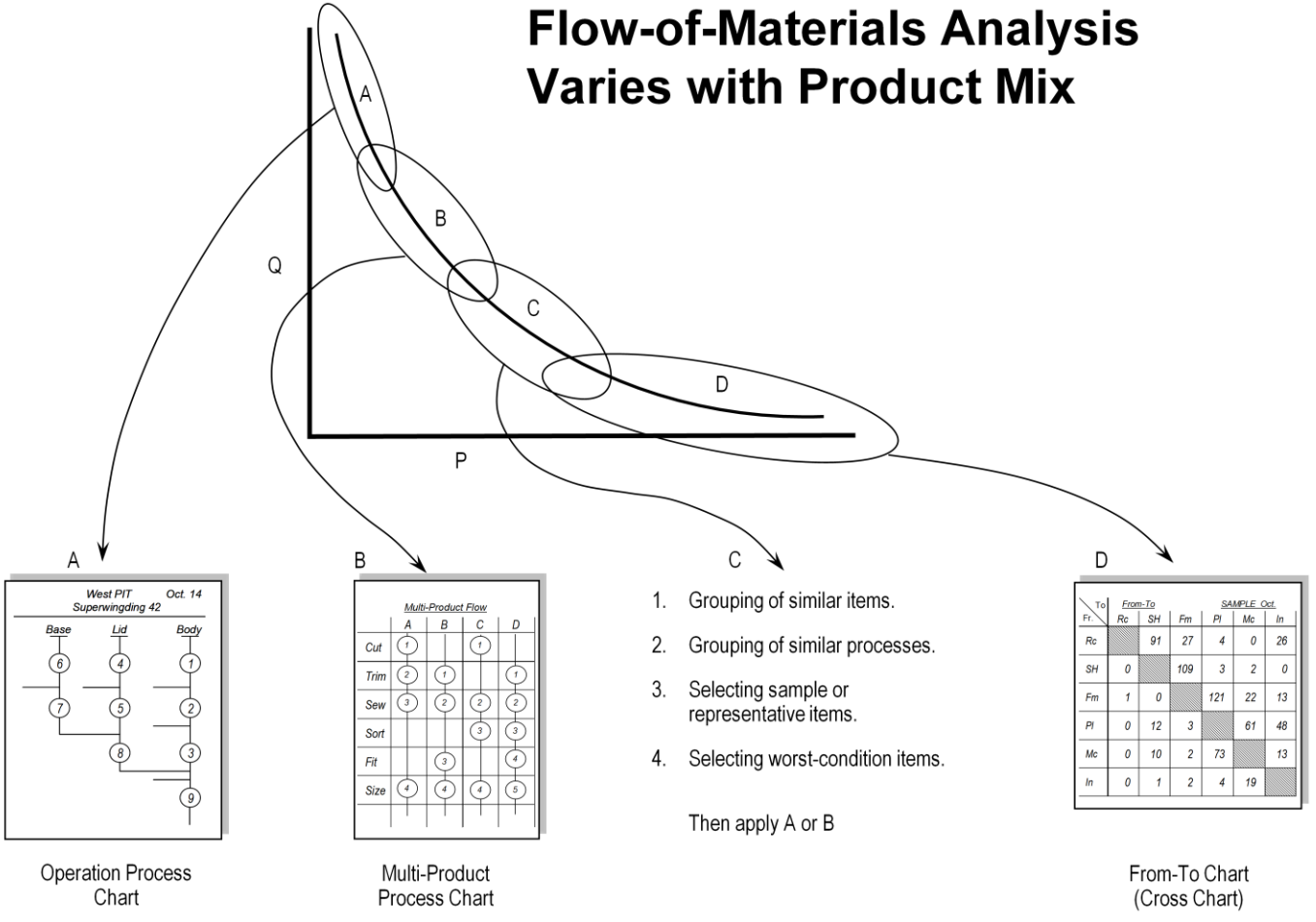
Systematic Layout Planning (SLP)

Four Ways to Analyze Flow of Materials

Main Points

1. Besides being a direct aid in planning a layout, the P-Q Chart is a guide to the type of flow analysis to use.
2. A plant having only a few high-volume items (A) will analyze its flow by the Operation Process Chart.
3. When several such charts are necessary for a given project, it becomes difficult to integrate these charts. Therefore, for several high-volume items (B), a Multi-Product Process Chart is a better technique for flow analysis.
4. When many items are involved (C), we follow still another course of analysis – selecting or grouping. Either we group the items – usually by like products or like equipment characteristics – or we select representative, sample, or "worst-condition" items, and then apply one or the other of the two techniques above.
5. Finally, if the project involves a great many diversified items of relatively small volume each (D), we use the From-To Chart-or Cross Chart

Flow-of-Materials Analysis Varies with Product Mix



Operation Process Chart

Multi-Product Process Chart

From-To Chart (Cross Chart)

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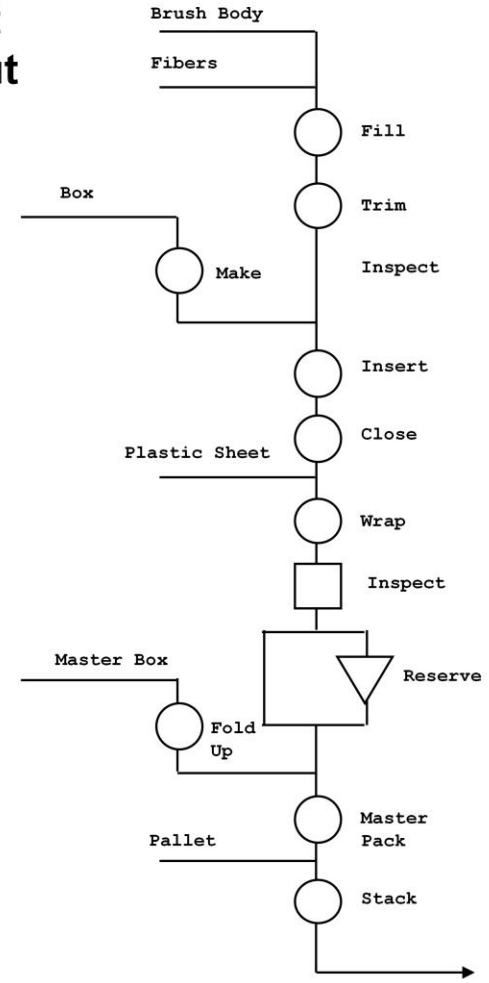
2

