The Development of New Insights into Driver Behavior to Improve High Visibility Highway Safety Enforcement Programs (HVE)

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Presentation Outline

1. Introduction
2. Goals and Objectives
3. Study Area and Data
4. Methodology
5. Research Results
6. Conclusion
7. Questions

Speeding and aggressive driving are associated with more than a quarter of all motor vehicle crash fatalities

- In order to decrease crash-related injuries and deaths speeding and aggressive driving behaviors must be reduced

- High Visibility Enforcement and Education (HVE) programs are an important strategy against these types of crashes

- HVE programs typically include vigorous targeted law enforcement coupled with media campaigns to educate drivers and alert them to the enforcement activities

Traditional evaluations of HVE program primarily rely on

- Identification of the number of crashes before and after the program
- Roadside observational studies of driver compliance
- Number of citations issued before, during and after the program
- Surveys to identify any self-reported changes in driver behaviors

- These strategies provide a measure of the effectiveness of the HVE program to change aggregate driver behavior but fall short in evaluating its effects on different groups of drivers
- The use of the SHRP2 NDS data provides the opportunity to examine driver behavior in response to HVE programs in ways that have not been possible in the past

Goals

- Improve the effectiveness and performance of HVE programs by identifying influential factors

- Demonstrate the unique perspective that SHRP2 NDS data has to explore factors affecting HVE effectiveness

Objectives

- Identify HVE aggressive driving programs conducted in Erie County, NY during the SHRP2 data collection program

- Define quantitative aggressive driving observables and metrics consistent with SHRP2 NDS data

- Acquire data and perform statistical analyses to identify significant variables that affect HVE programs

HVE STUDY AREA

Two HVE programs that focused on speeding and aggressive driving were identified that occurred during the SHRP2 NDS data collection program in Erie County, NY

- Conduct of the HVEs were conducted by local law enforcement and advertised in local media

- Three additional sites were used as control sites with similar characteristics; two in Erie County and one in Tampa, FL

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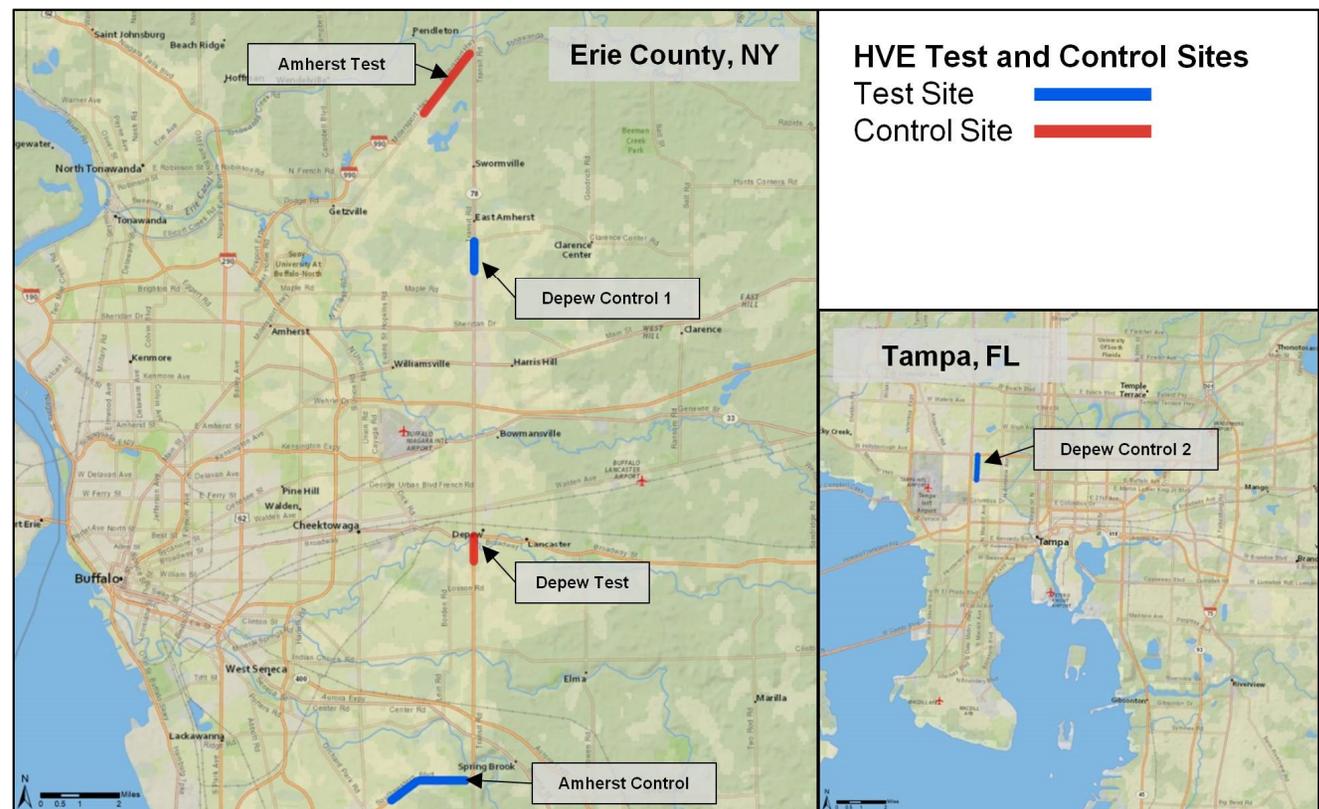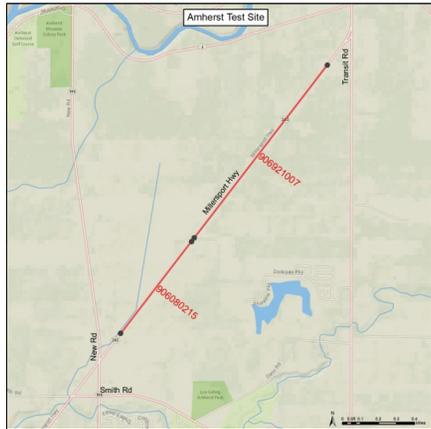
## Amherst Test Site

