Cell Phones as Traffic Probes and WZ Planning and Operations

ITS in Work Zones Workshop

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Contents

- ☐ Cell Probes in Context
- ☐ Is this Magic, or What?
- ☐ What Can They Do?
- ☐ Some Work Zone Applications

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Cell Probe Technology

☐ Part of general trend from using only fixed sensors toward vehicle-based information

☐ Reflects frustration with high costs and slow pace of deployment for traditional sensors

☐ More than just ITS - a broad management and planning tool (see NCHRP report)

☐ Characteristics:

  ■ Low cost

  ■ full regional coverage

  ■ performance-based, and

 ■ self sufficient business model

Cell Probe Technology

- ☐ Practical success requires more than cell phones
- ☐ Cell phone movement based on cell location and "hand-offs" from one cell to another – information the wireless carrier already has
- ☐ Pattern recognition techniques filter out data from those not on the highway
- ☐ Then traffic algorithms generate travel times and speeds on roadway links
- ☐ Cell phones need to be turned on, but not necessarily in use
- ☐ Full regional systems in place in Baltimore, Antwerp, and Tel Aviv
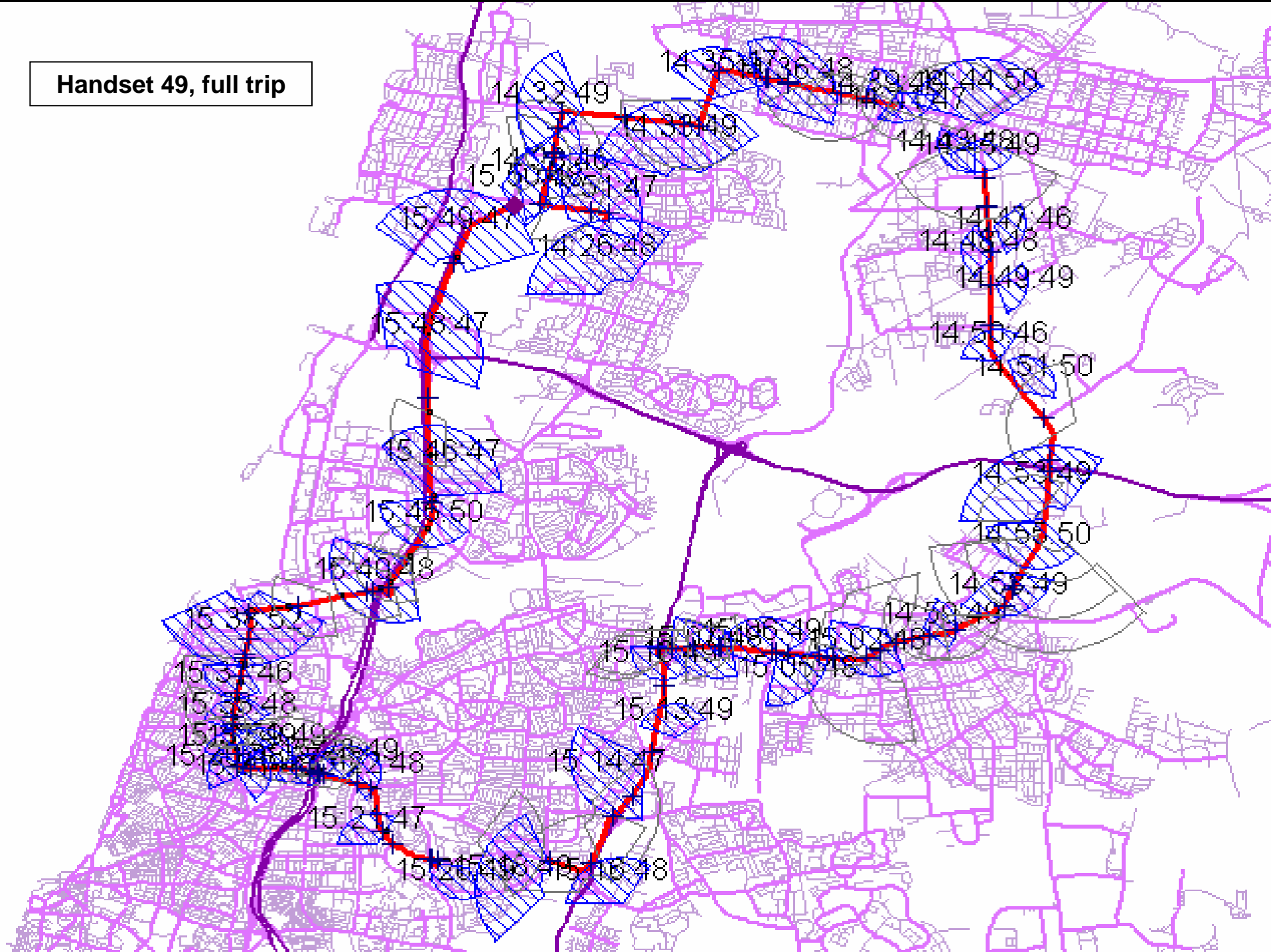 - ■ St. Louis, Kansas City, and rest of Missouri next – we hope

