Traffic Probes: Open for Business

2006 NRITS Conference

Big Sky, Montana

Delcan

TRANSPORTATION • INFORMATION TECHNOLOGY • WATER

Outline

- Background
- Technology
- Data
- Applications
- Conclusions

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Mobility Problem

- **The sustainment of a regional economy and meeting the needs of the motoring public demand a transportation system with "No Surprises"**

- **Traditional approaches will not solve the problem**
  - Fixed infrastructure
  - Incomplete data collection

- **Real-time traffic information on "all roads, all the time" will help:**
  - Regional planning
  - Measuring transportation system performance
  - Incident management
  - Evacuation planning and execution
  - Recovery from major disasters

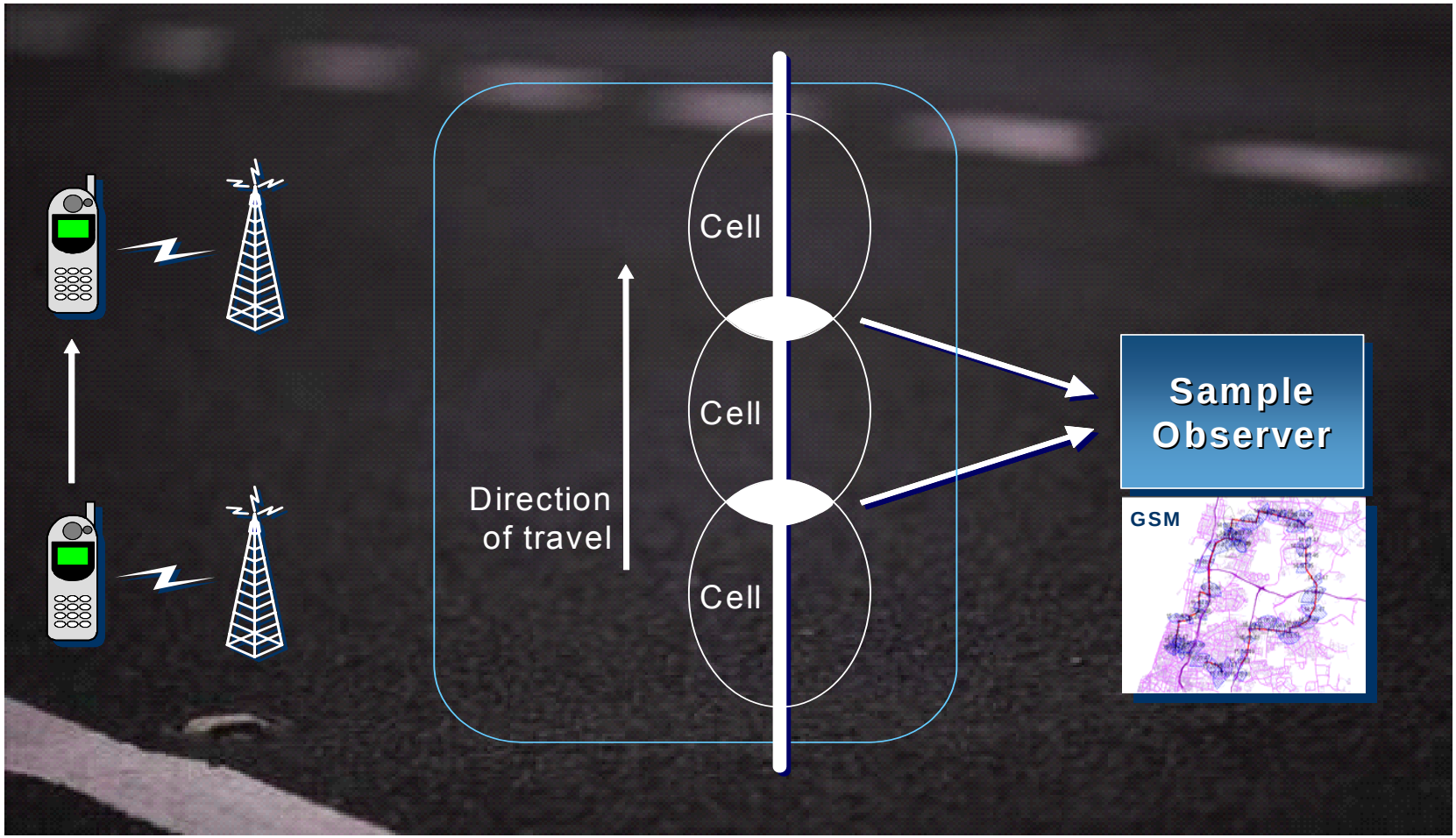
Traffic Probe Overview

- **Part of two general trends**
  - Away from fixed sensors and toward vehicle-based information (pre-cursor to VII)
  - Toward public purchase of data and data services ("application service provider" model)
- **Reflects frustration with high cost and slow pace of deployment for traditional sensors**
- **More than just ITS - a broad transportation management and planning tool**
- **Characteristics**:
  - Relatively low cost
  - Full regional coverage
  - Performance-based, and
  - Potentially self-sufficient business model – supports true PPP

