Passengers and dwell times for commuter trains

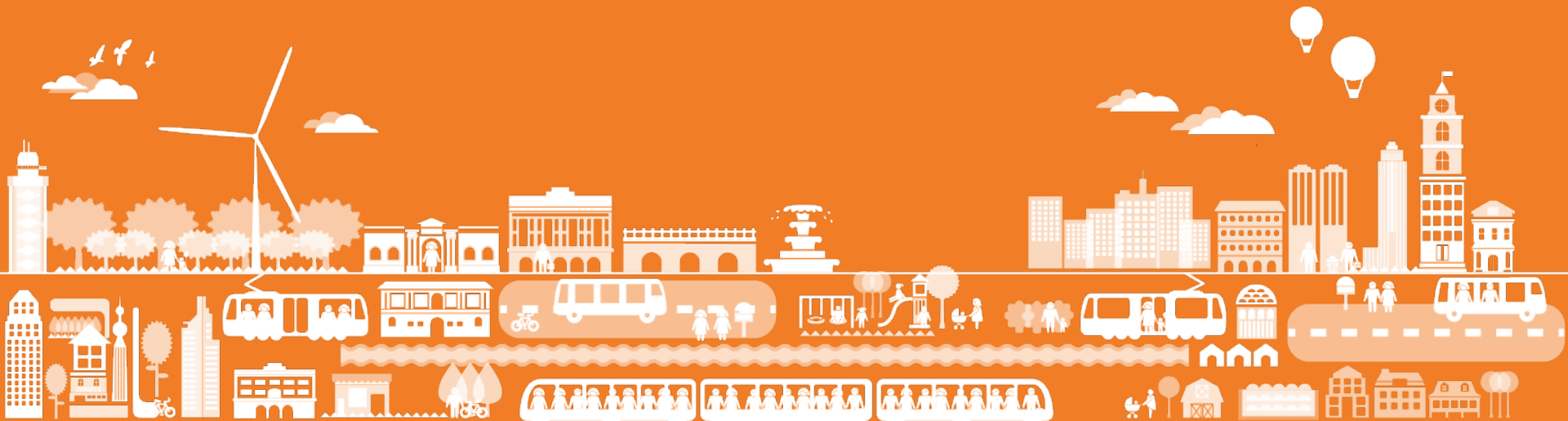**KAJT Höstseminarium 2021 – 2021/11/23**
Ruben Alaric Kuipers
K2 - Nationellt kunskapscentrum för kollektivtrafik
Lunds universitet

LUNDS UNIVERSITET

Why is dwell time important?

Dwell time refers to the time a train is stationary at a station and is defined by the difference between the arrival and departure time
(Li et al., 2014)

Punctuality is strongly influenced by dwell time
(Harris, 2005)

Dwell time delays at a *single station might be small*, however, the cumulative dwell time delays over an entire train run can amount to a *large portion of the journey time*
(Christoforou et al., 2020)

My research project   overview

Project title   Punctual Metropolitan Railways – an analysis of delays at stations and effects of altered dwell time planning approaches and effective traveler exchanges

Funder   K2 - Nationellt kunskapscentrum för kollektivtrafik

Time period   2020 – 2025

My research project

The plan

Understand in which ways passengers interact with dwell times

Literature

↓

Study the effect of this on dwell time delays

Data analysis

↓

Define and study measures to reduce the "negative" impact of passengers on dwell times

Case study

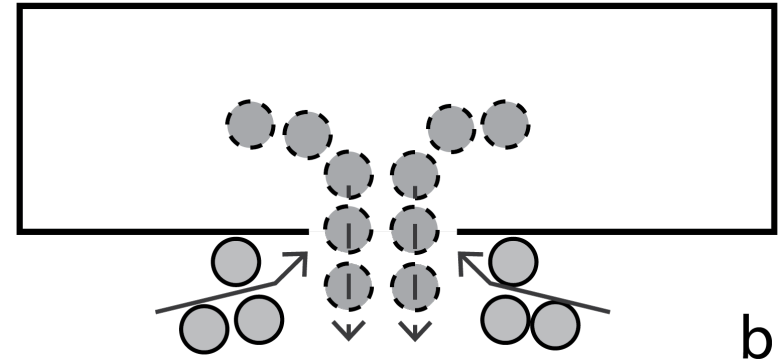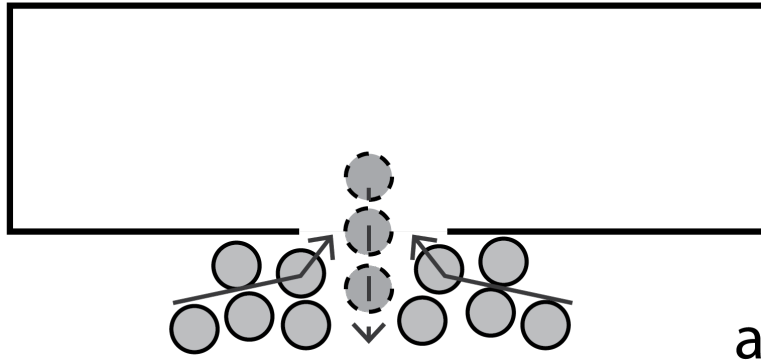# Literature review   Key findings

