

CHAPTER 7

CONCLUSION

There are two main things in this chapter, conclusion and suggestion. Conclusion is generated based on the research problem and the result of the research. While the suggestion is the recommendation that could be given to the next fleet sizing research.

7.1. Conclusion

Research objective is to determine the number of trolley in the production floor. To solve this problem, we use processing time and transportation time to know the lead time and finding the number of trolley. After that to prove which one is the best number of trolley, simulation is used. During the simulation, the fleet sizing is treated as the queueing theory. The result of this research is described below :

- a. Transportation model is using to determine the movement between each station based on the supply and demand of each station.
- b. The transportation model that generated is based on the reduced number of station due the limitation of ARENA software. The distance of the fused station is generated based on the equilibrium distance of those two stations.
- c. The objective function of this research is the highest utilization, the lowest queue time, and the lowest queue number.
- d. The queue time and queue number for the comparison has already been summed for all process in each stage.
- e. The optimum number of trolley for stage 1 is 170 trolleys. It based on the 1st alternative, using the requirement for the average demand condition.
- f. The optimum number of trolley for stage 2 is 154 trolleys. It based on the 1st alternative, using the requirement for the average demand condition.
- g. The optimum number of trolley for stage 3 is 126 trolleys. It based on the 2nd alternative, using the requirement for the maximum demand condition.
- h. The amount of fleet size that proposed in this research, will save the purchasing budget for THB 8.190.000 each two year.

7.2. Suggestion

In this research, it assumed that the trolley is serve only for the prime process, not for the rework process. For the further research, considering the rework process

and using software that more capable to do complex problem is highly recommended.



REFERENCES

- Barnes , Ralph M.;1980;*Motion & Times Study ,Design & Measurement of Work*
7th ed. Page: 406-440; John Wiley & Sons.
- Beamon,B., & Deshpade, A. (1998). A mathematical programming approach to simultaneous unit-load and fleet-size optimisation in material handling systems design. *The International Journal of Advanced Manufacturing Technology* 14(11), 858
- Ceder, A., & Stern, H. (1981). Deficit Function Bus Scheduling with Deadheading Trip Insertions for Fleet Size Reduction. *Transportation Science*, 338-363
- Dantzig, G. B., Fulkerson, D.R., & Johnson, S. M. (2008). Solution of a Large-Scale Traveling-Salesman Problem. In J.M. al., *50 Years of Integer Programming 1958-2008* pp. 7-28). Berlin, Heidelberg : Springer.
- Groover, M. (2007). *Automation, Production System, and Computer-Integrated*. New Jersey : Prentice Hall Press Upper Saddle River
- Köchel, P., Kunze, S., & Nieländer, U. (2003). Optimal control of a distributed service system with moving resources : Application to the fleet sizing and allocation problem. *International Journal of Production Economics*, 443-459
- List, G., Mirchandani, P., Turnquist, M., & Zografos, K. (1991). Modelling and Analysis for Hazardous Materials Transportation: Risk Analysis, Routing/ Scheduling and Facility Location. *Transportation Science* 25(2), 100-114
- List, G., Wood, B., Nozick, L., Turnquist, M., Jones, D., Kjeldgaard, E., & Lawton., C. (2003). Robust Optimization for Fleet Planning under Uncertainty. *Transportation Research Part E: Logistics and Transportation Review* 39(3), 209-227
- Marchwinski, C., Shook, J. & Schroeder, A. (2014). Lean lexicon. Cambridge, MA: Lean Enterprise Institute.
- Montgomery, D., & Runger, G. (2010). *Applied Statistics and Probability for Engineers*. Hoboken, NJ : Wiley

Niebel, Benjamin W., Andris Freivalds; 2003; *Method ,Standards, and work design* 11th ed. Page: 526-544; McGraw Hill.

Papier, F., & Thonemann, U. W. (2008). Queuing Models for Sizing and Structuring. *Transportation Science* 42(3), 302-317

Parikh, S. C. (1977). On a Fleet Sizing and Allocation Problem. *Management Science* 23(9), 972-977

Rossetti, M. (2015). *Simulation Modeling and Arena, 2nd Edition*. Wiley

Sayarshad, H., Javadian, N., Tavakkoli-Moghaddam, R., & Forghani, N. (2010). Solving multi-objective optimization formulation for fleet planning in a railway industry. *Annals of Operation Research* 181(1), 185-197

Schmidt, J., & Taylor, R. (1970). *Simulation and Analysis of Industrial*. Richard D. Irwin.

Song, D.-P., & Earl, C. (2008). Optimal empty vehicle repositioning and fleet-sizing for two-depot service systems. *European Journal of Operational Research* 185(2), 760-777

Taha, H. (1991). *Operationa Research: an Introduction (6th ed.)*. New Jersey : Pretince-Hall, Inc.

