



Active Traffic Management Experiences made in Hessen

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IVM Integrated Traffic Management

Region Frankfurt RheinMain



Freeways in Germany

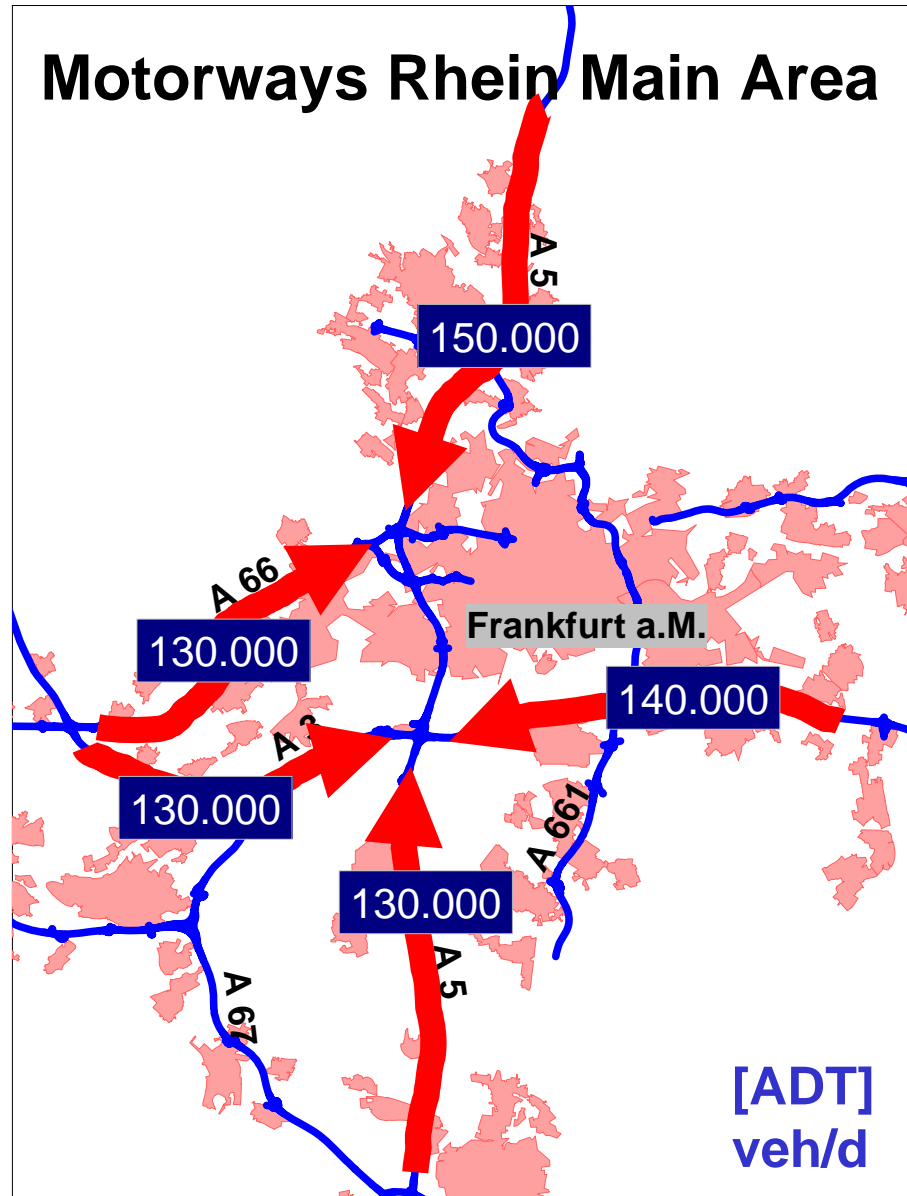
- Length of network 12.174 km
 - 4 lanes 9.007 km
 - 6 lanes 3.079 km
 - 8 lanes 88 km
- Average daily traffic volume 49.400 veh/day
 - same in Hessen 62.300 veh/day
 - Truck traffic ca. 10 %
- Speed restrictions in Hessen: 1/3 of freeways



Accidents



Road Works



Events



Incidents



Traffic Situation Today

- Increasing traffic volume until 2015
 - Passenger road traffic 16%
 - Truck traffic 60%
- Little potential to increase road capacity
 - Limited budgets
 - Ecological constraints
 - Increasing maintenance requirements

ATM can help easing congestion in utilizing existing infrastructure more efficiently

Traffic Situation on 1000 km Motorways in Hessen



22 Billion Vehicle*km per year

ca. 13.000 congestion warnings per year

ca. 23.000 hours of congestion per year



ca. 70% Capacity Problems

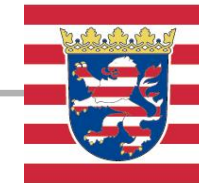
ca. 30% Safety Problems

Capacity Management

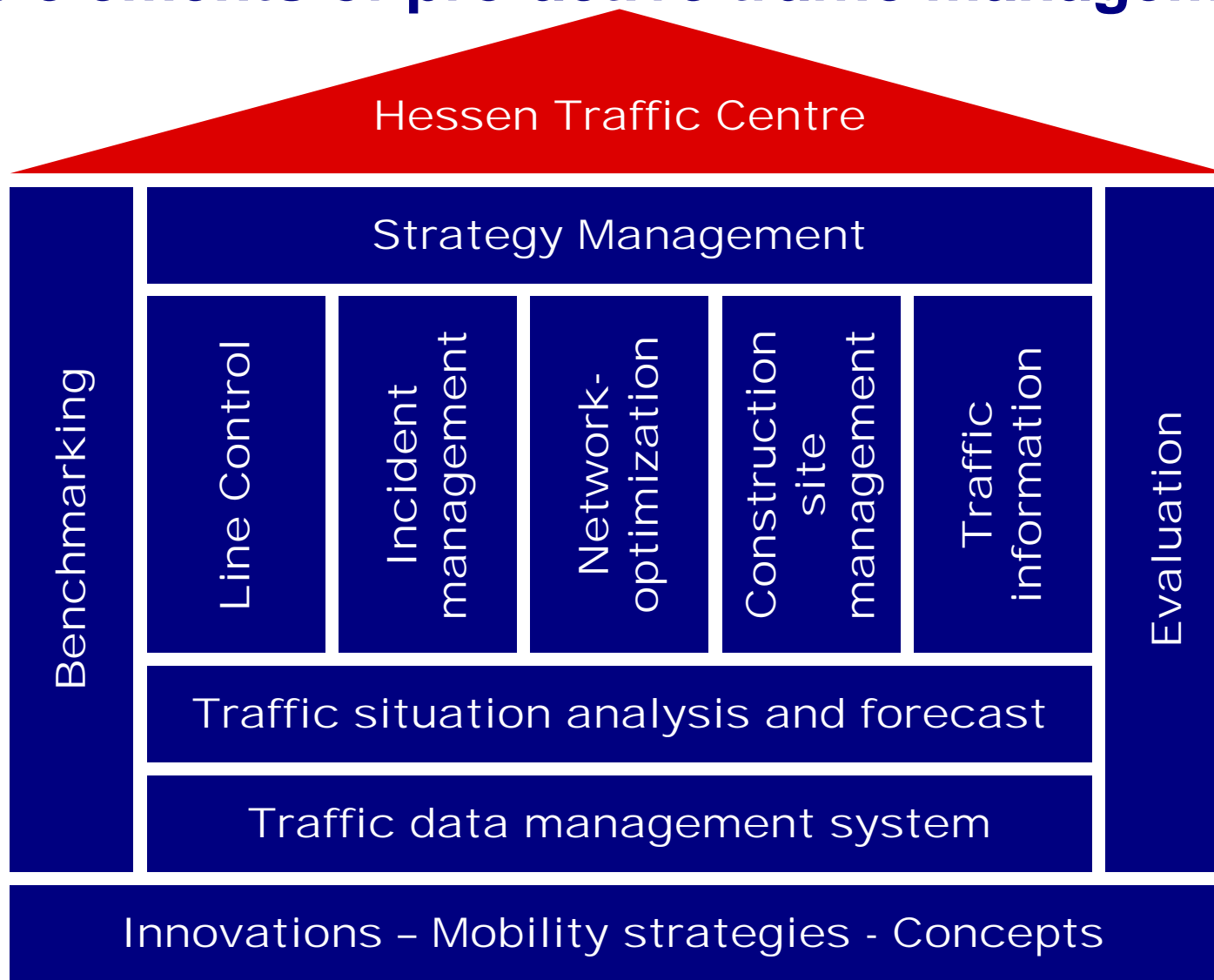
Increase Road Safety

Strategy Management

Increase Vehicle Safety



Core elements of pro-active traffic management





Capacity and Safety Management

- line control (variable traffic signs)
- network control (variable direction signs)
- intersection control (variable lane signalization) and ramp metering
- temporary use of hard shoulder
- variable message signing including congestion warnings and travel time information
- construction site management