Amherst Control Site
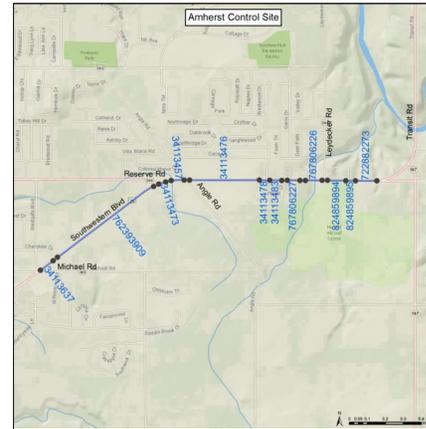
Depew Test Site

Depew Control Site 1
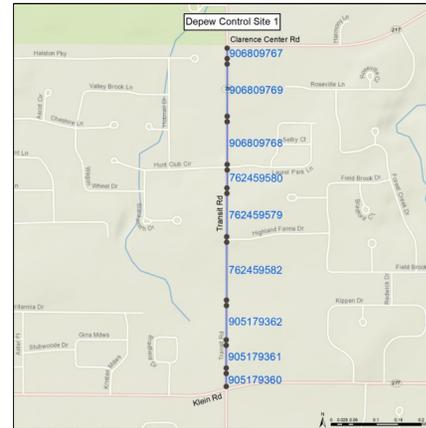
A sample of participants and traversals were selected to support the analysis

- A stratified random sample of drivers with traversals *before, during, and after* the HVE were drawn as well as those with frequent and infrequent trips

- The following **Time Series** data was requested

  - Time_Stamp
  - timestamp
  - file_ID
  - accel_x
  - accel_y
  - gyro_z
  - heading_gps
  - speed_gps

  - latitude
  - longitude
  - light_level
  - lane_distance_off_center
  - pedal_brake_state
  - pedal_gas_position
  - speed_network
  - steering_wheel_position

  - turn_signal
  - seatbelt_driver
  - video_frame
  - Leadvehicle_Target_Id
  - Leadvehicle_X_Pos_Processed
  - Leadvehicle_X_Velocity_Processed
  - Leadvehicle_Is_Lead_Vehicle
  - Leadvehicle_Headway

- In addition to the time series data, **Forward Video** and driver **Questionnaire** data was requested

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To correspond with the characteristics of the HVE programs and *suitability* for analysis the following filters were applied

- Number of roadway links traversed
- Continuous traversals
- Traversal Date
- Traversal Time of Day
- *Trip Exportability*

Site	Amherst Test	Amherst Control	Depew Test	Depew Control 1	Depew Control 2
Required	350	350	350	350	150
Available	1,696	4,944	5,016	2,209	1,549
Filtered	337	1,267	967	353	149

**Analysis focused on five aggressive driving behaviors**

- Speeding
- Tailgating
- Unsafe lane changes
- Failure to yield right-of-way
- Failure to obey traffic control device

Speeding and tailgating metrics were defined to capture the magnitude and duration of the episode