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Cell Probe Technology
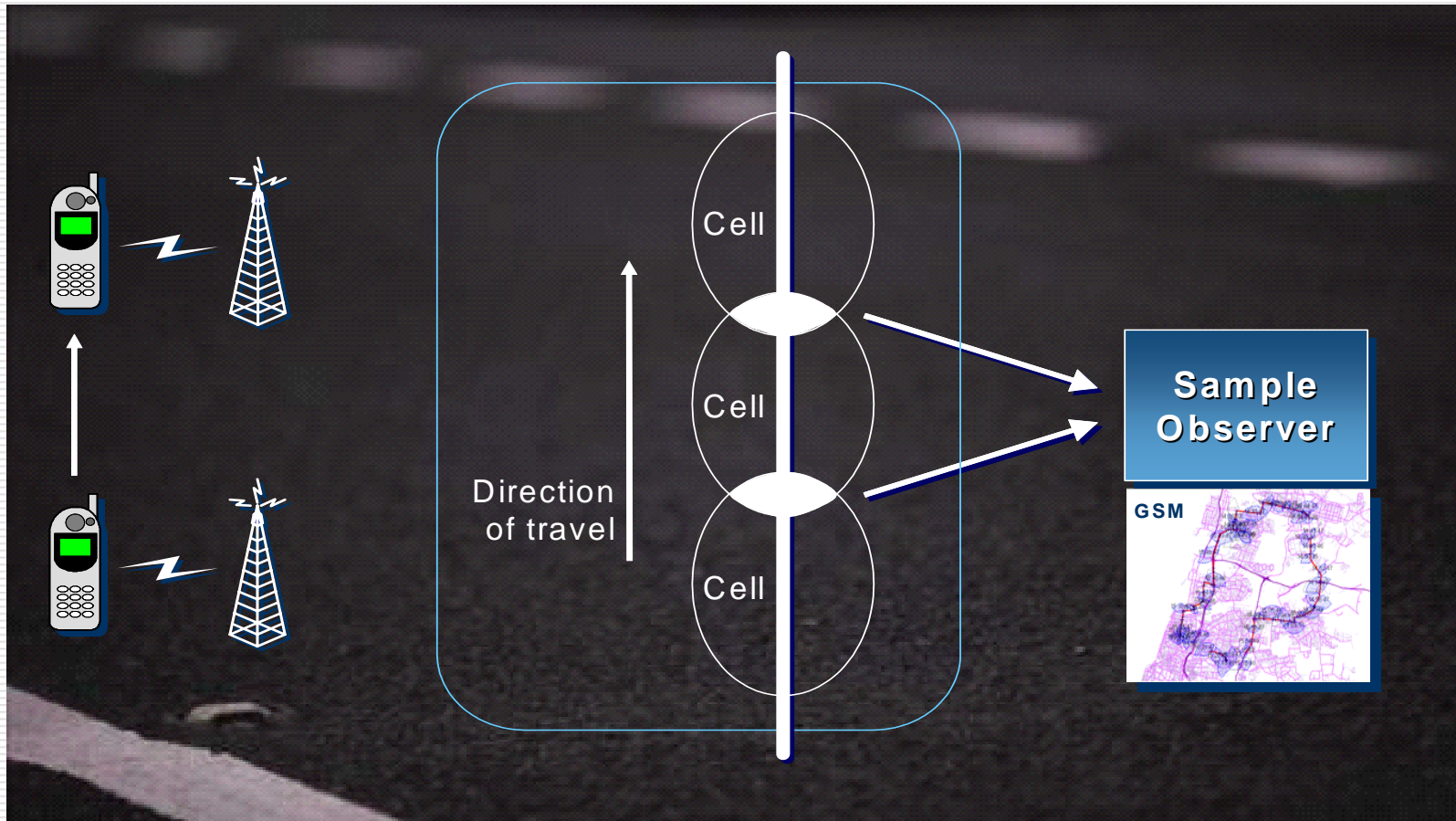
Cell Probe Privacy
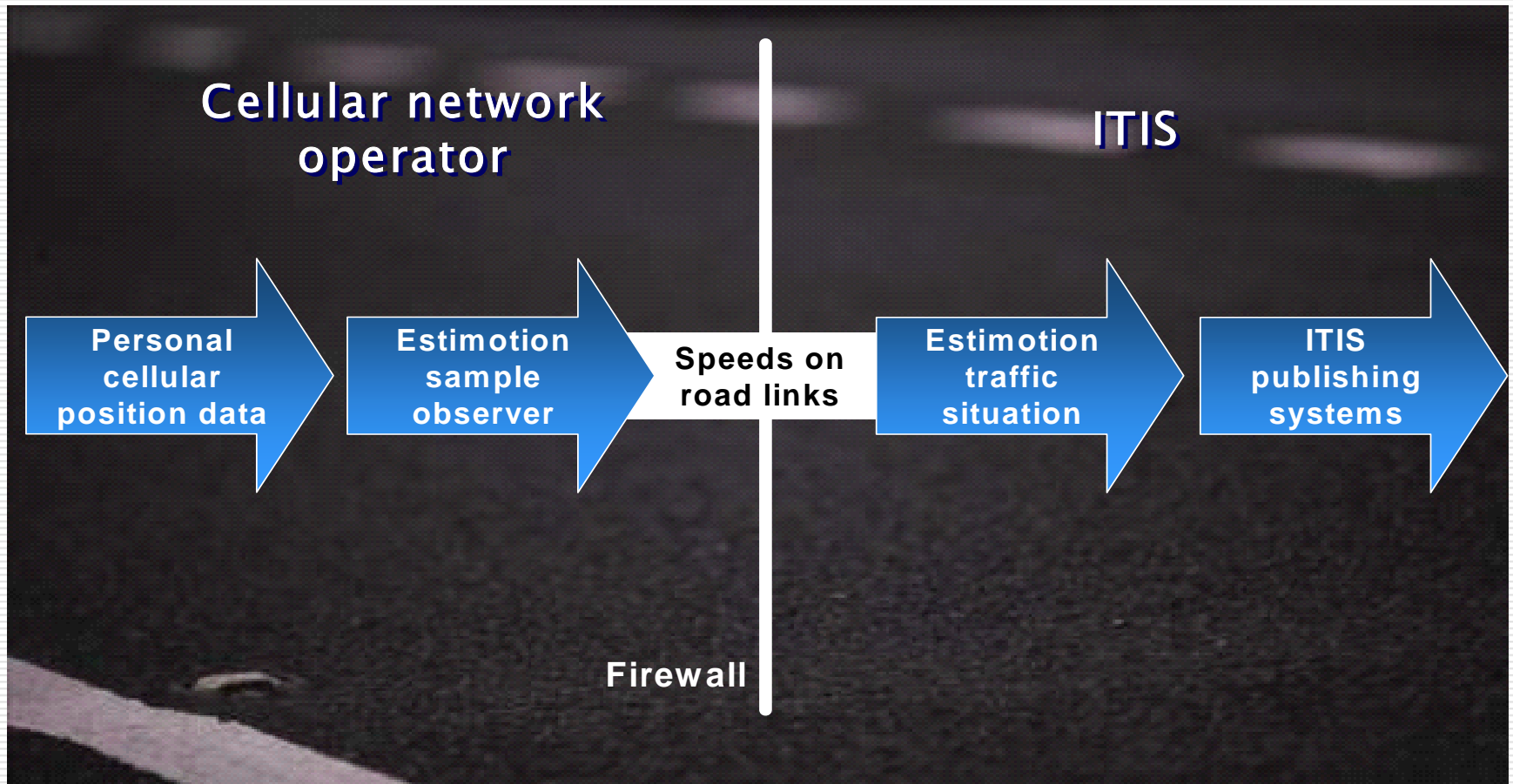
Handset 49, full trip

