

# Do commercial vehicles cruise for parking?

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1. Introduction: parking cruising
2. Methodology
3. Data
4. Results
5. Conclusion

# I. Introduction

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Parking demand  $\approx$  Parking supply  $\rightarrow$  Parking cruising



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- Cost of parking cruising
    - **Internal cost:** 7.5 minutes average search time
    - **External cost:** 34% average share of traffic cruising
- 1 h parking  $\rightarrow$  3.6 cars to cruise

Shoup (2011), Inci, Ommeren, Kobus (2017)

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- Factors affecting parking cruising: on-street/off-street parking cost, traffic and parking information, travel duration, activity type ...

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## Parking policies

### **Parking and cruising behaviours**

- Value of time
- Dwell time
- Patience
- Willingness to pay

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### Data-driven parking policies

- Parking enforcement
- Minimum parking requirements
- Parking pricing
- Time limits





# I. Introduction

## What about commercial vehicles?

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### Freight Parking demand

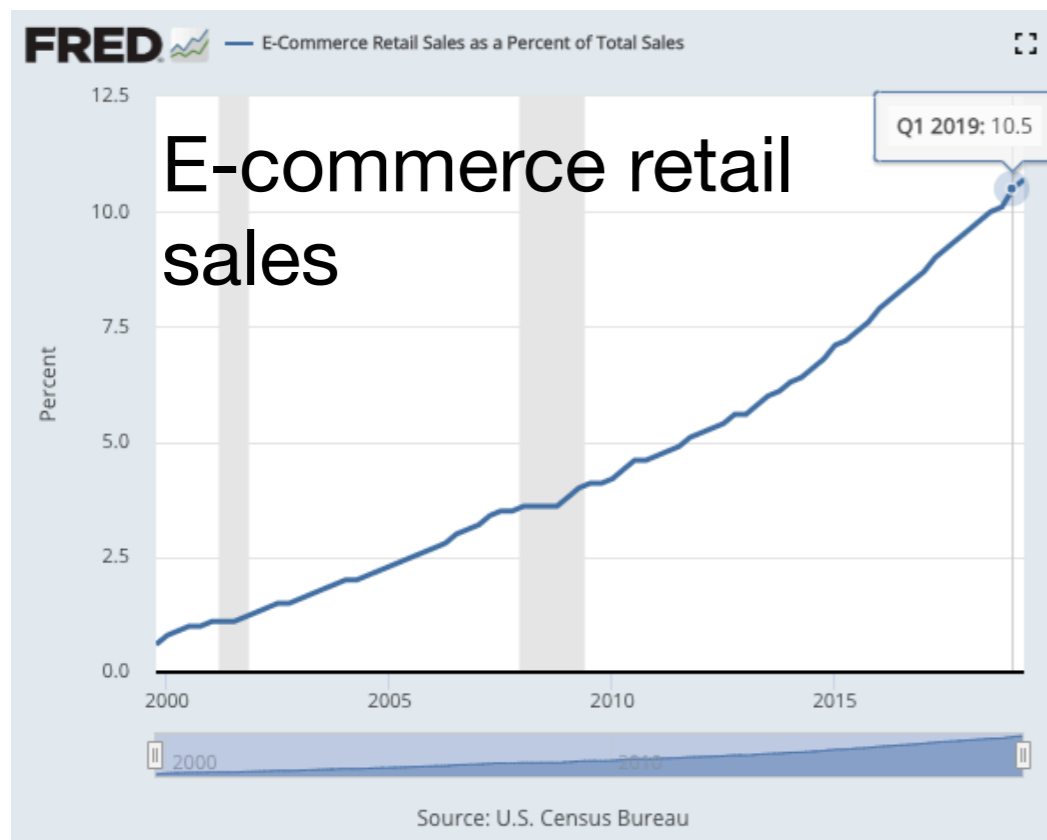


U.S. E-commerce retail sales as % of total sales  
(U.S. Census Bureau)

