

K.P. Boardwalk

Ticket Booth Additions

Kaitlyn Henderson





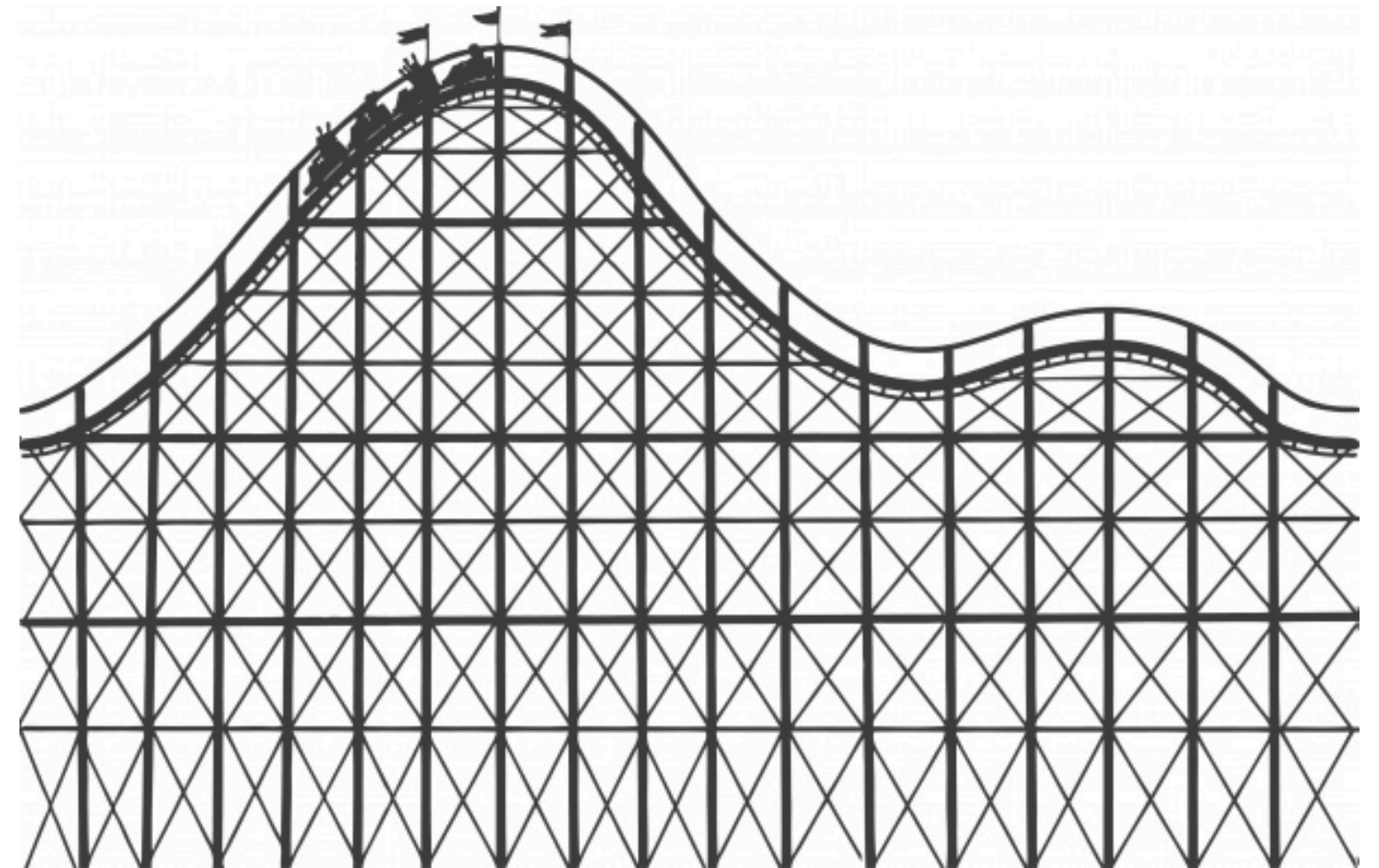
Agenda

- Introduction
- Goal of Model Simulations for the Boardwalk
- Expected Outcomes
- Model Breakdown & Findings
- Conclusion
- Simulation Challenges & Feedback



Expansion in the Midst

- Historical hot spot for locals & nation-wide guests
- Currently have 6 rides
- Additional ticket booths could help w/ future ride development
- Increase ticket purchases





Expected Outcomes

- Ticket booth waiting times will decrease
- More guests will get through the park during the 10 hour period
- The additional ticket clerks and current operators per rides queue will be more efficient
 - Positive change to the current base model
- Conclude that one model will be superior and present that to decision-makers.



Base Model





Base Model Components

Module Name	Module Type	Parameters	Explanation
Guest Arrivals	Create	Rando, value=0.25, unit=hours, entities per arrival=2, infinite arrivals	2 guests every 15-minute intervals arriving at the park
Main Ticket Booth	Process	SDR=3 clerks, triangular delay=2, 3, 4 minutes,	Triangular delay to provide min, max, and most likely
Which Ride?	Decide	N-way by chance: 15, 20, 30, 20, 15	The chance of an entity going to a certain ride
All Rides – 6 total	Process	SDR=1 operator each, expression between expo (3) & expo (5) minutes each ride	Small boardwalk: doesn't have long lines and each ride is quick
Ride Again?	Decide	2-way by chance: 80% true	Estimation of the likelihood someone will ride another ride versus only riding once
Visits Rest of Park	Dispose	Dispose of the 15% from the Ride Again? Decide module	Retains the remaining guests that do not return to the ride queue