Baltimore MMTIS

- Provides first full regional deployment of commercial-quality cellular traffic probes in North America
- Mutually profitable public-private partnership
  - Test commercial markets during project
  - Integrate with existing public data – including fixed sensors, transit and 911
  - Encourage public applications beyond traditional ITS
- Contract signed September 2004; data flow to Maryland DOT began April 2005
- Covers 600 square miles and more than 1,000 miles of expressways and arterials

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Baltimore MMTIS – Private Firms

- ☐ Delcan-NET
  - ■ Transportation and technology consultants
  - ■ Fifty plus years in business
  - ■ Profitable every year; staff = 500 plus
- ☐ ITIS Holdings
  - ■ Leader in traffic probes; staff = 100
  - ■ Commercial customers – 16 automobile firms, for-profit 511
  - ■ Profitable!
  - ■ Publicly traded on London exchange
- ☐ National cellular firms

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MARYLAND DOT CAMERAS SHOW ACCURACY OF TRAFFIC INFORMATION BEING CAPTURED USING CELL PROBES
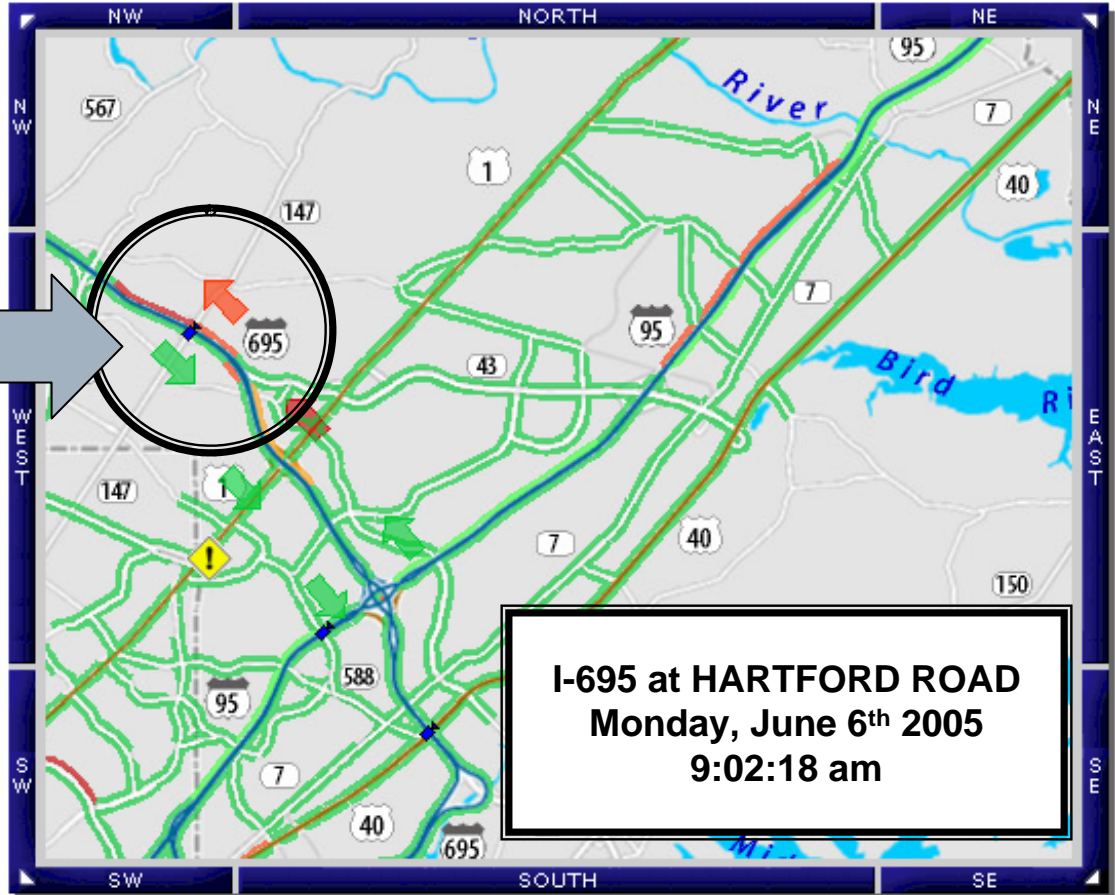
I-695 at HARTFORD ROAD
Monday, June 6th 2005
9:02:18 am

CELL PROBES ACCURATELY UPDATE
TRAFFIC CONDITIONS AS CHANGES OCCUR
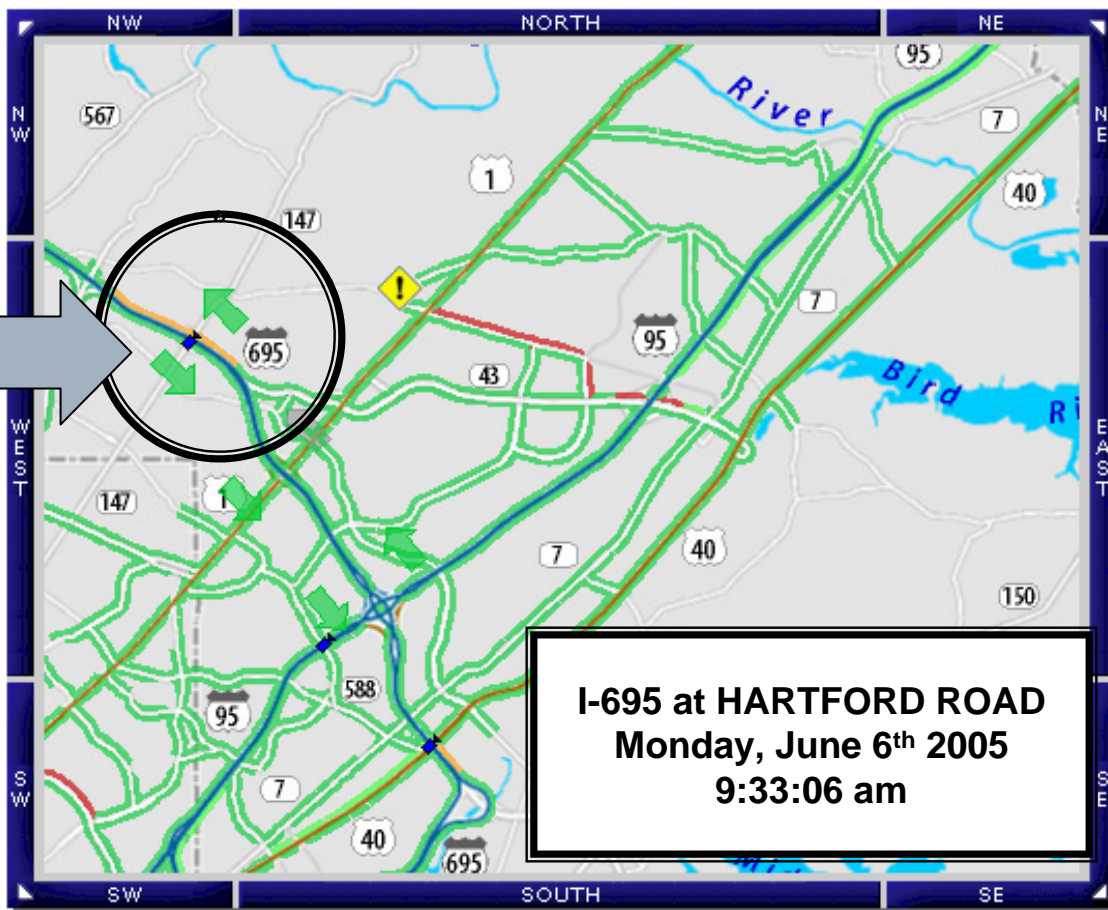
Travel time residuals relative to floating car data (n=21)