# I. Introduction

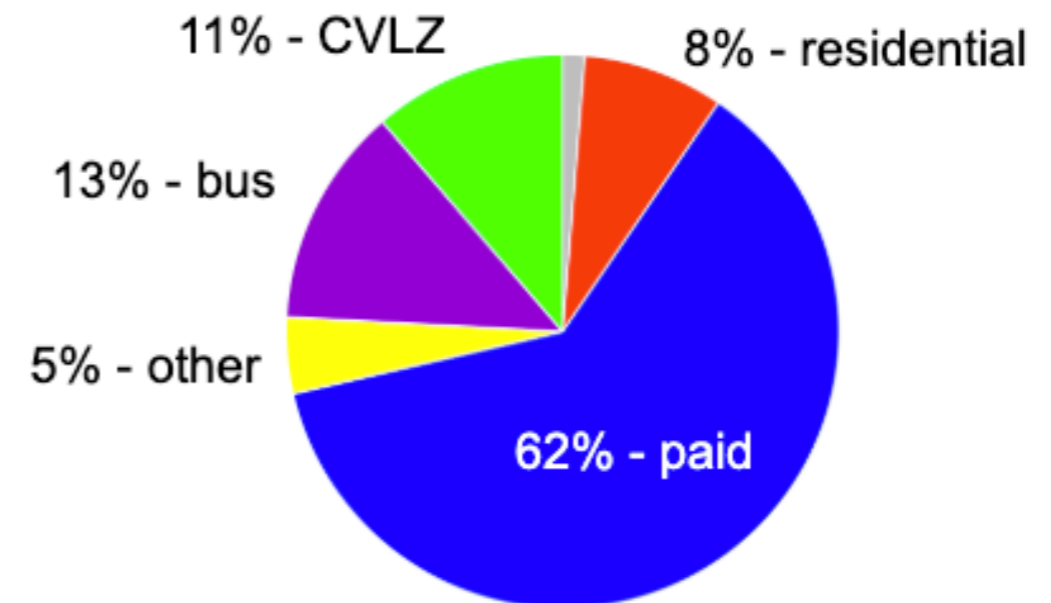
## What about commercial vehicles?

### Freight Parking demand



U.S. E-commerce retail sales as % of total sales (U.S. Census Bureau)

### Freight parking supply



Curbside parking allocation by parking type in Seattle (Seattle DOT)

# I. Introduction

## Research gaps & objectives

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### Research gaps

- Literature on parking cruising: focus on passenger vehicles
- Literature on commercial vehicles parking:
  - ➔ Common assumption: commercial vehicles do not cruise for parking
  - ➔ Empirical evidence of un-authorized parking

# I. Introduction

## Research gaps & objectives

### Research gaps

- Literature on parking cruising: focus on passenger vehicles
- Literature on commercial vehicles parking:
  - ➔ Common assumption: commercial vehicles do not cruise for parking
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### Research questions

- 1) Is there empirical evidence of parking cruising for commercial vehicles?
- 2) What is the “internal cost” of parking cruising?
- 3) What factors affects parking cruising?

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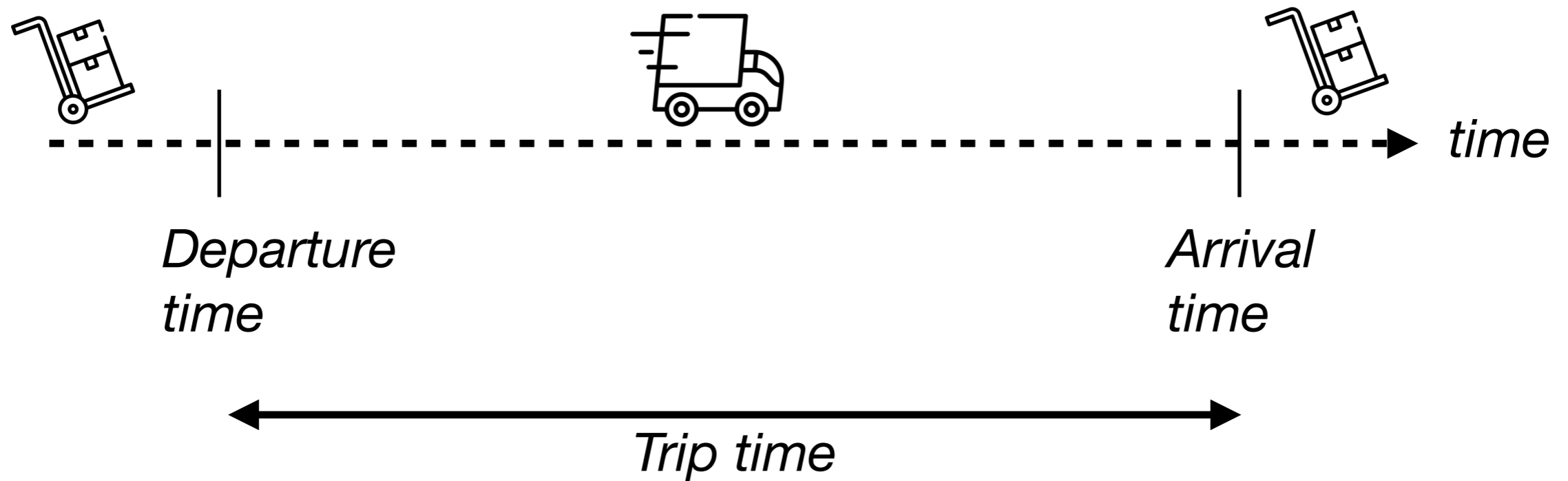
## 2. Methodology

