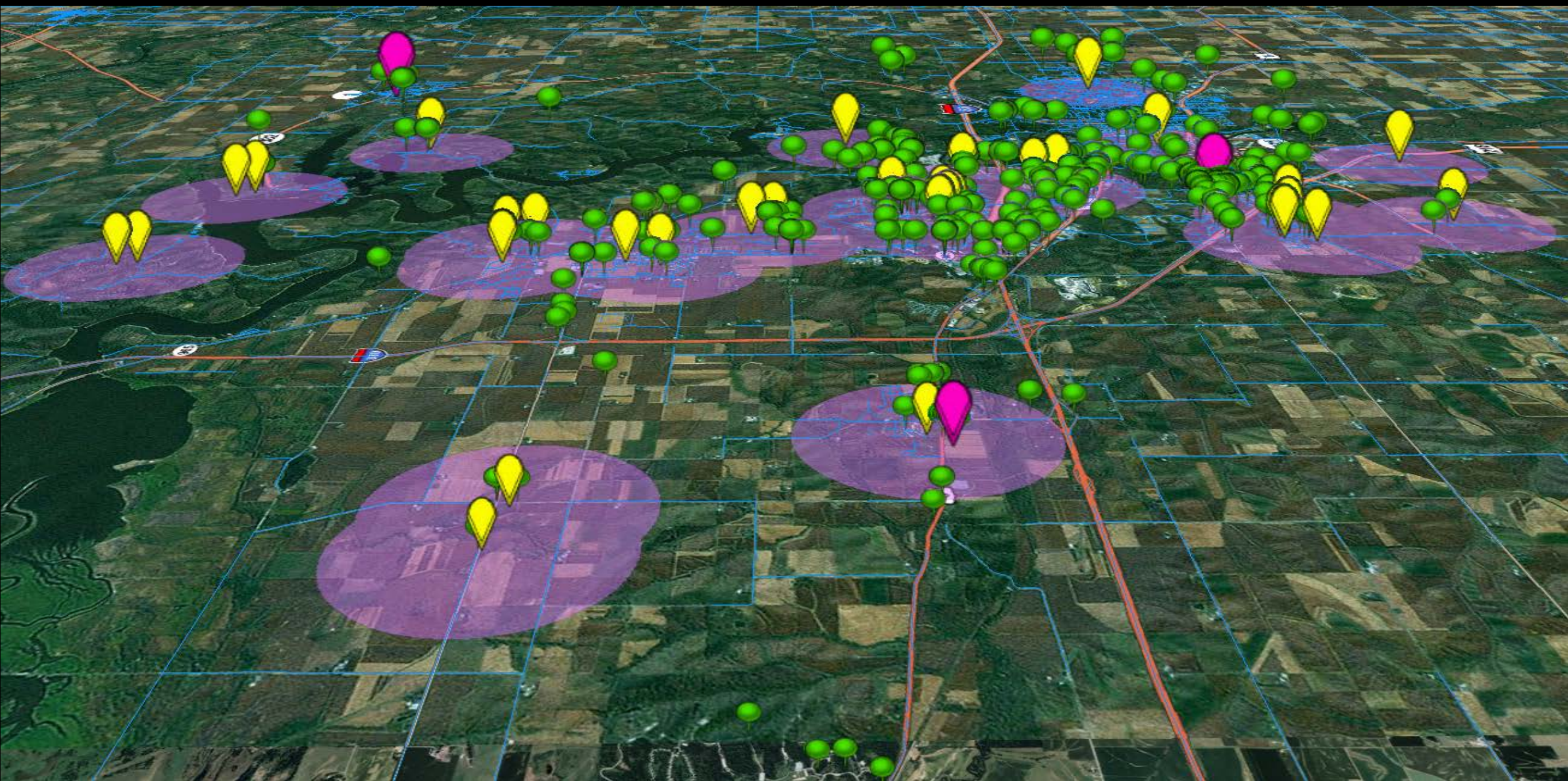# 3D Spatial Visualization Analysis of Safety Related Driving Events of Newly Licensed Teens in Proximity of Home and School

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Background

- For teens, crashes are the leading cause of death and injury in the US (NHSTA, 2011)

- In 2009, there were 2,336 fatalities and 196,000 injuries (aged 14-19) (NHSTA, 2011)

- First six months is the most dangerous and crash prone

Where and when do crash rates differ?