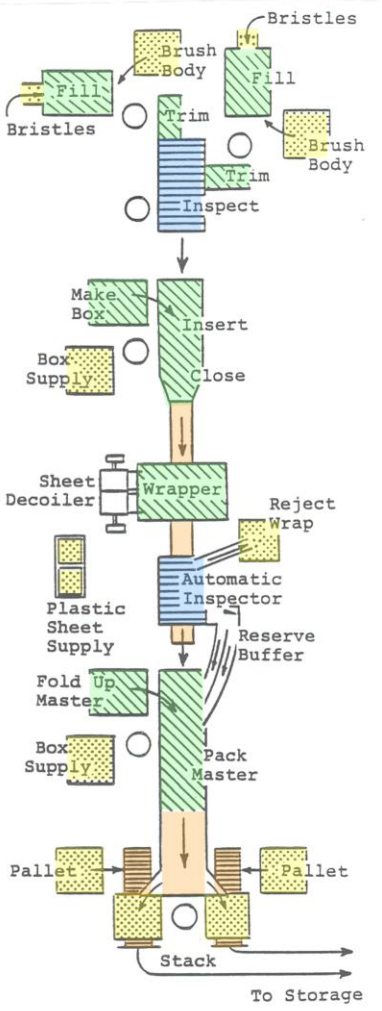
Notes

Main Points

1. When flow dominates the layout relationships, as it does in most manufacturing cells and in production lines, the operation process chart pictures the layout and is almost a layout in itself.
2. In this example, the process chart on the left is for making, sorting, and packing hair brushes. The actual layout is on the right.

The Process Chart Pictures the Layout





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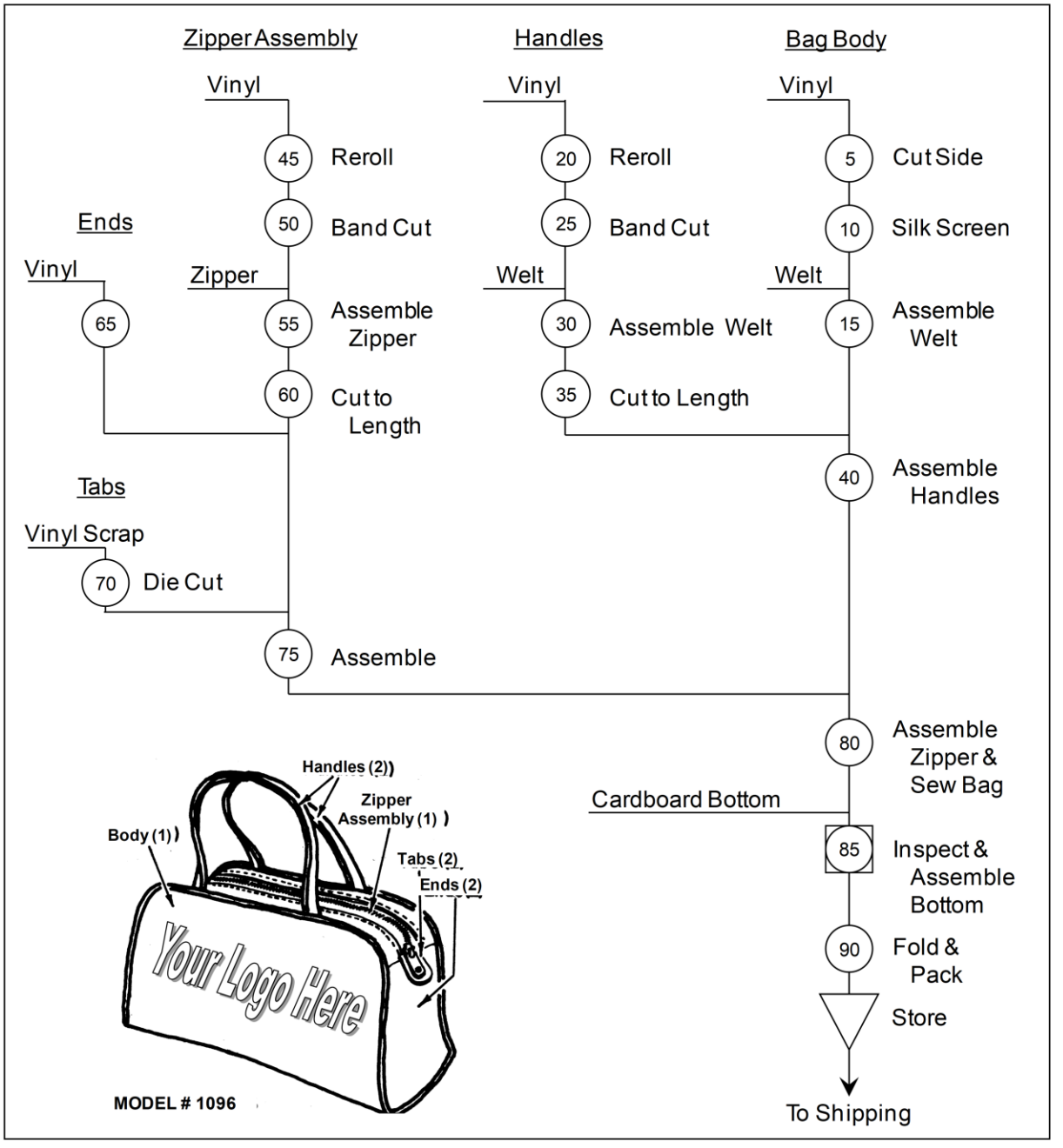
3

Notes

Operation Process Chart

Operation Process Chart showing the chronological sequence of operations and how and where the components go together.

With the exception of the final storage, only operations and inspection are shown. Intermediate delays, transports, handlings or storages do not appear.



