



# Validation of a Taxi-FCD System by GPS-Testdrives

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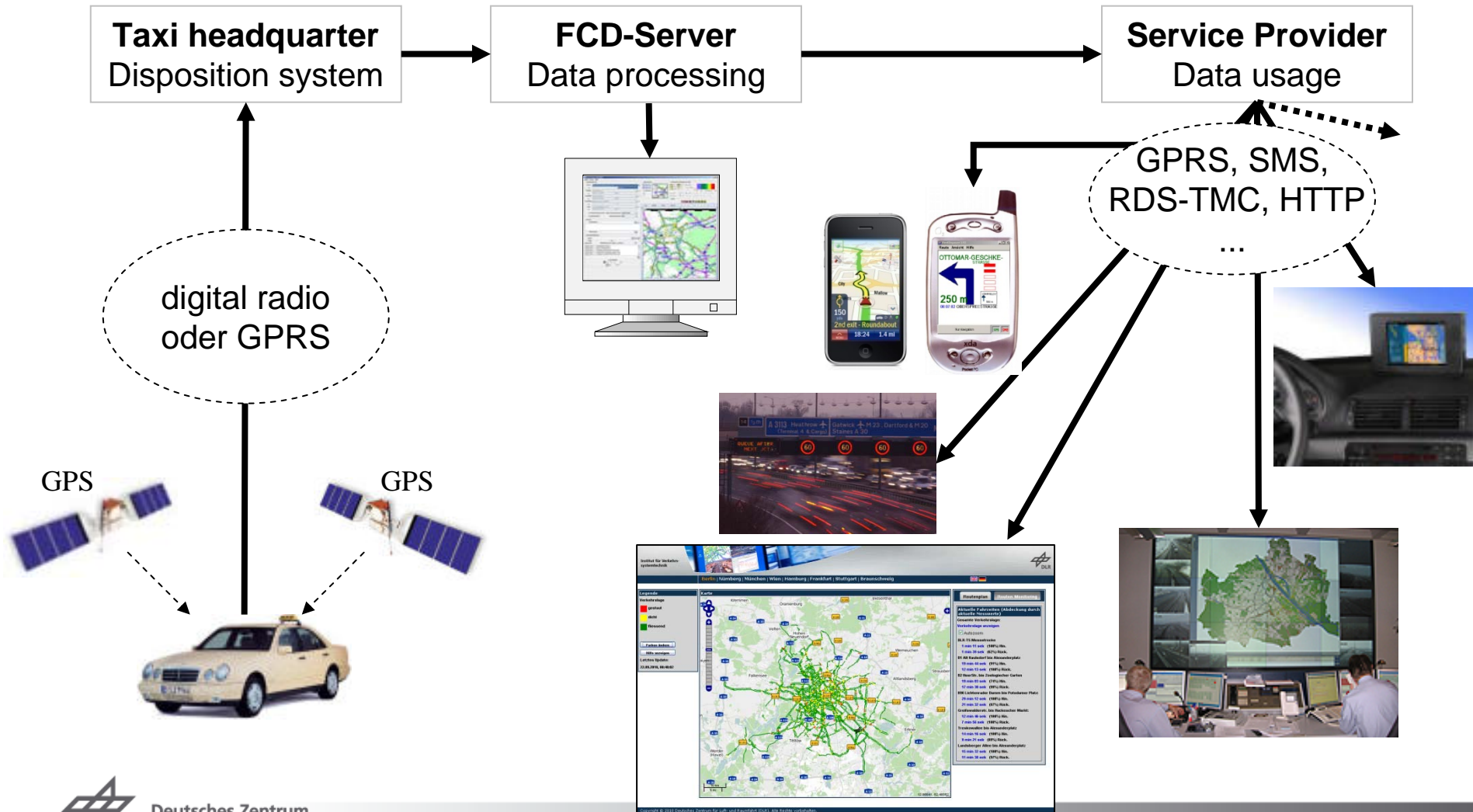
Institute of Transportation Systems, German Aerospace Center (DLR) , Berlin

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Deutsches Zentrum  
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in der Helmholtz-Gemeinschaft