Figure 1.0 Base Model - Module Description

Theme Park Base Model

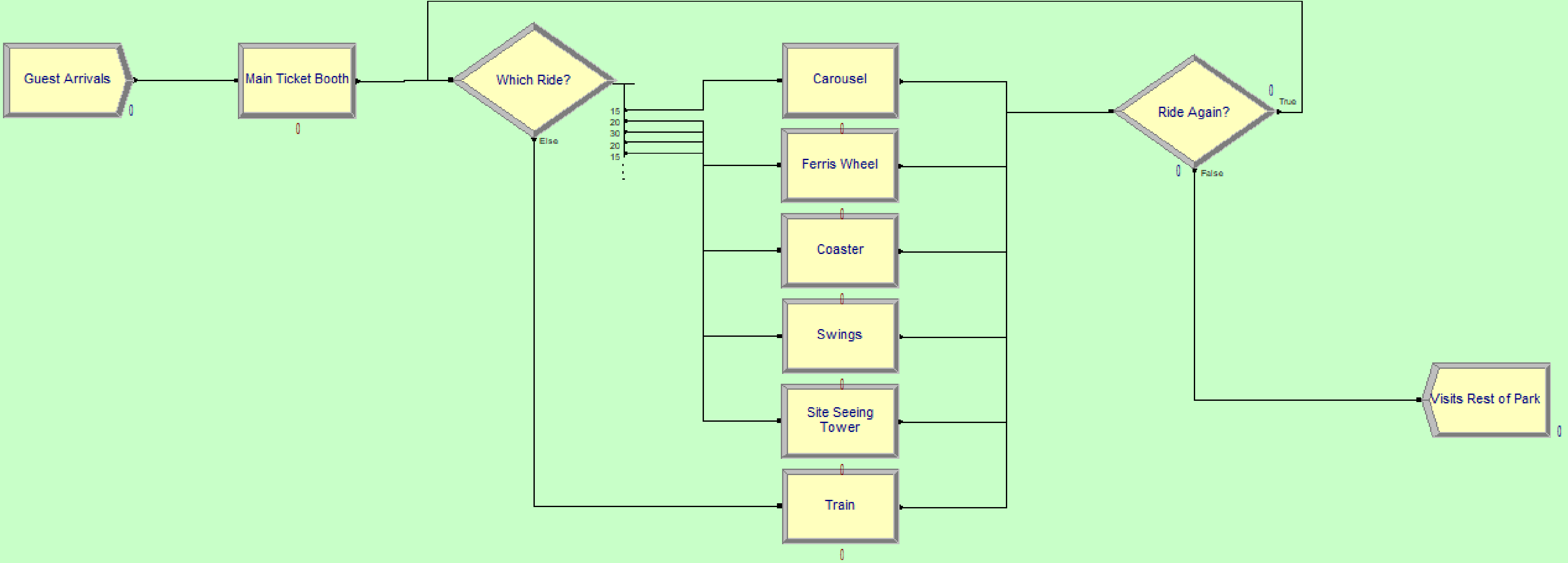


Figure 1.1 Base Model

Base Model Findings - Queue Time

Time

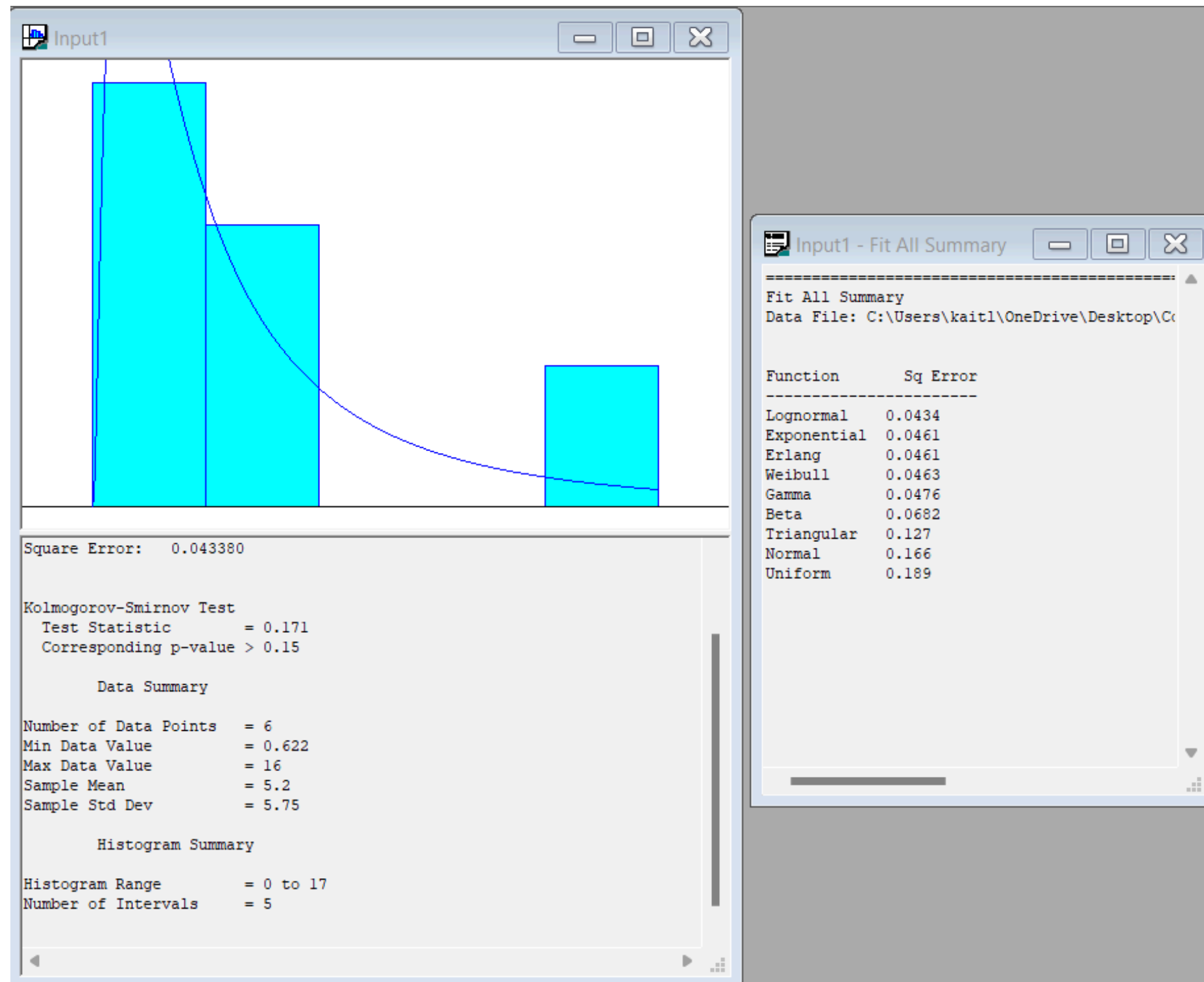
Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Carousel.Queue	0.6217	0.74	0.5636	0.6799	0.00	10.6015
Coaster.Queue	16.0456	26.01	13.9988	18.0925	0.00	52.4680
Ferris Wheel.Queue	6.2885	19.13	4.7831	7.7939	0.00	45.3005
Main Ticket Booth.Queue	4.9232	17.24	3.5667	6.2797	0.00	25.7293
Site Seeing Tower.Queue	1.2221	8.54	0.5499	1.8943	0.00	18.8402
Swings.Queue	2.1217	3.89	1.8157	2.4277	0.00	19.4667

