"Improving the Quality of Motorcycle Travel Data Collection"

Dan Middleton, Ph.D., P.E.
Texas A&M Transportation Institute

Research Objectives

- Develop methodology for determining MC count locations
- Determine the accuracy of selected detection systems

Major Research Activities

- Literature review
- Agency engagement
- Field data collection
- Data analysis
- Documentation

Background

- Motorcycle Crashes
  - In 1997 MCs were 5% of total traffic fatalities
  - In 2009 MCs were 14% of fatalities
  - MC crashes 37 times more likely to result in fatalities than auto crashes
  - Rate of increase in fatalities exceeded MC registrations and estimated VMT
- Motorcycle Counts

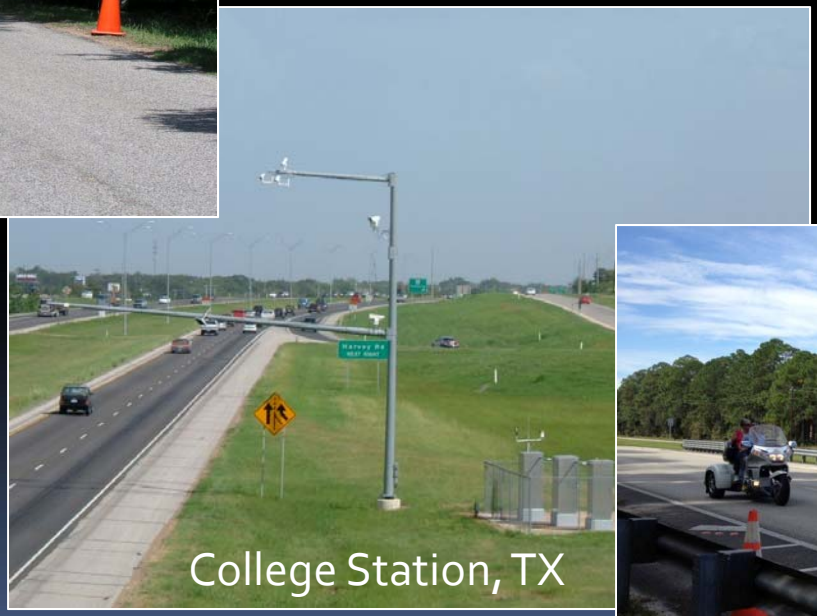
Technology Selection Criteria

- Accurate in all weather and light conditions
- Reasonable cost
- Simple to install and operate
- Adequate technical support
- Non-intrusive desired
- Covers full lane width