Passengers influence dwell time as a result of:

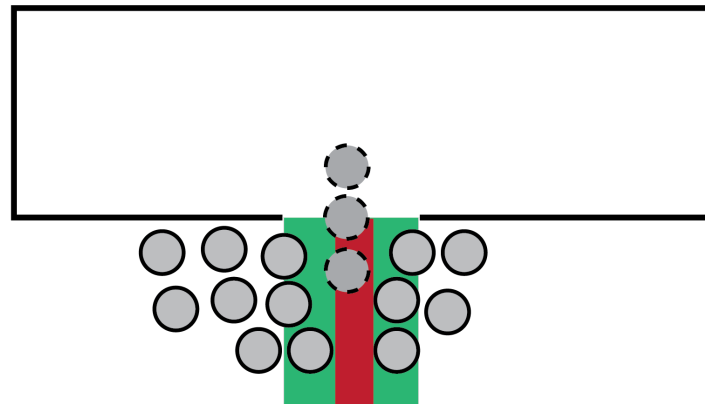Behaviour of passengers during boarding and alighting

- Ratio between boarding and alighting passengers

- Distribution of passengers between the doors of a train

Literature review   Key findings

a

b

Adapted from (Seriani et al., 2016)

Adapted from (Harris et al., 2014)

Passenger flows and dwell times for commuter trains in Stockholm

Location: Stockholm, Sweden

Focus: Understand how the volume and ratio of passengers influences dwell times

Data sources: Automatic passenger count & signaling data

(*Presented at the RailBeijing conference 2021*)

