



Application of agent based modelling for service quality assessment of airport terminal building

Speaker :

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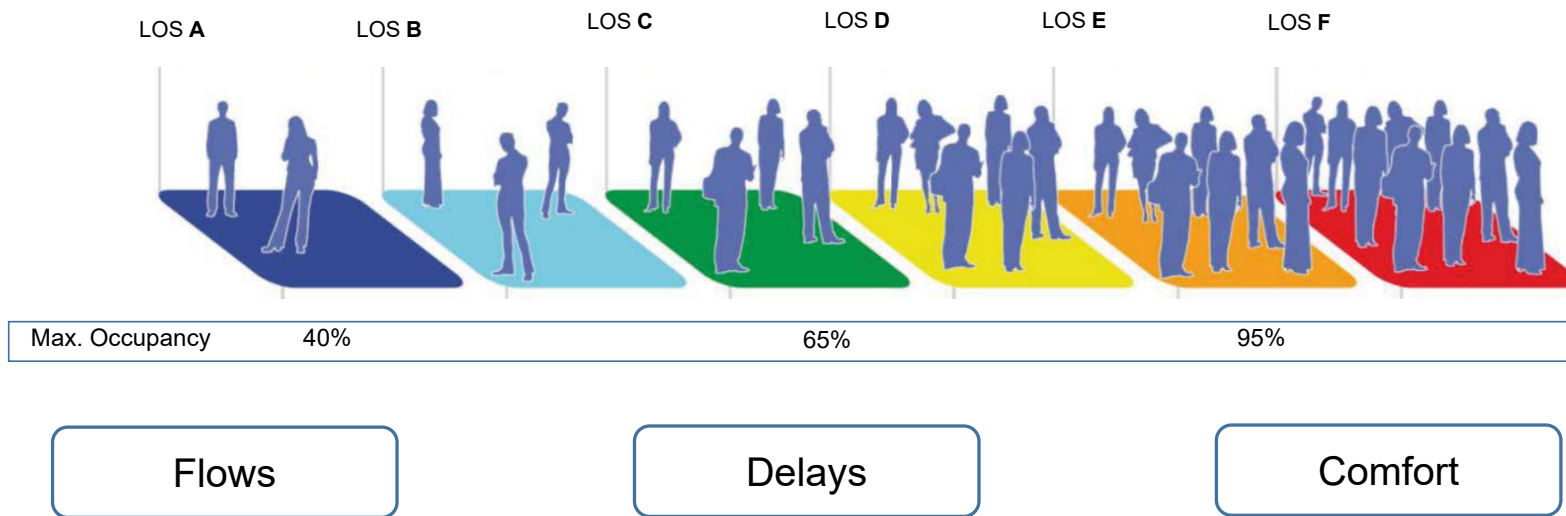
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INTRODUCTION



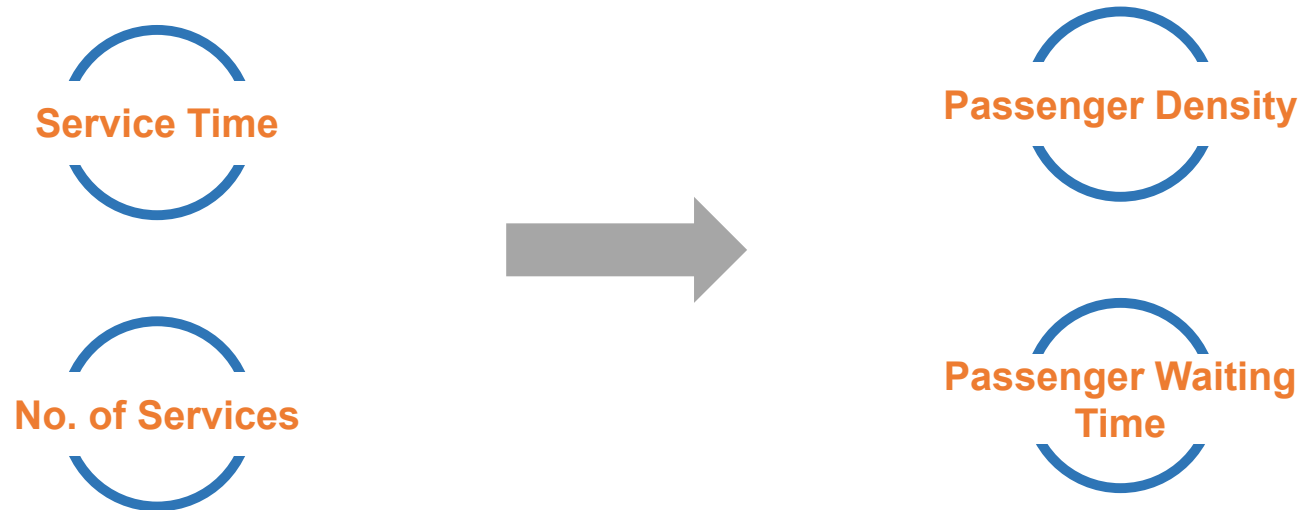
QUANTITY FACTOR

- **Temporal Factors (Processing Time)**
- **Spatial Factors (Distances/Density)**



OBJECTIVE

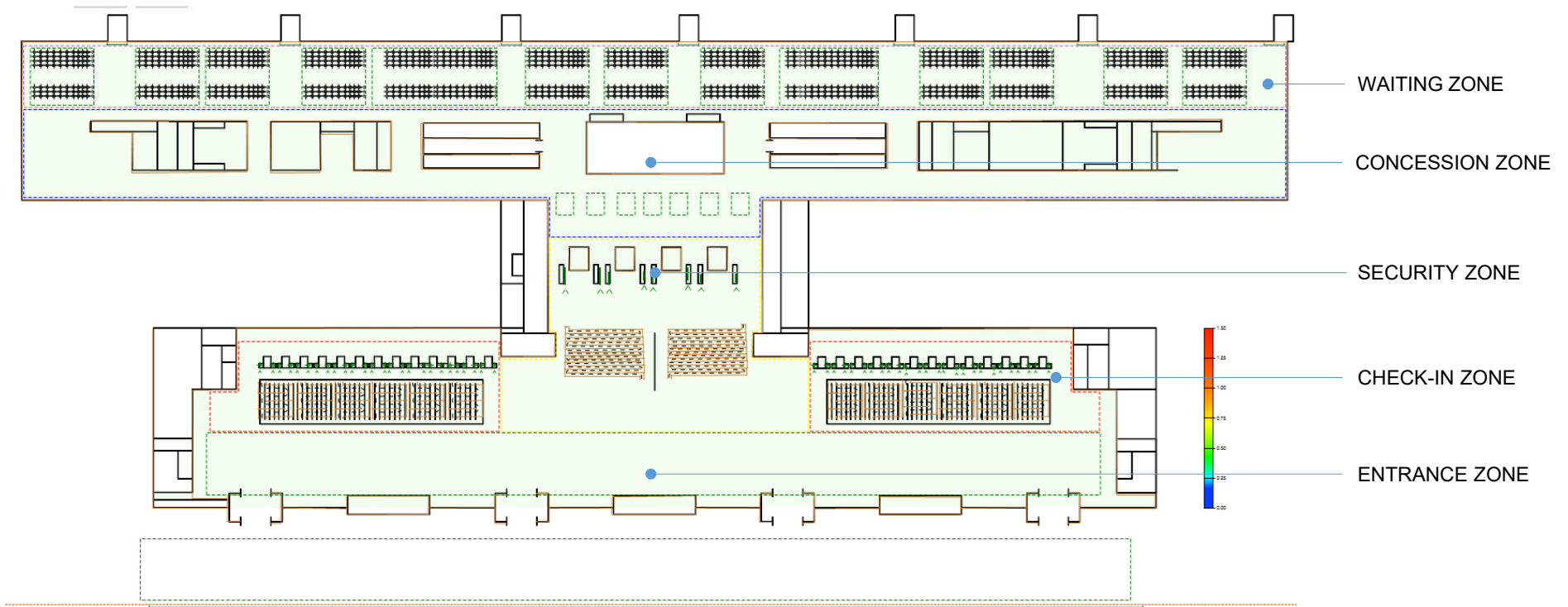
- Evaluate the dynamics of passenger occupancy at Check-in zone of terminal building for different level of services
- Estimate and compare the passenger density profiles and waiting time through ABM



