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Network-wide application of floating car data (FCD) particularly in cities using data fusion with measurement data of stationary traffic detection

MT-ITS Conference 2013, Dresden
December 2nd – 4th
Network-wide application of FCD using data fusion with local data

Agenda

- Traffic Management in Berlin:
  - Urban Traffic Control Center
  - Traffic Information Center
- History of Berlin traffic map
- Requirements of the State of Berlin
- A new solution – Data fusion of local data, floating car data (FCD) and traffic messages
- Experiences
- Conclusions
Network-wide application of FCD using data fusion with local data

Traffic Management in Berlin:
Traffic Control Center and Traffic Information Center

<table>
<thead>
<tr>
<th>Non-sovereign functions</th>
<th>2001</th>
<th>Traffic Management Center „VMZ“</th>
</tr>
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<tbody>
<tr>
<td>realized and operated as a public-private partnership (PPP) by a consortium of DaimlerChrysler Services and Siemens (since 2006: completely by Siemens)</td>
<td>2011</td>
<td>The new TIC „VIZ“</td>
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<td>operated in a service contract on behalf of the State of Berlin</td>
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<table>
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<tr>
<th>Sovereign functions</th>
<th>2005</th>
<th>The new Traffic Control Center „VKRZ“</th>
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<td>operated by the State of Berlin and the Police (Senate Department of Urban Development and Environment) „Verkehrslenkung Berlin“ = State Road Traffic Authority</td>
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Traffic Management in Berlin

Concept: effective traffic management by cooperation of traffic control and traffic information

Public administration

VKRZ Urban Traffic Control Center

Traffic Control via traffic lights, motorway and tunnel control systems
Coordination of state visit traffic
Traffic warning service

Service partner

VIZ Traffic Information Center

Traffic situation
Traffic forecast
Traffic news
Information services

Traffic Management in Berlin

History of Berlin traffic map
Requirements of the State of Berlin
A new solution
Experiences
Conclusions
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Tasks of the Urban Traffic Control Center operated by the State of Berlin

- Operation of Traffic Engineering Systems (Traffic Lights, Motorway Control)
- Traffic Warning Service (LMSt)
- Dynamic Traffic Control
- Incident Management
- State Visits and Demonstrations
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Urban Traffic Control Center Berlin: Technical Systems

<table>
<thead>
<tr>
<th>Control and Management</th>
<th>Detection</th>
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<tr>
<td>2050 traffic lights on junctions</td>
<td>800 Measurement points (motorways)</td>
</tr>
<tr>
<td>4 motorway control systems</td>
<td>350 Measurement points (major roads) via TIC</td>
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<tr>
<td>6 tunnel control systems</td>
<td>300 cameras (motorways)</td>
</tr>
<tr>
<td>dynamic lane assignment Heerstraße (5.2 Km)</td>
<td>40 video cameras (major roads)</td>
</tr>
<tr>
<td>5 variable message signs (motorways)</td>
<td></td>
</tr>
<tr>
<td>33 dynamic infopanels (major roads) via TIC</td>
<td></td>
</tr>
</tbody>
</table>
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Tasks of Berlin Traffic Information Center operated by a private service provider

- Improved traffic information for Urban Traffic Control Center
- Traffic and environment data for the administration
- Traffic information for the public: information panels, www.viz-info.de
- Traffic information for the media: radio stations, print&online media
- Accident and information management for the airports
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Berlin Traffic Information Center:
Input & output

- Detectors on major roads (Traffic Eyes)
- Detectors on motorways
- Data of traffic lights
- Floating Car Data (TomTom Traffic Flow)
- Up-to-date traffic news
- Construction sites, events
- Public transport (situation, time-tables, network etc.)
- Environment and weather
- Airport information (arrivals, departures)

Support of Traffic Control Center (VKRZ)

- Up-to-date traffic situation and traffic news
- www.viz-info.de
- Traffic forecast for media
- Information panels
- Traffic and environment data
- Regional traffic management (Berlin – Brandenburg)
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Berlin Traffic Information Center: Editorial Office (Mo – Fr 5:00 a.m. 8:00 p.m.)

