

# A Relocation Strategy for Munich's Bike Sharing System

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INSTITUTE FOR TRAFFIC, TRANSPORT AND REGIONAL PLANNING  
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# Overview

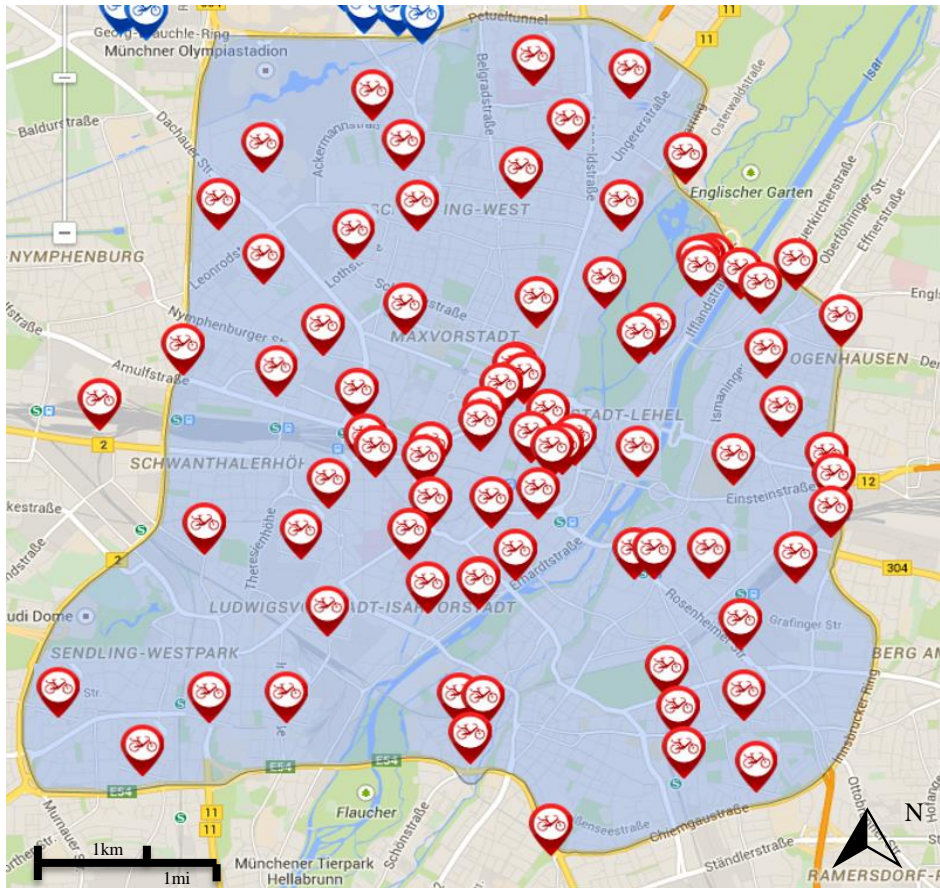
- 🚲 Bike Sharing System “Call a Bike”
- 🚲 Launched in Munich in 2001
- 🚲 Around 1200 bikes available
- 🚲 Pricing: 1€ / 30min
- 🚲 Non-station-based, but “free-floating”



# What does „free-floating“ mean?



# The Operating Area



- Renting/returning is allowed everywhere inside of the blue area
- Bikes are equipped with GPS devices
- Renting is possible via smartphone-app or phone call

# Workflow

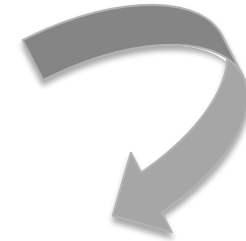
## Data Analysis

- Spatio-temporal booking patterns
- Detection of fleet imbalances

# Workflow

## Data Analysis

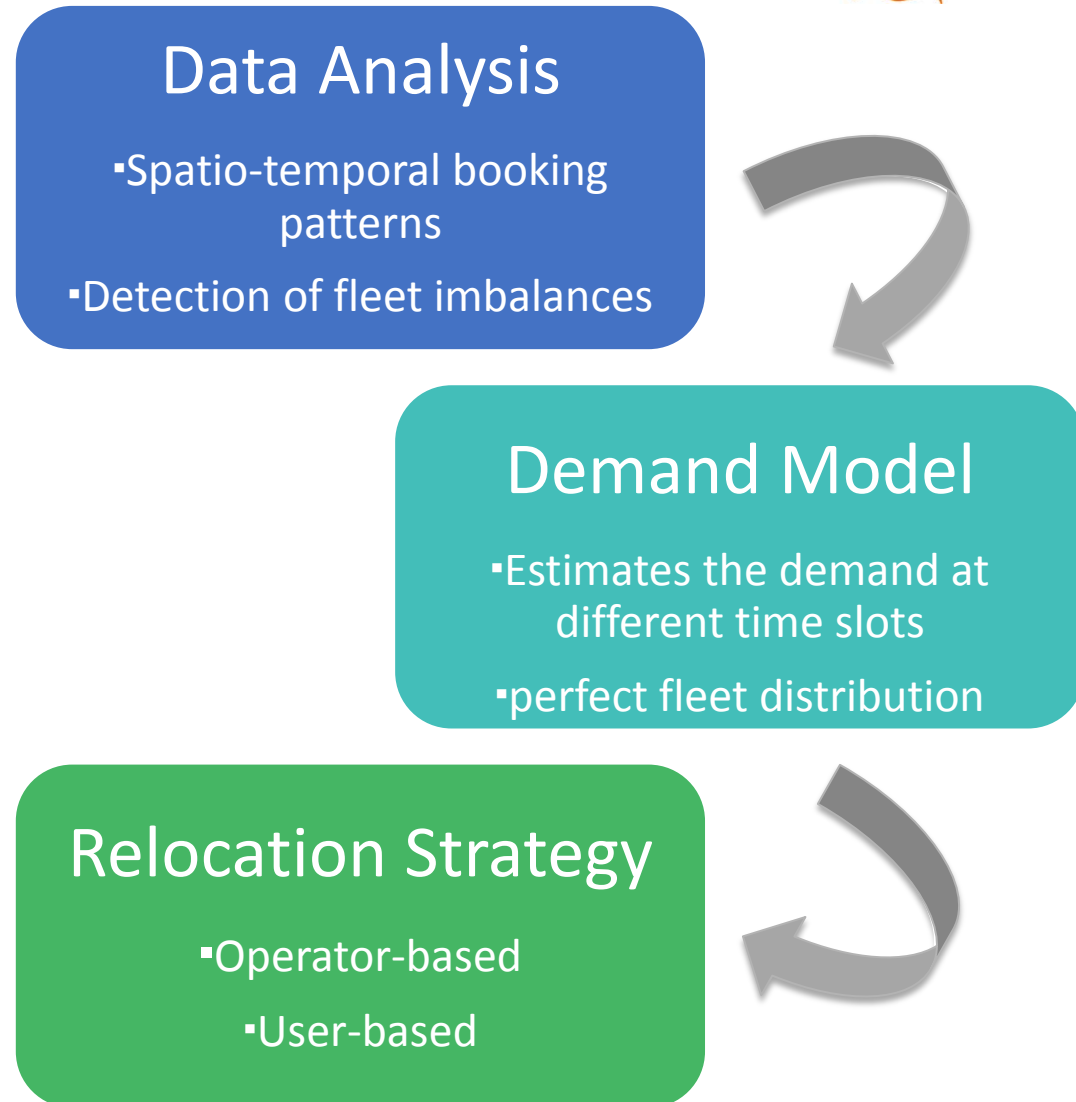
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- Detection of fleet imbalances