DETAILS OF THE STUDY

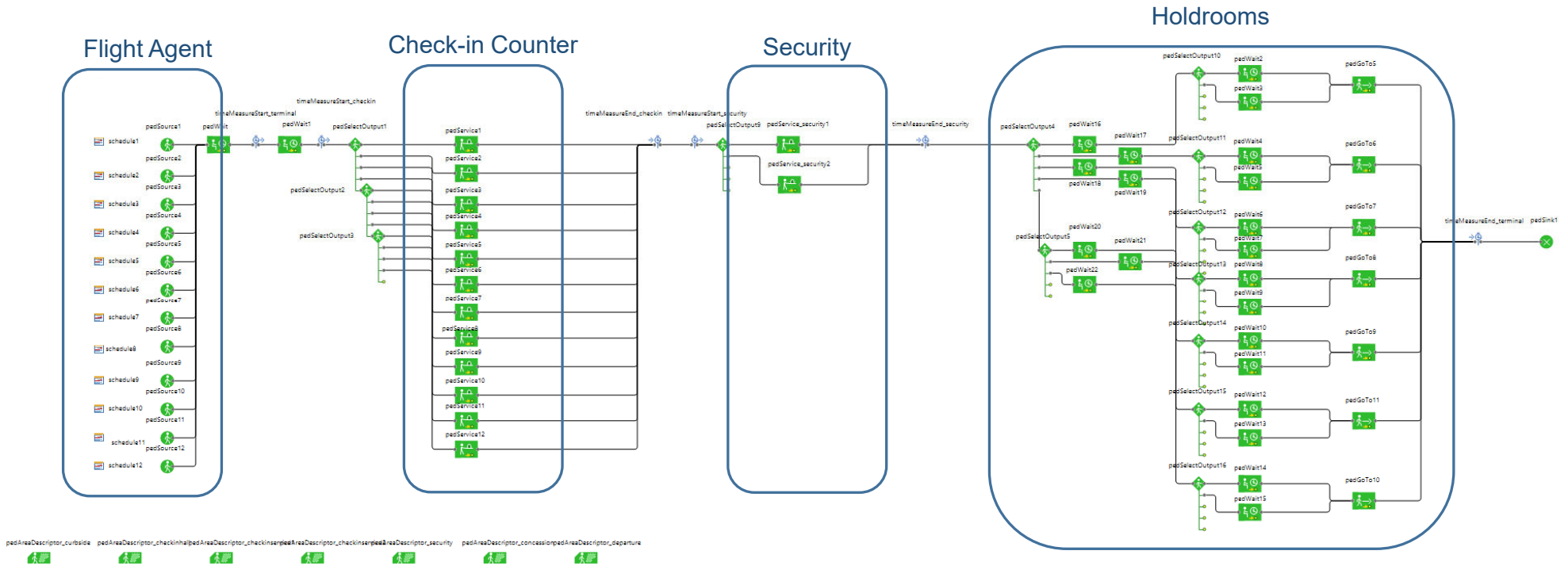
Chennai Domestic Terminal, India

Large Sized Airport



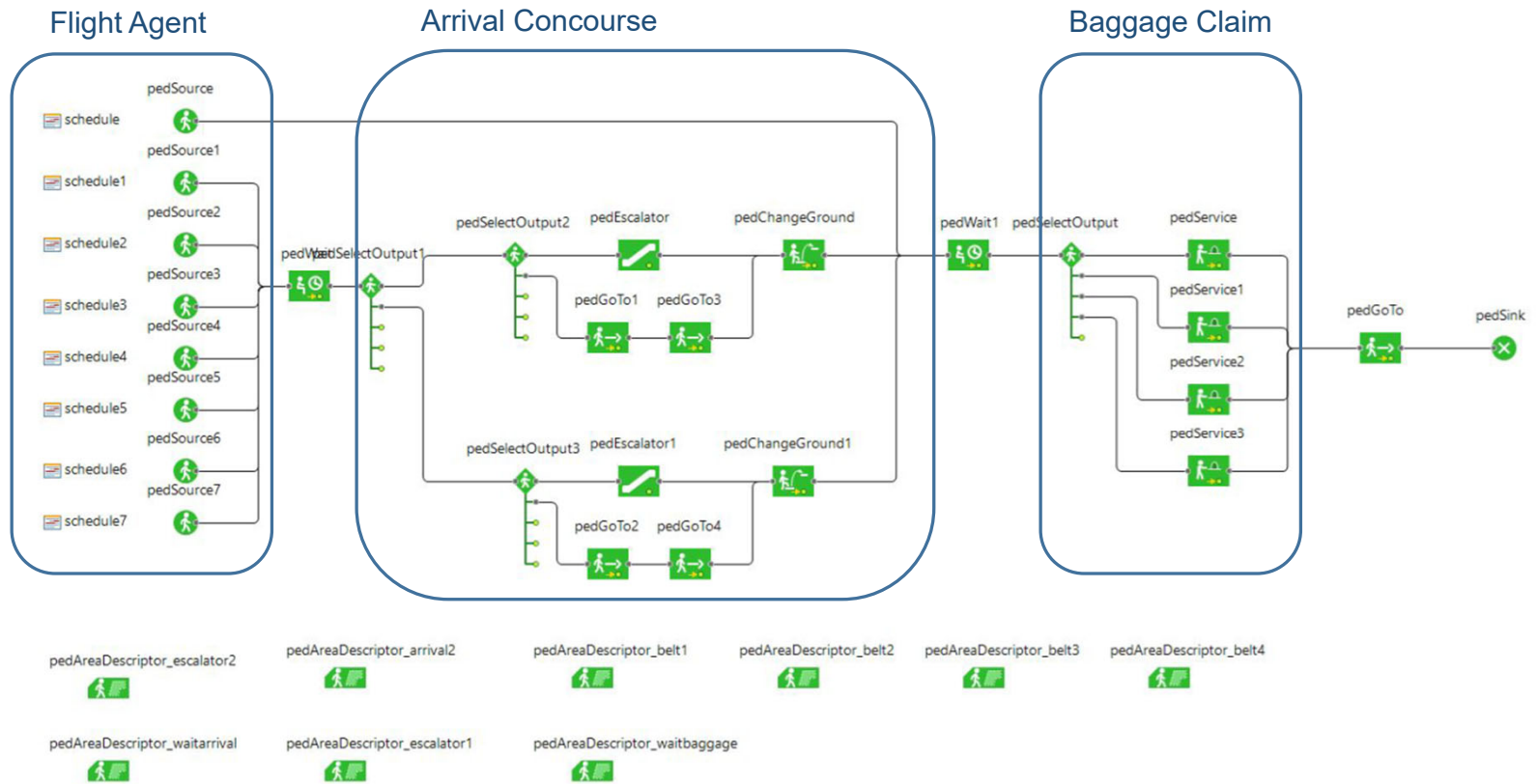
PASSENGER SEQUENCE

DEPARTURE PROCESS



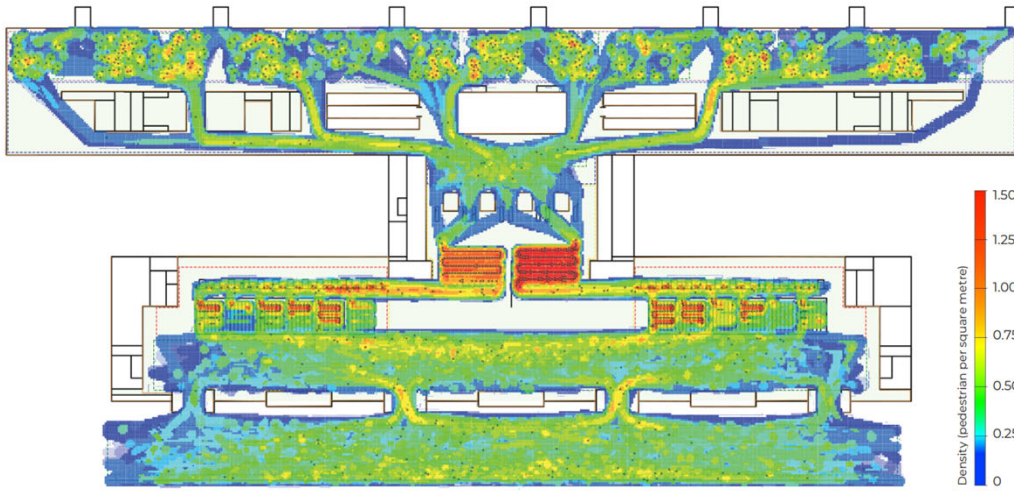