# Decomposing trip time



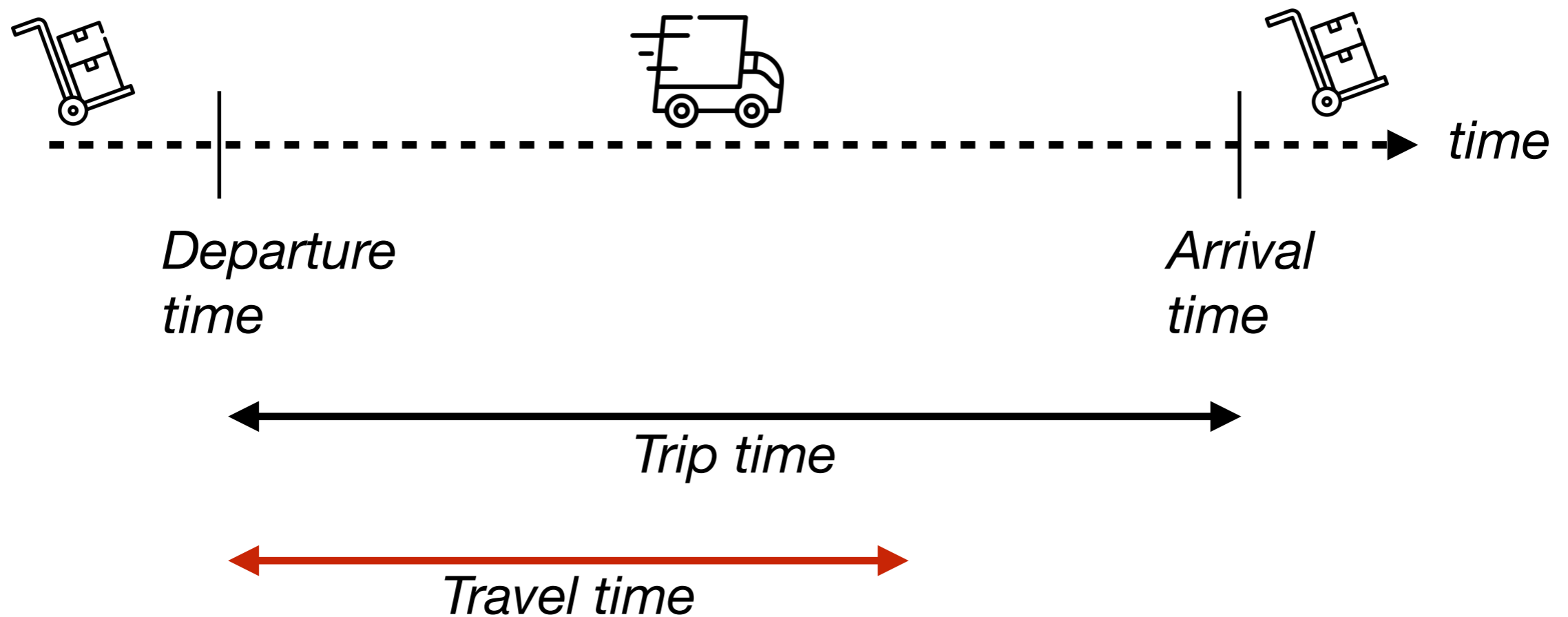
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# Decomposing trip time