- Crash rates vary geographically
  - Rural 56.6 %; urban 42.4 % (NHSTA, 2011)
- 52 % of crashes occur within a five mile radius of home (NHSTA, 2011)
- Crashes rates are higher close to school in the morning and afternoon (Abdek-Aty et al., 2007)

Previous research

- All studies (Abdek-Aty et al., 2007) related to driver crashes utilize straight line distance (Euclidean space) to understand the proximity distance of crashes from home or school
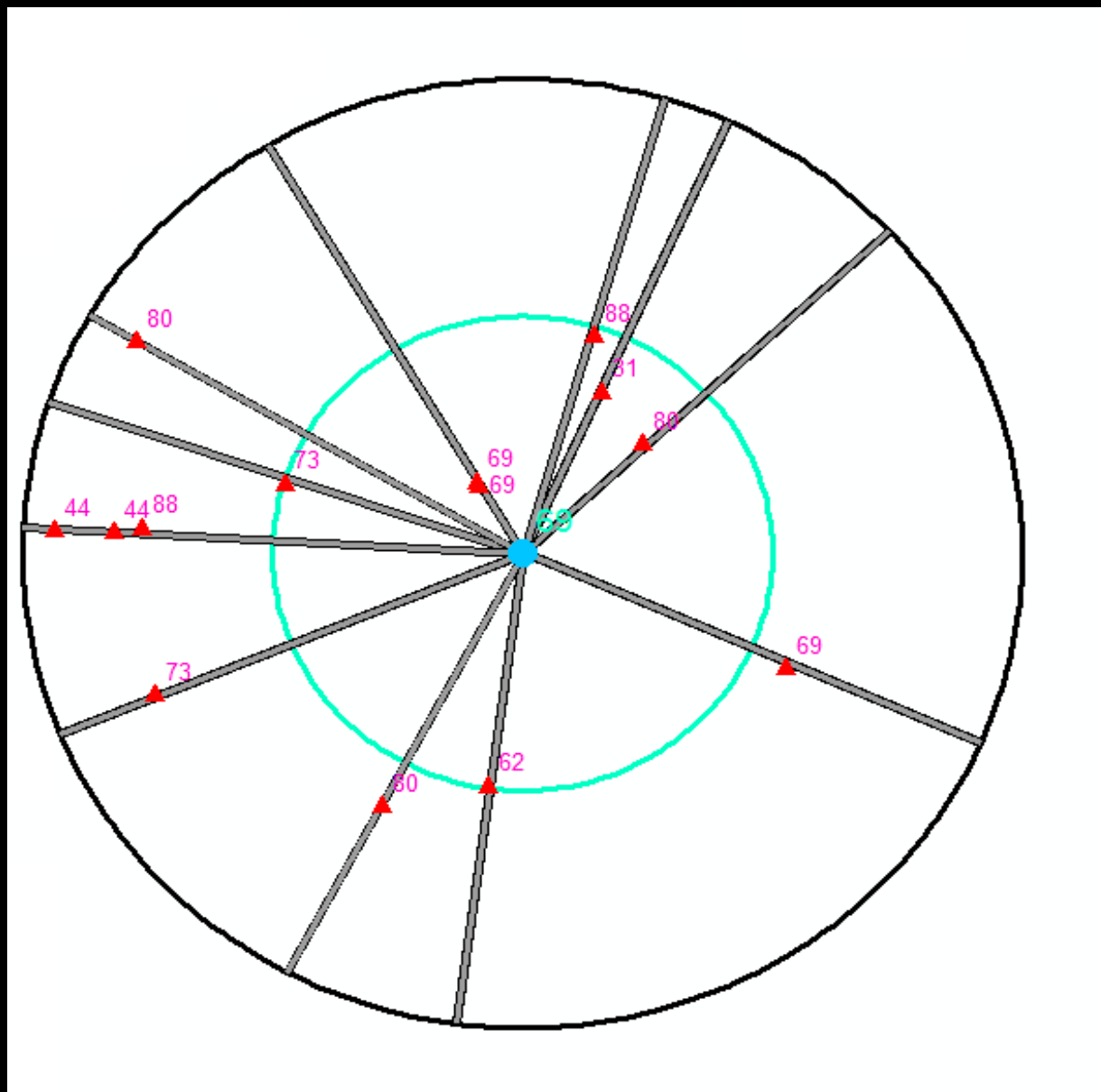
How this study is different ?

