AIFA AIRPORT SIMULATION LAB

User Parameter Guide

First Draft — Parameter definitions and input guidance

Interactive Passenger Terminal Simulation

Purpose of this guide

This guide explains the user-configurable parameters available in the AIFA Airport Simulation Lab. It is intended to help users define simulation scenarios consistently, understand the units of each input, and interpret how each parameter changes the experiment.

Draft **v0.2**

Prepared for user support and course use.

1. Using the Parameter Panel

The AIFA Airport Simulation Lab uses a predefined passenger-terminal simulation model. The user does not modify the internal model. Instead, the experiment is configured by entering values for selected parameters in the web interface and then running the scenario.

Important: Units are part of the parameter definition. Enter values using the unit indicated in the interface (for example, hours, minutes, seconds, metres per second, number of resources, or percentage of demand).

1.1 Numeric values and expressions

Some time and speed fields may accept either a fixed numeric value or a supported random expression. This allows the model to represent variability instead of assigning exactly the same value to every passenger.

Expression example: Random.Triangular(0.6,0.8,1.1) for passenger speed in m/s. See Section 1.2 for additional examples and guidance on variability and capacity inputs.

1.2 Example Input Expressions

Some parameters can be entered as either a fixed value or a probability-distribution expression. Fixed values are useful for controlled experiments, while random expressions represent the natural variability observed in passenger behaviour and processing times.

Parameter	Fixed example	Random-expression example	Unit
Passenger Speed	0.8	Random.Triangular(0.6,0.8,1.1)	m/s
Arrival Hall Dwell Time	15	Random.Uniform(10,15)	min
Check-in Processing Time	90	Random.Triangular(60,90,120)	s
Boarding Pass Control Time	7	Random.Triangular(3,7,12) or Random.Uniform(3,12)	s
Body Scan Time	12	Random.Uniform(8,12)	s
Security Preparation (Divest) Time	20	Random.Triangular(15,20,60) or Random.Uniform(15,60)	s

Using a Normal distribution. When appropriate, a Normal distribution may be entered as Random.Normal(mean, standardDeviation). Because the Normal distribution is unbounded, it can generate physically unrealistic values for a time-based process. For practical experiments, lower and upper limits should therefore be applied when necessary.

Bounded Normal example: Math.Min(upperBound, Math.Max(lowerBound, Random.Normal(mean, standardDeviation))). Replace the placeholders with realistic limits for the process being represented. This clips generated values to the defined limits and should be distinguished from a formally truncated Normal distribution.

Capacity versus variability. Resource and infrastructure parameters are normally entered as integers—for example, the number of open check-in positions, security lines, passport-control lines, baggage belts or customs lines. Changing these values allows the user to represent smaller or larger terminal capacities. Time and behavioural parameters, by contrast, can use fixed values or probability distributions to analyse operational variability. Combining both types of inputs makes it possible to study how infrastructure capacity and process variability jointly influence passenger flows and terminal performance.

Further reading. For additional background on probability distributions and their application in modelling and simulation, see: Flores de la Mota, I., Guasch, A., Mujica Mota, M., & Piera, M. A. (2017). *Robust Modelling and Simulation: Integration of SIMIO with Coloured Petri Nets*. Springer International Publishing. ISBN 978-3-319-53320-9. [Amazon book page]

1.3 Demand growth parameters

The departure and arrival growth settings scale passenger demand from a baseline representing approximately 2 million passengers per year. These parameters are intended for scenario analysis, allowing users to test how the terminal responds to higher or lower demand relative to the baseline.

2. General Simulation Parameters

These settings define the overall experiment and affect the complete model.

Parameter	Unit / input	What it controls	Notes
Simulation Duration	hours	Total simulated time represented by each run. It should be long enough for the model to represent a close-to-stable operating period for the scenario being tested.	Applies to each run.
Number of Replications	integer	Number of independent simulation runs performed for the same scenario. Replications are used to address the natural variability of the system and provide more robust results.	More runs capture variability.
Passenger Speed	m/s or expression	Walking speed assigned to passengers as they move through the terminal. A fixed value can be used, or a supported random expression can represent differences among passengers.	See Section 1.2.

3. Departure Parameters

These parameters are used when the departure process is enabled. They control passenger demand, waiting behaviour, manual check-in, boarding-pass control and security processing.

Parameter	Unit / input	What it controls	Notes
Departures ON	ON / OFF	Enables or disables the departure process in the experiment.	Use ON to evaluate departures.
Growth (Departures)	demand factor	Scales departure passenger demand relative to the baseline traffic level of approximately 2 million passengers per year.	Scenario demand setting.
Companion Waiting Time (Departures)	minutes	Time companions wait in the Departure Hall before completing their departure-side activity.	Waiting behaviour.
Passenger Waiting Time (Departures)	minutes	Time departing passengers wait in the Departure Hall before continuing to the next process.	Waiting behaviour.
% Manual Check-in	% of demand	Percentage of departing passenger demand processed at manual check-in counters.	Manual-processing share.
Open Check-in Islands	integer	Number of manual check-in islands available for processing passengers. Each island has 14 check-in counters	Capacity setting.