Appendix 1 : Operator Movement Time Observation

Operation : Transport				Studied by : Eleonora Maria P												
Product : HDD 3,5 inch				Date : 15/05/2017												
Line : -																
Worker	Action	Time Observation (Min-sec)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.00	Start	00.00.00	00.07.53	00.15.56	00.22.90	00.30.93	00.38.38	00.46.68	09.07.68	09.15.71	09.25.44	09.33.25	09.41.38	09.49.49	09.57.37	10.04.87
	End	00.07.53	00.15.56	00.22.90	00.30.93	00.38.38	00.46.68	09.07.68	09.15.71	09.25.44	09.33.25	09.41.38	09.49.49	09.57.37	10.04.87	10.13.85
	Second	00.07.53	00.08.03	00.07.34	00.08.03	00.07.45	00.08.30	08.21.00	00.08.03	00.09.73	00.07.81	00.08.13	00.08.11	00.07.88	00.07.50	00.08.98
	Start	10.13.85	10.21.82	10.29.37	10.37.27	10.45.24	10.52.60	11.00.02	11.07.69	11.15.85	11.23.25	11.31.10	11.38.56	11.46.38	11.53.83	12.01.40
	End	10.21.82	10.29.37	10.37.27	10.45.24	10.52.60	11.00.02	11.07.69	11.15.85	11.23.25	11.31.10	11.38.56	11.46.38	11.53.83	12.01.40	12.08.87
	Second	00.07.97	00.07.55	00.07.90	00.07.97	00.07.36	00.07.42	00.07.67	00.08.16	00.07.40	00.07.85	00.07.46	00.07.82	00.07.45	00.07.57	00.07.47
2.00	Start	00.00.00	00.07.60	00.15.41	00.23.16	00.31.04	00.39.57	00.47.38	00.54.61	01.02.58	01.10.59	01.18.75	01.26.56	01.33.97	01.41.26	01.48.60
	End	00.07.60	00.15.41	00.23.16	00.31.04	00.39.57	00.47.38	00.54.61	01.02.58	01.10.59	01.18.75	01.26.56	01.33.97	01.41.26	01.48.60	01.56.01
	Second	00.07.60	00.07.81	00.07.75	00.07.88	00.08.53	00.07.81	00.07.23	00.07.97	00.08.01	00.08.16	00.07.81	00.07.41	00.07.29	00.07.34	00.07.41
	Start	01.56.01	09.24.01	09.30.80	09.38.42	09.45.69	09.53.67	10.01.29	10.08.64	10.16.18	10.23.94	10.32.02	10.39.34	10.46.78	10.54.84	11.02.77
	End	09.24.01	09.30.80	09.38.42	09.45.69	09.53.67	10.01.29	10.08.64	10.16.18	10.23.94	10.32.02	10.39.34	10.46.78	10.54.84	11.02.77	11.10.79
	Second	07.28.00	00.06.79	00.07.62	00.07.27	00.07.98	00.07.62	00.07.35	00.07.54	00.07.76	00.08.08	00.07.32	00.07.44	00.08.06	00.07.93	00.08.02
3.00	Start	00.00.00	00.07.47	00.16.76	00.24.94	00.33.13	00.41.01	00.48.54	00.57.79	01.05.41	01.13.12	01.20.46	01.28.01	01.36.52	01.44.32	01.51.57
	End	00.07.47	00.16.76	00.24.94	00.33.13	00.41.01	00.48.54	00.57.79	01.05.41	01.13.12	01.20.46	01.28.01	01.36.52	01.44.32	01.51.57	01.59.02
	Second	00.07.47	00.09.29	00.08.18	00.08.19	00.07.88	00.07.53	00.09.25	00.07.62	00.07.71	00.07.34	00.07.55	00.08.51	00.07.80	00.07.25	00.07.45
	Start	01.59.02	02.06.55	02.14.00	02.21.98	02.29.60	02.37.47	02.45.10	02.52.55	03.00.73	03.08.69	03.16.07	03.24.05	03.32.20	03.40.03	03.47.77
	End	02.06.55	02.14.00	02.21.98	02.29.60	02.37.47	02.45.10	02.52.55	03.00.73	03.08.69	03.16.07	03.24.05	03.32.20	03.40.03	03.47.77	03.55.74
	Second	00.07.53	00.07.45	00.07.98	00.07.62	00.07.87	00.07.63	00.07.45	00.08.18	00.07.96	00.07.38	00.07.98	00.08.15	00.07.83	00.07.74	00.07.97
4.00	Start	00.00.00	00.07.34	00.15.44	00.22.80	00.30.57	00.38.16	00.45.48	00.52.94	01.00.42	01.07.62	01.14.55	01.22.11	01.29.74	01.37.59	01.44.92
	End	00.07.34	00.15.44	00.22.80	00.30.57	00.38.16	00.45.48	00.52.94	01.00.42	01.07.62	01.14.55	01.22.11	01.29.74	01.37.59	01.44.92	01.52.96
	Second	00.07.34	00.08.10	00.07.36	00.07.77	00.07.59	00.07.32	00.07.46	00.07.48	00.07.20	00.06.93	00.07.56	00.07.63	00.07.85	00.07.33	00.08.04
	Start	01.52.96	02.00.20	02.07.80	02.15.36	02.22.66	02.30.03	02.38.06	02.45.96	02.53.68	03.02.13	03.09.94	03.17.61	03.25.71	03.33.15	03.42.72
	End	02.00.20	02.07.80	02.15.36	02.22.66	02.30.03	02.38.06	02.45.96	02.53.68	03.02.13	03.09.94	03.17.61	03.25.71	03.33.15	03.42.72	03.50.50
	Second	00.07.24	00.07.60	00.07.56	00.07.30	00.07.37	00.08.03	00.07.90	00.07.72	00.08.45	00.07.81	00.07.67	00.08.10	00.07.44	00.09.57	00.07.78