- Extension of previous work by Carney et al. (2010) and McGehee et al. (2007) who used Event Triggered Video Recorders (ETVR) to study driver errors of newly licensed teens

- This study examines the **spatial distribution and density of driving errors** within the proximity of home and schools

- Also compares the variation of spatial patterns of driving errors with reference to license type using network distance
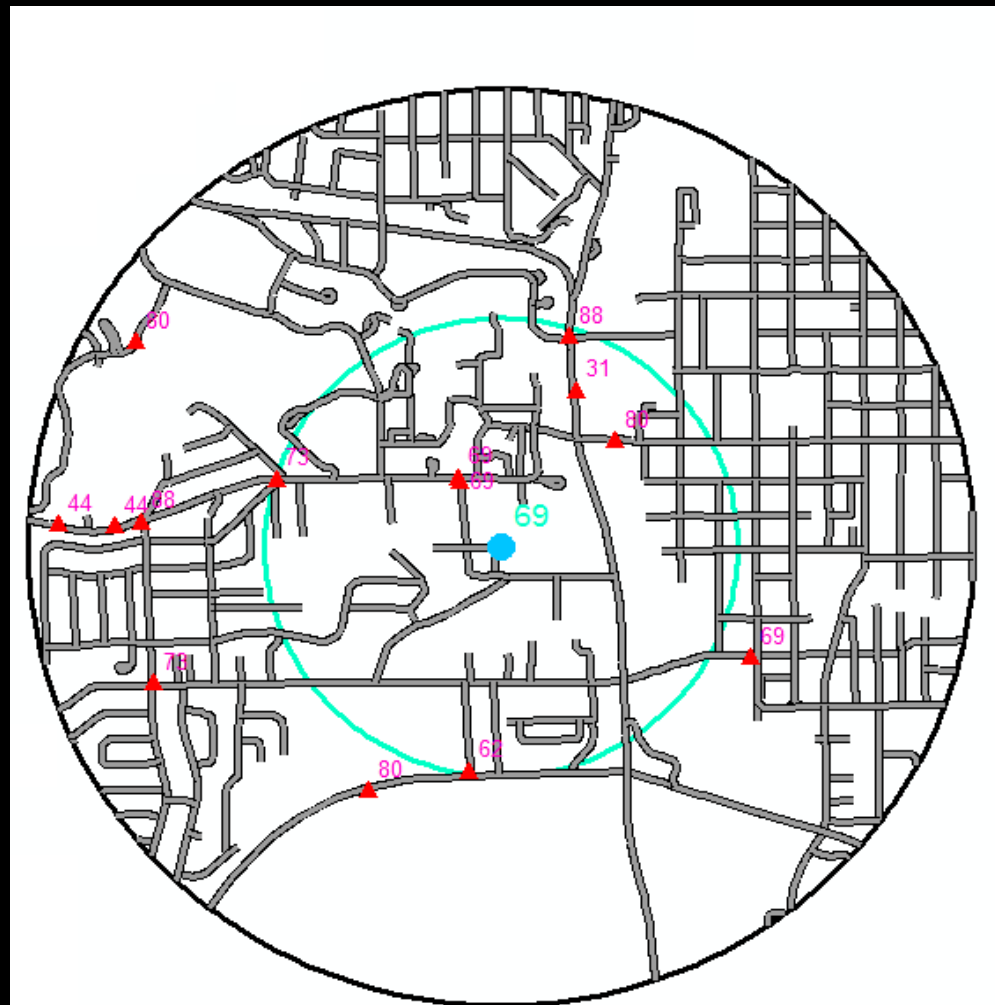
Research Questions