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Carousel.Queue	0.06388677	0.17	0.05072045	0.07705309	0.00	3.0000
Coaster.Queue	3.0213	3.41	2.7531	3.2895	0.00	10.0000
Ferris Wheel.Queue	0.7857	2.89	0.5580	1.0135	0.00	5.0000
Main Ticket Booth.Queue	0.6923	2.91	0.4637	0.9210	0.00	8.0000
Site Seeing Tower.Queue	0.1115	0.87	0.04307306	0.1800	0.00	3.0000
Swings.Queue	0.2647	0.60	0.2179	0.3116	0.00	5.0000
Train.Queue	0.00	0.00	0.00	0.00	0.00	0.00

Figure 1.2 Base Model - Queue

Base Model Findings - Input Analyzer



- Follows a Lognormal Distribution
- Lowest value at 0.622
- Max value at 16
- Sample mean 5.2 min

Figure 1.3 Base Model - Distribution



Base Model Findings - Resource Usage

Usage

Scheduled Utilization	Average	Half Width	Minimum Average	Maximum Average
Clerk 1	0.4603	0.37	0.4314	0.4893
Clerk 2	0.4603	0.37	0.4314	0.4893
Clerk 3	0.4603	0.37	0.4314	0.4893
Operator 1	0.3003	0.38	0.2703	0.3303
Operator 2	0.6209	0.60	0.5738	0.6680
Operator 3	0.8855	0.06	0.8807	0.8902
Operator 4	0.3532	0.09	0.3458	0.3606
Operator 5	0.2676	0.48	0.2298	0.3053
Operator 6	0.00	0.00	0.00	0.00

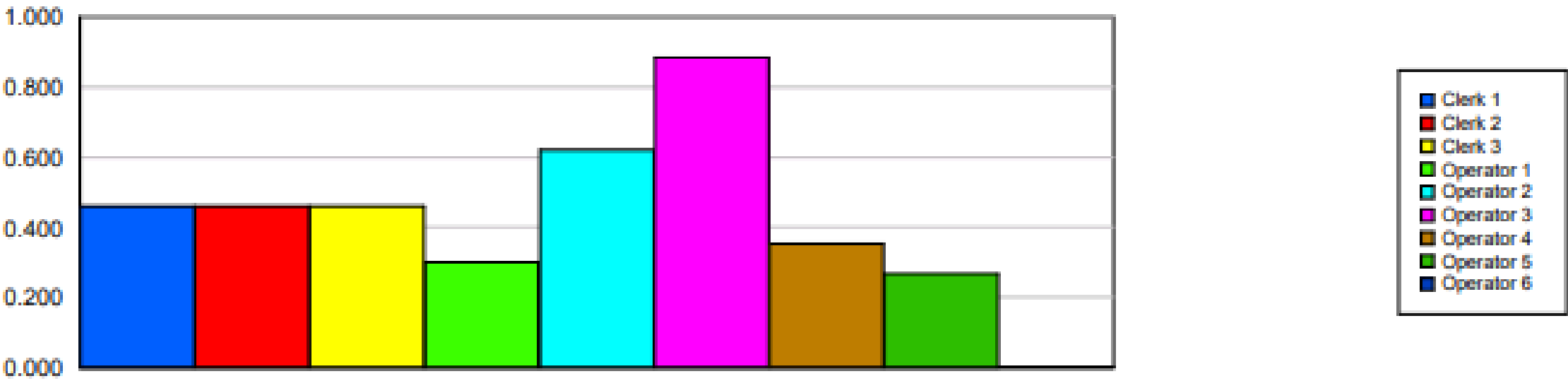


Figure 1.4 Base Model - Scheduled Utilization



Base Model Findings - Number Seized

Usage

Total Number Seized	Average	Half Width	Minimum Average	Maximum Average
Clerk 1	83.0000	63.53	78.0000	88.0000
Clerk 2	83.0000	63.53	78.0000	88.0000
Clerk 3	83.0000	63.53	78.0000	88.0000
Operator 1	61.0000	88.94	54.0000	68.0000
Operator 2	74.0000	50.82	70.0000	78.0000
Operator 3	110.00	101.65	102.00	118.00
Operator 4	74.5000	31.77	72.0000	77.0000
Operator 5	52.0000	63.53	47.0000	57.0000
Operator 6	0.00	0.00	0.00	0.00

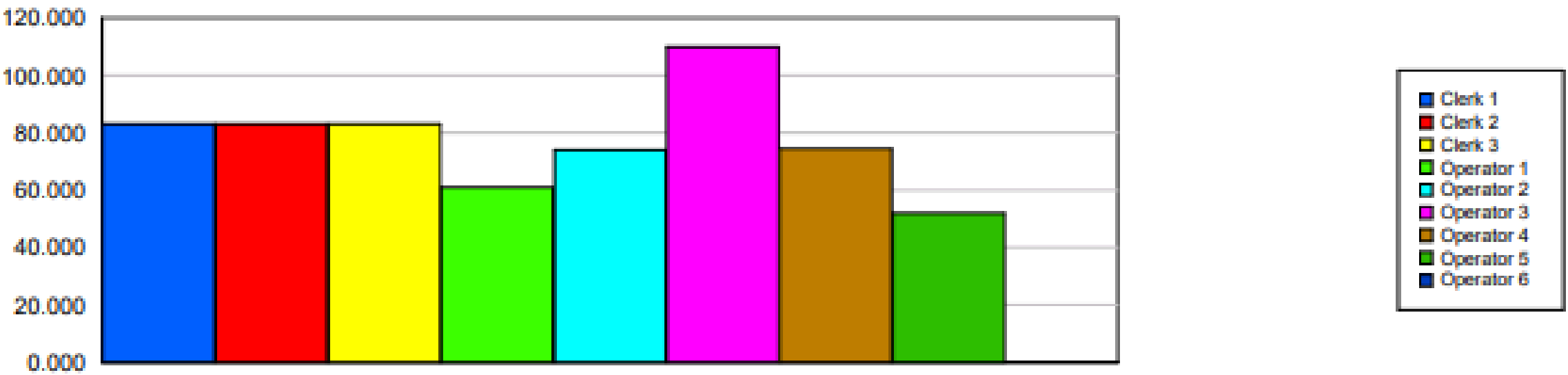


Figure 1.5 Base Model - Number Seized

Model 2





Model 2 Components

Module Name	Module Type	Parameters	Explanation
Guest Arrivals	Create	Rando, value=0.25, unit=hours, entities per arrival=2, infinite arrivals	2 guests every 15-minute intervals arriving at the park
Which Ticket Booth?	Decide	N-way by chance: 50	The chance of a guest going to main ticket booth or ticket booth 2
Main Ticket Booth	Process	SDR=3 clerks, triangular delay=2, 3, 4 minutes,	Triangular delay to provide min, max, and most likely
Ticket Booth 2	Process	SDR=3 clerks, triangular delay=2, 3, 4 minutes,	Triangular delay to provide min, max, and most likely
Which Ride?	Decide	N-way by chance: 15, 20, 30, 20, 15, else	The chance of an entity going to a certain ride
All Rides – 6 total	Process	SDR=1 operator each, expression between expo (3) & expo (5) minutes each ride	Small boardwalk: doesn't have long lines and each ride is quick
Ride Again?	Decide	2-way by chance: 80% true	Estimation of the likelihood someone will ride another ride versus only riding once
Visits Rest of Park	Dispose	Dispose of the 15% from the Ride Again? Decide module	Retains the remaining guests that do not return to ride queue

