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Next-Gen Fulfillment & Sortation: Adopting Artificial Intelligence

Presented by:
BEUMER Group
Objectives

- Explore Future of AI
- Uncover Next-Gen Fulfillment & Sortation Solutions
- Define Essential Checklist for Every Fulfillment Center Manager
Future of Artificial Intelligence

“AI is the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition and decision-making.”

- MIT Sloan Journal, 2017
Future of Artificial Intelligence
Software is the Glue Between Now & the Future
AI Applications in the Modern Distribution Center

- Demand Prediction and Inventory Management
- Predictive Analytics
- Image Recognition
- Barcode Reading
- Adaptive Order Selection
AI Applications in the Modern Distribution Center

- Demand Prediction & Inventory Mgmt.
- Predictive Analytics
- Image Recognition & Barcode Reading
- Adaptive Order Selection
e-Commerce Solution Set

1) SKU Proliferation
2) Order Volume
3) Order Profile
4) Service Levels

Manual Two-Pass e-Commerce Sortation

Challenges

Auto Two-Pass e-Commerce Sortation
Manual Two-Pass e-Commerce Solution
Sorter with Put Walls
Put Walls Along the Sorter
Decision Engine Behind Manual Two Pass

Carton Selection
Service Level
Order Completion Time
Sorter / Chute Management
Labor management
Exceptions management
Automatic Two-Pass eCommerce Solution
Primary Sort Discharge

• The two primary discharge belts are each 160’ long and have 240 discharge points, one every 8” (203.2 mm).

• If there are more than 240 mini-waves, more than one may share a discharge point.

• Typically, one belt wave is prioritized over the other, so their completion is staggered prior to transfer to secondary induction.

• Technical Note: The discharge distribution is calculated in advance, when the pick wave is received.

• This allows maximum flexibility for order allocation and completion in the primary sort, which positively impacts the secondary sort, completion, and turnover.
Transfer Process

Primary Sort To Secondary Sort Conveyor

Key Aspects of Design
- Complete contents of primary conveyor fits on transfer conveyor
- Powered belt curves
- Integrity of “mini-waves” maintained from primary sorter, through transfer, and to secondary induction
Transfer Conveyor: 90° Transfer & Waterfall
Secondary Sort
Secondary Induction
Cross Belt Packing Sorter – Secondary Sort
Work Station & Discharge Design

**Work Station**
The work stations at packout display Current Order, Suggested Carton Type and Size, the UPC, Item Description, and the quantity to be packed into the shipping container.
Summary of the Pack Sorter Design Options

The following is a quick comparison of the two Pack Sorter options – evaluating both capital costs and labor expense:

Automated 2-Pass Design
• Uses conveyor transfers to automate the transfer from 1st to 2nd pass
• (5) Virtual sorters

Manual 2-Pass Design
• Uses Put Walls to manage the final sort
• Only (4) Virtual sorters

Our comparison is driven by several key assumptions:

✓ Productivity and labor rates for the inductions and pack stations mirror current operations
✓ The productivity rates for the Put to Light system are based on a combination of our MOST analysis, Time and motion studies, and evaluation of current ‘like’ designs
✓ We held the Pack productivity constant between the two options; however, based on time and motion the pack rates for the Alternate design will be lower than the Base design
✓ Cost of labor was driven by the Amazon market rate of $15/hr and 2008 hour/year, with a burden rate of 43% - that yields an annual burden cost of labor at $43,071
## Summary of the Capital Costs

