ITS Maryland Spring Seminar

“Advanced Vehicle/Bike Detection Technologies”

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Roots in Maryland!
ITS MD- Detection Technology

Agenda

1. Thermal vehicle/bike detection
   a) Overview on video detection & thermal
   b) Features & benefits
   c) Regional deployments
   d) Future development

2. BlueTOAD speed/travel time system
   a) Overview on using BlueTooth technology
   b) Features & benefits
   c) Regional deployments & test sites

3. Passive pedestrian detection- QUICK update!
   a) Regional deployments
What is Video Detection?
Video Image Detection Systems (VIDs) Advantages

- Above-ground technology means
  - Not susceptible to milling, shifting pavement, surface temperature changes
  - No cutting loops means minimizing lane closures during installation
- Detection zones can be easily modified without disrupting detection
- Instant visual verification of detection, proper placement, etc.
- High detection rate with low false alarm frequency
- Rich array of traffic information
  - Traffic data, alarms and video images
- Video can be routed to central office for incident management
- Easy integration into existing traffic management systems
Video Image Detection Systems (VIDs) Advantages

- Loops average about $1,000 each
- Video is now in the range of $4K per camera, covering average of 4-5 lanes
- Instant savings
  - Today VIDs intersections under $18K
  - In 1994, VIDs intersections were about $55K
- Additional savings when factoring in minimizing
  - lane closures
  - man-hours
  - congestion
- ROI in 2-4 years
  - Possibly replacing inductive loop while video keeps on detecting
  - VIDS- Low maintenance costs (usually camera)
Traficon Video Detection
Product/Algorithm Evolution since 1982

- Video failure
  - Failsafe recall
- Degraded image, fog
  - Failsafe recall (user-defined)
- Shadow Processing
  - Has come a long way
  - Tree shadow suppression

- Image stabilization/compensation
- Occlusion “Manager”
- Directional sensitivity
- Remote comm & video (MPEG-2/4)
- True loop detector form factor (away from boxes)
- SDLC interface (TS2)
- THERMAL! (more later)
Video Image Detection Systems (VIDs)
VIP3D.Xs Card Menu

Detector type
System info
Detection Zones
Quality level
Detection Mode
Easy menu driven setup
Video Image Detection Systems (VIDs)
Camera Installation
Video Image Detection Systems (VIDs)
Camera Installation
Video Image Detection Systems (VIDs)
VIP Processor Cards

VIDs Processor
H.264 Comm Board

Anne Arundel, Howard, PG
Video Image Detection Systems (VIDs)
System Architecture
FLIR Acquires Traficon!

Thermal Vehicle and Bike Detection

Thermal ITS CCTV / AID

2013
FLIR Thermal Detection
Intro, Benefits

☐ Latest innovation for video detection
☐ “Sees” heat, not light
  ■ Can detect objects at -273°C
  ■ FLIR detects/“sees” 1/10th degree difference between objects
☐ Eliminates issues related to
  ■ Glare
  ■ Horizon
  ■ Shadows
  ■ Snow/Rain
  ■ Light fog
FLIR Thermal Detection
FC Camera/Sensor

- 3 fixed-lens models
  - (9mm) CAM-FC348T
  - (13mm) CAM-FC334T
  - (19mm) Cam-FC324T

- Connections
  - Power (3-conductor)
  - Coax (BNC-less option)
  - Optional junction box

- 10-year warranty on thermal core
FLIR Thermal Detection
Installation
FLIR Thermal Detection
Thermal Camera vs. Optical
FLIR Thermal Detection
Thermal Camera vs. Optical
FLIR Thermal Detection
Thermal Camera vs. Optical (Backlight, Sun)
FLIR Thermal Detection
FLIR Thermal Camera - Snow
FLIR Thermal Detection
Smoke (Tunnel, AID)
FLIR Thermal Detection
Comparison to “optical” camera
FLIR Thermal Detection
GDOT- Day to Night
FLIR Thermal Detection
Thermal Camera vs. Optical (Shadows/Glare)
FLIR Thermal Detection
Thermal Camera vs. Optical (Headlight Reflections)
FLIR Thermal Detection
Better Distance

Increased “visibility”
24/7
FLIR Thermal Detection
Traficon Thermal Firmware

Traficon developed “FLIR” firmware in 3.41 release
FLIR Thermal Detection
Detection Clip
Regional Deployments
Montgomery County, MD