Parameter	Unit / input	What it controls	Notes
Check-in Processing Time	seconds or expression	Service time required to process a passenger at manual check-in. A fixed value or supported random expression may be used.	Service-time input.
Check-in Staff	integer	Number of staff members serving each active manual check-in position.	Resource setting.
Boarding Pass Control Staff	integer	Number of staff members checking boarding passes before passengers access the security process.	Pre-security control.
Boarding Pass Control Time	seconds	Time required to check a passenger's boarding pass before access to security.	Service time.
Open Security Lines	integer	Number of departure security screening lines available to passengers.	Security capacity.
Body Scan Waiting Capacity	passengers	Maximum number of passengers who can wait for body/metal scanning within a security line.	Queue capacity.
Body Scan Time	seconds	Time required for the passenger body/metal screening process.	Screening time.
Security Tray Capacity	passengers	Number of passengers who can simultaneously use the tray/belongings preparation area in the security process.	Parallel capacity.
Security Preparation Time	seconds	Time passengers require to remove clothing or personal items and place belongings in security trays before screening.	Preparation time.

4. Arrival Parameters

Arrival flows can be enabled separately for domestic and international passengers. International arrivals include passport-control and customs-related settings, while both flows may use baggage reclaim and arrival-hall waiting parameters.

Parameter	Unit / input	What it controls	Notes
Domestic Arrivals ON	ON / OFF	Enables or disables the domestic arrival flow in the experiment.	Arrival flow selector.
International Arrivals ON	ON / OFF	Enables or disables the international arrival flow in the experiment.	Arrival flow selector.
Growth (Arrivals)	demand factor	Scales arrival passenger demand relative to the baseline traffic level of approximately 2 million passengers per year.	Scenario demand setting.
Companion Waiting Time (Arrivals)	minutes	Time companions wait for arriving passengers in the Arrival Hall.	Waiting behaviour.
Passenger Waiting Time (Arrivals)	minutes	Time arriving passengers wait after reaching the Arrival Hall before completing the arrival-side activity.	Waiting behaviour.
Manual Passport Lines	integer	Number of manual passport-control lines open for international arrivals.	International arrivals only.
Automatic Passport Lines	integer	Number of automatic passport-reading/control units available for international arrivals.	International arrivals only.
% Manual Passport Control	% of demand	Percentage of international arrival demand routed to manual passport control.	Routing share.

Parameter	Unit / input	What it controls	Notes
International Baggage Belts	integer	Number of baggage-reclaim belts available for international arriving passengers.	Baggage capacity.
Domestic Baggage Belts	integer	Number of baggage-reclaim belts available for domestic arriving passengers.	Baggage capacity.
Open Customs Lines	integer	Number of customs-inspection lines open for international arriving passengers.	International arrivals only.
% Customs Inspection	% of demand	Percentage of international arriving passenger demand selected or routed for customs inspection.	Inspection share.
Customs Inspection Time	seconds	Time required to inspect a passenger at customs.	Service time.

5. Data Collection Parameters

These parameters determine when the model begins recording performance indicators, how long data are recorded, and how frequently observations are sampled.

Parameter	Unit / input	What it controls	Notes
Data Collection Start	simulation hour	Simulation time at which performance-data recording begins. This can be used to exclude an initial period before measurements are collected.	Measured from simulation start.
Data Collection Duration	time interval	Length of time during which simulation results are collected after the data-collection start point.	Defines the observation window.
Sampling Frequency	time interval	Interval between successive data samples during the data-collection period.	Controls sampling resolution.

6. Recommended Experiment Workflow

1. Select the processes to evaluate. Enable departures, domestic arrivals and/or international arrivals as required.

2. Define demand. Set the relevant growth parameter(s) relative to the baseline passenger demand.

3. Configure resources and service capacity. Set check-in, boarding-pass control, security, passport control, baggage reclaim and customs resources as applicable.

4. Define passenger and process times. Enter waiting times, processing times, walking speed and supported variability expressions.

5. Configure the experiment. Set simulation duration, number of replications and data-collection settings.

6. Run and compare. Execute the scenario, review the results, modify one or more parameters and compare alternative configurations.

7. Notes for Interpretation

- A parameter changes the conditions of the experiment; it does not modify the structure of the underlying simulation model/infrastructure.
- Increasing the number of available resources does not automatically guarantee better overall performance. Effects should be evaluated using the simulation results.
- When random expressions are used, replications become particularly important because individual runs may produce different results.
- Demand-growth settings should be interpreted relative to the model baseline of approximately 2 million passengers per year.
- Data-collection settings should be selected so that the observation window represents the part of the simulated operation that the user intends to analyse.

8. Draft Status

This is the first draft of the user parameter guide. Parameter names, accepted syntax, default values, allowable ranges and examples should be aligned with the final web interface before publication. Screenshots of the interface can also be added to a later version to provide step-by-step visual guidance.

AIFA Airport Simulation Lab

An IGAMT simulation and educational initiative.
Web platform and simulation integration developed in collaboration with SCIAER – Airport Engineering Consultancy.