Passenger flows and dwell times for commuter trains in Stockholm

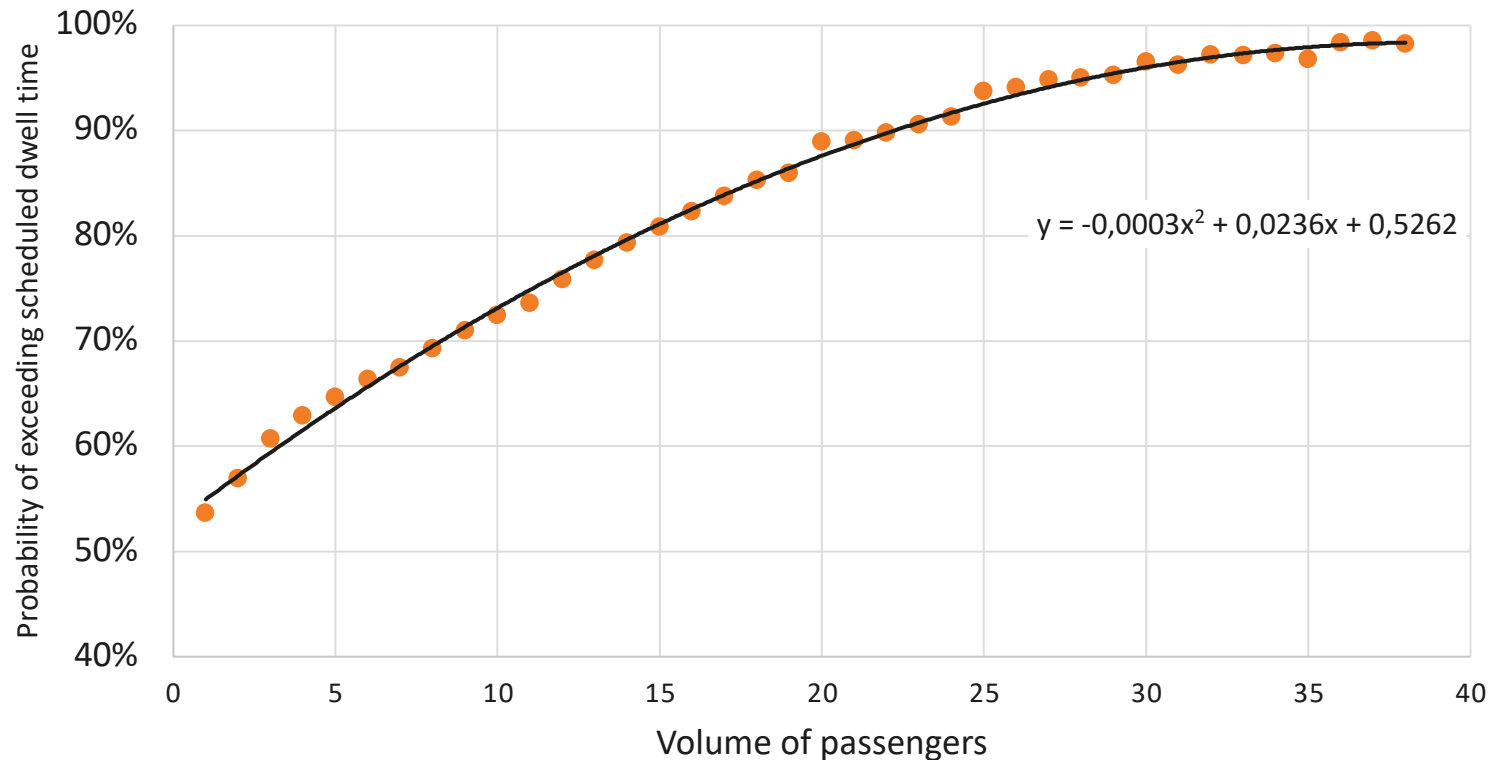| Automatic passenger counts	Signaling data
Collected between 2013 – 2016	Collected between 2013 – 2016
Around 1,370,000 data points	Around 9,700,000 data points
Number of boarding & alighting passengers aggregated for an entire train	No information on passenger volumes
Actual arrival and departure times on a second basis	Scheduled and actual arrival and departure times on a minute basis

Passenger flows and dwell times for commuter trains in Stockholm

Mean = 50
Std. Dev. = 14
N = 738,749

Frequency

Dwell time (s)