PASSENGER SEQUENCE

ARRIVAL PROCESS

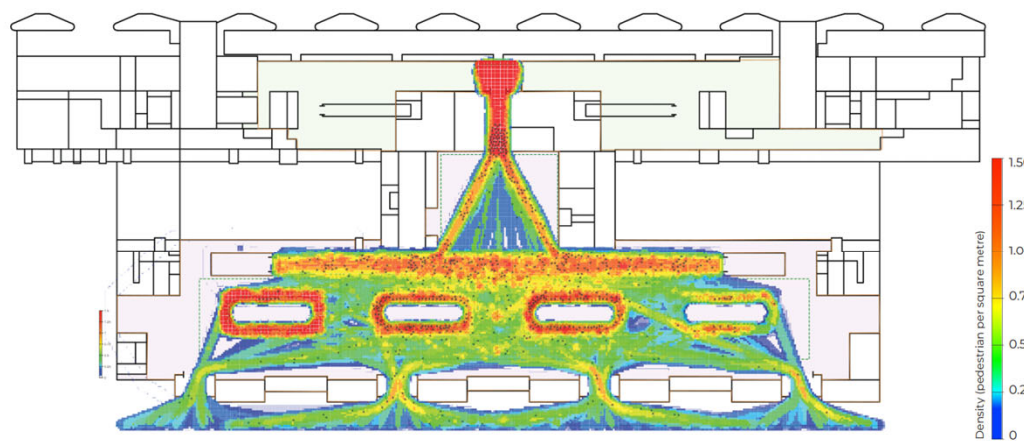


DENSITY MAP

CHENNAI DOMESTIC TERMINAL



Departure Floor Level

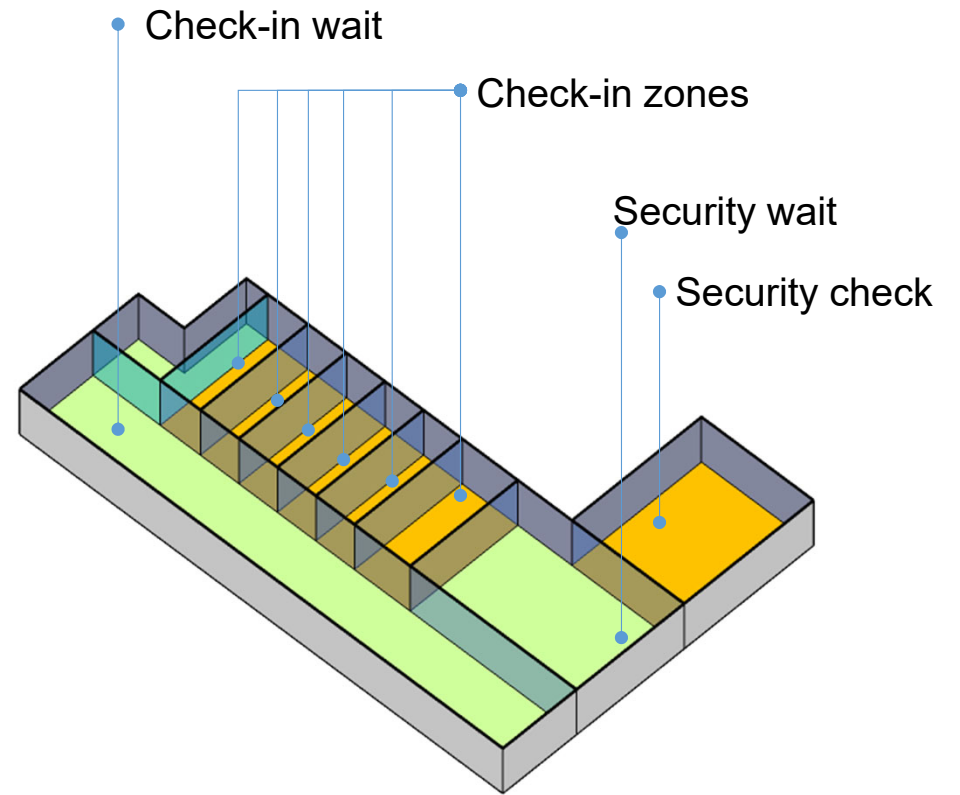
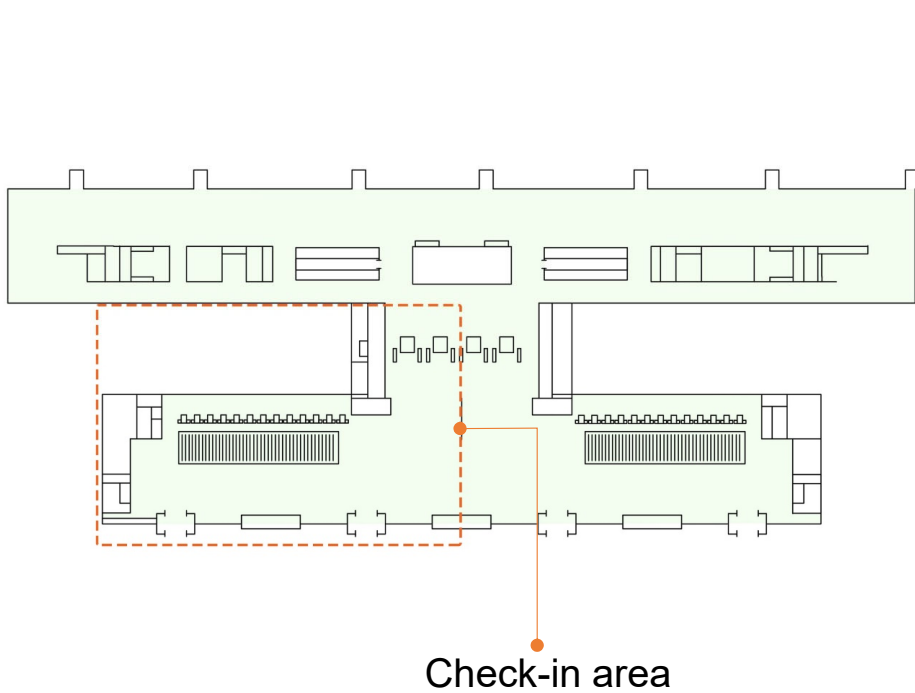