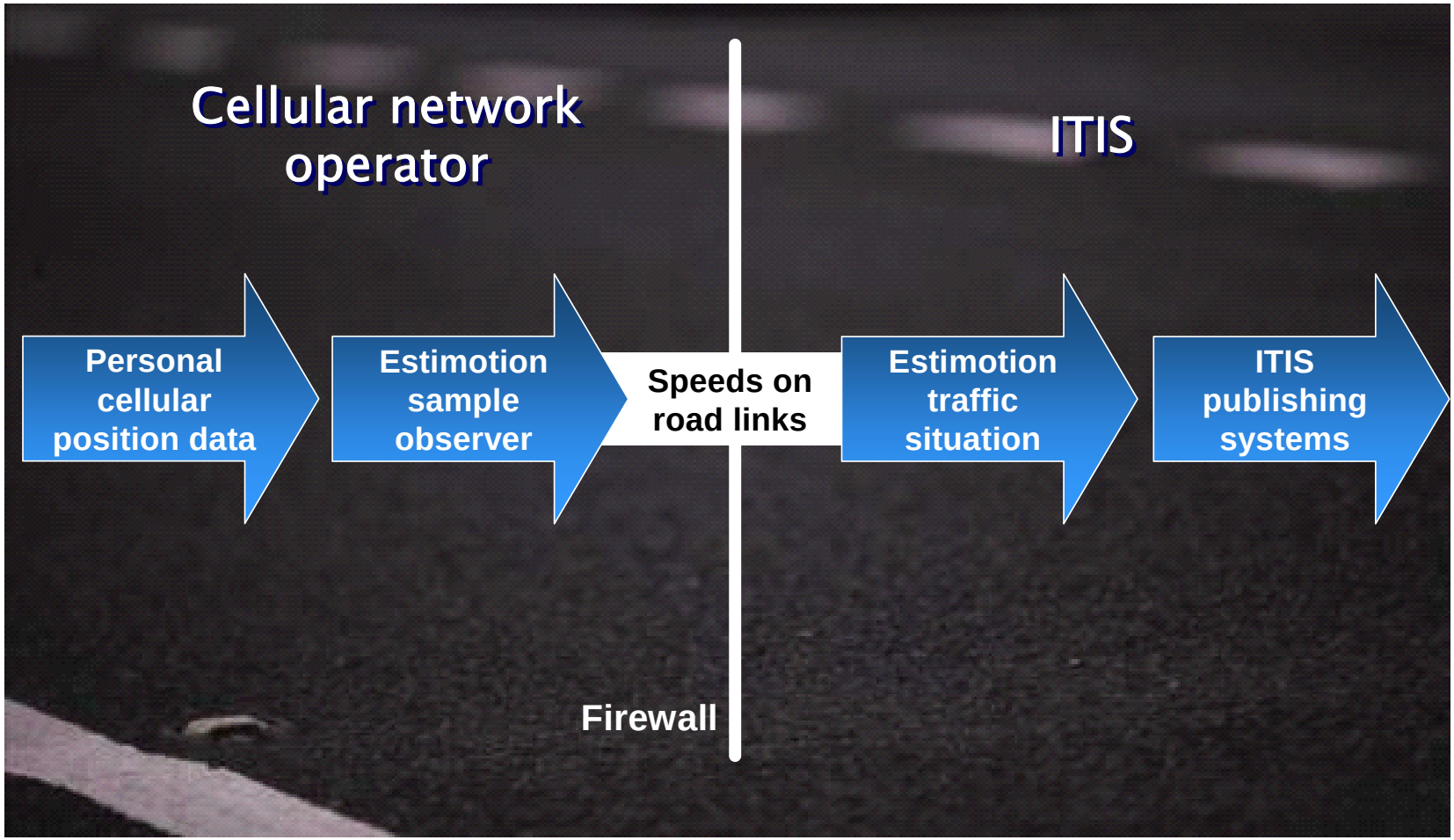
Traffic Probe Technology

- **Practical success requires more than cell phones**
  - Underlying traffic model
  - Integrate all sources of data – fleet GPS, fixed sensors, 911, transit
- **Cell phone movement based on cell location and "hand-offs" from one cell to another**
- **Pattern recognition techniques filter out data from those not on the highway**
- **Then traffic algorithms generate travel times and speeds on individual roadway links**
- **Experience – more than 20,000 miles in place on three continents**
  - Full regional systems in Baltimore, Antwerp, and Tel Aviv