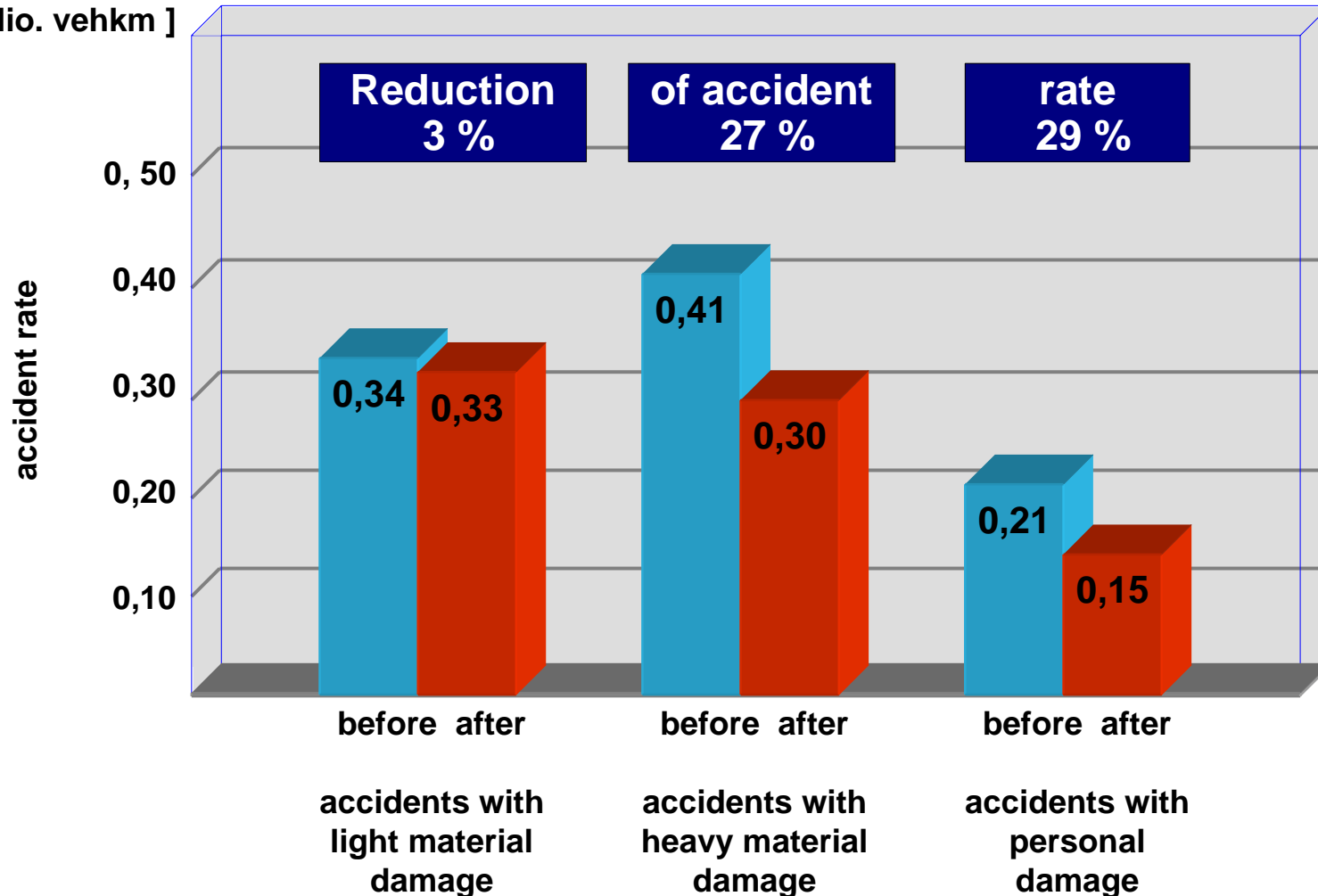


Line Control System A5 Friedberg - Frankfurt



Benefits of Line Control Systems

[accidents per
Mio. vehkm]





Variable Lane Signalization





Temporary Use of Hard Shoulder

- Hard shoulder use is allowed in emergency instances only
- Legal hard shoulder running required therefore changes in the existing traffic regulations (new traffic signs introduced)
- Hard shoulder running sections should be equipped with line control systems to harmonize traffic flow
- Decisions for implementations were made on detailed investigations (costs, benefits, capacity of exit ramps etc.)
- Some constructional changes and smaller markings of existing lanes were necessary to let trucks use the hard shoulder safely
- Today 50 km hard shoulder running are in operation in Hessen; 20 km are in preparation (high acceptance by road users)
- More than 100 video cameras are needed for monitoring
- Application in Hessen to 6-lane motorways only



Temporary Use of Hard Shoulder

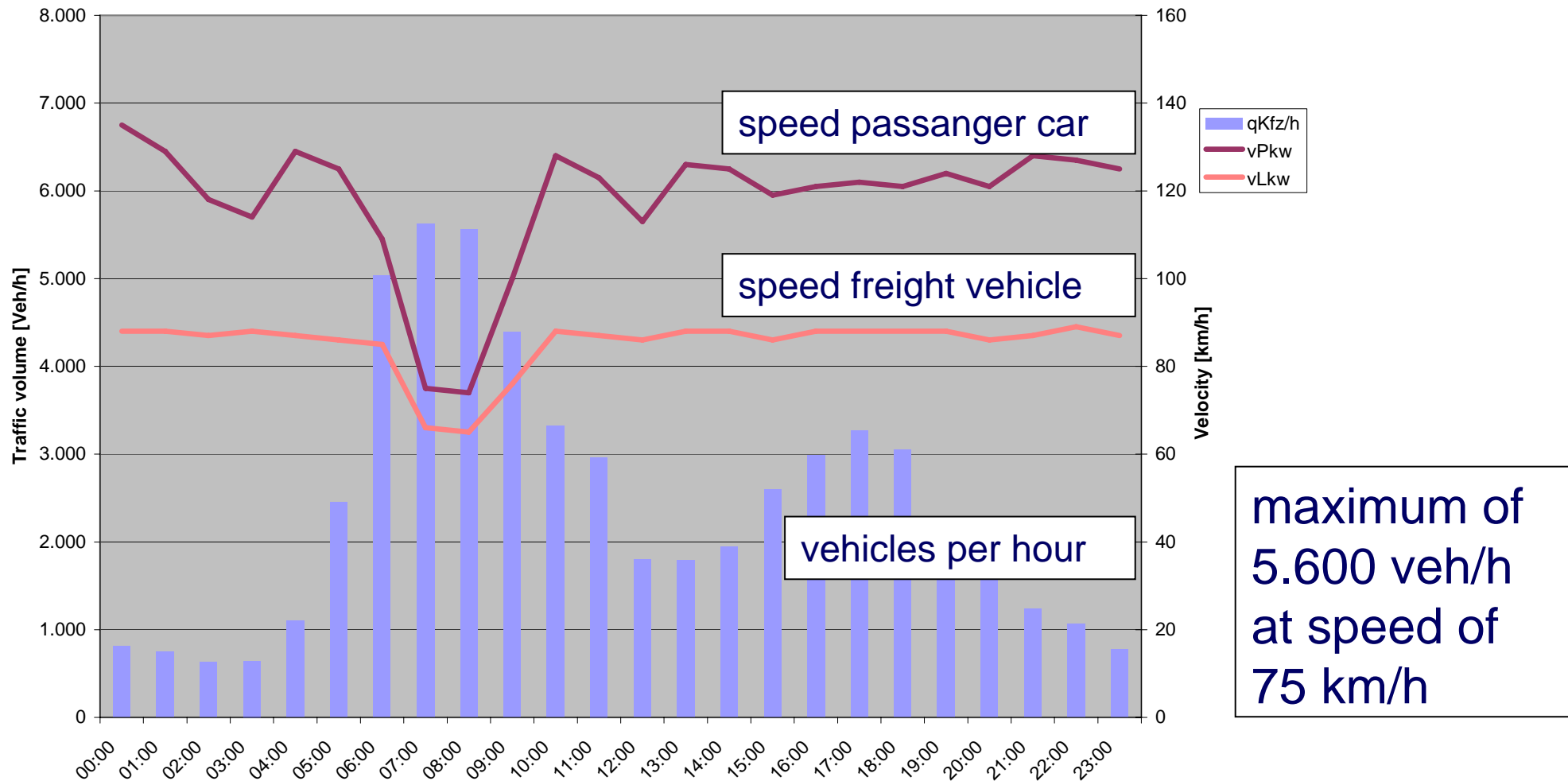
- Operation at times of extreme traffic volumes only
- Speed is limited according to traffic flow conditions
- Control system indicates when hard shoulder should be opened; opening procedure is performed manually
- Hard shoulder has to be monitored during operation using video cameras every 800 to 1000 m
- Operation has to be stopped whenever obstacles or car breakdowns are monitored
- Some constructional changes are necessary if hard shoulder operation is extended across intersections
- Exits need sufficient capacity