Legend:
- × Loop detectors
- ○ Cellular

X-axis: Floating-car travel time (min)
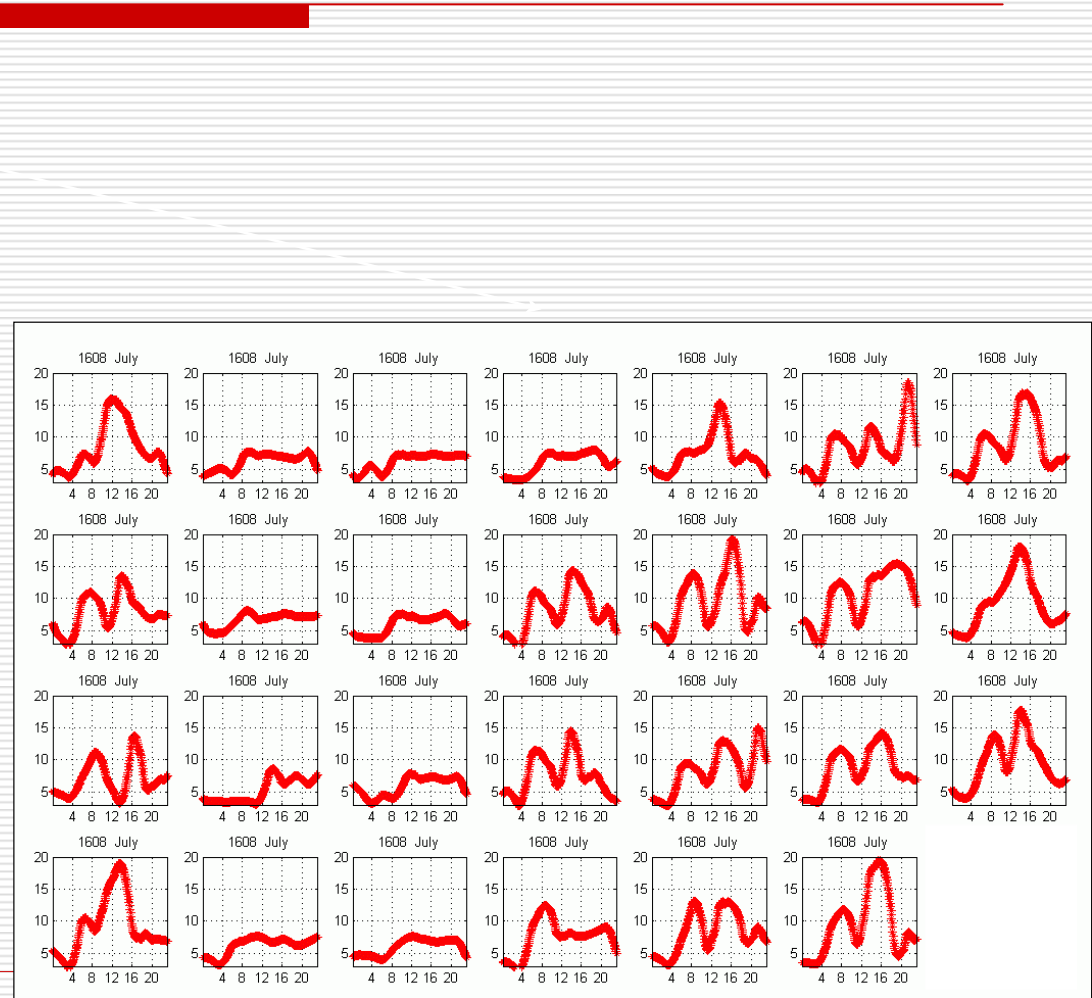Y-axis: Difference in travel time (min)