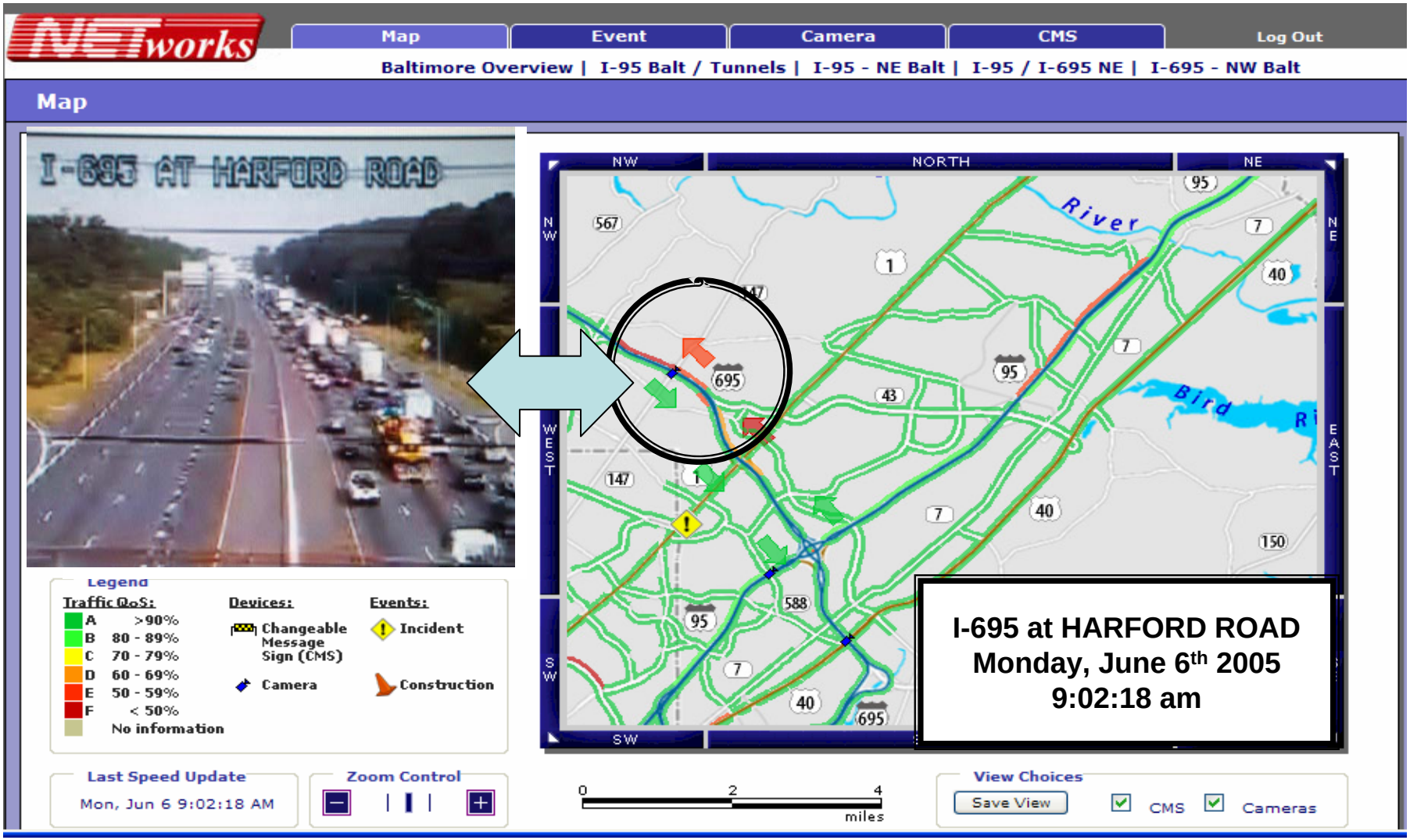
Traffic Probe Technology



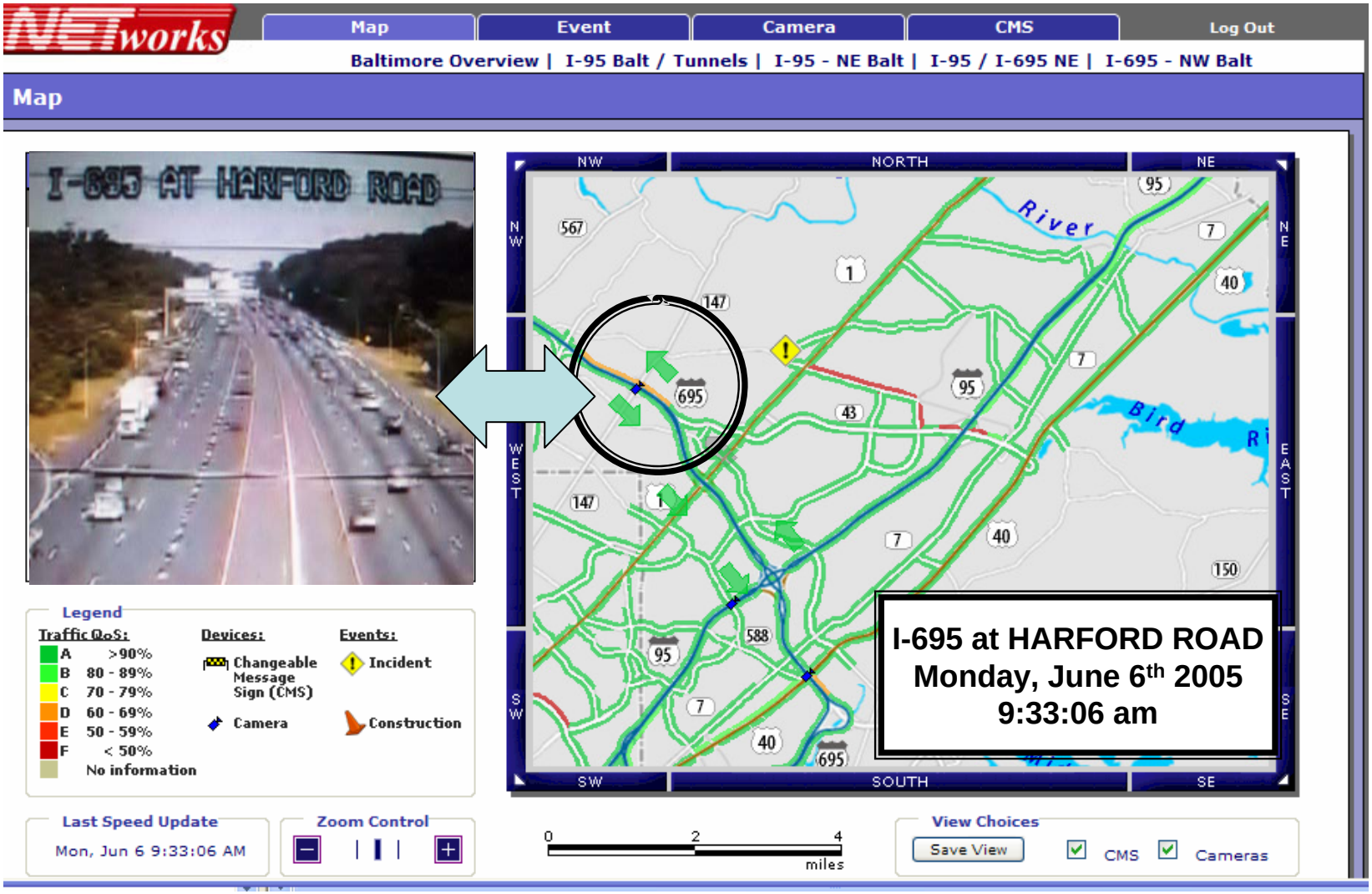
Traffic Probe Privacy



MARYLAND DOT CAMERAS/SENSORS SHOW ACCURACY OF TRAFFIC INFORMATION CAPTURED USING CELL PROBES



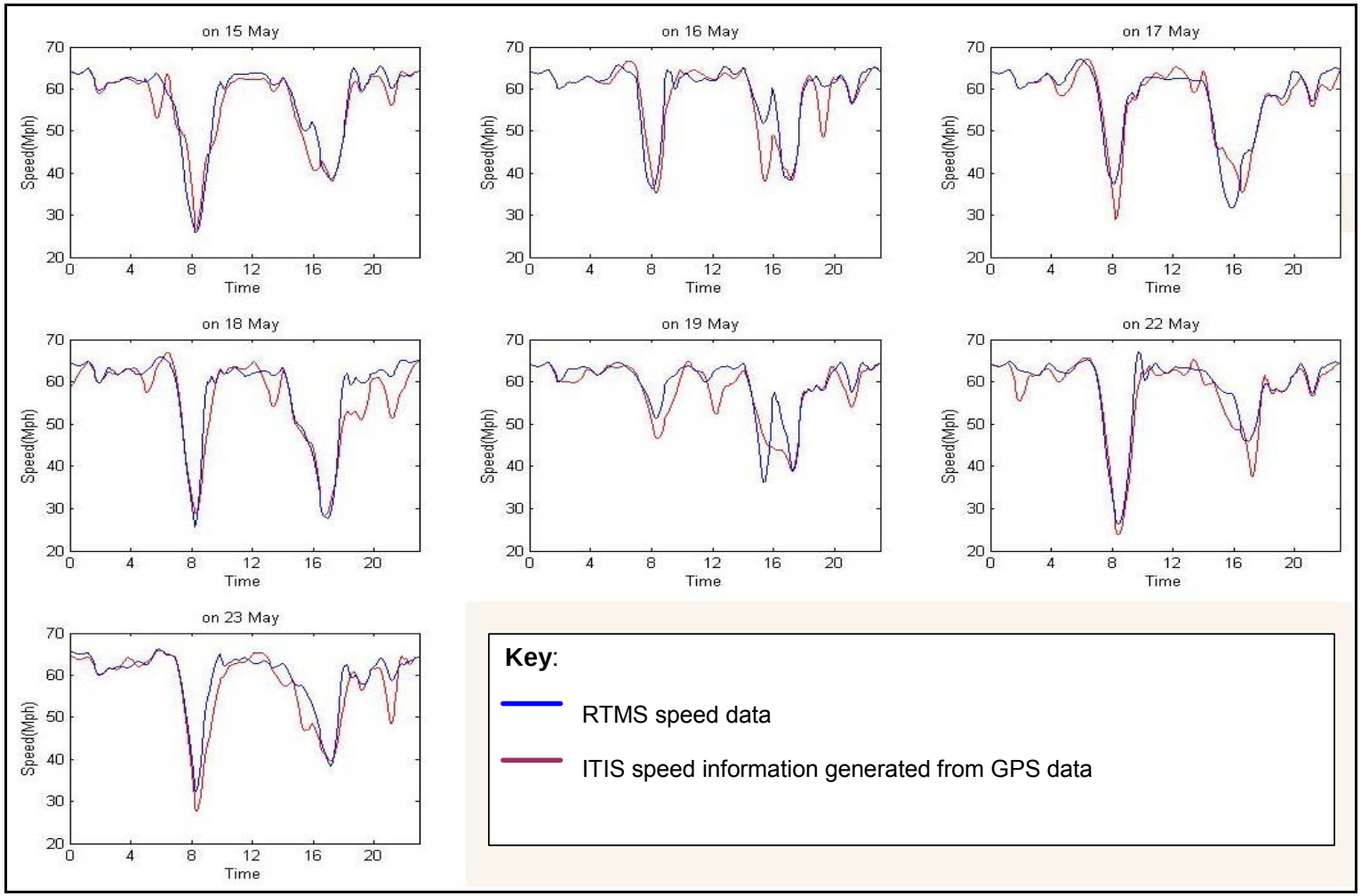