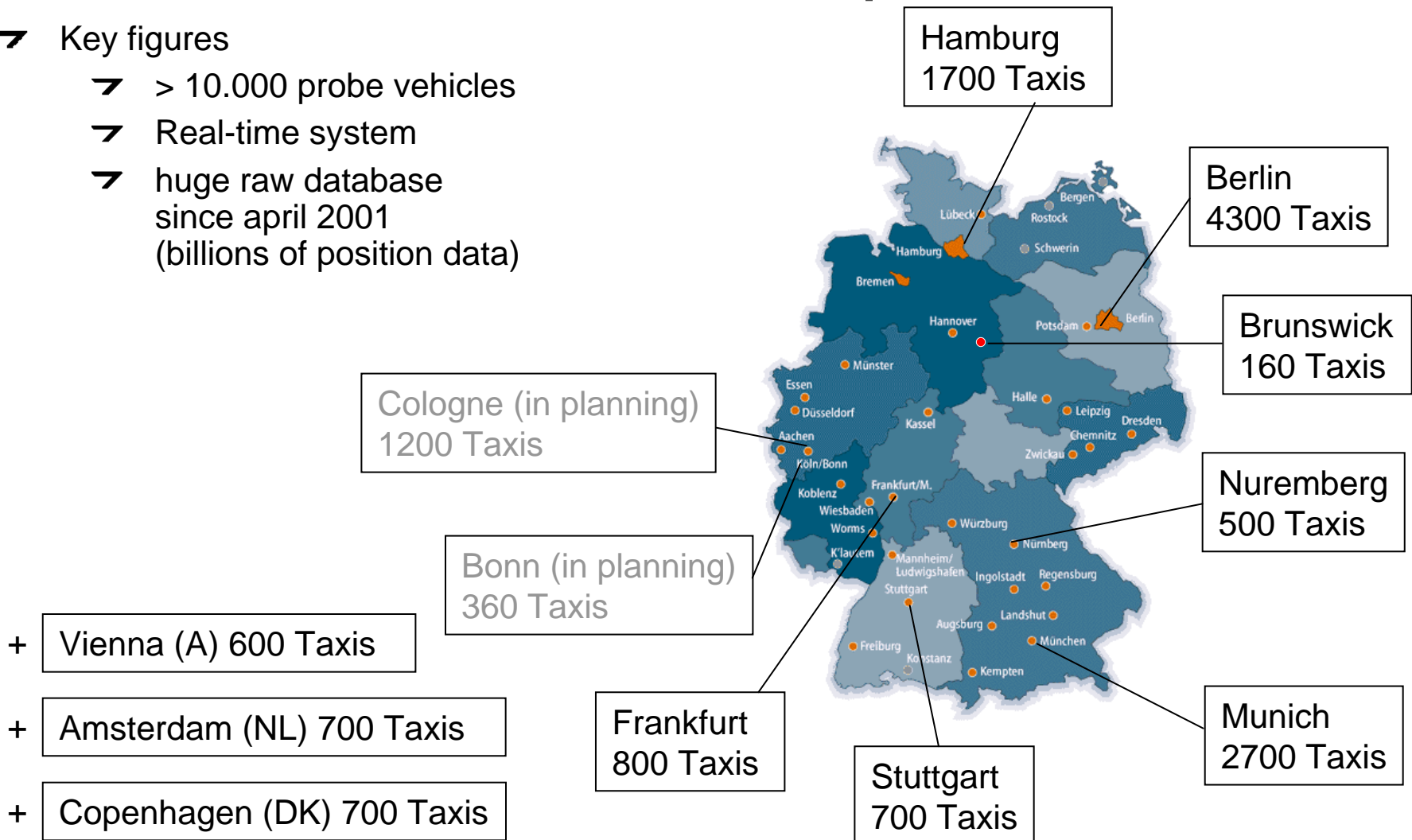
# FCD – System architecture



# FCD - Database German Aerospace Center

## ➤ Key figures

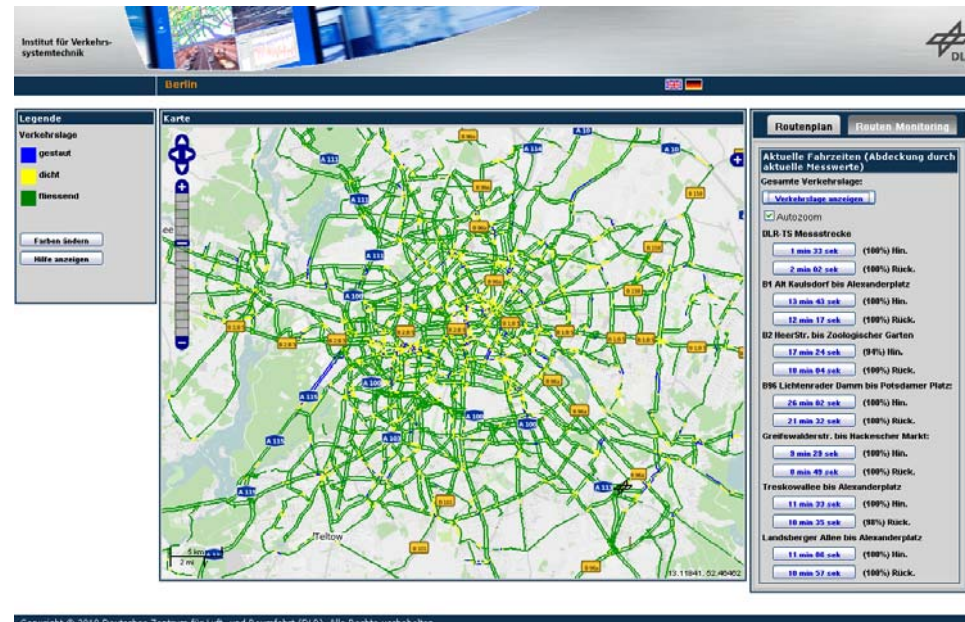
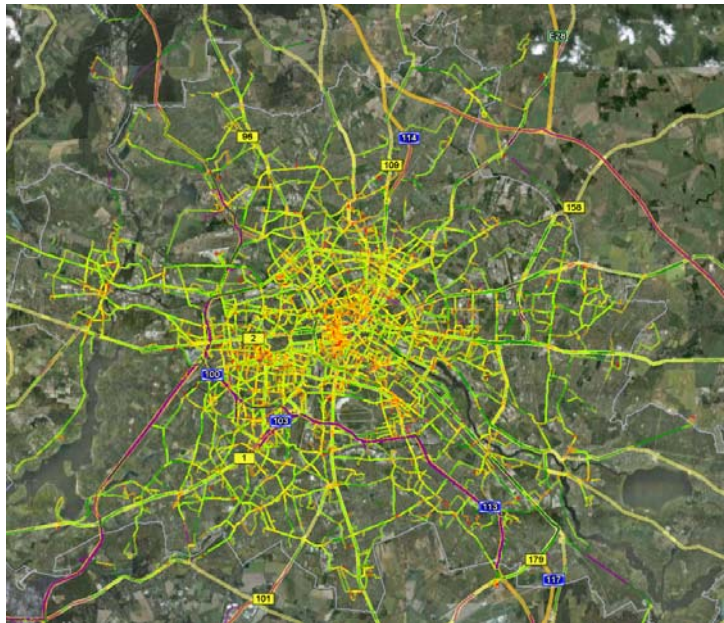
- > 10.000 probe vehicles
- Real-time system
- huge raw database since april 2001 (billions of position data)





