Society of Vertical Transportation

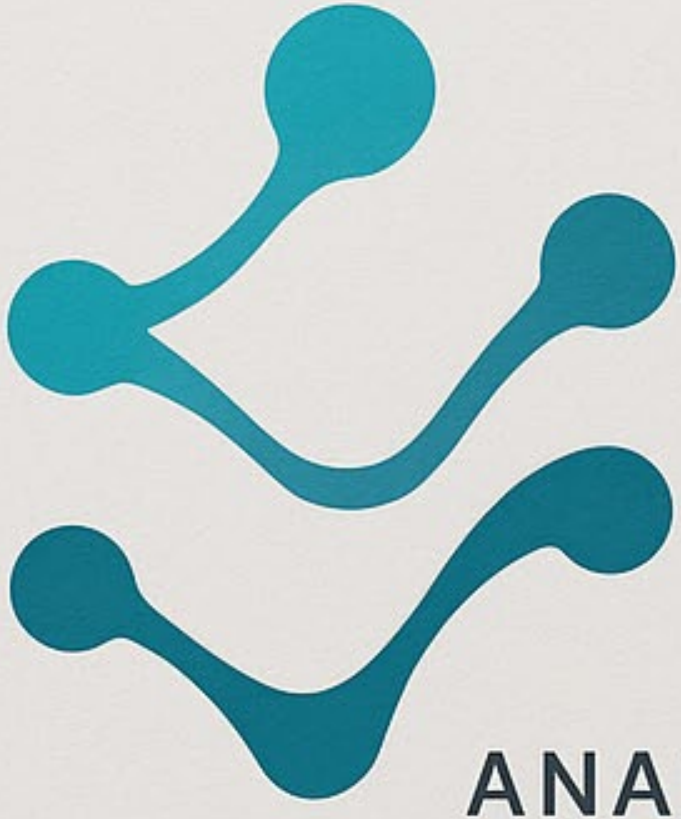
Annual Seminar 12 November 2025

80% Lift Traffic Design's Most Misunderstood Number

Dr Richard Peters

Peters Research Ltd

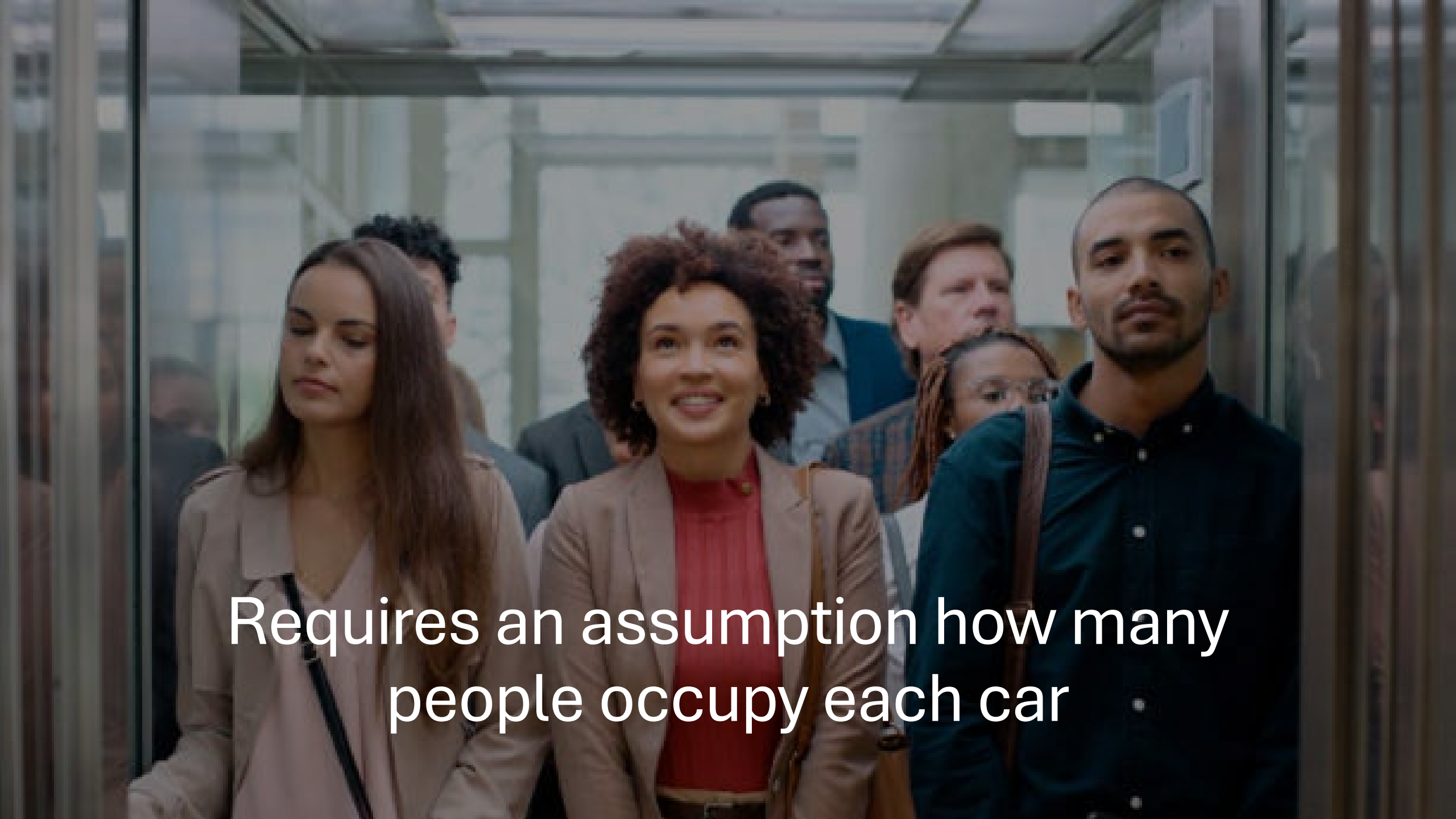
Peters Research



Lift Traffic

ANALYSIS AND SIMULATION


How effectively can we manage passenger demand at peak periods?