CELL PROBES UPDATE TRAFFIC CONDITIONS ON BELTWAY AND ARTERIALS



Validation Test Drives Summary

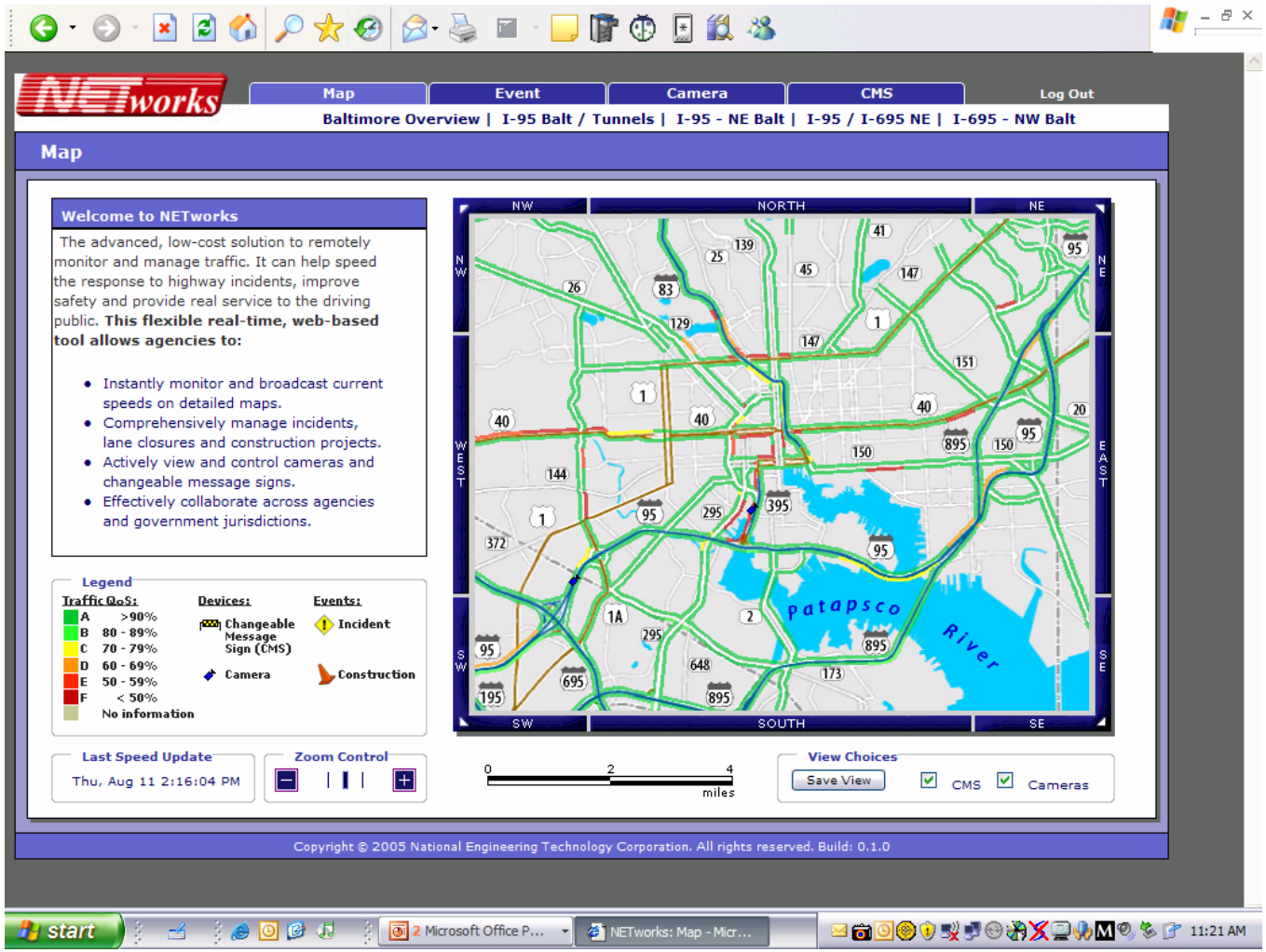
- **Travel time comparisons**:
- **GPS drives in Jan 2006 provide 'Ground Truth'**