Appendix 2 : Operator Movement Speed

Num	Operator 1		Operator 2		Operator 3		Operator 4	
	Time (sec)	Speed (m/s)	Time (sec)	Speed (m/s)	Time (sec)	Speed (m/s)	Time (sec)	Speed (m/s)
1	7.53	1.33	7.60	1.32	7.47	1.34	7.34	1.36
2	8.03	1.25	7.81	1.28	9.26	1.08	8.10	1.23
3	7.34	1.36	7.75	1.29	8.18	1.22	7.36	1.36
4	8.30	1.20	7.88	1.27	8.19	1.22	7.77	1.29
5	7.45	1.34	8.53	1.17	7.88	1.27	7.59	1.32
6	7.67	1.30	7.81	1.28	7.53	1.33	7.32	1.37
7	7.81	1.28	7.23	1.38	9.25	1.08	7.46	1.34
8	8.03	1.25	7.97	1.25	7.62	1.31	7.48	1.34
9	9.73	1.03	8.01	1.25	7.71	1.30	7.20	1.39
10	7.81	1.28	8.16	1.23	7.34	1.36	6.93	1.44
11	8.13	1.23	7.81	1.28	7.55	1.32	7.56	1.32
12	8.11	1.23	7.41	1.35	8.51	1.18	7.63	1.31
13	7.88	1.27	7.29	1.37	7.80	1.28	7.85	1.27
14	7.50	1.33	7.34	1.36	7.25	1.38	7.33	1.36
15	8.98	1.11	7.41	1.35	7.45	1.34	8.04	1.24
16	7.97	1.25	7.28	1.37	7.53	1.33	7.24	1.38
17	7.55	1.32	6.79	1.47	7.45	1.34	7.60	1.32
18	7.90	1.27	7.62	1.31	7.98	1.25	7.56	1.32
19	7.97	1.25	7.27	1.38	7.62	1.31	7.30	1.37
20	7.36	1.36	7.98	1.25	7.87	1.27	7.37	1.36
21	7.42	1.35	7.62	1.31	7.63	1.31	8.03	1.25
22	7.67	1.30	7.35	1.36	7.45	1.34	7.90	1.27
23	8.16	1.23	7.54	1.33	8.18	1.22	7.72	1.30
24	7.40	1.35	7.76	1.29	7.96	1.26	8.45	1.18
25	7.85	1.27	8.08	1.24	7.38	1.36	7.81	1.28
26	7.46	1.34	7.32	1.37	7.98	1.25	7.67	1.30
27	7.82	1.28	7.44	1.34	8.15	1.23	8.10	1.23
28	7.45	1.34	8.06	1.24	7.83	1.28	7.44	1.34
29	7.57	1.32	7.93	1.26	7.74	1.29	9.57	1.04
30	7.47	1.34	8.02	1.25	7.97	1.25	7.78	1.29

