

COMPARISON OF TRAVEL TIME MEASUREMENTS FROM DIFFERENT STATIONARY AND LINK-BASED DETECTORS

Master's Thesis by Foteini Orfanou

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Abstract

The purpose of the present thesis is the comparison of travel time measurements from five different data sources: Floating car data provided by ADAC and INRIX, CONSYST data which gives the virtual travel time, inductive loops and Bluetooth re identification. The different data sources are evaluated depending on their travel time values as well as other detector parameters. Travel time values are compared for days with and without an incident occurrence separately, as the traffic evolution significantly differs. For both cases the analysis is conducted in a qualitative and quantitative level, Firstly, data sources characteristics are identified based on the observation of travel time plots. Following their differences and similarities are further assessed and estimated via statistical analysis and pairwise comparison. The results are further evaluated and discussed.

Theoretical Background

- Different technologies have been applied for collecting travel time data
- Many technologies have been compared to each other and with ground truth travel time data in terms of accuracy and reliability
- Different technologies have been used for obtaining ground truth data
- Different methods of comparison have been implemented
- The comparison leads to various results
- Quantitative Comparisons between the different methods using statistical analysis
- Comparisons based only on travel time values

Study Area

- Data used comes from the Bavarian A3 motorway between the intersections AK Fürth/Erlangen and AK Altdorf next to the city of Nurnberg.
- 2 analysed segments: 20,235 km and 9,5 km in both directions (Fürth/Erlangen – Nurnberg and Nürnberg – Altdorf)
- Analysed Period: 01.10.2012 - 11.11.2012
- Datasets include: Speed data, travel time values and number of vehicles

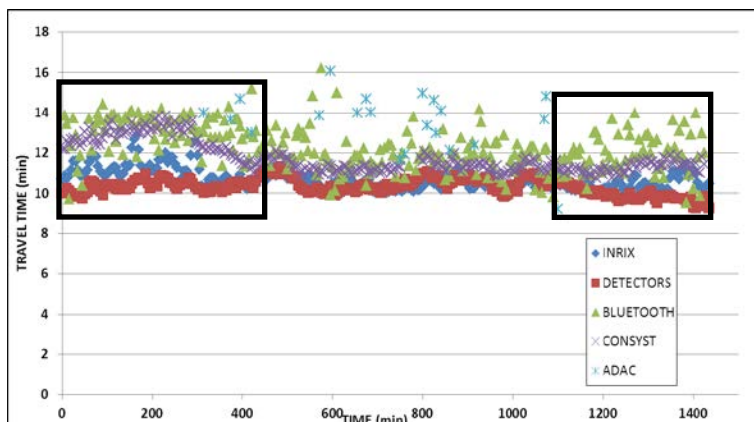
Results

Penetration rates

- Number of probe vehicles or vehicles equipped with Bluetooth devices divided by total number of vehicles
- Bluetooth presents the highest presentation rates (higher than 4%) while the majority of ADAC and INRIX penetration rates are between 1-2%.

Qualitative Analysis - Days with no Incident Occurrence

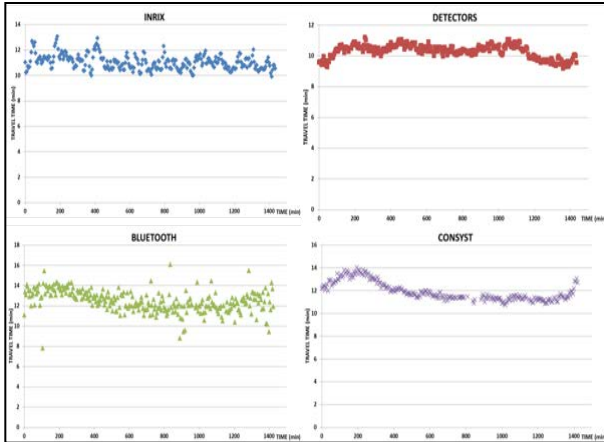
- Observation of travel time plots for all the segments and the whole analyzed period
- Detectors give the lowest travel time values
- Bluetooth presents higher travel time values early in the morning and late at night
- Most Bluetooth data is obtained by trucks driving these periods of the day
- During the same periods, CONSYST data is closer to Bluetooth and INRIX, compared to Detectors, despite the fact they use the same data
- CONSYST and Detectors present different trends especially on the larger segments
- Very low ADAC data availability and thus it was excluded from the analysis



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Separate plotting of each data source

Qualitative Analysis – Days with Incident Occurrence

30 incidents and 6 parameters are considered:

- ✓ Temporal Evolution
- ✓ Earliest Response
- ✓ Latest Response
- ✓ Earliest Dissipation
- ✓ Latest Dissipation
- ✓ Peak values
- Bluetooth most often earliest response and dissipation
- INRIX most often latest response and dissipation
- Differences in maximum travel time values
- Higher values by INRIX and BLUETOOTH
- Lowest by CONSYST and Detectors

Quantitative Analysis

- Each pair of data sources is statistically analysed - Bivariate correlation
- Level of Significance 0.05

Quantitative Analysis – Days without an incident occurrence

- Week

SOURCE	INRIX	DETECTORS	BLUETOOTH	CONSYST
INRIX		0,282	0,181	0,360
DETECTORS	0,282		0,245	0,382
BLUETOOTH	0,181	0,245		0,500
CONSYST	0,360	0,382	0,500	

- Morning Peak

SOURCE	INRIX	DETECTORS	BLUETOOTH	CONSYST
INRIX		0,587	0,185	0,432
DETECTORS	0,587		0,304	0,626
BLUETOOTH	0,185	0,304		0,238
CONSYST	0,432	0,626	0,238	

- Day

SOURCE	INRIX			DETECTORS			BLUETOOTH			CONSYST		
	TUE	WED	THU	TUE	WED	THU	TUE	WED	THU	TUE	WED	THU
INRIX				0,146	0,240	0,418	0,201	0,140	0,202	0,293	0,353	0,413
DETEC	0,146	0,240	0,418				0,225	0,128	0,349	0,334	0,324	0,454
BLUET	0,201	0,140	0,202	0,225	0,128	0,349				0,504	0,450	0,543
CONS	0,293	0,353	0,413	0,334	0,324	0,454	0,504	0,450	0,543			

- Same procedure for Saturdays and Sundays as well as for the smaller segments (Nurnberg – Altdorf)

Quantitative Analysis – Days with incident occurrence

2 parameters : temporal evolution and impact on traffic

- Low temporal evolution and impact
 - No relationship between INRIX and BLUETOOTH
 - Highest correlation between CONSYST and Detectors
- Higher impact on traffic and temporal evolution
 - Better correlation between all pairs of detectors
 - Higher correlation between CONSYST and Detectors
 - Lowest correlation between INRIX and BLUETOOTH
 - CONSYST data is better correlated with link-based detectors than Detectors data is.
- Special cases of incidents

Conclusions

- Higher penetration rate for Bluetooth data
- Increased travel time values recorded by Bluetooth data due to higher number of trucks
- During early in the morning and late at night CONSYST data closer to Bluetooth or INRIX
- During the rest of the day and especially in peak periods CONSYST and Detector data similar behavior
- In case of incident occurrence better correlation between CONSYST and Detectors
- Correlation between INRIX and BLUETOOTH depends on the impact and temporal evolution of the incident