  - Average difference under 10% (typical error for GPS test drives themselves)
- **Speed Band comparisons**:
  - 83% of links matched exactly the speed category from the test vehicle
  - Remaining 17% within 5 mph of ground truth speed category (acceptable fuzzy match)
- **Comparison with RTMS speed sensors and loops**
  - Good comparison against speed records

Traffic Probes Compared with RTMS



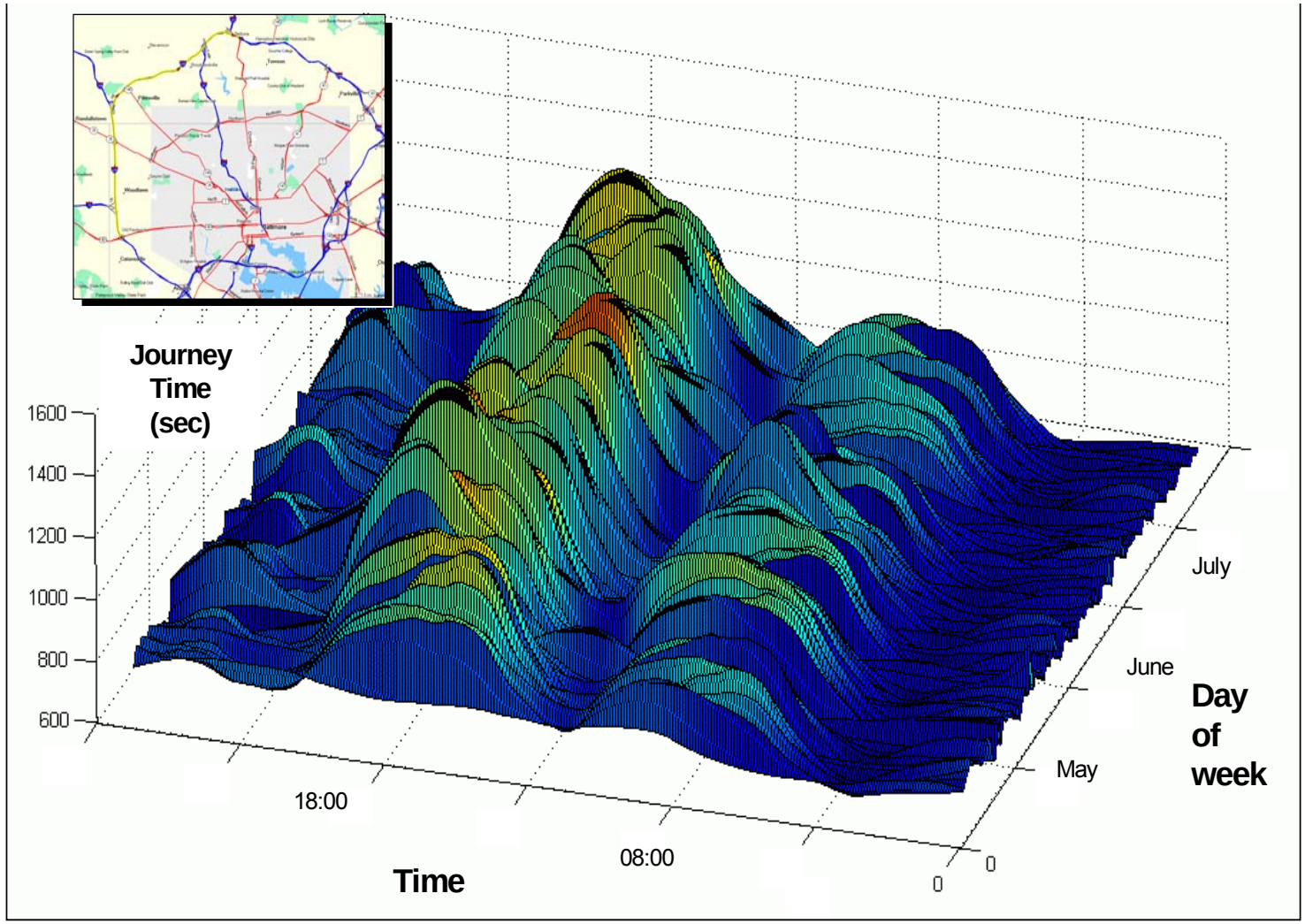
GPS data compared with RTMS data at the Stephenson Road location on Baltimore Beltway – May 2006

