“Improving the Quality of Motorcycle Travel Data Collection”

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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

Daytona Beach, FL

New Ulm, TX

College Station, TX

Daytona Beach, FL
S.H. 6 Test Facility

College Station SH6 TTI Test Site

Concrete Pad (enclosed by fence) with 3 large traffic cabinets

3-M Microloop 3 in Bores

Deep ADR-6000 Inductive Loops

SPP

G4 & HD 18 ft high On Pole

40 ft pole with 2 mast arms Lower 20 ft high ppcr 40 ft high

CAMERA

Merge Sign

FDOT TPP LPL AVC

Standard ADR-6000 Inductive Loops
Inductive Loops/Piezozs (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

<table>
<thead>
<tr>
<th>Technology</th>
<th>MC Accuracy</th>
<th>Non MC Accuracy</th>
<th>Cost per lane</th>
<th>Fixed/Portable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loop/piezo</td>
<td>45%</td>
<td>95%</td>
<td>$33,000</td>
<td>Fixed</td>
</tr>
<tr>
<td>Magnetometer</td>
<td>75%</td>
<td>95%</td>
<td>$10,204</td>
<td>Fixed</td>
</tr>
<tr>
<td>Multi-technology</td>
<td>50%</td>
<td>N/A</td>
<td>$6,000</td>
<td>Fixed</td>
</tr>
<tr>
<td>Tracking video</td>
<td>75%</td>
<td>95%</td>
<td>$15,000</td>
<td>Fixed</td>
</tr>
<tr>
<td>IR Classifier</td>
<td>95%</td>
<td>98%</td>
<td>$26,850</td>
<td>F/P</td>
</tr>
</tbody>
</table>

- **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

<table>
<thead>
<tr>
<th>From Traffic Count Database</th>
<th>From Crash Database</th>
<th>Categories</th>
<th>Data Element: Number of Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday AADT – Class 1 only</td>
<td>No. weekday MC crashes</td>
<td>Unweighted</td>
<td>No. crashes near count site</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weighted</td>
<td>Along same road as count site</td>
</tr>
<tr>
<td>Weekend AADT – Class 1 only</td>
<td>No. weekend MC crashes</td>
<td>Unweighted</td>
<td>No. crashes near count site</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weighted</td>
<td>Along same road as count site</td>
</tr>
<tr>
<td>Weekday AADT – All classes</td>
<td>No. weekday MC crashes</td>
<td>Unweighted</td>
<td>No. crashes near count site</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weighted</td>
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</tr>
</tbody>
</table>
## Data Collection Protocols

- **Michigan results: weekday vs weekend**

### Time Period

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Crash Frequency</th>
<th>Traffic Volume Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Motorcycle</td>
</tr>
<tr>
<td>Weekday</td>
<td>Unweighted</td>
<td>0.302*</td>
</tr>
<tr>
<td></td>
<td>Weighted</td>
<td>0.467**</td>
</tr>
<tr>
<td>Weekend</td>
<td>Unweighted</td>
<td>0.279*</td>
</tr>
<tr>
<td></td>
<td>Weighted</td>
<td>0.462**</td>
</tr>
</tbody>
</table>

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

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

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