

Webinar: Material Handling 101



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Distribution Operations Analysis and Design (DOAD) Series

Material Handling 101 Fundamentals, Analysis and Selection

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Preview of our On-Site Course

O Day One –

- How to Attack Material Handling Problems
- Systematic Handling Analysis (SHA)
- Fundamental Principles & Concepts
- Warehousing Case Problem

O Day Two –

- Inbound Logistics & Handling
- Manufacturing Case Problem
- Workplace Handling & Ergonomics
- How to Select the Best Handling Methods

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About This Preview

- Not teaching how to; showing what we teach in our work course.
- Not fully-explaining each slide; just giving you an idea of what we cover.
- Going to move very fast; clicking through animations that we do slowly in class.
- Showing case exercises; not reading them.
- Time permitting, will show applications by users of the method we are teaching, incl. graduates of the class.
- Available for follow-up questions by email or phone. <u>www.RichardMuther.com</u> or 770-859-0161

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Notes	

<u>Main Points</u>

- 1. Many material handling problems can be resolved with common-sense instinct and experience. But when the scope is large, or the choices unfamiliar, this approach breaks down.
- 2. Universal problem-solving procedures can be used, such as those found in Continuous Improvement or Total Quality programs (also called "Lean" and "Six Sigma").
- 3. Surveys are an organized way to uncover opportunities.
- 4. Measurement of existing conditions can also reveal and define problems and opportunities for improvement.
- 5. Organized, systematic analysis is the best way to tackle large or complex projects.

Work Course Objectives

- 1. Provide formal training in material handling analysis
- 2. Boost your confidence when analyzing and justifying material handling investments
- 3. Improve the professionalism of your plans and proposals
- 4. Insulate you from industry fads and hype
- 5. Prepare you to lead material handling improvements

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Notes	

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How to Attack Material Handling Problems

- 1. Instinct & Experience
- 2. Universal Problem-Solving Procedure
- 3. Checklists, Rules, Principles
- 4. Measurement of Existing Conditions
- 5. Organized, Systematic Handling Analysis (SHA)

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Notes

- 1. Systematic Handling Analysis (SHA) is an organized universally applicable approach to any materials handling project.
- 2. SHA consists of:
 - Framework of Phases
 - Pattern of Procedures
 - Set of Conventions
- 3. SHA was first published in the 1960s by Richard Muther and Knut Haganäs. Its development and subsequent refinement reflects the experience of more than 1000 projects.
- 4. SHA is a companion to the well-known Systematic Layout Planning (SLP) also developed by Richard Muther.