Arrival Floor Level



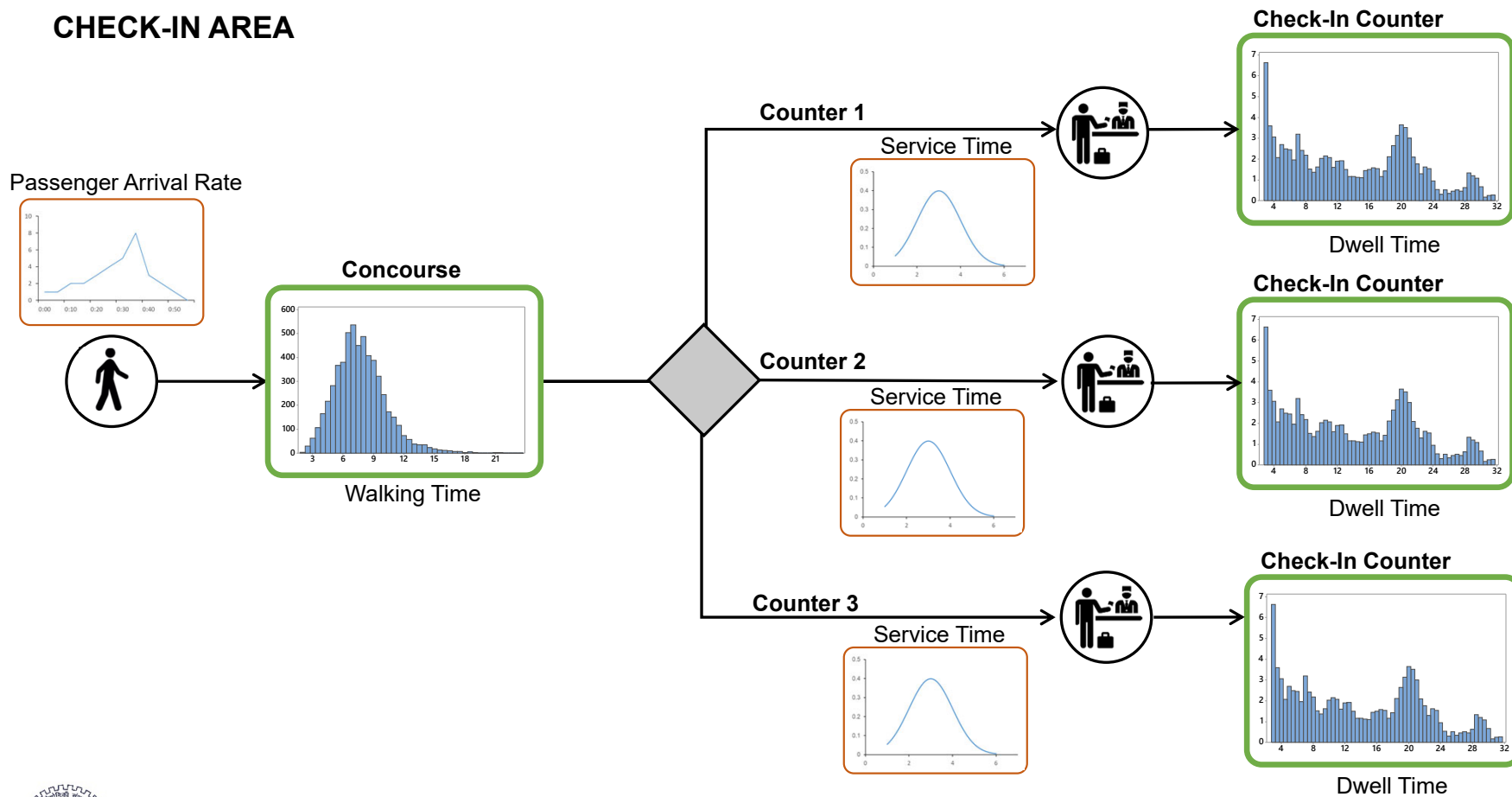
CHECK-IN AREA

CHENNAI DOMESTIC TERMINAL



MODEL SUMMARY

CHECK-IN AREA



MODEL DESCRIPTION

AGENT MODELLING



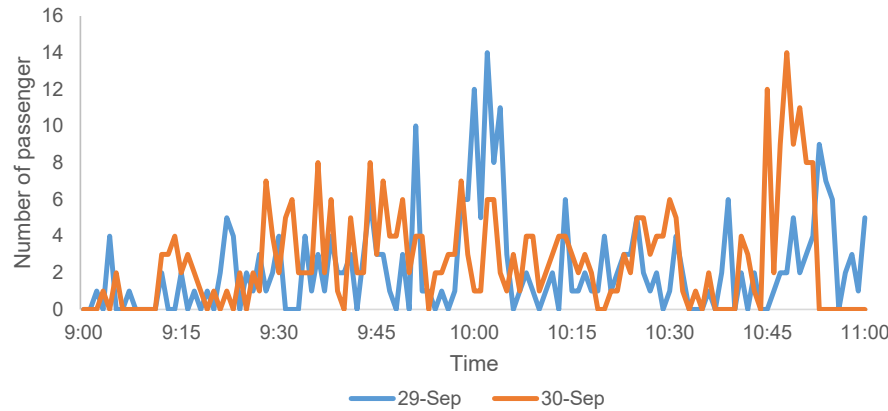
Walking Speed (metre/seconds)
 $\mu=0.7, \sigma=0.37$



Storage variables
 Waiting Time
 Walking Time



Decision variables
 Gender
 Flight number
 Class



Properties pedSource7 - PedSource

Name: Show name Ignore

Appears at: line point (x,y) area

Target line:

Arrive according to:

Rate schedule:

Modify rate:

Limited number of arrivals:

Maximum number of arrivals:

Pedestrian

New pedestrian:

Comfortable speed: meters per second

Initial speed: meters per second

Diameter: meter

Groups

Create groups:

Advanced

Add pedestrian to: default population of root agent custom population

Actions

On exit:

Advanced

Description

Activate Windows
Go to Settings to activate Windows.



MODEL DESCRIPTION

SERVICE POINTS (FIELD STUDY DATA)

