Traffic Management and ITS Implementations in Frankfurt Rhein-Main

Prof. Dr.-Ing. Manfred Boltze

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Traffic Management and ITS Implementations in Frankfurt Rhein-Main

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1. General

Region and City Frankfurt Rhein-Main

City of Frankfurt am Main

- 645,000 inhabitants
- 560,000 jobs
- 290,000 commuters
  - 90,000 by public transport
  - 200,000 by car

Due to the narrow boundaries of the City, Frankfurt depends very much on a cooperation with other cities and countries in the Rhein-Main Region.

Region and City Frankfurt Rhein-Main

Region Rhein-Main

- 3.8 mio. inhabitants
- 1.9 mio. jobs
- polycentric metropolitan area
- historically grown concentration of functions
- high degree of functional interdependencies
- located in the heart of Europe and in the center of Germany
- very good location in all traffic networks
- throughpassing traffic
- HIGH DEMAND FOR MOBILITY

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Frankfurt Airport

42 mio. passengers/year (2nd in Europe)
1.4 mio. tons airfreight/year (1st in Europe)
420,000 movements/year
170 airlines
57,500 employees

→ Today's capacity is limited to 460,000 movements/year.
→ According to current forecasts capacities will be consumed in 2003.
→ New Runway under consideration.

Regional Rail Infrastructure

High-speed line
Köln (Cologne) - Frankfurt
under construction.

Regional distribution and
international connection.

Access to the Trans-
European Transport
Network (TEN-T).

Overlapping of local,
regional and long-distance
trains.

Increased travel-times at
Frankfurt Central Station due
to being a dead-end station.

Frequent delays and
congestion.

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Regional Rail Infrastructure - Project "Frankfurt 21"

Main Station Frankfurt
300,000 passengers/day
Dead-end station with severe capacity problems
Feasibility study "Frankfurt 21" for an additional tunnel to allow through-passing traffic (with major effects also on regional rail traffic)

Source: Unternehmensberatung Frankfurt: Verkehrssituation in der Region Frankfurt Rhein-Main - Die Bedeutung einer einheitlichen Datenbasis für die Verkehrswirtschaft, Frankfurt am Main, 1999

Regional Road Infrastructure

- High quality road network
- Expansion of regional road infrastructure limited to connective elements and additional lanes
- Extension of intersection "Frankfurter Kreuz" (300,000 vehicles/day)

- Frequent congestion of regional road infrastructure.

Source: www.hessen.de/verkehrsgewerbewesen
Extension of Intersection “Frankfurter Kreuz”

Systematical reduction of weaving traffic.

Intermodality at Frankfurt Airport

Frankfurt Rhein-Main Airport (110,000 passengers/day)

New AirRail Terminal for High-speed Trains at Frankfurt Rhein-Main Airport

Motorway intersection „Frankfurter Kreuz“ (300,000 vehicles/day)
Comprehensive P+R Infrastructure

- Approximately 25,000 P+R spaces in the region.
- City of Frankfurt financed P+R facilities outside the city to decrease commuting by car.
- Preference for small P+R facilities close to homes instead of big P+R terminals close to the city centre.

2. Organisational Aspects

Organisational Aspects

Traffic problems and the high number of involved institutions indicate an urgent need for co-operation of regional traffic and transport actors.

The Region Rhein-Main is no unit in terms of organisation.

Significant progress in information exchange and co-operation:

1994 Founding of RMV - Rhein-Main Public Transport Authority.

1998 Founding of
- ZIV - Institute for Integrated Traffic and Transport Systems and
- FIV - Association for Promoting Integrated Traffic and Transport Systems.

Joined project work - partly initiated by EC research projects (FRUIT, RHAPIT, ENTERPRICE, TASTE).

Common goal concept for traffic management.