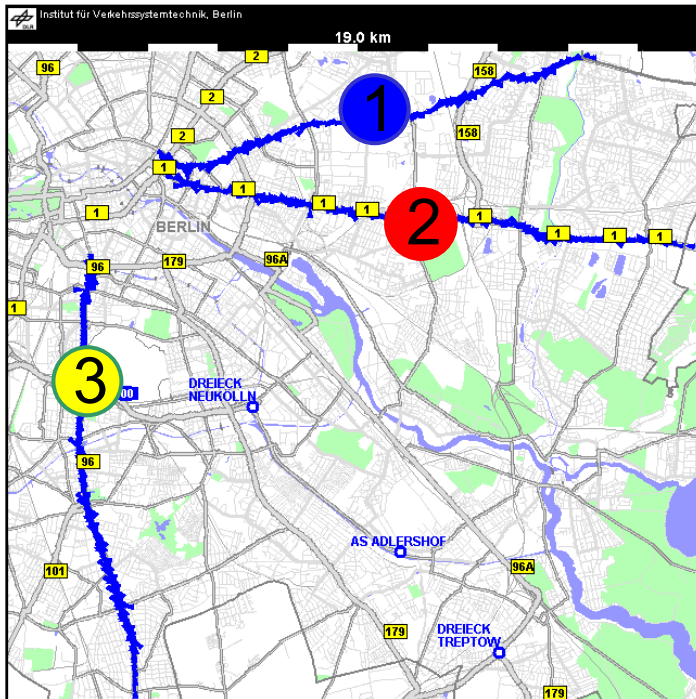
# Taxi-FCD System – Berlin

- 4300 Taxis (~2500 on the road)
- 30~60s delivering interval
- Continuous generation of a traffic-state map and travel-time information on selected arterial routes



# Validation campaign Berlin

- GPS - Testdrives on 3 arterial roads (both directions) of about 12 - 14 km length
- 17th-21th May (5 days), 5am-9pm (16h)
- 2 cars with 1s delivering interval



Day	Vehicle-nr	Route-ID
Monday	Veh 1	2
	Veh 2	1
Tuesday	Veh 1	2
	Veh 2	1
Wednesday	Veh 1, Veh 2	3
Thursday	Veh 1	2
	Veh 2	1
Friday	Veh 1	2
	Veh 2	1

# Results

- ① 67 + 63 traces (towards and from city center)
- ② 57 + 56 traces (towards and from city center)
- ③ 34 + 32 traces (towards and from city center)