Requires an assumption how many people occupy each car

Car capacity using mass

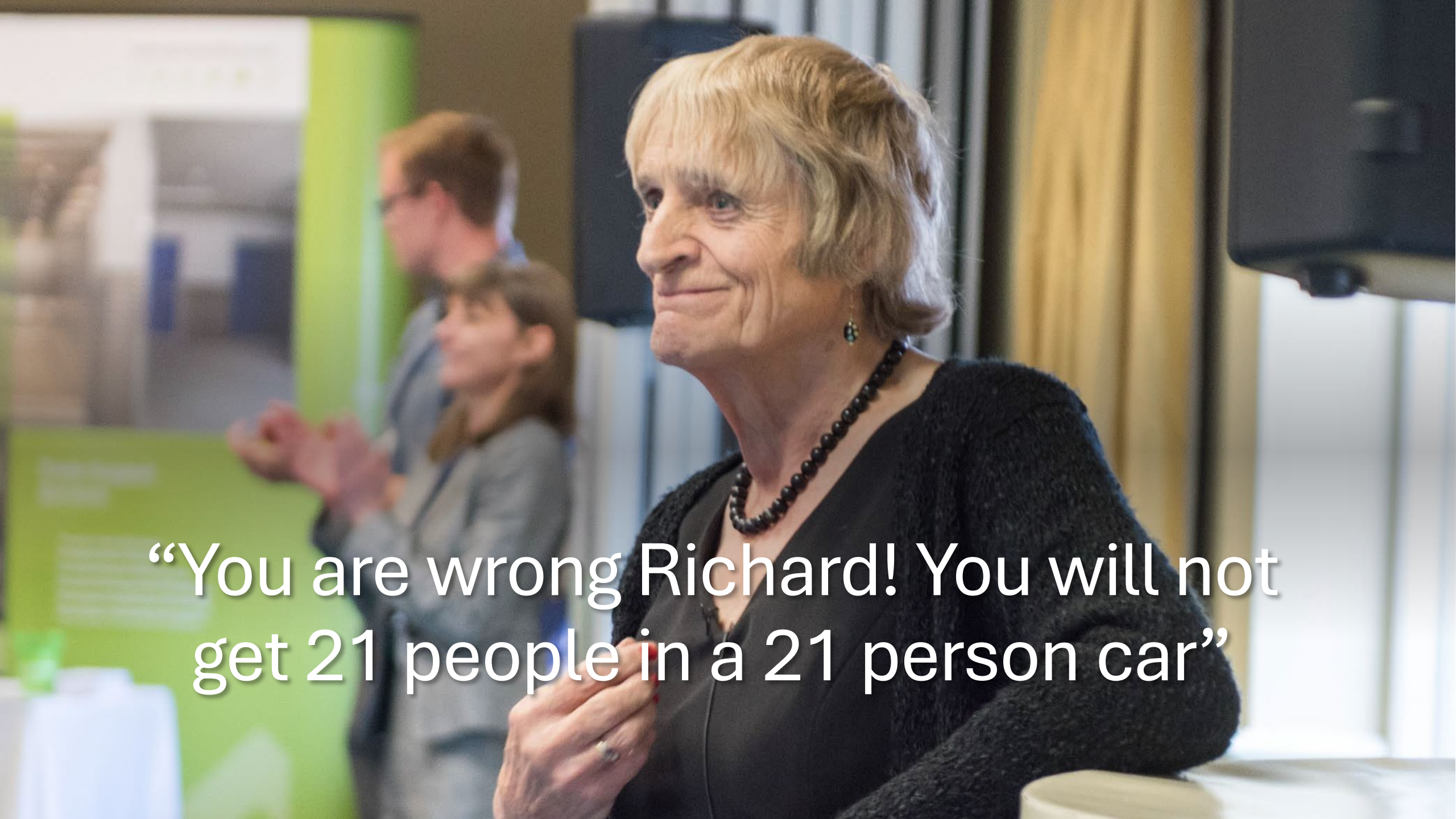
1990's

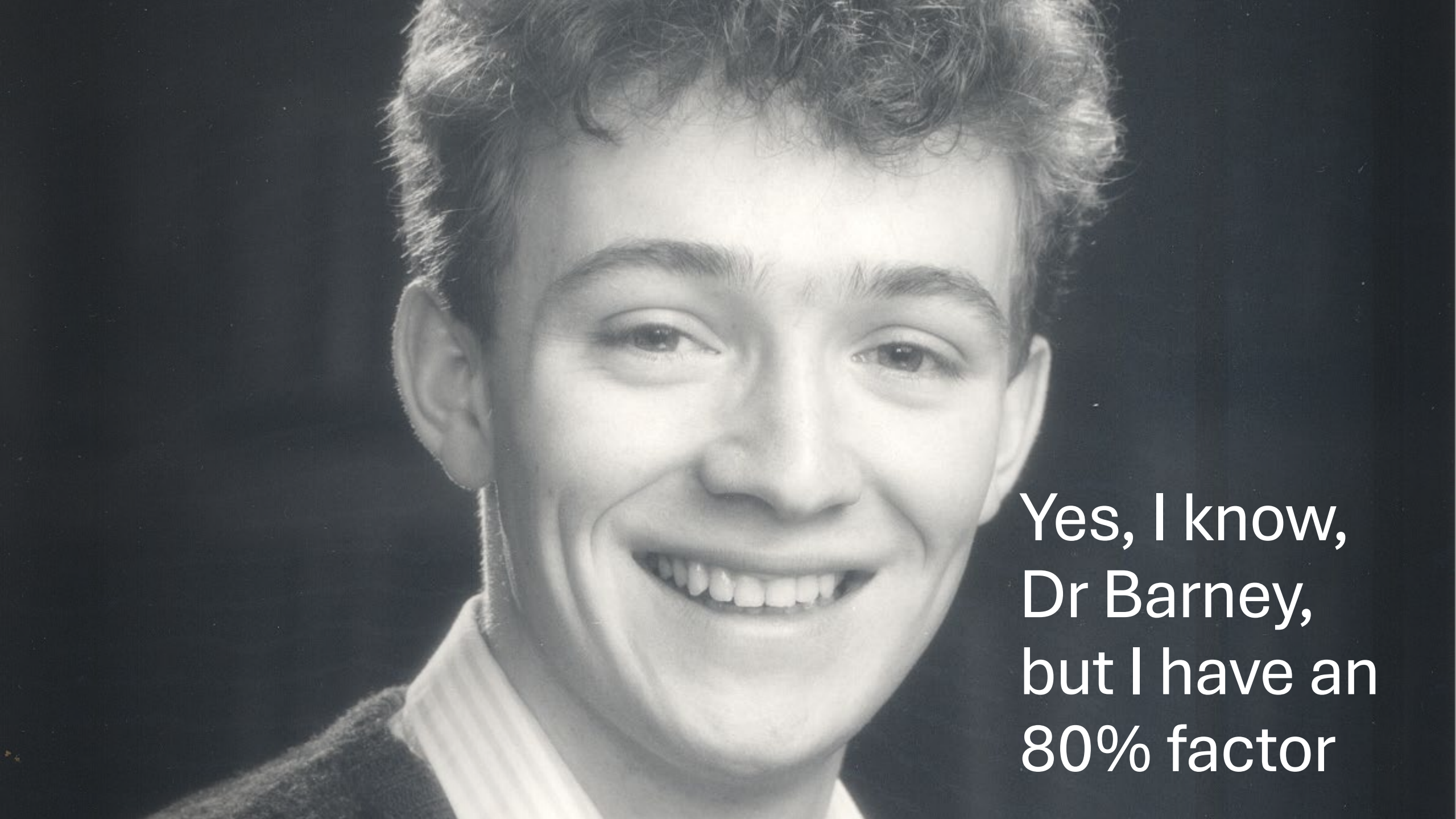
$$CC_m = floor\left(\frac{LC}{M}\right)$$

$$= floor\left(\frac{1600}{75}\right)$$

$$CC_m = 21 \text{ persons}$$

- determine the car capacity in persons based on rated (elevator) lift capacity *LC* and passenger mass *M*
- floor (x) is a function that returns the greatest integer less than or equal to x, e.g. floor (21.3) = 21


“You are wrong Richard! You will not get 21 people in a 21 person car”


Yes, I know,
Dr Barney,
but I have an
80% factor

Number of people in the car

$$P = 80\% \; of \; 21$$

$$P = 16.8$$


“You are still wrong Richard!”

Table 1 Rated load vs. maximum car area (from BS ISO 8100-30:2019) and resulting area per person, assuming 75 kg/passenger (rounded down to the nearest whole number).

Rated load, mass (kg)	Maximum available car area (m^2)	Rated passenger capacity (persons)	Area per person (m^2/person)
630	1.66	8	0.21
800	2.00	10	0.20
1000	2.40	13	0.18
1275	2.95	17	0.17
1350	3.10	18	0.17
1600	3.56	21	0.17
1800	3.88	24	0.16
2000	4.20	26	0.16
2500	5.00	33	0.15


&!%%*,
she’s right!

Car capacity using mass and area

$$CC_m = floor\left(\frac{LC}{M}\right)$$

$$= floor\left(\frac{1600}{75}\right)$$

$$CC_m = 21 \text{ persons}$$

$$CC_a = \left(\frac{A_c}{A_p}\right)$$

$$= \left(\frac{3.56}{0.21}\right)$$

$$CC_a = 17.0 \text{ persons}$$

$$P = min(CF_a.CC_a, CF_m.CC_m)$$

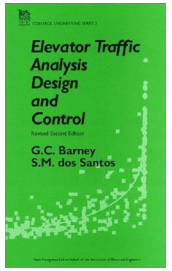
$$= min(80\% \text{ of } 21, 80\% \ of \ 17.0\ )$$

$$P = 13.6 \text{ persons} \quad (\text{was } 16.8 \text{ persons})$$

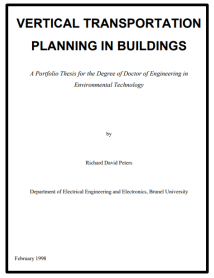
That’s better!

CIBSE Guide D: Traffic analysis and control

From violently disagreeing to almost violently agreeing



1993 → 2000 → 2005 → 2010 → 2015 → 2020 → 2025



2000 → 2005 → 2010 → 2015 → 2020 → 2025

An Engineer is guided by principle, but corrected by truth.

INTERNATIONAL STANDARD

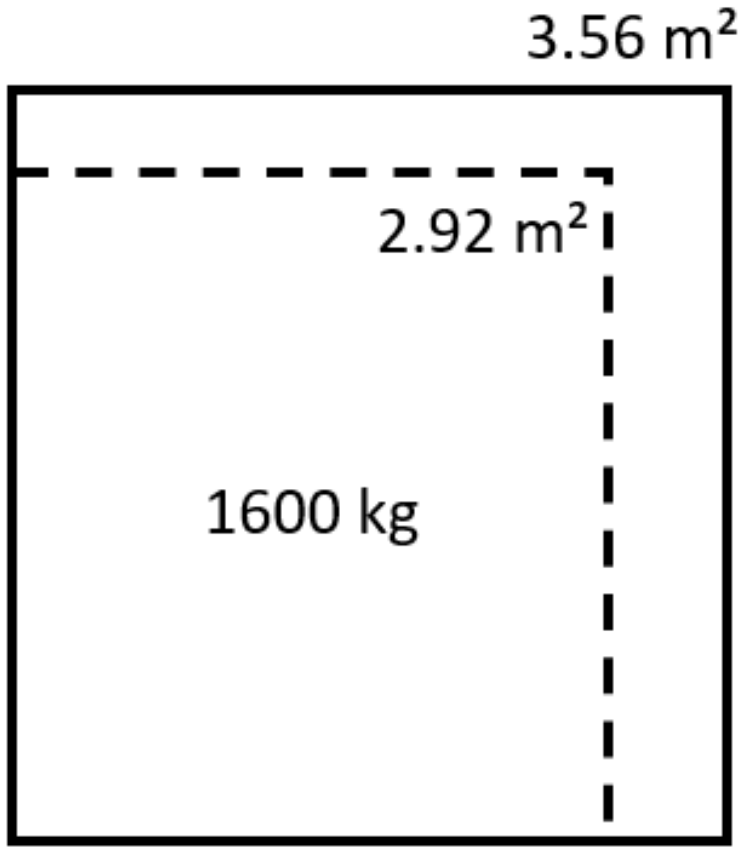
ISO 8100-32

First edition
2020-06

Lifts for the transportation of persons and goods —

Part 32:
Planning and selection of passenger lifts to be installed in office, hotel and residential buildings

In many cases, the available platform area is less than the maximum allowed



The car had a nominal capacity of 1600 kg / 75 kg/person = 21.3 persons (normally rounded down to 21 persons).