Figure 2.0 Model 2 - Module Description

Theme Park Model 2

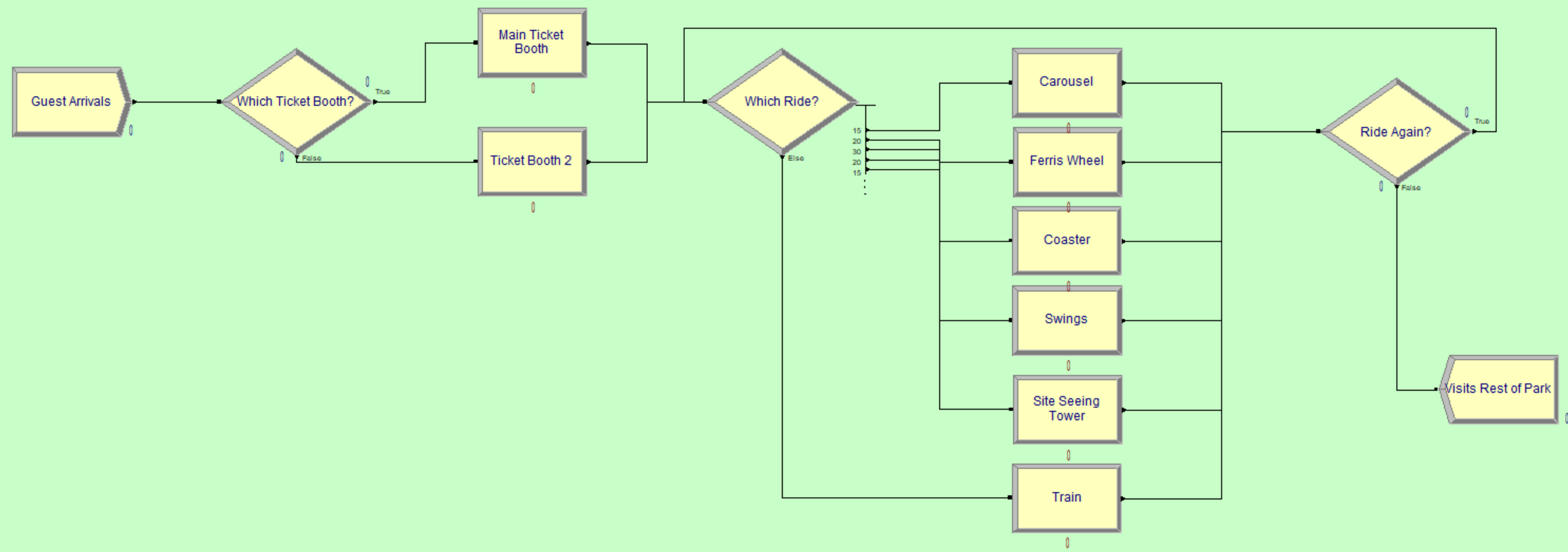


Figure 2.1 Model 2

Model 2 Findings - Queue Time

Time

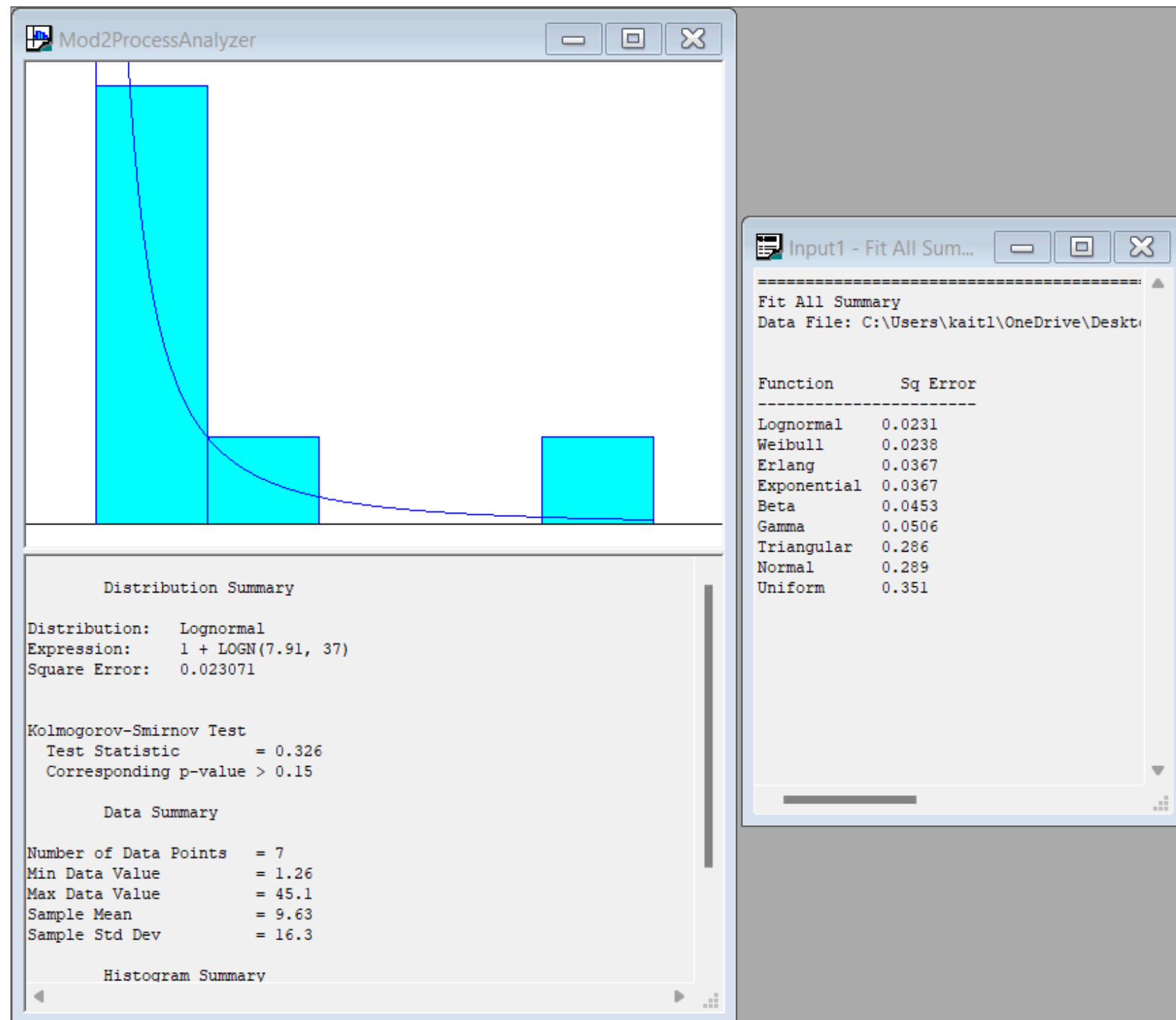
Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Carousel.Queue	2.0027	15.91	0.7503	3.2551	0.00	21.4413
Coaster.Queue	45.0731	247.26	25.6132	64.5330	0.00	123.24
Ferris Wheel.Queue	14.2562	130.04	4.0214	24.4911	0.00	75.1603
Main Ticket Booth.Queue	1.4699	2.46	1.2765	1.6633	0.00	8.8494
Site Seeing Tower.Queue	1.7463	7.40	1.1641	2.3286	0.00	22.8137
Swings.Queue	1.6335	6.82	1.0968	2.1701	0.00	14.6145
Ticket Booth 2.Queue	1.2630	5.59	0.8228	1.7032	0.00	8.8505