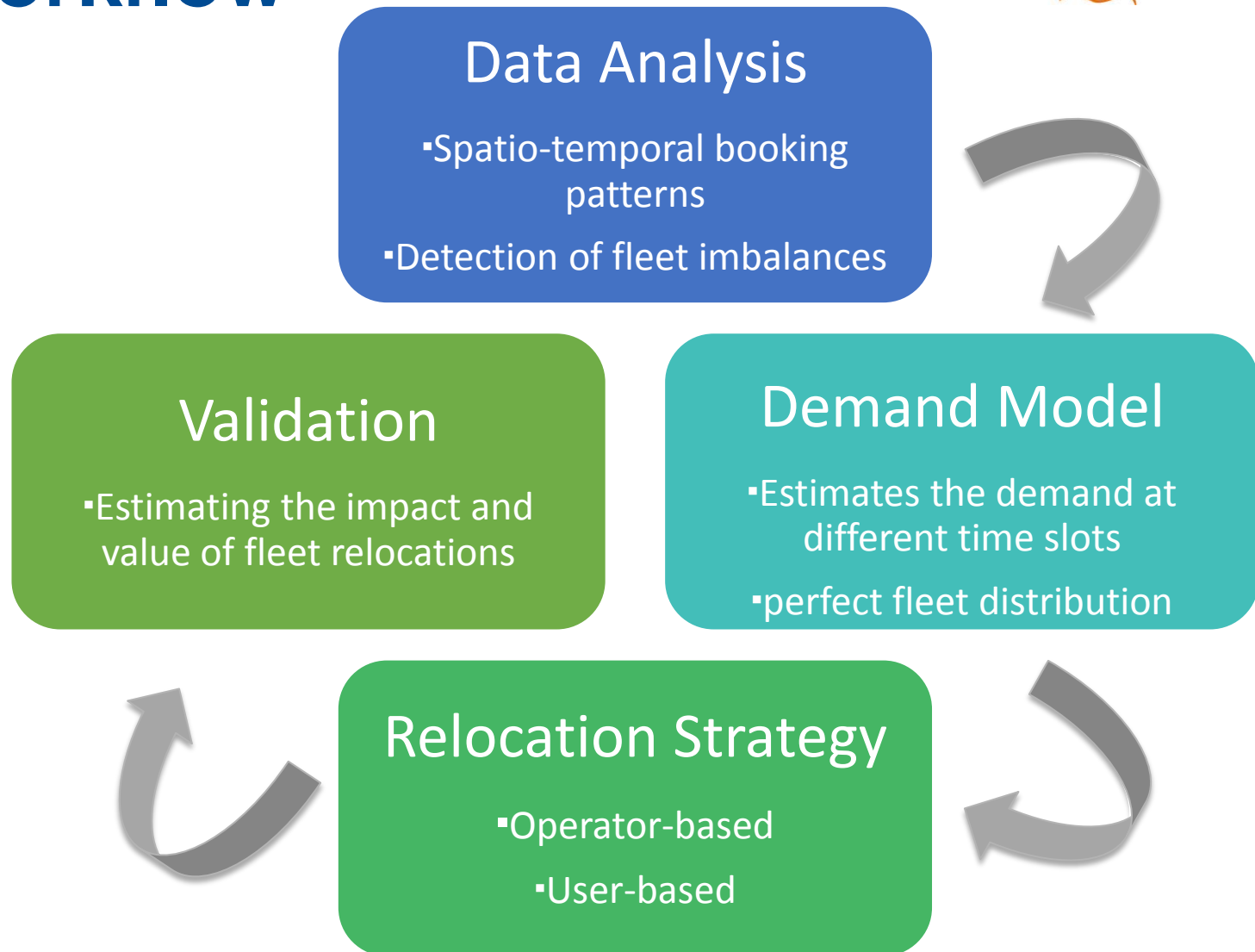
## Demand Model

- Estimates the demand at different time slots
- perfect fleet distribution

# Workflow

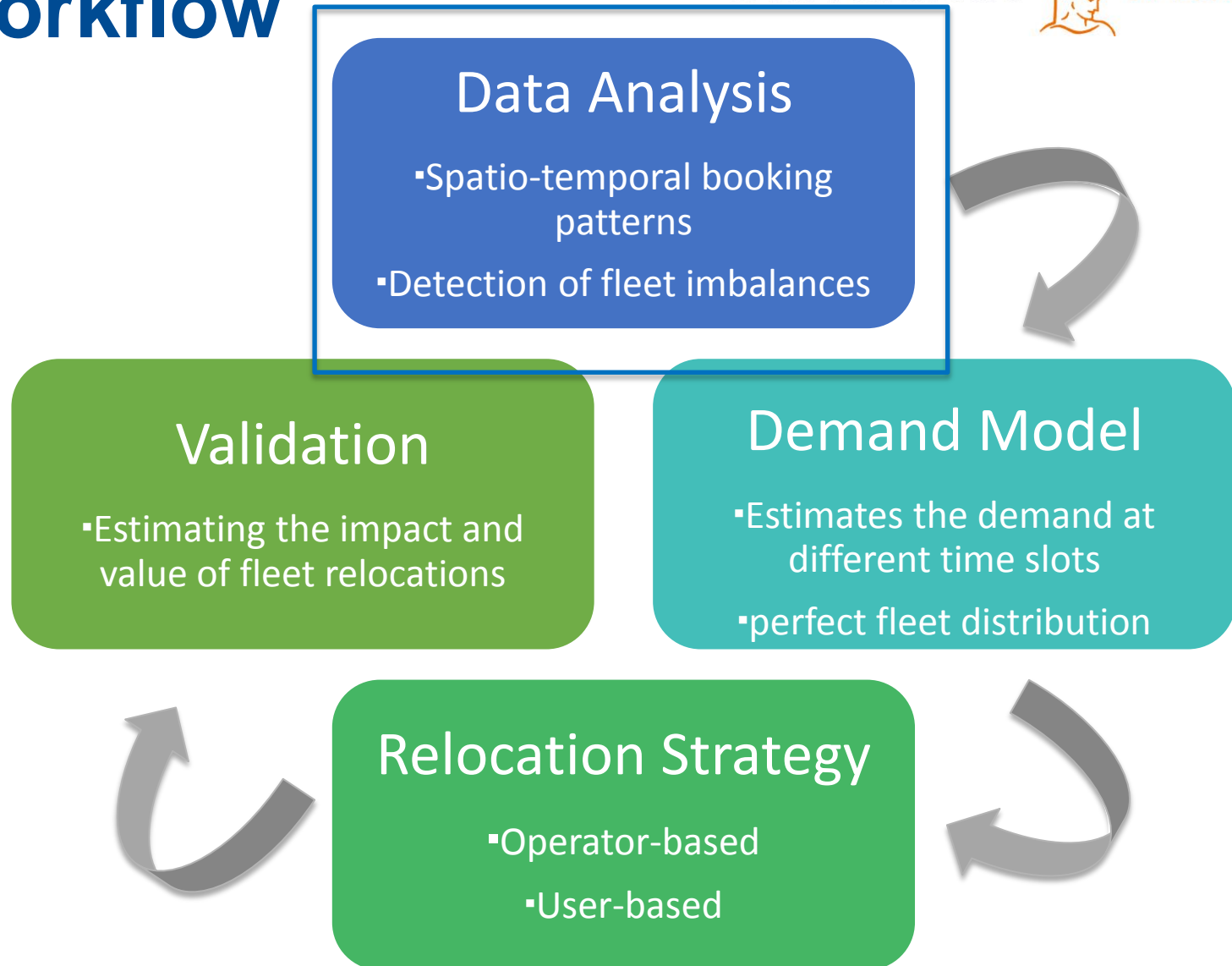


# Workflow





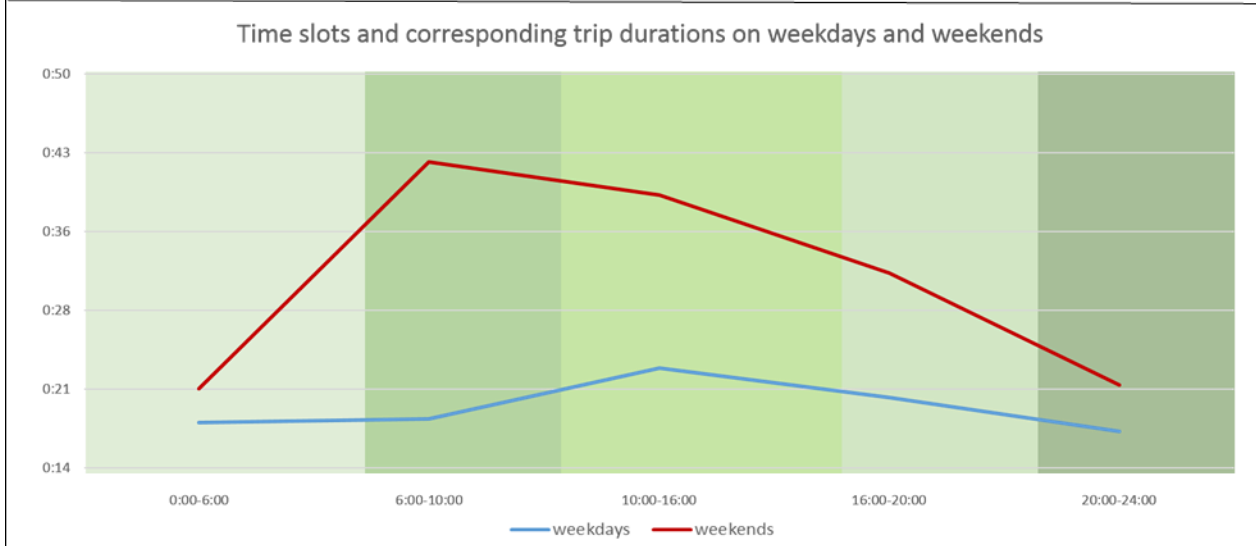
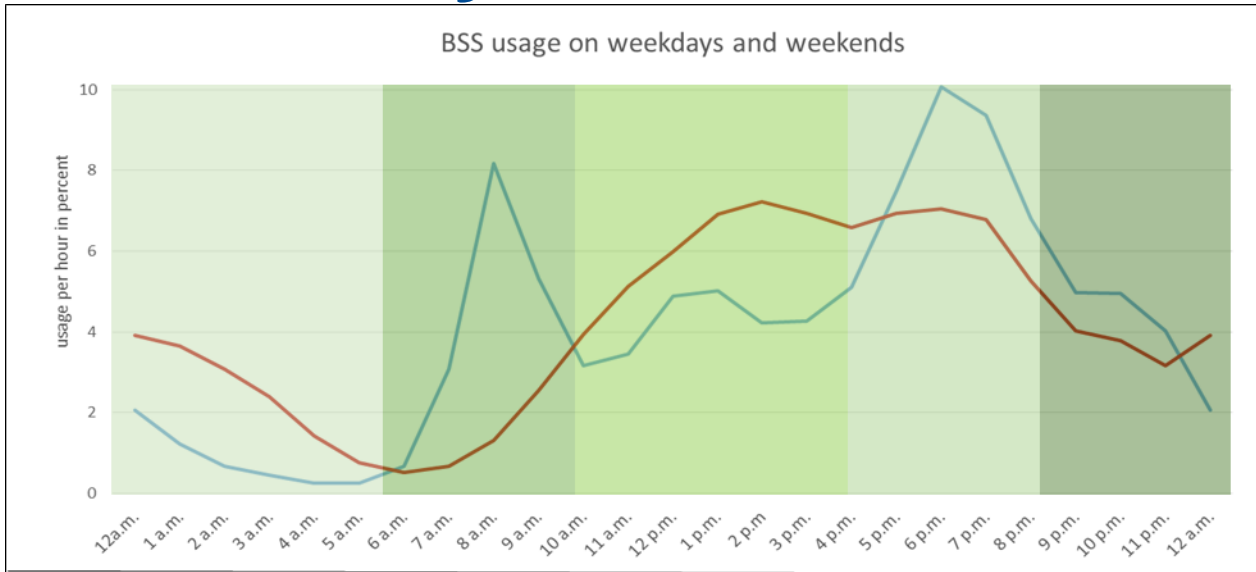
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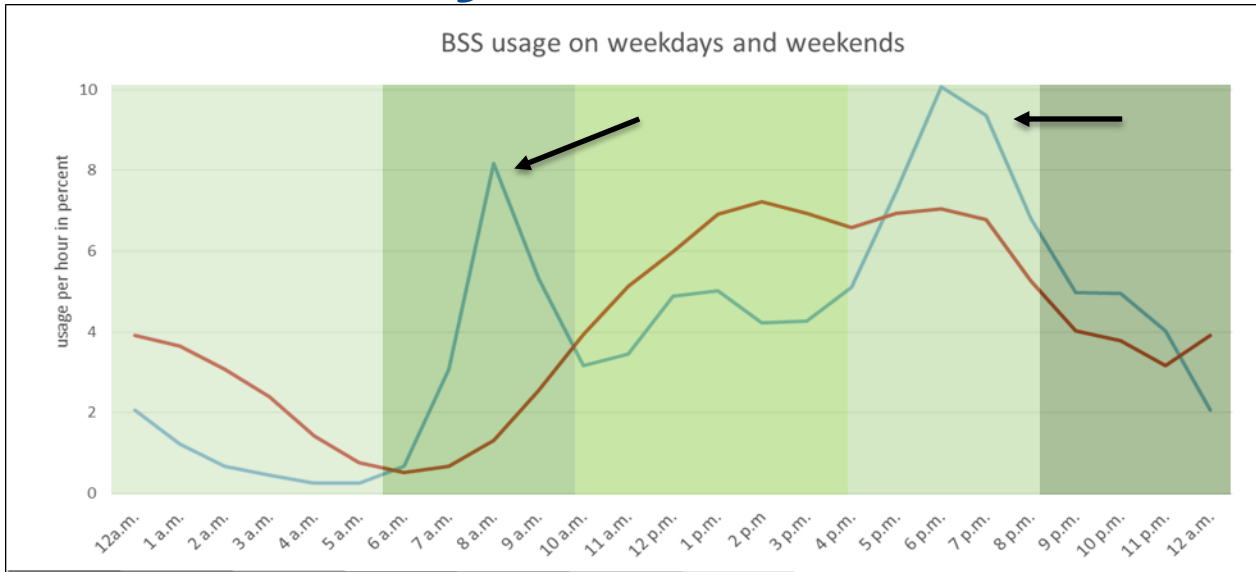
# Data Analysis