				NDLIN	IG ANALYSIS	(SHA	.)	Cap	sule Summa	ry		
PHASES			S PLANS	ON				,1 ,2 ,3	INPUTS (PQRST) & HANDLING THEORY LAYOUT & ANALYSIS OF MOVES		MATERIAL CLASSIFICATION QUANTIFIED FLOW DIAGRAM & D-I PLOT	
PROCEDURE	MATERIALS HANDLING = (Analyz	e			4 5	KNOWLEDGE OF M.H. METHODS MODIFICATIONS & LIMITATIONS EVALUATION &		PRELIMINARY HANDLING PLANS PLANS ALTERNATIVE HANDLING PLANS	YZ
PRC	ANALYSIS Development -		Visual	Set Plan:	$\begin{array}{c} & & \\ & \\ \hline \\ & \\ \hline \\ & \\ \hline \\$	il & Install 6		↑ E	APPROVAL THIRD EDITION		HANDLING PLAN for this phase ok	
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	Process Chart Symbols & Action*	Identify Equipment & Space	Ident.	Black & White**	Explanations	Letter	Value	Lines	Material Moves	Code	Evaluating Description	ו
	Symbols & Action*	Identify Equipment & Space		White**	Explanations Intensity (I) = nP/t Designated by width		Value 4	Lines	Abnormally High Intensity of Moves	Code Red**	<u>Almost Perfect Results</u> (Excellent)	
S	Symbols & Action* Operation	Identify Equipment & Space Forming or Treating Equipment & Space Assembly, Sub-Assembly, Dis-Assembly	Ident. Green** Red**	White**	Explanations Intensity (I) = nP/t Designated by width of flow line Distance (D)	Letter	Value	Lines	Material Moves	Code	Almost Perfect Results	4
SNOI	Symbols & Action* * Operation * Transportation	Identify Equipment & Space Forming or Treating Equipment & Space Assembly, Sub-Assembly, Dis-Assembly Transport-related Equipment & Space	Ident. Green** Red** Orange Yellow**	White**	Explanations Intensity (I) = nP/t Designated by width of flow line Distance (D) Designated by length of flow line	A	Value 4	Lines	Material Moves Abnormally High Intensity of Moves	Code Red** Orange	Almost Perfect Results (Excellent) Especially Good Results	5 E
ENTIONS	Symbols & Action* Coperation Coperation Handling	Identify Equipment & Space Forming or Treating Equipment & Space Assembly, Sub-Assembly, Dis-Assembly Transport-related Equipment & Space Handling Areas Pick-up & Set-Down	Ident. Green** Red** Orange Yellow** Orange	White**	Explanations Intensity (I) = nP/t Designated by width of flow line Distance (D) Designated by length of flow line <u>Transport Work</u> (TW) TW = 1 x D = nP/t X D	A	Value 4 3	Lines	Material Moves Abnormally High Intensity of Moves Especially High Intensity of Moves	Code Red** Orange Yellow**	Almost Perfect Results (Excellent) Especially Good Results (Very Good) Important Results	6 E
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CONVENTIONS	Symbols & Action* Coperation Coperation Handling	Identify Equipment & Space Forming or Treating Equipment & Space Assembly, Sub-Assembly, Dis-Assembly Transport-related Equipment & Space Handling Areas Pick-up & Set-Down Storage Equipment	Ident. Green** Red** Orange Yellow** Orange Yellow** Orange Yellow**	White**	Explanations Intensity (I) = nP/t Designated by width of flow line Distance, (D) Designated by length of flow line <u>Transport Work</u> (TW) TW = I x D = nP/t X D Designated by area of flow line <u>Example</u> .	Letter A E I O U	Value 4 3 2 1 0 dotted) lir	Lines	Material Moves Abnormally High Intensity of Moves Especially High Intensity of Moves Important Intensity Ordinary Intensity Unimportant Moves of	Code Red** Orange Yellow** Green** Blue** Uncol- ored**	Almost Perfect Results (Excellent) Especially Good Results (Very Good) Important Results (Good) Qrdinary Results (Fair) Unimportant Results	4
CONVENTIONS	Symbols & Action* C Operation C Transportation Handling Storage Delay	Identify Equipment & Space Forming or Treating Equipment & Space Assembly, Sub-Assembly, Dis-Assembly Transport-related Equipment & Space Handling Areas Pick-up & Set-Down Storage Equipment and Space Set-down or Hold Areas Inspect, Test, Check Equipment	Ident. Green** Red** Orange Yellow** Orange Yellow** Orange Yellow**	White**	Explanations Intensity (I) = nP/t Designated by width of flow line Distance (D) Designated by length of flow line <u>Transport Work</u> (TW) TW = I x D = nP/t X D Designated by area of flow line	Letter A E I O U * Dash (o two rati	Value 4 3 2 1 0 dotted) lin ngs re (IMMS)	Lines	Material Moves Abnormally High Intensity of Moves Especially High Intensity of Moves Important Intensity Qrdinary Intensity Unimportant Moves of Negligible Intensity tes half a line, or half-way b y minus sign behind vowel	Code Code Code Code Code Code Code Code	Almost Perfect Results (Excellent) Especially Good Results (Very Good) Important Results (Good) Ordinary Results (Fair) Unimportant Results (Poor) Not Accentable Results	

- 1. Any material handling study involves three fundamentals:
 - a. <u>Materials</u> to be moved
 - b. Moves to be made
 - c. <u>Methods</u> of moving the materials.
- 2. Selection of methods should follow a systematic analysis of materials and moves.
- 3. By applying the three fundamentals *in the order shown* the material handling engineer assures better decisions and methods.

What Is Material Handling?



- The three fundamentals of Materials, Moves, and Methods can be related on a simple chart or table.
- 2. Columns represent each class of similar or common material.
- 3. Rows represent each route on which movement takes place.
- Individual moves are represented at the intersections of columns and rows – wherever a class moves on a route.
- 5. Methods are needed for each move.
- 6. Material handling analysis seeks the best set of material handling methods.

What Is Material Handling?



- 1. Equipment is only one aspect of a material handling method.
- 2. A method also includes its transport unit whatever is being physically moved.
- 3. A method includes the manner or system in which the move is made.
- 4. A material handling method is not completely described until all three aspects are decided or known.

Methods, Plans, and Systems

- Material handling *method:*
 - Handling equipment (E)
 - Transport unit
 - System of moves

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Notes

- By Material Handling Systems we mean the general way in which the different movements are tied together, both from a geographical and physical standpoint.
- 2. In a Direct System, materials move from origin to destination over the shortest practical path.
- 3. In a Channel System, materials move is a preestablished route and flow to destination together with other materials moving to or from other areas.
- 4. In a Central System, materials move from origin to a centralized sorting and/or dispatching area and then on to destination.