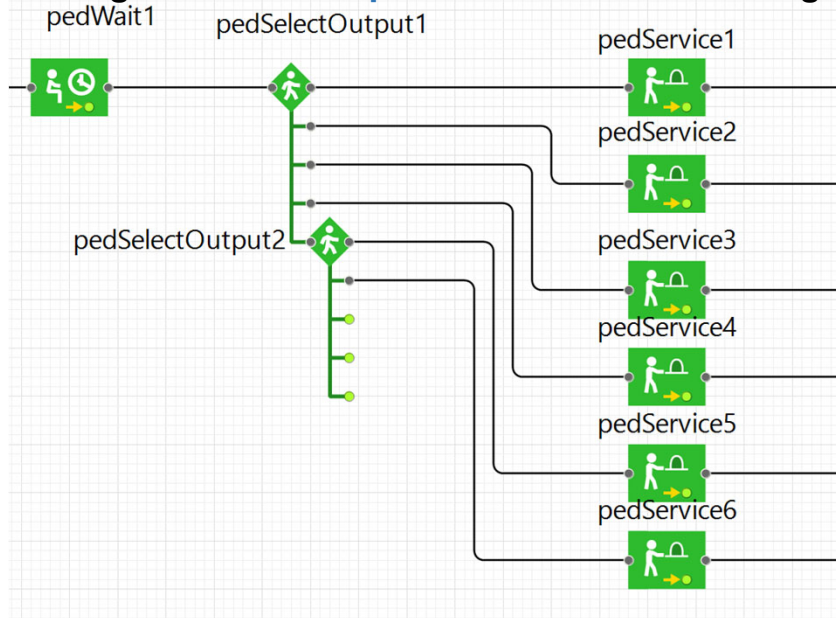
Service points	Probability distribution	Distribution parameters (units in seconds)
Entry gate	Normal	Mean = 14.50, Stnd = 5.715
Check-in entry	Gamma	Shape = 5.937, Scale = 1.768
Self check-in	Weibull	Shape = 2.393, Scale = 39.25
Assisted self check-in	Loglogistic	Location = 3.229, Scale = 0.1422
Baggage screening	Weibull	Shape = 1.075, Scale = 59.86
Baggage after screening	Lognormal	Location = 4.121, Scale = 0.38
Check-in counter	Logistic	Location = 79.12, Scale = 18.87
Security b4 screening	Weibull	Shape = 1.596, Scale = 129.2
Security screening	Normal	Mean = 35.64, Stnd = 56.371
Security after screening	Normal	Mean = 30.55, Stnd = 17.17
Boarding process	Loglogistic	Location = 0.9783, Scale = 0.1670
Baggage belt	Weibull	Shape = 1.284, Scale = 498.3
Entry Queueing	Normal	Mean = 46.02, Stnd = 15.82
Check-in Queueing	Weibull	Shape = 0.7315, Scale = 1148
Security Queueing	Weibull	Shape = 2.225, Scale = 66.33
Boarding Queueing	Weibull	Shape = 1.332, Scale = 250.4



MODEL DESCRIPTION

DECISION MODEL FOR CHOOSING CHECK-IN COUNTER

Using PedSelectOutput For Decision Modelling



Using Conditional Output

pedSelectOutput1 - PedSelectOutput

Name: Show name Ignore

Use: Probabilities Conditions Exit number

Condition 1:

Condition 2:

Condition 3:

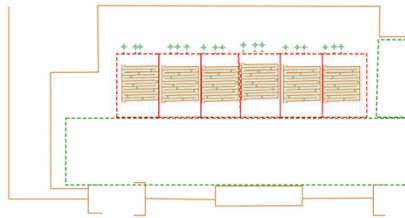
Condition 4:



MODEL DESCRIPTION

Check-in Counter modelled as PedService

SPATIAL MODEL



services_CheckIn1 - Service With Lines

Name: Ignore Visible on upper level Lock

Visible: yes

Ground:

Number of services:

N of queues:

Type of queue: Line Serpentine

Type of service: Point Linear

N of reverse queues:

Serve pedestrians from: Longest queue Closest queue (strict) Closest not empty queue Next queue (round robin) Priority queue Other

STOCHASTIC MODEL

Weibull

alpha:

beta:

min:

The histogram displays the distribution of service times. The x-axis represents time in minutes, ranging from 0 to 14. The y-axis represents frequency. A blue histogram shows the data points, and a red curve represents the Weibull distribution fit. Vertical dashed lines are drawn at the minimum value (2.02) and at the mean (approximately 4.5).

pedService1 - PedService

Name: Show name Ignore

Services:

Queue choice policy:

Delay time:

Recovery delay:

Pass through in reverse direction:



LEVEL OF SERVICES SCENARIOS

CHENNAI DOMESTIC TERMINAL

LOS E

- Process time : **Weibull(1.8, 3.0, 2.02)** in minutes
- No. of counters : **18**

LOS C

- Process time : **Weibull(1.8, 3.0, 2.02)** in minutes
- No. of counters : **26**

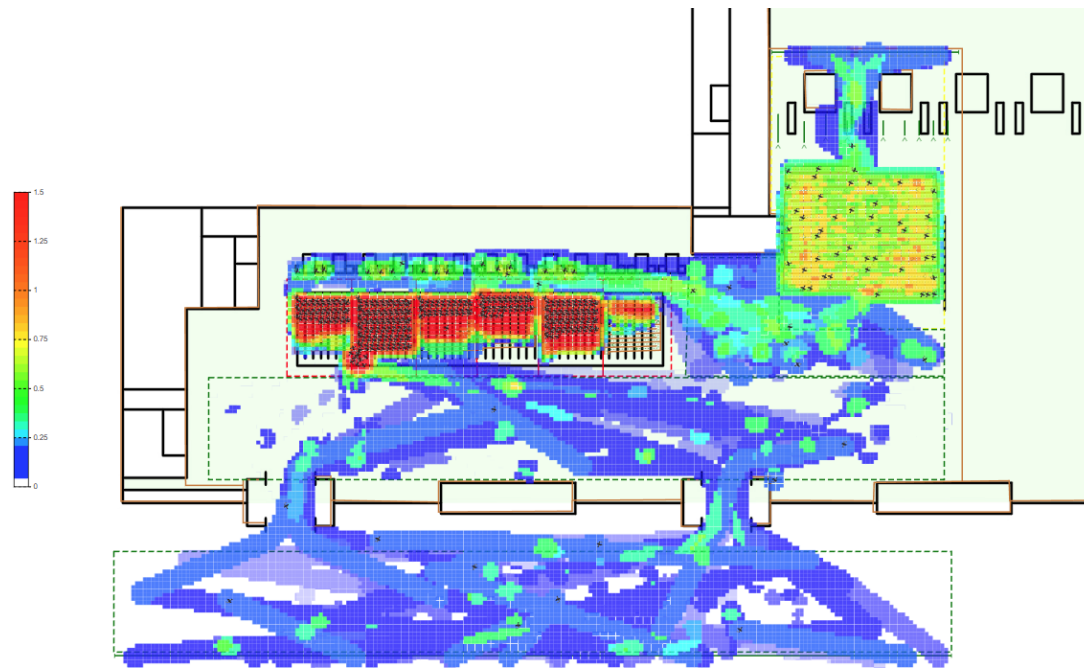
LOS A

- Process time : **Weibull(1.49, 2.22, 1.02)** in minutes
- No. of counters : **26**