- 🚲 investigating different time slots
- 🚲 different mobility patterns during
  - 🚲 workdays and weekends
  - 🚲 time of the day
- 🚲 dividing the operating area in zones

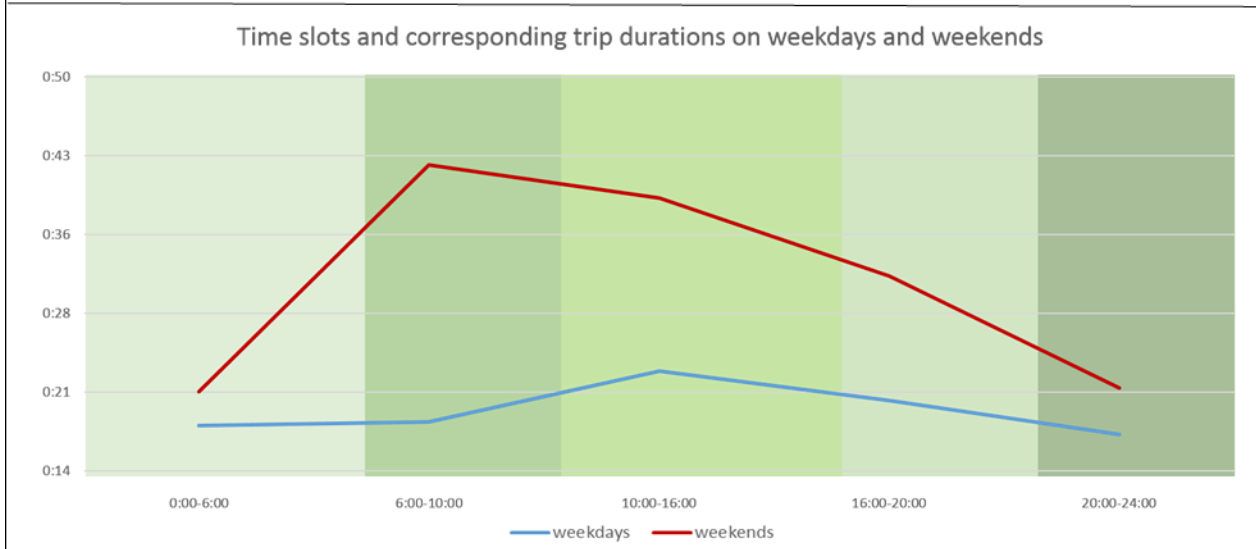
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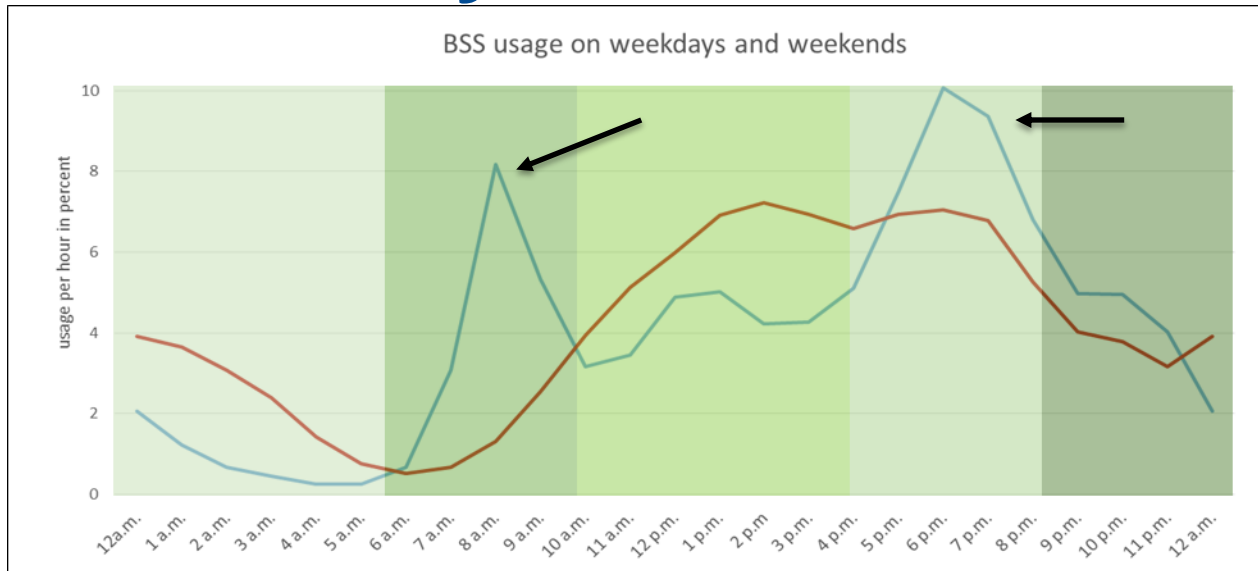
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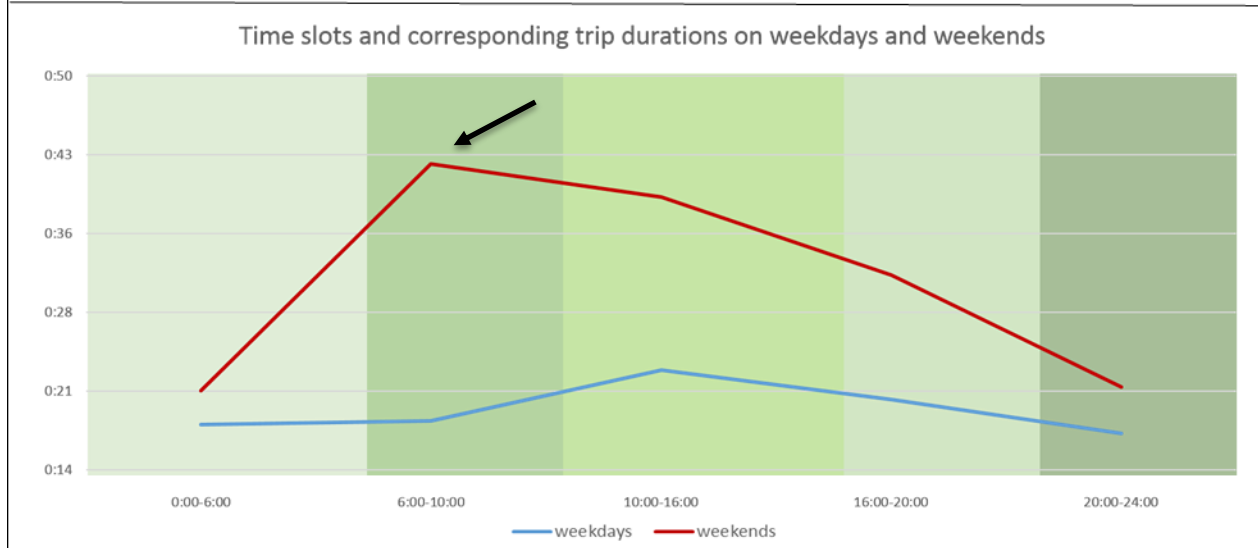
 **Commuter peaks in the morning and evening**




# Data Analysis

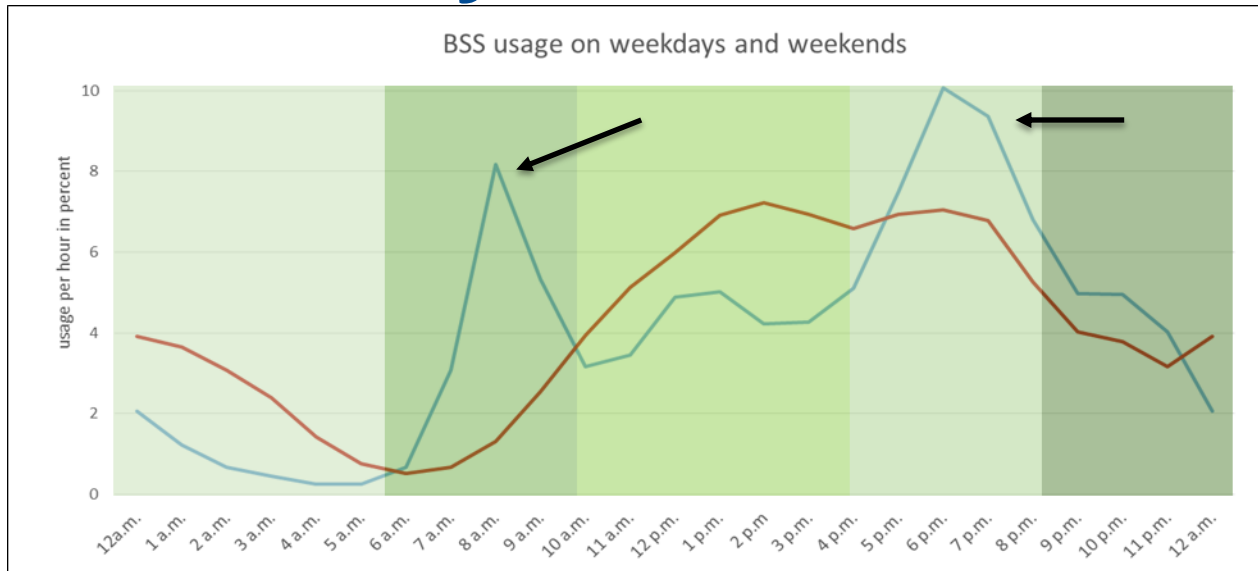



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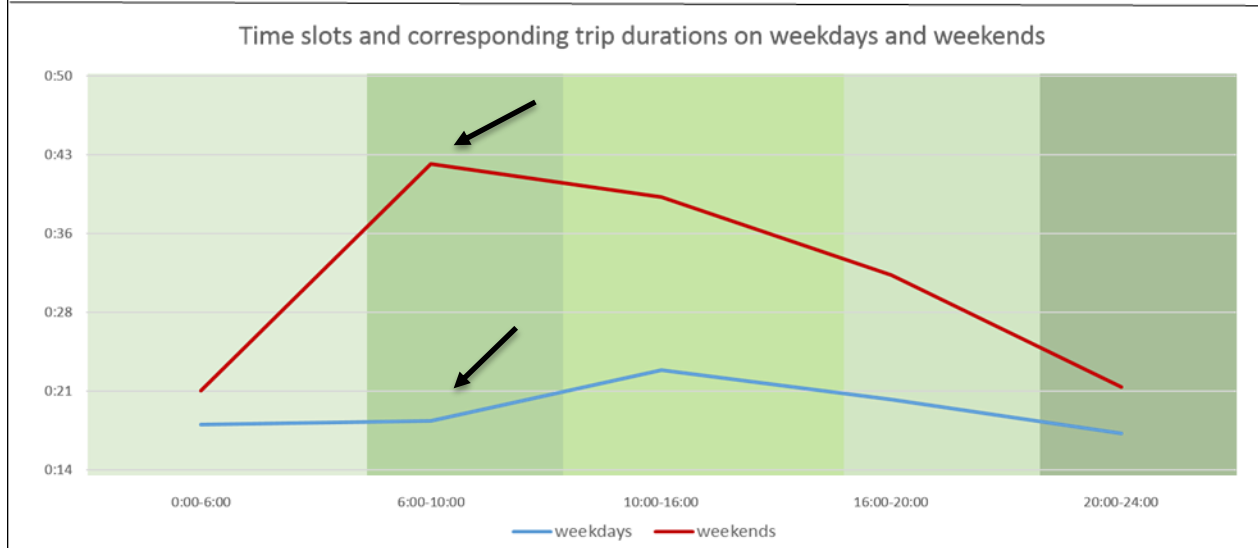