Memorandum of Understanding from all cities and counties of the region to initiate a framework for co-operation in traffic management (WAYflow).
RMV - Rhein-Main Public Transport Authority

- Integrated planning for all public transport sub-systems
- Uniform tariff system for regional public transport
- Integrated Information Services
- Uniform Marketing Strategy
- "Job Tickets", "Semester Tickets", "Kombi Tickets"

Source:

Common Goal Concept

GOALS
- to use space compatibly with social and environmental conditions
- to improve availability and accessibility
- to reduce (unnecessary) motorised road traffic
- to promote pedestrian and cycling traffic
- to promote public transport
- to operate traffic compatibly with social and environmental conditions
- to operate traffic economically

SUPREME GOALS
- to improve quality of housing environment
- to support improvements of local economy
- to save natural resources and to reduce environmental impacts
- to satisfy mobility requirements
- to increase traffic safety
- to improve economical reliability

Source:
3. Strategies for Dynamic Traffic Management

Strategies for Dynamic Traffic Management

Definition:
Predefined concept for actions, in which initiated through certain events one or more selected measures are realised.

... e.g. for the traffic control center but also for other bodies
... traffic related events but also others
... with traffic control and information systems but also through personell

Process of Actions
automatic ("closed loop")
with manual interaction ("open loop")

Realisation of Dynamic Traffic Management Strategies

Problems
Selection of measures
Measures
Systems

Traffic
Traffic
60
Influence

60

Information systems
Diversion of traffic streams
VMS
Advice to use public transport

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Problem-oriented Elaboration of Strategies

- road network overloaded
- public transport network overloaded
- parking facilities overloaded
- bottlenecks in the road network (construction sites, accidents, ...)
- bottlenecks in the public transport network (breakdowns, ...)
- delays in public transport
- events, not foreseen events
- environmental problems (weather, smog, ...)
- ...

Strategies against Problems

Important Basis: Systematical Analysis of Problems

Regulatory overloaded road section with direction (1st priority)
Frequently overloaded road section with direction (2nd priority)
Frequently overloaded intersection

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Darmstadt University of Technology (Germany), Transport Planning and Traffic Engineering
Steps to Develop Traffic Management Strategies

Examples of Measures for Traffic Management

deviation of traffic streams
allowance to use the emergency lane
access control
speed control
provision of additional parking space (incl. P+R)
modal shift from cars to public transport (PT)
provision of additional busses, trams, ...
provision of substitution for transport means
ensuring connection in public transport

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Darmstadt University of Technology (Germany), Transport Planning and Traffic Engineering
### Matrix of Problems and Measures

<table>
<thead>
<tr>
<th>Problems</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overloaded road network</td>
<td>Deviation of traffic streams (X) Access control (X) Speed control (X) Provision of additional parking space (X) Modal shift from cars to public transport (X) Provision of additional busses, trams, ... (X) Provision of substitution for transport means (X) Ensuring connection in public transport (X)</td>
</tr>
<tr>
<td>Overloaded public transport network</td>
<td></td>
</tr>
<tr>
<td>Overloaded parking facilities</td>
<td></td>
</tr>
<tr>
<td>Bottlenecks in the road network (construction sites, accidents, ...)</td>
<td></td>
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<td>Delays in public transport</td>
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<td>Events, not foreseen events</td>
<td></td>
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<tr>
<td>Environmental problems (weather, smog, ...)</td>
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</tbody>
</table>

AS&IP, 1997

### Matrix of Measures and Systems

<table>
<thead>
<tr>
<th>Measures</th>
<th>Traffic Control Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deviation of traffic streams (X)</td>
<td>Variable Message Signs (X) Variable Direction Signs (X) Freeway display (X) Parking guidance system (X) Traffic lights (X) Operation and control systems (PR) (X) Staff (X)</td>
</tr>
<tr>
<td>Allowance to use the emergency lane (X)</td>
<td></td>
</tr>
<tr>
<td>Access control (X)</td>
<td></td>
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<td>Provision of substitution for transport means (X)</td>
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<td>Ensuring connection in public transport (X)</td>
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</table>

AS&IP, 1997

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Assessment of Dynamic Traffic Management Strategies

Example:
Simulation Tool AIMSUN2

Microscopic Simulation with AIMSUN 2

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Microscopic Simulation with AIMSUN 2

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4. Examples for Traffic Management Measures

Traffic Control on Highways

Examples for Traffic Management Measures in Frankfurt

- Parking management (dynamic PGI system, parking pricing, reservation of parking space for residents)
- Computerised Operation and Control System for public transport vehicles
- Priority treatment for all tram and bus lines (infrared detection and radio transmission at 320 intersections, separate bus lanes and separate signals)
- Speed limit 30 km/h in app. 200 residential areas
- Advanced traffic signal control with green waves and access reduction (760 traffic lights, 320 intersections with traffic detection)
- More pedestrian crossings in the inner city and an enhanced bicycle route network
- Passenger information systems et al.
**Dynamic Parking Guidance and Information System**

- 23 garages
- 12,800 parking spaces
- 90 dynamic signs
- planned: extension with P&R signs

5 parking areas

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**www.frankfurt.de: Frankfurt’s Traffic Information**

Approximately 10,000 hits per month.