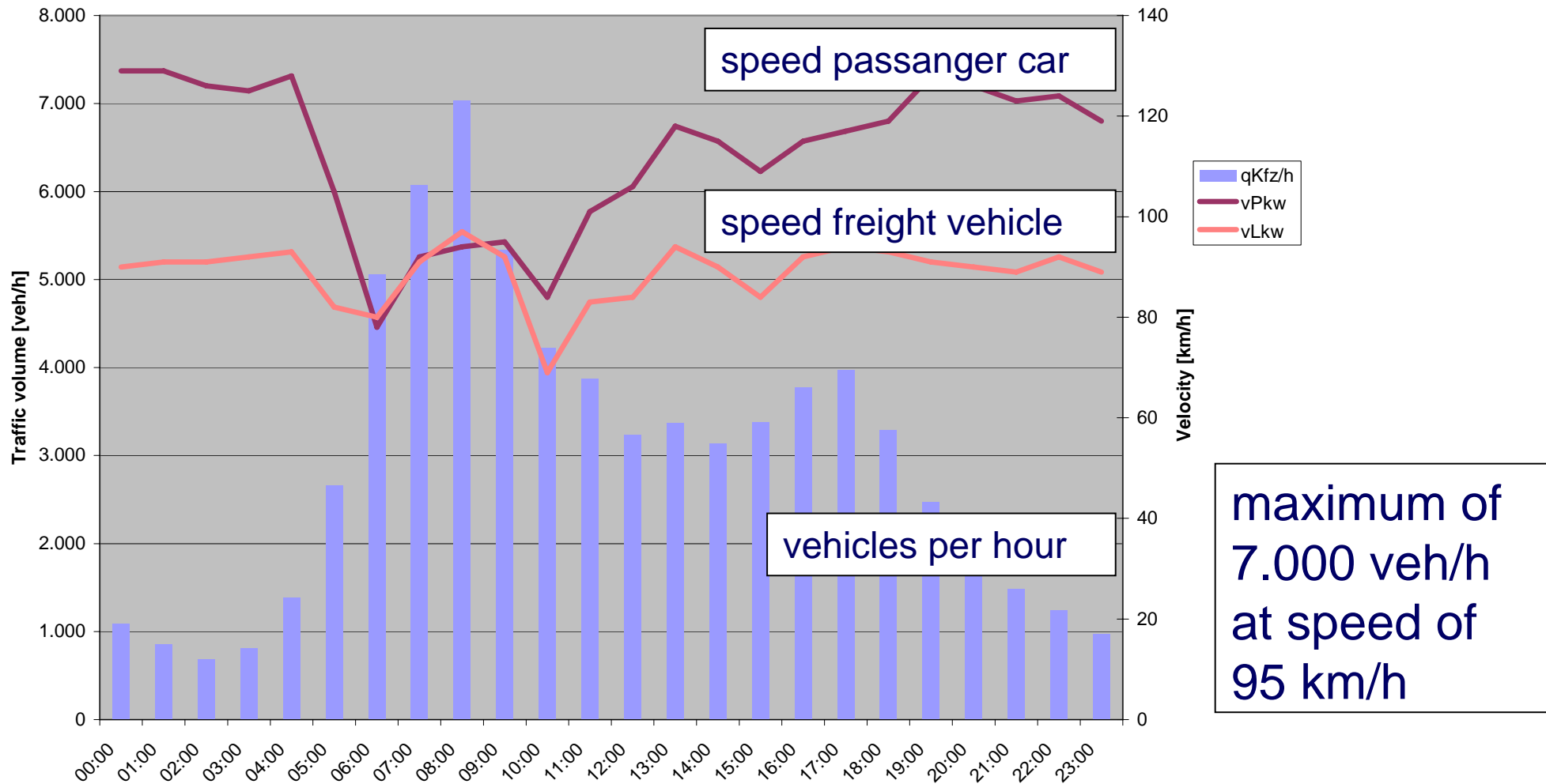
Temporary Use of Hard Shoulder



A5 southbound **without** hard shoulder operation



A5 southbound **with** hard shoulder operation





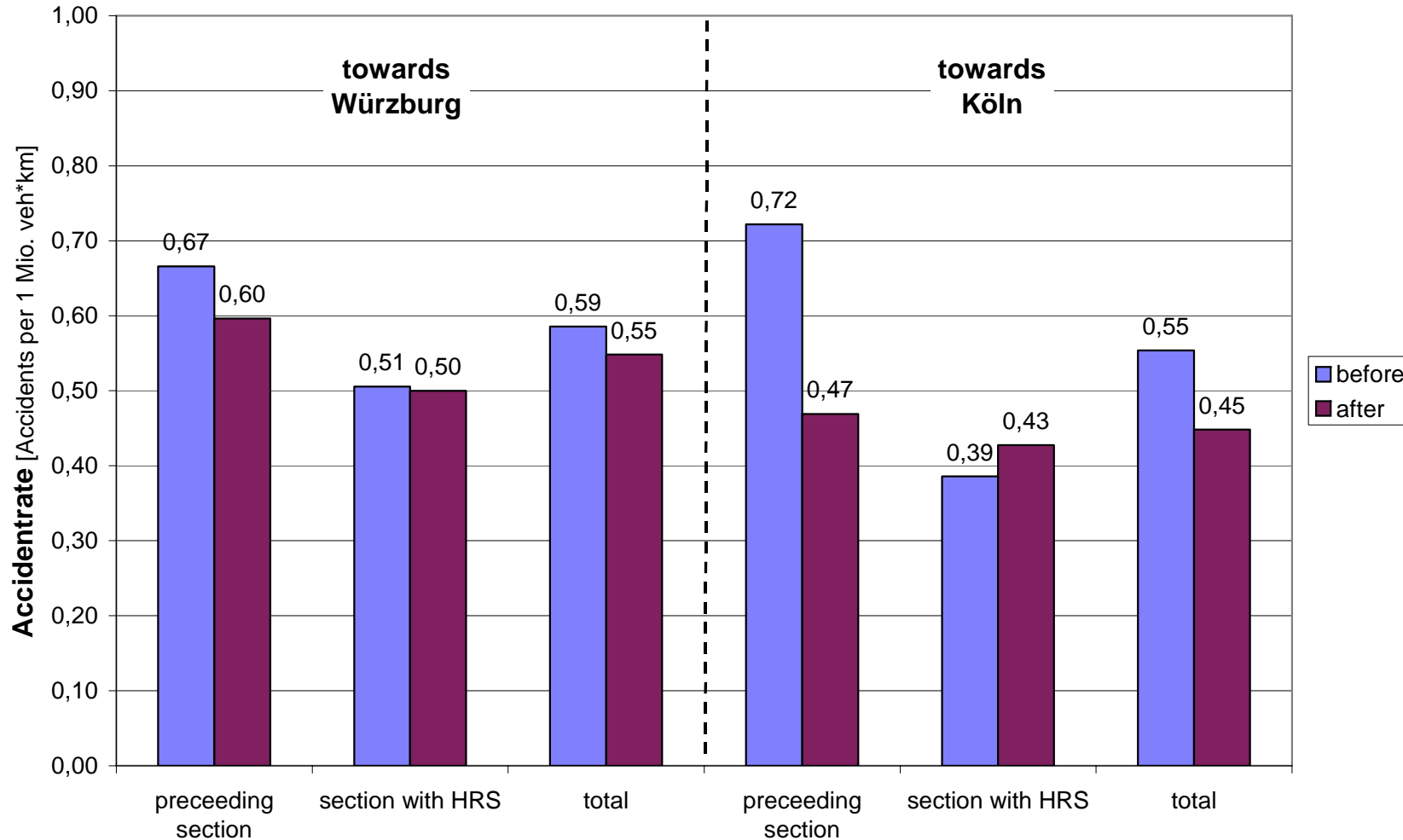
Cost-Benefit-Analysis

Invest in traffic control infrastructure	13.0 Mio. €
Invest in hard shoulder reconstruction	<u>12.7 Mio. €</u>
	25.7 Mio. €

Time savings when	2,920 pass.car*h / day
operating hard shoulders	<u>300 truck*h / day</u>
	3,220 vehicle*h / day

Economic benefit	48,000 € per day
	10.6 Mio. € per year

A3: Impact of Hard Shoulder Operation on Safety

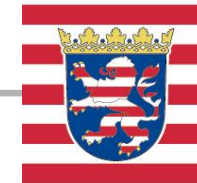




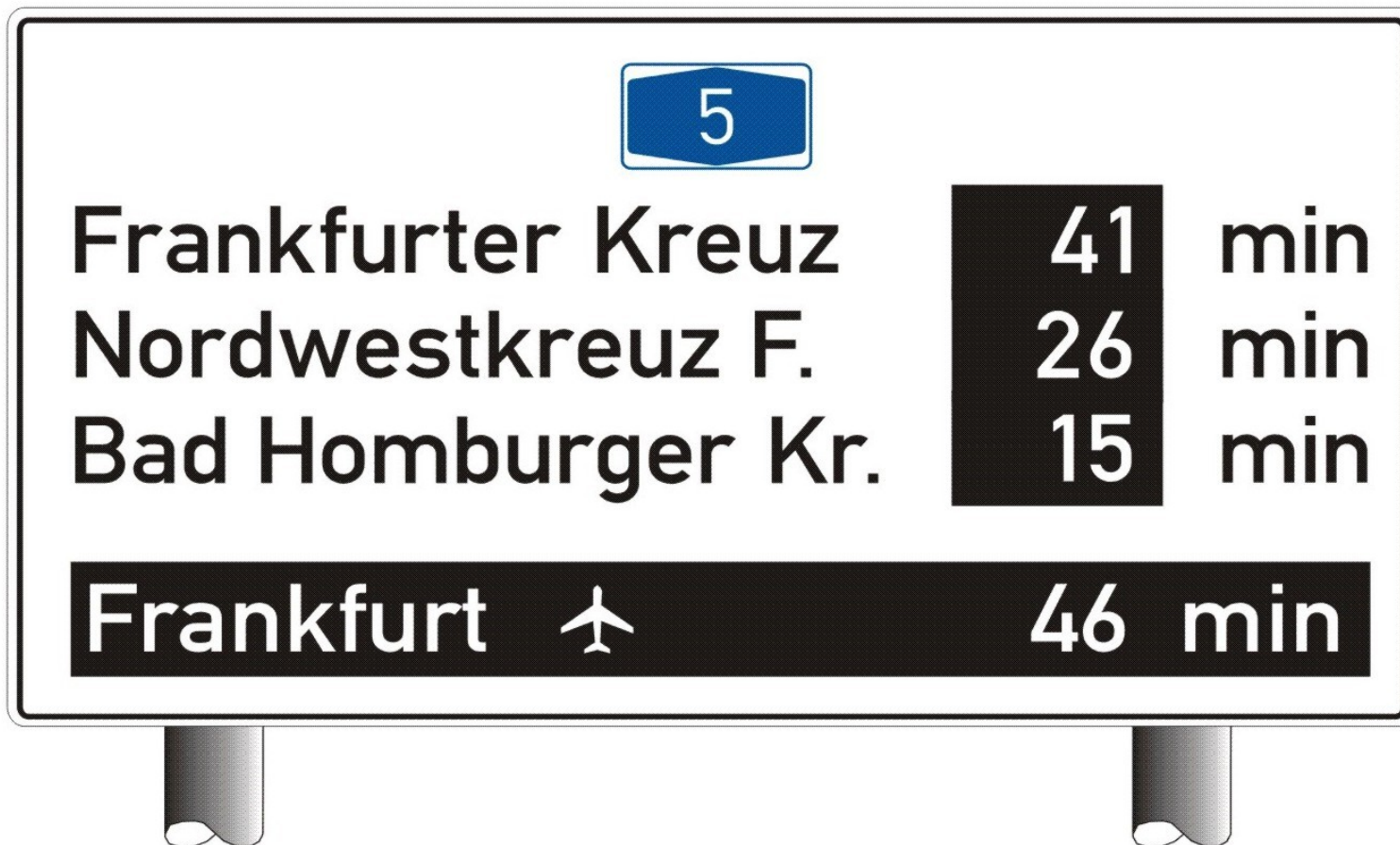


Variable message signing including congestion warnings and travel time information