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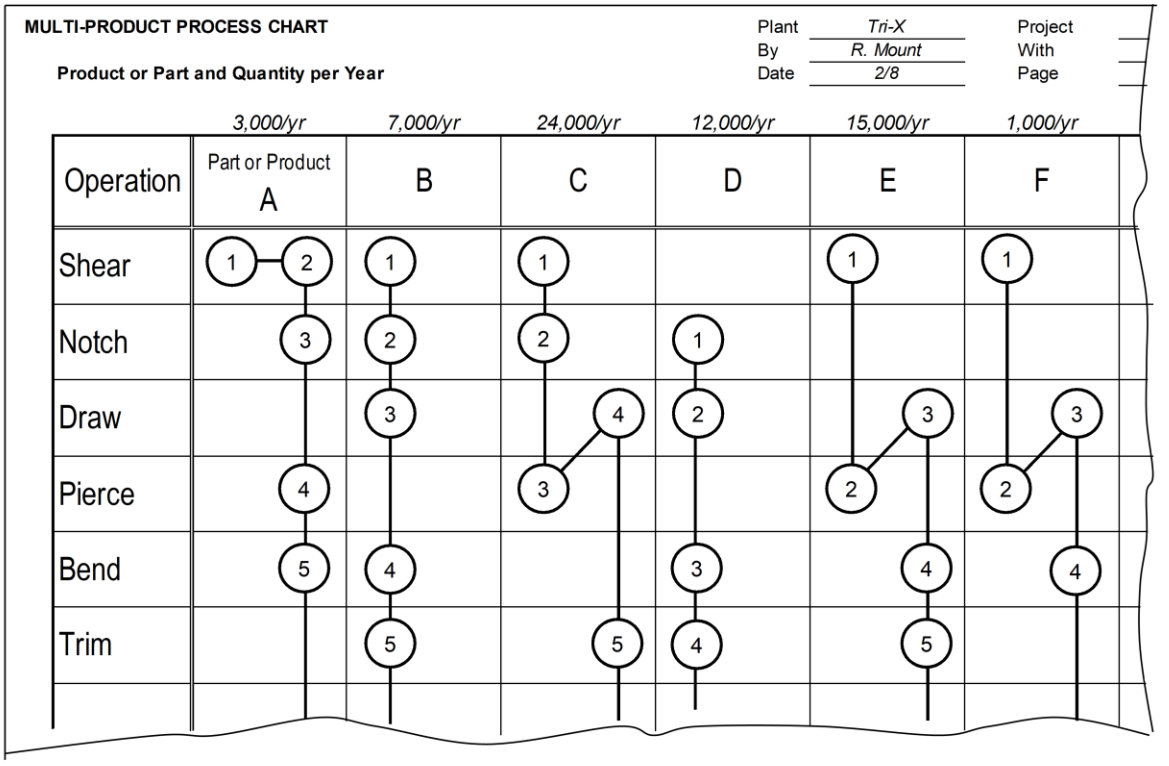
Multi-product process charts

Questions

1. Horizontal rows _____
2. Vertical columns _____
3. Vertical line connecting operations _____
4. Purpose of this chart _____
5. Operation 1 and 2 for Prod. A _____ _____
6. Sequence of operations 3 to 4 for Prod. C. _____
7. Why "Quantity per Year?" _____
8. Which product has greatest intensity of flow? _____ _____
9. Why? _____
10. What is the total intensity of flow between Notch & Pierce? _____
11. Can the arrangement of work areas be improved in sequence? _____
12. Other factors _____



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Notes

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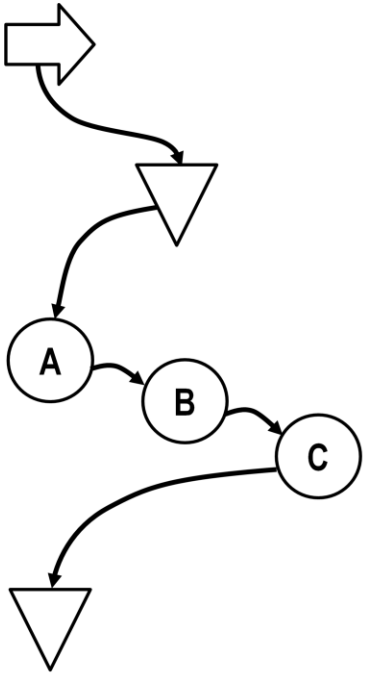
_____

Main Points

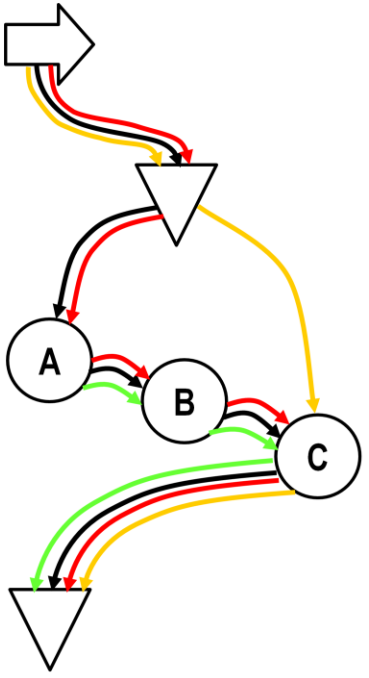
1. When the number of items to be charted reaches somewhere between 30 and 50, grouping or selecting become necessary.
2. To simplify the analysis, consider grouping items that are alike in design or process, or that begin and end at the same operations, or which pass through certain key operations.
3. Such grouping may lead to cellular layout by "group of parts" which can be very effective.
4. When grouping is impossible or impractical, select a sample of representative parts.
5. Samples may be based on various criteria such as every 100th part (a cross-section of all parts); items ordered on various types of orders, or day, week, or month. Or, possibly a random sample.
6. Another approach is to select "worst condition" items on the assumption that if the resulting layout can handle these, it can handle them all.,
7. Characteristics to consider: Heaviest, Largest, Most awkward to handle, Greatest quantity, Worst quality, Highest cost…
8. When there are a great many items and none are particularly dominant in terms of quantity, the best approach may to use a From-To Chart in stead of a Process Chart.