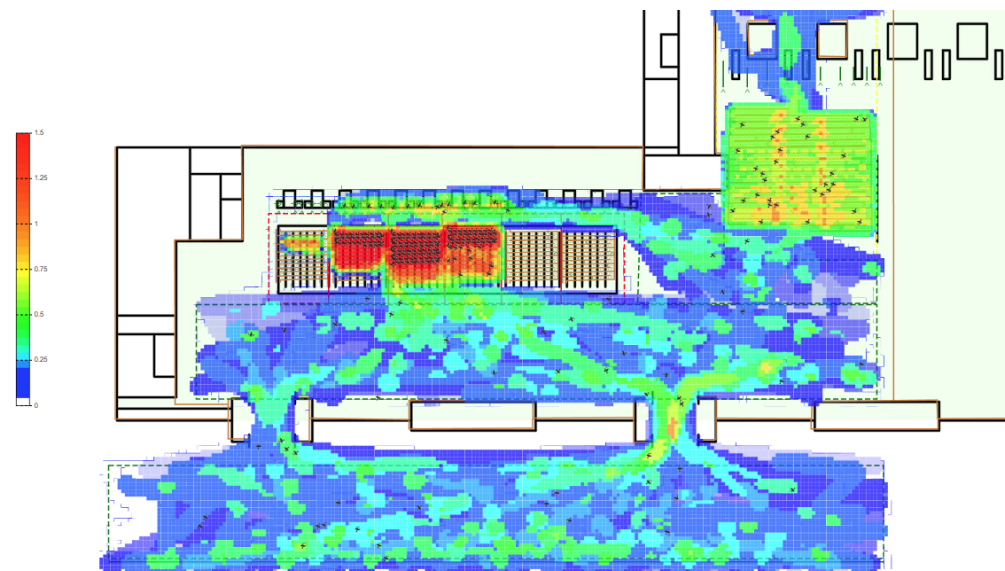
LEVEL OF SERVICE E

CHENNAI DOMESTIC TERMINAL



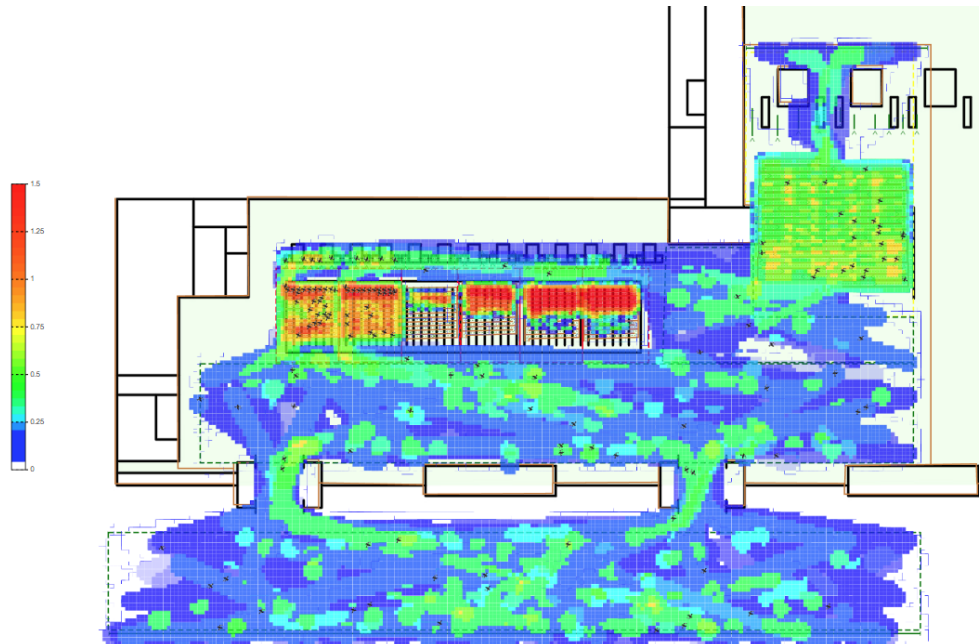
LEVEL OF SERVICE C

CHENNAI DOMESTIC TERMINAL



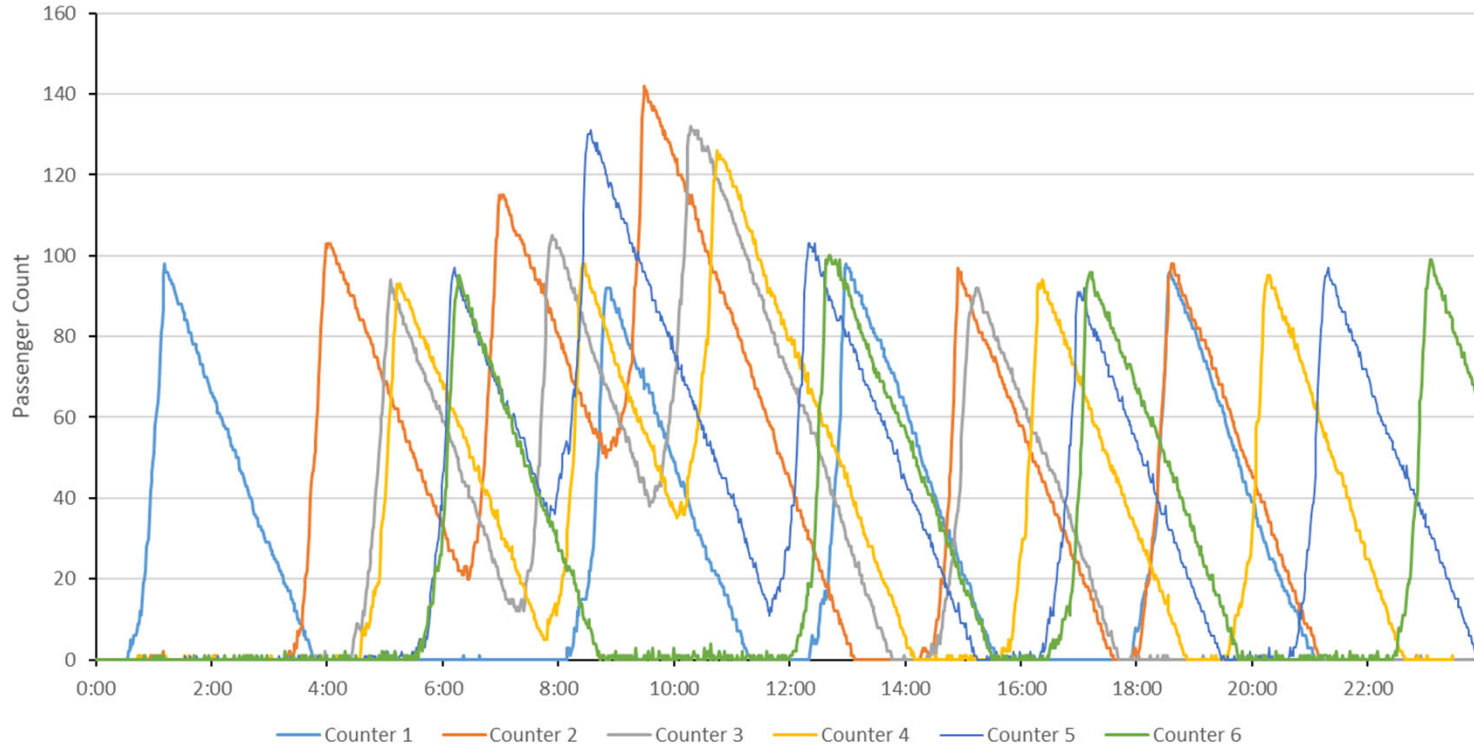
LEVEL OF SERVICE A

CHENNAI DOMESTIC TERMINAL



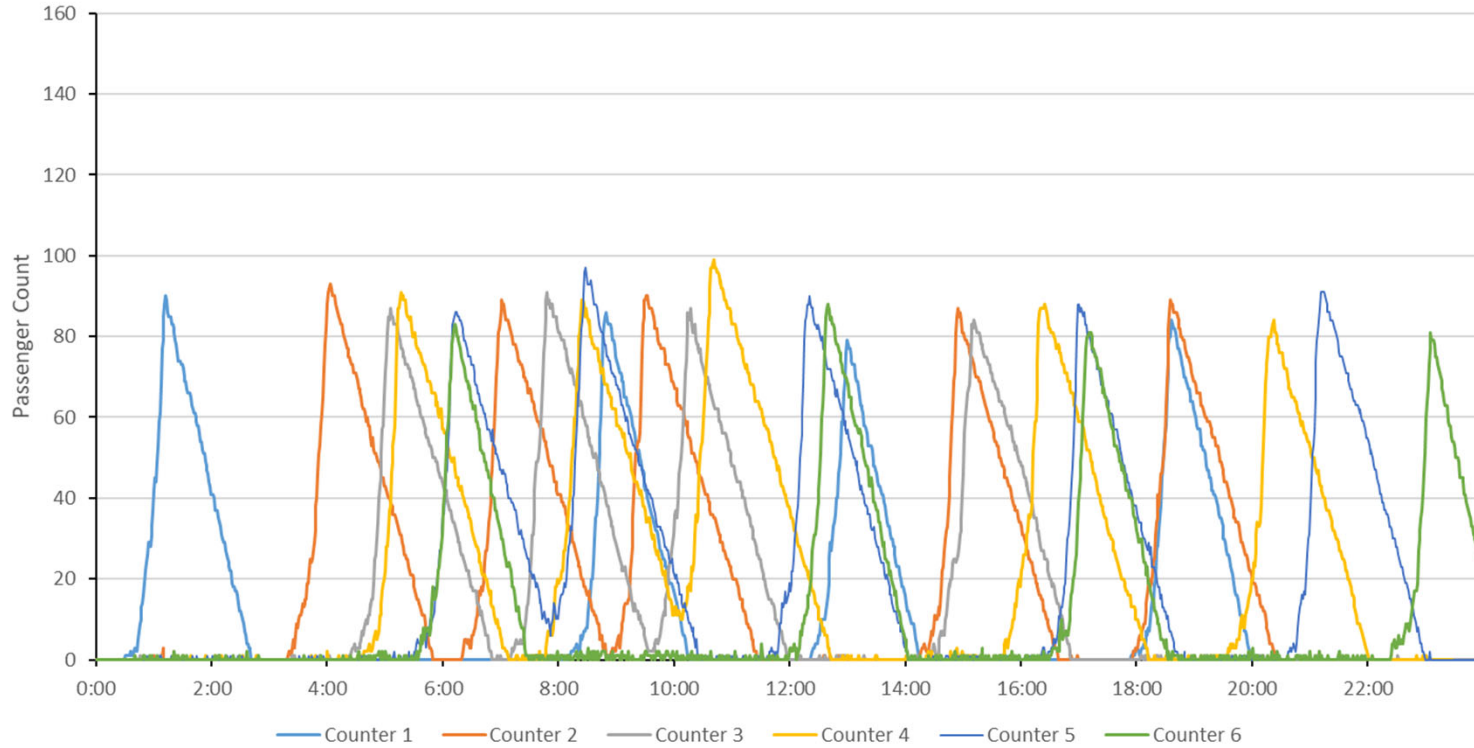
LEVEL OF SERVICE E

TYPICAL WEEKDAY DENSITY PROFILE



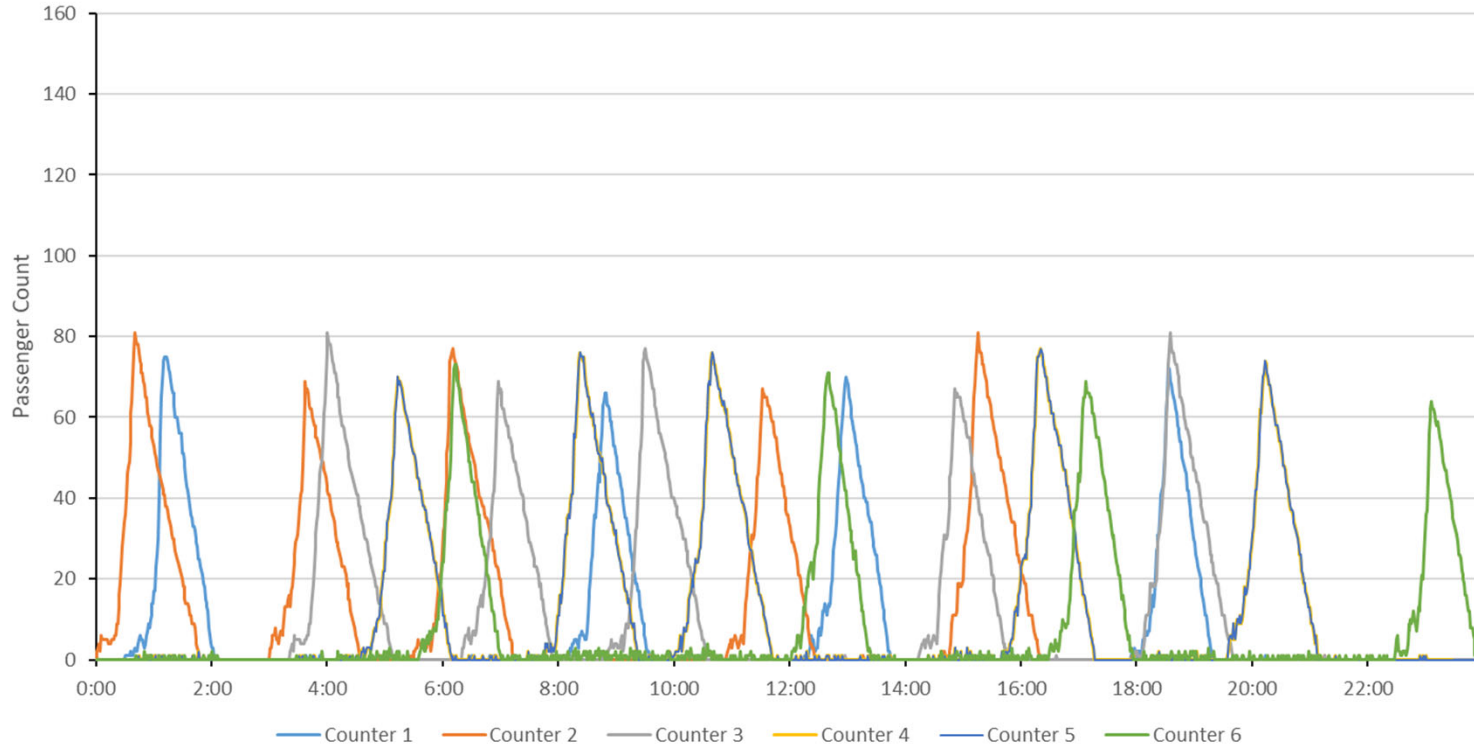