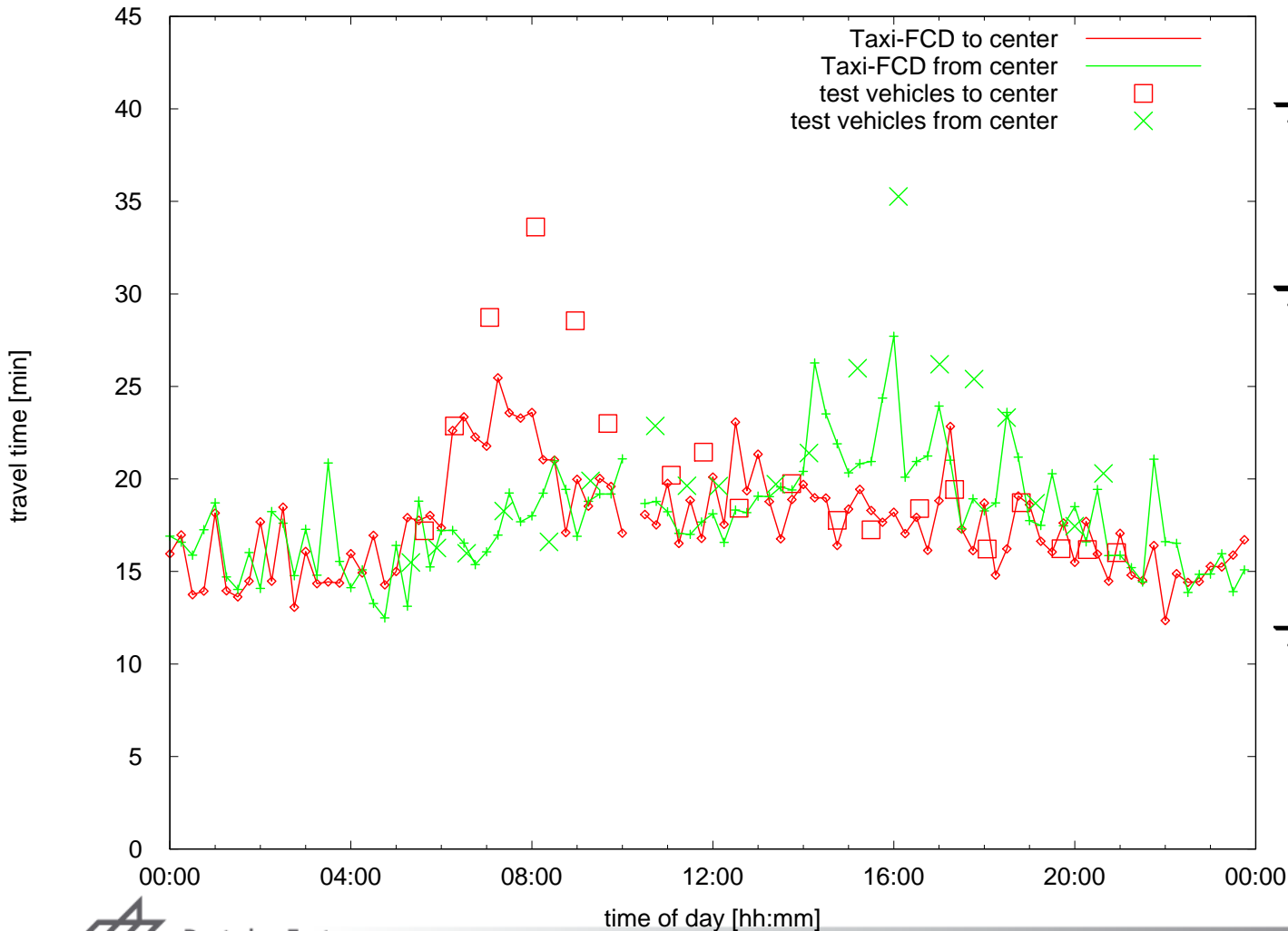
➤ In total 309 traces

➤ Comparing travel times of the test drives with travel time data only of the most current taxi data at the same day