Increasing Complexity in Flow of Materials Analysis



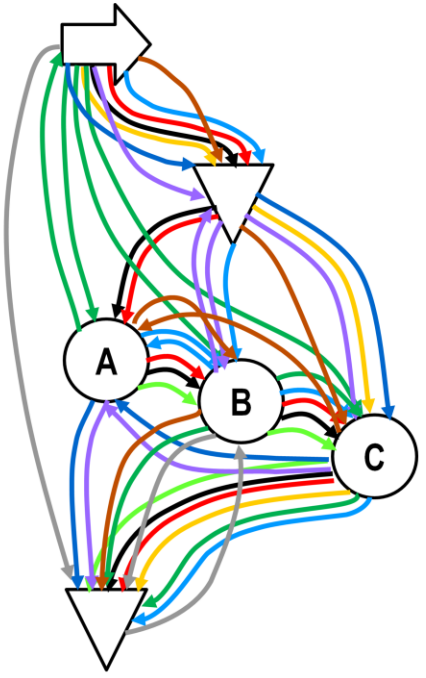
One or a few products (or parts or materials) with common routing.

Record with operation or flow process chart.



Several products (or parts or materials) with similar routing.

Record on multi-product process chart.



Many diverse products and routings.

Group or sample in some way to simplify, then use operation or flow process chart, or multi-product process chart, or

Summarize numerically on From-To Chart.

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Notes

FROM-TO-CHART

Plant _____ Project _____

By _____ With _____

Item(s) Charted: _____ Basis of Values: _____ Date _____ Page _____ of _____

Activity or Operation **TO** / Activity or Operation **FROM**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	**TOTAL**
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					
16																					
17																					
18																					
19																					
20																					
TOTALS																					

NOTES:

Main Points

1. When the materials are uniform or moved in the same way, the From-To Chart can be populated loads or moves per time period – typically per hour, per shift, or per day.
2. Annual moves may also be used and will be less sensitive to seasonal or other calendar-driven variability.
3. "Trips" are a function of material handling method, and the method may not yet be known or firm. And if conveyors are used, "trip" becomes a confusing unit of measure.
4. For these reasons, it is generally better to measure the movement of materials rather than the movement of handling equipment.
5. In this example, all moves are made by fork lift and the flow unit is thus a fork-lift load.
6. This is acceptable if fork lifts will continue to be used, or if the loads themselves are equally "transportable" and would still be moved as loads by other means.

From-To Chart Uniform Materials

FROM-TO-CHART

Plant: *Manchester* | Project: *Plant Layout*
By: *SLP Team* | With: *RMA*
Date: *5/7* | Page: *1* of *1*

Item(s) Charted: *All Material Classes*

Basis of Values: *Fork Lift Loads per Day* *+3 year forecast*

No.	Activity or Operation FROM / TO — Name/Description	1 Bulk Tanker Unloading	2 Tank Farms	3 Receiving	4 Outdoor Warehouse	5 Indoor Chemical Storage & IBCs	6 Raw & Pack	7 Label Storage	8 Molding Operation	9 Molded Bottle Storage	10 Cleaner Formulation	11 Premix Formulation	12 Chem Treatment	13 Multi-Size Line	14 One-Liter Line	15 Two-Liter Line	16 Future Line	17 Four-Liter Line	18 Flexible Pack	19 Specials	20 Promtional Packaging Area	21 Palletizing incl Empty Pallet Staging	22 Finished Goods Staging	23 Aerosol Storage incl. Receiving	24 Direct Delivery Loading	25 AerosolLoading	26 Shipping Dock	27 Water Treatment Areas	TOTAL
1	Bulk Tanker Unloading	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Tank Farms	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Receiving	-	-	-	93	4.6	120	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150	-	-	-	-	399.2
4	Outdoor Warehouse	-	-	-	-	-	-	-	-	-	-	3.5	3.9	-	-	-	-	-	6.7	9.5	-	68	-	-	-	-	-	1.6	93.0
5	Indoor Chemical Storage & IBCs	-	-	-	-	-	-	-	-	-	0.7	1.4	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	0.0	6.1
6	Raw & Pack	-	-	-	-	-	-	-	14	-	-	-	-	17	19	12	31	17	3.7	34	-	-	-	-	-	-	7.3	-	153.9
7	Label Storage	-	-	-	-	-	-	-	-	-	-	-	-	4.0	4.0	4.0	4.0	4.0	8.0	4.0	-	-	-	-	-	-	1.0	-	33.0
8	Molding Operation	-	-	-	-	-	3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	4.3
9	Molded Bottle Storage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Cleaner Formulation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Premix Formulation	-	-	-	-	-	-	-	1.0	-	-	-	-	-	1.0	0.6	1.6	0.3	0.3	-	-	-	-	-	-	-	-	4.0	8.9
12	Chem Treatment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.0	4.0
13	Multi-Size Line	-	-	-	-	-	4.3	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0
14	One-Liter Line	-	-	-	-	-	4.3	0.8	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.1
15	Two-Liter Line	-	-	-	-	-	4.8	0.8	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.2
16	Future Line	-	-	-	-	-	9.0	1.5	-	-	-	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.1
17	Four-Liter Line	-	-	-	-	-	4.6	1.0	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.0
18	Flexible Pack	-	-	-	-	-	5.1	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	7.5
19	Specials	-	-	-	-	-	5.1	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.1
20	Promtional Packaging Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	Palletizing incl Empty Pallet Staging	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	125	-	-	-	840	-	965.3
22	Finished Goods Staging	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	125	-	-	-	125.5
23	Aerosol Storage incl. Receiving	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.3	142	-	150.0
24	Direct Delivery Loading	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Aerosol Loading	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Shipping Dock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	Water Treatment Areas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	-	-	92.6	4.6	160.7	39.8	15.0	-	0.7	8.4	6.4	20.5	24.0	16.5	36.5	21.2	18.7	47.2	-	67.8	125.5	150.0	125.5	8.3	991.3	10.9	

Flow measured in Fork Lift Loads per Day

NOTES:

