Fusion of xFCD and local road weather data for a reliable determination of the road surface condition
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Negative effects of critical road weather

Physics of traffic
• reduced traction between tyre and road surface
• extended stopping distance
• reduction of bearable radial forces
• water films cause spray that may limit driver’s visibility

Traffic safety
2004 > 12% of all fatal accidents in the EU can be traced back to critical road surface conditions.
SAFETY NET 2006

Traffic flow
• reduced speeds
• reduced capacity
MANGOLD 1996
How it’s done today

Critical Road Weather / surface condition

Detection by stationary sensors

Control algorithms

Variable Message Signs: Warnings, Speed limits

Protection from snow, snow removal, methods against slickness in winter

Section Control

Winter Maintenance
Motivation

- Meteorological events are highly instationary and inhomogeneous
- So far: measurements are taken locally (~ 2-5 km)
  - The picture is not precise enough (spatially)
  - No information in case of break down of one station
- Exact information about actual road weather should be available
- Optimization of winter maintenance
- Acceptance of variable message signs depends on plausibility

► several research projects are in progress
Project “Reliable determination of the road surface condition”

**Basic idea**
Aggregate locally detected road weather data and extended Floating Car Data (xFCD) towards more reliable and more accurate information about road condition on the stretch

**Funded by**
Federal Highway Research Institute
German Federal Ministry for Transport (BMVBS)

**Duration**
October 2007 - June 2009

► no results available yet!
Project overview

Increase in Traffic Safety & optimized Traffic Flow
Probe vehicles

- A passenger car (Audi A4) and a van (VW Multivan) are used to collect data in the Greater Munich area
- No additional sensors ("series-production vehicles")
- Methods can easily be exploited
Documentation

- Every trip is recorded by video camera
- Driver’s subjective impression of road surface is recorded by microphone
Driving scenarios

1

Audi A4 → VW Bus

2

Audi A4 → VW Bus

3

Audi A4 → VW Bus

4

Audi A4 ← VW Bus
Test site “Eching Ost”

www.vt.bv.tum.de/umfeldaten
Test site “Eching Ost”
Good knowledge about “real” environmental conditions (“Reference”):
- a lot of sensor systems
- test site is regularly attended
- 4 webcams

www.vt.bv.tum.de/umfelddaten
xFCD vehicle data: Wiper status

xFCD

Precipitation intensity
Precipitation class
Road surface condition

Stationary detected data

Optimized information about precipitation and/or spray on a road stretch
xFCD vehicle data: Air temperature

xFCD

Air temperature

Precipitation

Road surface temperature-
& condition

Humidity

Air temperature

Stationary detected data
learning models with historic database

Optimized information about
risk of an icy road surface on a road stretch
xFCD vehicle data

Safety Systems
Information about e.g. Antilock Breaking System (ABS) and Electronic Stabilization Program (ESP) is used as input for information about road surface condition on the road stretch. These systems operate just in case of emergency, so an improved result will be derived by considering the wheel rotation.
Prominent features

- consolidation of traffic control and winter maintenance
- feedback-loop for optimization of algorithms
- application of experiences in other xFCD-projects
- great historical data base of environmental data
- for validation: well equipped test site for road weather data
- no additional (vehicle-)sensors in use
- focus on quality / plausibility checks
Expected benefits ...

- better knowledge about stretchwise road surface condition
  usable for **traffic control**
    → faster and more reliable warning of drivers
- and **winter maintenance**
  → more efficient and timely disposition of winter maintenance
    service vehicles
- additional possible applications:
  → information services
  → positioning of new sensors
  …

▶ increase in traffic safety and optimized traffic flow
▶ results will get published
Questions, comments …?

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