Classical Material Handling Systems



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<u>Notes</u>

- 1. SHA Pattern of Procedures is a five-section series of procedures resting squarely of the three fundamentals of *materials, moves* and *methods*.
- 2. The Pattern applies to both Phase II, Overall Handling Plan, and Phase III, Detailed Handling Plans.
- 3. The left-hand boxes of the pattern represent data collection and analysis.
- 4. The right-hand boxes represent synthesis and output of results.
- 5. The SHA Pattern requires that two or more alternatives be developed and evaluated before a plan is approved.
- 6. The more complicated the problem, the more useful and time-saving this pattern becomes.



S.H.A. in Action



Steps and key documents of Systematic Handling Analysis (SHA). The example is for the overall handling plan (Phase II) between departments in a pharmaceutical manufacturing plant.

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1. Key Input Data: P, Q, R, S, T

Analyzing Materials & Moves



- 1. Distance and intensity are the primary drivers of material handling cost.
- 2. Distance and intensity can be visualized as a flow diagram or as a plot.
- 3. Transport Work is the product of Intensity times Distance and approximates material handling cost.
- 4. In a Quantified Flow Diagram, the length of a flow line gives the Distance, the width gives the Intensity, and the area under the flow line is Transport Work.
- 5. In a Distance-Intensity Plot, the area "behind" a plotted points is Transport Work.
- The Quantified Flow Diagram and the Distance-Intensity Plot display the same information (Distance, Intensity, and Transport Work) in different ways.



Case Problem

Please review all pages of the case. Then use the information provided to prepare a Preliminary Handling Plan.

Homart Distributors

Homart distributes clothing and soft home goods from its central warehouse to over 70 branch retail stores. Large cartons and bundles are received, weighing up to 50 kilograms (about 100 lbs.) and are up to 1 meter (39 inches) cubed. A table of data showing the materials moved inside the building (in Kg./hour) is shown on RMA-7232-2. The company's situation is shown on RMA-7232-3.



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Homart					Classes of	f Materials				
Distributors Move Summary Data		Route	Dist. in m.	Tubs of Loose Items (a)	Bundles, banded & Firm (b)	Large Cartons (c)	Other Odd Items (d)	(e)	(f)	Transp. Work (g)
	1	1 2	10		20	42	3			
	2	1 3	16				1			
	3	1 7	60			5				
	4	2 4	45	3	5	2				
	5	2 5	65	5	8	7				
	6	2 6	88	1	4	10				
	7	3 2	6				1			
	8	4 9	20	9		1				
	9	5 9	40	14		6				
	10	6 9	60	5		10				
	11	7 9	25			5				
	12	8 11*	35				1*			
	13	9 10	20		20	25	5			
	14	10 11	10		20	25	5			
	15	11 12	40				5			
		Totals								

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- 1. The "cost-drivers" of distance and intensity result in four general classes of material handling equipment:
 - a. Simple handling
 - b. Simple travel
 - c. Complex handling
 - d. Complex travel
- 2. The Quantified Flow Diagram pictures distance and intensity and thus suggests the appropriate general class of equipment.
- 3. When general classes are overlaid on technical classes, the result is a general guide to equipment selection.
- 4. Such a guide is only as complete as the builder's or user's knowledge and understanding of material handling equipment.
- 5. Research and added experience will always increase the choices available.

Guide to Materials Handling Equipment Selection

Type Shape-of-Line	Vehicles	Conveyors	Cranes/Hoists	Combinations/ Others
Short Thin Line • Simple (Inexpensive) Handling Equipment	مو مو مو مو مو	× ∞ ∞ Ø		ᢞᠧᢆᢔ
Long Thin Line Simple (Inexpensive) Travel Equipment	8-0 ≥-			, M N
Short Thick Line Complex (Expensive) Handling Equipment		B	لی ^{کر} لی لی لا کر	
Long Thick Line Complex (Expensive) Travel Equipment	₿ ₽ ₽		᠂᠋ᠧ᠃ᠮ	
Basic components include: Note: This does not cover all po quantities, and routes. It relates cranes (hoists).	ossible handling metho		what to consider for	
RICHARD MUTHER - 1241-ppt F	From: SIMPLIFIED SYSTEM	ATIC HANDLING ANALYSIS	, R. Muther et al., Mgmt. & Ir	d'l. Research Publications
<u>Notes</u>				

TIE-IN SHEET

Plant

Date

By

Project

With

Sheet

_____ of _____

Alternative Plan

\sim	PRODUCT-															
	MATERIAL															
ROUTE		S	E	Т	S	Е	Т	S	Е	T	S	Е	T	S	Е	Т
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																$\overline{\}$

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- 1. In Section 5 of the SHA Pattern, alternative plans are evaluated on costs and intangible factors or considerations.
- 2. SHA uses a vowel-code convention to rate the performance of each plan on each of several weighted factors.
- 3. Vowel code ratings are converted to points and multiplied by factor weights to arrive a scores. These are totaled for each plan.
- 4. A plan must score 15% better than the next highest alternative to be considered better.
- Plans receiving an "X" (Not acceptable) rating on any factor are removed from consideration unless the objectionable feature can be eliminated or corrected.
- 6. In the example here, Plan A is the clear winner, but the others are comparable. Costs and payback are considered separately. To be selected, Plan A must provide an acceptable financial return. And a less desirable alternative could be chosen on the basis of better financial results.