0 to 6, 6 to 12, 12 to 18, 18 to 24, 24 to 30, 30 to 36, 36 to 42, 42 to 48, 48 to 54, 54 to 60, 60 to 66, 66 to 72, 72 to 78, 78 to 84, 84 to 90, 90 to 96, 96 to 102, 102 to 108, 108 to 114, 114 to 120, 120 to 126
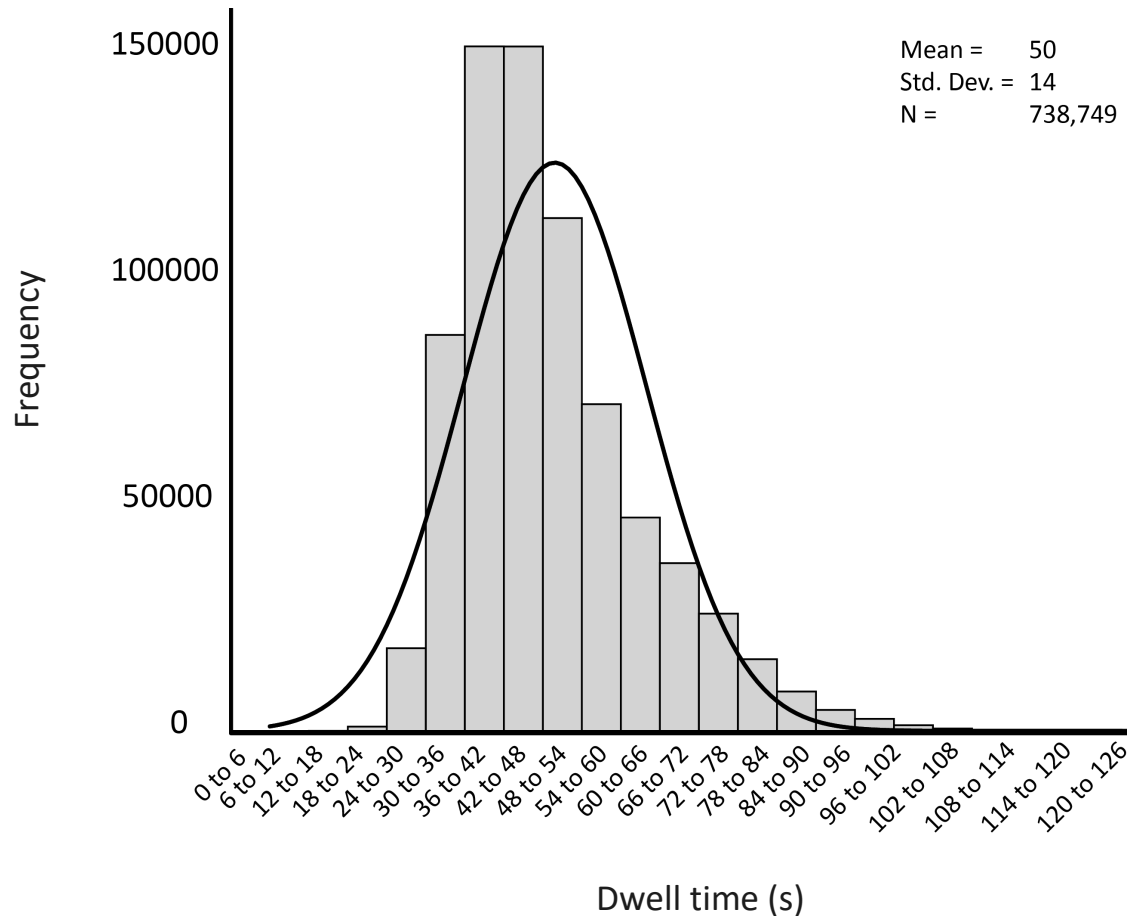
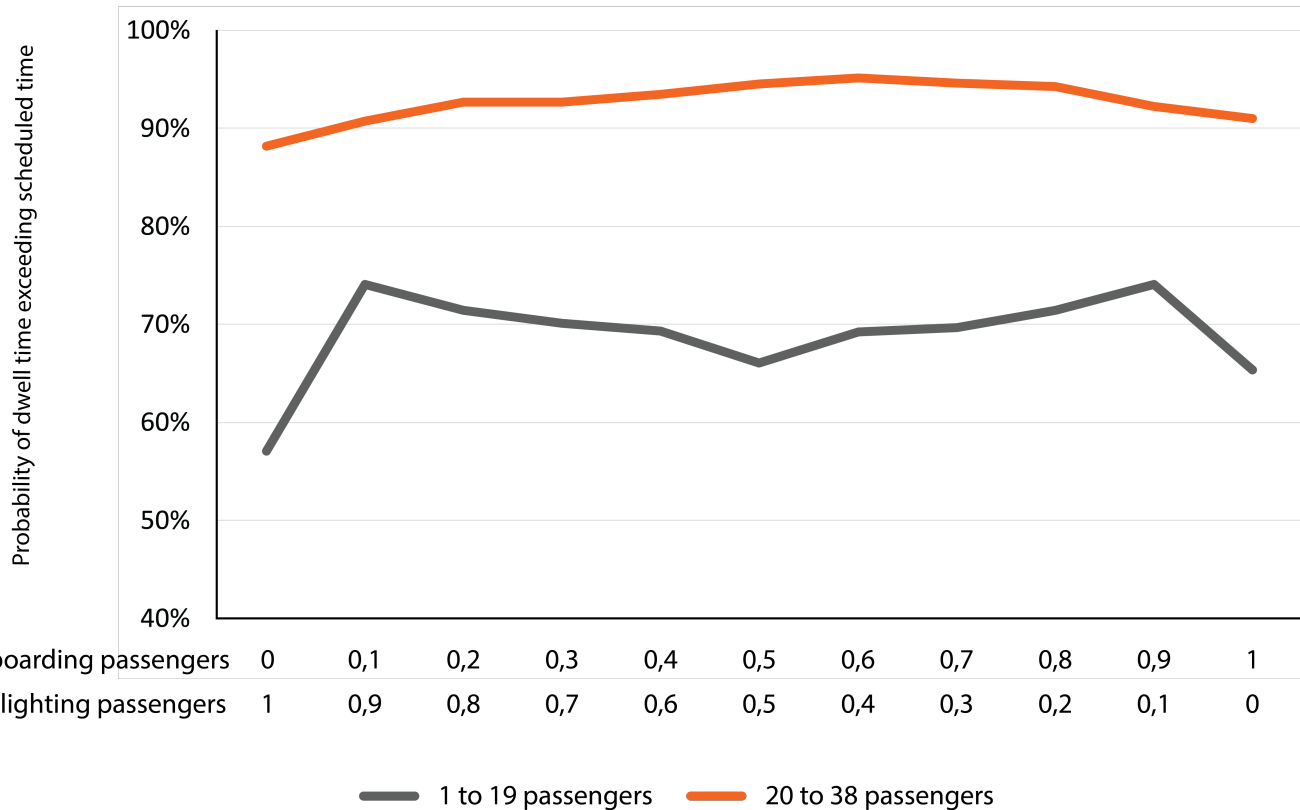# Passenger flows and dwell times for commuter trains in Stockholm