Appendix 3 : Load In for Machine X

Observation	Operator 1	Operator 2	Operator 3	Operator 4
1	1.79	1.57	1.65	1.66
2	1.55	1.88	1.49	1.72
3	1.57	1.76	1.87	1.76
4	1.92	1.48	1.56	1.65
5	1.47	1.91	1.81	1.68
6	1.83	1.71	1.67	1.84
7	1.60	1.83	1.58	1.76
8	1.77	1.87	1.53	1.48
9	1.81	1.69	1.68	1.57
10	1.85	1.90	1.72	1.83
11	1.66	1.77	1.66	1.71
12	1.77	1.47	1.63	1.62
13	1.76	1.80	1.82	1.90
14	1.63	1.68	1.77	1.83
15	1.84	1.50	1.48	1.73
16	1.66	1.84	1.66	1.48
17	1.51	1.61	1.71	1.76
18	1.81	1.87	1.54	1.87
19	1.88	1.64	1.64	1.79
20	1.51	1.81	1.68	1.76
21	1.53	1.75	1.80	1.71
22	1.51	1.81	1.82	1.57
23	1.91	1.51	1.59	1.53
24	1.73	1.83	1.80	1.51
25	1.55	1.76	1.52	1.91
26	1.58	1.73	1.86	1.73
27	1.87	1.84	1.57	1.59
28	1.67	1.78	1.81	1.59
29	1.84	1.75	1.53	1.57
30	1.77	1.71	1.57	1.82

Appendix 4 : Load Out for Machine X

Observation	Operator 1	Operator 2	Operator 3	Operator 4
1	1.65	1.89	1.78	1.87
2	2.13	1.73	2.06	2.04
3	2.02	2.12	1.89	1.95
4	1.72	2.06	1.89	1.89
5	1.91	1.92	2.14	1.87
6	1.57	1.88	1.57	2.00
7	1.76	1.69	1.95	2.12
8	2.00	1.96	1.70	1.96
9	1.79	1.58	1.75	2.05
10	1.90	1.72	1.94	2.00
11	2.04	1.74	1.63	1.96
12	2.07	1.78	1.69	1.96
13	1.92	2.06	1.74	1.91
14	1.70	2.19	1.94	1.71
15	1.84	1.91	1.88	1.71
16	1.84	1.87	1.65	2.04
17	1.71	1.99	1.70	1.74
18	1.61	2.01	1.97	1.78
19	1.99	1.83	1.89	2.08
20	1.77	1.88	2.15	1.63
21	2.02	1.67	1.95	1.63
22	1.83	1.64	1.75	1.80
23	1.83	1.91	1.66	2.15
24	2.11	1.57	1.66	1.78
25	2.07	1.72	1.87	1.90
26	1.73	1.89	1.91	2.05
27	2.15	1.89	1.99	2.18
28	2.09	1.87	2.19	1.67
29	2.12	1.72	2.00	2.13
30	1.65	1.86	1.85	2.07

Appendix 5 : Load In for Machine Y

Observation	Operator 1	Operator 2	Operator 3	Operator 4
1	5.32	5.01	5.50	5.12
2	5.07	5.10	5.12	5.24
3	5.12	5.03	5.18	5.51
4	5.57	5.11	5.11	5.44
5	5.04	5.24	5.20	5.07
6	4.98	5.55	5.62	5.55
7	5.29	5.36	5.12	5.15
8	5.38	5.35	5.28	5.51
9	5.51	5.02	5.60	5.61
10	5.31	4.98	5.36	5.43
11	4.99	5.24	5.52	5.49
12	5.17	5.38	5.56	5.17
13	5.54	5.40	5.06	5.25
14	5.14	5.62	5.03	5.50
15	5.25	5.22	5.46	5.11
16	5.11	5.06	5.19	5.21
17	5.11	5.47	5.00	5.19
18	5.51	5.07	5.42	5.21
19	5.33	5.04	5.22	5.59
20	5.38	5.07	5.06	5.32
21	5.18	5.17	5.19	5.59
22	5.36	5.41	5.41	5.60
23	5.58	5.61	5.45	5.51
24	5.19	5.58	5.40	5.32
25	5.47	5.15	5.52	5.29
26	5.41	5.10	5.09	5.03
27	5.21	5.34	5.11	5.57
28	5.23	5.04	5.02	5.60
29	5.50	5.33	5.19	5.38
30	5.18	5.48	5.07	5.17

Appendix 6 : Load Out for Machine Y

Observation	Operator 1	Operator 2	Operator 3	Operator 4
1	3.42	3.64	3.52	3.56
2	3.43	3.47	3.74	3.71
3	3.32	3.57	3.61	3.63
4	3.35	3.76	3.76	3.45
5	3.31	3.59	3.46	3.33
6	3.36	3.50	3.53	3.44
7	3.40	3.57	3.77	3.67
8	3.47	3.70	3.31	3.67
9	3.42	3.34	3.52	3.30
10	3.74	3.61	3.49	3.62
11	3.60	3.45	3.55	3.66
12	3.51	3.64	3.67	3.55
13	3.75	3.69	3.47	3.36
14	3.59	3.76	3.57	3.44
15	3.71	3.75	3.48	3.45
16	3.46	3.41	3.59	3.71
17	3.57	3.64	3.73	3.75
18	3.48	3.30	3.77	3.36
19	3.53	3.56	3.76	3.71
20	3.62	3.39	3.66	3.52
21	3.45	3.41	3.47	3.65
22	3.77	3.59	3.33	3.73
23	3.38	3.36	3.52	3.69
24	3.44	3.61	3.62	3.47
25	3.58	3.29	3.34	3.71
26	3.66	3.71	3.59	3.36
27	3.40	3.74	3.69	3.40
28	3.49	3.34	3.68	3.76
29	3.47	3.48	3.52	3.69
30	3.43	3.59	3.32	3.62