➤ no “historical” data (days before or same weekdays before) is used

# Results – Comparing travel times on Route 1 1

Route 1 Landsberger Allee - 2010-05-17 - 11.92 km

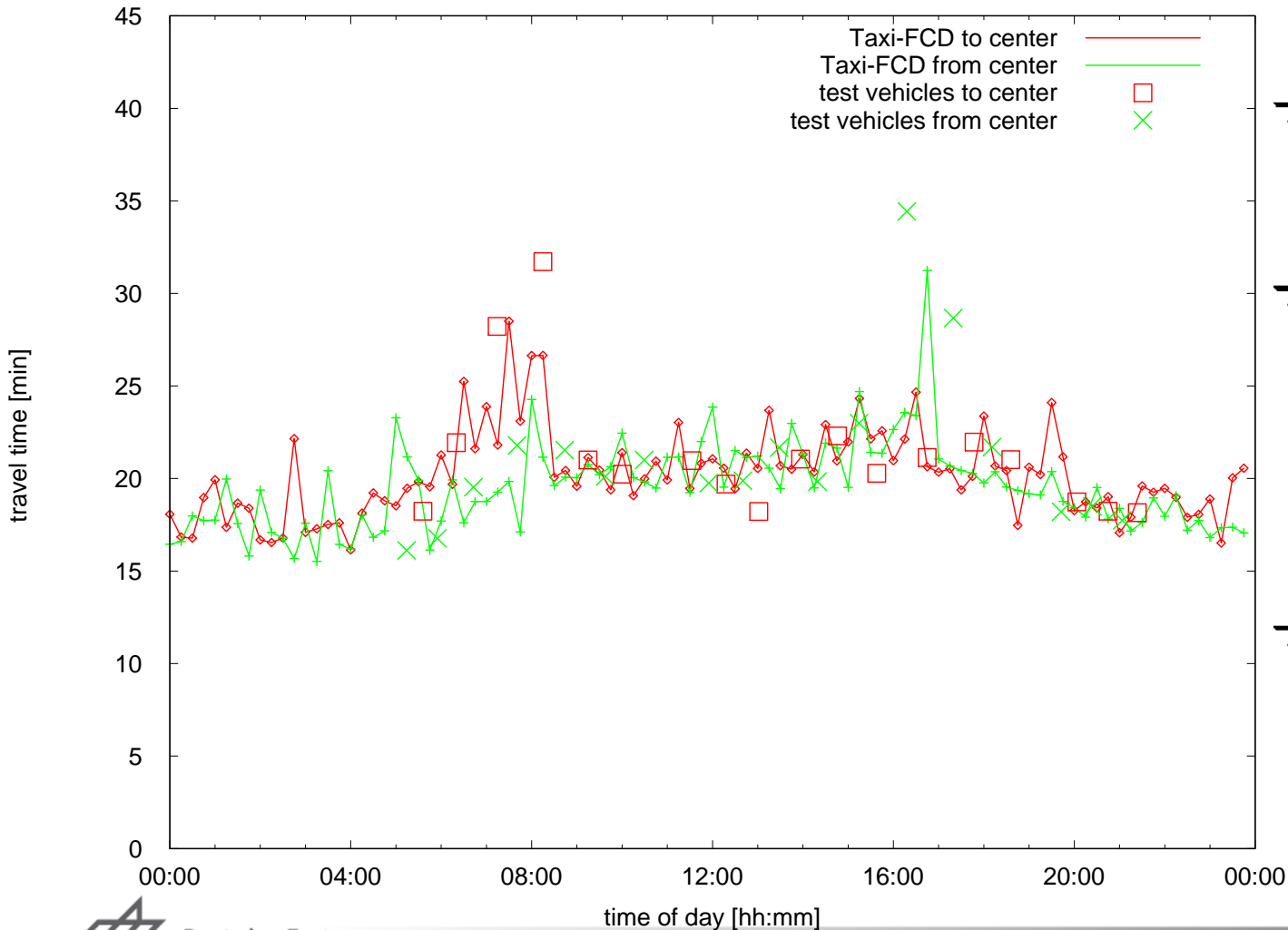


- In general good match
- Towards center: 19 traces, morning peak from test drives higher
- From center: 19 traces, outlier at 4 P.M.