1. Are there differences in the number of driver errors in proximity to school and home?

2. Does the relative mean distance of driver errors in proximity to home and school differ by license type?

3. Are there differences in driver errors location by license type?

4. What percentage of driver errors occur within 5 miles from home and school?
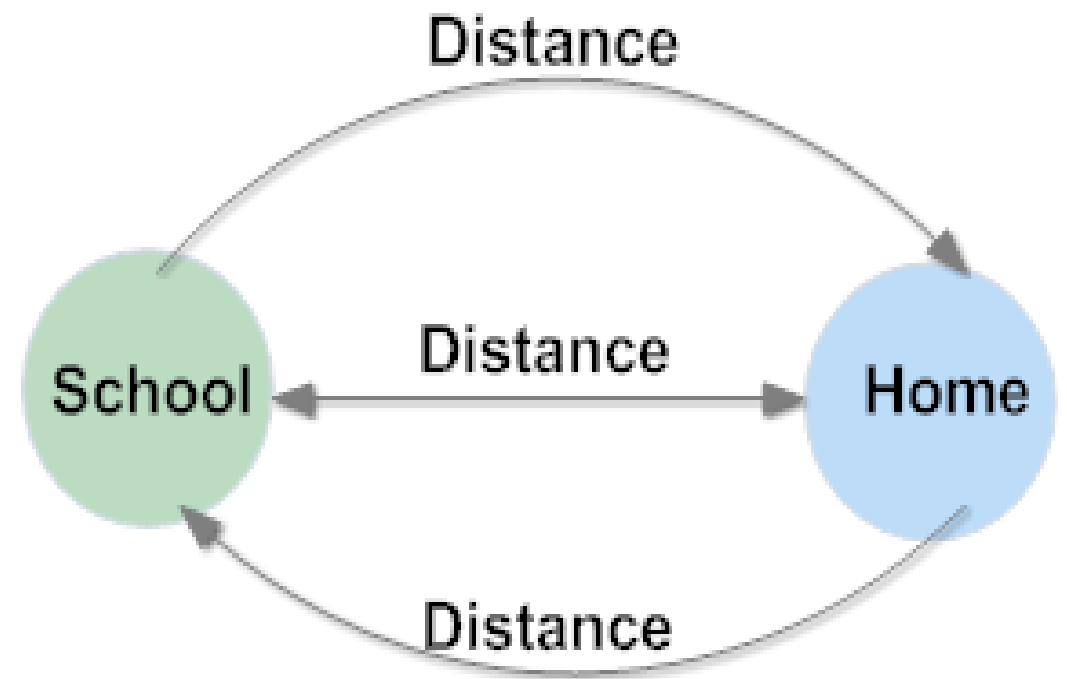
Participants

- 34 newly licensed drivers aged 14-16 years from three rural high schools of eastern Iowa