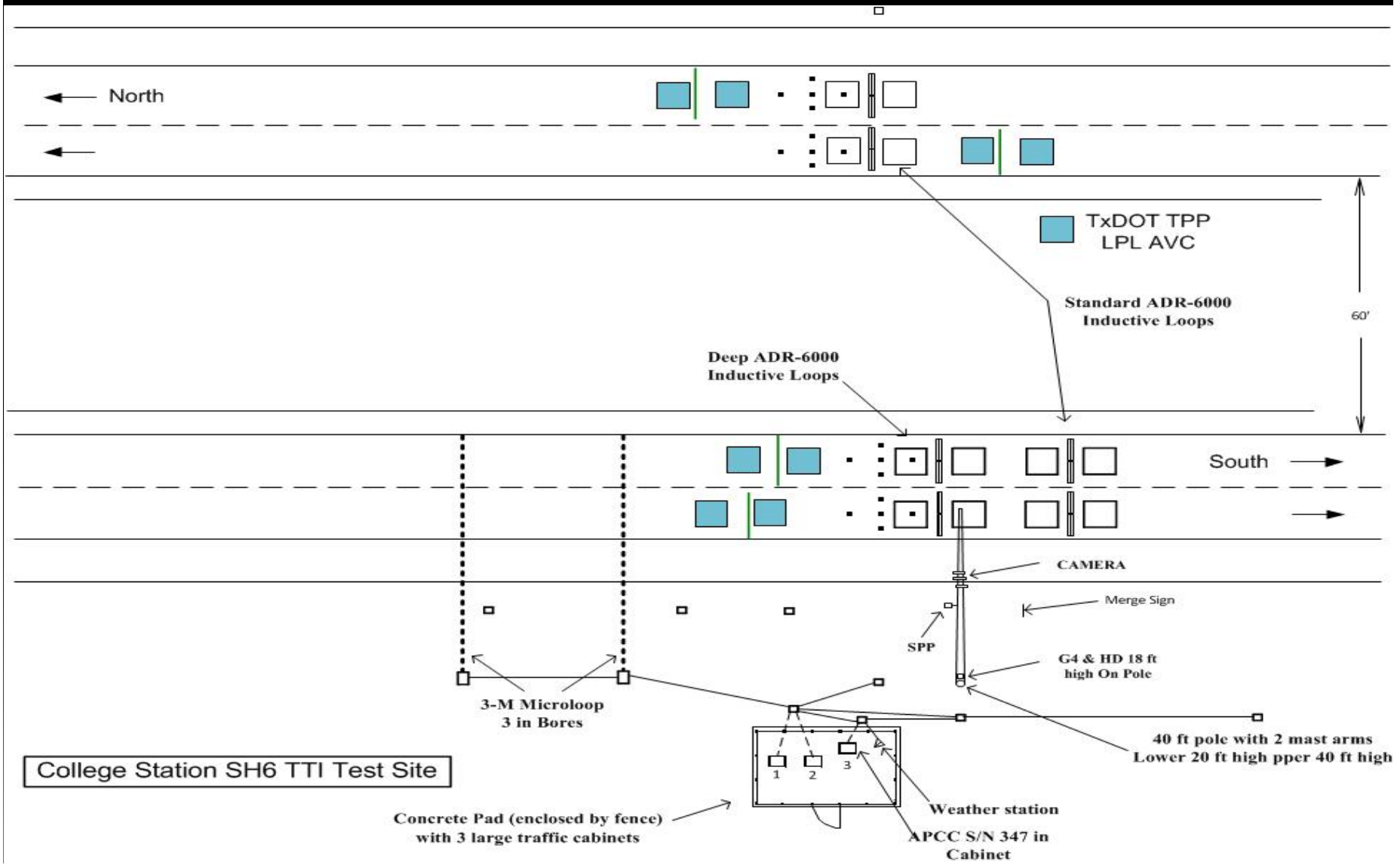
Detectors Selected

- Inductive loops/piezoelectric sensors
- Magnetometers by Sensys Networks
- Multi-technology system by Migma
- Tracking video by TrafficVision
- Transportable Infrared Traffic Logger (TIRTL)