“Side fire” OK- not depending on headlights at night
Regional Deployments
Baltimore County, MD (test site)

Horizon visible but OK
Regional Deployments
Alexandria, VA

Looking east into sunrise. Tree canopy may cause issues with optical cameras.
Regional Deployments
Winchester, VA
Regional Deployments
Washington, DC

Raised barrier blocked headlights at night
Regional Deployments
Virginia Beach, VA

1st test site (signal glare).
30+ FLIRs installed now
Regional Deployments
VDOT- Staunton District

Long off ramp to signal (headlights and horizon)
Regional Deployments
Charlotte, NC

Increased “visibility” 24/7 (improved “set back” detection)
Overspeed Truck Application
FLIR Thermal Camera - Data Collection
Overspeed Truck Application
FLIR Thermal Camera- Data Collection

Thermal gives 24/7 visibility. Required for this application to be able to classify vehicle length with no ambient light.

Play Video
Regional Agencies Using FLIR

- VA-
  - Arlington
  - Alexandria
  - Winchester
  - Harrisonburg
  - VDOT- Staunton
  - VDOT- Hampton Roads
  - City of Staunton
  - Newport News
  - Hampton
  - Va Beach
  - Suffolk

- VA-
  - Henrico County

- MD-
  - Montgomery County
  - Baltimore County (testing)
  - MdTA (testing, axle verification ICC)

- NC-
  - City of Charlotte
FLIR Thermal Sensors for ITS
Better Surveillance

Play Video

VDOT
Regional Agencies Using FLIR

- VA-
  - Arlington
  - Alexandria
  - Winchester
  - Harrisonburg
  - VDOT- Staunton
  - VDOT- Hampton Roads
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- VA-
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- MD-
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- NC-
  - City of Charlotte
Bicycle Pedestrian Detection
California Policy Directive

- 2008- Began developing recommendations for uniform standard and specs to detect bicycles & motorcycles at traffic actuated signals.
- Technology-neutral to allow for current and future technologies. Video detection determined to be a practical method.
- Detection required in each travel lane of a new or modified traffic signal.
- Guidance for timing- cyclists
  - Crossing speed of 10mph (14.7 ft./sec)
  - Plus additional time needed for a “standing start” (6 sec)
Bicycle Pedestrian Detection
Thermal Video Detection Solution

- Four (bike presence) detection zones
  - Mixed thru lane(s)
  - Mixed left turn lane(s)
  - Mixed right turn lane(s)
  - Dedicated bike lane

- Bike presence information to controller via
  - (4) open-collector outputs
  - SDLC
  - TCP/IP using SDK

- Remote access for management and H.264 streaming video
Bicycle Pedestrian Detection
Thermal Video Detection Solution
Bicycle Pedestrian Detection
Thermal Video Detection Solution
Future Development?

Thermal Integrated Products
BlueTOAD Speed/Travel Time System
Who is TrafficCast?

- Leader in travel time forecasting and traffic information.
- 10+ years, traffic data platform, historical and real-time traffic for over 450K miles of roadways in the US.
- TrafficCast analyzes real-time data from:
  - Expressways
  - Major arterials
  - Secondary and tertiary roadways
  - Weather conditions
  - Roadway incidents and events
  - Construction
  - Historical traffic patterns
- BlueTOAD more “granular” data
How does BlueTOAD work with Bluetooth..
BlueTOAD Configuration Options

For all Configurations...

- Permanent or Temporary deployments
- Ethernet and/or Cellular communications
- AC or DC Solar Power
- Real-Time or Post Processed data collection
- Web-enabled and Archived data management
BlueTOAD Spacing
Arterials- .5 – 2 miles
Freeways- 2-? miles
Data Outliers- Examples

- Multiple/Simultaneous Pedestrians
- Cyclists

2 MILES

Data from 2011-09-23 17:38 to 2011-09-25 17:38

- Raw speeds
- Smoothed speeds

Date/Time
Reporting Capabilities

- 5 and 15 minute reporting capability on all archived data
- Individual speeds available
- HTML, CSV and graphing outputs
Reporting Capabilities

- Before and After reports on all pairs and routes
- TOD selectable (AM or PM Peak)
- HTML, CSV and graphing outputs
Reporting Capabilities

- Origin / Destination Study
- % Matches of Selected Paths
- Pie/Bar Charts, Map, HTML, CSV display options
Measuring Adaptive Systems