 **Long trips on weekends for leisure**


# Data Analysis



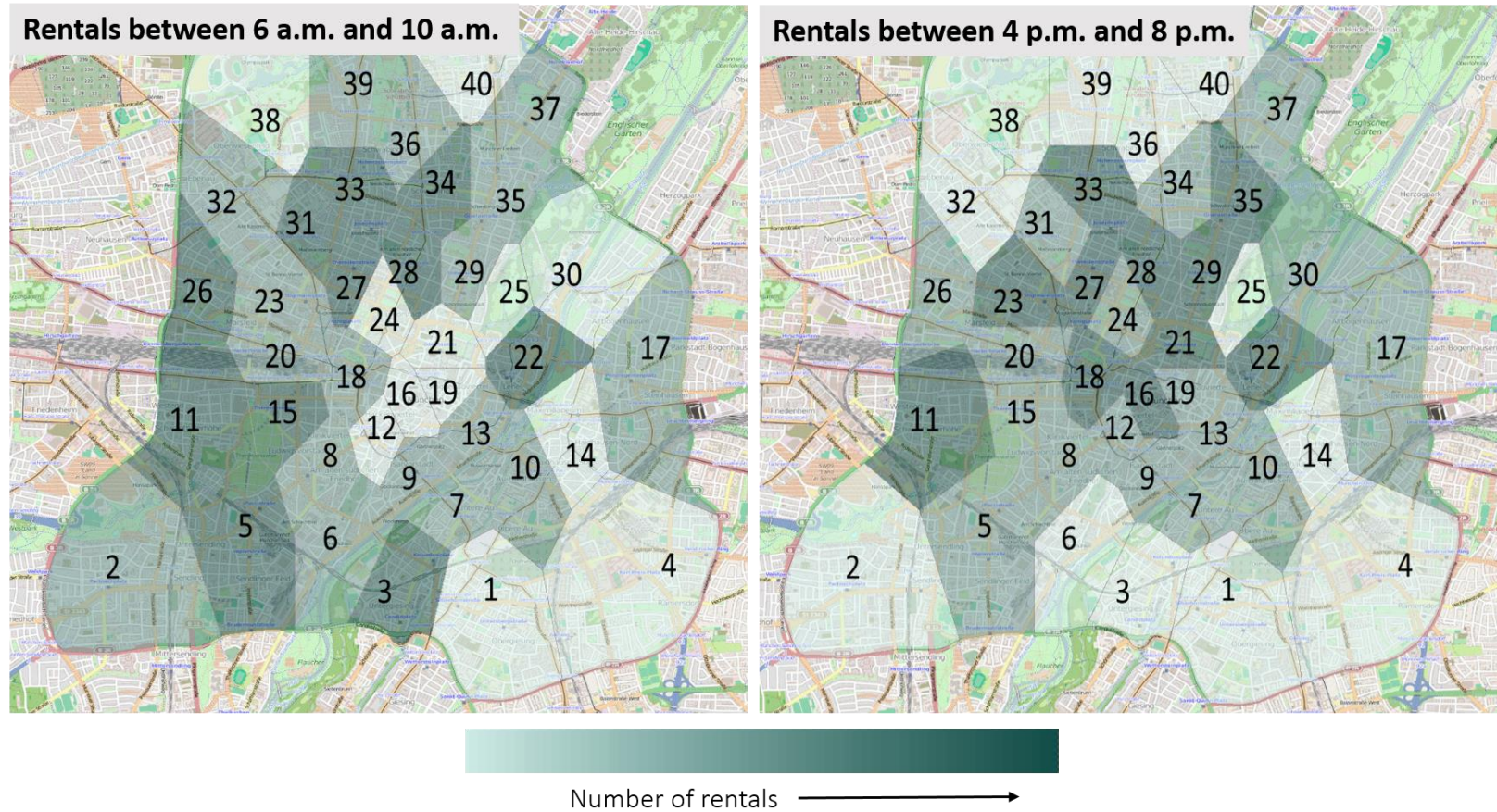
 **Commuter peaks in the morning and evening**