Example of Calculated Speeding Metric
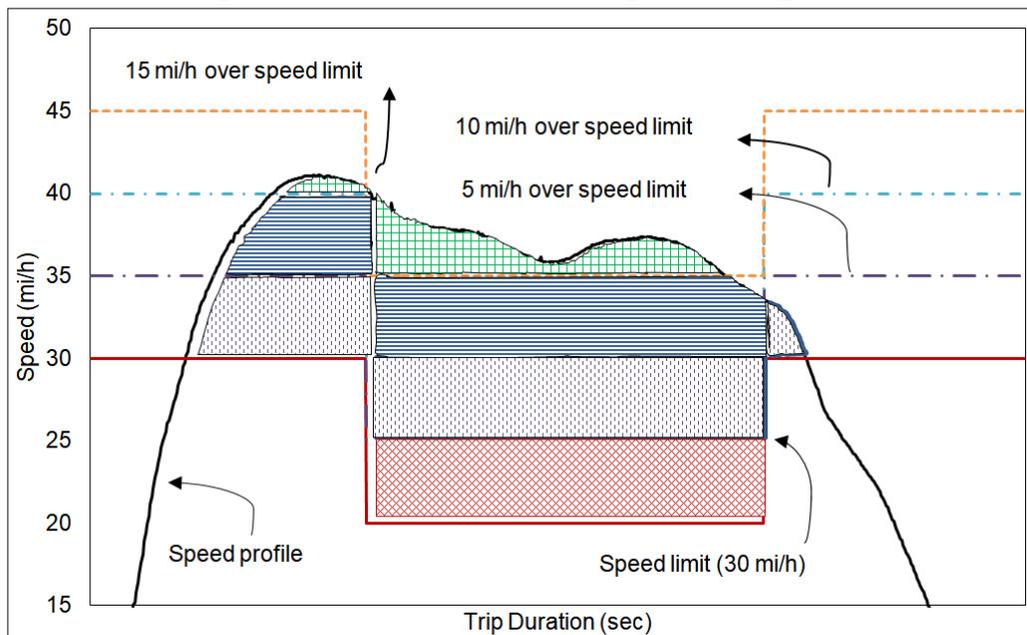
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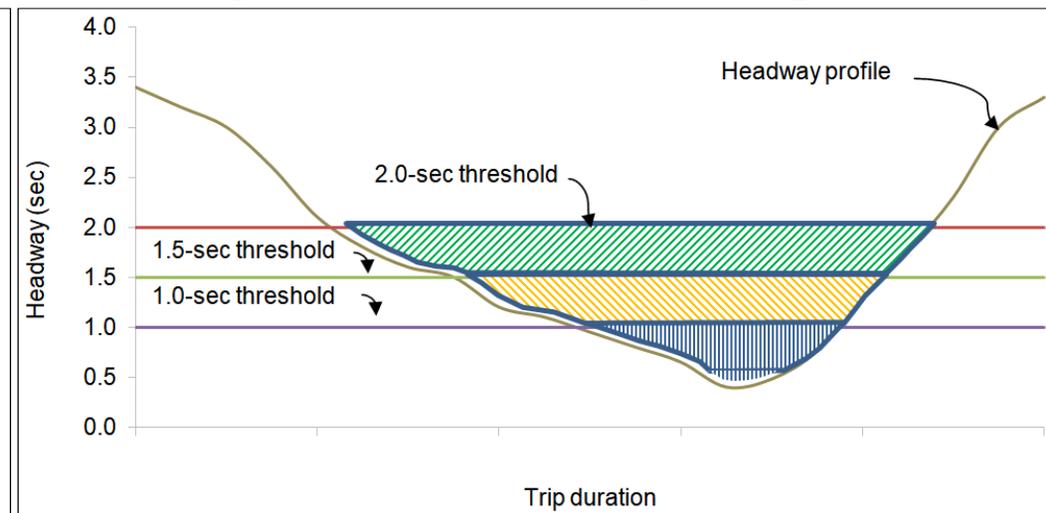
A rigorous modeling approach was developed to identify significant influential factors

- Seemingly unrelated regression equation (SURE) models were estimated to simultaneously examine the likelihood of speeding and tailgating occurrence
- Grouped random parameters bivariate probit models were estimated for failure to obey traffic control devices, failure to yield right-of-way, and failure to signal lane changes
- The employed modeling frameworks account for significant misspecification issues arising from the nature of the dataset, namely, for unobserved heterogeneity, panel effects, and cross-equation error correlation

Speeding Results

The most significant factors that contributed to a change in speeding behavior in the overall metric were (+ positive / - negative):

+ Driver 's age less than 35 years

+ Household income between $40,000 and $99,999

+ Driver drove less than 25K miles in previous year

- Traversal made in control area in the month of May

- Vehicle age older than five years

- Study vehicle is used for business purposes

Tailgating Results

The most significant factors that contributed to a change in tailgating behavior in the overall metric were:

+ Driver 's age less than 35 years

+ Single parent household or lives alone, some high school education

+ Participant drove more than 15K miles in previous year

- Traversal made in control area in the month of May

- Participant had informal driver training

- Participant was older than 65 years of age

Other Aggressive Behavior Results

The most significant factors that contributed to an unsafe lane changes:

+ Household size greater than two and number of vehicles owned greater than two

+ Driver owns residence and resided there for more than 5 years

- Driver made more than 5 traversals

- Driver was older than 65 years old

The most significant factors that contributed to failure to yield right-of-way or obey traffic control device:

+ Driver does not perceive risk in making illegal turns and had at least one crash

+ Driver was of Hispanic or Latino ethnicity

- Female driver without full time employment

- Number of people in household greater than two

The main contributions of this study include

- Successfully defined observables and metrics from SHRP2 NDS data to identify five aggressive driving behaviors
- Developed unique scaled speeding and tailgating metrics that provide a robust assessment of both the intensity and duration of speeding and tailgating behaviors
- Utilized a robust modeling approach based on the SURE and bivariate probit models
- Identified several key factors that influenced the extent, frequency, and duration of aggressive driving behaviors
- Residual effects of HVE programs could not be determined at a statistically significant level
- Provides a pathway for local law enforcement to target HVE campaigns toward specific driver groups/demographics

Questions?