# Results – Comparing travel times on Route 2

Route 2 Frankfurter Allee - 2010-05-20 - 14.59 km

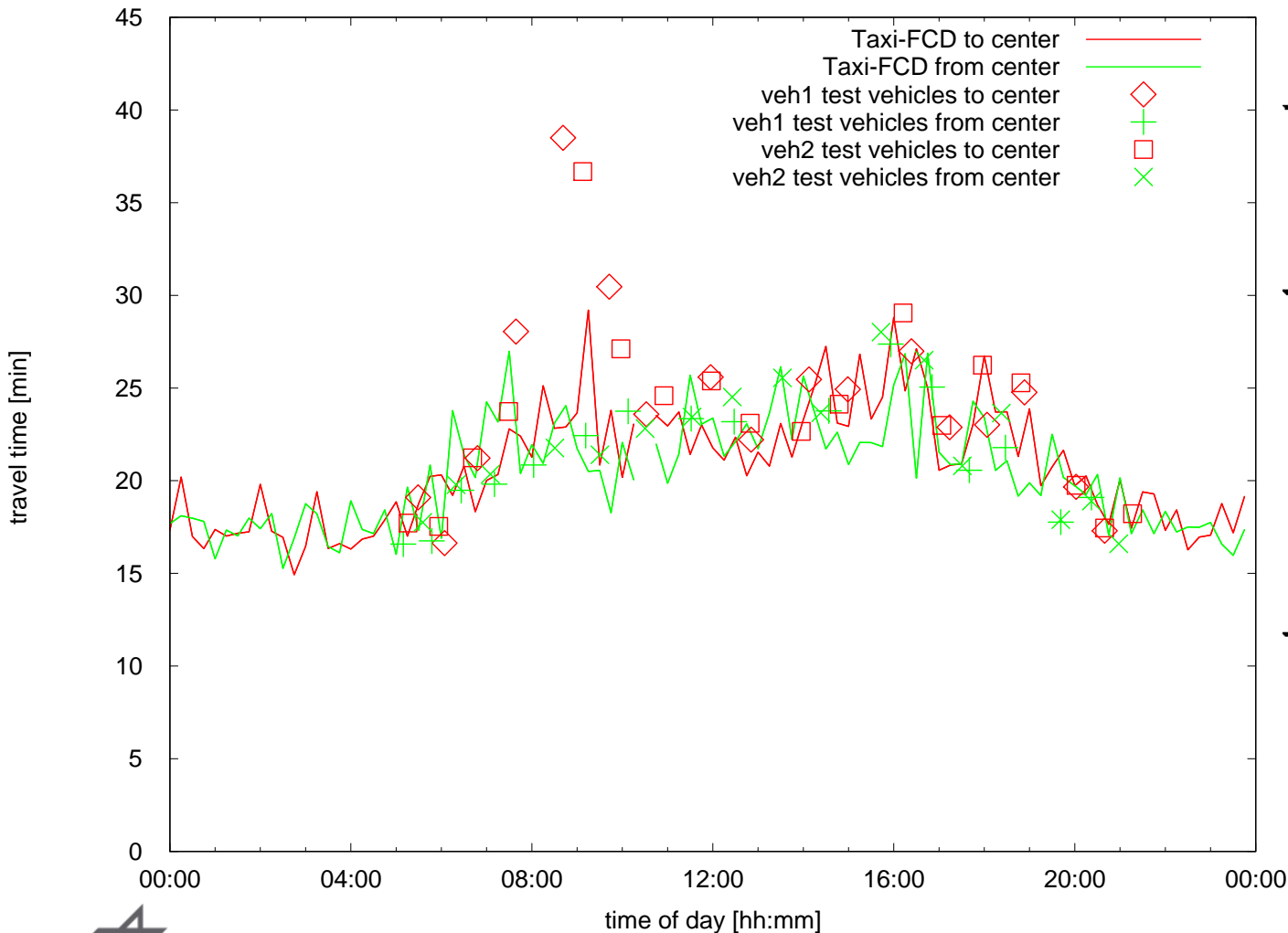


- In general good match
- Towards center: 18 traces, morning peak from test drives a bit higher
- From center: 17 traces, outlier at 4 P.M.



# Results – Comparing travel times on Route 3

Route 3 Tempelhofer Damm - 2010-05-19 - 11.85 km



➤ In general good match

➤ Towards center: 36 traces, morning peak from test drives much higher

➤ From center: 36 traces, very good match

# Results – Comparing travel times – Overall Errors

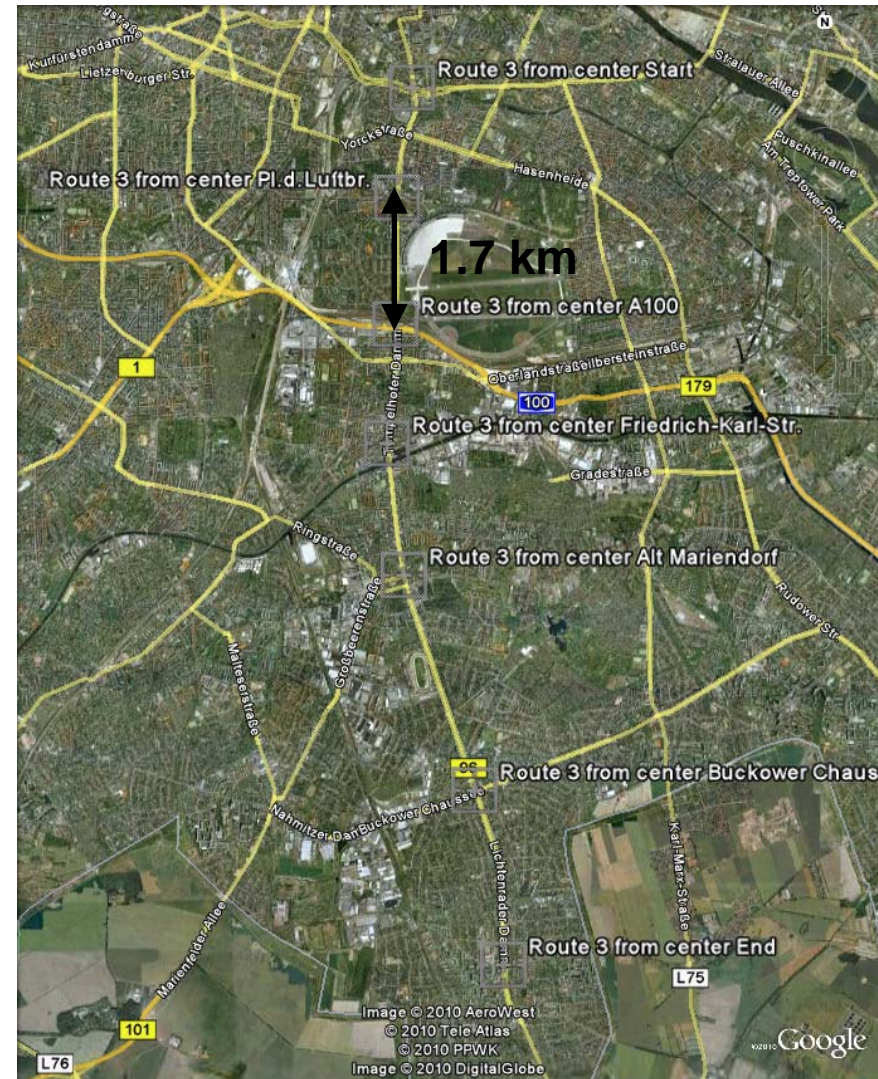
- Calculation of the symmetric mean absolute percentage error all 309 traces (comparing 15-min intervals)

$$SMAPE = \frac{1}{N} \sum_1^N \frac{|tt(TEST)_i - tt(FCD)_i|}{(tt(TEST)_i + tt(FCD)_i) / 2}$$

ROUTE		SMAPE		
1	1-1 Landsberger Allee to center	11.19 %	12,73 %	11,04 %
	1-2 Landsberger Allee from center	14.38 %		
2	2-1 Frankfurter Allee to center	7,19 %	8,75 %	
	2-2 Frankfurter Allee from center	10.34 %		
3	3-1 Tempelhofer Damm to center	12,71 %	11,63 %	
	3-2 Tempelhofer Damm from center	10,48 %		

