Intelligent Transport Systems

Concepts and Instruments of Traffic Management

State of the Art

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Contents

Intelligent Transport Systems:

- how do they work?

- applications in Munich

- where are we today?
The approach of Intelligent Transport Systems

- Total mobility
  - Comfort of individuals
  - Prosperity of economy
- Limited resources
- Protection of environment

Solutions by transportation politics

Intelligent Transport Systems

Traffic and Mobility Management
ITS-projects in Germany by 2004

'Mobility in Conurbations' Research Program of German BMBF (1998-2004)
Objectives of Traffic Management

- Environment friendly traffic
- Safe transportation
- Efficient transport system
- Comfortable travelling

to support the overall goal

'Sustainability in Transportation'
General approach of traffic management

1. Avoid
   - causes of traffic demand
2. Shift
   - in time / space / mode
3. Operate
   - conformity to overall objectives

TM is a long-term general concept for cities, conurbations or regions.
ITS in the context of
Traffic Management – Mobility Management – Infrastructure Planning

- demand oriented
- 'hard' measures (infrastructure)
- supply oriented
- 'soft' measures information & control

Intelligent Transport Systems
ITS – the functional structure

Transport Demand

Information Acquisition

Information & Control System

Transport Supply

Traffic Flow

Vehicle Systems

Traffic Control

Traffic Information

Travel/Trip Information

Demand Management

on-trip

pre-trip
MOBINET
New concepts for Mobility and Traffic Management in Munich

Traffic demand

Traffic supply

long term

Transport quality & impacts

Optimization of traffic on the primary road network

Multimedia information services

Amendment of Modal Split by inter-modal transport

Innovative concepts for a mobile society

Main functions with data network and MOBINET-centre

short term
Demand management

- Objectives and Measures
  - influence transport demand in mode, time and space
  - traffic flow / parking
  - tolling and pricing
  - inter-modal offers for the traveller
  - public or private mobility advisory services
MOBINET-Concept for Amendment of Modal Split
'Push and Pull' for inter-modal transport
MOBINET-Concept for Amendment of Modal Split
'Push': restrictive management of parking space in the city centre

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MOBINET-Concept for Amendment of Modal Split

'Pull': Incident management for the light-rail network

Online simulation and effects determination
Online assessment of control strategies

→ fast return to normal operation mode

Assignment
Forecast 'Schedule'
Forecast 'Operation'
Traveller Information

SALTOS
MOBINET-Concept for Amendment of Modal Split

'Pull': demand responsive PT services

Feeder Services from/to Light Rail
Demand management

- Objectives and Measures
  → influence transport demand in mode, time and space
  → traffic flow / parking
  ◆ tolling and pricing
  ◆ inter-modal offers for the traveller
  ◆ public or private mobility advisory services

- Successes and Problems
  + positive results for individual measures in all modes
  + creation of strong public awareness
  - danger of shifting the problem
  - integration with infrastructure planning
Travel- and traffic information

- Objectives and Measures
  - improved usage of available multi-modal transport supply in time and space
  - information for planned trips (pre-trip) or for trip-corrections (on-trip)
  - mobility advice...radio...info-terminals...Internet...PT infosystems...dynamic info-panels...
New approaches to traffic information

**Collective Route Guidance**
Information and Recommendation

**NetzInfo**
Graphical Display of Traffic Situation on all Main Routes towards Munich
New approaches to traffic information

VisionAir

TrafficVision

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New approaches to traffic information effects analysis

Do you rely in the information?

- Ja: 75%
- Nein: 4%
- keine Angabe: 21%

n = 176

Did you save traveltime by the information?

- Ja: 67%
- Nein, genauso lang gebraucht: 13%
- Nein: 15%
- Weiß nicht: 5%

n = 100

Would you suggest further information panels?

- Ja: 82%
- Nein: 13%
- keine Angabe: 5%

n = 200
Travel- and traffic information

- Objectives and Measures
  - improved usage of available multi-modal transport supply in time and space
  - information for planned trips (pre-trip) or for trip-corrections (on-trip)
  - mobility advice...radio...info-terminals...Internet...PT infosystems...dynamic info-displays...

- Successes and Problems
  + mono-modal systems far developed
  + positive effects on travel time and mode shift
    - integration, full inter-modality
    - individualization of services
    - business models for ppp unclear
Traffic control

- Objectives and Measures
  - optimised usage / adaptation of transport supply
  - guidance and control
  - traffic lights...PT-prioritization...network control...
  - motorway control...ramp metering...
  - strategic control...
Traffic control on the main roads

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Traffic control

- Objectives and Measures
  - optimised usage / adaptation of transport supply
  - guidance and control
  - traffic lights...PT-prioritization...network control...
  - motorway control...ramp metering...
  - strategic control...