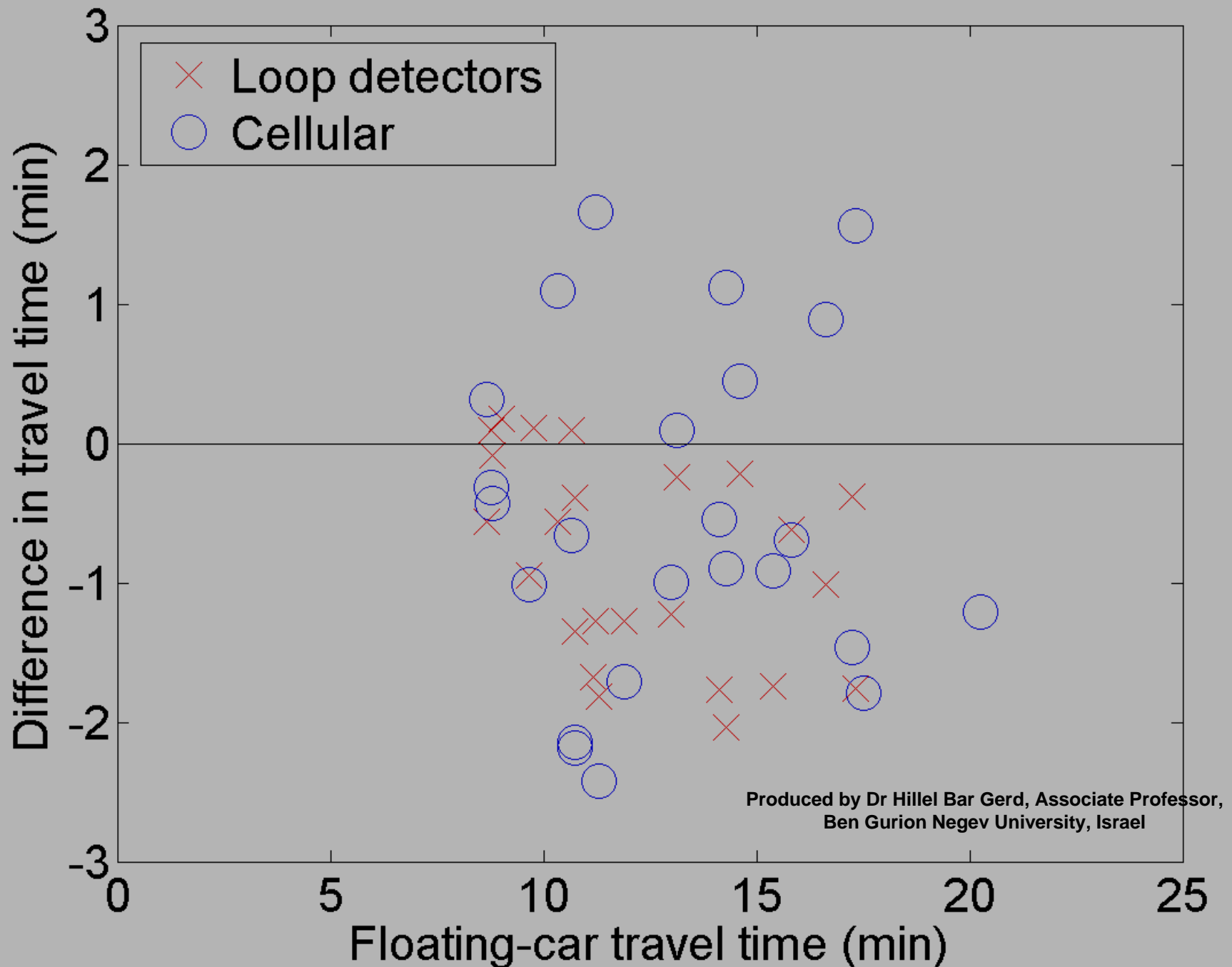
Produced by Dr Hillel Bar Gerd, Associate Professor,
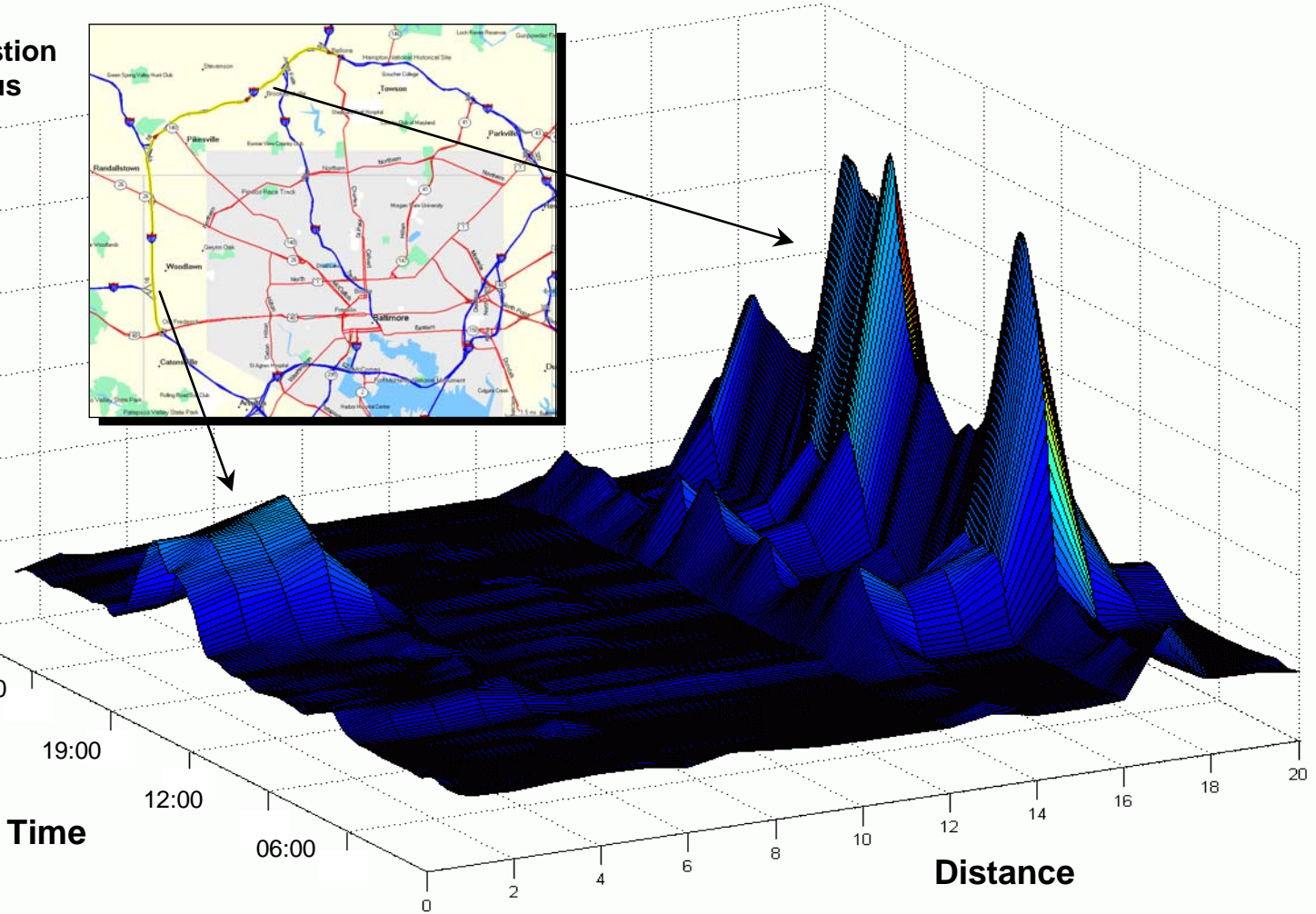Ben Gurion Negev University, Israel