- Installed ETVRs on first day of license

  - School License: 14 years old independent drivers

  -Intermediate License: Traditional 16 year old drivers

  -Both : Teens that held a school license before intermediate license
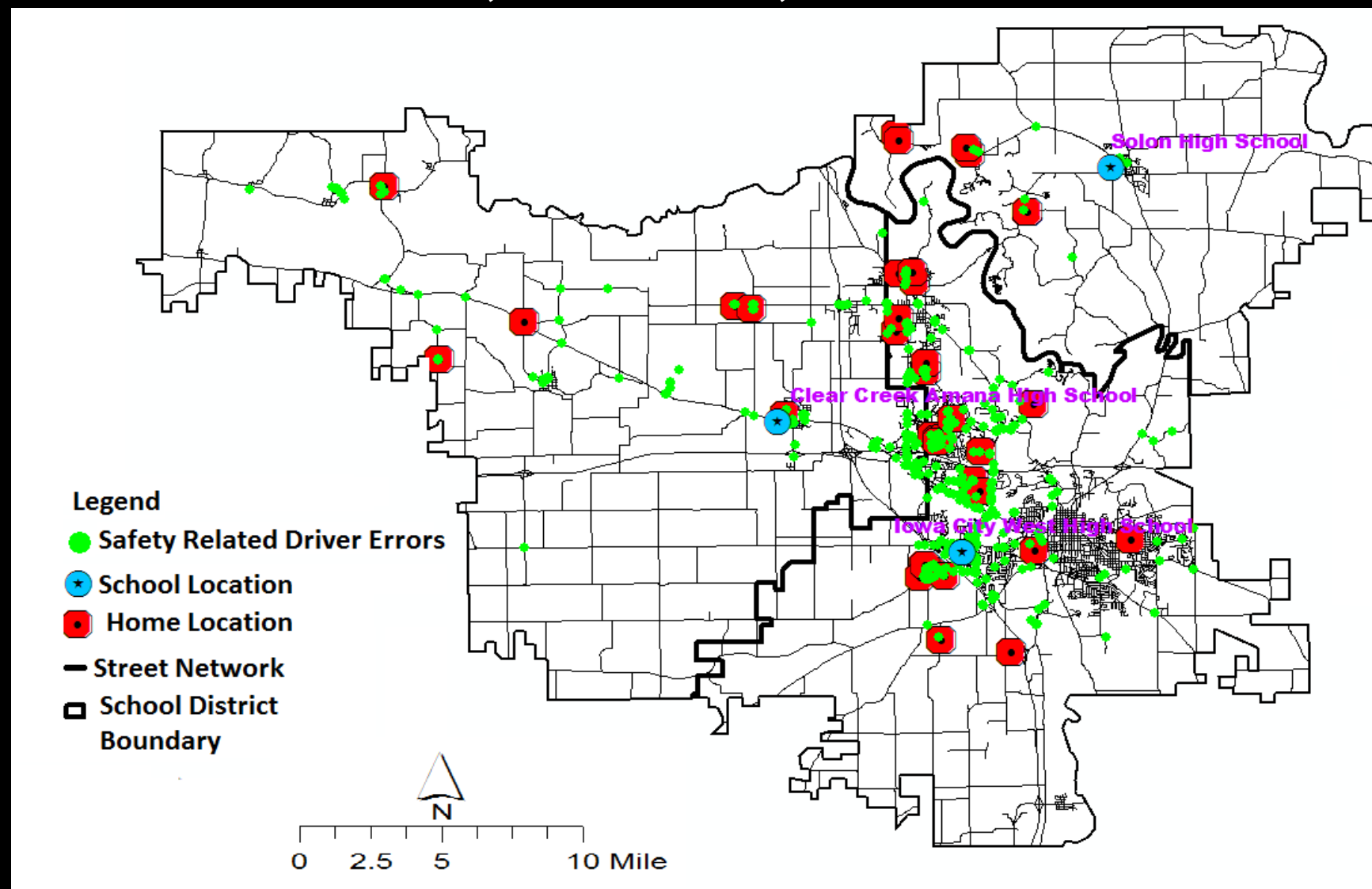
- Students must be the primary driver of their car