If the car loading had been calculated by area, allowing 0.21 m^2/persons, the maximum loading would have been calculated as 2.92 m^2 / 0.21 m^2/person = 13.9 persons.

The observed maximum loading was 14 persons.

So what is the 80% for then?

What Is Network Capacity Planning? How To Measure & Plan

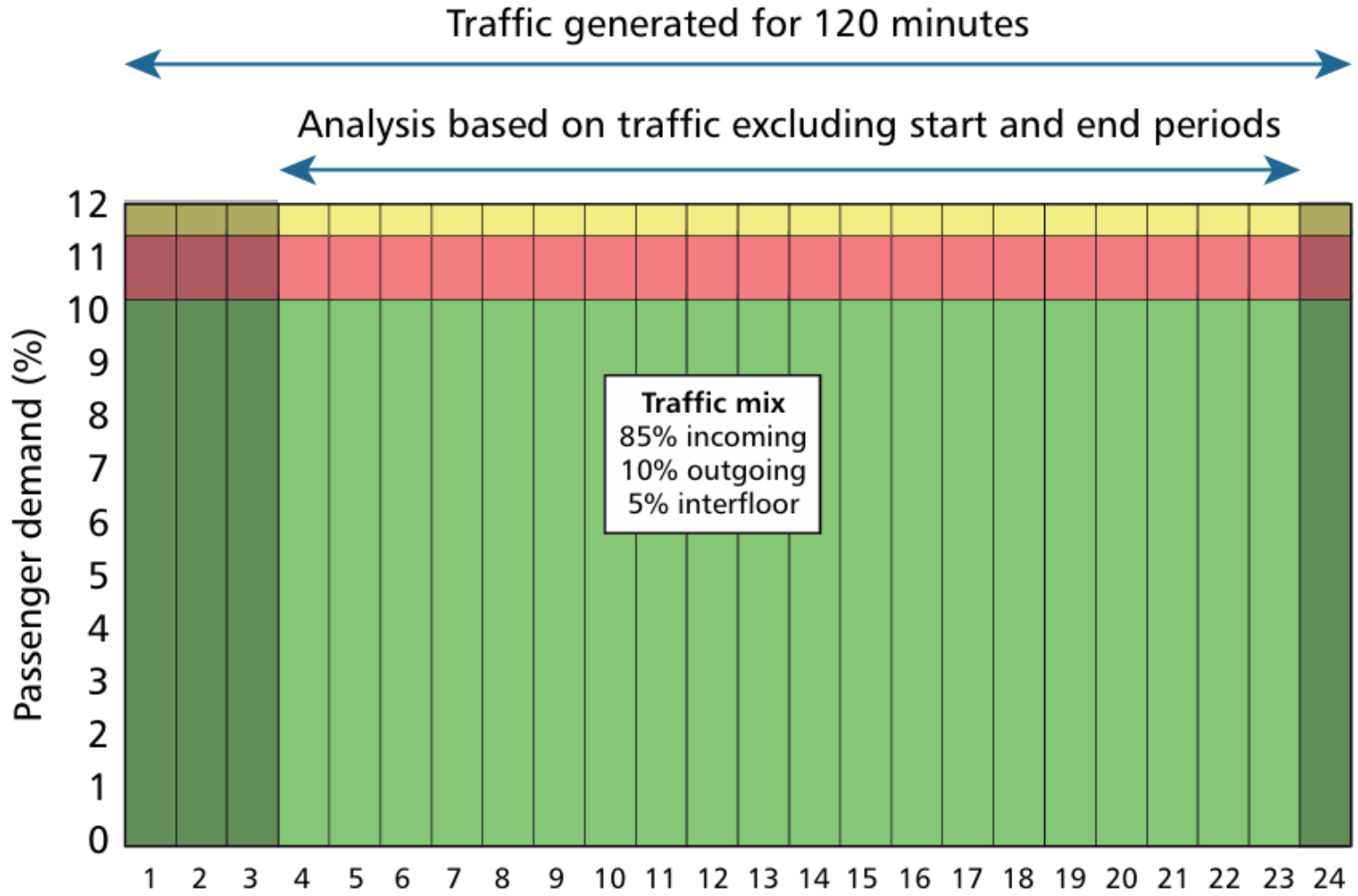
What are network capacity alerting methods?

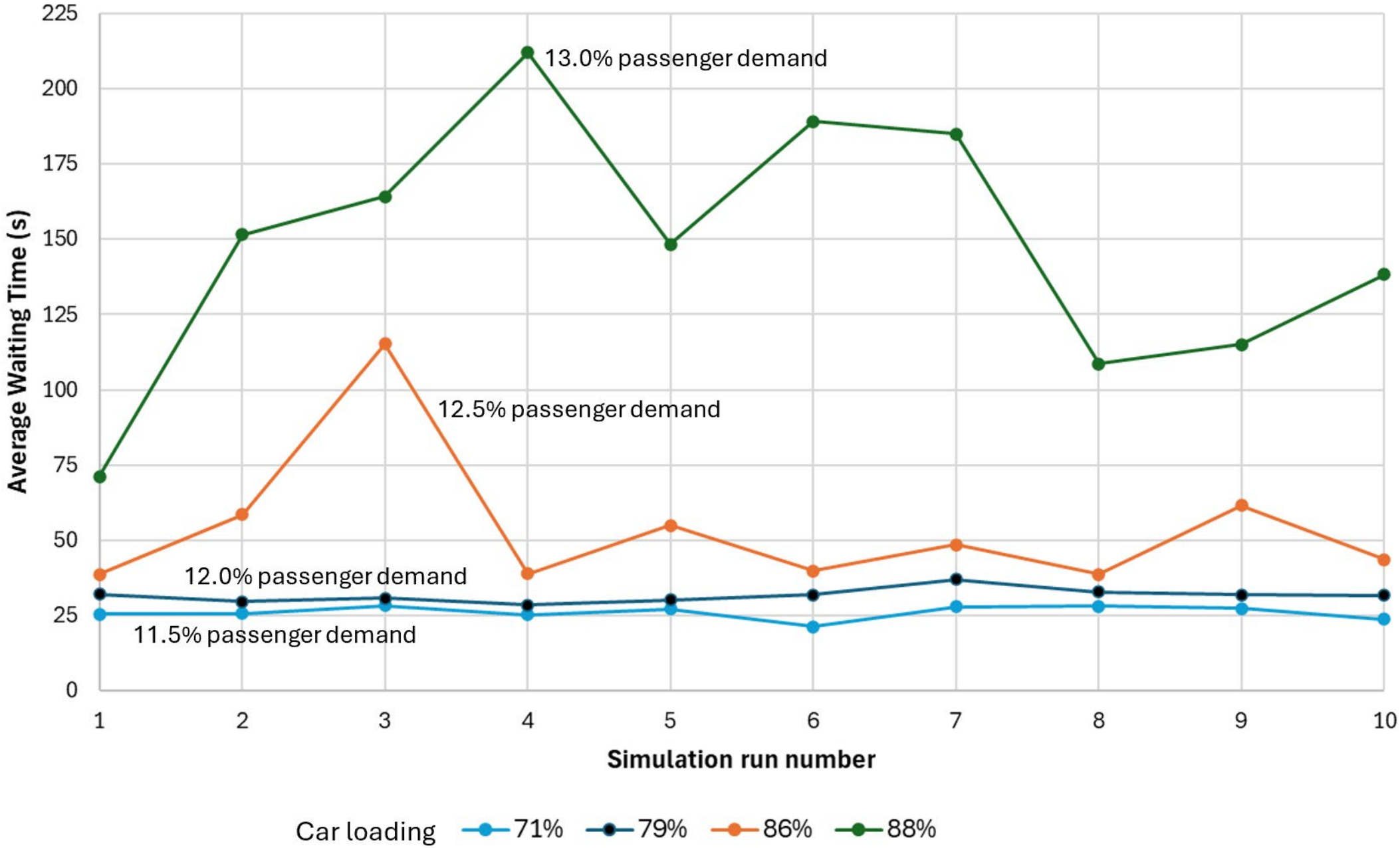
Network capacity alerting is a feature of network monitoring systems that sends notifications to network administrators when certain capacity thresholds are reached or exceeded. This function is crucial for maintaining the smooth operation of a network as it allows for timely interventions before users experience slowdowns or outages.

