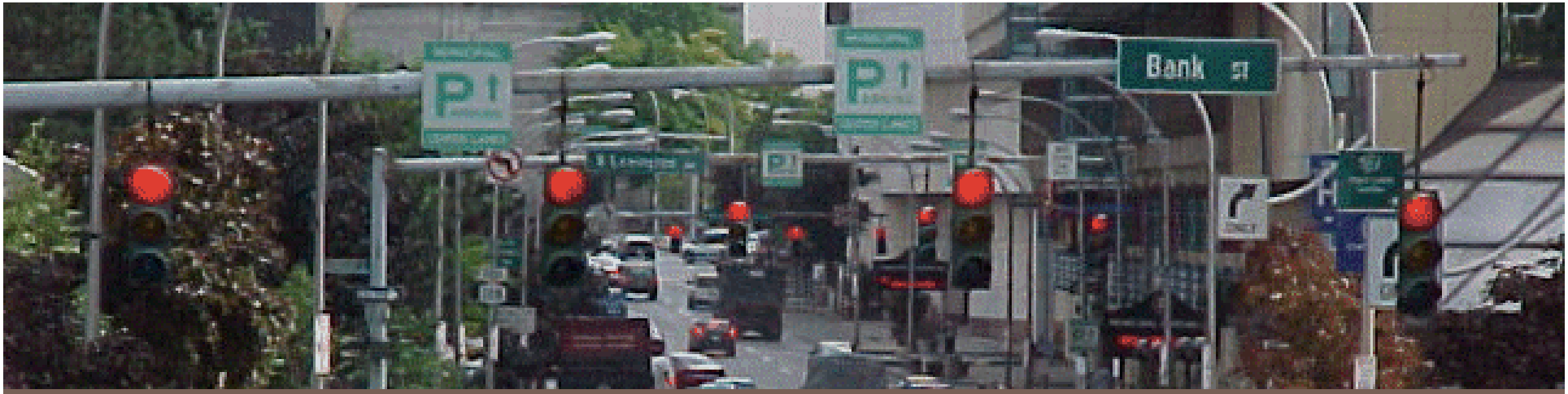
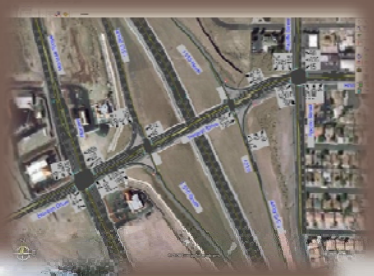


Innovations in Data Collection





11/5/2009

Jeff Gerken, P.E., PTOE, Traffic Operations Manager
Sandra Gonzalez, P.E., FDOT District 7 Traffic Operations

STATE OF FLORIDA • DEPARTMENT OF TRANSPORTATION

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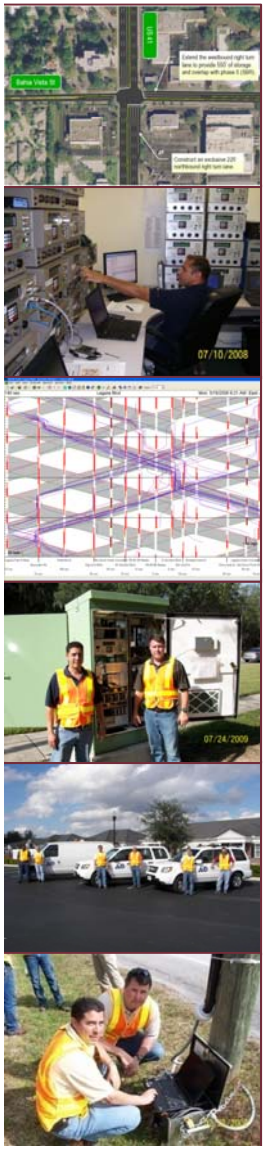
Presentation Overview