Event triggered video recorders

Spatial analysis and visualization

- Created spatial distribution maps of driver errors using the lat/long recorded by the ETVR
- Geocoded home and school addresses
- Visualized location of home, school, and driver error location
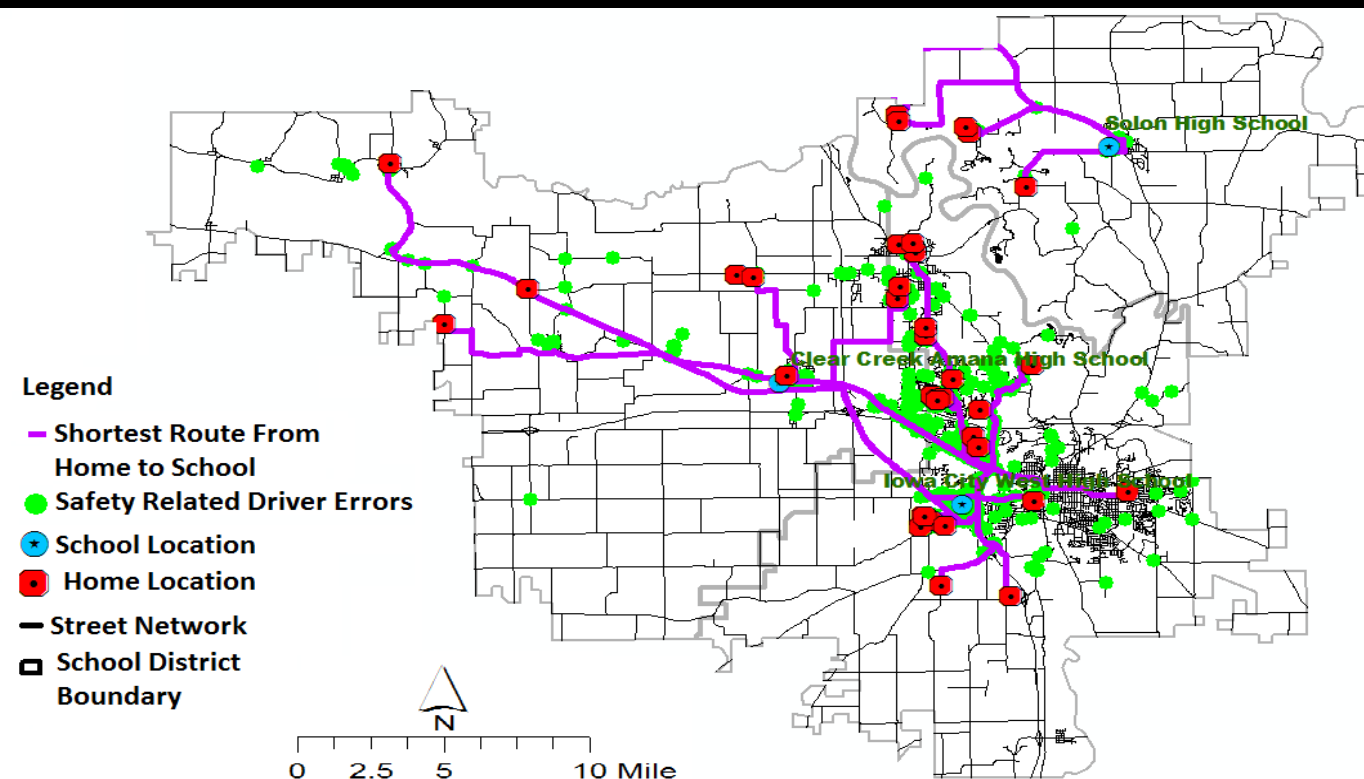
Spatial Analysis and Visualization (Cont.)