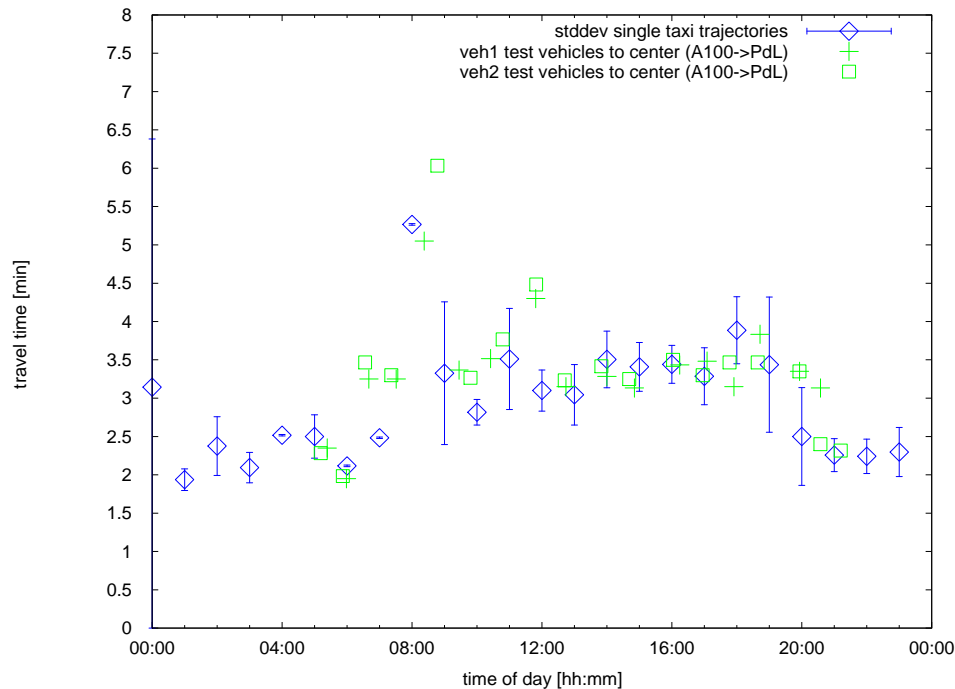
## Results 2 – Comparison of complete traces on Route 3 3

- Measuring the „system immanent“ variation of travel times of single vehicle
- Division of Route 3 into six route parts
- Comparison of the test drives with taxis which drove the same complete route parts at the same time
- Detail analysis for one 1.7 km route part

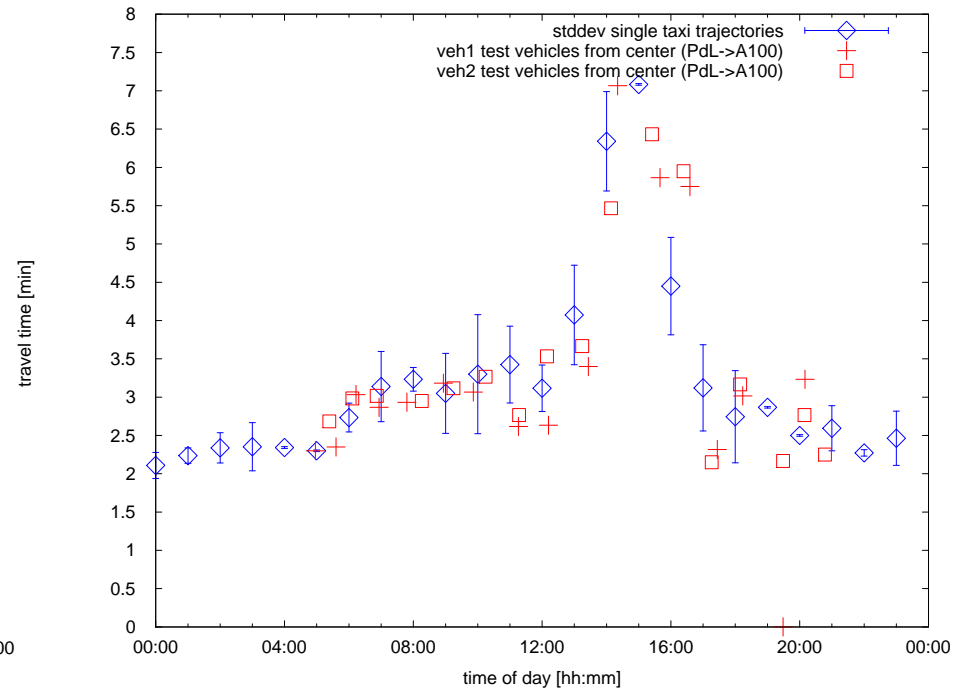


# Results 2 – Comparison of complete traces on Route part 3-2

towards center



away from center



➤ 79 % of test vehicles within standard deviation of single taxi drives

➤ 15.8 % is the system immanent variation range over all route parts of route 3



# Summary & Conclusion

- DLR – FCD system delivers quite good results with errors in travel times of about 11 %
- Peak periods are sometimes not that accurate
  