- State of the Practice
  - Segment counts using road tubes
  - Turning movements counts via manual methods
- New innovations in data collection platforms
  - Wavetronix (HD units in temporary installations)
  - Miovision
  - Accuracy testing of volume counts (Wavetronix and Miovision)
  - Accuracy testing of classification (Wavetronix only)
- Conclusions
- Portable Video Camera application in Traffic Counts
  - Description / setup demonstration
  - Advantages
  - Disadvantages

Typical Data Needed

- Traffic volume data are the backbone of transportation analysis
- Segment Counts:
  - Obtainable from system detectors, when infrastructure operational
  - Directional segment count across all through lanes
  - Used for planning and operational analysis
- Turning Movement Counts
  - Obtainable from intersection detection, when infrastructure operational
  - Count of each movement at an intersection, includes:
    - vehicle (passengers and trucks)
    - Pedestrians
    - U-turns
- Miscellaneous Studies:
  - Saturation flow, lane utilization, pedestrian interaction, safety conflict, etc.

State of the Practice – Segment Counts

- Machine Counts (Road Tubes)
  - records the passage of each vehicle axle by receiving air impulses, typically binned into 15 minute periods
  - Placed for 1-7 days typically
- Positives:
  - Easily procured with low staff training requirements
  - Applies to most arterial cross sections
  - Industry accepted
- Negatives:
  - tube counters require work in the roadway to place and recover the equipment
  - tubes degrade rapidly under heavy traffic flow and if broken may be difficult to repair immediately
  - tube setups have limitations on data obtained (e.g., typically applicable for low-speed roadways)

State of the Practice – Intersection Turning Movement Counts

- Manual Turning Movement Counts
  - record the passage of each vehicle (by classification) served for each movement as well as pedestrians every 15 minutes
  - Typically covers multiple peak hours for weekday and weekend
- Positives:
  - Easily procured with moderate staff training requirements
  - Industry accepted
- Negatives:
  - turning movement counts are expensive to obtain since it requires trained personnel to be in the field during the periods of data collection
  - personnel are exposed to the elements during data collection periods or they utilize vehicles, which typically requires parking near the intersection in order to observe the movements
  - higher traffic volumes require more personnel (and equipment) to count all movements
  - data collected typically show served traffic versus demand traffic

New Innovations in Data Collection Platforms – Segment Counts

- Problem statement: we were looking for a solution that is:
  - *Portable, non-intrusive* platform that can emulate the data obtained from road tubes (count, classification, speed)
  - Sensors had to be as *accurate* as road tubes and capable of installation for >7 days
  - *All weather* sensor and support equipment
  - Blends into roadside environment: don't create another hazard, low possibility of vandalism or theft
  - Capable of installation with a 2 person crew and transportable in one vehicle (assumes 4 units in our case)
  - Easy to use, low to moderate training requirements

New Innovations in Data Collection Platforms – Segment Counts

- Wavetronix Smartsensor HD™ units
  - uses a dual-radar technology for detection with a patented auto-configuration process to define the roadway cross-section and direction of vehicles in each lane. Microwave sensors have been widely deployed as roadway sensors but recently have been evaluated for temporary installations.
  - One sensor is capable of collecting across 10 lanes (multi-directional)
  - Count, classification, speed, occupancy; all by lane
  - Transportation Control Systems of Tampa designed and built the battery/interface box
  - PVC conduit from sensor to battery box
  - Requires rigid mounting of sensor
  - Mounting heights based on pole offset from traveled way

New Innovations in Data Collection Platforms – Turning Movement Counts

- Problem statement: we were looking for a solution that is:
  - *Portable, non-intrusive* platform that can emulate the data obtained from manual methods (count, classification)
  - As *accurate* as manual counts
  - Durable system, immune to fatigue
  - Blends into roadside environment: don't create another hazard, low possibility of vandalism or theft
  - Capable of installation with a 2 person crew and transportable in one vehicle (12 intersection template in our case)
  - Easy to use, low to moderate training requirements