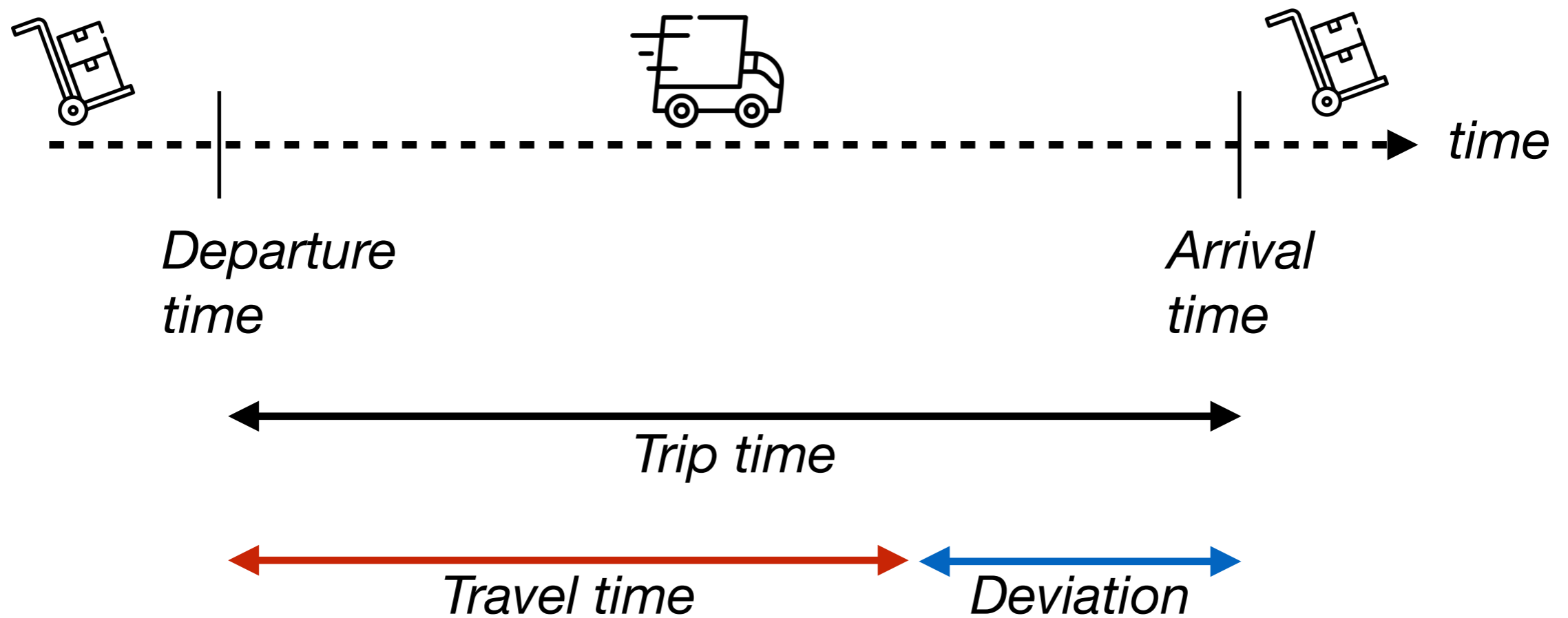
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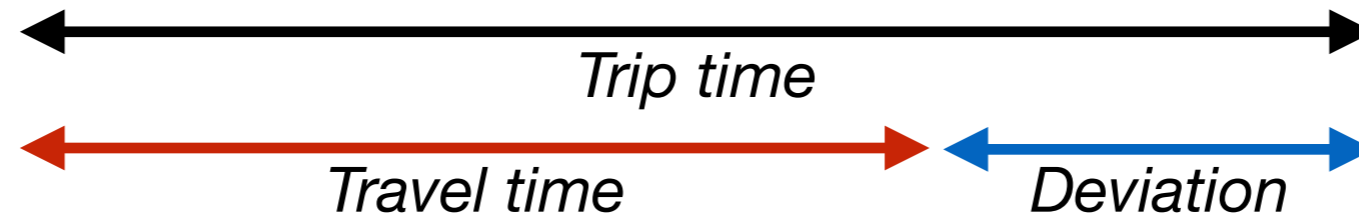
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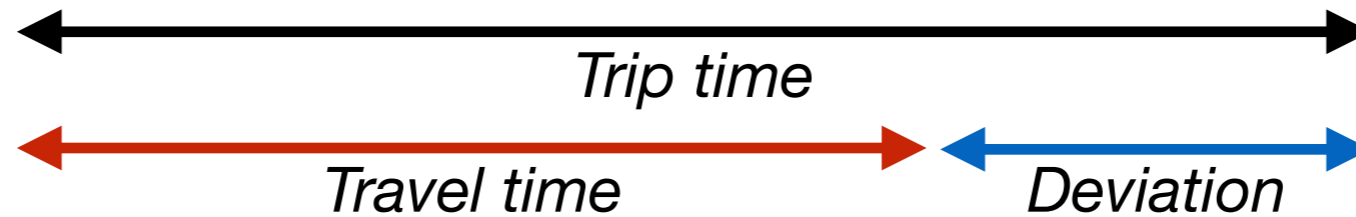
# Travel time estimation



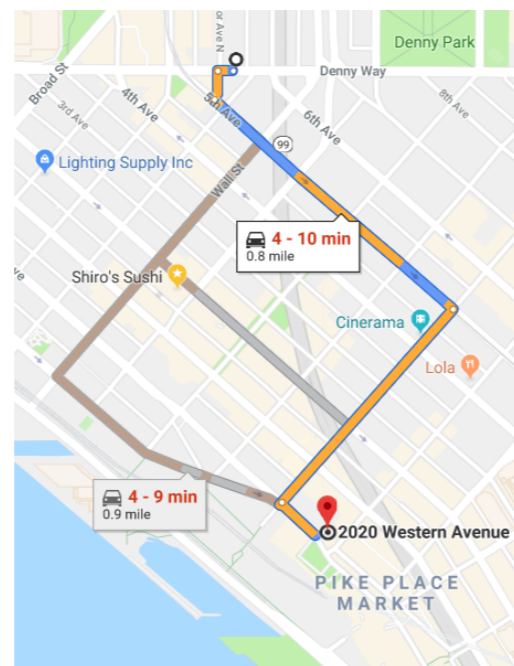
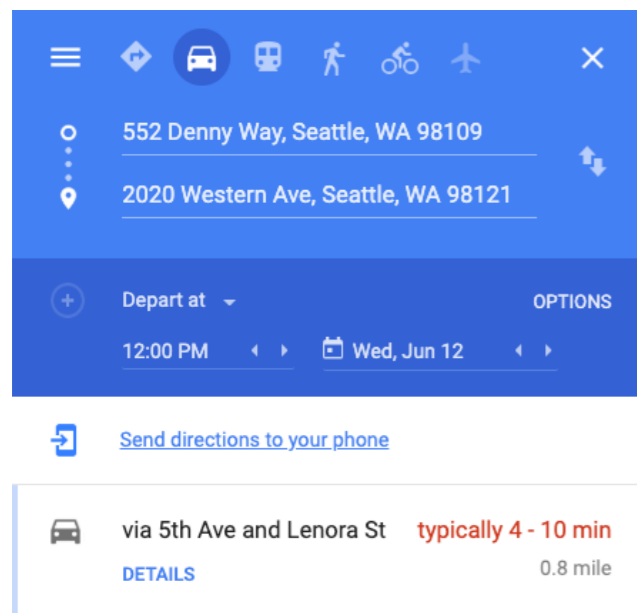
- 1) Observe real trip times
- 2) Obtain reliable travel time estimations
- 3) Deviation = Real travel time - estimated travel time
- 4) Check whether parking infrastructure affects deviations

