Traffic Performance Measurement Using High-Resolution Data –

Recent Developments on the SMART-Signal System

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Problem: Arterial Traffic Congestion
The Solution: SMART-SIGNAL
(Systematic Monitoring of Arterial Road Traffic Signals)

• An automatic and continuous data collection system from existing traffic signals

• A performance measurement system for intersection queue length and arterial travel time, especially under congested traffic conditions

• A performance tuning system for optimization of traffic signal parameters
Technology Innovations

• It provides solutions to two long-standing traffic engineering problems:
  – how to measure intersection queue length when the vehicular queue spills over to the detector location, and
  – how to estimate arterial travel time reliably.

• The two algorithms to solve the above problems are patent-pending.
Data Collection
SMART-SIGNAL System Architecture

**FIELD**
- Signal Detectors
  - Local Data Collection Unit
- Field Data Collection Unit
  - Data Server at Master Cabinet
  - DSL Communication

**Database**
- Preprocessed Data
  - Performance Measures

**TMC**
- Direct/Internet Access
  - Traffic Engineers
    - Monitor
    - Diagnosis
    - Fine-tuning
  - Road Travelers
    - Travel Decision

**Internet Access**

**USERS**
SMART-SIGNAL Implementation Sites

• 11 intersections on France Ave. in Bloomington (March 07 – June 09)
• 6 intersections on TH55 in Golden Valley (Feb. 08 – Sept. 09)
• 3 intersections on PCD in Eden Prairie (Current)
• 6 intersections in the City of Pasadena, California (Iteris, Current)
• 14 intersections on TH13 (Fall 2011, Expected)
• 16 intersections on TH55 (Fall 2011, Expected)
Recent Developments

• Expanding System Functionality
  – New algorithms are being developed

• Developing New Data Collection Hardware
  – Mainly for the TS-2 Cabinets

• Developing An Integrated Web Portal
  – www.signal.umn.edu

• Technology Transfer
Algorithms Under Development

• Vehicle classification / speed estimation
  – Both arterial and freeway applications

• Integrated Corridor Management (ICM)
  – Balancing freeway and arterial traffic

• Queue length / travel time prediction
  – Stochasticity of Arterial Traffic Flow

• Fine-tuning signal timing parameters
  – Offsets, Green Splits, “Break Points” for time of day …
Data Collection in TS1 Cabinet
Data Collection in TS2 Cabinet
Hardware Design-Block Diagram
Plug-and-Play Device for TS2 Cabinet
Field Implementation

• Four Simple Steps:
  1. Plug in SDLC Port.
  2. Plug in power adapter.
  3. Plug in Ethernet connection.
  4. Turn on the power.

• To debug in the field:
  1. Connect your laptop with the device using the Serial Port.
  2. Log into the field device using the Linux system.
http://signal.umn.edu
Technology Transfer

- Licensed to Iteris, Inc. for technology demonstration in the City of Pasadena
- In discussion with the University’s OTC for a start-up company to commercialize the technology
Lessons Learned from SMART-SIGNAL

- Although traffic is traditionally modeled as “continuous flow”, traffic, after all, is discrete.
- Measuring traffic flow parameters using the data collected at the individual vehicle level
- Don’t aggregate data before useful information being derived
- Technological advances support such data collection at affordable prices
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