- Successes and Problems
  + use of various dynamic traffic data
  + increasing adaptiveness of the systems
  + positive effects on efficiency, travel time, emissions
  - incompatible architectures
  - user- versus system-optimum unsolved
  - missing quality surveillance
Vehicle control

- Objectives and Measures
  - time- and cost-efficient guidance of the traveller under given traffic conditions
  - improvement of safety and comfort
    - automatic driver assistance
    - information and navigation systems
Use of Floating Car Data
FCD from taxi-fleet

Munich airport

Munich

Graph showing travel times and distances from Munich to Munich airport.
Use of Floating Car Data
Taxi-positions during 9 hours in Munich
Driver Assistance and Warning
GPS-positioning plus DAB/TPEG plus ADAS

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Vehicle control

- **Objectives and Measures**
  - time- and cost-efficient guidance of the traveller under given traffic conditions
  - improvement of safety and comfort
  - automatic driver assistance
  - information and navigation systems

- **Successes and Problems**
  + static navigation is 'solved'
  + commencing use of floating car data (fcd)
  + time savings for equipped cars, safety gains
  - missing traffic responsiveness
  - integration collective – individual
  - loss of drivers's competence
Integration in Traffic Management
"from Polyphony to Symphony"

Data and Information
Management Measures
Organisation and Operation
Systems Technology
Integration in Traffic Management
Integration of Data by Modelling and Fusion

Dynamic Traffic Data

DINO
- Traffic Assignment
- Information Minimizing

Updating
- LOS-calculation

Dynamic Traffic State

User
Integration in Traffic Management
Integration of Measures by Strategic Control

Principle:

Events
Problems
States

define a

Situation

Measure A
Measure B
Measure C
form as bundle of activities a

Strategy

+ = Scenario

Quelle: FGSV, 2003
**Implementation:**

→ hierarchical structure

<table>
<thead>
<tr>
<th>Strategiemanagement</th>
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<tr>
<td><strong>Strategien</strong></td>
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<td>Innenstadt-überlastung</td>
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<td><strong>Maßnahmen</strong></td>
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<td>Hauptstrecke priorisieren</td>
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<td><strong>Steuerungsinstrumente</strong></td>
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<tr>
<td>Kollektive Info-Tafel</td>
</tr>
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</table>
Integration in Traffic Management
Integration of Measures by Strategic Control

**tools:**
Integration in Traffic Management
Integration of Measures: collective - individual

normal flow towards city centre

vehicles are guided via this fastest route
Integration in Traffic Management

Integration of Measures: collective - individual

- traffic accident on main road
Integration in Traffic Management
Integration of Measures: collective - individual

→ Public strategy:
Green Wave towards city, adjustment of green times for more capacity

 Incident is broadcast via TMC, but strategy is unknown

Routing inconsistent with strategy → waiting times occur
Integration in Traffic Management
Integration of Measures: collective - individual

→ Public strategy:
Green Wave towards city, adjustment of greentimes for more capacity

Traffic Management Centre informs private service provider on collective strategy

Result:
consistent individual routing → best route
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Estimation of effects by scenario techniques

Space

Large scale
Small scale

Time

Today
Near future
Far future

Scenario 1
Scenario 2

Pilots
MOBINET
Estimation of effects by scenario techniques
MOBINET
Estimation of effects by scenario techniques

Scenario 1 (small scale)

Reduction of the total **traffic load** of the motorized individual traffic by 25 mio km **(0,13%)** per year.

Reduction mainly on highly congested and sensitive network sections.

Reduction of **CO$_2$-emmissions** caused by traffic by **12,000 tons** **(0,3%)** per year.

Around **17,000 persons** per day will **change** from individual to public transport. Estimated **economic benefit** is approx. **30 mio € per year**.

Scenario 2 (large scale)

Reduction of the total **traffic load** of the motorized individual traffic by 70 mio veh km **(0,35%)** per year.

Estimated **economic benefit** will rise to approx. **80 mio € per year**.
Implementing ITS: a complex job

System Architecture Levels

Logical Architecture
- Reference Model
- Functional Architecture
- Data-/Informational-Architecture

Technical System Architecture
- Physical Architecture
- Data-/Communication-Architecture

Organisational Architecture
Implementing ITS: organizational approach

Sources of Data / Information

Traffic Control
Public/Authority Tasks

Traffic Information
Private Services

Dissemination
Public / Private Partnerships

Actors

Clients
Implementing ITS: organizational approach

**PPP - approach 'Ruhrpilot', 2005**

**Private Betriebs-gesellschaft**

**Öffentliche Besitz-gesellschaft**

**Aufgaben:**
- Errichtung des Systems
- Garantiert die Verfügbarkeit kostenfreier Dienste
- Finanzierung und Aufrechterhaltung des Betriebs

**PPP Vertrag**

**Aufgaben:**
- Eigentümerin der Infrastruktur
- Bauüberwachung
- Finanzierung der Investition
- Qualitätsmanagement
Intelligent Transport Systems: Where are we today?

- The technologies and concepts of ITS are far developed and have proven their general ability to safeguard and promote mobility.

- **BUT:**
  The potential of ITS is by far not yet fully used and needs intensive further research, piloting, standardizing and marketing.
Important future fields of activity are, e.g.:

- Organisation of traffic management
  (public/private services, integration region/city, institutionel aspects,...)
- Financing of ITS, business models for ppp
- Integration of infrastructure planning and traffic management
- Inclusion of commercial transport
- Consolidation and enlargement of transport databases
  (demand patterns, environmental data, consistent data models)
- Integration of individual and collective measures
- Harmonisation/standardisation of system architectures
- Seamless quality management
  (systems technology, functions, processes)
- Improvement of general knowledge about costs and benefits
Resume

- Traffic Management and ITS have 'grown-up'.
  - We enter a period of normality with respect to the very basic and most important measures.

- Due to its expected effects ITS can be a powerful complementary supplement to infrastructure measures, but not a replacement.
  - A close integration of traffic management with long-term traffic and infrastructure planning is necessary.
  - We need 'ITS Masterplans'!

- Further activities are requested to gain the full potential of Intelligent Transport Systems.
  - System architectures, organisation of traffic management, quality supervision are predominant.
Thank you for your kind attention!