Appendix 7 : Load In for Machine P

Observation	Operator 1	Operator 2	Operator 3	Operator 4
1	4.76	4.59	4.34	4.27
2	4.66	4.20	4.66	4.28
3	4.69	4.51	4.43	4.74
4	4.53	4.57	4.51	4.45
5	4.76	4.41	4.64	4.69
6	4.27	4.69	4.37	4.22
7	4.56	4.72	4.32	4.31
8	4.58	4.47	4.66	4.50
9	4.61	4.23	4.23	4.41
10	4.24	4.56	4.43	4.28
11	4.34	4.36	4.49	4.63
12	4.59	4.31	4.33	4.60
13	4.70	4.68	4.47	4.27
14	4.48	4.19	4.70	4.58
15	4.20	4.73	4.73	4.57
16	4.76	4.52	4.30	4.28
17	4.44	4.47	4.36	4.75
18	4.20	4.64	4.62	4.43
19	4.35	4.45	4.71	4.63
20	4.56	4.71	4.46	4.66
21	4.27	4.66	4.42	4.40
22	4.72	4.37	4.37	4.48
23	4.64	4.43	4.56	4.52
24	4.28	4.26	4.36	4.68
25	4.63	4.44	4.21	4.21
26	4.35	4.33	4.70	4.49
27	4.19	4.34	4.41	4.19
28	4.34	4.29	4.29	4.67
29	4.32	4.66	4.49	4.27
30	4.37	4.25	4.31	4.61

Appendix 8 : Load Out for Machine P

Observation	Operator 1	Operator 2	Operator 3	Operator 4
1	3.45	3.14	3.05	3.01
2	3.46	3.42	3.03	3.55
3	3.38	3.18	3.23	3.50
4	3.36	3.58	3.35	3.15
5	2.96	3.03	3.49	2.99
6	3.15	2.97	3.46	3.41
7	3.25	3.01	3.47	3.33
8	3.05	3.36	3.05	2.98
9	2.97	3.05	3.44	3.32
10	2.98	3.52	3.40	3.45
11	3.24	2.99	3.04	3.17
12	3.29	2.96	3.20	3.59
13	3.02	3.00	3.16	3.07
14	3.45	3.63	3.60	3.30
15	3.21	3.44	3.58	3.46
16	3.41	3.55	3.54	3.09
17	3.53	2.97	3.36	3.10
18	3.17	3.27	3.06	3.03
19	3.49	3.02	3.35	3.09
20	3.05	3.36	3.01	3.61
21	3.18	3.18	3.49	3.43
22	3.36	2.99	3.04	3.54
23	3.10	3.46	3.36	3.07
24	3.15	3.42	3.01	3.25
25	3.31	3.46	3.22	3.26
26	3.30	3.49	3.32	3.49
27	3.62	3.42	3.01	3.17
28	3.38	3.44	3.53	3.10
29	3.00	3.25	3.26	3.39
30	3.03	3.45	3.58	3.46