Notes

From-To Chart

Questions

1. What is the flow from Material Storage to Fluorescent Assembly? _____
2. What is the total flow between these two areas? _____
3. What is the total flow into Small Parts Sub-Assembly? _____
4. What is the total flow out from Small Parts Sub-Assembly? _____
5. What explains more flow into an area than coming out? _____ _____
6. What is the total flow into Wire Stringing? _____
7. The total flow from Wire Stringing? _____
8. What explains more coming out of an area than went in? _____ _____
9. What explains balanced flows to and from Material Storage? _____
10. Why might the "equivalent flow" coming out of Painting be higher than going in? _____ _____

FROM-TO-CHART

Plant: White Lighting Co.
By: K.W.M
Date: 22 June

Item(s) Charted: All Items
Basis of Values: Equivalent skids per year x 1000

No.	Activity-Area (FROM \ TO)	1 Receiving	2 Material Storage	3 Machining	4 Wire Stringing	5 Small Parts Sub-Assembly	6 Fluorescent Assembly	7 Mercury Vapor Assembly	8 Façade Light Assembly	9 Finished Fixture Storage	10 Pipe Receiving & Storage	11 Pipe Bending	12 Welding	13 Painting	14 Outside Pole Storage	15 Shipping	TOTALS
1	Receiving		60	0	0	0	0	0	0	0	0	0	0	0	0	0	60
2	Material Storage	0		9	4	0	22	1	30	0	0	0	0	0	0	0	66
3	Machining	0	1		0	9	0	0	0	0	0	0	0	0	1	0	11
4	Wire Stringing	0	0	0		0	2	1	3	0	0	0	0	0	0	0	6
5	Small Parts Sub-Assembly	0	0	0	0		6	1	0	0	0	0	0	0	0	0	7
6	Fluorescent Assembly	0	2	0	0	0		0	0	24	0	0	0	0	0	0	26
7	Mercury Vapor Assembly	0	0	0	0	0	0		0	2	0	0	0	0	0	0	2
8	Façade Light Assembly	0	3	0	0	0	0	0		25	0	0	0	0	0	0	28
9	Finished Fixture Storage	0	0	0	0	0	4	0.5	5		0	0	0	0	0	50	60
10	Pipe Receiving & Storage	0	0	0	0	0	0	0	0	0		60	40	0	0	0	100
11	Pipe Bending	0	0	0	0	0	0	0	0	0	0		80	0	0	0	80
12	Welding	0	0	0	0	0	0	0	0	0	0	0		120	0	0	120
13	Painting	0	0	0	0	0	0	0	0	0	0	0	0		140	0	140
14	Outside Pole Storage (b)	0	0	0	0	0	0	0	0	0	0	0	0	0		140	140
15	Shipping	0	0	0	0	0	0	0	0	10 (a)	0	0	0	0	0		10
16	(a) Packing materials are best stored in the finished fixture storage area.																0
17	(b) Including scrap accumulation depot.																0
	TOTALS	0	66	9	4	9	34	4	38	61	0	60	120	120	141	190	856

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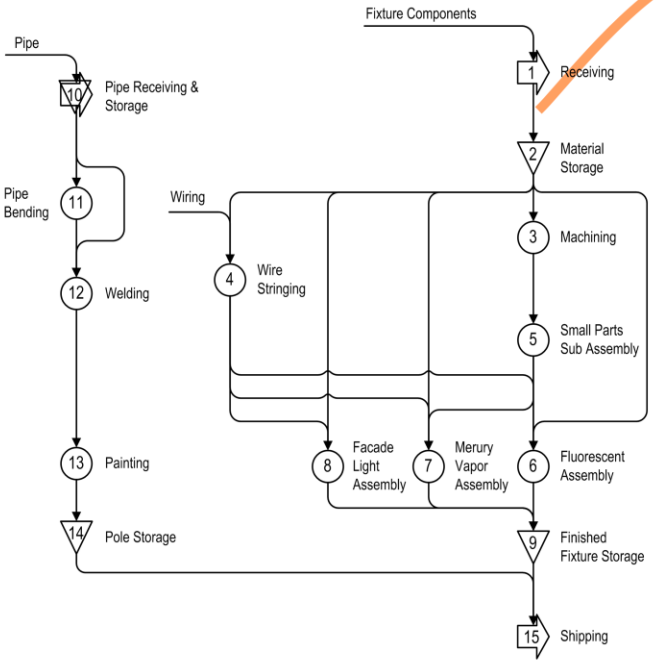
Main Points

1. A goal of most industrial layouts is to minimize distance on the most heavily-traveled routes. To assure a good flow-based layout the planner must identify and measure the flows between areas.
2. The operation process chart shown here uses numbered symbols to represent areas in the layout. Connecting lines indicate routes and directions of flow.
3. The From-To Chart quantifies the flow in each direction between each pair of areas. Naturally, the flow is zero when no route exists in the process chart.
4. Flow must be posted in a common or equivalent unit, typically based upon cubic volume or weight. This is a challenge when diverse materials are being moved.
5. This example uses equivalent skids per year, since most materials are moved on a standard wooden skid.
6. Systematic Layout Planning (SLP) converts actual numerical flow values to relative flow using a vowel code and color convention. Routes coded "A" and "E" represent the most important relationships to be honored in the layout plan. Converting to vowel codes also lets the planner compare and combine flow-based relationships with other, non-flow relationships that may also be important.
7. From a layout perspective, the total, two-way flow between activities is what matters. So any back flows must be added before converting to vowel letter ratings.