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# Travel time estimation



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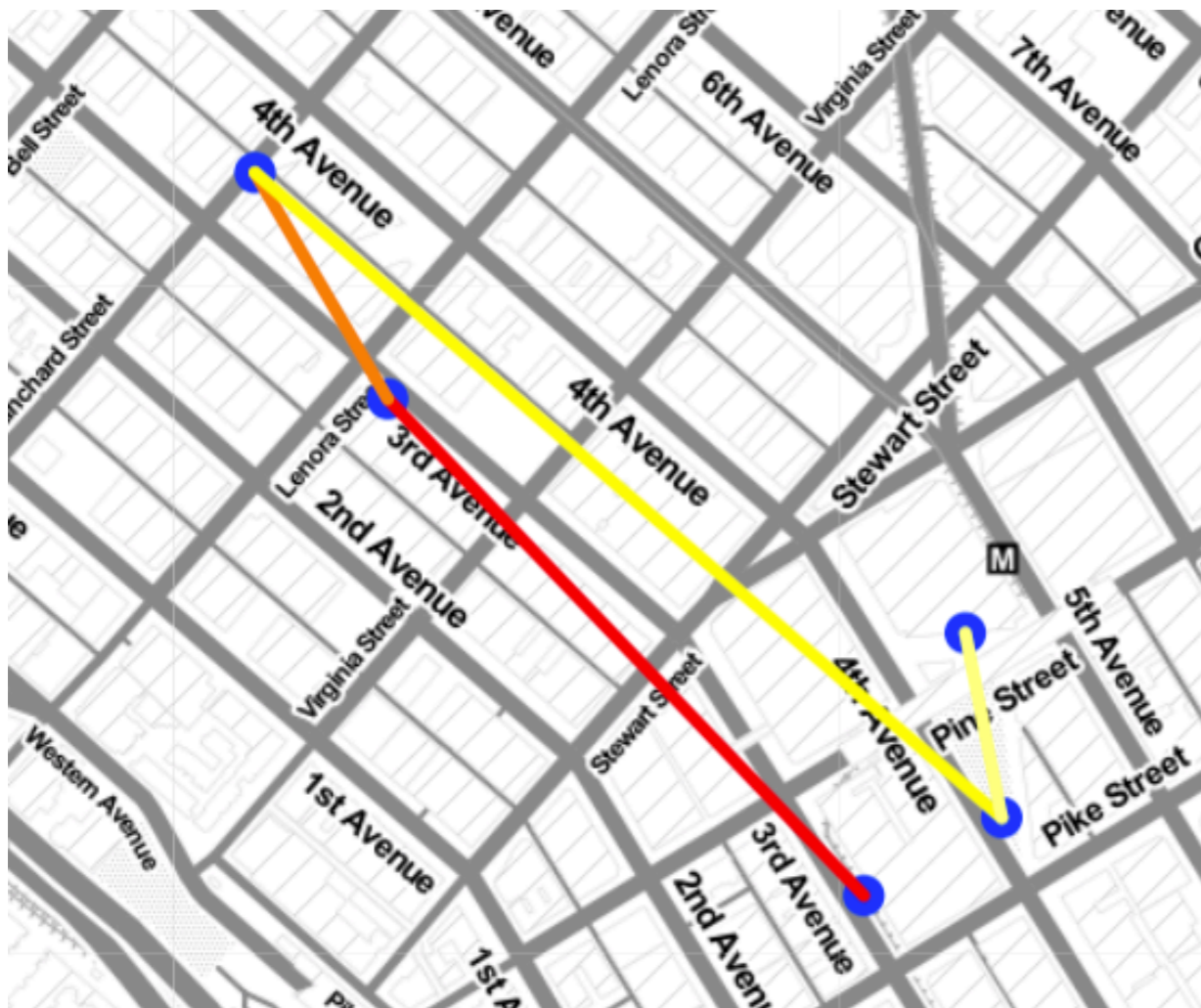
### Google Maps' Distance Matrix API