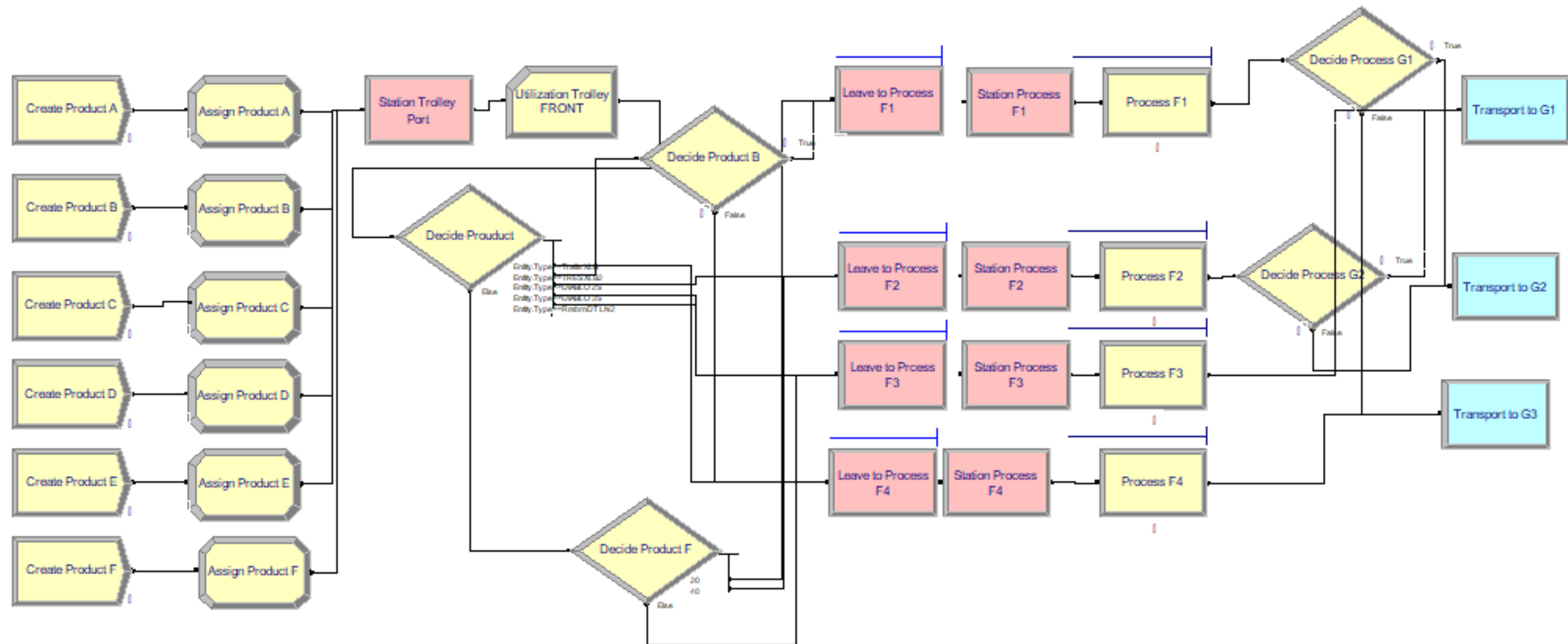
Appendix 9 : Load In for Machine Q

Observation	Operator 1	Operator 2	Operator 3	Operator 4
1	4.50	4.64	4.34	4.60
2	4.55	4.56	4.57	4.45
3	4.64	4.31	4.52	4.70
4	4.34	4.59	4.48	4.56
5	4.59	4.35	4.29	4.33
6	4.58	4.29	4.58	4.49
7	4.49	4.51	4.39	4.59
8	4.57	4.50	4.67	4.44
9	4.42	4.39	4.28	4.50
10	4.71	4.62	4.44	4.36
11	4.52	4.32	4.33	4.35
12	4.69	4.28	4.36	4.65
13	4.53	4.69	4.37	4.64
14	4.42	4.45	4.48	4.44
15	4.58	4.45	4.60	4.35
16	4.62	4.52	4.33	4.64
17	4.54	4.70	4.55	4.30
18	4.43	4.40	4.43	4.34
19	4.45	4.56	4.69	4.45
20	4.61	4.57	4.59	4.29
21	4.37	4.34	4.43	4.63
22	4.45	4.66	4.47	4.28
23	4.29	4.68	4.38	4.33
24	4.34	4.61	4.31	4.70
25	4.58	4.60	4.64	4.34
26	4.33	4.54	4.36	4.30
27	4.69	4.54	4.64	4.48
28	4.54	4.50	4.71	4.51
29	4.43	4.59	4.63	4.45
30	4.66	4.51	4.70	4.56