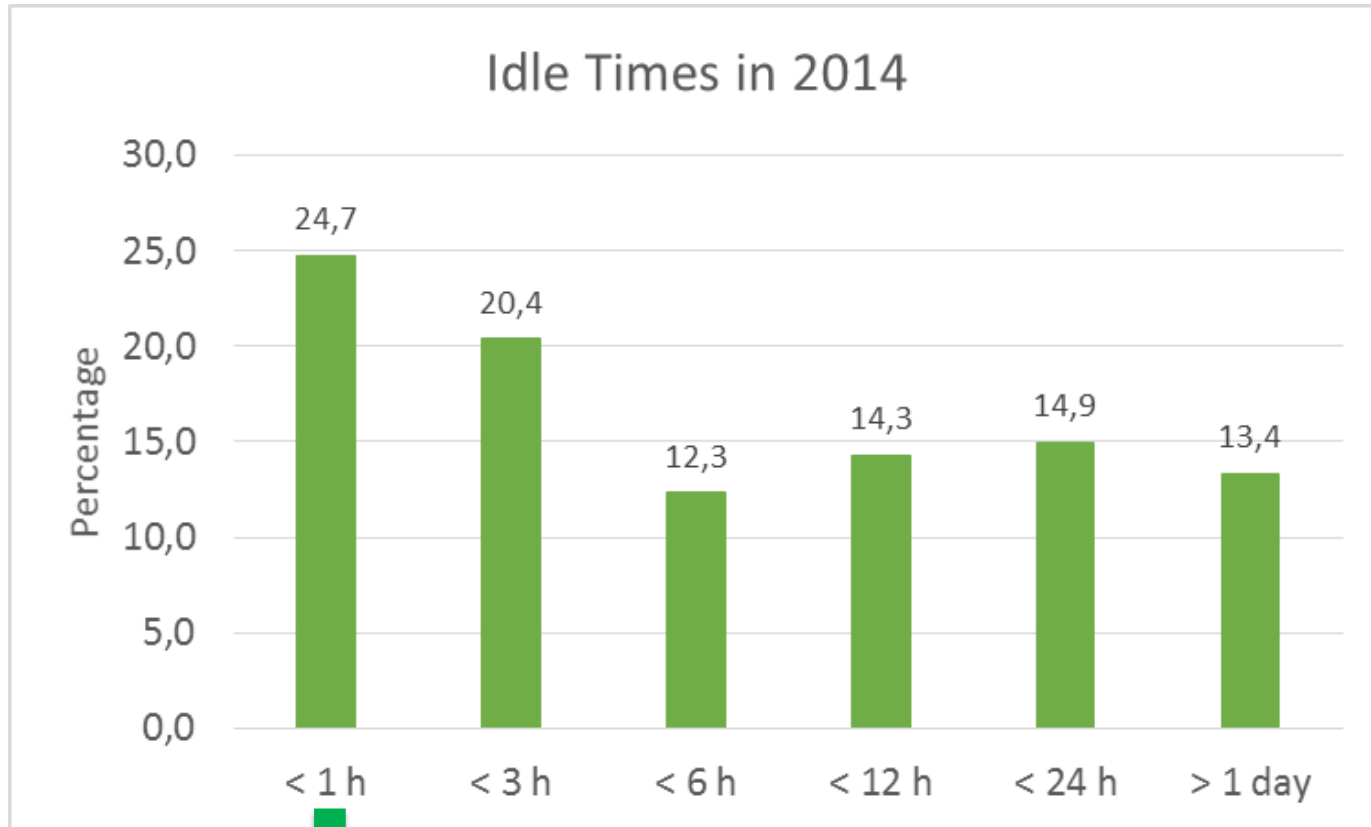
 **Long trips on weekends for leisure**

 **Short trips on workdays esp. in the morning**

# Data Analysis



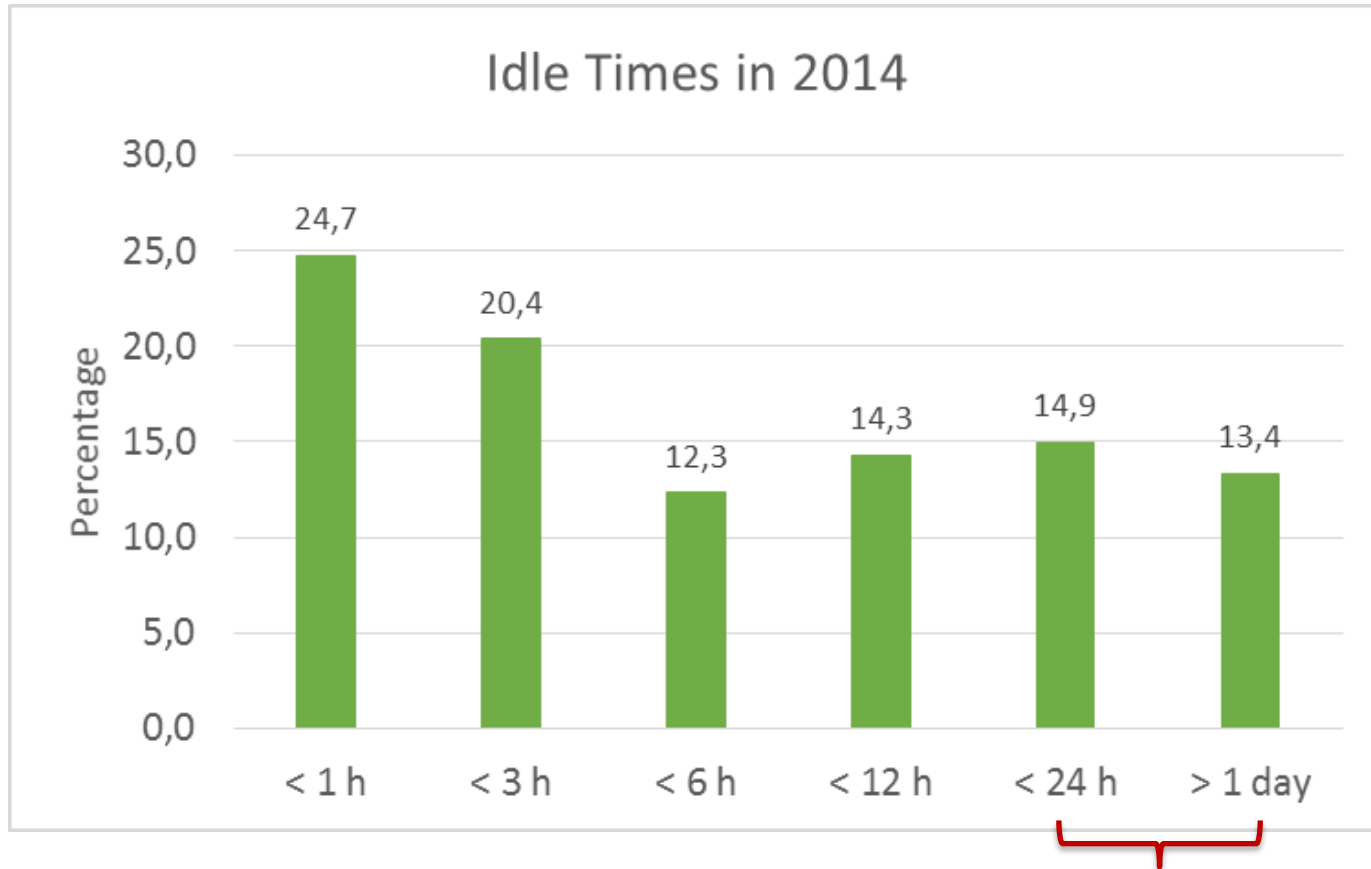
# Idle Times



~25% is in motion permanently

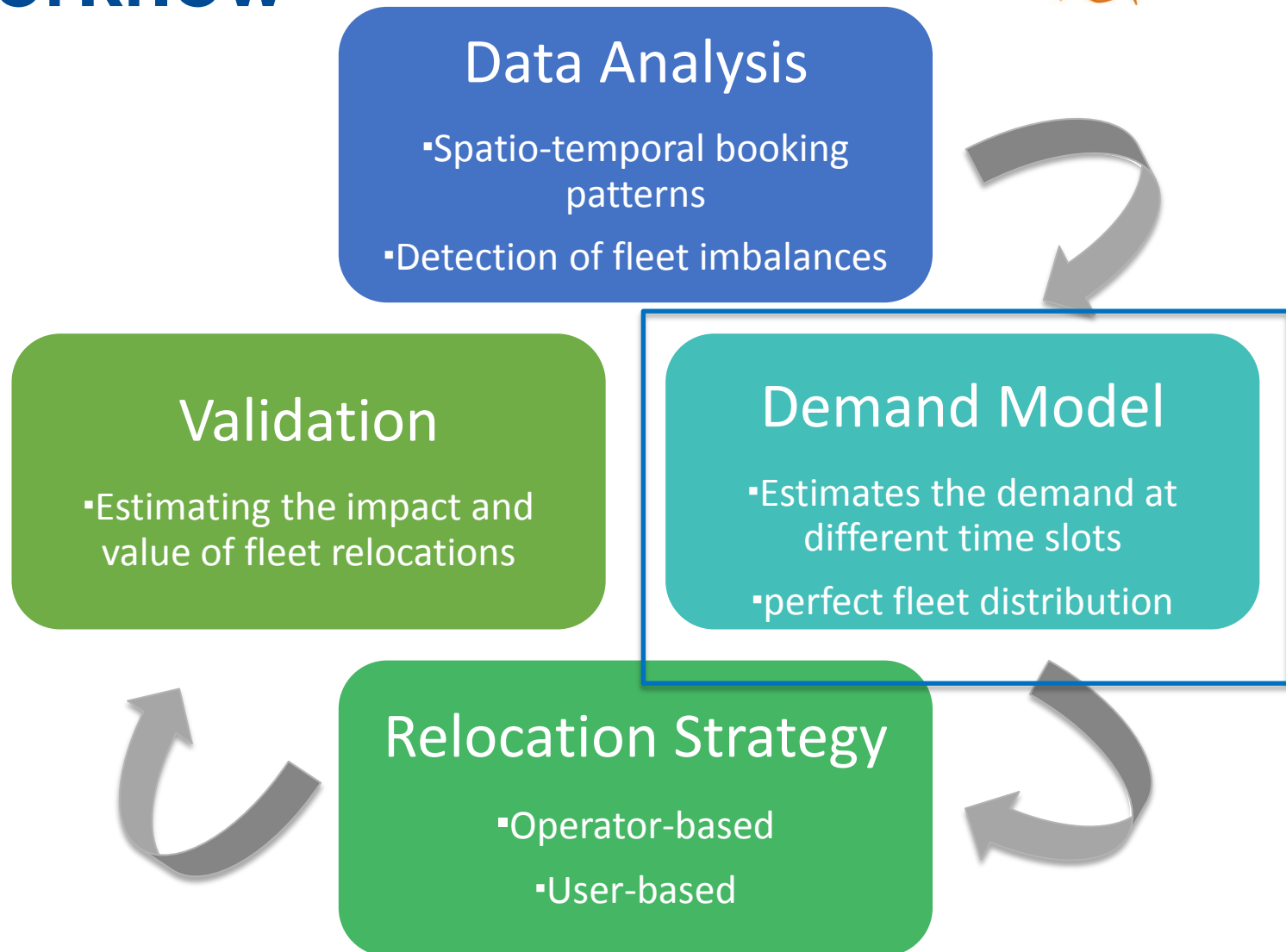


# Idle Times

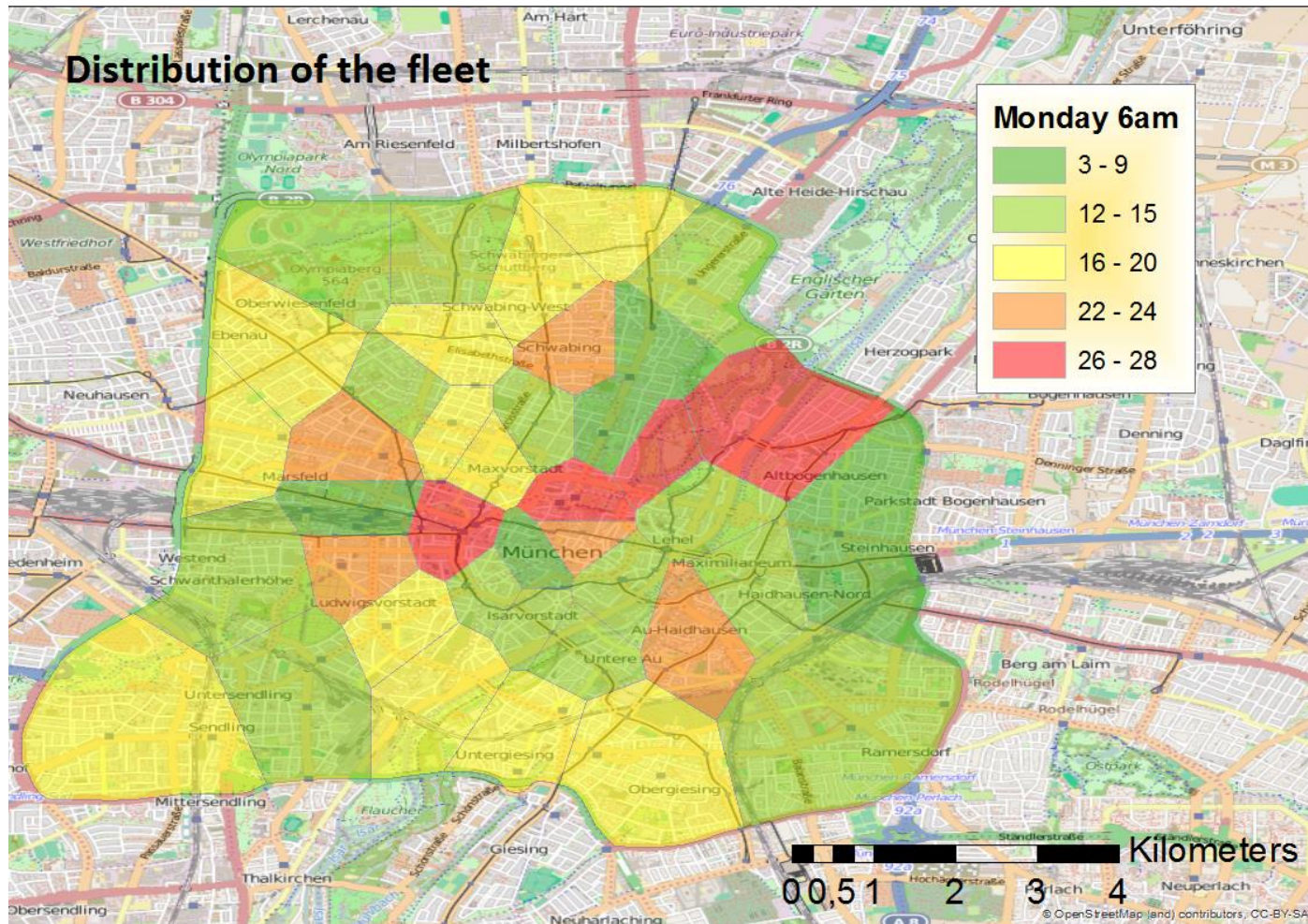


**~30% of the fleet is idling longer than 12 hours!**

# Workflow



# Demand Model



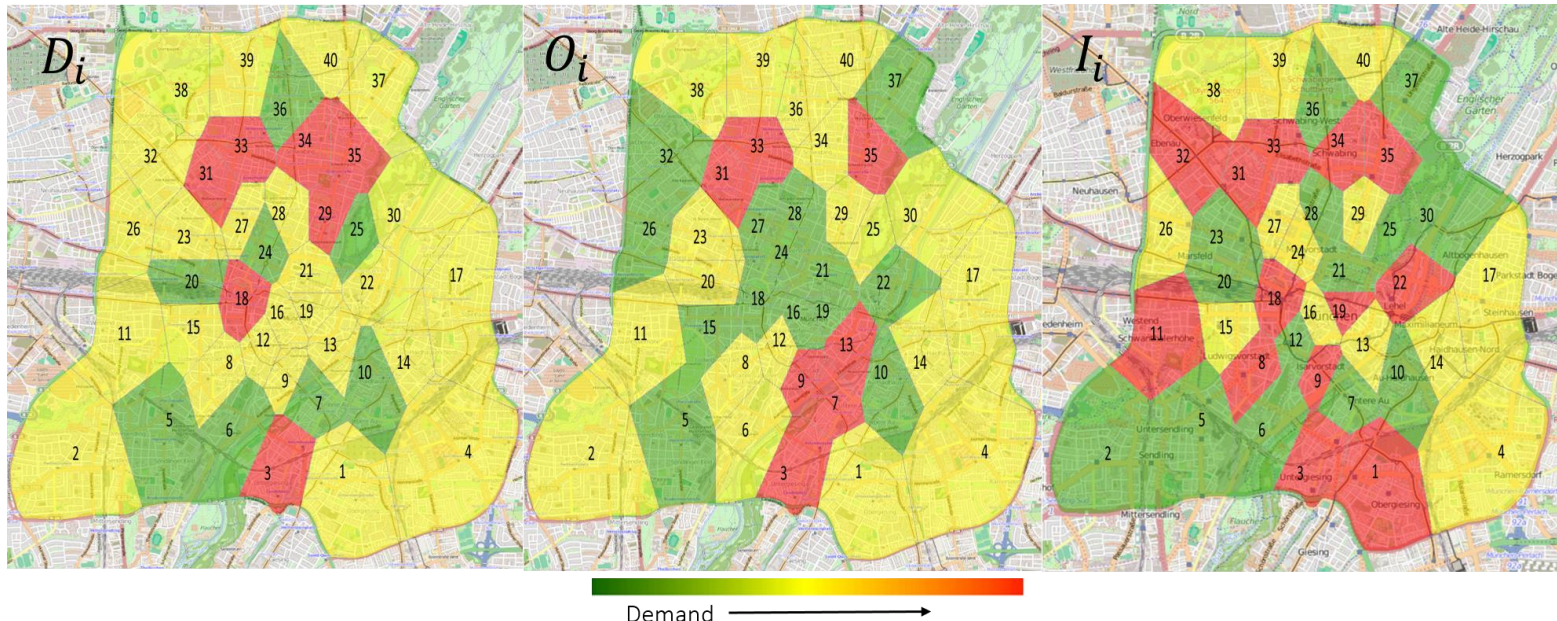