LEVEL OF SERVICE C

TYPICAL WEEKDAY DENSITY PROFILE



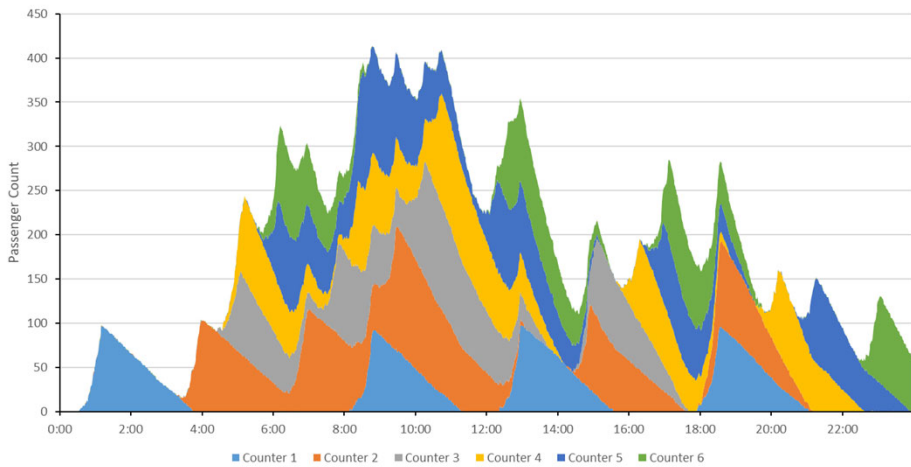
LEVEL OF SERVICE A

TYPICAL WEEKDAY DENSITY PROFILE

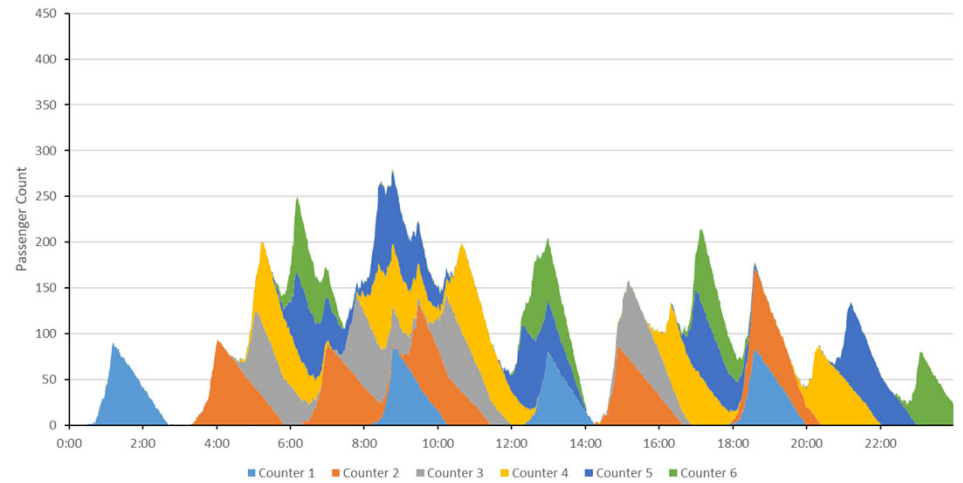


CROWDING COMPARISON

TYPICAL WEEKDAY DENSITY PROFILE



LOS E

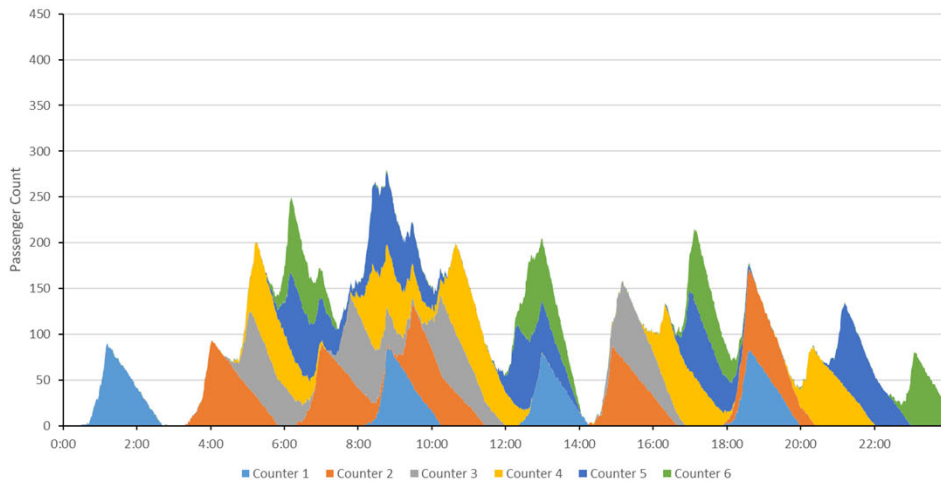


LOS C

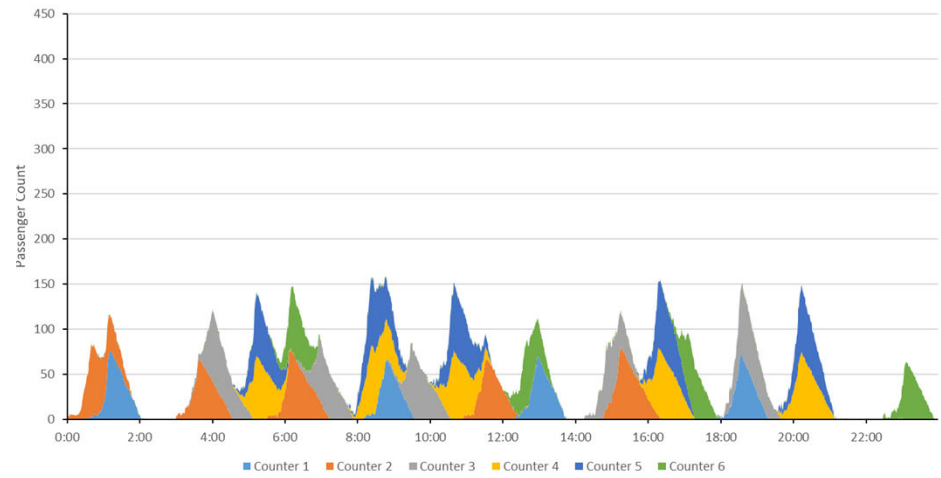


CROWDING COMPARISON