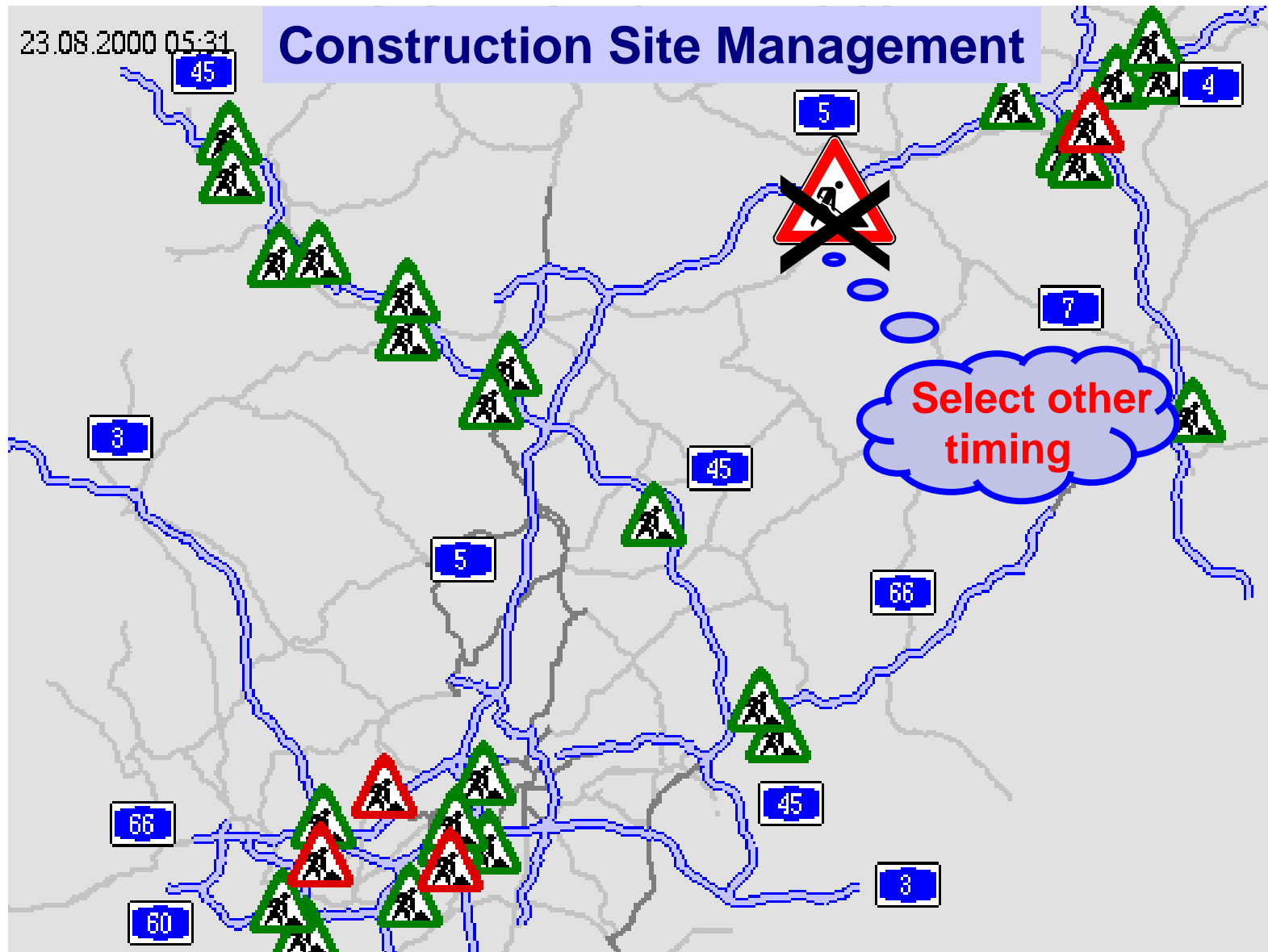
Estimated Travel Time Information



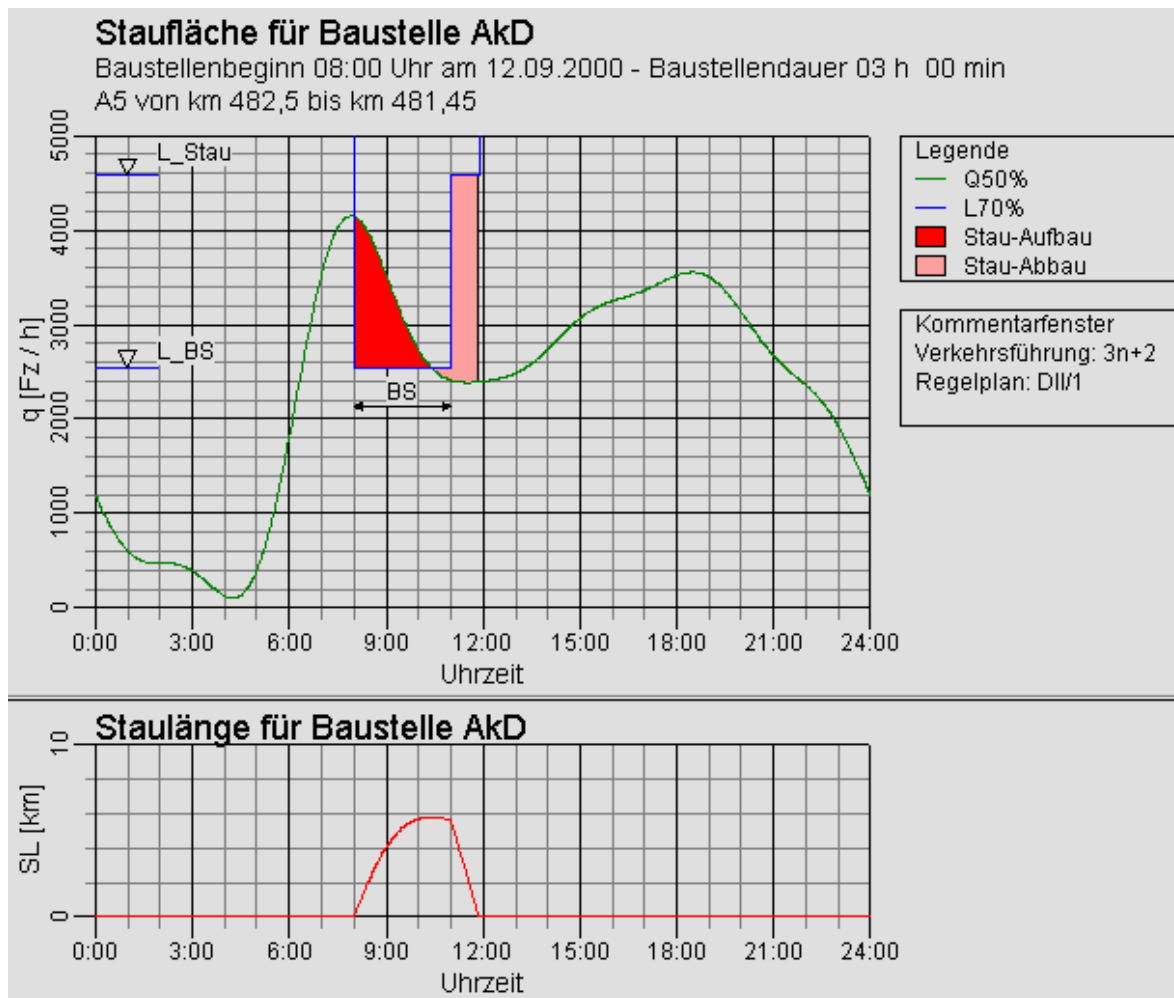


Construction Site Management

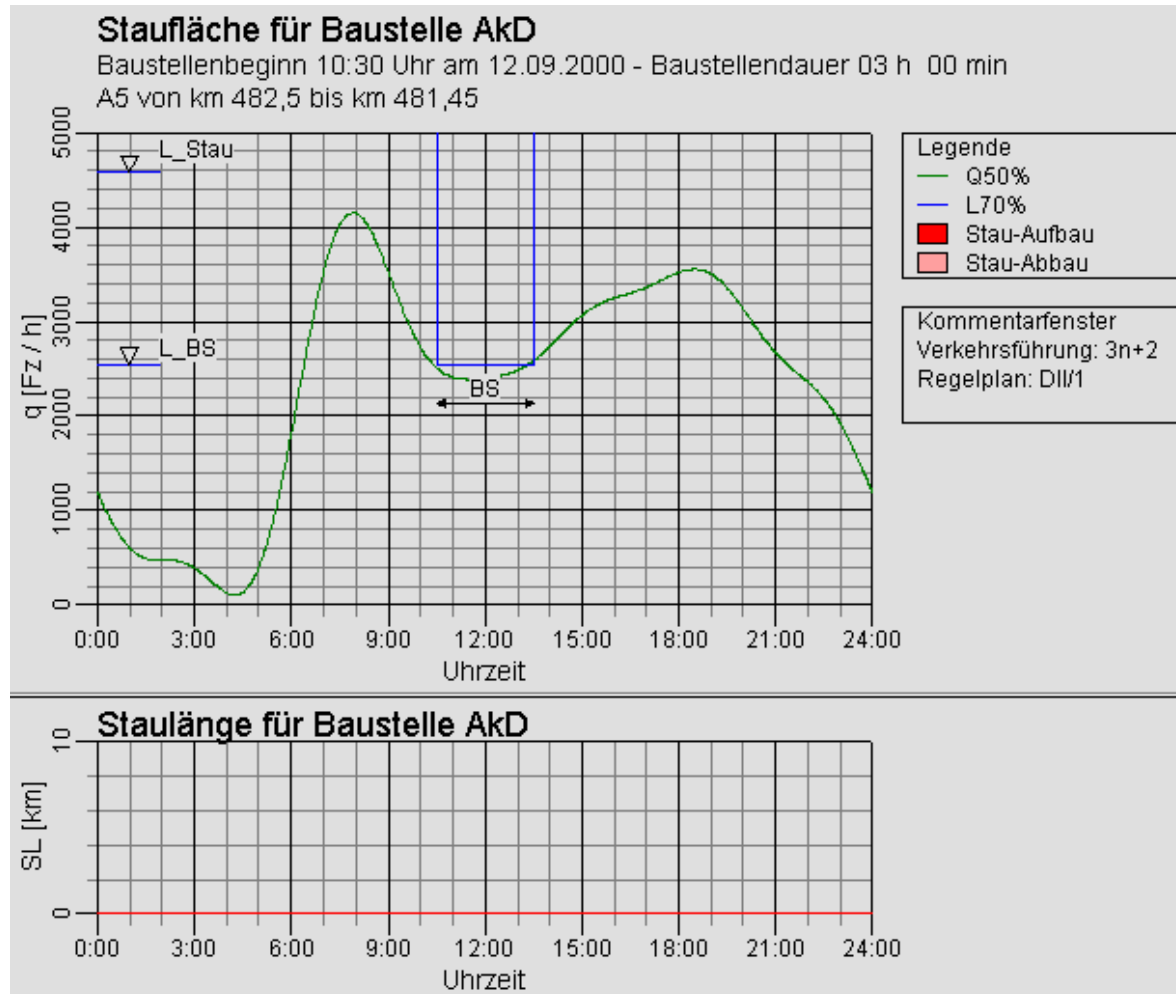
- Objective: organizing and planning of road construction sites such to minimize travel time losses and congestion
 - better timing of short term work zones
 - monitoring of approved timing
 - optimal planning of long term construction sites (simulation of traffic flow, impact on traffic safety and congestion)
 - balance of road user requirements (safety and congestion) and requirements of road construction