Flow Analysis & Relationships

Flow Process Chart



From-To Chart

Plant: White Lighting Co.
By: K.W.M
Date: 22 June
Basis of Values: Equivalent skids per year x 1000

No.	Activity Area	1 Receiving	2 Material Storage	3 Machining	4 Wire Stringing	5 Small Parts Sub-Assembly	6 Fluorescent Assembly	7 Mercury Vapor Assembly	8 Façade Light Assembly	9 Finished Fixture Storage	10 Pipe Receiving & Storage	11 Pipe Bending	12 Welding	13 Painting	14 Outside Pole Storage	15 Shipping	TOTALS
1	Receiving		60	0	0	0	0	0	0	0	0	0	0	0	0	0	60
2	Material Storage	0		9	4	0	22	1	30	0	0	0	0	0	0	0	66
3	Machining	0	1		0	9	0	0	0	0	0	0	0	0	1	0	11
4	Wire Stringing	0	0	0		0	2	1	3	0	0	0	0	0	0	0	6
5	Small Parts Sub-Assembly	0	0	0	0		6	1	0	0	0	0	0	0	0	0	7
6	Fluorescent Assembly	0	2	0	0	0		0	0	24	0	0	0	0	0	0	26
7	Mercury Vapor Assembly	0	0	0	0	0	0		0	2	0	0	0	0	0	0	2
8	Façade Light Assembly	0	3	0	0	0	0	0		25	0	0	0	0	0	0	28
9	Finished Fixture Storage	0	0	0	0	0	4	0	5		0	0	0	0	50	0	60
10	Pipe Receiving & Storage	0	0	0	0	0	0	0	0	0		60	40	0	0	0	100
11	Pipe Bending	0	0	0	0	0	0	0	0	0	0		80	0	0	0	80
12	Welding	0	0	0	0	0	0	0	0	0	0	0		120	0	0	120
13	Painting	0	0	0	0	0	0	0	0	0	0	0	0		140	0	140
14	Outside Pole Storage (b)	0	0	0	0	0	0	0	0	0	0	0	0	0		140	140
15	Shipping	0	0	0	0	0	0	0	0	10 (a)	0	0	0	0	0		10
16	(a) Packing materials are best stored in the finished fixture storage area.																0
17	(b) Including scrap accumulation depot.																0
	TOTALS	0	66	9	4	9	34	4	38	61	0	60	120	120	141	190	856

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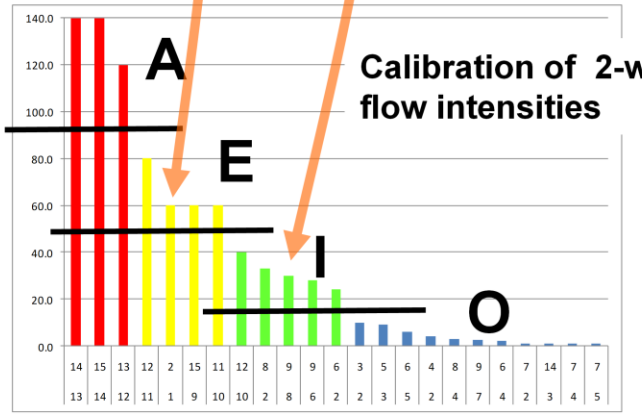

Calibration of 2-way flow intensities

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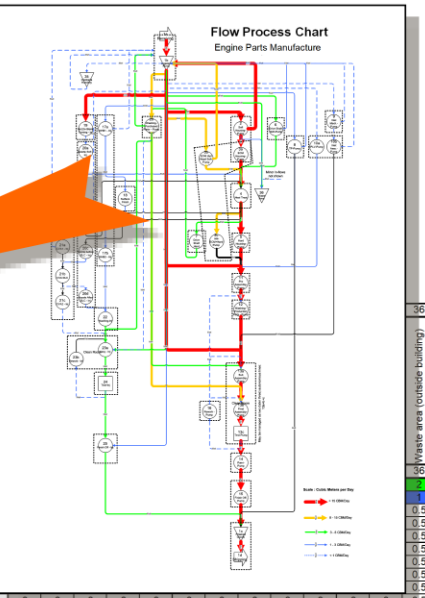
Notes

Main Points

1. Each operation symbol on the process chart is assigned to an activity-area.
2. Each flow line on the chart represents movement between two areas to be measured and filled in with flow values on the From-To Chart.
3. In this example, all materials are moved in wire baskets of several sizes. Flow was measured in cubic meters of baskets moving between areas.
4. Ranges of cubic meters per day were assigned an SLP vowel-letter rating: A,E,I,O (and O- in this example).
5. Flows were entered on the chart as point values using the SLP convention: 4, 3, 2, 1, 0.
6. When layouts must be prepared quickly and/or data is unavailable, pick a few easy-to-measure routes, being sure to select some with very high, medium and low flow.
7. Then "calibrate" the measured (actual) flows to the SLP vowel-letter scale.
8. Use informed judgment of material handlers and operating personnel to "rate" the remaining flows with the SLP conventions. The resulting From-To chart will be populated with point values: 4, 3, 2, 1…

From-To Chart

Flow of Materials measured in cubic meters of wire baskets/day
Recorded in SLP rating values: 4, 3, 2, 1