TYPICAL WEEKDAY DENSITY PROFILE



LOS C

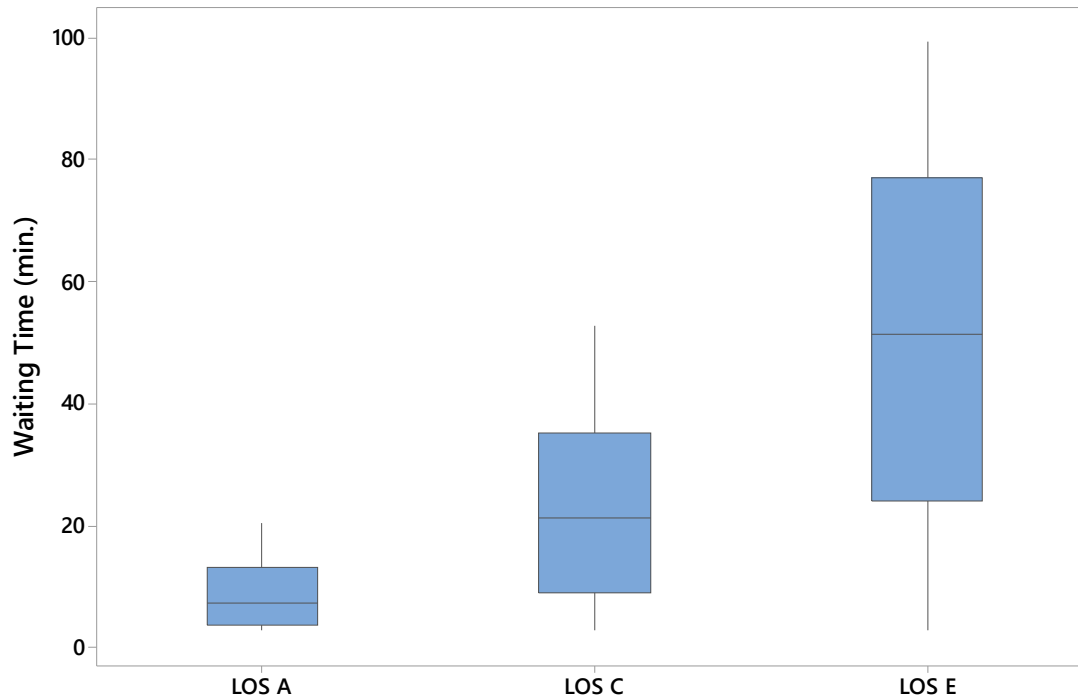


LOS A



WAITING TIME AT CHECK-IN ZONE

TYPICAL WEEKDAY DENSITY PROFILE



WAITING TIME (in minutes)

Cases	Mean	St. Dev
LOS A	8.732	5.402
LOS C	22.81	15.123
LOS E	50.466	29.213





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Questions and Comments

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