Evaluation of Short Term Construction Sites



Evaluation of Short Term Construction Sites



Locating Short Term Construction Sites

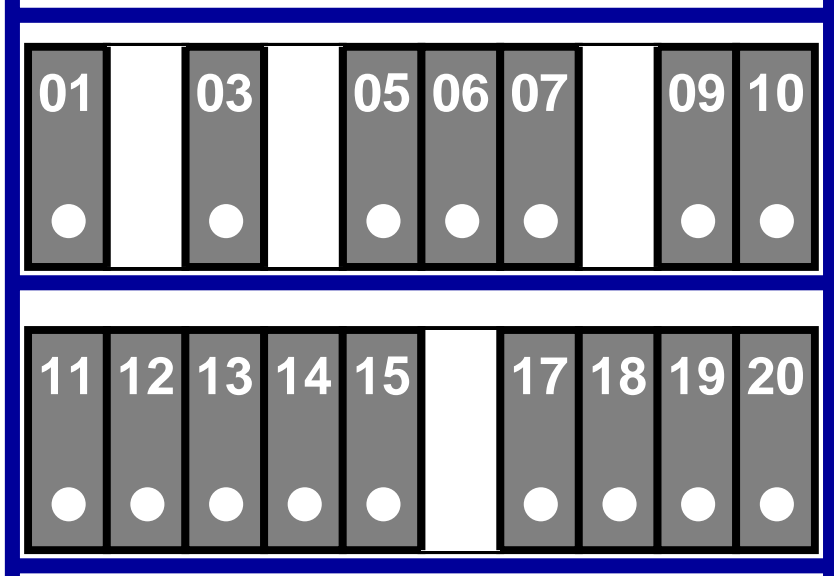


Infofenster	
Tour	1009
Tourabschnitt	7543
Zeitpunkt	« 03.08.2006 14:45:55 »
Position	8.602627° östliche Länge 49.881095° nördliche Breite
Applikationsmeldung (7543)	
Zustand	Langsamfahrt
Richtung	190
Zustand Pfeil	Rechts
Zustand Lampen	Pfeil
Strasse	
Name	A5
Km	518.435
Letzte AS	AS Weiterstadt
Nächste AS	AS Darmstadt
Richtung	Darmstadt

Intermodal Strategy Management

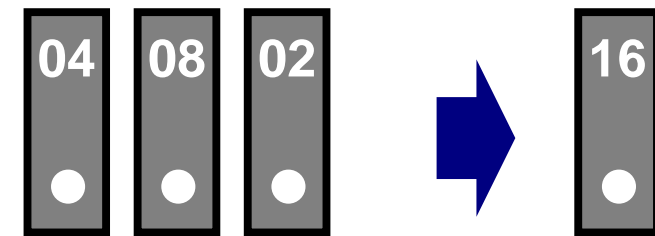


Strategy Library



Strategy Selection

Activation



Priority: 1. 2. 3. 4.



Benefits of Intelligent Traffic Management

- Reducing heavy damage accidents up to 30%
- Travel time reduction up to 20%
- Increasing line capacity up to 25 % at least temporarily
- High acceptance of variable message signs as long as indicated speed limits are perceived reasonable
- Less congestion through optimal construction site management
- Less congestion in diverting traffic to alternate routes according to predicted traffic volumes



Road and Vehicle Safety

- 25% of congestion is caused by accidents
- truck accidents have extreme impacts on congestion
- **Traffic safety has to be improved further**
- ACC systems should become mandatory for trucks
- introducing short range vehicle to vehicle communication improves hazard warnings
- linking “intelligent roads” and “intelligent vehicles” will utilize ITS potentials for safer and more reliable transport systems even further



Linking “intelligent” vehicles to “intelligent” road infrastructure

Vehicle to vehicle communication:
exchanging hazard warnings
among vehicles

Vehicle to infrastructure communi-
cation:

transmitting hazard information
to traffic control centers,
from there hazard warnings or
detour recommendations to all
vehicles





**Thank you
for listening**



Congestion-free Hessen 2015: Objectives

- Better utilization of existing infrastructure
- Optimize traffic management and traveler information
- Reduce traffic disturbances caused by road constructions and maintenance work
- Increase traffic safety, in particular for trucks
- Improve accident and incident management with special focus on lost materials
- Extend road infrastructure moderately and more intelligently according to the actual needs



Framework and Responsibilities

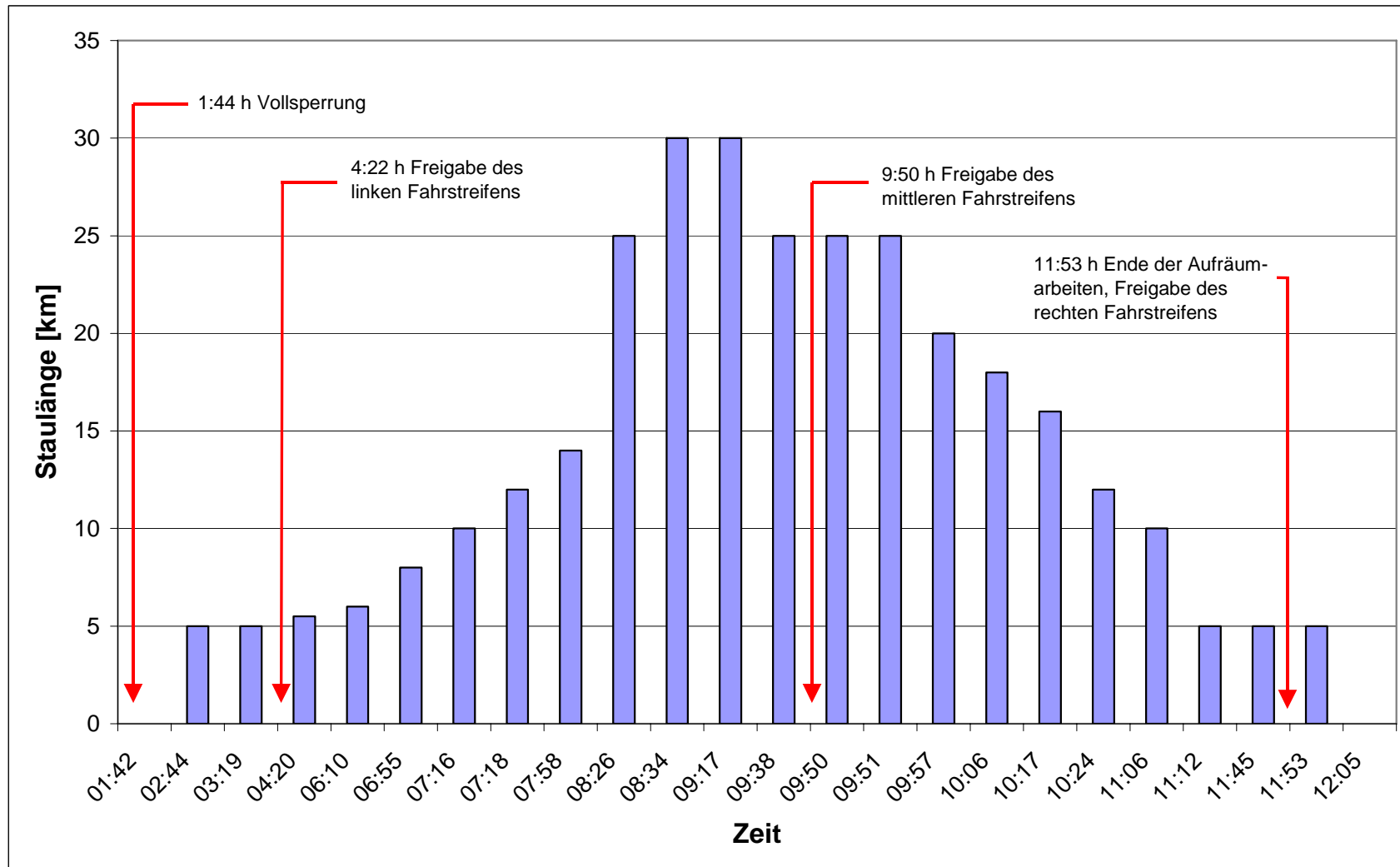
- Federal government
 - owner of freeways and federal highways
 - Federal Highway Extension Plan
 - financing of road and telematic infrastructure as well as its maintenance
- State governments
 - acting on behalf of the federal government
 - planning and its realization
 - performing maintenance and operation
 - financing of all the planning and operating activities
 - taking care of traffic safety and traffic regulations

