
- Future labor costs such as retirement plans

Overtime Hours – median is 7%
WERC Watch DC Measures 2006

Reduced Personnel Support Costs via AS/RS

- Clerical staff needed for managing health plans and payroll are smaller.
- Personnel supplies; gloves, safety gear, uniform requirements are lowered.
- Training and re-training expenses are lowered or eliminated.

Indirect Labor Cost Savings via AS/RS

Liability Issues

- Workers comp claims / insurance coverage premiums can lower.
- Employee lawsuits - discrimination, work rules violations, injury, health conditions have cumulative legal costs.

Reduced HR costs via AS/RS

- Less frequent employee acquisition expenses can be realized, as less FTEs are needed, such as:
  - advertising,
  - screening medical tests,
  - placement testing,
  - severance packages,
  - out placement expenses, &
  - future golden handshakes.

IT Systems Value via AS/RS

ASRS provide opportunities to:

- Employ End-to-End Traceability & visibility
- Integrate data with WMS, TMS & ERP
- Reduce RF needs, terminals, etc.
- Reduce data entry labor & errors and expense

Inventory Savings via AS/RS

- Inventory accuracy is consistently better allowing for less safety stock.
- There are less lost sales from shelf and stock outages due to better control.
- Minimal or no returns occur from expired date code or packaging problems.

Lost Sales (from stock outs) – median 4%
WERC Watch DC Measures 2006

Inventory Savings Areas continued

- Expediting product to cover short orders is reduced or eliminated.
- Back orders resulting from ship shorts are reduced.
- Manufacturing disruption and plant productivity loss is eliminated by maintaining manufacturing schedules versus responding to emergency runs for short ship products.
- Inventory optimization by SKU is realized due to improved visibility of on-hand inventory and speed of service.

2005 inventory carrying costs were 17%
CSCMP 17th Annual State of Logistics Report

Carrying Cost Reduction via AS/RS

- Minimal maintenance and utilities are required to maintain the warehouse space as only product is affected – not personnel.
- Lower property taxes are due on assessments as less acreage is required.
- Capital availability improves as less is spent for land and facility construction costs.

Indirect distribution cost % of total cost – median 7%
Best practice is 1.2% WERC Watch DC Measures 2006

Loss Reduction via AS/RS

- Control of overage product loss improves.
- Stock rotation handling is dramatically reduced.
- Stacking damage is eliminated.
- Packaging damage from equipment contact (collision & spearing) is eliminated in the warehouse.
- Over capacity damage due to product crushed into fork truck aisles during peak inventory build can be eliminated.
- Theft is deterred when stored product is in fenced-in ASRS (inaccessible product).

Manufacturing & Logistic Savings & Opportunities via AS/RS

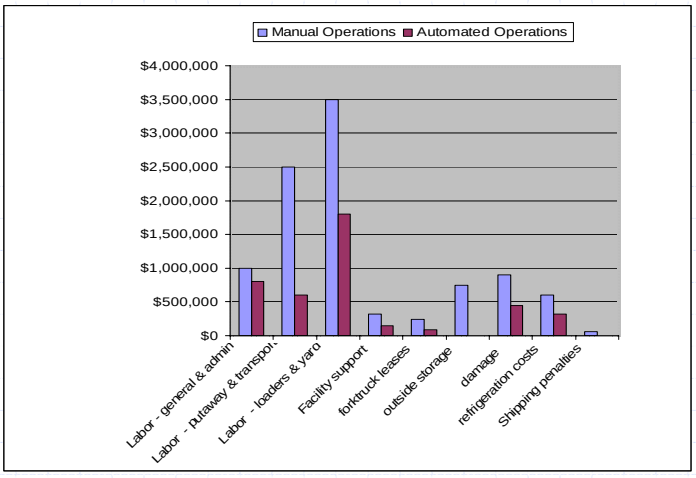
- Opportunities to use reduced package strength due to single high stacking methods can be leveraged to provide per case & pallet savings.
- The ability to manage ‘perfect’ loads due to gentle handling in ASRS lowers dunnage in trailers and rail cars.

New Construction/Expansion Design Savings Opportunities via AS/RS

- Faster possible depreciation (rack supported ASRS buildings depreciate as equipment), 10 years versus 30 years.
- Dock area square foot reduction for staging can be integrated into ASRS, cutting the square footage in half (60' to 30').
- Less need for personnel support construction at facilities - e.g. bathrooms, locker rooms, parking areas, etc., reduces overall costs of the building.
- Lower land development cost occurs because of a smaller footprint.

Expense comparison

1.8 MM Pallet Manufacturing Distribution



Justification Summary

- Building and construction costs can reduce 30-70% when all of the benefits of ASRS facility and site design is captured.
- Expense savings are not from labor alone, but from many areas, including logistics and manufacturing.
- Offsetting capital expenses for equipment or construction that are no longer required can be included in the ROI calculation.

Part 5

Business Considerations - A few planning points to ponder in light of all the good news about ASRS

Business Considerations continued

Vision of the Business must be clear

- To build-in flexibility into the design, up-front.
- To allow realistic changes in the culture.
- To get buy-in across all departments.

Project Cycle Time must be defined

- Need to include sufficient schedule (beneficial use 10-18 months after contract).
- Employ realistic contract terms to reflect the schedule.
- Internal business costs and efforts must be reflected (operational transition costs).

Business Considerations continued

Capital and Return

- Clear expectations for how long and how much return will be delivered.
- Clear measurement terminology up and down the Buyer company is needed to avoid missed expectations.

Business Considerations continued

Interface to WMS & ERP

- Proper definition effort offsets this risk.

Material Handling - design for reliability & repeatability

- Consistent dimensions - CHEP pallets or grade A1 pallets must be identified.
- Captive pallets are low risk, add flexibility and should be considered.
- Consistent Packaging, Cases, or Totes must be used everywhere possible.

Business Considerations

People and Operations

- Allowance for a new operations paradigm (and processes) must be incorporated.
- Training for the initial design must be solid and thorough.

Support

- On-going training for staff must be managed.
- 24/7 capability from Suppliers is a must.

Part 6

Closing thoughts for serious evaluation of AS/RS solutions

Final Thoughts

- Every business problem requires thorough analysis of the issues. AS/RS is not appropriate for every application. To determine the value derived from this kind of warehouse, the project team requires a clear sense of alignment with business strategies, operational risk management, and the financial return on the investment.
- Looking at the AS/RS industry for solutions, Supply Chain Management Teams can derive alternative approaches to apply to their distribution and logistics that can reduce one-time and on-going costs and deliver competitive advantage from superior performance.

Preparation

Your understanding of the following areas will arm you to develop a comparative understanding of AS/RS and how it can deliver value to your business:

- current and future business requirements overall
- material handling characteristics managed in orders, their flows & rates and finally
- the financial measures for the business as it operates today, and as it might operate in a future state.

Thank You!

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