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Carousel.Queue	0.2570	2.25	0.08002877	0.4340	0.00	4.0000
Coaster.Queue	9.5713	50.61	5.5883	13.5542	0.00	28.0000
Ferris Wheel.Queue	2.6426	25.83	0.6099	4.6752	0.00	17.0000
Main Ticket Booth.Queue	0.1562	0.55	0.1128	0.1996	0.00	4.0000
Site Seeing Tower.Queue	0.2164	1.00	0.1377	0.2950	0.00	5.0000
Swings.Queue	0.2124	1.05	0.1299	0.2950	0.00	3.0000
Ticket Booth 2.Queue	0.1112	0.72	0.05485267	0.1675	0.00	3.0000
Train.Queue	0.00	0.00	0.00	0.00	0.00	0.00

Figure 2.2 Model 2 - Queue

Model 2 Findings - Input Analyzer



- Follows a Lognormal Distribution
- Lowest value at 1.26
- Max value at 45
- Sample mean 9.63 min

Figure 2.3 Model 2 - Distribution

Model 2 Findings - Resource Usage

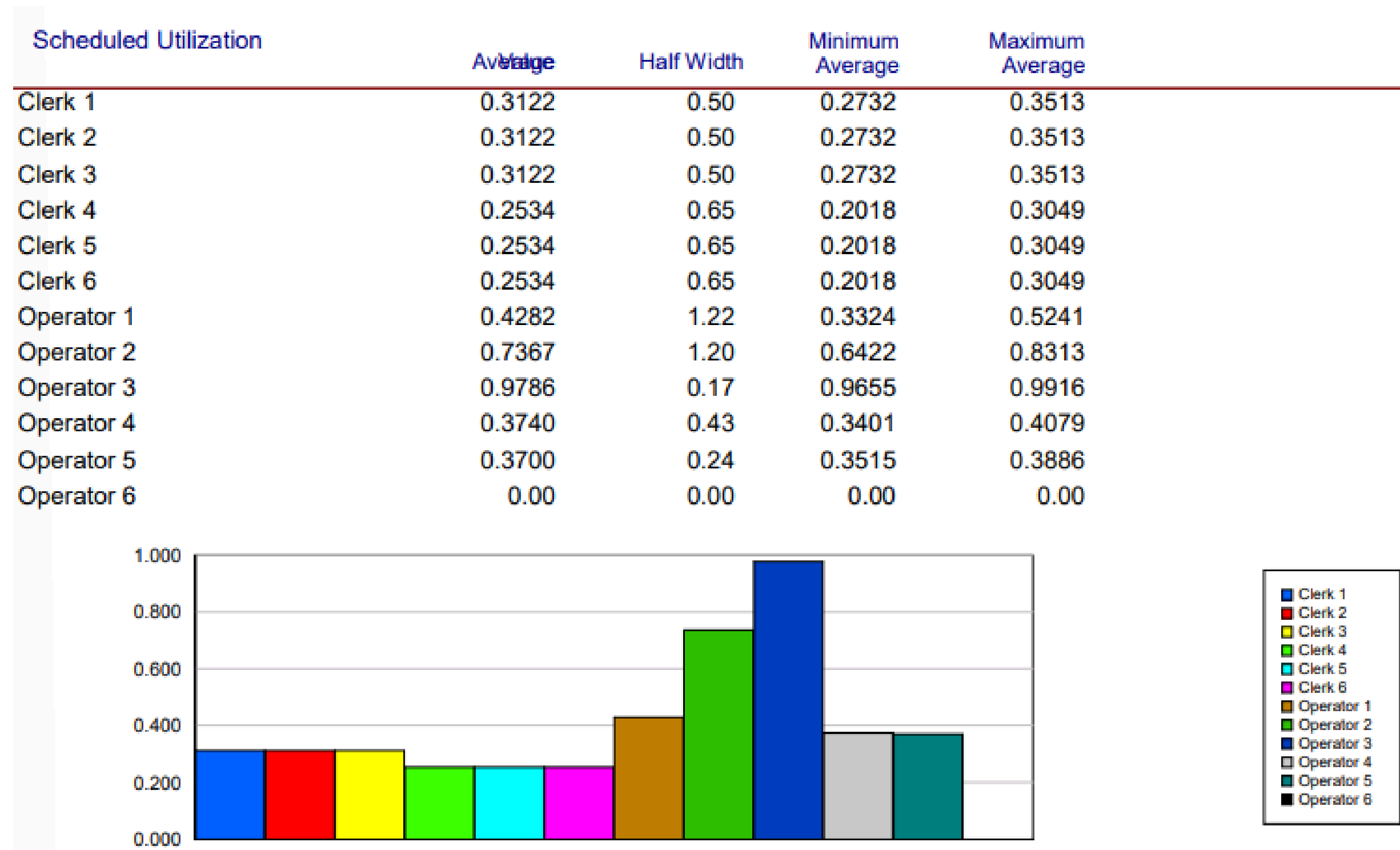


Figure 2.4 Model 2 - Scheduled Utilization



Model 2 Findings - Number Seized

Usage

Total Number Seized	Average	Half Width	Minimum Average	Maximum Average
Clerk 1	62.5000	120.71	53.0000	72.0000
Clerk 2	62.5000	120.71	53.0000	72.0000
Clerk 3	62.5000	120.71	53.0000	72.0000
Clerk 4	49.5000	120.71	40.0000	59.0000
Clerk 5	49.5000	120.71	40.0000	59.0000
Clerk 6	49.5000	120.71	40.0000	59.0000
Operator 1	72.0000	101.65	64.0000	80.0000
Operator 2	100.50	120.71	91.0000	110.00
Operator 3	106.50	6.35	106.00	107.00
Operator 4	76.0000	63.53	71.0000	81.0000
Operator 5	73.5000	31.77	71.0000	76.0000
Operator 6	0.00	0.00	0.00	0.00