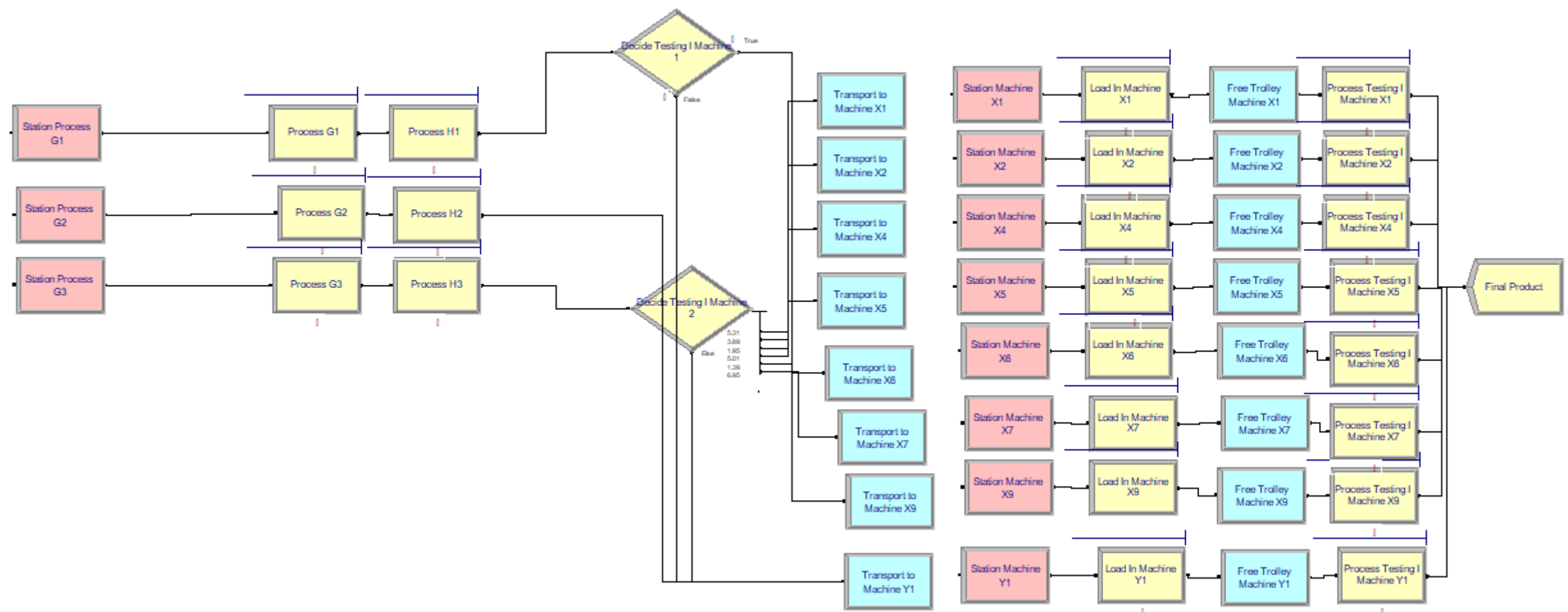
Appendix 10 : Load Out for Machine Q

Observation	Operator 1	Operator 2	Operator 3	Operator 4
1	3.60	3.33	3.53	3.47
2	3.34	3.14	3.05	3.42
3	3.07	3.23	3.62	3.10
4	3.49	3.40	3.56	3.15
5	3.14	3.33	3.41	3.31
6	3.17	3.08	3.54	3.20
7	3.62	3.53	3.46	3.17
8	3.05	3.34	3.59	3.33
9	3.23	3.41	3.35	3.28
10	3.14	3.03	3.56	3.18
11	3.52	3.33	3.44	3.33
12	3.57	3.15	3.43	3.61
13	3.26	3.08	3.40	3.63
14	3.63	3.41	3.48	3.12
15	3.11	3.60	3.18	3.63
16	3.31	3.00	3.54	3.42
17	3.40	3.15	3.46	3.18
18	3.42	3.34	3.56	3.58
19	3.25	3.23	3.34	3.61
20	3.54	3.24	3.16	3.60
21	3.18	3.62	3.42	3.27
22	3.53	3.16	3.25	3.30
23	3.52	3.46	3.40	3.51
24	3.56	3.53	3.25	3.20
25	3.40	3.58	3.41	3.36
26	3.53	2.98	3.06	3.43
27	3.63	3.43	3.26	3.54
28	3.07	2.99	3.33	3.53
29	3.29	3.16	3.37	3.06
30	3.20	3.02	3.25	3.34