- Future research:
  - Supplementation of current taxi data with “historical” data (same weekdays, same daytimes) for badly covered route parts
  - More comprehensive comparison of test traces with complete taxi traces
  - Deriving quality information by analyzing how many taxi data are available for which time of day

Berlin



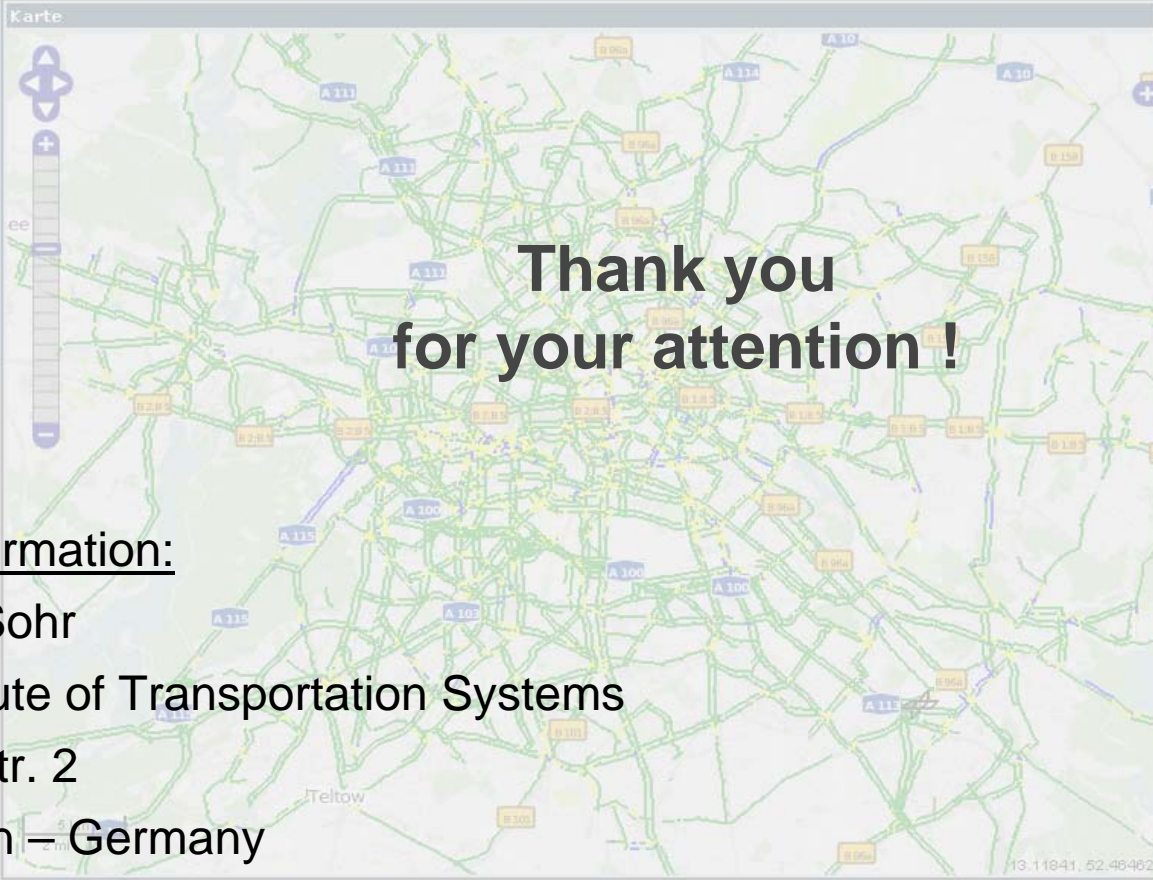
**Legende**

Verkehrslage

- gestaut
- dicht
- fließend

Farben ändern

Hilfe anzeigen



**Routenplan** | **Routen Monitoring**

**Aktuelle Fahrzeiten (Abdeckung durch aktuelle Messwerte)**

Gesamte Verkehrslage:  

 Autozoom

**DLR-TS Messstrecke**

- 1 min 33 sek (100%) Hin.
- 2 min 02 sek (100%) Rück.

**B1 Alt Kaulsdorf bis Alexanderplatz**

- 13 min 43 sek (100%) Hin.
- 12 min 17 sek (100%) Rück.

**B2 HeerStr. bis Zoologischer Garten**

- 17 min 24 sek (94%) Hin.
- 18 min 04 sek (100%) Rück.

**B96 Lichtenrader Damm bis Potsdamer Platz:**

- 26 min 02 sek (100%) Hin.
- 21 min 32 sek (100%) Rück.

**Greifswalderstr. bis Hackescher Markt:**

- 9 min 29 sek (100%) Hin.
- 8 min 49 sek (100%) Rück.

**Treskowallee bis Alexanderplatz**

- 11 min 33 sek (100%) Hin.
- 10 min 35 sek (98%) Rück.

**Landsberger Allee bis Alexanderplatz**

- 11 min 06 sek (100%) Hin.
- 10 min 57 sek (100%) Rück.

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