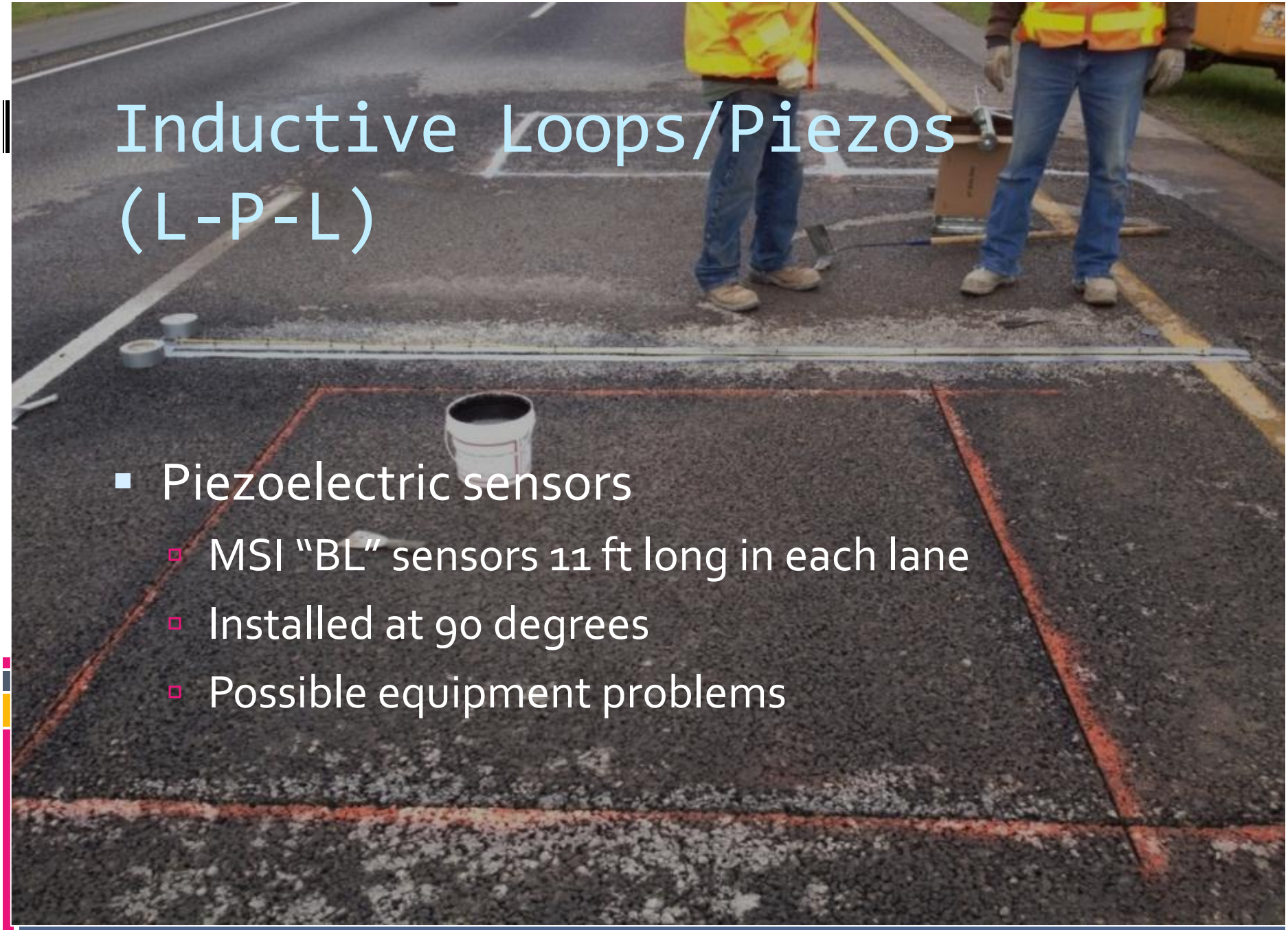
Test Locations



S.H. 6 Test Facility



Inductive Loops/Piezos (L-P-L)



- Piezoelectric sensors
  - MSI "BL" sensors 11 ft long in each lane
  - Installed at 90 degrees
  - Possible equipment problems

Magnetometers

- Communicates wirelessly
- Battery life in the sensor node 10 yrs
- Improvements since early MC tests
  - Requires two stations for speed and length
  - Sensitivity settings
  - Place three per station



Multi-Technology System

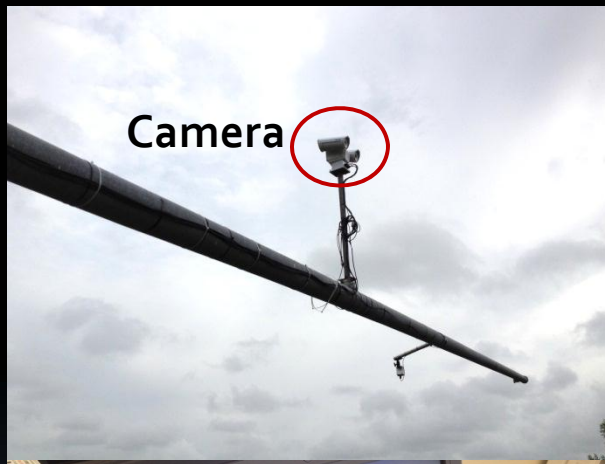
- Designed specifically for MCs
- Initially designed as pedestrian detector
  - Infrared camera
  - Visible light stereo camera
  - Acoustic sensor
- 2d phase SBIR underway

Hybrid Sensor

Source: Migma Systems, Inc.

Video Detection

- Can provide image of roadway
- Accuracy compromised
  - Inclement weather
  - Shadows
  - Artifacts on lens
  - Camera motion
  - Vehicle occlusion
- Light transition periods




TIRTL
Accurate for MC (& non-MC) detection
Classifies all 13 FHWA classes
Non-intrusive
Low power consumption
Portable or fixed
Cost competitive

Equipment Results Summary

Technology	MC Accuracy	Non MC Accuracy	Cost per lane		Fixed/ Portable
			Two-lane	Four-lane	
Loop/piezo	45% [a]	95%	$33,000	$61,000	Fixed
Magnetometer	75%	95%	$10,204	$15,964	Fixed [c]
Multi-technology	50%	N/A	$6,000	$12,000	Fixed [c]
Tracking video	75%	95%	$15,000	$15,000 [b]	Fixed [c]
IR Classifier	95%	98%	$26,850	$26,850	F/P

[a] Low accuracy might be due to equipment problem.