	Project	Material H	andling Sys	stem	Date 6/2	
Weights set by Rl, RM, RW Tally by LH Ratings by <u>Plan Team</u> Approved by EVALUATING DESCRIPTION A Almost Perfect O Ordinary Results E Especially Good U Unimportant I Important X Not Acceptable	Desc Ente A. B. C.					
	E.					
	WT.		B	ALTERNATI C		Е
FACTOR / CONSIDERATION 1 Utilization of space	3	A E 9	A 12	E 9	D - A - 12	E
2 Break-down & maintenance problems	8	E 24	A- 28	0 8	E 24	
3 Flexibility (New products; higher volumes)	7	E 21	A- 25	1	E 21	
4 Installation problems	4	7 8 A	E- 10	0 4 A	8	
5 Ease of supervision	9	36	18	36	18	
6 Ability to meet peak requirements	10	A 40	E 30	A 40	A- 35	
7 Working conditions & safety	10	A 40	1 20	E 30	1 20	
0						
20			-			
Totals		178	143	141	138	
teference Notes: a. b.	•	d. e.				
с.		f.				

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<u>Notes</u>

Please read all four pages of the case problem and then answer the questions that follow.	

Case Problem

Shipping	Receiving	FlexiFab, II	1 c.
Finished Storage	In-Storage	The General Manager bel may be possible to reduce handling cost by changing layout. He has asked you the current material flow s and a proposed forklift ad	material g the plant to review situation
	Machine		Service
Press	_		
		Assemble	Test

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Case Problem

Please read all four pages of the case problem and then answer the questions that follow.

On this page, please fill in the empty column on the right with total flow intensity.

Note: You must first decide on a unit of measure for total flow.

Current Flows		Mate	rials*	
	Distance	Pallet Loads	Trays/Pans	
Route	In Feet	Per Day	Per Day	
Flow in one direction				
1. Receiving – In Storage	150	20		
 In-Storage – Press In Storage – Machine 	350 240	20 5		
4. Press – Machine	300	30		
5. Machine – Assemble	150	35		
6. Press – Assemble7. Assemble – Finished Storage	290 500	10 35		
8. Finished Storage – Shipping	180	35		
9. Machining Shipping	375	10	20	
Flow in both directions				
10. Test – Press	460		10	
11. Test – Machine	260		10	
12. Test – Assemble 13. Test – In Storage	160 560	 10	15	
13. Test – In Storage 14. Service – Press	530		20	
15. Service – Machine	230		25	
16. Service Assemble	240		20	

Pallets are used to transport all raw and work-in-process. Trays of various sizes are used, but are generally 12" x 18". Pans are about the same but deeper. Assume 5 trays/pans equal one pallet load.

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<u>Notes</u>		

FlexiFab continued...

Shipping Finished Storage	Receiving In- Storage	Layout Change	
	Machine		Service
Press		Assemble	Test

Could material handling be reduced by improving the current layout? What techniques might be used to compare alternative plans?



Additional Forklift Is an additional forklift necessary? How might the productivity of existing trucks be improved? What techniques might be used to arrive at an answer?



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TIE-IN SHEET

Plant

Date

By

Project

Sheet

With

____ of ____

Alternative Plan

	PRODUCT- MATERIAL															
ROUTE		S	Е	Т	S	Е	Т	S	Е	Т	S	Е	Т	S	Е	Т
1																
2																
3																
4																
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<u>Main Points</u>

- Many line-feeding and cell delivery systems are indirect – meaning that a route is traveled to serve two or more line stations, cells, or drop zones feeding line stations or cells.
- 2. Deliveries from an intermediate storage area, (stock room or supermarket) are inherently indirect, central systems in which items are received from multiple sources and typically dispatched to multiple places along a line or in cells.
- 3. Choice of system is driven by such considerations as:
 - a. Distance and travel time.
 - b. Space constraints or other conditions at point of use.
 - c. Types of equipment used or needed in storage and for travel to lines or cells.
 - d. Organizational structure and responsibilities for material handling.
 - e. Availability of labor in line or cell (e.g. idle time to replenish).
 - f. Operational availability and balance. (Is material handling always available?)