Passenger flows and dwell times for commuter trains in Stockholm

Current study

Study into the relationship between the **spread of passengers** and dwell times

Automatic passenger count data from Skånetrafiken for the period 2017 – 2018

Logistic regression

Current study

Map adapted from Skånetrafiken (2021).

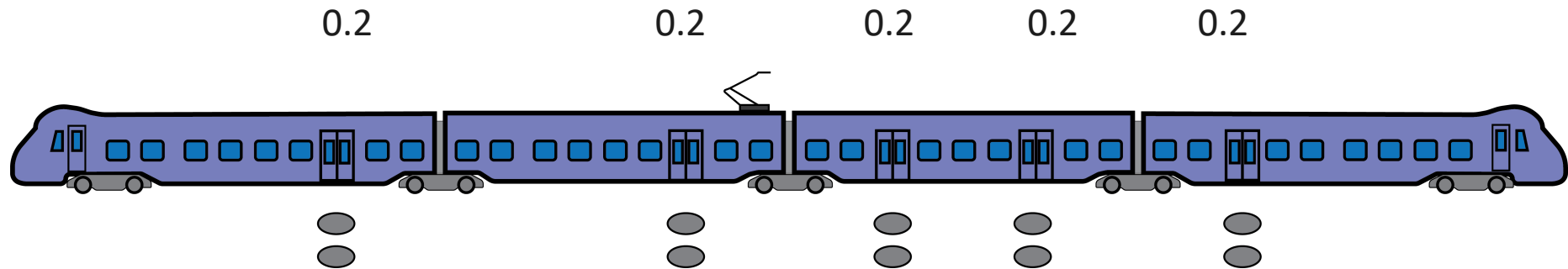**Data from Skånetrafiken**

Automatic passenger count data (APC)