New Innovations in Data Collection Platforms –Turning Movement Counts

- Miovision™ Video Collection Units (VCU)
  - uses digital video recording to capture all vehicle turning movements. Miovision has developed proprietary machine vision technology to count the traffic for each movement.
  - The video collection equipment is manufactured using two platforms; a tripod system and the newer pole mount system. The VCU is set up to turn on and off based on user programming.
  - Video recorded and stored on SD card, up load video via office computer to the Miovision web server (bandwidth dependent). Per hour charge to process the count.
  - Count , classification by movement
  - Requires adequate pole to attach to (as well as permission)
  - Manual telescoping camera to 25’ (no settings for pan, tilt or zoom)
  - Capable of studies up to ~24 hours, new battery packs can get up to 72 hours.

General Comparison of Technologies

ATTRIBUTE	*TECHNOLOGY PLATFORM*		
	Road Tubes	**Wavetronix HD**	**Miovision VCU**
Advertised Data Capabilities	Directional Count, Speed, Classification, Gaps	Bi-directional Count, Speed, Classification, Occupancy, Headways, Gaps (all by lane)	Turning Movement Count, Directional Count, Classification
Crew Size Recommended to Install	2	2	1 (we use 2)
Portability/Storage	ATDR extremely lightweight and self-contained w/handle (road tubes must be regularly checked and maintained)	Separate power supply cabinet very heavy, otherwise lightweight assembly (extension ladder required for mounting)	Self-contained VCU w/handle, lightweight pole-mount assembly, 6-foot expandable (to 25 feet) camera mast
Ease of Set-Up[1]	60-75 min. (exposed to traffic)	45-50 min. (no exposure to traffic)	10-15 min. (no exposure to traffic)
Max. Record Time[2]	30 days (solar re-charge)	10 days (10-12 hrs for re-charge)	24 hrs (4-5 hrs for re-charge)
Data Acquisition	Download to separate licensed software on laptop (immediate processing)	Download to separate licensed software on laptop (immediate processing)	VCU memory card to proprietary Internet-based video uploading, analysis and storage (48 hrs. min. turnaround)
Total Equipment Cost per Location[3]	~$2,600	~$6,700	~$2,950 (+ hourly processing charges)

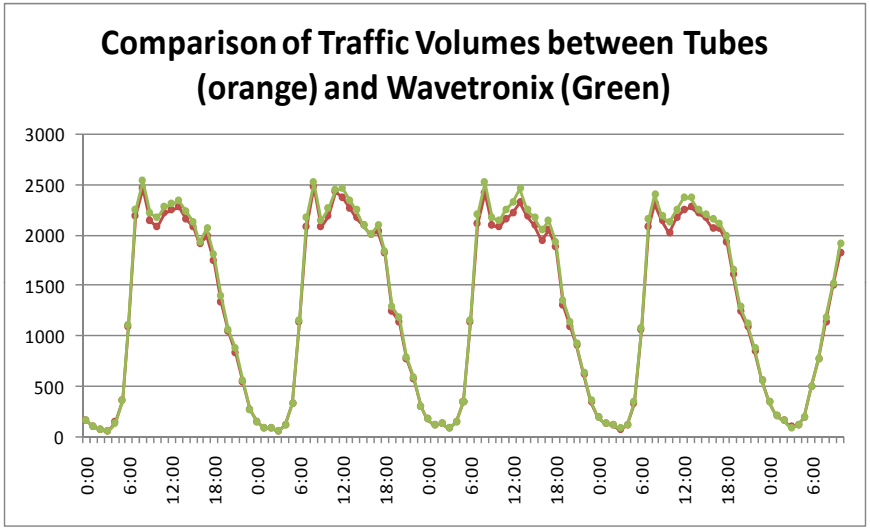
[1] Time shown includes 2-person set-up per location.