# Demand Model

Demand according to:

Booking data

O/D Analysis

Idle times

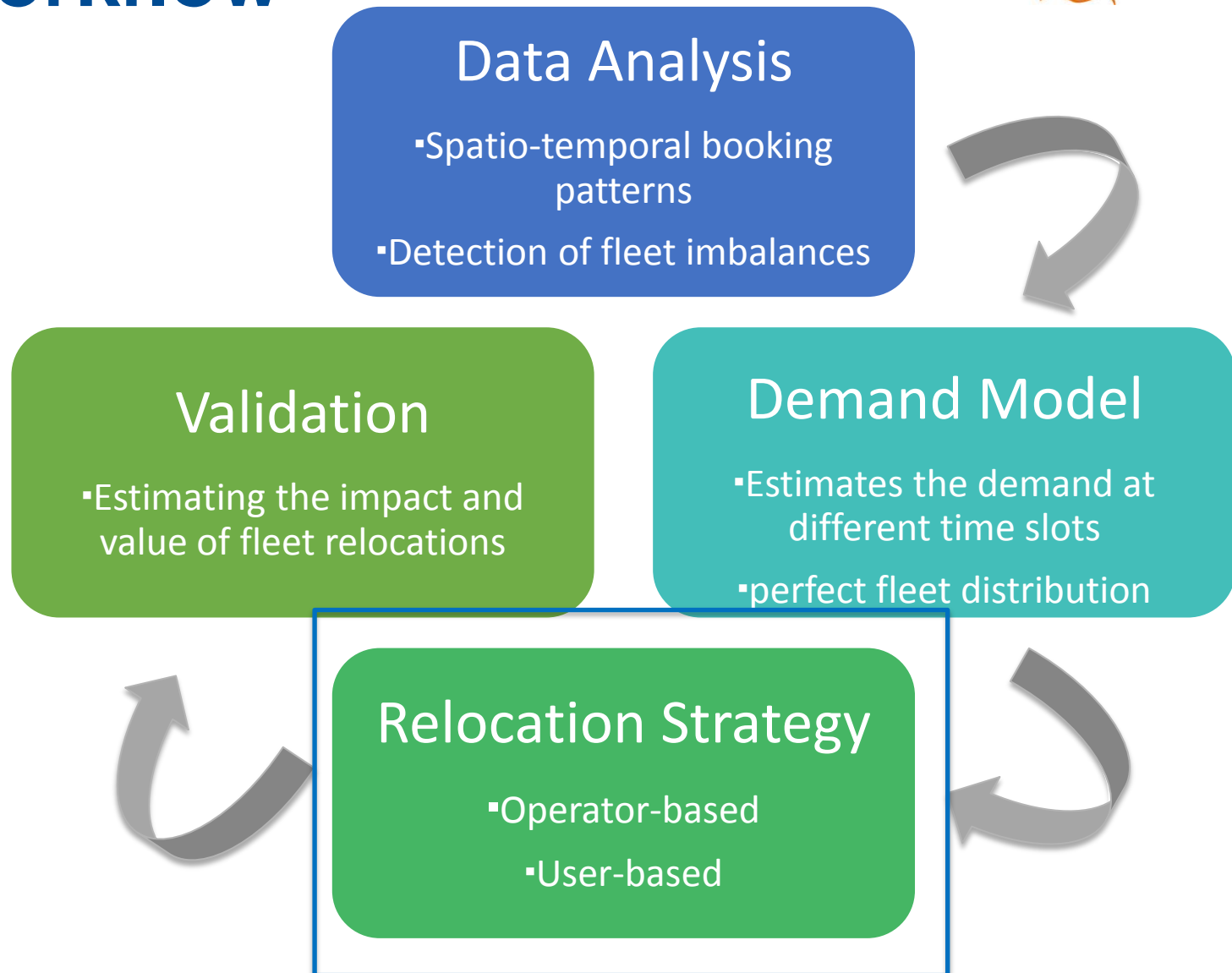


⇒ These factors determine the demand for each zone and every time interval

# Demand Model

- 🚲 The model is based on
  - 🚲 current stock and rentals per zone
  - 🚲 O/D-relations
  - 🚲 idle times per zone
  
- 🚲 Deviation between actual distribution and calculated *perfect* distribution are needed relocation steps