Door by door level

Number of boarding & alighting passengers
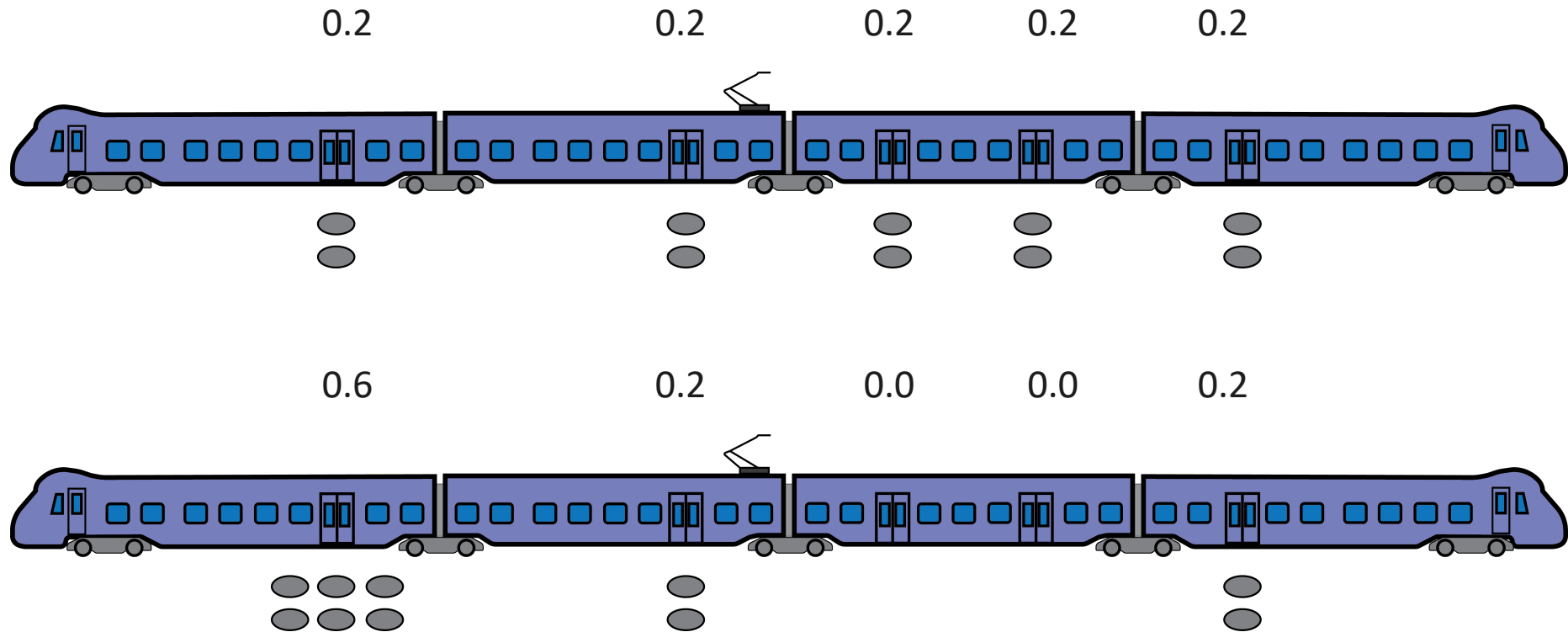
Actual arrival and departure time (s)

Actual dwell times (s)

Current study

0.2   0.2   0.2   0.2   0.2

$$\text{Spread of passengers} = \max.\left(\frac{\text{Passengers at door (x)}}{\text{Total number of passengers}}\right)$$

Current study

0.2   0.2   0.2   0.2   0.2
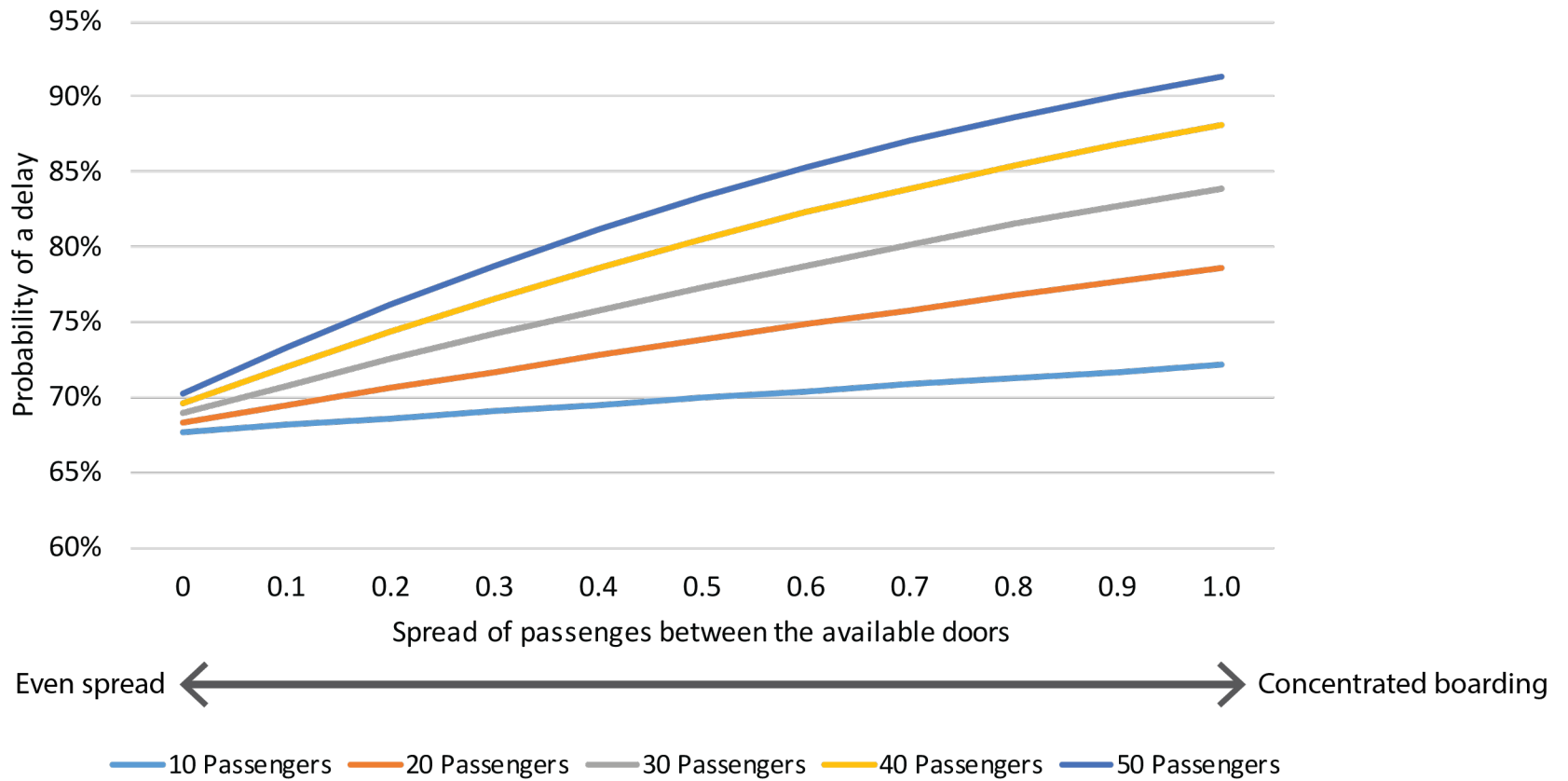
0.6   0.2   0.0   0.0   0.2