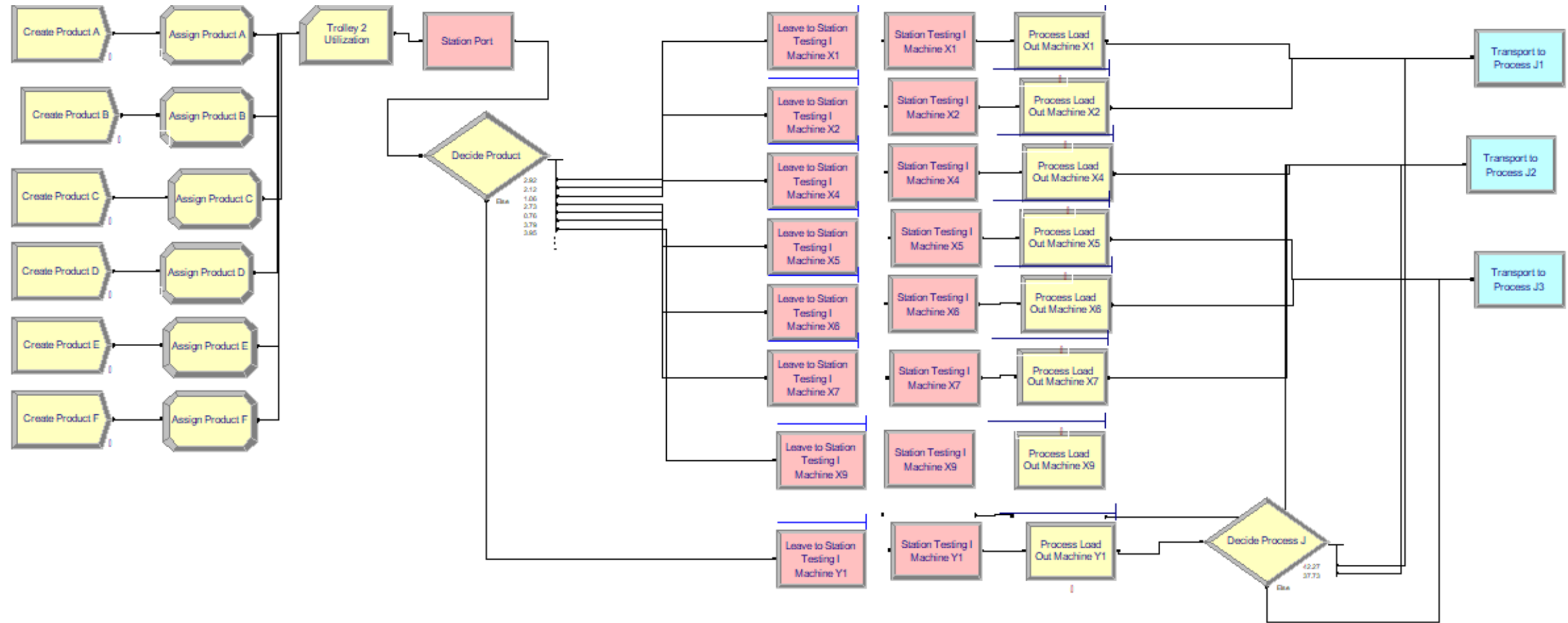
Appendix 11 : Stage 1 Part 1 Model



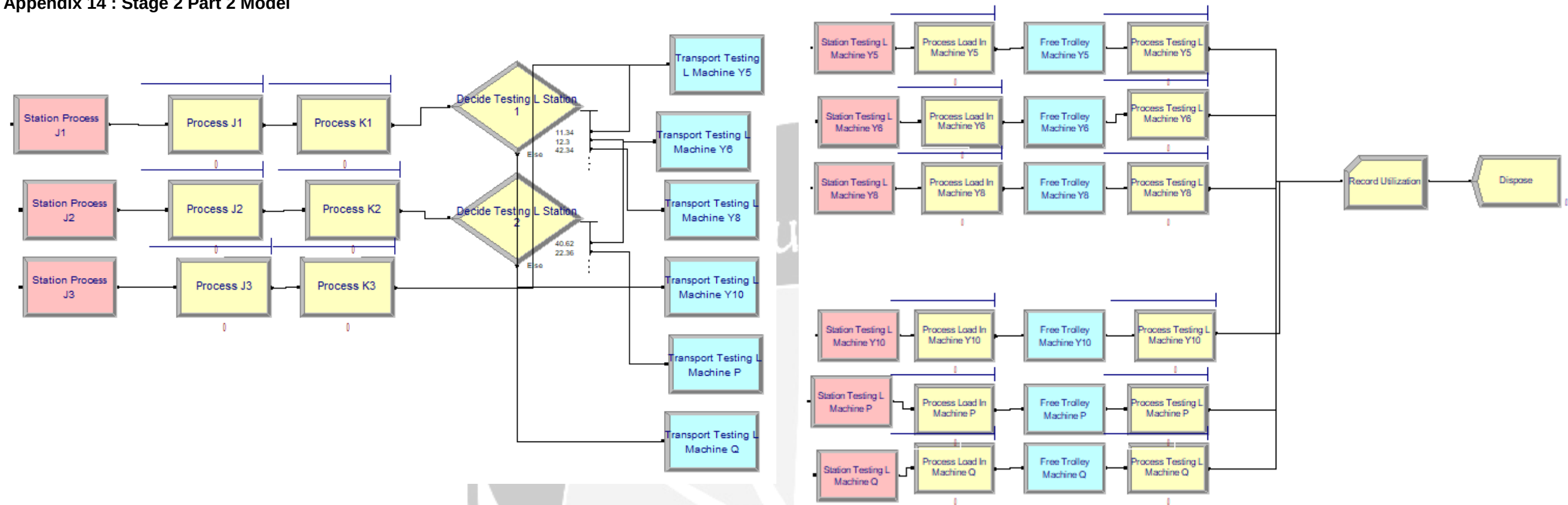
Appendix 12 : Stage 1 Part 2 Model



Appendix 13 : Stage 2 Part 1 Model



Appendix 14 : Stage 2 Part 2 Model



Appendix 15 : Stage 3 Model