Events

Individual Traffic

Public Transport

Traffic Situation

Traffic News

Information Panels
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Berlin Traffic Information Center:
Local traffic detection: approx. 1,000 meas. points
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Traffic map 2002 – 2012: Brief description

- Automatic calculation of current traffic situation respecting road works and other events limiting the traffic flow
- Network coverage: approx. 900 km (major roads)
- Calculation every 15 minutes (24x7)
- No reflection of non-planned events like demonstrations, accidents or tunnel closures
- Accuracy problem e. g. of queue lengths
- Maintenance costs for digital networks, references and corresponding demand matrixes (24x7)
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Traffic map 2002 – 2012
www.viz-info.de
Network-wide application of FCD using data fusion with local data

Requirements of the State of Berlin on the new traffic map

- Double the network coverage: 900 km → 1.600 km
- Reduce the link length of the network elements: start a new link element at least at all junctions controlled by traffic lights
- Improve the refresh rate (less than 15 minutes)
- Improve the quality (indicators and quotes for streets with local detection and those without)
- No extra local traffic detection installed

- Requirements are focused on the result, but not on the method
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Analysis of existing solutions / products

- Solutions:
  - Macroscopic, mesoscopic and microscopic models
  - Various FCD sources
  - Data fusion ideas (esp. local detection – FCD)

- Criterias:
  - Quality of the results
  - Requirements on the input data
  - Calculation time
  - Costs: initial setup and operations/maintenance
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Result of the analysis (simplified)

Input data

Traffic demand

Network capacities, signal programs, ...

Known restrictions (road works, ...)

Unforeseen events

Local detection

Model

Traffic model

Results

Result: Traffic flow

Result: Travel times

Result: Level of service

Quality criterias

Traffic Management in Berlin

History of Berlin traffic map

Requirements of the State of Berlin

A new solution

Experiences

Conclusions
Network-wide application of FCD using data fusion with local data

Alternative Solution
Part 1 – Traffic flow: use a traffic model

- Input data
- Model
- Results

Traffic demand
Network capacities, signal programs, ...
Known restrictions (road works, ...)
Local detection

Traffic model

Result: Traffic flow
Network-wide application of FCD using data fusion with local data

Alternative Solution
Part 2 – Travel times, LOS: use data fusion

Input data
- Local detection
- Measured travel times (FCD)
- Messages (road closures, reasons for traffic jams like accidents, ...)
- Other data

Fusion

Results
- Result: Travel times
- Result: Level of service
- Quality criterias

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The new traffic situation map since 2012

Brief description of Berlin implementation

- Network coverage: 1.600 km
- Reduced link length of the network elements: start a new link element at every single junction
- Refresh rate: 5 minutes at www.viz-info.de, several seconds at the internal content platform SITRAFFIC CONCERT
- Improved quality: consistence at all streets with and without local traffic detection; much more realistic than before
- Technology: data fusion of local traffic detection, TomTom Traffic Flow and own traffic messages
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Advantages of the new solution

- Much more realistic traffic information, e.g. due to the respect of delays caused by unforeseen events
- Double network coverage with no additional local detector
- Short update rate
- Scalable technical solution
- Fusion of advantages of different data sources (FCD: network coverage, travel times; local detection: reliability, 24x7 availability; messages: reasons for traffic jams)
- Consistent network-wide traffic information
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Coverage: www.viz-info.de
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Coverage and resolution: www.viz-info.de
Network-wide application of FCD using data fusion with local data

Quality of traffic information

- Continuous monitoring of input data quality
- Continuous monitoring of data fusion quality

![Quality of traffic information chart](image-url)
Conclusions

- VMZ Berlin has used a macroscopic model to calculate the current traffic state since 2002.
- The old model doesn’t fit the new requirements of the State of Berlin: coverage, resolution, update rate, quality of results
- Current traffic models don’t fit the requirements, especially due to missing or imprecise input data
- VMZ Berlin and Siemens have developed a new data fusion method respecting local detection data, FCD and messages
- The results fit all requirements since “going live” in Berlin in August 2012.
Thank you for your attention!
Feel free to visit the SIEMENS stand at MT-ITS 2013.

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