For example, an alert threshold could be set to trigger when bandwidth usage reaches 80% of its total capacity. This allows network administrators to take action, such as reallocating bandwidth, upgrading network infrastructure, or identifying and addressing unusually high demand from specific applications or devices.

Automated network capacity alerting within Nile's Access Service helps to prevent network overloads and outages, allowing for quick resolution of potential issues. It ensures optimal network performance and contributes to overall network efficiency. It's an essential tool for proactive network capacity management.

How that works out with simulation

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Average Waiting Time (s)
13.0% passenger demand
12.5% passenger demand
12.0% passenger demand
11.5% passenger demand
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Simulation run number
Car loading
71%
79%
86%
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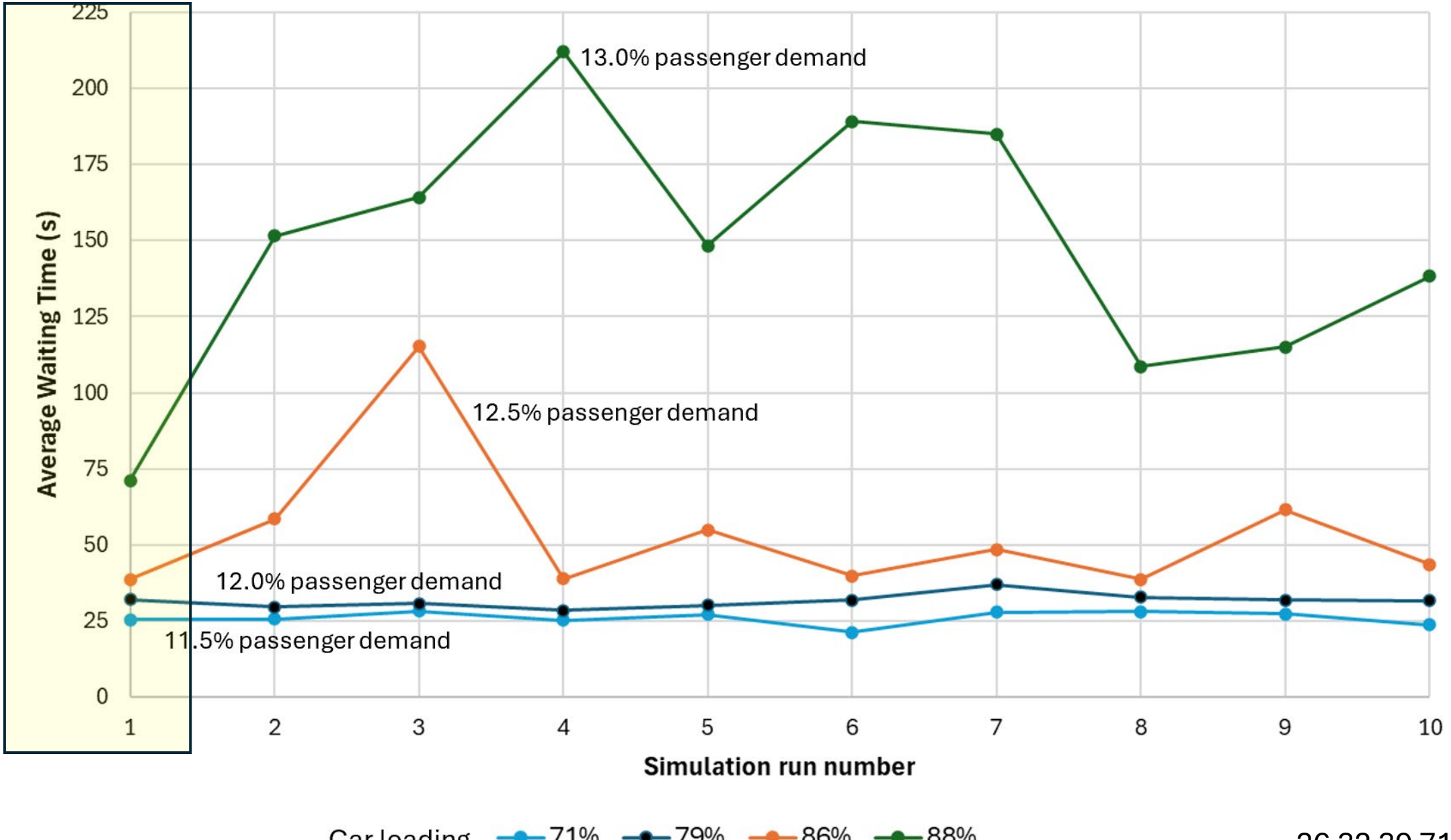
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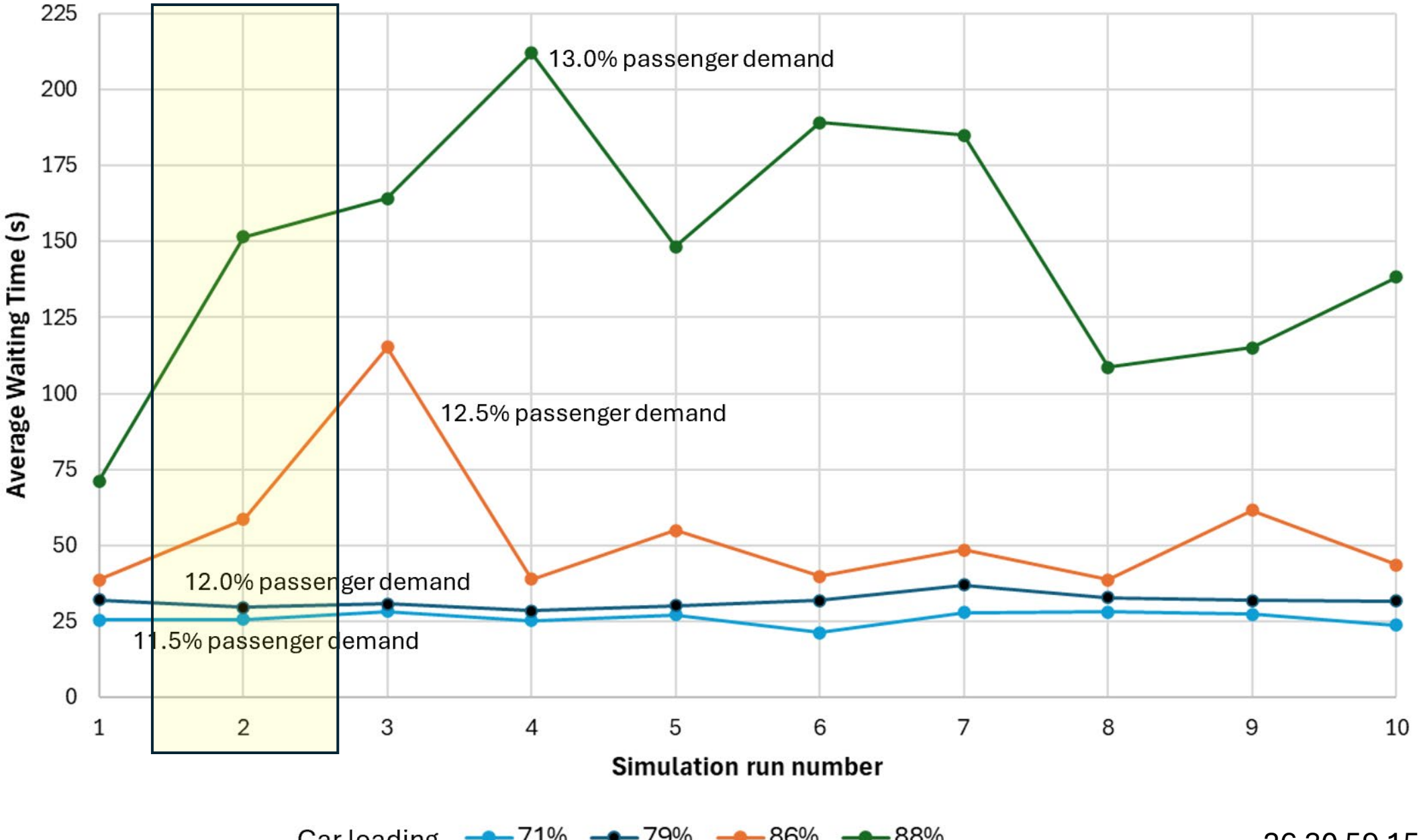
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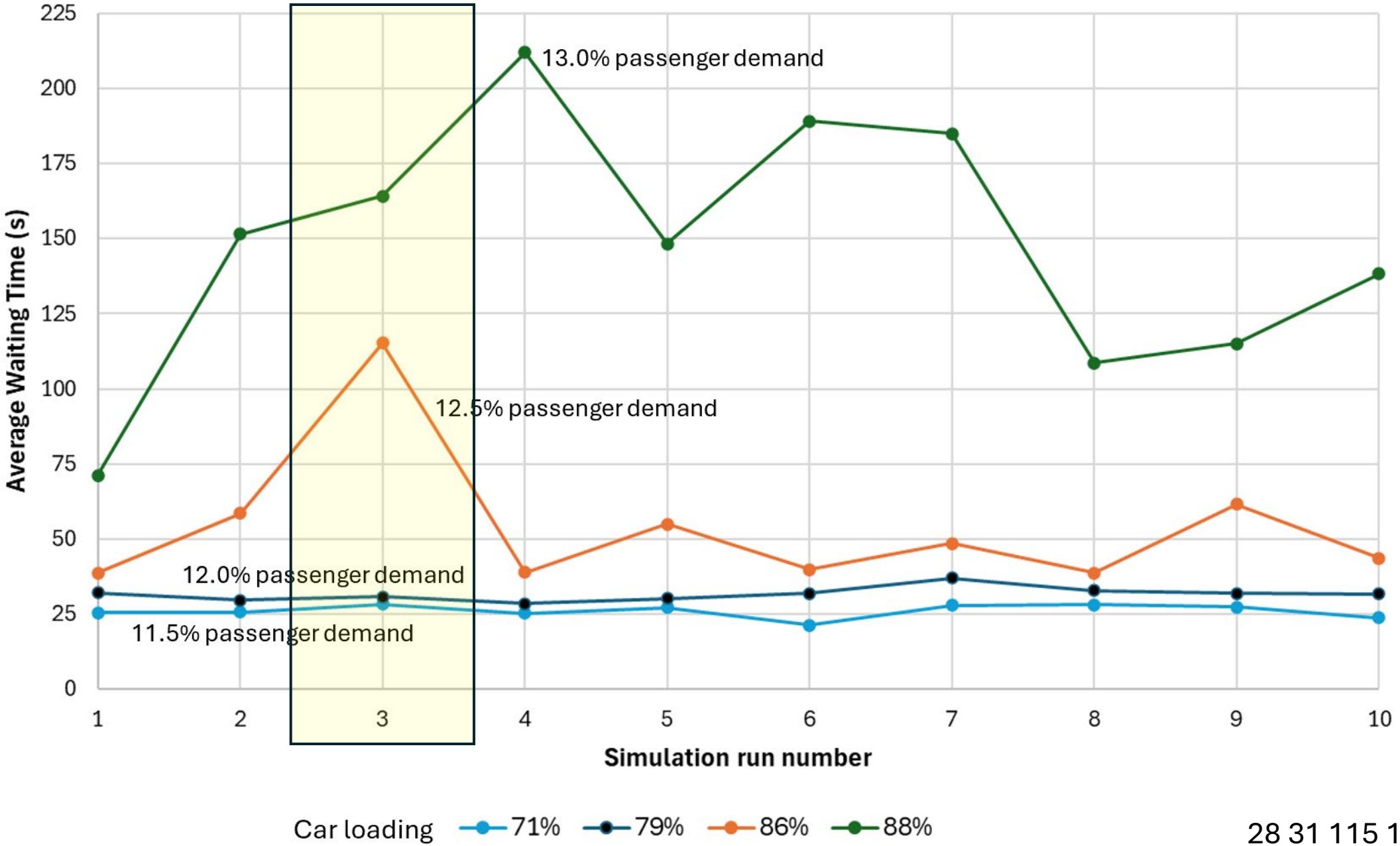
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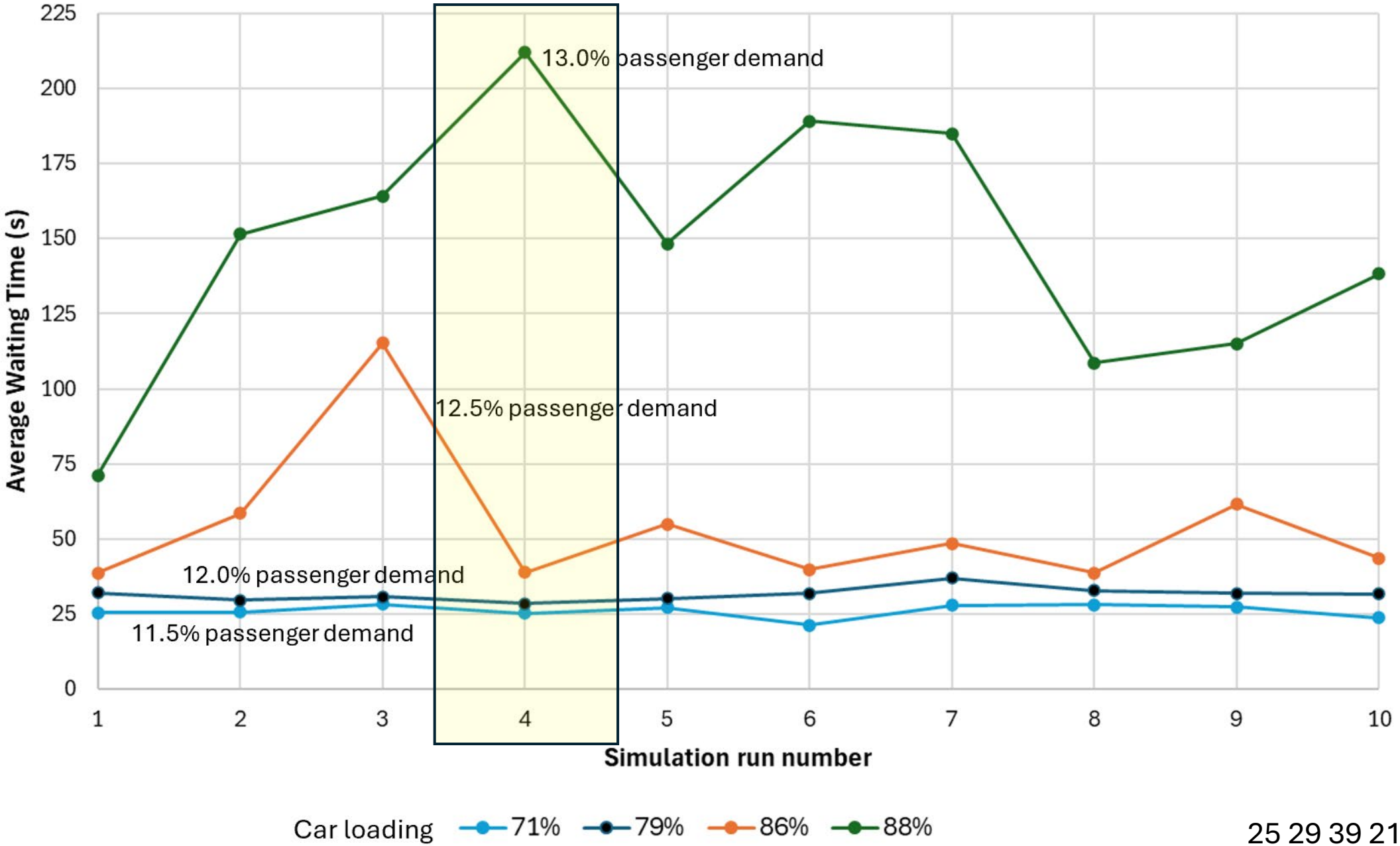
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Simulation run number
Car loading
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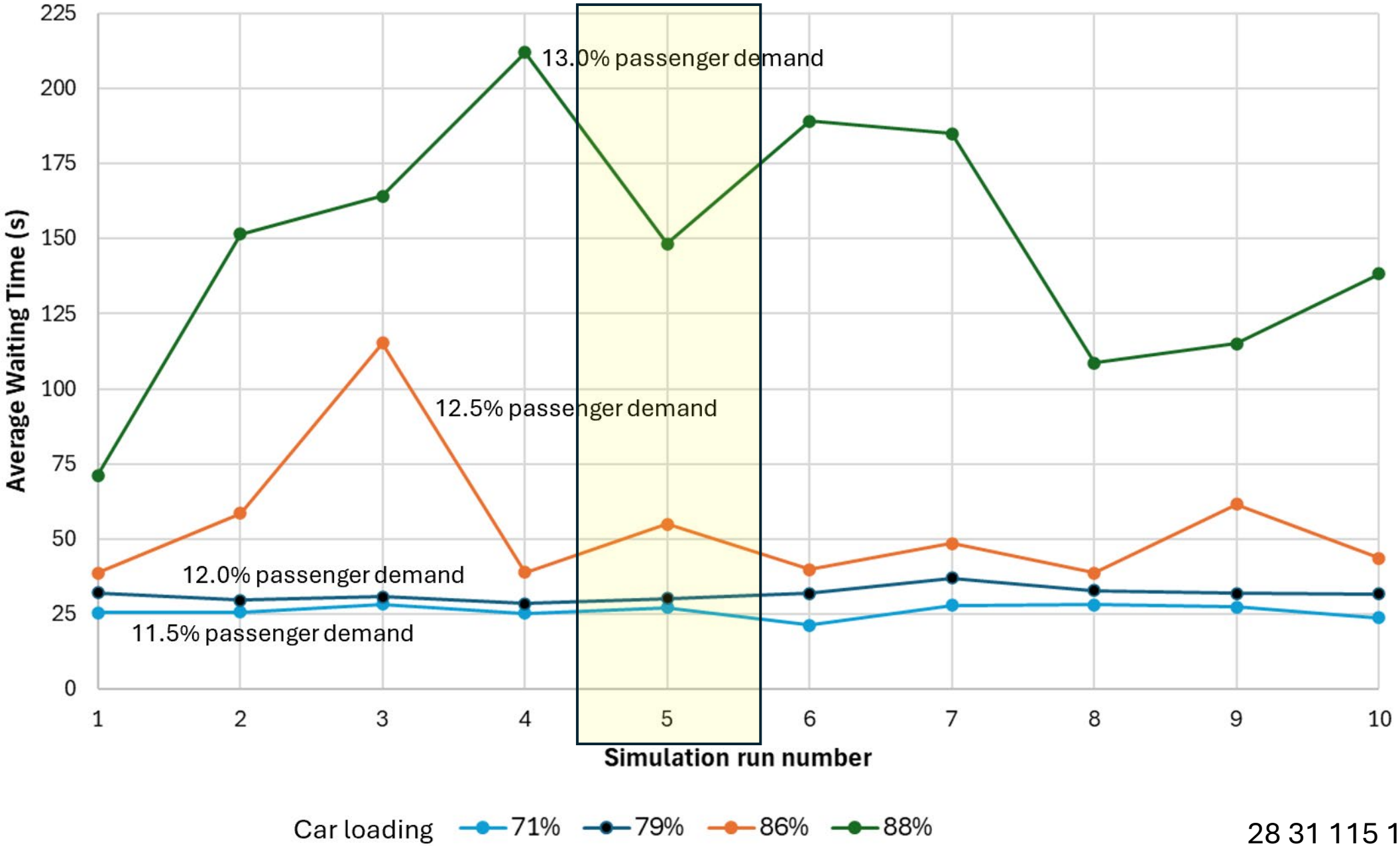
79%
86%
88%