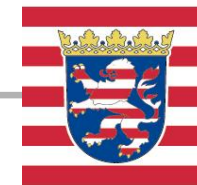


Road and Vehicle Safety

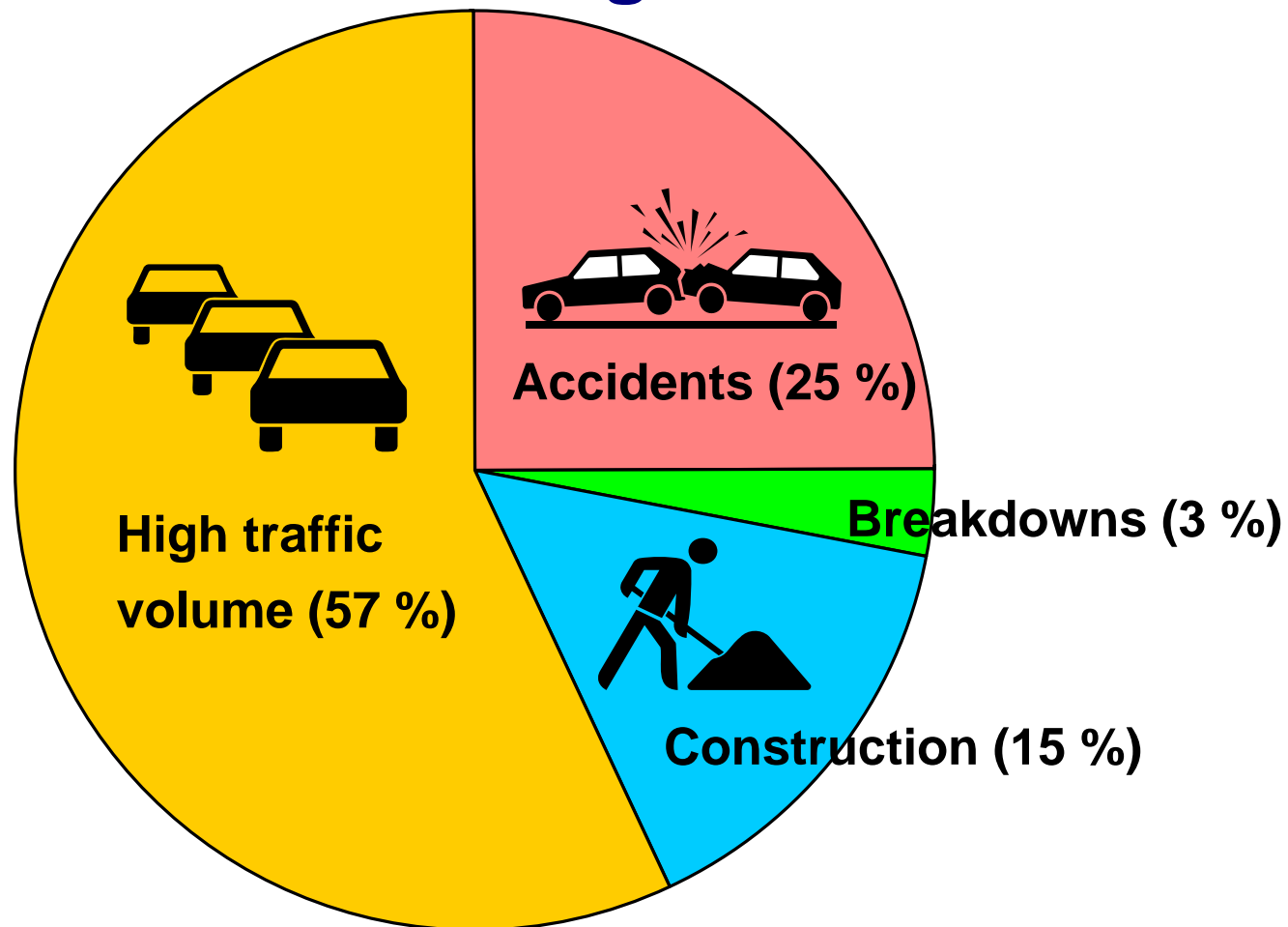
- 25% of congestion is caused by accidents
- truck accidents have extreme impacts on congestion

Truck Accident on A3: Queue development





Sources of Congestion



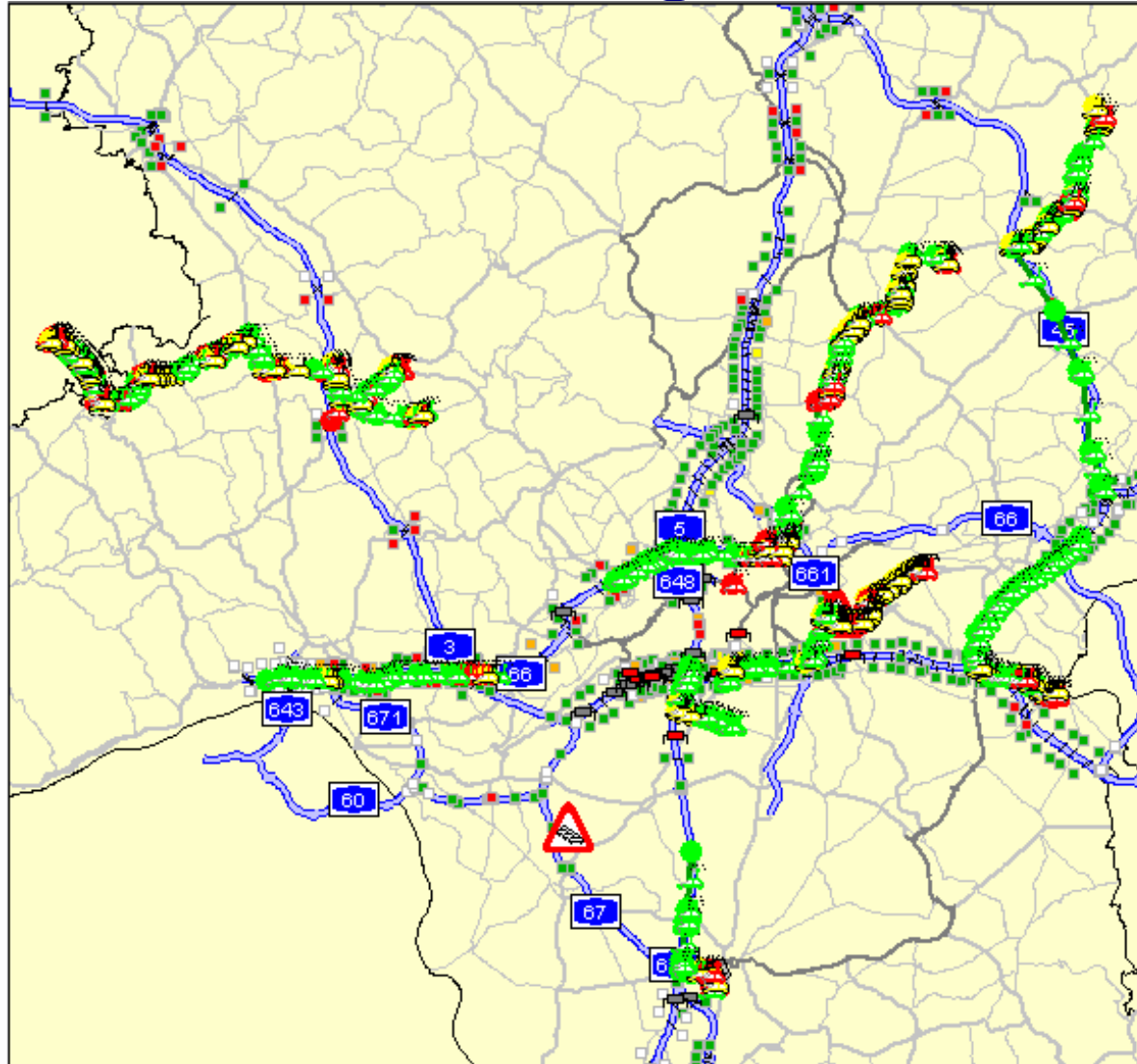


Description of Traffic Performance

- Data collection
 - loop detectors and other sensors
 - floating car data
 - video cameras
- Data processing
 - traffic flow, speed, headways
 - level of service
 - congestion estimation and prediction
 - travel time estimation
 - share of truck vehicles