[b] Assumes one system can cover four lanes.

[c] Some components portable.

Data Collection Protocols

- Objective
  - Confirm hypothesis that crashes are reasonable predictor of count sites
- Method
  - Use ArcGIS to develop map of crash locations and current count sites
  - Comparison using correlation coefficient (Pearson's *R*)
- Findings
  - Spatial distribution of MC crashes is associated with spatial distribution of MC traffic

Calculation of Weighted Crashes

$$Weighted\ crashes = N \times \frac{1}{\frac{1}{N}\sum_{i=1}^{N} D_i}$$

Where:

N = raw crash frequency in the vicinity of the count station.

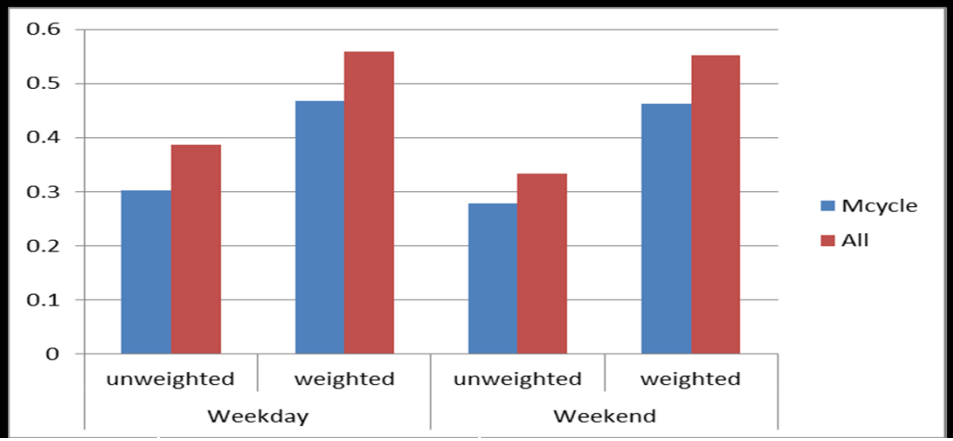
D_i = distance of crash i from the count station.

Data Elements and Pairings

From Traffic Count Database	From Crash Database	Categories	Data Element: Number of Crashes
Weekday AADT – Class 1 only	No. weekday MC crashes	Unweighted	No. crashes near count site
		Weighted	Along same road as count site
Weekend AADT – Class 1 only	No. weekend MC crashes	Unweighted	No. crashes near count site
		Weighted	Along same road as count site
Weekday AADT – All classes	No. weekday MC crashes	Unweighted	No. crashes near count site
		Weighted	Along same road as count site
Weekend AADT – All classes	No. weekend MC crashes	Unweighted	No. crashes near count site
		Weighted	Along same road as count site

Data Collection Protocols

- Michigan results: weekday vs weekend



Time Period	Crash Frequency	Traffic Volume Counts	
		Motorcycle	All
Weekday	Unweighted	0.302*	0.387*
	Weighted	0.467**	0.559**
Weekend	Unweighted	0.279*	0.333*
	Weighted	0.462**	0.552**

*N=51 (weekday); N=50 (weekend), $p<0.05$

**N=51 (weekday); N=50 (weekend), $p<0.001$

Conclusions

- Conclusions
  - Improving count locations
    - States can use the methodology to determine MC count locations
    - Might require states to count by weekends/weekdays
    - Might need to add GIS component
  - Improving count accuracy
    - Full lane-width detection
    - Cost-effective, portable, accurate

Recommendations

- TIRTL results
  - Classifies according to FHWA Scheme F
  - Can be portable or fixed
  - Cost per lane is competitive
  - Modifications make it even better
- Supplemental research
  - Verify accuracy of TrafficVision, Migma, and TIRTL in inclement weather
  - Loop/piezo equipment problems
  - Magnetometers require three nodes per station

Recommendations

- Based on four states:
  - Crash sites are reasonable representation of count sites
  - Need count data weekend vs. weekday
  - Use weighting factor based on distance measured along count roadway
  - Needs further testing in other states

Contact Information

Dan Middleton, Ph.D., P.E.
Texas A&M Transportation Institute
2929 Research Parkway
3135 TAMU
College Station , TX 77843-3135
Phone: (979) 845-7196
Email: d-middleton@tamu.edu