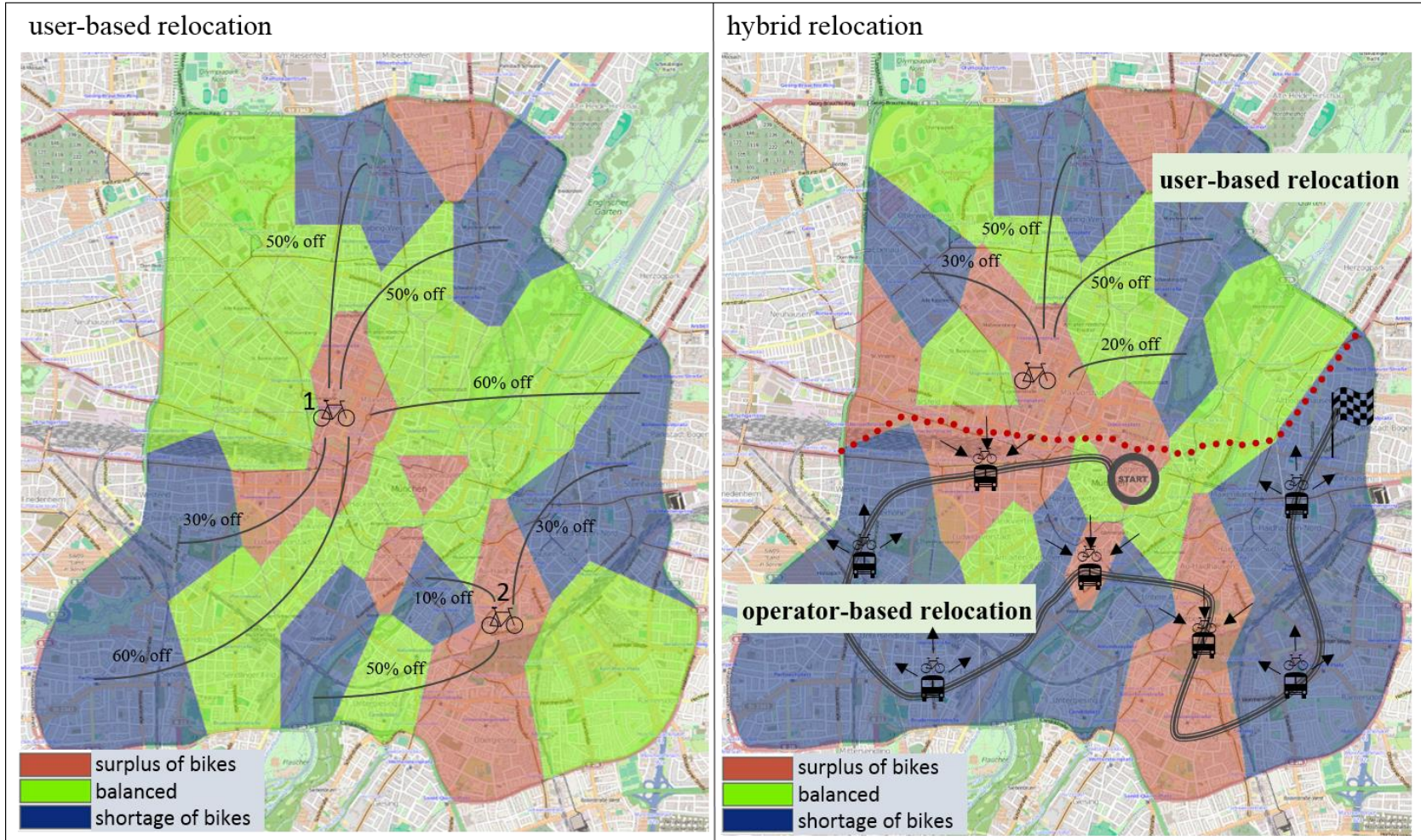
# Workflow



# Relocation Strategy

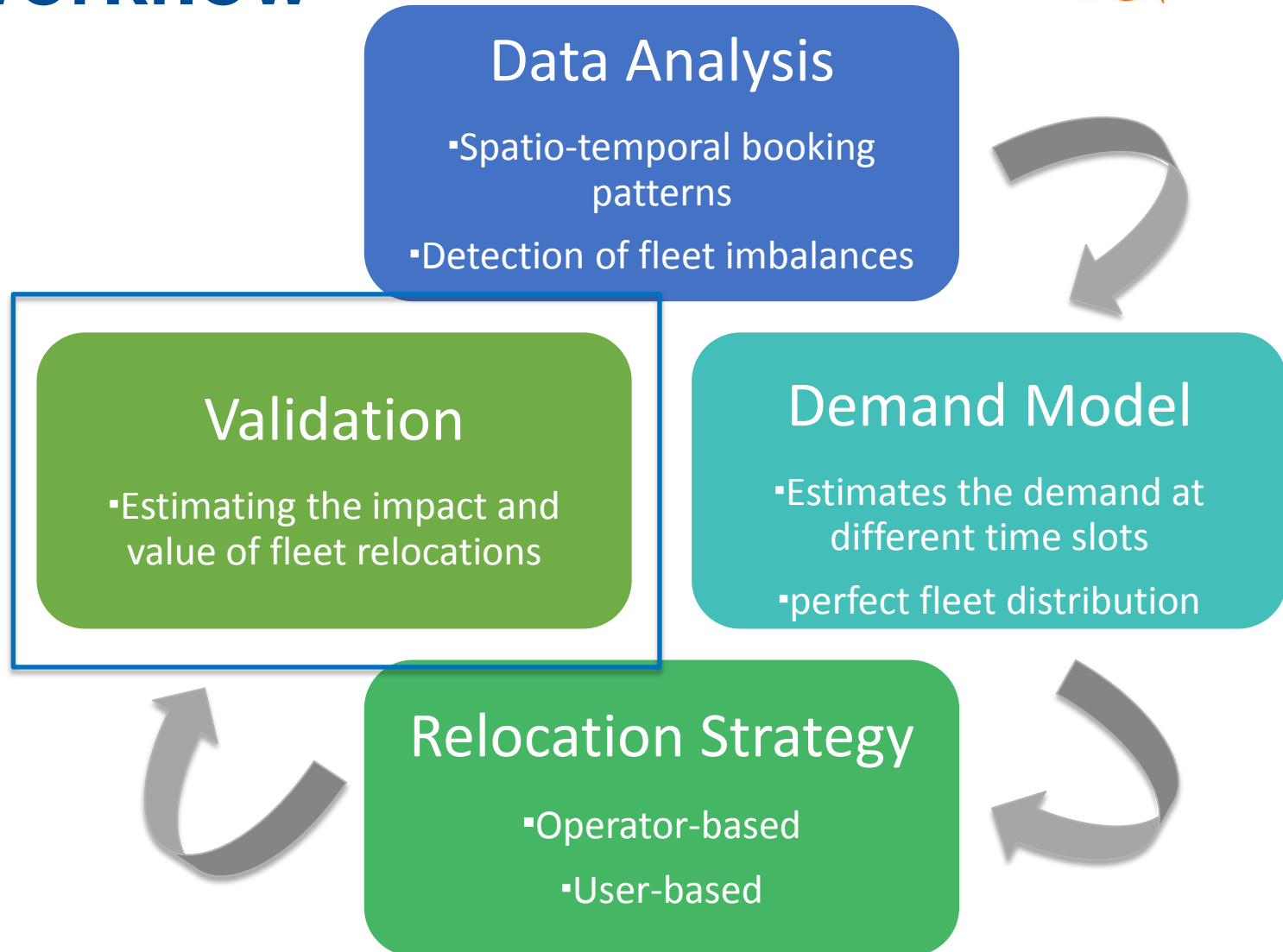
- 🚲 The demand model provides a *perfect fleet distribution* for each time slot
- 🚲 Deviation between actual distribution and calculated *perfect* distribution are needed relocation steps
- 🚲 Minor relocations can be done by users themselves:

# Relocation Strategy



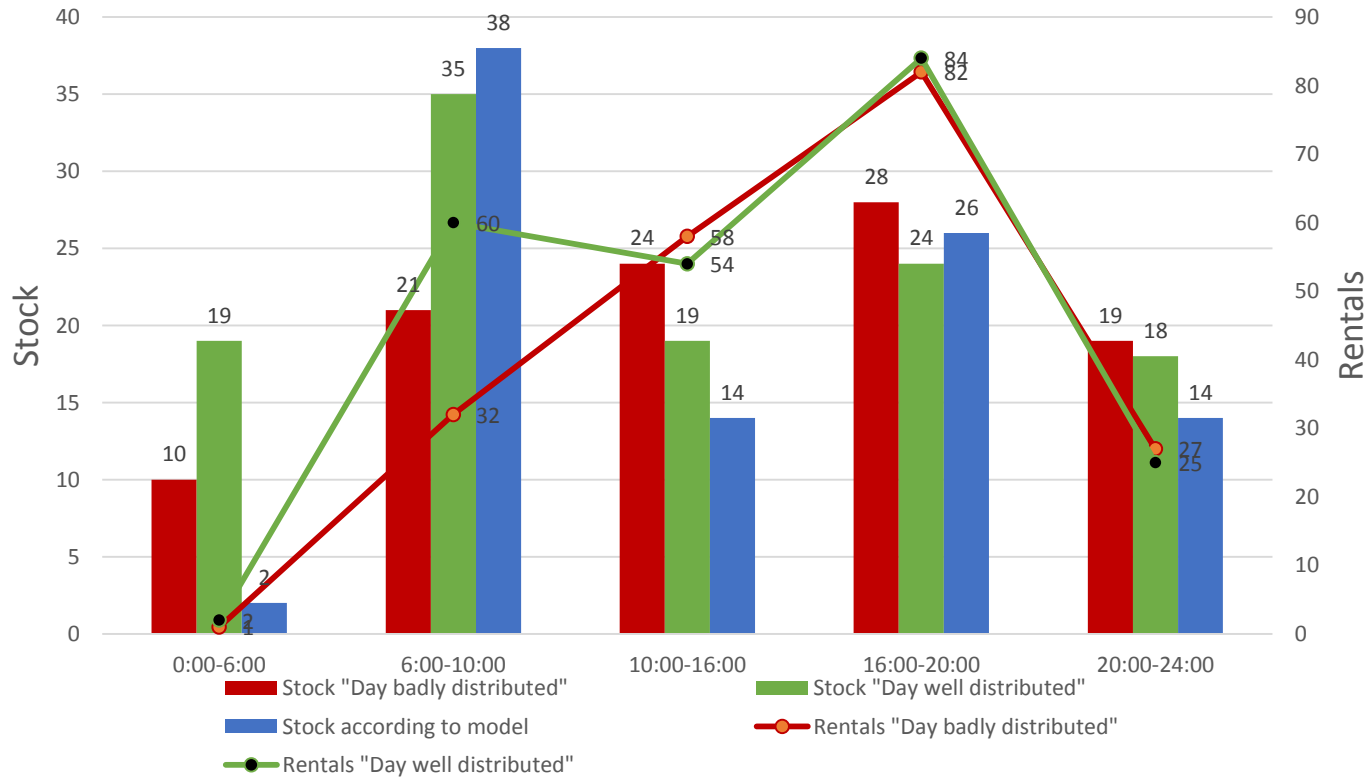


# Workflow



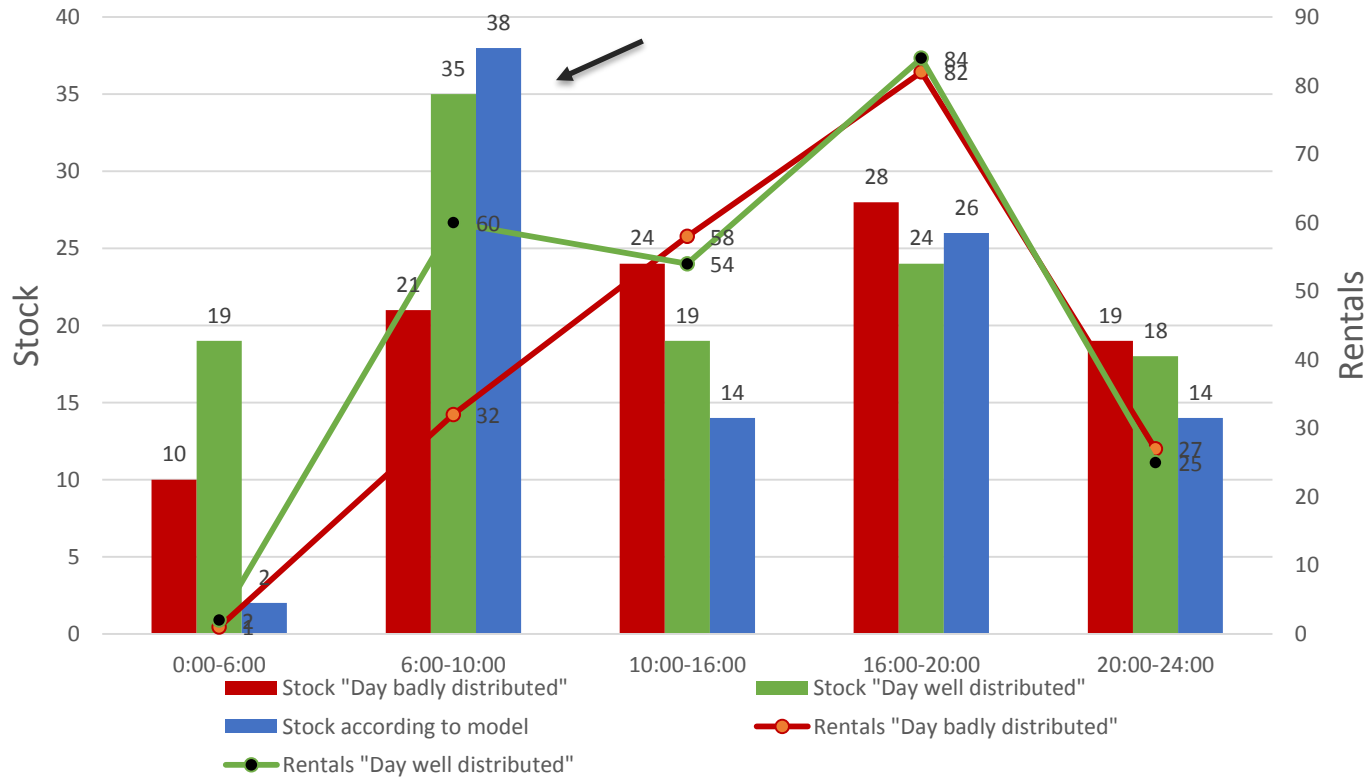
# Validation


Validation in zone 26 "Nymphenburg"