<table>
<thead>
<tr>
<th></th>
<th>Base: Automated 2-Pass</th>
<th>Alternate: Manual 2-Pass</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorter 1</td>
<td>$8,200,000</td>
<td>$6,500,000</td>
<td>Includes inducts, sorter, destination</td>
</tr>
<tr>
<td>Sorter 2</td>
<td>$8,200,000</td>
<td>$6,500,000</td>
<td>Includes inducts, sorter, destination</td>
</tr>
<tr>
<td>Sorter 3</td>
<td>$4,052,000</td>
<td>$0.00</td>
<td>The alternate does not include the extra sorter capacity included in the base</td>
</tr>
<tr>
<td>Put-to-Light</td>
<td>$0.00</td>
<td>$1,500,000</td>
<td>Estimate based on similar system – 5000 cubbies at $350 per cubby</td>
</tr>
<tr>
<td>Auto bagger Pack Station</td>
<td>$6,392,000</td>
<td>$6,392,000</td>
<td>Same requirements and similar design no impact: includes Auto baggers, Printers for pack list, PC with Monitor, Scanner</td>
</tr>
<tr>
<td><strong>Total Investment</strong></td>
<td><strong>$26,844,000</strong></td>
<td><strong>$20,892,000</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Delta</strong></td>
<td><strong>($5,952,000)</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Our comparison is driven by several key assumptions:

- Solutions are designed to handle >700,000 units per day or 35,000 units per hour over 20 hours
- Average order profile of 8 units/order
# Summary of the Labor Analysis

<table>
<thead>
<tr>
<th>Labor</th>
<th>Daily FTE Required</th>
<th></th>
<th>Daily FTE Required</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Volume</td>
<td></td>
<td>Peak Volume</td>
<td></td>
</tr>
<tr>
<td>Primary Induct</td>
<td>29.54</td>
<td>29.54</td>
<td>67.37</td>
<td>67.37</td>
</tr>
<tr>
<td>Secondary Induct</td>
<td>22.98</td>
<td>0</td>
<td>52.40</td>
<td>0</td>
</tr>
<tr>
<td>Put to Put Wall</td>
<td>0</td>
<td>82.72</td>
<td>0</td>
<td>188.64</td>
</tr>
<tr>
<td>Pull from Put Wall</td>
<td>0</td>
<td>18.58</td>
<td>0</td>
<td>42.37</td>
</tr>
<tr>
<td>Pack – Auto bagger</td>
<td>42.25</td>
<td>42.25</td>
<td>96.36</td>
<td>96.36</td>
</tr>
<tr>
<td>Pack - Manual</td>
<td>7.46</td>
<td>7.46</td>
<td>17.00</td>
<td>17.00</td>
</tr>
<tr>
<td><strong>Total FTE Required Daily</strong></td>
<td><strong>102.23</strong></td>
<td><strong>180.55</strong></td>
<td><strong>233.13</strong></td>
<td><strong>411.74</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Average Day Volume</th>
<th>Peak Day Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate: Manual 2-Pass FTE/Day</td>
<td>180.55</td>
<td>411.74</td>
</tr>
<tr>
<td>Base: Automated 2-Pass FTE/Day</td>
<td>102.23</td>
<td>233.13</td>
</tr>
<tr>
<td>FTE/Day Delta</td>
<td>78.32</td>
<td>178.61</td>
</tr>
<tr>
<td>Months/Year</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Burden per FTE Cost/month</td>
<td>$3,590</td>
<td>$3,590</td>
</tr>
<tr>
<td><strong>Annual FTE Cost Delta</strong></td>
<td><strong>$2,530,519</strong></td>
<td><strong>$1,923,630</strong></td>
</tr>
</tbody>
</table>

Estimated additional annual labor cost for the Manual 2-Pass design: $4,454,149
Essential AI Checklist
Essential Fulfillment Checklist

✓ Do your homework on AI, Fulfillment & Sortation
Essential Fulfillment Checklist

✓ Identify problems to be solved, e.g. complex or labor intensive tasks
Essential Fulfillment Checklist

✓ Assign Value of Problem-Solving with AI
Essential Fulfillment Checklist

✓ Contact an Expert to Begin a Pilot Project
Key Takeaways

• In the near-term, consider impact of predictive analytics, smart-sortation and smart-fulfillment on your operations

• Follow the Checklist. Identify areas of your business where AI can be of value and effectively integrated.

• Partner with an expert for projects beyond internal capabilities.
For More Information

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