Indirect Systems for Line-feeding and Cell Delivery



- As each project runs its course – from initial stated objective to installed physical reality – it passes through four sequential and phases. For best results, the phases should overlap.
- 2. Phase I and Phase IV are frequently not part of the material handling engineer's specific problem. In a sense, they "frame" the strictly planning phases II and III.
- 3. Phase I considers situations and conditions *outside* our problem area, over which we may have little or no control. Yet these "externals" may influence or constrain our plans in Phases II and III.



- 1. The acronym PFEP stands for "Plan for Every Part" and is popular among disciples of the Toyota Production System.
- 2. Each part gets delivered somehow. But rarely does a document (i.e. Material Handling Plan) describe all aspects of its containment, movement, and storage.
- 3. When engineering lean material handling systems, it is essential to document the replenishment of each part or item.
- 4. Ideally, the planner should have all of the data elements listed on RMA L-2224.
- 5. An electronic database will be useful in maintaining this large amount of information.
- To develop a plan for every part, it is wise to follow Systematic Handling Analysis (SHA) and work "top down." First establishing the overall plan for major classes of materials or parts. Then work out the details of each part or item within the methods planned for its class.



MOVEMENT SUMMARY MOVE MEASUREMENT

MATERIAL

Intensity of Material Movement

recorded in Equivalent Pallets

SHA Application Retail DC: 800K Sq. ft. 66 routes

				\cup				Tecolu										-	
MAT	ERIA	L CLASSES		-		а	l	D	0	2	0	b	6	e		f	ROUTE	TOTAL	
<u>o</u> .	No.	ROUTES Activity Name		ituation	Pal	up 1 lets	Pal	up 3 lets		ked ses	Pic Inne Eac	rs &	Carl	ked tons	Err Pal	ks of npty lets	Intensity in	Transport Work in	
Route No.	Activity No.	From - To Both Directions	Distance in	Physical Situation	Intensity, Condition	Rating, T.W.	(Equiv.) Pallets	Pallet Feet per Day	RATING										
1	1	Receiving	299		68	Е	0		0		0		0		0		68		
		Special Processing	299			20332		0		0		0		0		0		20332	
2		Receiving	720		0		13	0	0		0		0		0		13		0
<u> </u>		Other Group 3			123	0	0	9360	0	0	0	0	0	0	0	0	123	9360	
3		Receiving NE/NS Pallet Pick	247			E 30381		0		0		0		0		0		30381	Е
4		Receiving			10	0	0	Ū	0	Ū	0	Ŭ	0	Ū	0	0	10		
		NE/NS Case Flow	1,070			10700		0		0		0		0		0		10700	0
5	1	Receiving	845		4	U	0		0		0		0		0		4		U
	13b	NE/NS <carton each<="" td=""><td>043</td><td></td><td></td><td>3380</td><td></td><td>0</td><td></td><td>0</td><td></td><td>0</td><td></td><td>0</td><td></td><td>0</td><td></td><td>3380</td><td>0</td></carton>	043			3380		0		0		0		0		0		3380	0
6	1	Receiving	229		174	А	0		0		0		0		0		174		Е
		NE/NS Reserve			29	39846	0	0	0	0	0	0	0	0	0	0	29	39846	
7		Receiving	623		- 29	0	0		0		0		0		0		29		0
		Seasonal			43	18067	0	0	0	0	0	0	0	0	0	0	43	18067	
8		Receiving	152		43	I					0		0				43		0
		Fragile			7	6536	0	0	0	0	0	0	0	0	0	0	7	6536	
9		Receiving	617			U											,		υ
		Secure			15	4319	0	0	0	0	0	0	0	0	0	0	15	4319	
10		Receiving	502			0			0		0		0		0		10		0
	23	Store Replenishment				7530		0		0		0		0		0		7530	
	М	ATERIAL	Intensity	у	473		13		0		0		0		0		486	\ge	
		LASS TOTAL	Transp.	Work		14 109 1		9360		0		0		0		0	\times	150451	
			Rating		A		0		Е		0		U				C	heck Tota	s

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SHA Application Retail DC: 800K Sq. ft. 66 routes