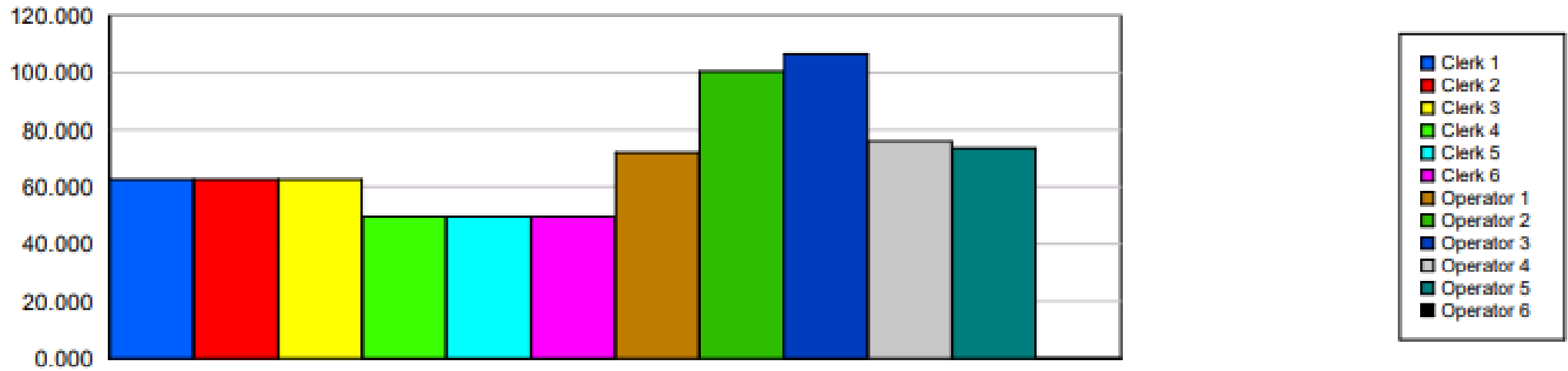


Figure 2.5 Model 2 - Number Seized

Model 3





Model 3 Components

Module Name	Module Type	Parameters	Explanation
Guest Arrivals	Create	Rando, value=0.25, unit=hours, entities per arrival=2, infinite arrivals	2 guests every 15-minute intervals arriving at the park
Which Ticket Booth?	Decide	N-way by chance: 40, 35, else	The chance of a guest going to main ticket booth or ticket booth 2
Main Ticket Booth	Process	SDR=3 clerks, triangular delay=2, 3, 4 minutes,	Triangular delay to provide min, max, and most likely
Ticket Booth 2	Process	SDR=3 clerks, triangular delay=2, 3, 4 minutes,	Triangular delay to provide min, max, and most likely
Ticket Booth 3	Process	SDR=3 clerks, triangular delay=2, 3, 4 minutes,	Triangular delay to provide min, max, and most likely
Which Ride?	Decide	N-way by chance: 15, 20, 30, 20, 15, else	The chance of an entity going to a certain ride
All Rides – 6 total	Process	SDR=1 operator each, expression between expo (3) & expo (5) minutes each ride	Small boardwalk: doesn't have long lines and each ride is quick
Ride Again?	Decide	2-way by chance: 80% true	Estimation of the likelihood someone will ride another ride versus only riding once
Visits Rest of Park	Dispose	Dispose of the 15% from the Ride Again? Decide module	Retains the remaining guests that do not return to ride queue