Baltimore Comparison with RTMS Data

Legend: ITIS CFVD™ data — RTMS data
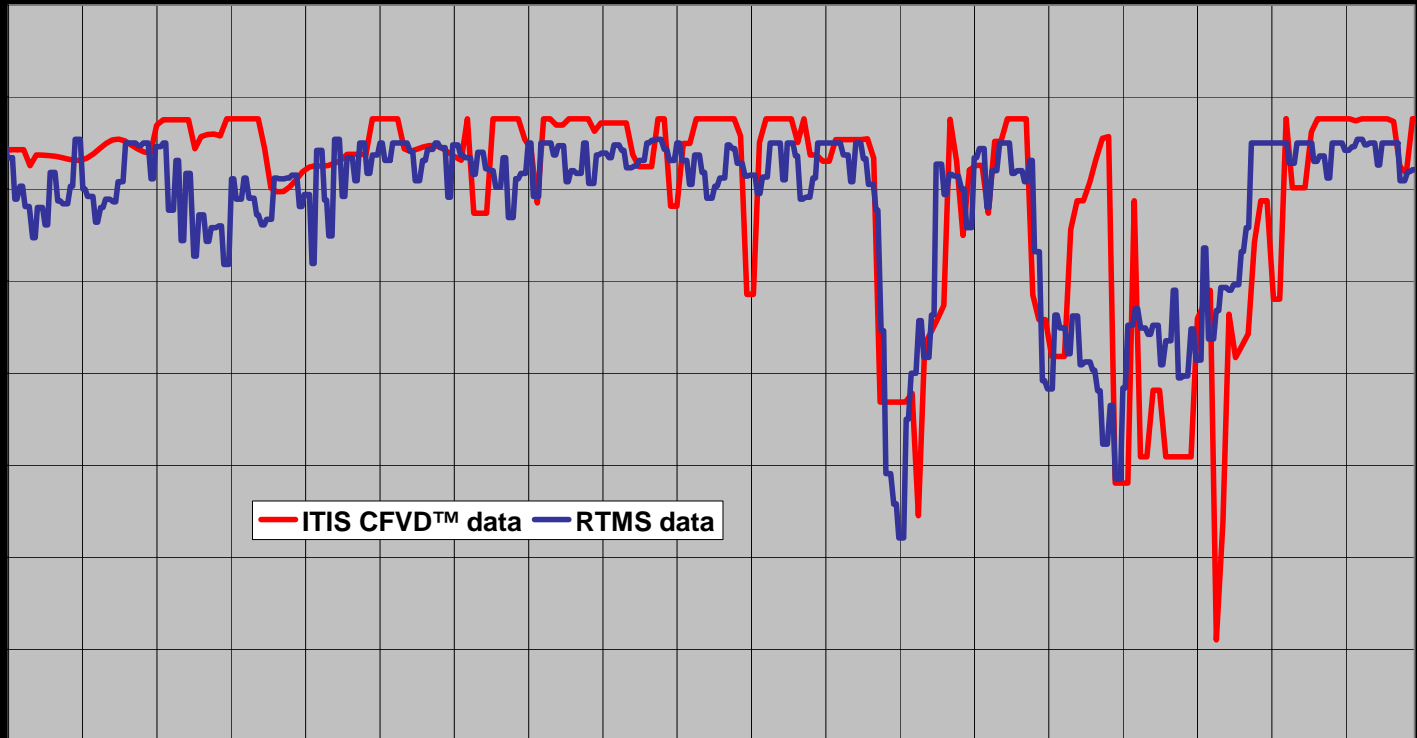
Performance data I-695 – July 2005

Baltimore I-695 Weekday Patterns

Baltimore I-695 Saturday Patterns
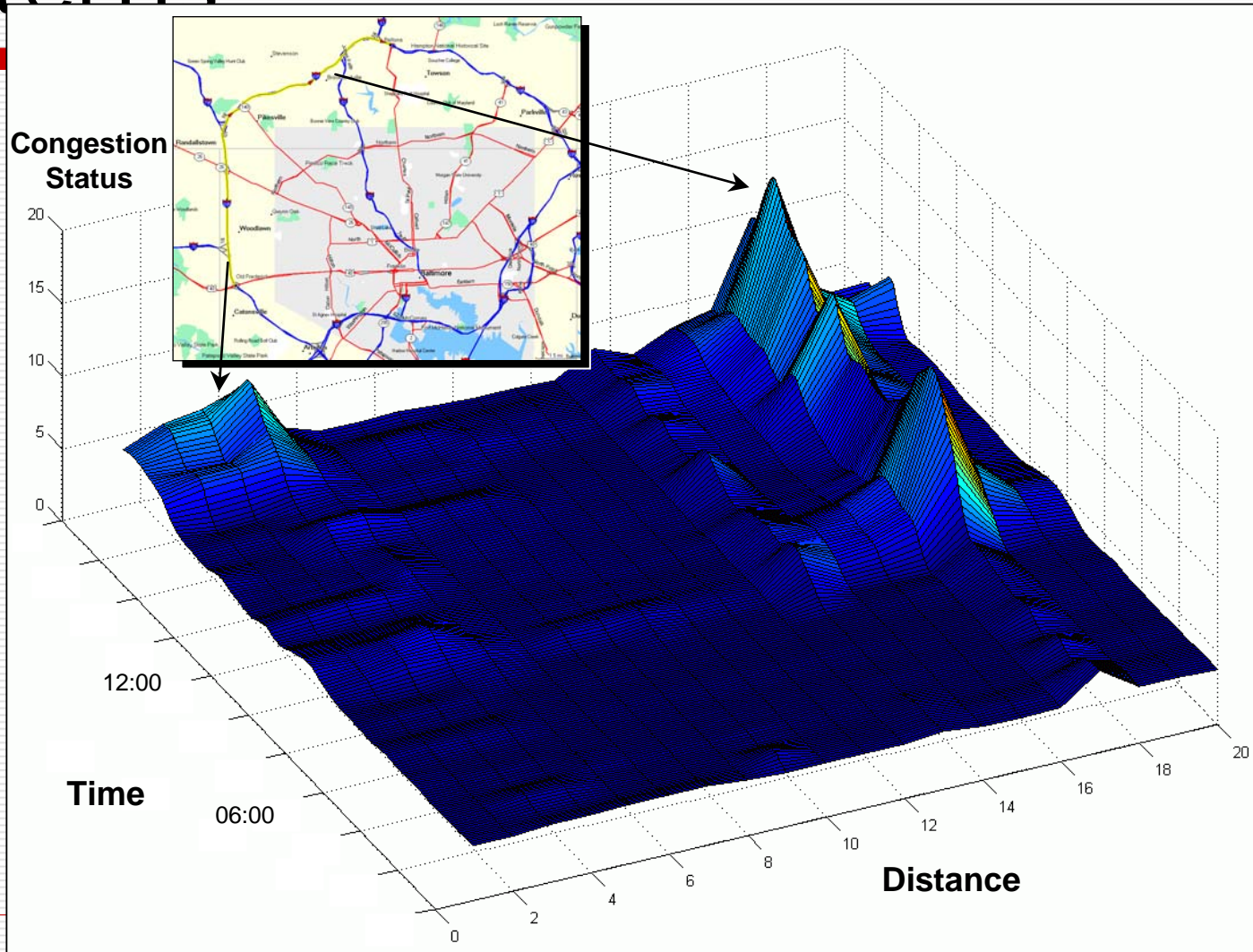
Baltimore I-695 Route Travel Time