http://demo2.atlanta.nateng.com:9910/networks-servlets

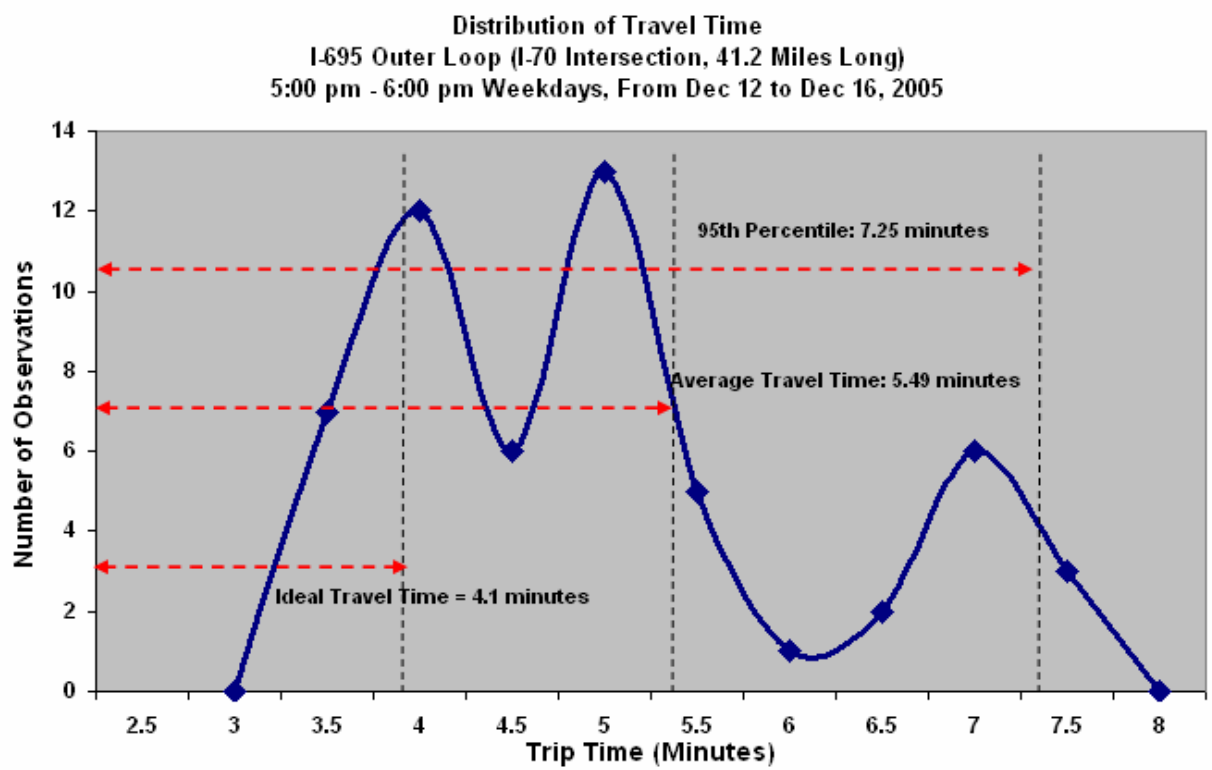


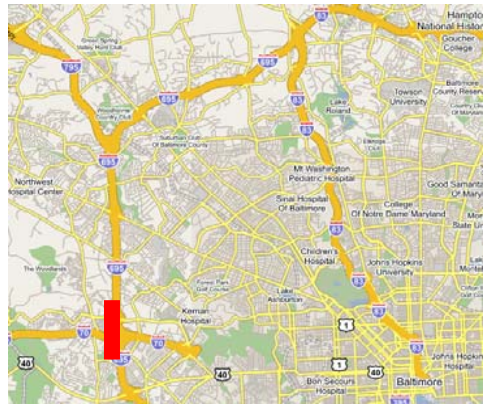
Baltimore Cellular Probe Demo

Baltimore I-695 Route Travel Time



Reliability Measurements for Road Segments





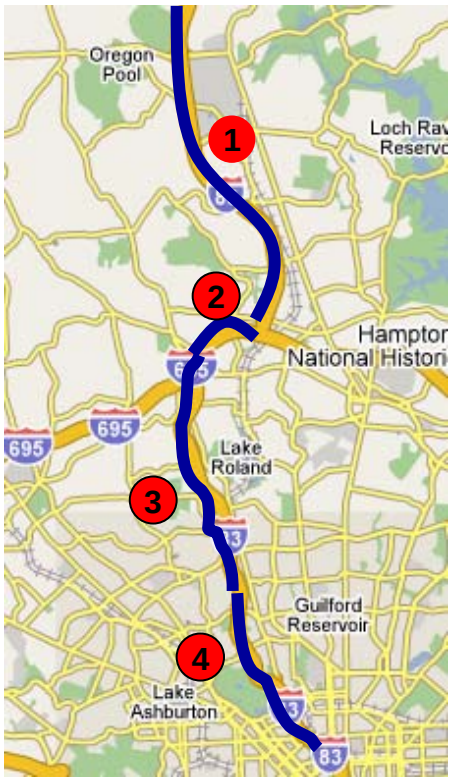
Measures	MMTIS	TTI Report *
Planning Time	7.25 Minutes	Not Available
Planning Time Index	1.77	Not Available
Buffer Index	32%	Not Available
Travel Time Index	1.34	1.37 **

*** Texas Transportation Institute Annual Mobility Report**
**** For the entire Baltimore region, Year 2003**

Data can assess any group of road segments over any time interval

January 2006 Morning Commute to Downtown on I-83 (7:30am – 9:00am)

Corridor Total Length = 20.31 miles
Corridor Free Flow Time = 22.16 minutes



Segment Measures and Analysis

Segment	Characteristics	Length (mile)	Speed Limit Travel Time (minute)	Weekday Average Travel Time					Daily Average Travel Time	Daily Travel Time Index
				Mon	Tue	Wed	Thu	Fri		
I-83 (Shawn Rd to I-695)	Suburb Freeway	8.3	9.05	8.43	9.01	9.12	8.49	8.58	8.73	96.42%
I-695	Freeway Intersection	2.81	3.07	3.19	3.23	3.30	3.18	3.15	3.21	104.72%
I-83 (I-695 to Cold Spring Rd)	Suburb Freeway	4.43	4.83	6.27	6.83	7.26	7.18	6.45	6.76	139.88%
I-83 (Cold Spring Rd to Fayette Rd)	Urban Freeway	4.77	5.20	6.45	7.06	7.20	7.73	7.44	7.12	136.83%

Key Measures	January 2006						
	Mon	Tue	Wed	Thu	Fri	Month Average	Bad Weather Days*
Average Travel Time	24.31	26.11	26.84	26.52	25.59	25.81	27.10
Travel Time Index	110%	118%	121%	120%	115%	116%	1.25
95 Percentile Travel Time	35.00	34.50	36.00	33.50	31.00	34.25	38.00
Buffer Index	0.44	0.32	0.34	0.26	0.21	0.33	0.40