25 29 39 212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86%
88%

Standard Deviation

Statistical measure that quantifies variation in set of values.

For simulation, indication of how results fluctuate across multiple simulation runs.

Low standard deviation suggests that the system behaves consistently under repeated conditions

High standard deviation indicates instability and unpredictability.

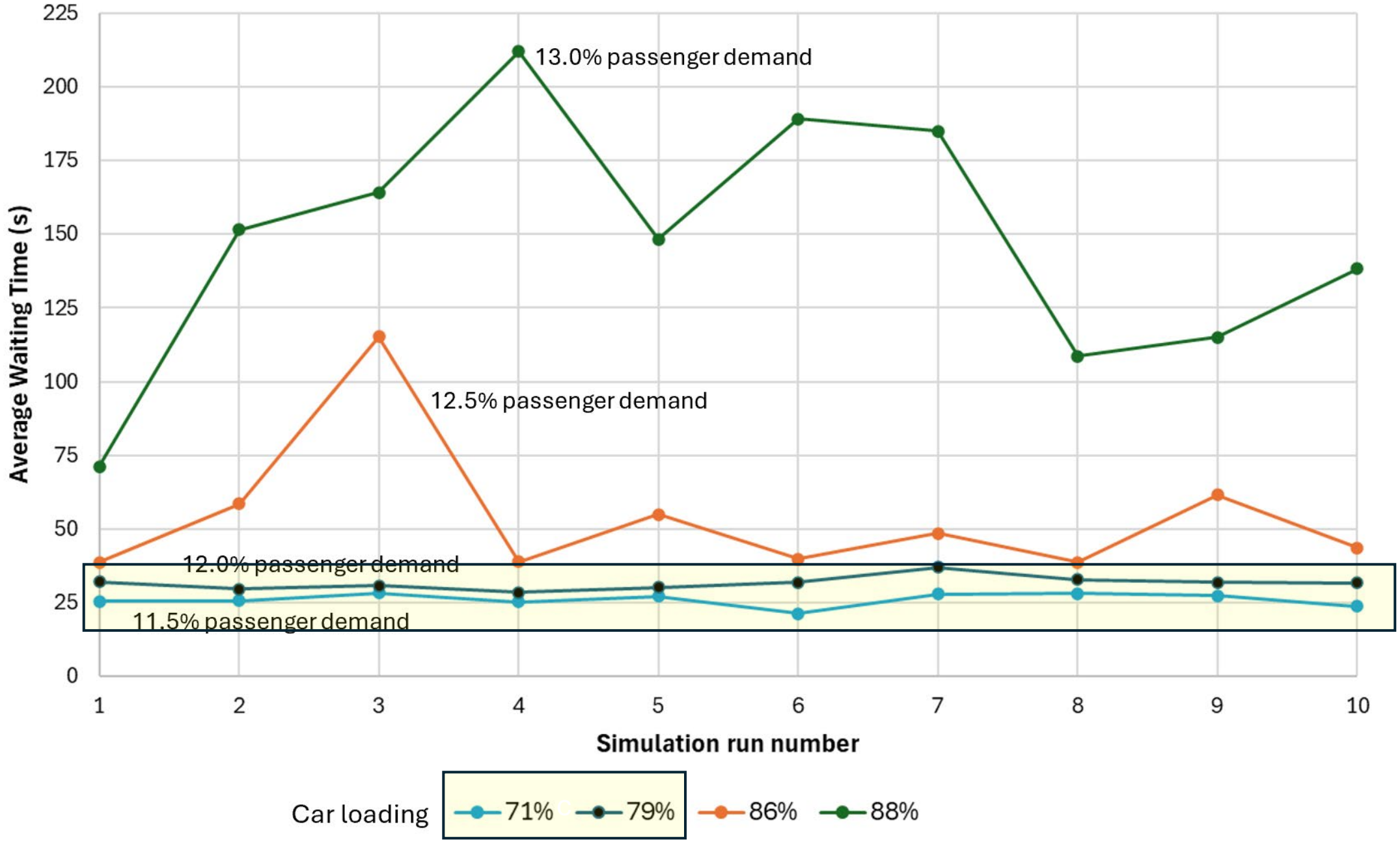
Passenger demand (% population per 5 minutes)	Car loading by area (%)	Waiting time standard deviation over 10 runs
11.5	71	2.2
12.0	79	2.3
12.5	86	23.3
13.0	88	42.2

Standard Deviation

Low standard deviation suggests that the system behaves consistently under repeated conditions