Journey Time (sec)

1600
1400
1200
1000
800
600

18:00

08:00

July

June

May

0

0

Time

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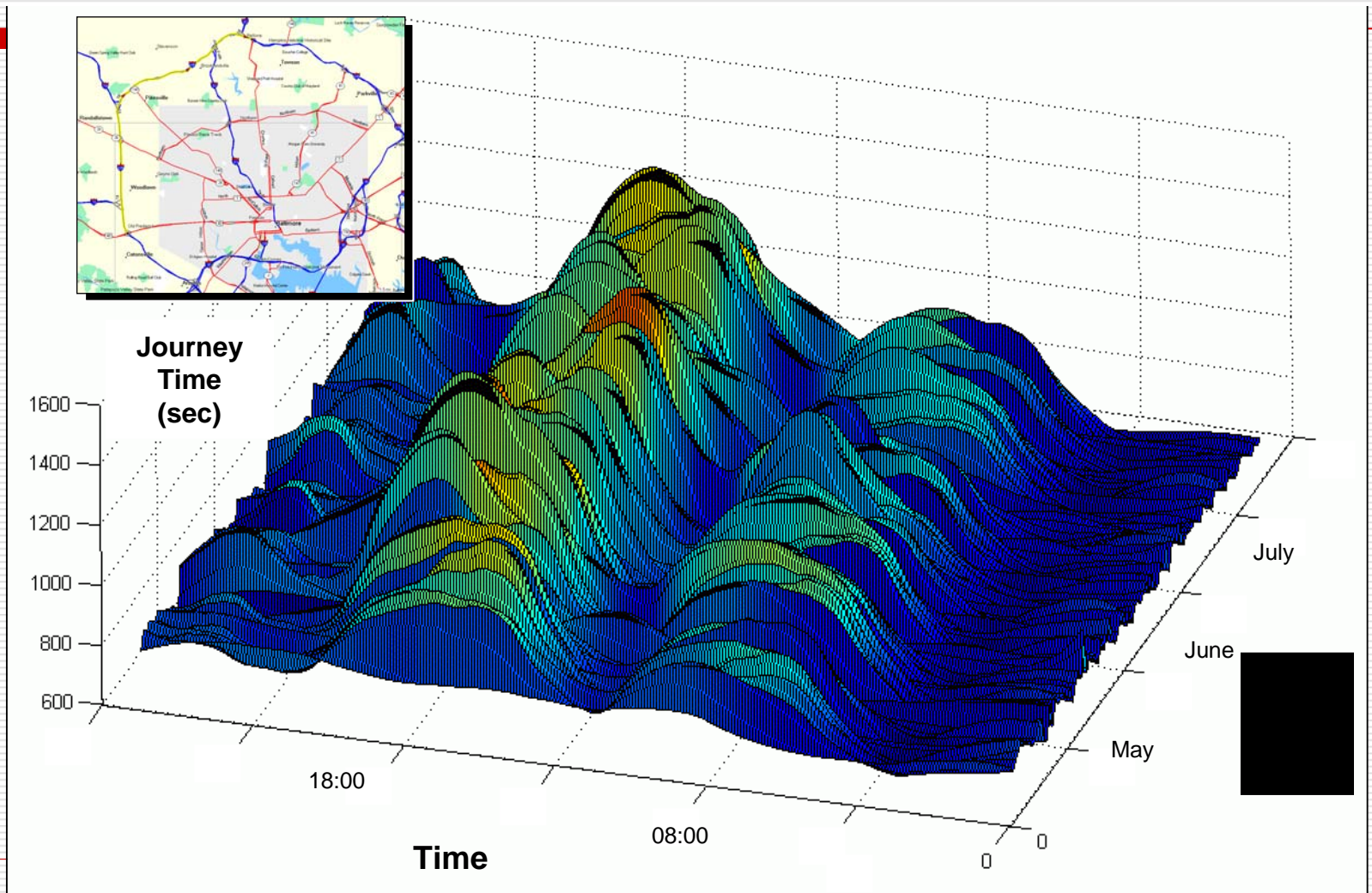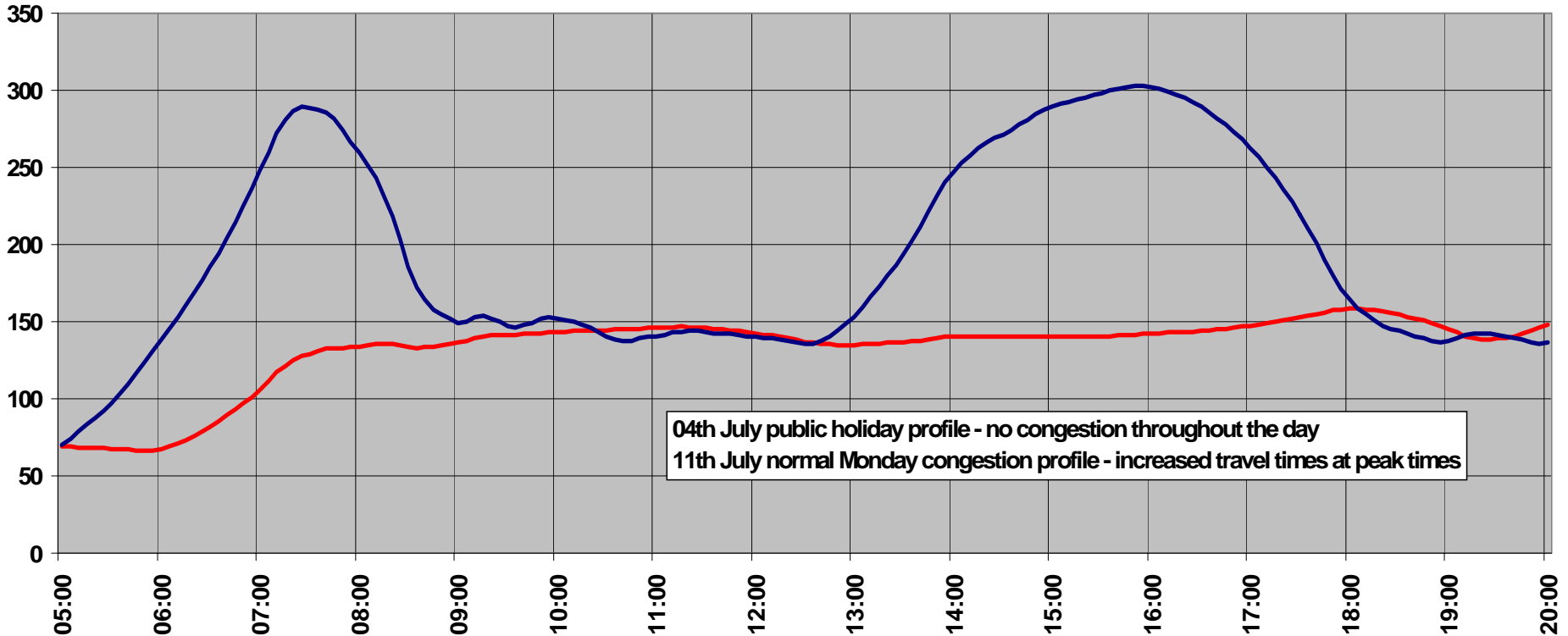
Travel time comparisons over a common road section
Road section of 1.225 miles on I-695 Baltimore Beltway - junction 22 to 23
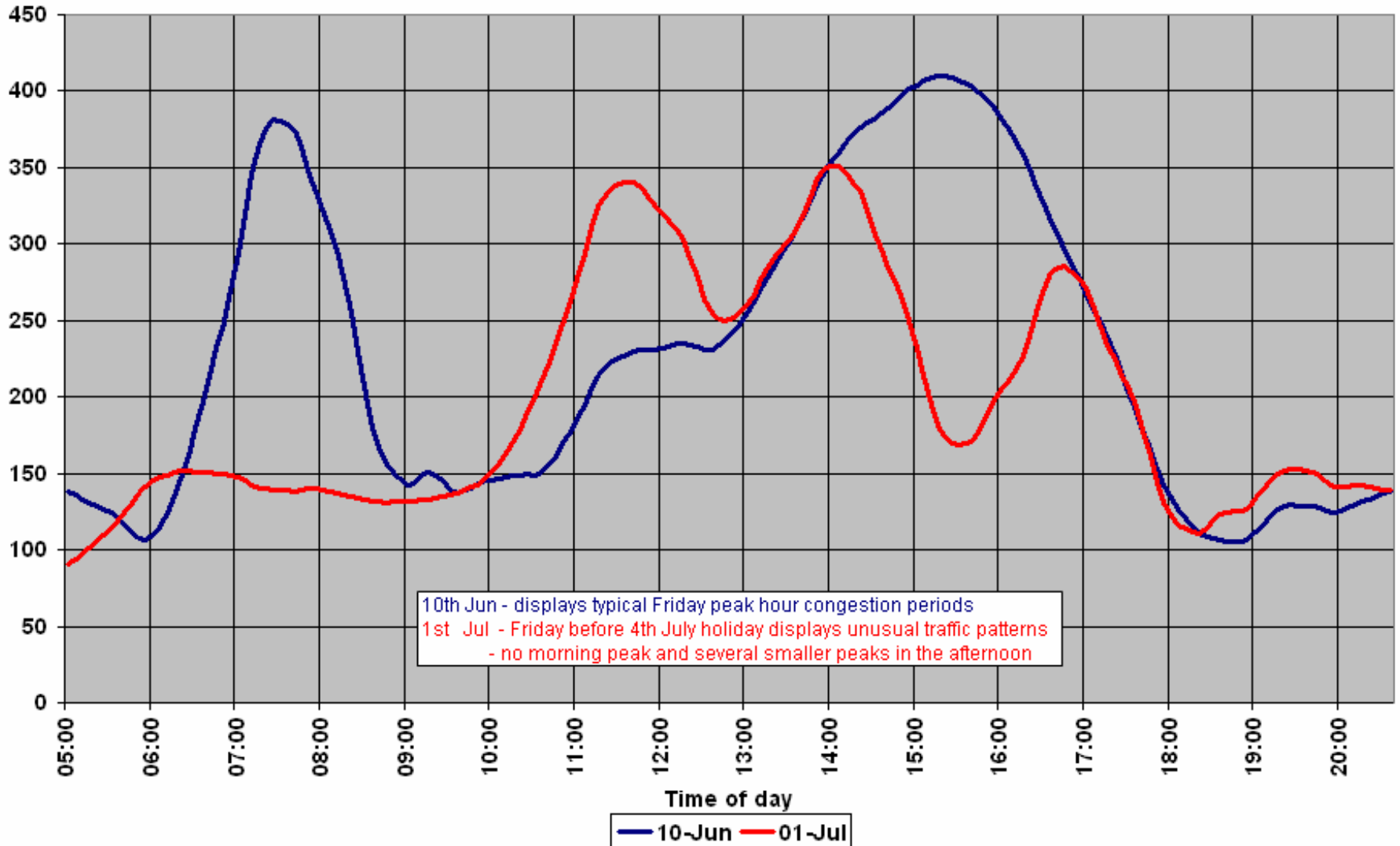
Travel time (seconds)