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www.flughafen-frankfurt.de: Flight Information

www.bahn.de: German Rail Schedule Information

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www.rmv.de: RMV Schedule Information

Fahrtszeitplan für: Sonntag, 20.08.2000
Abfahrt: 11:12 Uhr
von: Nieder-Ramstadt/Haus Burgwald
nach: München/Leopoldstraße 1

Fahrtstrecken: Fahrtdauer: Umsteigen:
1. Fahrt am 20.08.2000:
5 Std. 34 Min.
5
von 19:17 bis 00:51 Uhr

20.08. / 19:17: ab Nieder-Ramstadt/Haus Burgwald
20.08. / 19:26: ab Eberstadt Wartehalle
20.08. / 19:32: ab Eberstadt Wartehalle
20.08. / 19:37: ab Darmstadt-Eberstadt Bahnhof
20.08. / 20:17: ab Darmstadt-Eberstadt Bahnhof
20.08. / 20:23: ab Darmstadt Hauptbahnhof
20.08. / 20:35: ab Darmstadt Hauptbahnhof
20.08. / 22:06: ab Stuttgart Hauptbahnhof (oben)
Fahrdienstleistung: reservierungspflichtig
Fahrdienstleistung: begrenzt
möglich
Bordrestaurant
20.08. / 22:17: ab Stuttgart Hauptbahnhof (oben)
21.08. / 00:23: ab Pasing
Bitte reservieren
21.08. / 00:33: ab Pasing
21.08. / 00:45: ab Marienplatz
21.08. / 00:46: ab Marienplatz
21.08. / 00:51: ab Universität

- Stadtbahn NE
- Richtung Eberstadt Wartehalle
- Stadtbahn P
- Richtung Hahn Eicher Straße
- SE 15070
- Richtung Frankfurt Hauptbahnhof
- IC 619 Ösler Schiemmer
- Richtung Stuttgart Hauptbahnhof (oben)

- ICE 999 Gabriele Münster
- Richtung München Hbf Hauptbahnhof
- S-Bahn S5
- Richtung Ostbahnhof München
- U-Bahn U6
- Richtung Kiefergarten

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www.hessen.de: Highway Traffic Information Service

Proposal for Driver Information at Frankfurt Airport

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Mobility Service Centers

600 customers per day.
Questionnaire:
Shift of 11% from car to public transport.

TV Text: Traffic Information

- A3: Köln - Frankfurt zwischen Rauenheim und Kelsterbach in beider Richtungen Fahrübertragung bis ca. 31.03.97
- A 3/4 A 67 Mönchhof Dreieck: Auf der Verbinung A 3 aus Frankfurt zur A 67 Richtung Darmstadt: Fahrpurreduzierung bis ca. 31.03.97

Stand: 10:15 Uhr
Traffic Information Based on WAP Technology

Frankfurt's Traffic Control Centers

Schaltzentrale 1951, Polizeipräsidium Frankfurt

Sources:
B. Hirsch
Verkehrsleitzentrale Frankfurt am Main
Schriftvermerke des Hochbauamtes zu Bausachen der Stadt Frankfurt am Main: Der Magistrat der Stadt Frankfurt am Main, Dezernat Bau, Hochbauamt, 1992

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Frankfurt's Traffic Control Centers

Source: Stadt Frankfurt am Main (ca. 1998)

Source: Stadtwerke Frankfurt am Main, o. J. (ca. 1990)

Integrated (Intermodal) Traffic Management Center

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# Integrated Intermodal Traffic Management Center
Planned Extension of Frankfurts PROTIC