High standard deviation indicates instability and unpredictability

< 5% (ideally closer to 2–3%) would be a reasonable and practical definition of a stable result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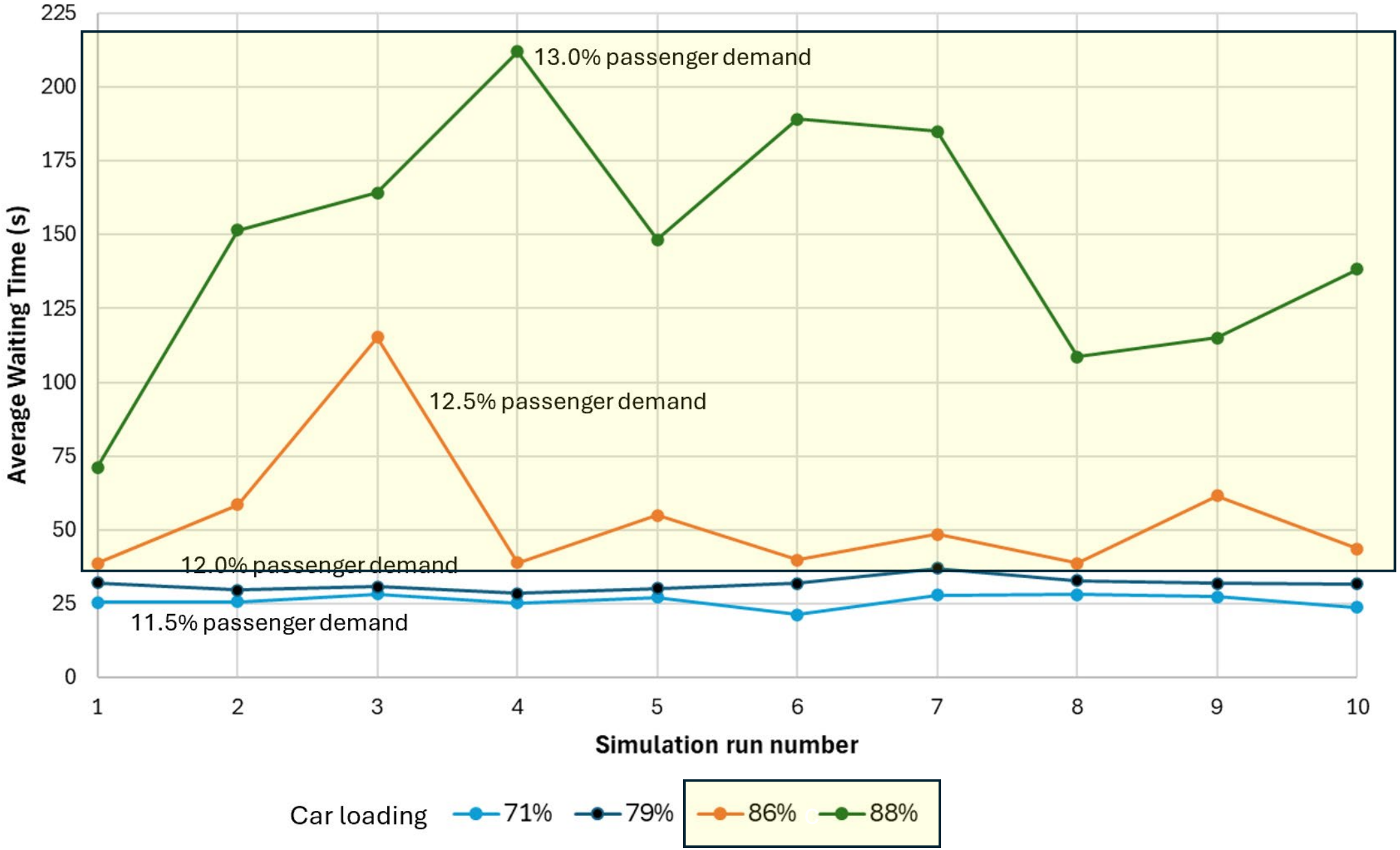
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11.5% passenger demand
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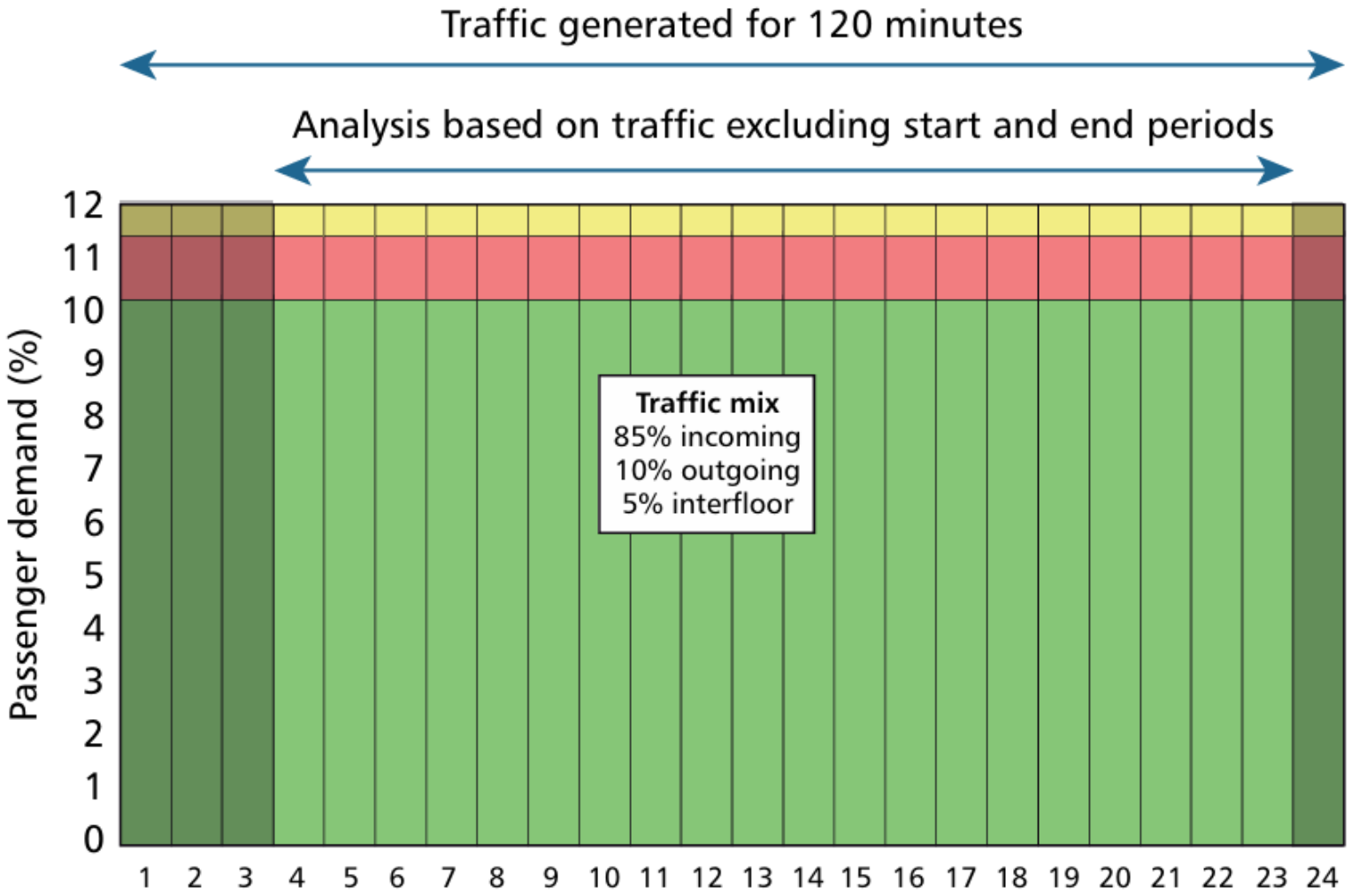
Simulation run number
Car loading
71%
79%
86%
88%