- Assume fastest route
- Outputs a travel time estimation
- Considers historical traffic conditions

## 3. Data

### Trip data

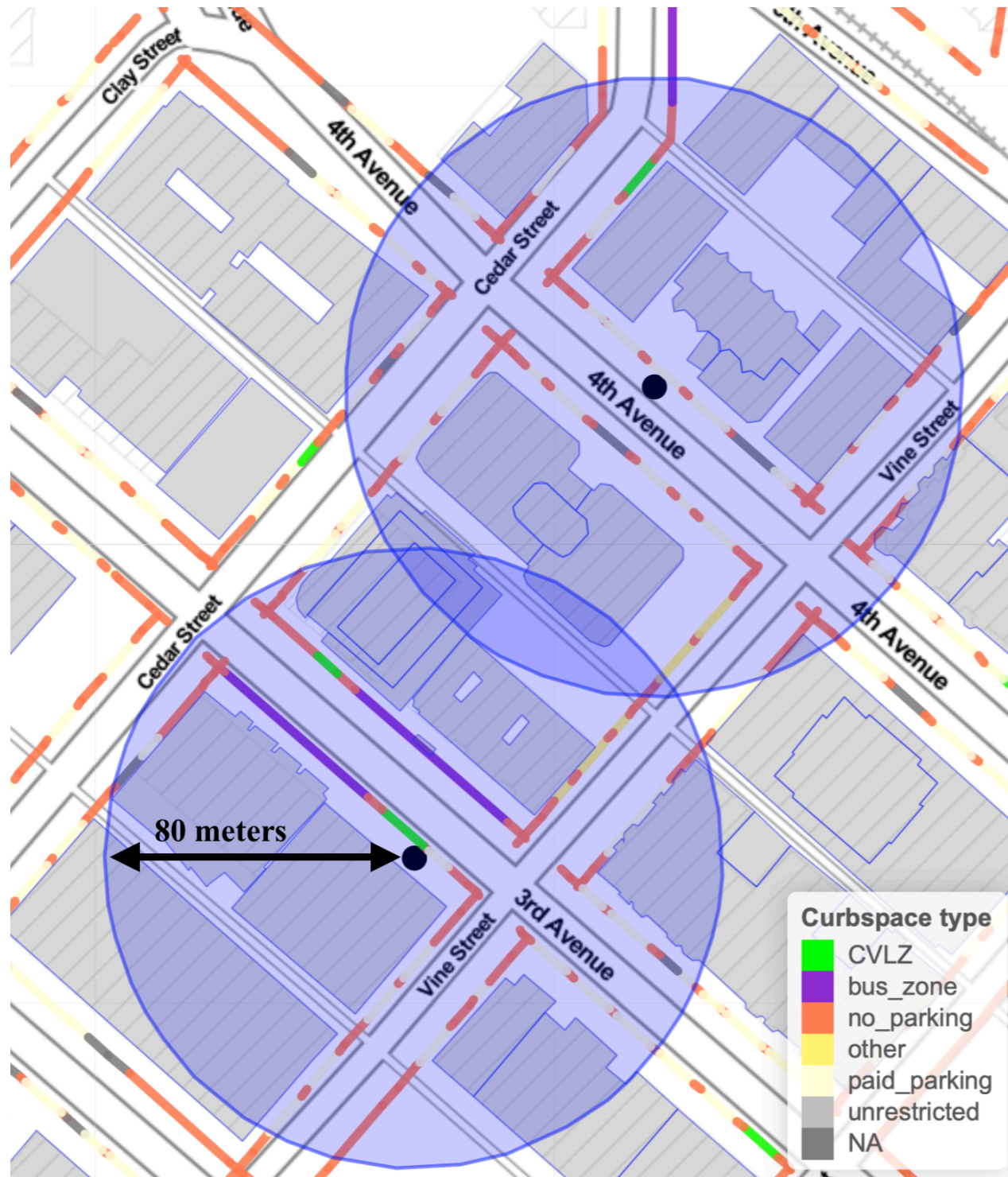
- 2,011 real truck trips are obtained from a parcel delivery company
- Trips are performed by 11 drivers over 28 weekdays (Oct-Nov 2018)
- For each trip, the trip start time, end time and start/end GPS locations are recorded



Trip ID	Start	End	Trip time
1	10:10:10	10:11:01	51 sec.
2	10:45:18	10:49:00	222 sec.
3	11:00:06	11:03:12	186 sec.
4	11:05:48	11:06:32	44 sec.

### 3. Data

# Parking infrastructure and occupancy data



## Parking buffers

- centred at the destination parking location
- 80 meters (260 feet) rad.