<table>
<thead>
<tr>
<th>Interfaces to other control centers:</th>
<th>Main future tasks:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Transport</td>
<td>To produce an intermodal report on traffic situation including traffic prognosis (using simulation tools) and an assessment of this situation.</td>
</tr>
<tr>
<td>Police</td>
<td>To control intermodal traffic based on pre-defined, network-related traffic management strategies.</td>
</tr>
<tr>
<td>Taxi</td>
<td>To gain concertation of such traffic management strategies with regional partners.</td>
</tr>
<tr>
<td>Fire Department</td>
<td>To give recommendations to other control centres in case of unexpected situations.</td>
</tr>
<tr>
<td>Freight</td>
<td>To provide intermodal traffic information for various information service providers.</td>
</tr>
<tr>
<td>other Cities</td>
<td></td>
</tr>
</tbody>
</table>

## 5. The Projekt WAYflow

### Map of Traffic Control Systems in Rhein-Main Region

Every dot indicates a separate traffic control system.

In 1997, there were already more than 60 different systems in Hessen.


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**The Project**

**Aim:** The realisation of a new and comprehensive concept of regional traffic management.

**Beginning:** October 1998

**Duration:** 4 years

**Main partners:**
- RMV (Rhein-Main Public Transport Authority)
- HLSV (Hessen State Road and Traffic Authority)
- Philips Semiconductors
- debis IT Services
- DB Regio AG (German Rail)

**Scientific Consulting:**
- ZIV - Center for Integrated Traffic and Transport Systems at Darmstadt University of Technology

**Promotion:**
- German Ministry of Research and Education

**Characteristics:**
- Integration of existing know-how
- Extensive Public Private Partnership
- Field tests and evaluation of results
- Optimisation according to the user needs
- Practical realisation and durable operation
- Compatibility with other regions and problems

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**Main Contents**

- **InfoPool**
  - Traffic simulation
  - Traffic management strategies

- **MobiChip**
  - Information supported by: bmb+f (German Ministry of Research and Education)

- **MobiManagement**
  - Initialisation of a regional traffic management including the development of intermodal traffic management strategies.

- **InfoPool**
  - Development of an intermodal regional traffic data base with distributed data storage, based on a multi-agent system.

- **MobiChip**
  - Development of the MobiChip for individualised personal travel assistance.
Intermodal and Comprehensive Routing

Planned improvements of the existing German Rail Service Platform:

1.) Door-to-door information:
- Giving addresses or locations as inquiry input instead of station names.
- Showing the footpaths to the relevant station on a map.

2.) Intermodal alternatives:
Considering and comparing private vehicle traffic, taxi and air traffic by communicating with the Router of the InfoPool.

3.) Comprehensive fare information:
- Calculating all individual fares of the whole trip.
- Comparison with the costs of travelling by private car.

4.) Consideration of the actual traffic situation:
Actual delays and divergences from the timetable are considered in information services, even on-trip.

MobiChip: Personal Travel Assistance


Technical Characteristics: Chip placed on contactless smart cards (telephone cards, credit cards,...), to be read by public terminals (for example ticket machines) or portable phones, laptops...

Advantages: It supplies the user with individually relevant data and actualises automatically the profile of its user's traffic behaviour.

Outlook: Future applications like electronic ticketing and e-purse can be integrated.
6. Conclusion and Outlook

Some Actual Problems in Traffic Management

Intermodality.

Intermodal, regional, decentralised organisation not yet established sufficiently.

Not enough participation and interest in traffic management at the regions smaller cities and districts.

Not enough financial resources and staff dedicated to traffic management (partly no additional activities possible).

Problems in public-private cooperation, eg. conflicts of interest in data providing.

Aged technology (eg. for data transmission), missing standards to integrate such old equipment.

Data detection is not sufficient and data from many traffic detectors are not used.

No sufficient knowledge about impacts of measures and bundles of measures.

Some Aims for Future Activities

To integrate other cities and communities of the region in the ITS planning and implementation process.

To realise an improved organisational scheme for traffic management in the region.

To develop comprehensively strategies for dynamic traffic management.

To elaborate an overall strategic ITS implementation plan for cities and region based on these strategies (including means of data detection).

To take advantage of new technologies, searching for simple solutions.

To learn more about useful bundles of measures and their impacts, highlighting intermodal aspects.

To exchange experiences with other cities and regions on an international level.

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Critical Factors of Success

- User acceptance
- Intention of partners to co-operate
- Working public-private partnerships
- Realisation of interfaces