04th July public holiday profile - no congestion throughout the day
11th July normal Monday congestion profile - increased travel times at peak times

Time of day

04-Jul 11-Jul

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Travel time comparisons on section of the I-695 Baltimore Beltway between junction 22 and junction 23

Travel time (seconds)

10th Jun - displays typical Friday peak hour congestion periods
1st Jul - Friday before 4th July holiday displays unusual traffic patterns
- no morning peak and several smaller peaks in the afternoon

Time of day

— 10-Jun — 01-Jul

Applications

- ☐ General Planning and Management
  - ■ Regional congestion management
  - ■ Rapid evaluation of alternatives
- ☐ Performance Measurement
  - ■ System performance in near real time
  - ■ Reliability measures (travel time index, planning time index, etc.)
- ☐ Travel Demand and Air Quality Modeling
- ☐ Safety
- ☐ Communication – with traveling public etc.
- ☐ Freight Operations

Work Zone Examples

- ❑ Full regional coverage supports most work zone locations
  - ◼ Also shares costs with other applications
- ❑ Travel Time
  - ◼ Through work zone
  - ◼ Covers alternative routes
    - ❑ Major and minor arterials
  - ◼ Current, Predicted, and versus Historical
- ❑ Support for
  - ◼ Variable speed
  - ◼ Alternative routes
  - ◼ Evaluation – near real time
  - ◼ Contractor incentives