- Infrastructure & built env:
  - Curb allocation
  - No. bus stops,
  - No. bus routes
- Parking occupancy
  - Mean paid parking occupancy estimate

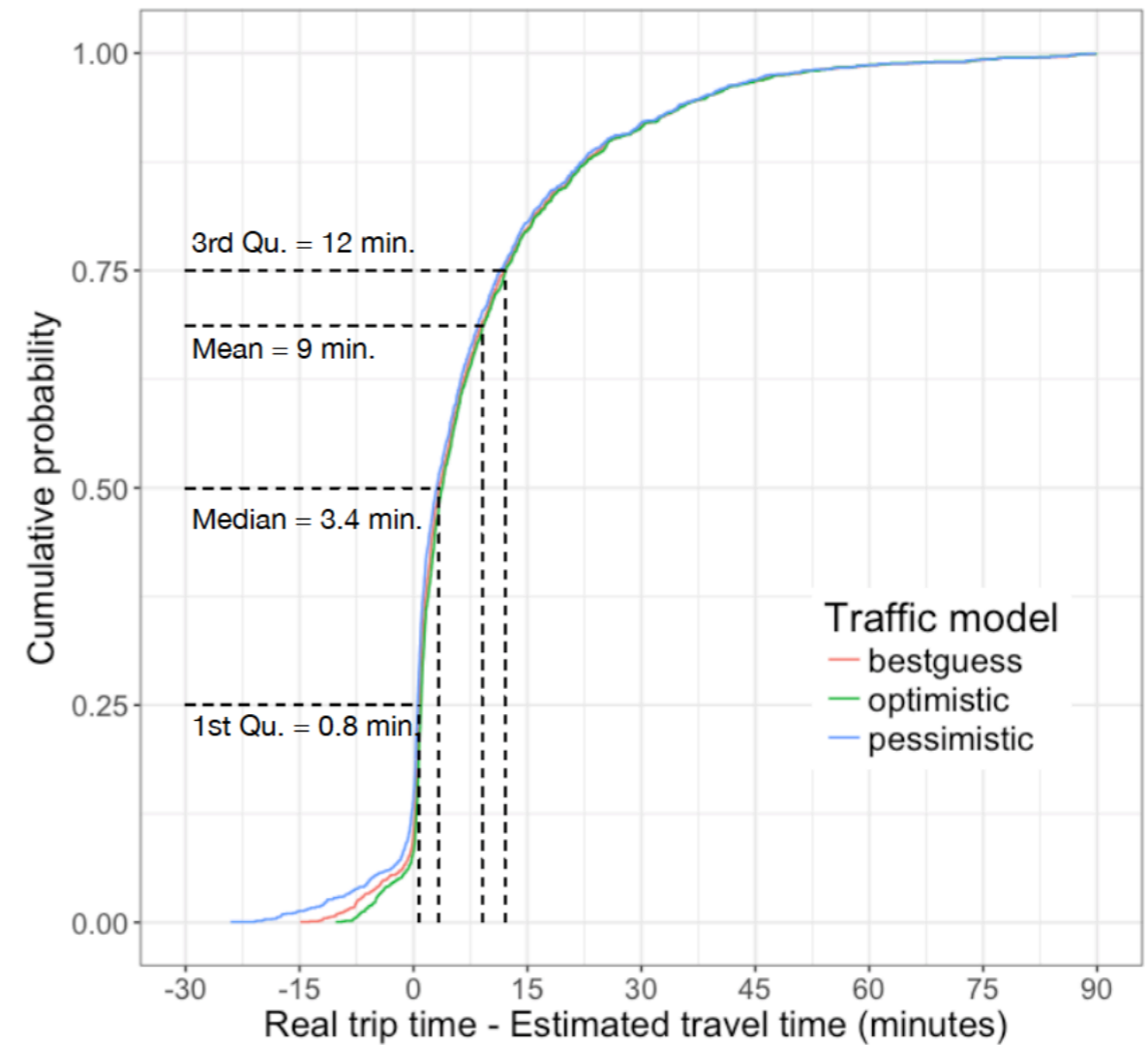
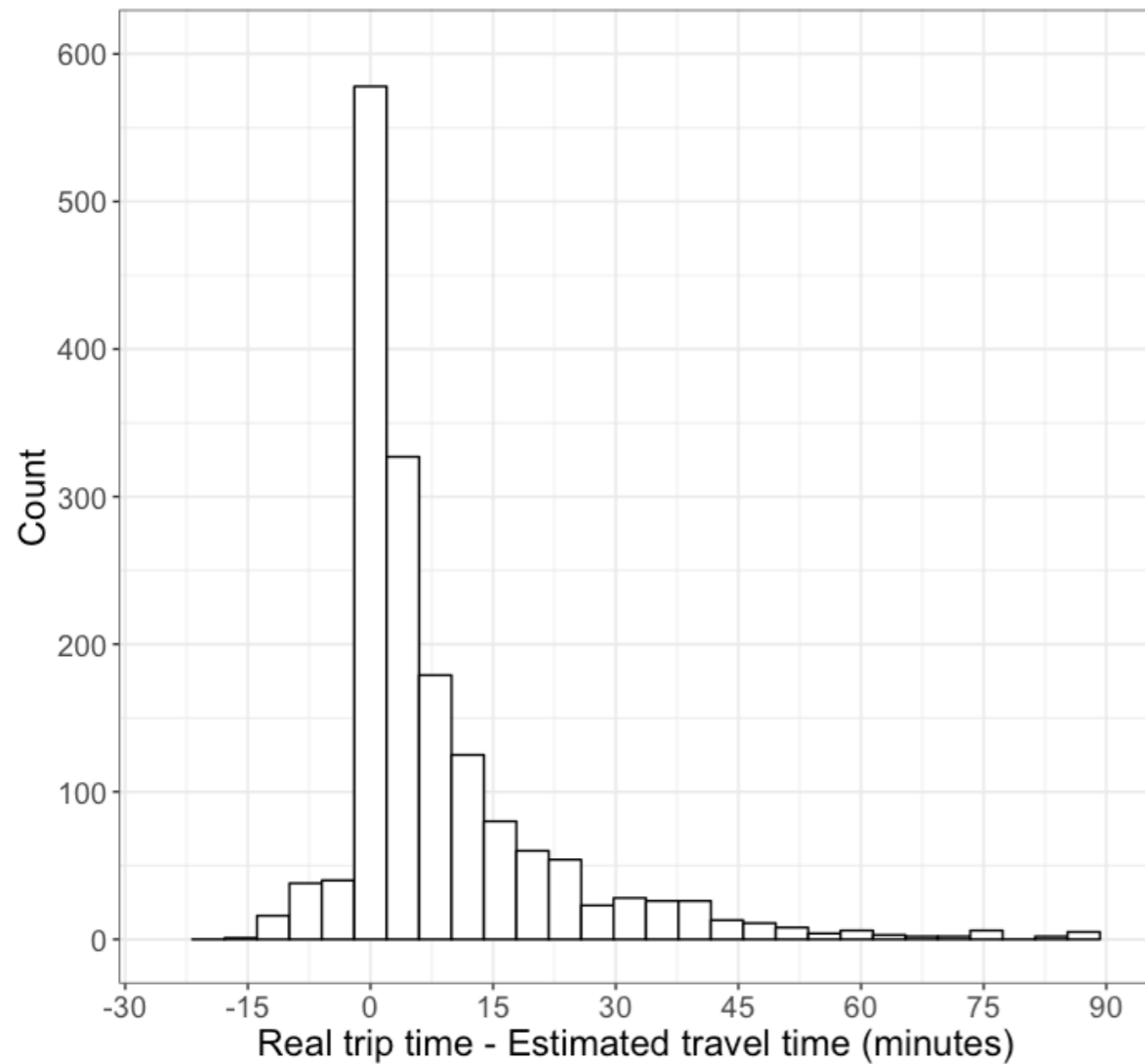
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## 4. Results