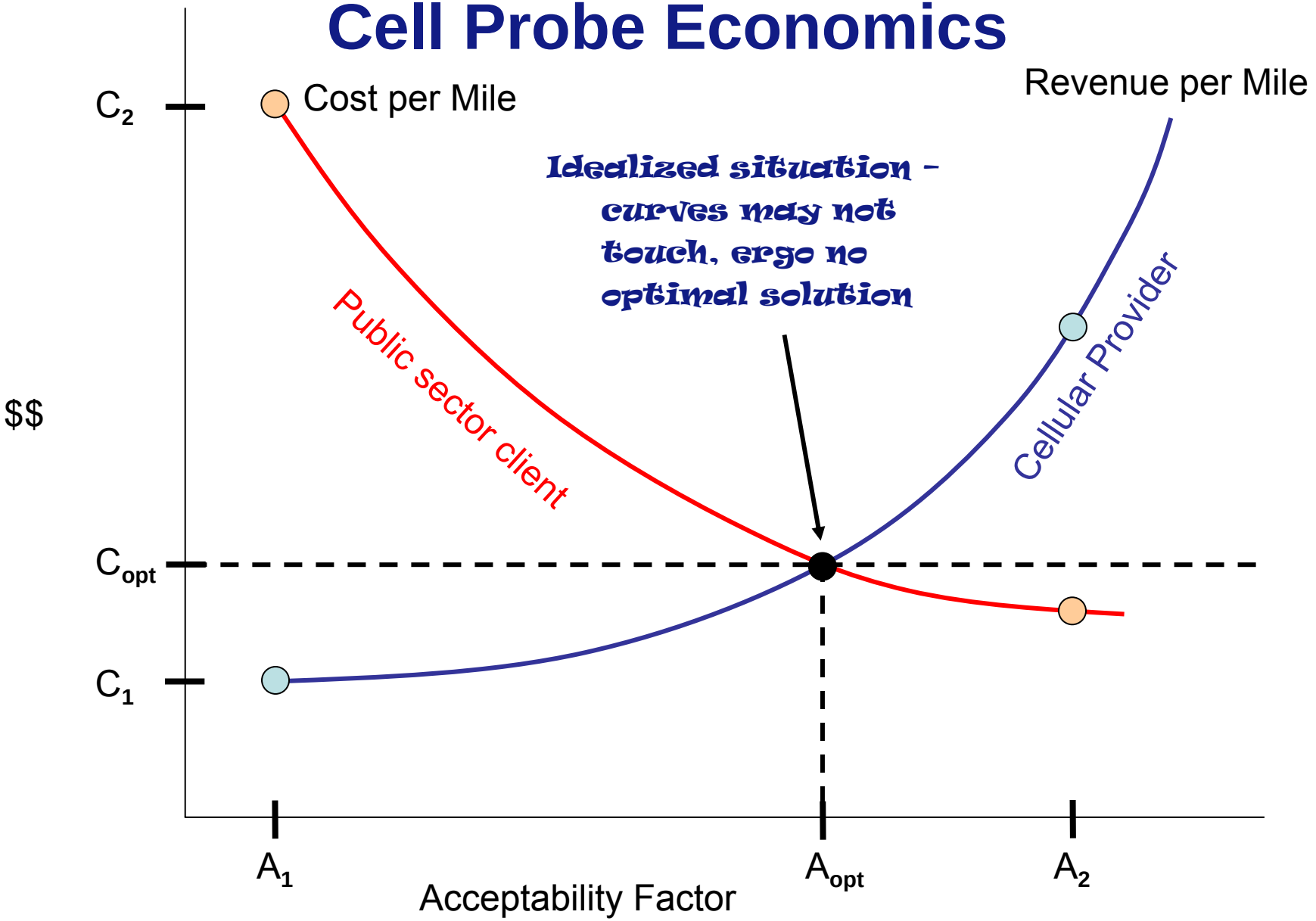
Nature of Data

- **Square-mile pricing model**
  - All roads, all the time
  - Adaptable to changing conditions – major events, hurricanes
  - Pricing can be converted to linear per-mile basis
- **Travel times and speeds on individual segments (links)**
  - A few blocks in downtown to a mile or so in suburbs.
- **Provides direct measure of system performance**
- **Traffic volume can be estimated**
- **Origin-Destination data – development in process**

Business Model

- **Public sector important first customer, but only one of several**
  - Auto OEMs, “new” media (internet and wireless) ; “old” media (radio and TV); fleets
- **Believe in true PPP**
  - $3.5 million in hard and soft dollars for Baltimore – versus $1.9 million public funds
  - Provide full non-federal match – zero Maryland DOT dollars
- **Other sources of funds (based on size of project):**
  - Revenue share
  - Cost savings (over fixed infrastructure deployments)
- **Commercial 511**

Cell Probe Economics



Traffic Probe Applications – Overview

Quoted from Maryland SHA Administrator Neil Pedersen's presentation "Use of Traffic Probe Data for Transportation Planning" at 2006 TRB Annual Meeting:

- *"The nature of issues and decisions in transportation planning has changed*
- *Many of the issues and analyses require better speed and speed variability data*
- *Cell phone probe data open up a "whole new world" of potential for analyses and analysis tools to aid in the types of decisions planners are being asked to support today and into the future"*

- ***Applications***
- ***Speed and reliability data collection and reporting***
- ***Historical trend analysis***
- ***Model development, calibration, validation***
- ***Air quality model inputs***
- ***Safety analyses***
- ***ITS/operations planning***
- ***Freight planning***
- ***Economic analyses***
- ***Customer service planning***
- ***Investment decision support***

Other Performance Measures with Traffic Probe Data

Geographic Coverage	Accessibility	Mobility/Reliability	Safety	Economic Development
Roadway Segment	► Average travel time from A to B ► Average speed at access, egress, and transfer points including inter-modal facilities	► Average speed ► Average time ► Travel time index ► % of congested travel ► Total delay ► Buffer index ► Planning time index ► During of congestion	► Response time to accidents ► Traffic recover time	► Capital improvement plan ► Investment priority
Corridor/ Network System	► Modal split by route ► Transfer time b/w modes ► Corridor mobility index	► Average daily traffic volume ► Maximum service flow rate ► Volume-to-capacity ratio ► Level of service: % of system congested	► Accident risk index by route ► Number of high accident locations ► Work zone accident rate	► VMT Forecast ► % of jobs within 10 and 30 minutes
Regional	► Modal split by region	► VMT ► Vehicle miles of delay ► Average commute hours ► Average commute distance ► Lost time due to congestion	► Accident risk index by region ► Number of accidents per year, VMT, and capital	► Population distribution ► Job growth rate ► Employment rate ► Real estate trend ► House hold transportation cost

Deployments

- **Baltimore MMTIS**
  - First regional deployment of commercial-quality cellular traffic probes in North America
  - Sole source award
  - Public-private partnership w/ MD SHA, MTA, Baltimore County
  - Integrate with existing public data – including transit (MTA) and 911 (Baltimore County)
  - Encourage public applications beyond traditional ITS
  - Contract signed September 2004; data flow to Maryland SHA began April 2005
- **Missouri Statewide Deployment**
  - Competitive award
  - Contract signed
  - Coverage will include 5,500 miles of expressways and arterials

Private Sector Partners

- **Delcan**
  - Transportation and technology consultants
  - Fifty plus years in business
  - Extensive ATMS/integration experience; staff = 500 plus
- **ITIS Holdings**
  - Leader in traffic probes; staff = 100
  - Commercial customers – 17 automobile firms, commercial 511
  - Purchased cell probe estimating technology (Estimotion)
  - Publicly traded on London exchange
- **National cellular firms**
- **National and regional GPS-equipped fleets**

Conclusions

- Probe vehicles provide the best current opportunity to expand real-time network reporting
- Economic and business model issues will continue to be refined with increased usage
- Travel times and travel time variability are of great interest to transportation system users
- Privacy issues are more perception than fact – but proactive outreach to media is mandated

QUESTIONS?

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RTMS Speed Comparison