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4 ELFA G1 Pallet Pick			4215		0		0		0		0		0		4215				13b NE/NS <carton each<="" td=""><td></td><td></td><td></td><td>0</td><td>(</td><td>)</td><td>0</td><td></td><td>247</td><td></td><td>•</td><td></td><td>0</td><td></td><td>247</td><td>-</td></carton>				0	()	0		247		•		0		247	-
13 2 ELFA Receiving	207	0		3	U	0		0		0		0		3		U		40	11 NE/NS Pallet Pick	234		0		0	-	3 U	0		0		0		3		υ
5 ELFA G3 Pallet Pick	207		0		621		0		0		0		0		621	0			25 Fulfillment Pack		_		0	(702		0		0		0		702	-
14 2 ELFA Receiving	165	2	U	2	U	0		0		0		0		4		U		41	12 NE/NS Case Flow	543		0		0	4	18	0		0		10	0	58		
6 SK G1&3 Pallet Pick	105		330		330		0		0		0		0	1	660	0		1	23 Store Replenishment	0.0			0)	2606	4	0		0		5430		31494	
15 2 ELFA Receiving		1	U	0		0		0		0		0		1		·	1	42	13a NE/NS <ctn inner="" sm<="" td=""><td>438</td><td></td><td>0</td><td></td><td>0</td><td></td><td>0</td><td>29</td><td>0</td><td>0</td><td></td><td>6</td><td>U</td><td>35</td><td></td><td>0</td></ctn>	438		0		0		0	29	0	0		6	U	35		0
7 ELFA Case Flow	220		220		0		0		0		0		0	1	220	U		-	23 Store Replenishment	430			0	()	0		12702		0		2628		15330	Ŭ
16 2 ELFA Receiving		42	F	0		0		0		0		0		42				43	13a NE/NS <ctn inner="" sm<="" td=""><td>240</td><td></td><td>0</td><td></td><td>0</td><td></td><td>0</td><td>3</td><td>U</td><td>0</td><td></td><td>0</td><td></td><td>3</td><td></td><td></td></ctn>	240		0		0		0	3	U	0		0		3		
9 ELFA/SKAN Reserve	377		15834		0		0		0		0		0		15834	0			25 Fulfillment Pack	240			0)	0		720		0		0		720	U
		28	0	0		0		0	<u> </u>	0	Ť	0		28	10004			44	13b NE/NS <carton each<="" td=""><td></td><td></td><td>0</td><td>-</td><td>0</td><td></td><td>0</td><td>5</td><td>U</td><td>0</td><td></td><td>0</td><td></td><td>5</td><td></td><td></td></carton>			0	-	0		0	5	U	0		0		5		
17 2 ELFA Receiving 20 Corrugated	89		2492		0		0		0		0		0		2492	0			25 Fulfillment Pack	275			0		,	0		1375		0		0		1375	U
		78	E	0	0	0	0	0	-	0	-	0	0	78	2492			45	13c_NE/NS <ctn inner="" lg<="" td=""><td></td><td>- 1</td><td>0</td><td>-</td><td>0</td><td></td><td>0</td><td>16</td><td>0</td><td>0</td><td></td><td>3</td><td>U</td><td>19</td><td>1010</td><td></td></ctn>		- 1	0	-	0		0	16	0	0		3	U	19	1010	
18 2 ELFA Receiving	74										0					1		140	23 Store Replenishment	472			0			0		7552		0		1416		8968	0
22 IRIS Crossdock		19	5772	12	0	0	0	0	0	0	0	0	0	31	5772	-		<u> </u>			-1	0	-	0	_	0	1	U	0	-	0	1410	1	0900	
19 2 ELFA Receiving	270		0		0											0		40	13c NE/NS <ctn inner="" lg<="" td=""><td>427</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>427</td><td></td><td>0</td><td></td><td>0</td><td></td><td>407</td><td>U</td></ctn>	427								427		0		0		407	U
34 Floor Stack		9	5130	0	3240	0	0	0	0	0	0	0	0	9	8370	-			25 Fulfillment Pack			107	0	0		0	0	427	0	0	0	0	107	427	
20 3 Special Processing	1,033	-	U											Ť		U		47	14 NE/NS Reserve	485	-		E											51895	Е
4 ELFA G1 Pallet Pick		6	9297	0	0	0	0	0	0	0	0	0	0	6	9297	-	-	\vdash	11 NE/NS Pallet Pick		-	38	1895	0	_	0	0	0	0	0	0	0	38	51895	
21 3 Special Processing	748		U					0				0		Ů		U		48	14 NE/NS Reserve	909													00		0
11 NE/NS Pallet Pick		44	4488	0	0		0	0	0	0	0	0	0	44	4488		-	\vdash	12 NE/NS Case Flow		_		4542	0		0	0	0	0	0	0	0	31	34542	
22 3 Special Processing	374	44	1			0						0		44		0		49	14 NE/NS Reserve	560		51	0										51		0
14 NE/NS Reserve			16456		0		0		0	-	0		0		16456				13a NE/NS <ctn inner="" sm<="" td=""><td></td><td>_</td><td>17</td><td>7360</td><td>0</td><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>17</td><td>17360</td><td></td></ctn>		_	17	7360	0		0	0	0	0	0	0	0	17	17360	