Figure 3.0 Model 3 - Module Description

Theme Park Model 3

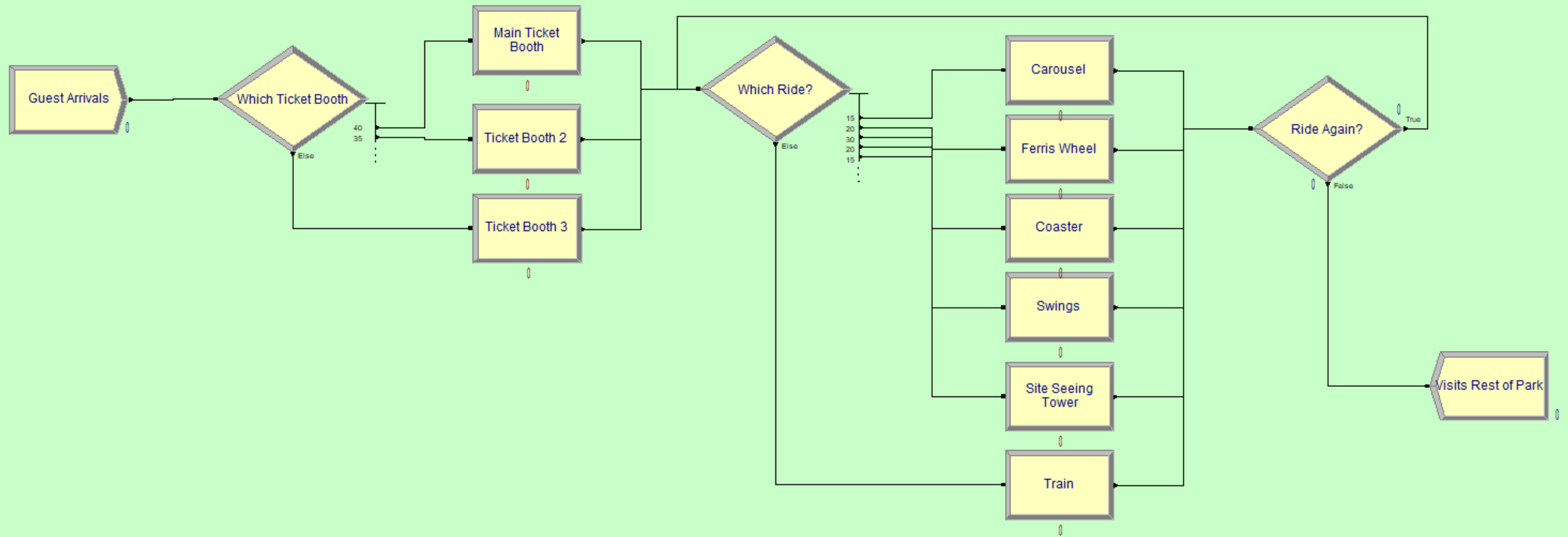


Figure 3.1 Model 3

Model 3 Findings - Queue Time

Time

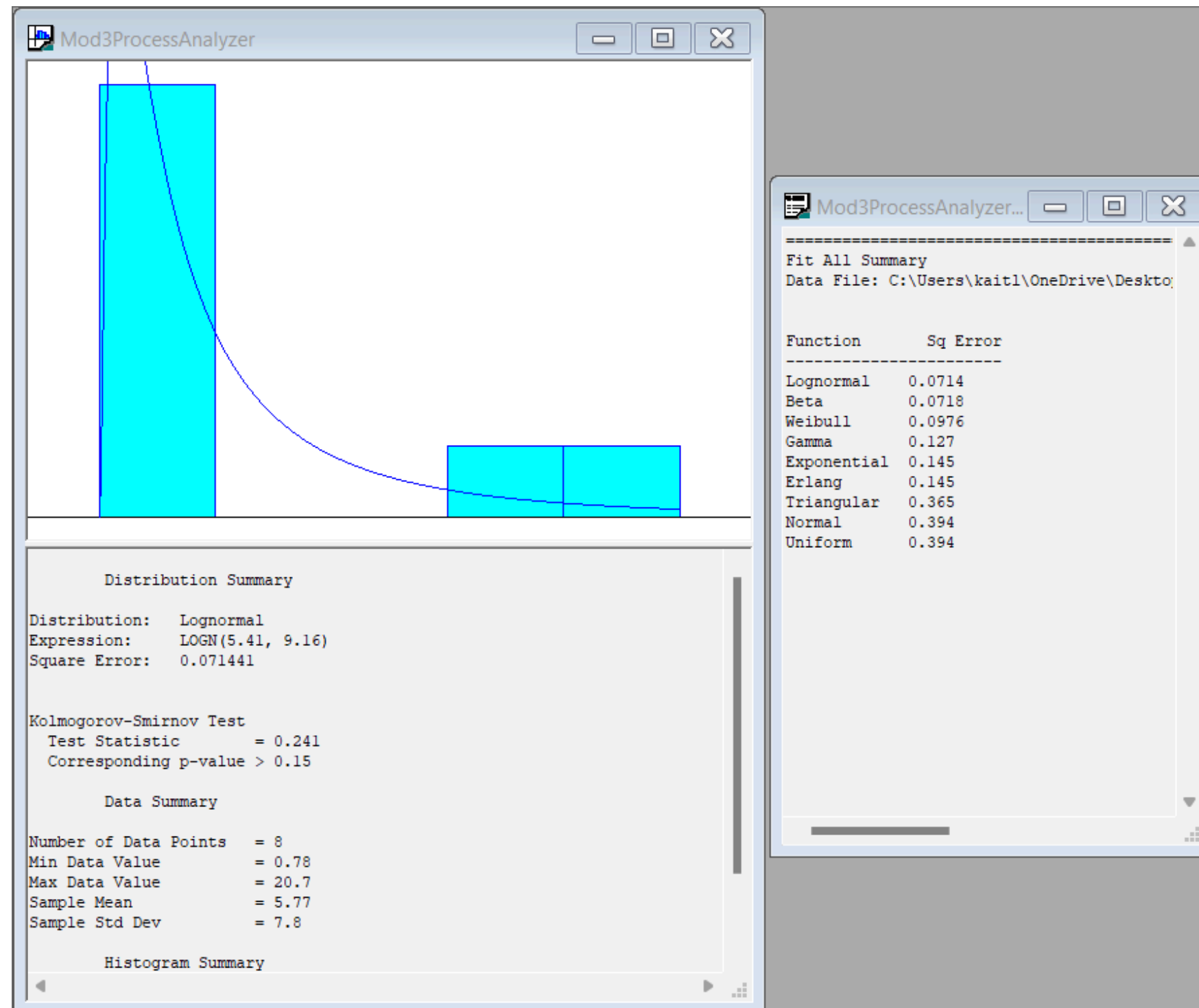
Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Carousel.Queue	2.1405	12.34	1.1696	3.1114	0.00	14.0646
Coaster.Queue	20.7026	22.26	18.9507	22.4546	0.00	67.5216
Ferris Wheel.Queue	15.6512	25.26	13.6628	17.6395	0.00	64.4313
Main Ticket Booth.Queue	1.2789	4.46	0.9281	1.6297	0.00	10.9219
Site Seeing Tower.Queue	1.9581	15.01	0.7769	3.1392	0.00	19.1392
Swings.Queue	2.8204	7.17	2.2558	3.3849	0.00	24.4841
Ticket Booth 2.Queue	0.8496	3.58	0.5679	1.1312	0.00	5.6013
Ticket Booth 3.Queue	0.7797	0.06	0.7748	0.7846	0.00	3.8874

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Carousel.Queue	0.3246	2.07	0.1618	0.4874	0.00	4.0000
Coaster.Queue	4.5705	5.77	4.1164	5.0245	0.00	20.0000
Ferris Wheel.Queue	2.4686	5.62	2.0266	2.9105	0.00	9.0000
Main Ticket Booth.Queue	0.0911	0.29	0.06806229	0.1141	0.00	4.0000
Site Seeing Tower.Queue	0.2586	2.23	0.08286991	0.4343	0.00	4.0000
Swings.Queue	0.4400	1.29	0.3384	0.5416	0.00	5.0000
Ticket Booth 2.Queue	0.05189660	0.35	0.02460972	0.07918347	0.00	3.0000
Ticket Booth 3.Queue	0.03377048	0.03	0.03138258	0.03615838	0.00	2.0000
Train.Queue	0.00	0.00	0.00	0.00	0.00	0.00

Figure 3.2 Model 3 - Queue

Model 3 Findings - Input Analyzer



- Follows a Lognormal Distribution
- Lowest value at 0.78
- Max value at 20.7
- Sample mean 5.77 min