# Empirical distribution of deviations

Trip deviation = real trip time - estimated travel time



## 4. Results

# Geographical distribution of deviations



- 1) Hierarchical clustering
- 2) Mean cluster trip deviation

## 4. Results

# Do parking infrastructure affect deviations?

$$\log(\text{trip time}) = \beta_0 + \beta_{tt}\text{travel time} + \dots + \beta_{lc}\text{length CVLZ} + \dots + \varepsilon$$

- Independent variable: trip time
- Explanatory variables:

Trip variables	Travel time & distance, dwell time, departure time
Tour variables	Tour time & distance, no. stops, driver ID, ...
Parking variables	Curb space allocated to CVLZ, paid parking, ... Parking occupancy, no. bus routes

- Model formulations:
  - 1) OLS
  - 2) location random effect
  - 3) location & driver random effect

## 4. Results

# Regression model results

Independent variable: **trip time**

Variable	Sign	Stat. Significance		
		(1)	(2)	(3)
Travel time	+	***	***	***
<b><u>Tour variables</u></b>				
Stop sequence in tour	-	***	***	***
Time per stop	+	***	**	.
# stops per tour	-	*	.	.
<b><u>Parking variables</u></b>				
Length CVLZ	-	***	*	.
Length bus zone	+	***	.	.
Length paid parking	+	.	.	***

## 5. Conclusion

# Do commercial vehicles cruise for parking?

We found:

1. Non-zero trip time deviations w.r.t. estimated travel time (9 min., 70% trip times  $>0$ )
2. Deviations are statistically significantly affected by parking infrastructure provided at destination

Which other factors might explain trip time deviations?

- Re-routing
- Exceptional traffic conditions
- Exceptional events
- Noise in the data

Thank you!

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