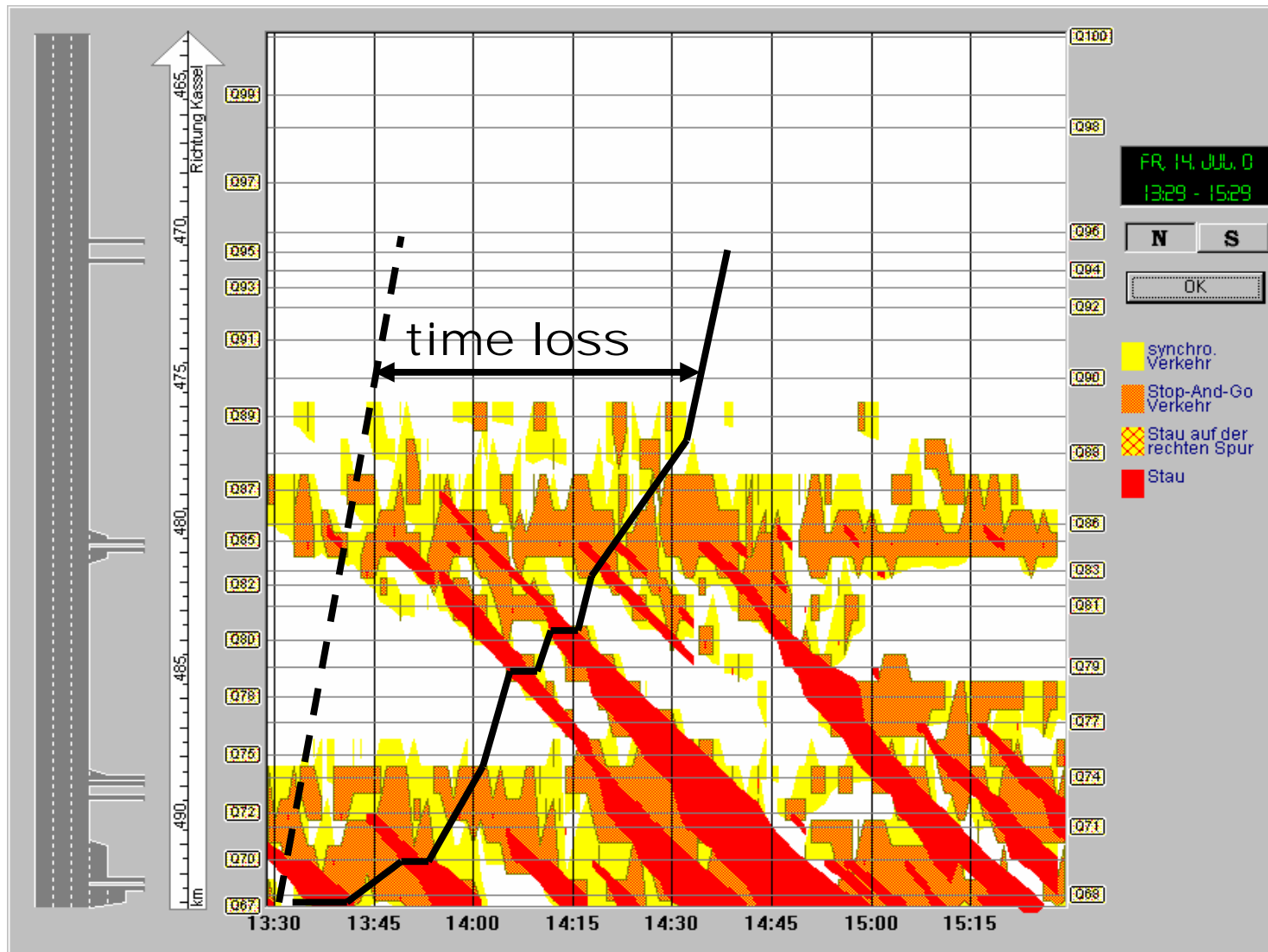


DIANA - Floating Car Data





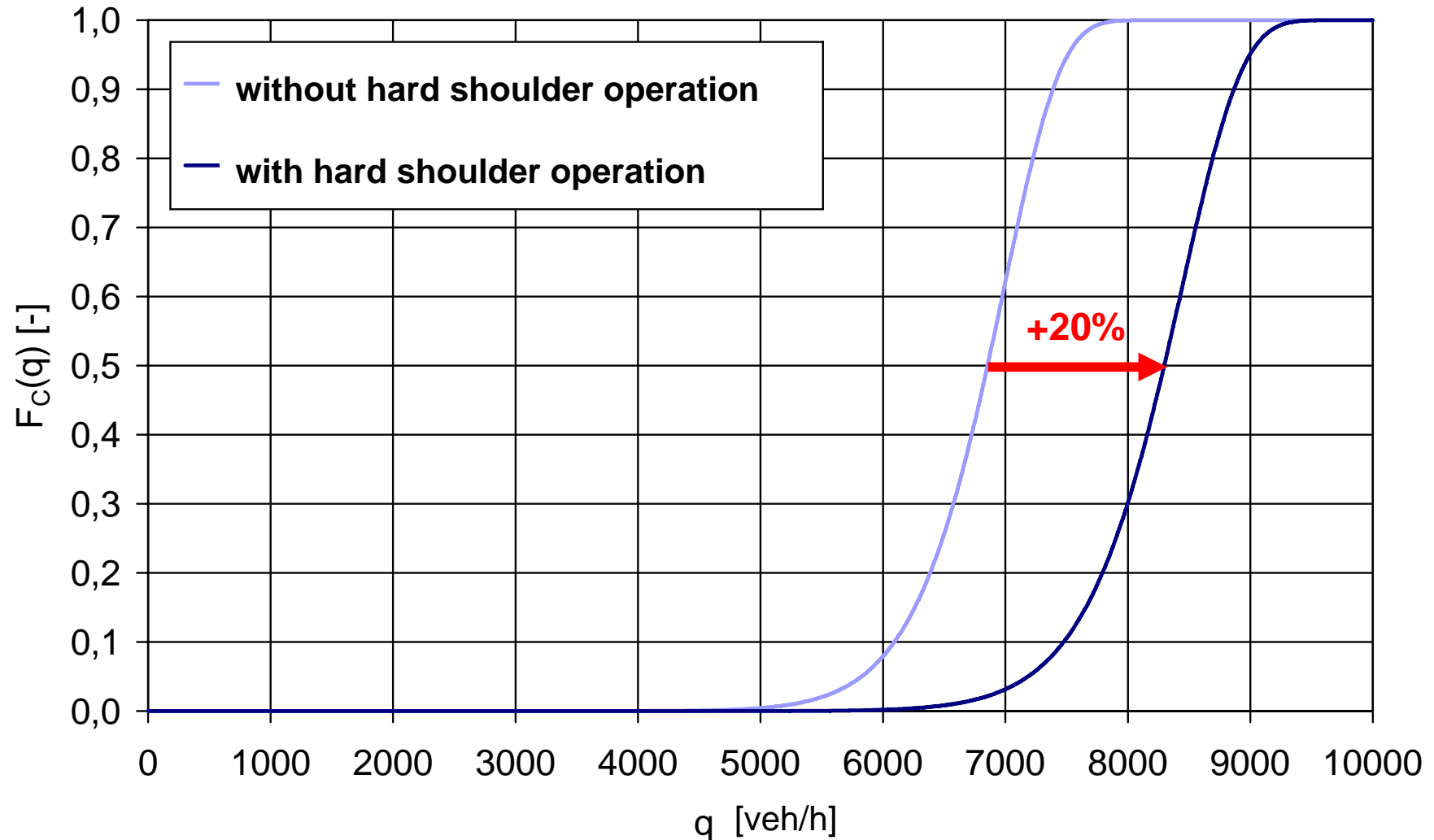
Histogram of congestion



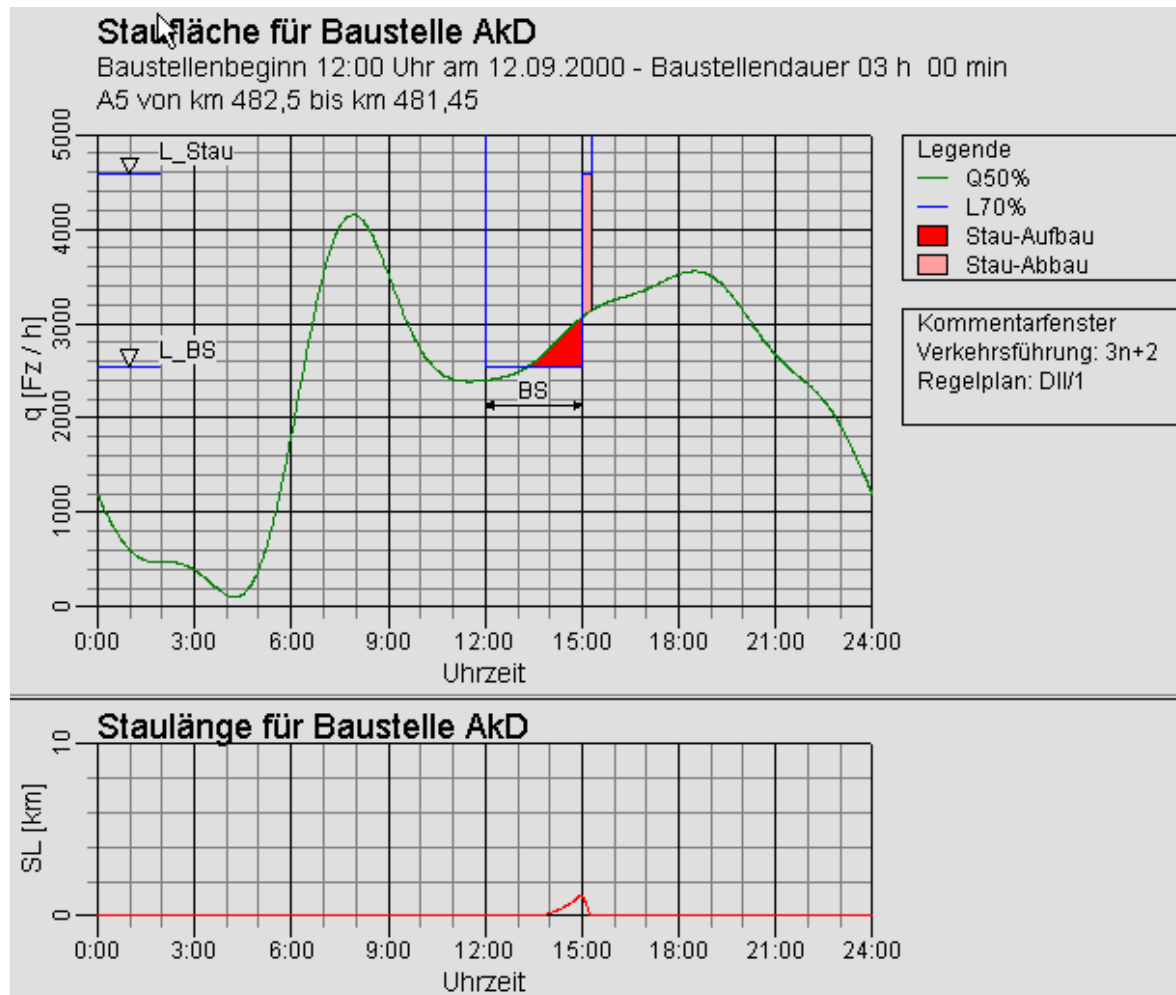
■ synchroized traffic

■ congestion

A3 eastbound: Capacity distribution



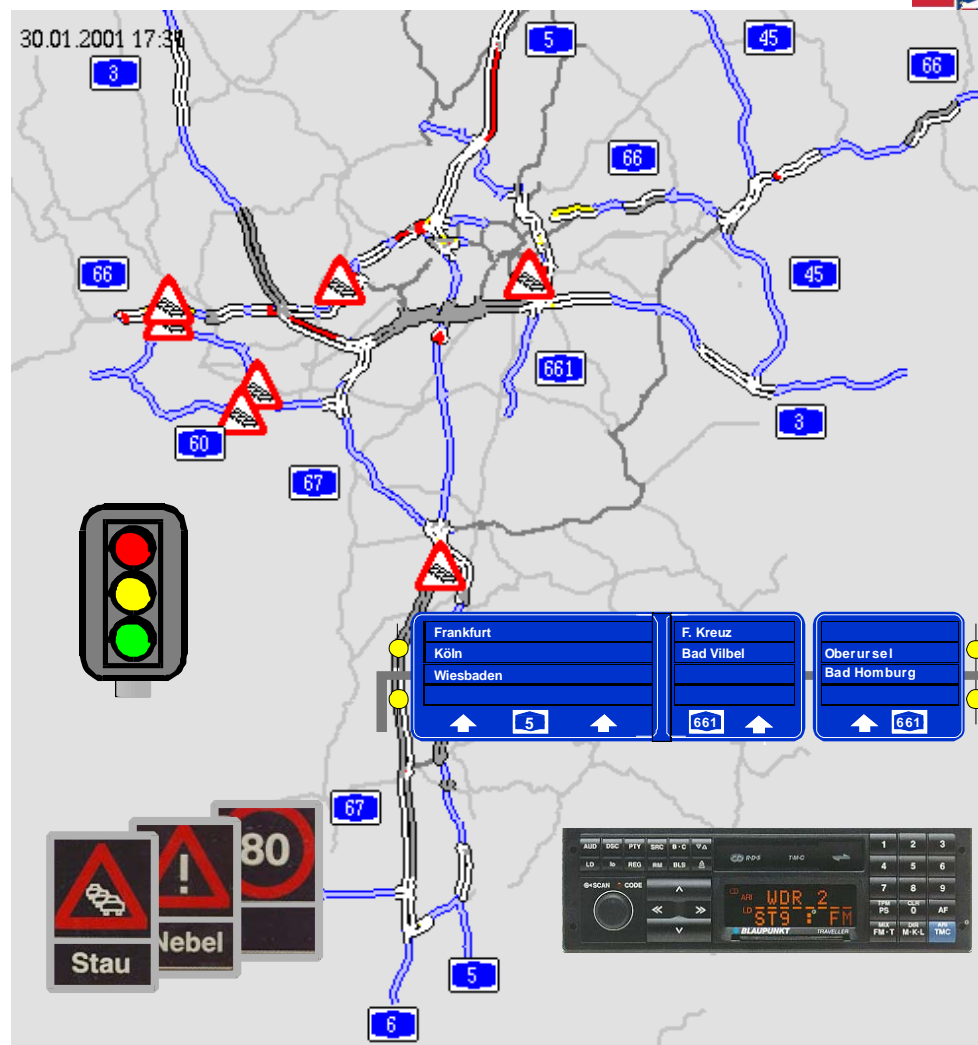
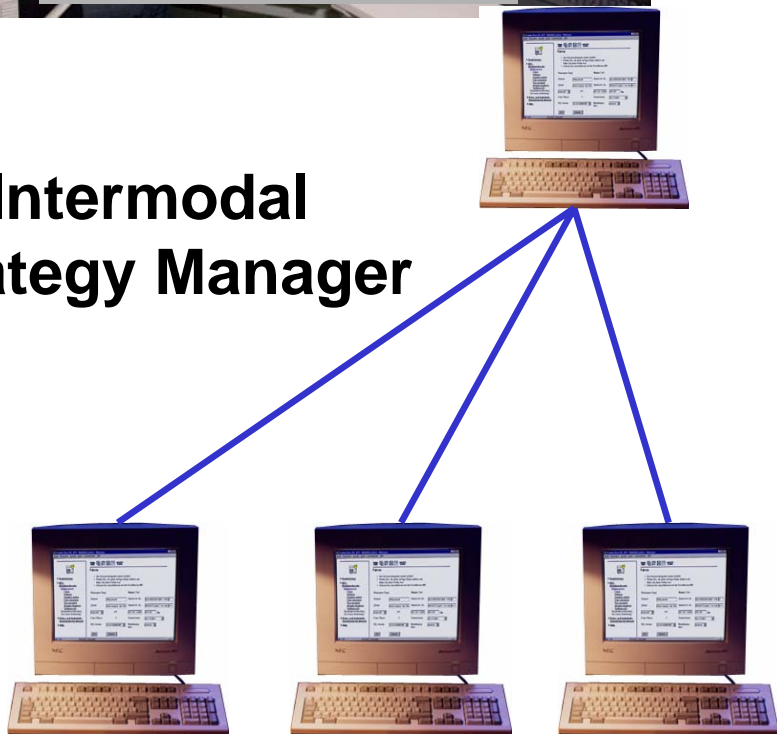
Evaluation of Short Term Construction Sites





Control Center

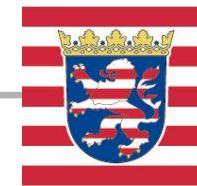
Intermodal Strategy Manager



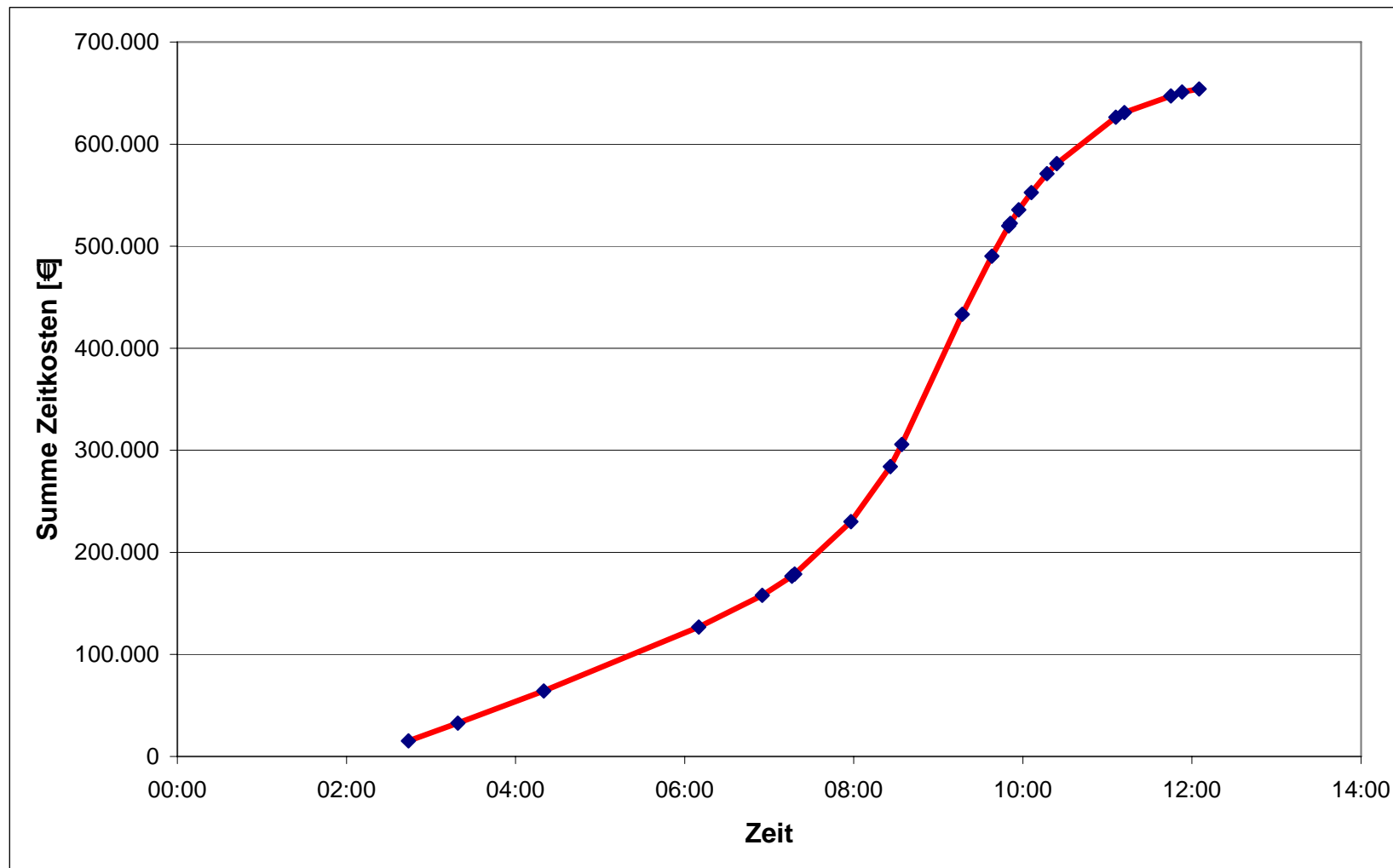


Benefits of Intelligent Traffic Management

- Utilization of synergy effects achieved by cooperation of car manufacturers with road infrastructure operators in public-private-partnerships
- Results:
 - Increased traffic safety and less congestion
 - Improved mobility



Truck Accident on A3: Costs of Time Losses





Main Objectives of Freeway Operation

- Maintain/increase traffic safety
 - harmonizing traffic flow
 - providing hazard warnings
 - dynamic in-vehicle information (RDS-TMC and traffic response navigation systems)
- Maintain mobility/reduce congestion
 - optimal use of network capacity (diverting traffic to alternate routes using variable direction signing)
 - temporary increase of road capacity (variable speed control, temporary use of hard shoulders)