# Validation

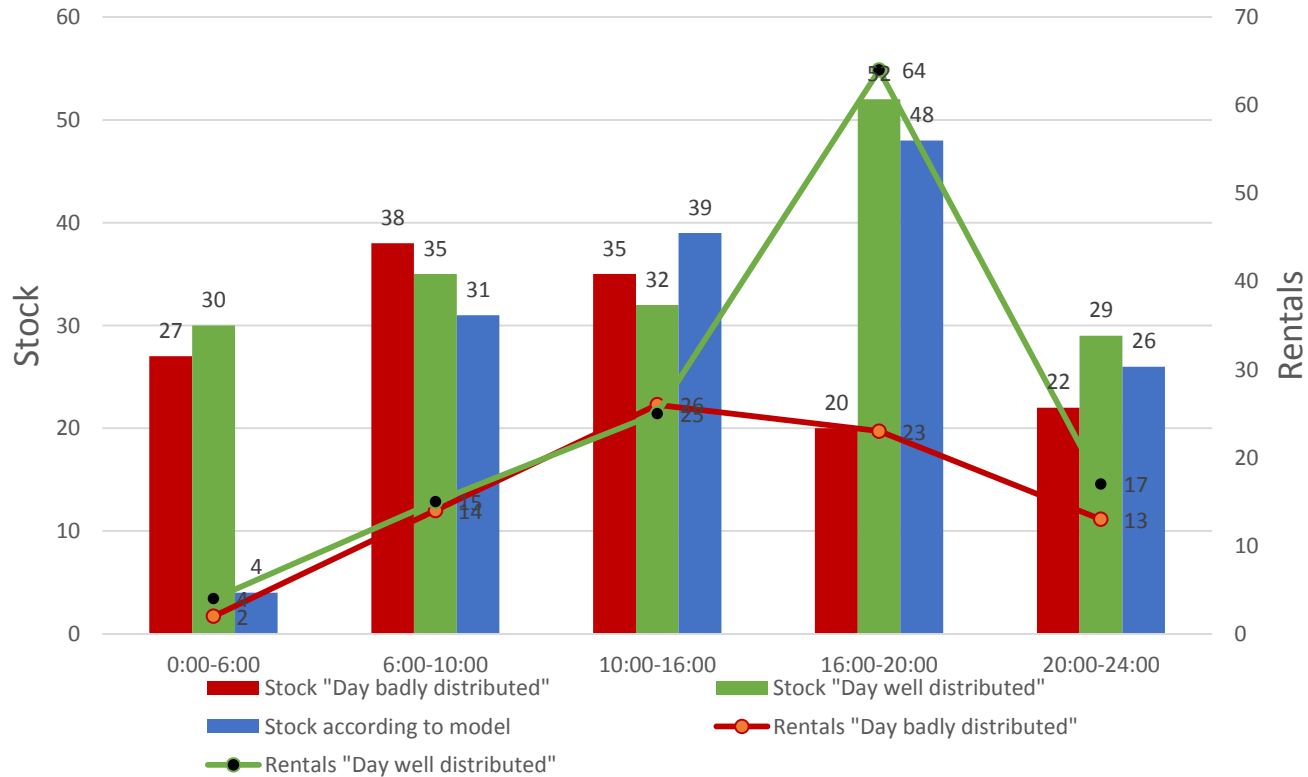
Validation in zone 26 "Nymphenburg"



 More bikes generate up to 50 trips more per time slice

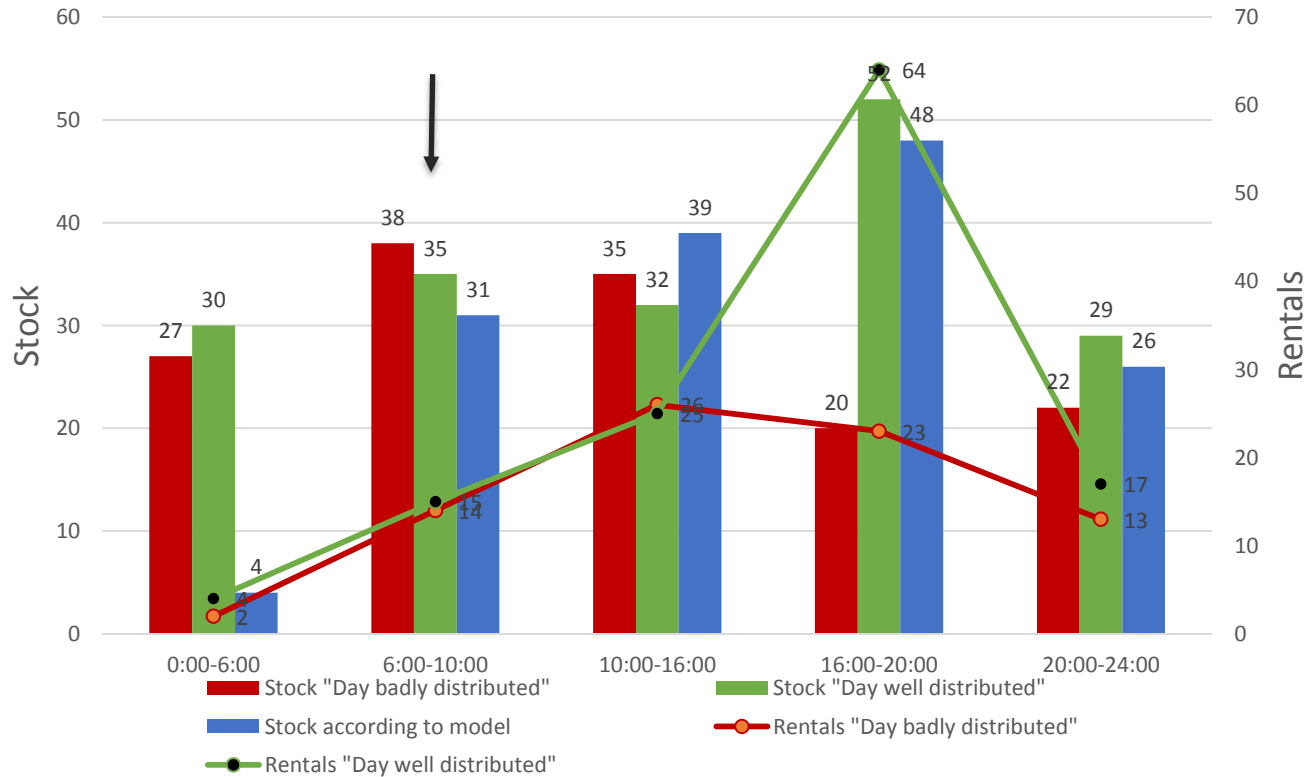
# Validation


Validation in zone 29 "Universität"



# Validation

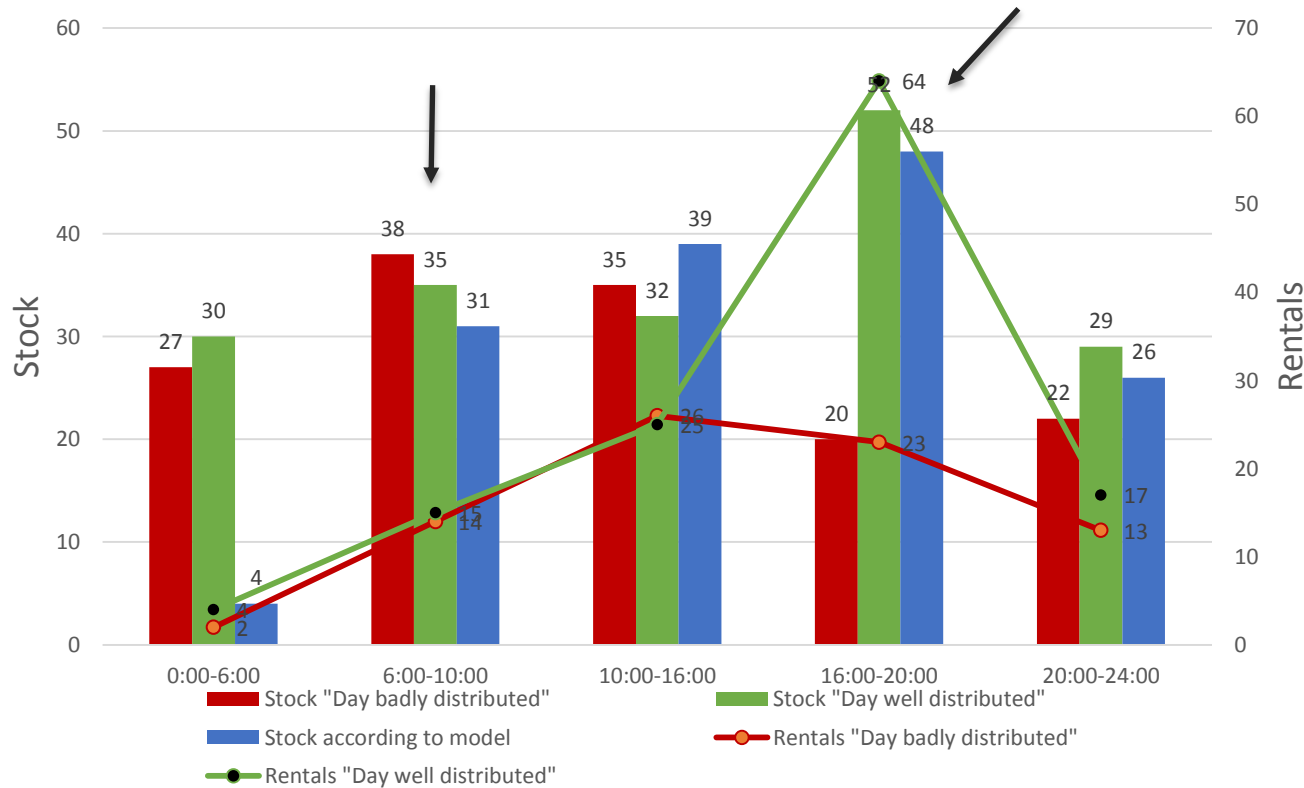
Validation in zone 29 "Universität"



 In the morning: Demand is satisfied with less bikes

# Validation

Validation in zone 29 "Universität"



🚲 In the morning:  
 Demand is satisfied with less bikes

🚲 In the evening:  
 More bikes generate up to 50 trips more per time slice

# Key Findings

- 🚲 Fleet imbalances occur esp. after public holidays or weekends
- 🚲 Relocations have a huge impact on following bookings
- 🚲 Adding a user-based strategy (discount) is very cost and time-efficient
- 🚲 By relocations the system gets more attractive for users and more economic for the operator

**Thanks for listening!**