Figure 3.3 Model 3 - Distribution

Model 3 Findings - Resource Usage

Usage

Scheduled Utilization	Average	Half Width	Minimum Average	Maximum Average
Clerk 1	0.2142	0.01	0.2136	0.2148
Clerk 2	0.2142	0.01	0.2136	0.2148
Clerk 3	0.2142	0.01	0.2136	0.2148
Clerk 4	0.1694	0.58	0.1240	0.2148
Clerk 5	0.1694	0.58	0.1240	0.2148
Clerk 6	0.1694	0.58	0.1240	0.2148
Clerk 7	0.1330	0.18	0.1191	0.1469
Clerk 8	0.1330	0.18	0.1191	0.1469
Clerk 9	0.1330	0.18	0.1191	0.1469
Operator 1	0.4186	0.71	0.3628	0.4743
Operator 2	0.7690	0.20	0.7536	0.7843
Operator 3	0.9275	0.31	0.9032	0.9518
Operator 4	0.5119	0.35	0.4842	0.5396
Operator 5	0.3985	0.71	0.3426	0.4543
Operator 6	0.00	0.00	0.00	0.00

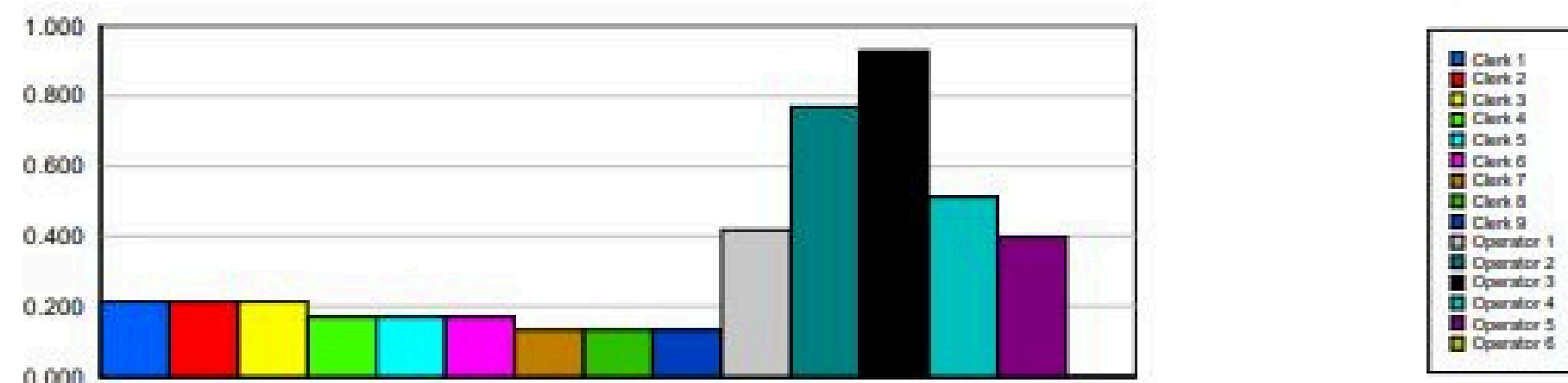


Figure 3.4 Model 3 - Scheduled Utilization

Model 3 Findings - Number Seized

Usage

Total Number Seized	Average	Half Width	Minimum Average	Maximum Average
Clerk 1	43.0000	12.71	42.0000	44.0000
Clerk 2	43.0000	12.71	42.0000	44.0000
Clerk 3	43.0000	12.71	42.0000	44.0000
Clerk 4	34.0000	101.65	26.0000	42.0000
Clerk 5	34.0000	101.65	26.0000	42.0000
Clerk 6	34.0000	101.65	26.0000	42.0000
Clerk 7	26.0000	25.41	24.0000	28.0000
Clerk 8	26.0000	25.41	24.0000	28.0000
Clerk 9	26.0000	25.41	24.0000	28.0000
Operator 1	88.5000	69.88	83.0000	94.0000
Operator 2	94.0000	63.53	89.0000	99.00
Operator 3	115.50	95.30	108.00	123.00
Operator 4	93.0000	38.12	90.0000	96.0000
Operator 5	73.5000	120.71	64.0000	83.0000
Operator 6	0.00	0.00	0.00	0.00

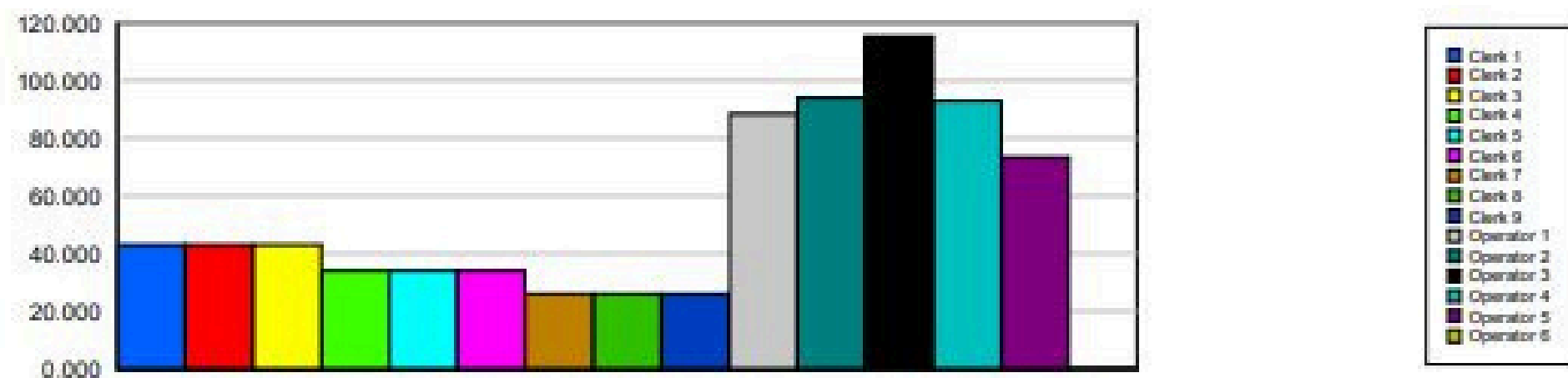


Figure 3.5 Model 3 - Number Seized



Conclusion of Findings

The Best Model

- Model 3 has a quicker processing time
- The number of guests increase
 - Riding rides
 - Park visits
- Model 2 & 3 are still improvements to the Base Model
- Having 3 booths will help for future ride additions

Model Improvements

- Route and Station modules perform similar simulation
- Adding more operators at each ride
- Creating a schedule w/ breaks for operators

Challenges & Software Feedback

- Running time w/ number of entities
- Adding more rides
 - Processing times per ride
 - Difficult to run processes with comparable numbers to job
- Lacked animations for amusements/theme parks



Thank you!