No.	Name/Description	TO:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	36	TOTAL
		FROM:	Logistics Area	Soft Housing - Pump	ECM Areas HH soft & hard; Hou	Heat Treat	Hard Housing - Pump	Drive Shaft - Soft Pump	Drive Shaft - Hard Pump	TP- Pump (Kit & stage)	Inlet Machine - Pump	PLV + Inlet Assembly	Pre-assembly - Pump	Washing - Production Pump	Pump Assembly & Test	Paint - Pump	Pump Finish Off	Pump Rework Area	NHB	Surface Finish	Nozzle Blank	Nozzle Machining	Injector Assembly & Rework	Injector Assembly & Rework	Injector Assembly & Rework	Waste area (outside building)	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	36	
1	Logistics Area			4	3	0	0	2	0	1	0.5	0.5	4	0	4	0	0	0	1	0	4	0	0.5	0	2	2	33
2	Soft Housing - Pump		3		4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8
3	ECM Areas HH soft & hard; Housing		2	0		4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	6.5
4	Heat Treat		0	0	3		4	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	9.5
5	Hard Housing - Pump		0	0	0	0		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.5	4.5
6	Drive Shaft - Soft Pump		1	0	0	2	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	3.5
7	Drive Shaft - Hard Pump		0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	2.5
8	TP- Pump (Kit & stage)		0.5	0	0	0	0	0	0		0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.5	2
9	Inlet Machine - Pump		0.5	0	0	0	0	0	0	0		0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	1.5
10	PLV + Inlet Assembly		0.5	0	0	0	0	0	0	0	0		0.5	0	0	0	0	0	0	0	0	0	0	0	0	0.5	1.5
11	Pre-assembly - Pump		0	0	0	0	0	0	0	0	0	0		4	0	0	0	0	0	0	0	0	0	0	0	0.5	4.5
12	Washing - Production Pump		?	0	0	0	0	0	0	0	0	0	0		4	0	0	0	0	0	0	0	0	0	0	0.5	4.5
13	Pump Assembly & Test		0	0	0	0	0	0	0	0	0	0	0	0		4	0	0.5	0	0	0	0	0	0	0	0.5	4.5
14	Paint - Pump		0	0	0	0	0	0	0	0	0	0	0	0	0		4	0	0	0	0	0	0	0	0	0.5	4.5
15	Pump Finish Off		4	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0.5	4.5
16	Pump Rework Area		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0.5	1.5
17	NHB		0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	1	0	0	0.5	3
18	Surface Finish		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0.5	1.5
19	Nozzle Blank		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0.5	1.5
20	Nozzle Machining		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	1	0	0.5	3.5
21	CVA Area		0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5		0	0	0.5	2
22	Washing - Injector		?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	0.5	2.5
23	Injector Assembly & Rework		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.5	2.5
24	Injector Test		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0.5	3
25	Injector Finish Off		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	2.5
26	Washing-Purchased Parts - Pump		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	6
27	Lunchroom		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
28	Employee Entrances & Lockers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
29	Maintenance incl.tooling shop		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	Tool Re-sharpening		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	Metrology Lab		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	Training Room (Operator Training)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	Building Services Areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	Social Area/Office		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	Central & Humidity Controlled Stora		0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	1
36	Waste area (outside building)																										0

Flow in cubic meters per day

Rated as:		M³/day	Color
"A"	4 points	>15	Red
"E"	3 points	8 – 15	Yellow
"I"	2 points	3 – 8	Green
"O"	1 point	1 – 3	Blue
"O-"	0.5 points	<1	Blue dash

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Notes

Calibration of Two-Way Flow

Main Points

1. Recognize that a From-To Chart shows exactly what it says – the flow from each area to every other area.
2. Some routes (activity-pairs) will have flow in one direction only. Others will have flow in both directions.
3. Good layout tries to minimize the distance between those activity-areas with the highest flow (traffic) between them.
4. Therefore, layout planners must determine the total two-way flow between each pair of activity-areas.
5. The total two-way flows are calibrated to determine the relative flows and closeness desired, using the vowel, point, and color-code conventions of Systematic Layout Planning (SLP).
6. In this example, one-way material flows have been expressed in SLP point values: 4, 3, 2, 1.
7. Two-way flow between Activity-Areas 1 & 2 is 4+3=7.
8. The two-way flow between Activity-Areas 1 and 3 is 5.
9. Both pairs have been assigned a combined (two-way) flow rating of A.

No.	Name/Description FROM:	TO: 1 Logistics Area	2 Soft Housing - Pump	3 ECM Areas HH soft & hard; Hou	4 Heat Treat	5 Hard Housing - Pump	6 Drive Shaft - Soft Pump
		1	2	3	4	5	6
1	Logistics Area		4	3	0	0	2
2	Soft Housing - Pump	3		4	0	0	0
3	ECM Areas HH soft & hard; Housing	2	0		4	0	0
4	Heat Treat	0	0	3		4	0
5	Hard Housing - Pump	0	0	0	0		0
6	Drive Shaft - Soft Pump	1	0	0	2	0	
7	Drive Shaft - Hard Pump	0	0	0	0	0	0

Flow of Materials Recorded in SLP rating values: 4, 3, 2, 1

No.	Activity-Pair		Flow Between: From - To	Flow Between: To - From	Two-Way Flow	SLP Flow Rating: Vowel	SLP Flow Rating: Value
1	1	2	4	3	7	A	4
2	1	3	3	2	5	A	4
3	1	6	2	1	3	I	2

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Notes

Main Points

Converting to the vowel-letter convention is a fairly simple problem of calibrating:

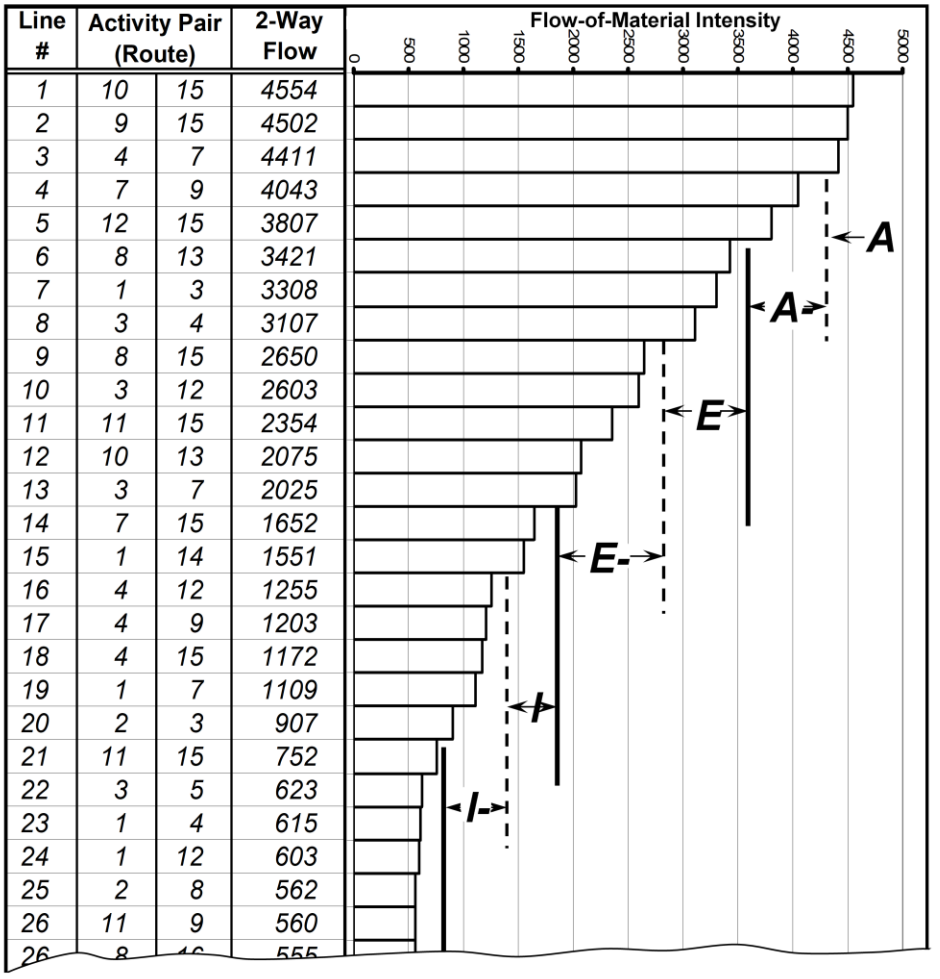
1. Identify each route by activity-areas serving as the origin and destination of the move (always keeping lowest number at left).
2. Complete a common-denominator measurement for the total flow of material (all products or materials in both directions) for each route (or pair of activity-areas).
3. Rank, in descending order of magnitude, the flow intensity for each route.
4. Plot the intensity of each route on a bar chart or graph.
5. Divide the bars at logical break points, recognizing that the A's may bracket perhaps only 10% of the highest routes (but the top 40% of intensity values) and that the O's may bracket intensity values of perhaps only 10% of the largest value (but the lowest 40% of the routes).
6. Draw division lines to indicate the range of vowel-letter ratings, using minus-sign ratings for degrees of flow intensity in between full vowel letters if appropriate.