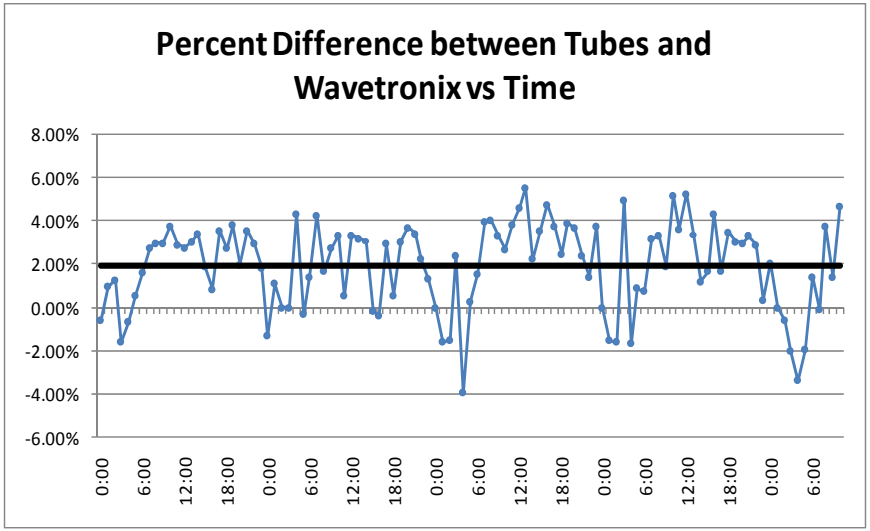
[2] Determined by life of road tube for JAMAR, and battery and/or storage disk capacity for Wavetronix and Miovision.

[3] Includes all basic unit accessories, software, power supply, cabling, etc. and two JAMAR ATDRs. Site defined as bi-directional installation for segment counts and one Miovision VCU per intersection.

New Innovations in Data Collection Platforms – Wavetronix Volume Count Accuracy

- Methodology:
  - Three test locations representing various arterial roadway cross-sections of either four or six lanes, with both raised and painted medians.
  - Compare road tube counts to Wavetronix over a five day continuous period.
  - Also deployed Miovision in order to collect video and establish a control volume by manually counting via the collected video
  - Raw volume and percent volume comparisons to right (only 1 test shown, others similar)





New Innovations in Data Collection Platforms – Wavetronix Volume Count Accuracy

- Results:
  - Overall, both tubes and Wavetronix performed well compared to the control volume with overall error of less than 4 percent.

Segment Count Accuracy Results		Control Volume	Wavetronix	% delta	JAMAR	% delta
March 24, 2009 (noon-1pm)						
Site 1	NB	2,274	2,314	1.8%	2,252	-1.0%
	SB	2,317	2,211	-4.6%	2,166	-6.5%
Site 2	NB	1,533	1,418	-7.5%	1,478	-3.6%
	SB	1,488	1,490	0.1%	1,424	-4.3%
Site 3	NB	1,259	1,260	0.1%	1,249	-0.8%
	SB	1,451	1,382	-4.8%	1,402	-3.4%
March 28, 2009 (10-11am)						
Site 1	NB	1,911	1,914	0.2%	1,828	-4.3%
	SB	1,511	1,488	-1.5%	1,422	-5.9%
Site 2	NB	1,226	1,182	-3.6%	1,196	-2.4%
	SB	1,239	1,248	0.7%	1,196	-3.5%
Site 3	NB	1,073	1,052	-2.0%	1,025	-4.5%
	SB	1,221	1,126	-7.8%	1,158	-5.2%
	Total Count	18,503	18,085	-2.3%	17,796	-3.8%