- Estimated the shortest route distance from home to school using network distance (ND)

- Estimated the shortest distance from home and school to driver error location using (ND)

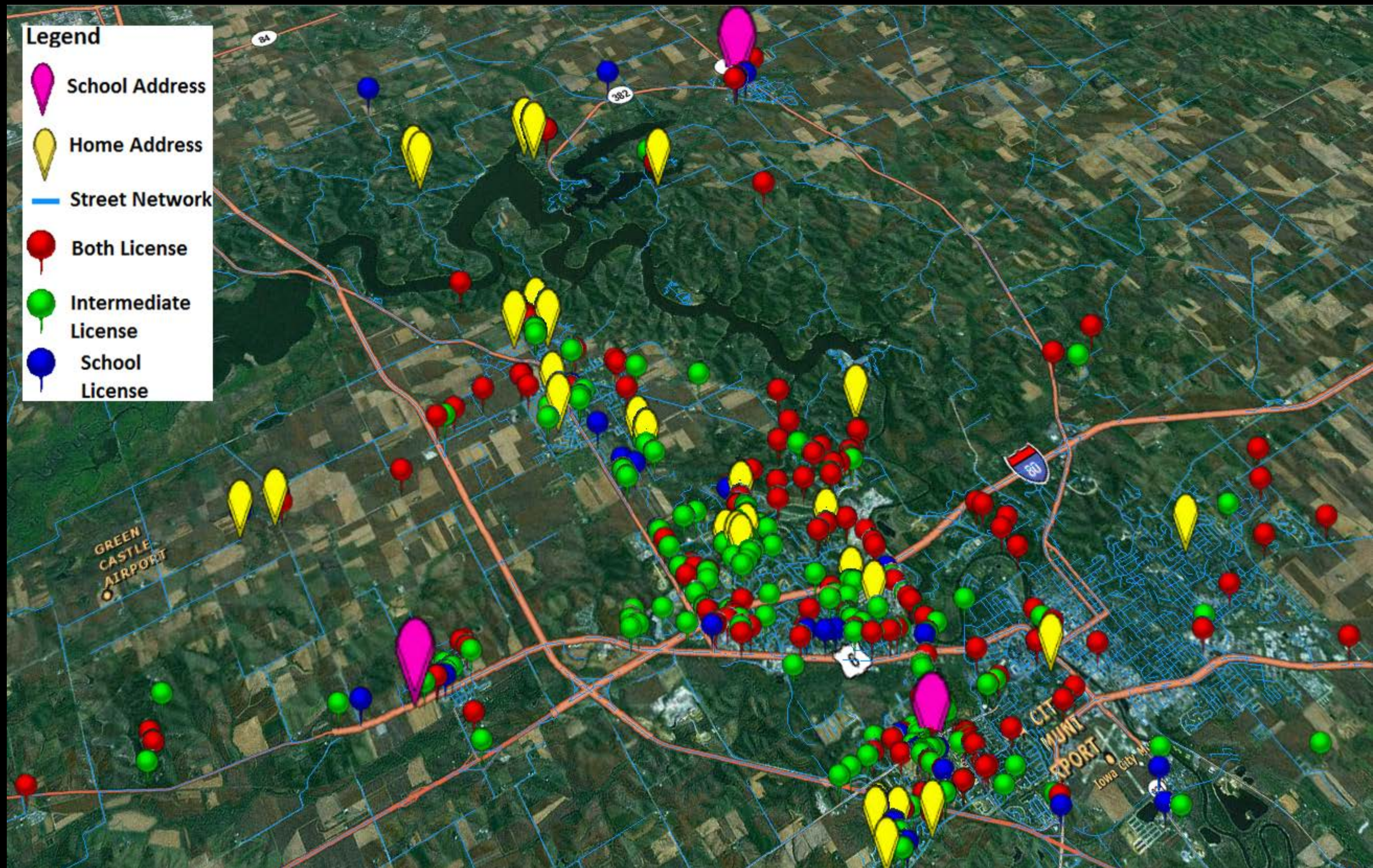- Calculated the relative distance for each driver error location from home and school