Calibration of Two-Way Flow

Calibrating or converting flow-of-material intensities against the vowel-letter rating scale.

With five ranges (or classes), A, E, I, O, U, of flow intensity – nine if half degrees (minus-sign ratings) are used – each route is put into a simple, realistic, order-of-magnitude relationship, ready for subsequent use in comparing closeness desired among the various activity-areas.

Line #	Activity Pair (Route)		2-Way Flow
1	10	15	4554
2	9	15	4502
3	4	7	4411
4	7	9	4043
5	12	15	3807
6	8	13	3421
7	1	3	3308
8	3	4	3107
9	8	15	2650
10	3	12	2603
11	11	15	2354
12	10	13	2075
13	3	7	2025
14	7	15	1652
15	1	14	1551
16	4	12	1255
17	4	9	1203
18	4	15	1172
19	1	7	1109
20	2	3	907
21	11	15	752
22	3	5	623
23	1	4	615
24	1	12	603
25	2	8	562
26	11	9	560



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Notes

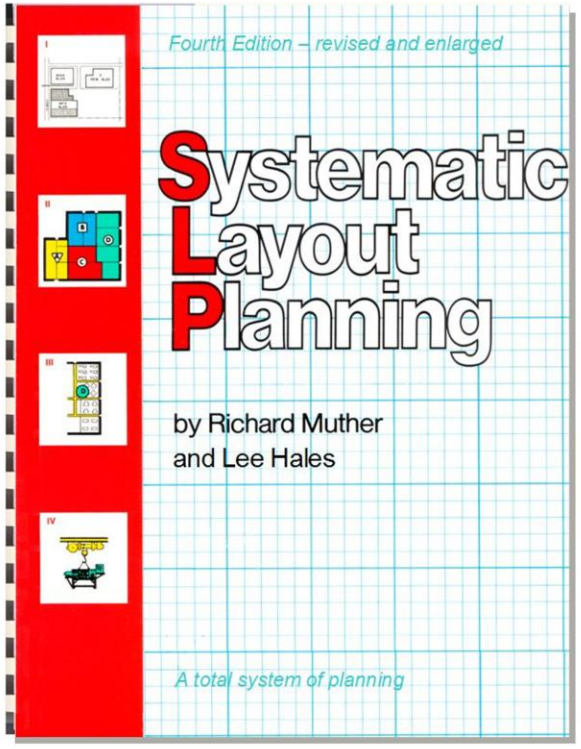
Here's What I Know

Question	Which Answer Is (Most) Correct	Got It
1. Which of these techniques may be useful when analyzing the flow of materials through a layout?	A. Operation or Flow Process Charts B. Multiproduct Process Chart C. Grouping or similar items and/or processes D. Selecting a sample or representative, or worst-case items E. From-To Chart F. All of the above	
2. Material flows for one or a few high-volume items should typically be analyzed with operation or flow process charts.	A. True B. False	
3. Several products flowing through a common set of processes can be analyzed on multi-product process charts.	A. True. B. False.	
4. Dozens of items moving on dozens of routes are best analyzed using the From-To Chart.	A. True. B. False.	
5. In layout planning, closeness desired should reflect the total two-way flow between pairs of activity-areas.	A. True B. False.	

Summary

- Products with the highest volumes and thus highest flow intensities should receive individual attention using Operation or Flow Process Charts.
- When multiple products move across the same set of operations, the multi-product process chart may be helpful.
- When flow analysis must examine many parts or items moving on many routes, it becomes difficult to do with diagrammatic charts. They become complex and tedious to read. In this situation, the tabular From-To Chart is essential.
- The From-To Chart records flows between pairs of activities in both directions From #1 to #2 and from #2 back to #1. Outbound flows from an operation or area appear on its row; inbound flows appear on its column. Flows from a higher numbered area to a lower one appear below the diagonal.
- When the material flow is uniform – say all on pallets, or in standard containers – then the estimated flows can be entered directly on each route and direction. But if the materials flowing are diverse, some equivalence factors or adjustments may be needed to account for differences in transportability or risk.
- In Systematic Layout Planning (SLP), the From-To Chart is used to summarize flows, even when a flow process chart contains the same information. The flows in both directions are added and then the activity-pairs are ranked to identify the relative two-way flows between them and then to assign vowel-letter closeness ratings.

Supplemental Reading



For more depth on this topic, see Chapter 4

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