23 3 Special Processing	671	1	U	0		0		0		0		0		1		U		50	14 NE/NS Reserve	752	_	17	0										17		0
15 Seasonal			671		0		0		0		0		0		671	Ŭ		┶	13c NE/NS <ctn inner="" lg<="" td=""><td></td><td></td><td></td><td>2784</td><td>(</td><td>· .</td><td>0</td><td></td><td>0</td><td></td><td>0</td><td></td><td>0</td><td></td><td>12784</td><td></td></ctn>				2784	(· .	0		0		0		0		12784	
24 4 ELFA G1 Pallet Pick	162	0		0		48	1	0		0		10	0	58				51	11 NE/NS Pallet Pick	89		0		0	23	32 A	0		0		46	1	278		A
23 Store Replenishment	102		0		0		7776		0		0		1620		9396				23 Store Replenishment				0			2064	в	0		0		4094		24742	
25 5 ELFA G3 Pallet Pick	283	0		0		2	U	0		0		1	U	3		u		52	14 NE/NS Reserve	893		18	0	0		0	0		0		17	0	35		0
8 ELFA Broken Case	203		0		0		566		0		0		283	1	849	0			23 Store Replenishment	035			6074)	0		0		0	1	15181		31255	Ŭ
26 5 ELFA G3 Pallet Pick	242	0		0		18	0	0	Í	0	Í	4	U	22		0		53	15 Seasonal	273		0		0	1	0	17	0	0		6		34		0
23 Store Replenishment	242		0		0		4356		0		0		968	1	5324	0			23 Store Replenishment	213			0)	3003		4641		0		1638		9282	
27 6 SK G1&3 Pallet Pick		0		0		2	U	0		0		1	U	3			1	54	15 Seasonal	233		0		0		0	2	U	0		0		2		
8 ELFA Broken Case	336		0		0		672		0		0		336	1	1008	U			25 Fulfillment Pack	233			0)	0		466		0		0		466	U
28 6 SK G1&3 Pallet Pick		0	-	0	-	4	U	0	-	0	-	1	U	5		-	1	55	16 Fragile			0		0	(0	0		0		0		0		
23 Store Replenishment	188		0		0		752		0		0		188		940	U			16 Fragile				0)	0		0		0		0		0	U
29 7 ELFA Case Flow		0	Ŭ	0	Ŭ	2	U	0		0	Ť	0	100	2	040	+	-	56	17 Secure		-	0	-	0		2 U	4	U	0		1	U	7		
23 Store Replenishment	187		0		0		374		0		0		0		374	U		1‴	23 Store Replenishment	646			0			1292		2584		0		646		4522	U
		0	-	0	0	10	0	0	-	0	0	2	U	12	3/4	-		57			- 1	0		0	,		1	U	0	0	0	040	1	4522	
30 8 ELFA Broken Case 23 Store Replenishment	450		0		0		4500				0		900		5400	0		⊣ "	17 Secure 25 Fulfillment Pack	338	-		0					338		0		0		338	U
		0	0	0	0	1	4500 U	0	0	0	0	0	900	1	5400							0		0	·	2 U	0	330	0	0	0	0	2	330	-
31 8 ELFA Broken Case	427				_											U		58	20 Corrugated	494						988		0						000	U
25 Fulfillment Pack		11	0	0	0	0	427	0	0	0	0	0	0	11	427			-	8 ELFA Broken Case			0	0	0) 2	07	0	0	0	0	5	0	32	988	
32 9 ELFA/SKAN Reserve	396		0													0		59	20 Corrugated	364	-					0						U			0
4 ELFA G1 Pallet Pick		0	4356	7	0	0	0	0	0	0	0	0	0	7	4356			+	23 Store Replenishment			0	0	0		9828	0	0	0	0	0	1820	32	11648	
33 9 ELFA/SKAN Reserve	320				U											U		60	21 Store Bays/Supplies	1,062						0									0
5 ELFA G3 Pallet Pick		4	0	0	2240	0	0	0	0	0	0	0	0	4	2240	-	-	-	23 Store Replenishment			70	0	0		3398	4 0	0	0	0	0	0	78	33984	
34 9 ELFA/SKAN Reserve	374		U											1		U		61	22 IRIS Crossdock	211			E										,0		
6 SK G1&3 Pallet Pick		1	1496	0	0	0	0	0	0	0	0	0	0	1	1496	_	4	\vdash	23 Store Replenishment		-	0	6458	0		0	0	0	21	0	0	0	21	16458	
35 9 ELFA/SKAN Reserve	401		U	0		0		0		0		0				U		62	25 Fulfillment Pack	77							0		21	0	0		21		0
7 ELFA Case Flow		10	401	-	0	6	0	0	0		0	_	0	0.0	401				27 Parcel/LTL Shipping				0	(0		0		1617	-	0		1617	
36 9 ELFA/SKAN Reserve	710	19	0	0		0		0		0		4	U	23		0		63	26 Wholesale Pack	94		0		0		0	0		0	?	0		0		υ
23 Store Replenishment			13490		0		0		0		0		2840		16330	Ľ			27 Parcel/LTL Shipping				0	(0		0		0		0		0	
37 10 Other O		0		0		10	0	0		-		<u> </u>		10		0		64	34 EL	L(14	~	0		0	0		-		0		14		0
																Ľ		1	A FIEA CA Dellet Dev	• •															