$$\text{Spread of passengers} = \max.\left(\frac{\text{Passengers at door (x)}}{\text{Total number of passengers}}\right)$$

Current study

Preliminary findings

Concentrated boarding has a negative effect on dwell times when passenger volumes are higher
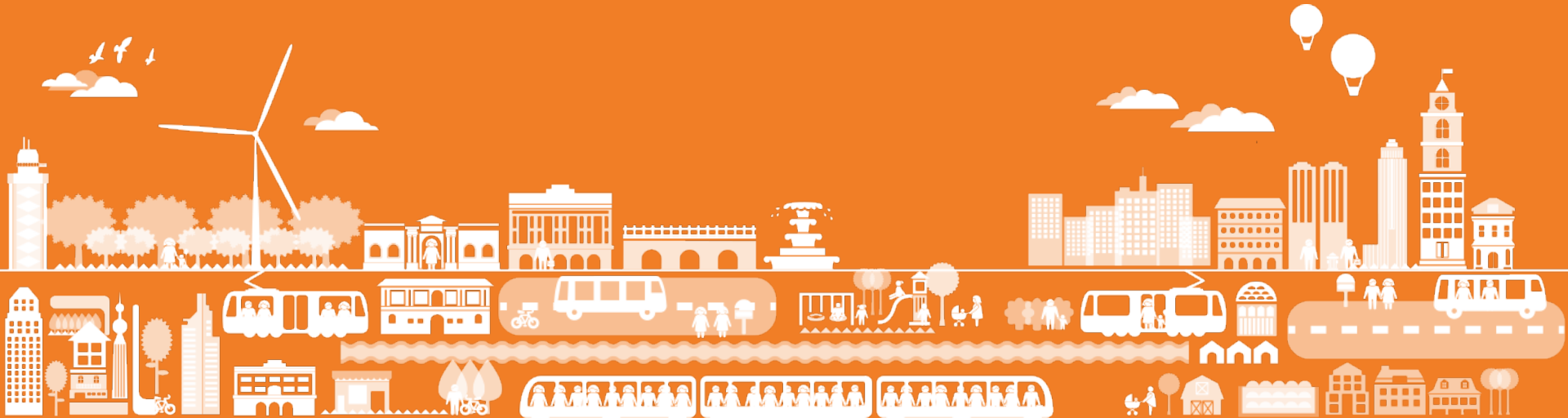
Current study

What is to come?

Comparing the effect of passengers on dwell times between Skåne and Stockholm

Observation of measures on station platforms

- Study on how to conduct such studies
- Study on the effect of "simple" platform measures

ruben.kuipers@tft.lth.se

Current study