- Virginia DOT- Testing “Traffic Adaptive” signal systems at locations around the state

<table>
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<th>Period Time</th>
<th>Jubal Early Drive at Apple Blossom Drive (a=0) -&lt; to U.S. 17/50/322 at I-81 SB ramp (x=306) -&lt;</th>
<th>Jubal Early Drive at Apple Blossom Drive (a=0) -&lt; to U.S. 17/50/322 at I-81 NB ramp (x=306) =&lt;</th>
<th>Percent difference</th>
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<td>Day 1 00:00-02:00</td>
<td>2011-08-07 18.47 mph 2012-05-14 28.41 mph</td>
<td>5.2</td>
<td>5.2</td>
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<td>Day 1 02:00-04:00</td>
<td>2012-05-07 28.71 mph</td>
<td>2012-05-14 27.98 mph</td>
<td>2.6</td>
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<tr>
<td>Day 1 04:00-06:00</td>
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<td>Day 1 06:00-08:00</td>
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<td>Day 1 08:00-10:00</td>
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<td>Day 1 10:00-12:00</td>
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<tr>
<td>Day 1 12:00-14:00</td>
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<td>Day 1 18:00-20:00</td>
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Arterial Traffic Management

- PG County testing-data can be sent via XML to County CCTV management website as a layer
User Defined Speed Thresholds

- Adjust speed threshold by either *Speeds* or *Percentage*
- Optional Blue
Comparison Report (PG County)
Device Report (PG County)

MAC Detections for Marlboro Pike & Forestville Rd (u175)
from 2013-06-04 00:00 to 2013-06-04 23:59

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<th>Type</th>
<th>ID</th>
<th>From</th>
<th>To</th>
<th>Name</th>
<th>Speed</th>
<th>Time</th>
<th>Last Match</th>
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<tr>
<td>Pair</td>
<td>10243</td>
<td>224</td>
<td>175</td>
<td>Marlboro Pike &amp; Donnell Dr (u224) &amp; Marlboro Pike &amp; Forestville Rd (u175) - East Bound</td>
<td>22</td>
<td>1.56</td>
<td>06-04 17.58</td>
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<tr>
<td>Pair</td>
<td>10244</td>
<td>175</td>
<td>224</td>
<td>Marlboro Pike &amp; Forestville Rd (u175) to Marlboro Pike &amp; Donnell Dr (u224)</td>
<td>25</td>
<td>1.41</td>
<td>06-04 17.57</td>
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Device Report (PG County)
Arterial Congestion Management

- Seminole County, FL
  - Arterial travel-times for signal timing comparison (Before & After Report)
  - Arterial DMS Updates (Cameleon 360 software interface)
  - Arterial Congestion Monitoring (speed map monitoring)
Quick Regional Update

Video-Based Pedestrian Detection
Passive Pedestrian Detection
“PUFFIN” Crossings (UK)-

- Ped signals angled on near side.
- Ped has view of oncoming traffic
- No flashing Yellow for drivers
- No flashing Red/Don’t Walk for peds
Passive Pedestrian Detection
Introduction to "Stereo-vision"
Passive Pedestrian Detection
“Stereo-Vision”- 3D examples

“Detection Images” on right (dark area) do not measure flat surface
Passive Pedestrian Detection

Installation

Arlington, VA

(Signalized Mid-block)
Passive Pedestrian Detection
Arlington, VA (Oct 2012)- Wide Angle Demo Site
Passive Pedestrian Detection
Arlington, VA (Oct 2012)
Passive Pedestrian Detection
Blacksburg, VA
Passive Pedestrian Detection
Washington, DC (Mar 2013)

16th St & Jonquil St,
NW
HAWK/PHB System at Synagogue
Passive Pedestrian Detection
Washington, DC (Mar 2013)
Passive Pedestrian Detection
Washington, DC (Mar 2013)
Passive Pedestrian Detection
What’s Next?

- Occupancy
  - Activate output when pedestrian is first detected.
  - Activate a second output when detection zone is more than “x” percent occupied-priority call
Passive Pedestrian Detection
Occupancy

2 %
Passive Pedestrian Detection
Occupancy

6 %
Passive Pedestrian Detection
Occupancy

20 %
Passive Pedestrian Detection
Occupancy

30 %
Passive Pedestrian Detection Occupancy

50 %
ITS Maryland Spring Seminar

Thank You!

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