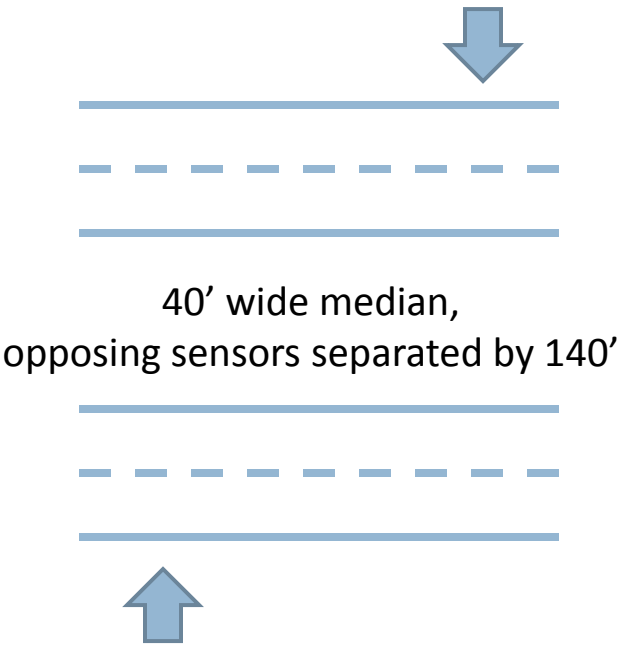
Wavetronix – 97.7% accurate

Road Tubes – 96.2% accurate

  - Given the reduced risk exposure to personnel, the flexible installation options and the high degree of accuracy Wavetronix units provide a viable alternative to road tube installations.
  - Standing water caused unreliable results (water ponding due to heavy rain)

New Innovations in Data Collection Platforms – Wavetronix Classification Accuracy

- Methodology:
  - Two Wavetronix sensors separated and in opposing configuration, no opportunities for traffic stream to change
  - Desired to determine if sensors provided comparable classification and if so, are they appropriate for DOT Scheme F classification
- Results:
  - Determined lane by lane classification (beyond passenger car and heavy vehicle bins) not deemed accurate enough for Scheme F classification



New Innovations in Data Collection Platforms – Miovision™ VCU Accuracy

- Methodology: compare control counts vs manual vs Miovision
  - Conducted two internal tests to compare Miovision to our personnel using electronic count boards. The control count was established by counting the video in the office.
  - Montana DOT conducted similar test

Case Study	Length (hr)	Control Volume	Sum of Absolute Errors		Accuracy	
			Manual	Miovision	Manual	Miovision
Babcock St	3.0	7,425	307	269	95.9%	96.4%
Lynnhaven Pkwy	2.0	4,412	160	222	96.4%	95.0%
Montana DOT	5.5	33,654	1,134	886	96.6%	97.4%

New Innovations in Data Collection Platforms – Miovision™ VCU Accuracy

- Results
  - Testing results compiled over 10 hours of data (~480 data points). Reviewed aggregate counts as well as period specific count comparisons.
  - Miovision appears to be more consistent and does not appear to have significant outliers.
- Our takeaway: Miovision is accurate
  - Likely more accurate over length of study
  - Installation/setup is key to good study, ensure a good field of view
- Miovision becomes a business decision at this point
  - Good solution for data collection teams conducting a lot of counts, especially if deployed (volume pricing on per hour analysis rate)
  - Need high bandwidth to upload video files
  - Economic analysis of the business model will likely dictate use

New Innovations in Data Collection Platforms – Comments and Conclusions

- Commentary:
  - Non-intrusive data collection techniques offer significant reduction in risk exposure over traditional segment count methods and moderate reductions in risk exposure for traditional turning movement count methods.
  - The Wavetronix HD is accurate for count and basic classification data. Volume accuracy likely better under heavier flow conditions. The ease of installation and additional data metrics by lane provided (speed, classification, occupancy, etc.); make Wavetronix a viable alternative to road tubes.
  - Miovision VCUs are accurate. The additional benefits of easy deployment, reduced requirements for trained staff, and the unique aspect of an audit trail make Miovision a viable alternative to traditional manual turning movement counting. The issue of counting served traffic versus demand traffic is not solved by using Miovision, nor any known technology available. Engineering judgment still pertains to data collection.