RICHARD MUTHER & ASSOCIATES - D-2268a-ppt

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SHA Application Manufacturing: 350K sq.ft. Metal Fab

SYSTEMATIC ENGINEERING	MATERIAL MOVE METHOD	}		By HK	nt 3 Welding Ent Project With	R-11118		MOVE METHOD	T -	Plan By	Plant 3 Welding Ent. P HK V	Projec <u>R-11118</u> Nith LH
TIE-IN SHEET		Alternative			30/2011 Sheet	of	TIE-IN SHEET		Alternative #	Date		Sheet 3 of 4
MATERIAL CLASSES	Cass identa	Class Ident. b Dolly: Large, oversized	Cass Kent_C	Class ident. d	Cass dent	Class ident Wible bads >8 to12 on	MATERIAL CLASSES	Class Ident Contained parts (Tubs,	Class ident. h Mixed bads (Small	Class IdentClass Ident Kits & Kit Carits Fix tures	Cass dent	Class ident
	Extra Long	Manufa otu red	Description	parts/webments/ assembles	assembly (pallet or each)	palets or racks	e z z ROUTES Activity Name	pallets, orates, Gay birds, ceneral	cartons, KLTs, Totes)		Description	Description
Prom - To Both Directions		SE T	SE T	×.SE T	SE T		Prom-To 2 Structure 2 Struct	S E T	S E T	S E T S E	T S E	T SE T
1 Entrance 2 Supermark et (Piece	ੱ ⁸ ਾਟਾ 1			₽₿₿	▋▞▓	<mark>₽ 8</mark>	1 _1 Entrance 2 Supermark et (Piece	╔╴ <u>┣</u> ╹╻				
2 1 Entrance 4 LSB Sub Weld,							2 <u>1</u> Entrance 4 LSB Sub Weld,		K R M			
3 1 Entrance 3 LSB Cutter Sub-Asy							3 1 Entrance 3 LSB Cutter Sub-As y		K R M			
4 1 Entrance							4 1 Entrance		K RU M			
5 1 Entrance							5 1 Entrance					
6 1 Entrance							6 1 Entrance		K M			
7 LSB Axle & Weld Pobol 2 Arm 7 1 Entrance	\blacksquare	8			\blacksquare		7 LSB Axle & Weld Bobol & Acu 7 1 Entrance				71	
LSB Sub Weld (Top Entrance							8 LSB Sub Weld (Top					
S LSB Tongue, Floor,							9 LSB Tongue, Floor, 9 1 Entrance					
10 SSB Main Frame							10 SSB Main Frame					
10 1 Entrance							11 RB & LSB Door,					JEAS
11 1 12 RB Pick-up, Shield,							11 1 12 RB Pick-up, Shield, 12 Kinisa ISB Comm				- HIC	
12 1 Entrance 13 RB Welding – Pick-							12 <u>1</u> Entrance 13 RB Welding - Pick-	ਾ ਲਾ ਹ	<mark>⊡:</mark> ØJ <mark>™</mark>			
13 1 Entrance 14 Draper Support Weld							13 1 Entrance 14 Draper Support Weld	8 -0				
14 <u>1</u> Entrance 15 Dynaflex and/or							14 1 Entrance 15 Dynaflex and/or	╔╓	× B P P			
15 1 Entrance 16 Cornhead Sub-Weld							15 1 Entrance 16 Cornhead Sub-Weld					
16 <u>1</u> Entrance 17 Corn Head Mainframe	DI						16 _1 Entrance 17 Corn Head Mainframe		K R M			
17 Entrance							17Entrance					
18 1 Entrance							18 1 Entrance					
19 3 Point Mower Weld 19 1 Entrance 20 Rotary Head Sub-							19 3 Point Mower Weld 19 1 Entrance 20 Rotary Head Sub-		K			
20 1 Entrance							20 1 Entrance					
21 Sickle Reel Welding							21 Sickle Reel Welding					
1RICHARDM 17 1 Entrance	101701+1ER & /		E® D-226	Ba-ppt	0 0	0	0 287	200.9 0 0	0 2.15	617.1 ALL RI U 0 2	GHIS RESE	RVE96
	351						d					

Webinar: Material Handling 101



Lee Hales

Instructor, Georgia Tech Supply Chain & Logistics Institute President, Richard Muther & Associates <u>www.RichardMuther.com</u>

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