Just check car loading not exceed 80% at required passenger demand



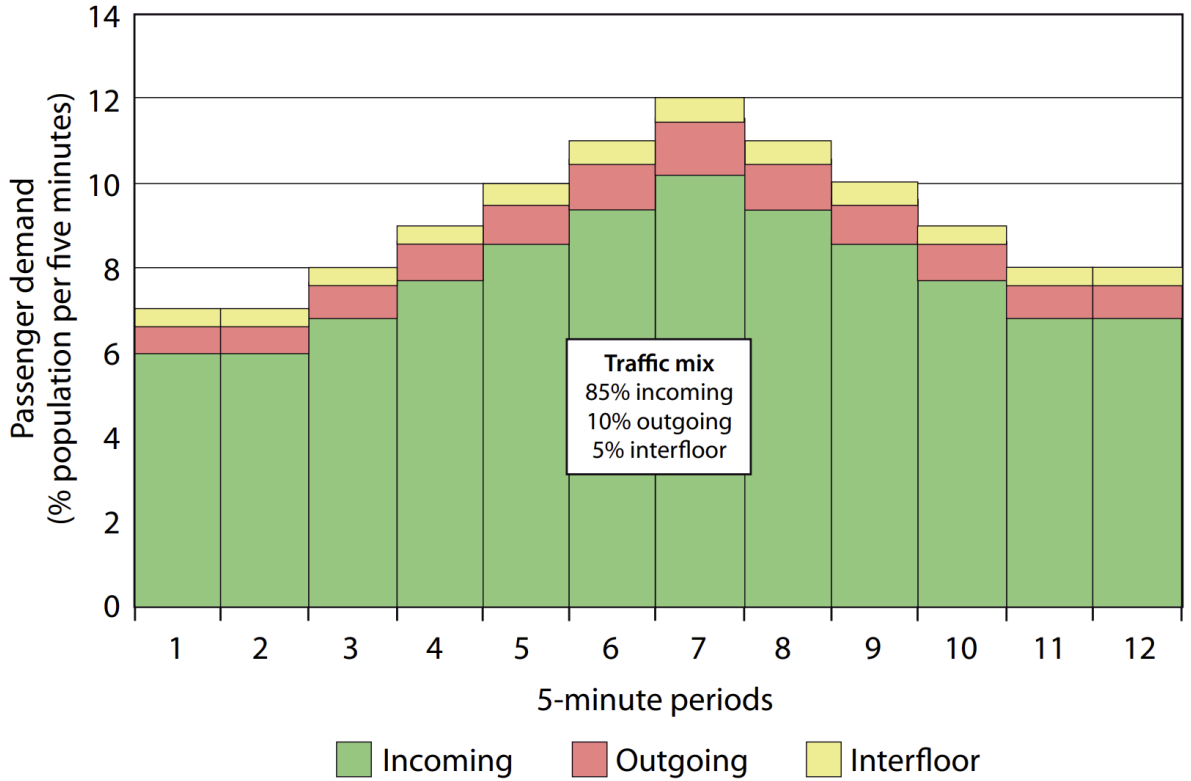


Figure 4.7 CIBSE office uppeak traffic template

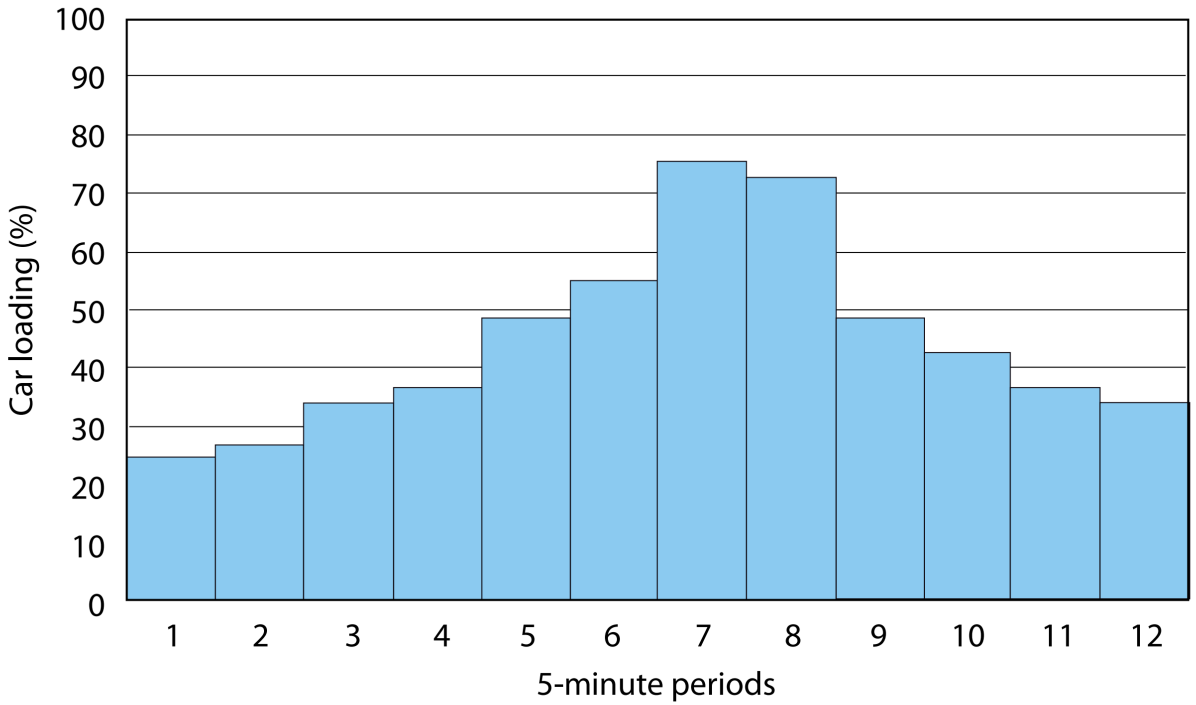


Figure 4.3 Average car loading in simulation

Application

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Untitled File (1)

Duplicate History

Back to files

Job data | Analysis data | Building data | Elevator data | Passenger data | Report options | Report

Analysis data contains general information about the analysis you want to perform.

Saved

Analysis type

- (●) Uppeak calculation
- ( ) Enhanced uppeak calculation
- ( ) General analysis
- ( ) Simulation

Round trip time losses (%)

5.0

Measurement system

Metric

Previous
Next

Approximate credit cost: 100 Calculate now

Dashboard
Files
See all
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Untitled File (1)

Duplicate History

Back to files

Job data | Analysis data | Building data | Elevator data | Passenger data | Report options | Report

Passenger data contains information about the passengers using the elevators.

Saved

Loading times (s)

Auto

Passenger mass (kg)

75.0

Capacity factor by mass (%)

Specify 80.0

Passenger area (m²)

Specify 0.21

Capacity factor by area (%)

Specify 80.0

Stair factor (%)

Dashboard
Files
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Duplicate History

Back to files

Job data | Analysis data | Dispatcher data | Building data | Elevator data | Passenger data | Report options | Report

Analysis data contains general information about the analysis you want to perform.

Saved

Analysis type

- ○ Uppeak calculation
- ○ Enhanced uppeak calculation
- ○ General analysis
- ◉ Simulation

Round trip time losses (%)

5.0

Number of simulations for each configuration

10

Random seed for passenger generation

1

Measurement system

Metric

Previous
Next

Approximate credit cost: 100 Calculate now

Dashboard
Files
See all
Shared with me
Archive

Job data | Analysis data | Dispatcher data | Building data | Elevator data | Passenger data | Report options | Report

Passenger data contains information about the passengers using the elevators.

Saved

Passenger data mode

Standard

Loading times (s)

Auto

Passenger mass (kg)

75.0

Capacity factor by mass (%)

Specify 100.0

Passenger area (m²)

Specify 0.21

Capacity factor by area (%)

Specify 100.0

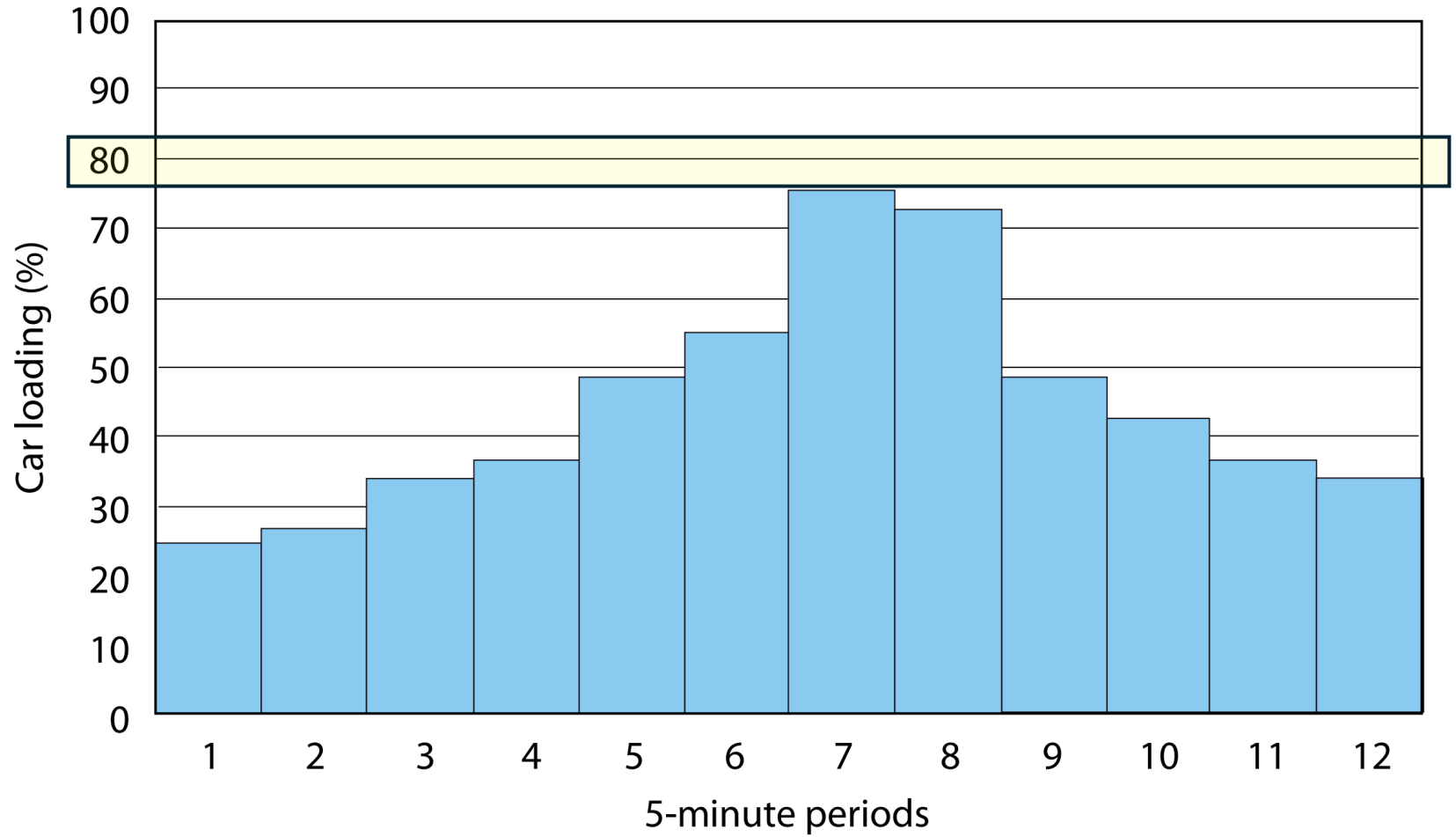

Figure 4.3 Average car loading in simulation

Conclusions

Gina was right most of the time (but not always)

INTERNATIONAL STANDARD

ISO 8100-32

First edition
2020-06

Lifts for the transportation of persons and goods —

Part 32:
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I violently agreed with Gina on car loading!

Avoid conflation

- The 80% rule **does not** exist to compensate for the mismatch between rated capacity (in kg) and the actual number of passengers a car can fit
- Car loading should be calculated by area (a secondary mass check is OK)
- For bigger passengers, increase the area per person, e.g.
  - 0.21 m^2 per person for general office traffic,
  - 0.3 m^2 per person for hotels and residential buildings,
  - Larger values for healthcare or other environments where luggage or mobility aids are common

Consistency between calculation and simulation

In calculation design to 80% loading

In simulation allow 100% loading, but check average load in peak 5 minutes does not exceed 80%

If average loading simulation exceeds 80% simulation results are likely to be unstable

Final thought

Evacuation calculations need to get this right, as they involve life safety

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