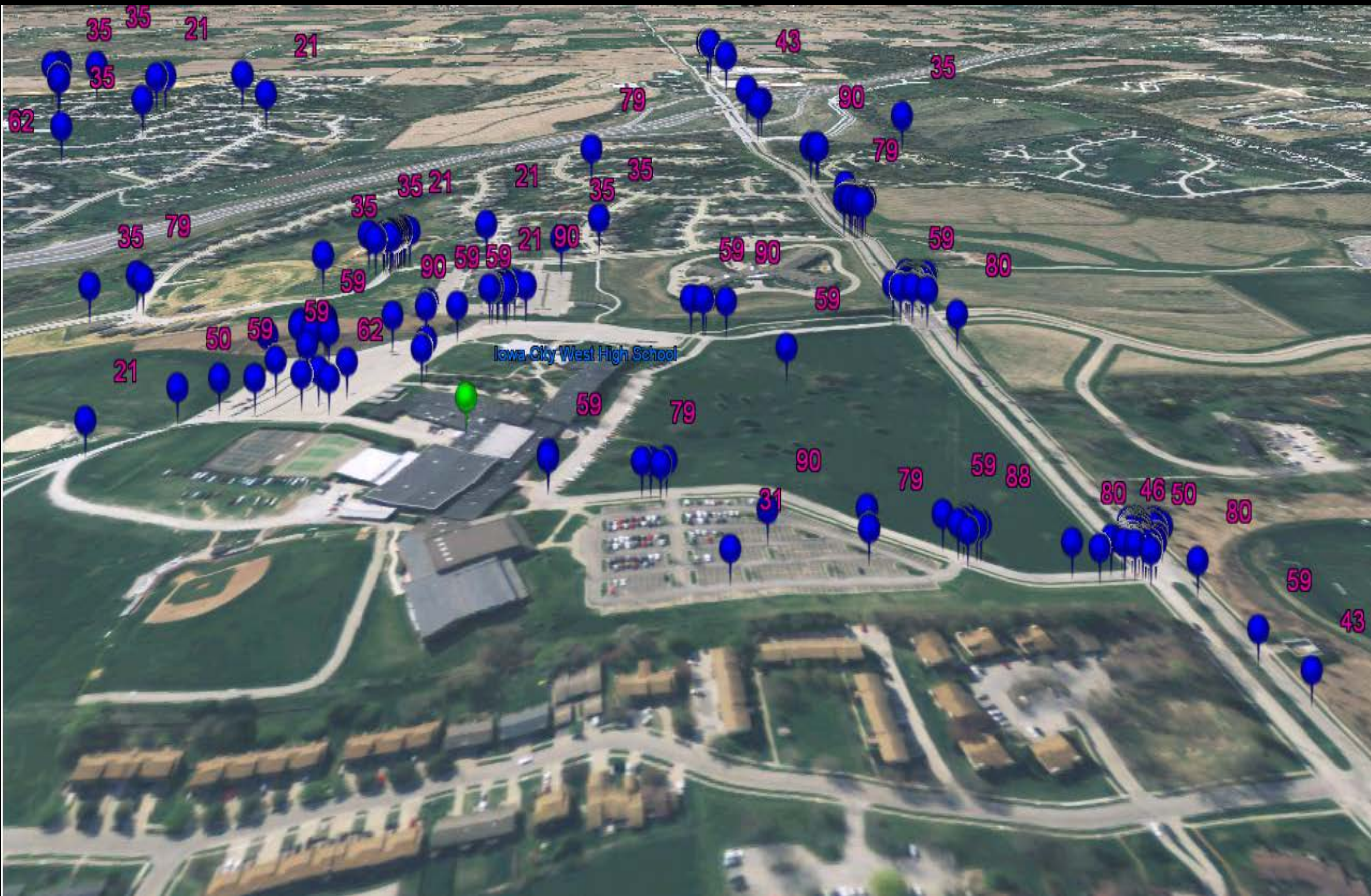**Relative Distance**

$$R_{ij\,H} = \frac{D_{ij\;E,H}}{D_{j\;H,S}}$$

$$R_{ijS} = \frac{D_{ij\;E,,S}}{D_{j\;H,,S}}$$

Legend

— Shortest Route From Home to School
● Safety Related Driver Errors
⊙ School Location
■ Home Location
— Street Network
▫ School District Boundary

N

0   2.5   5   10 Mile

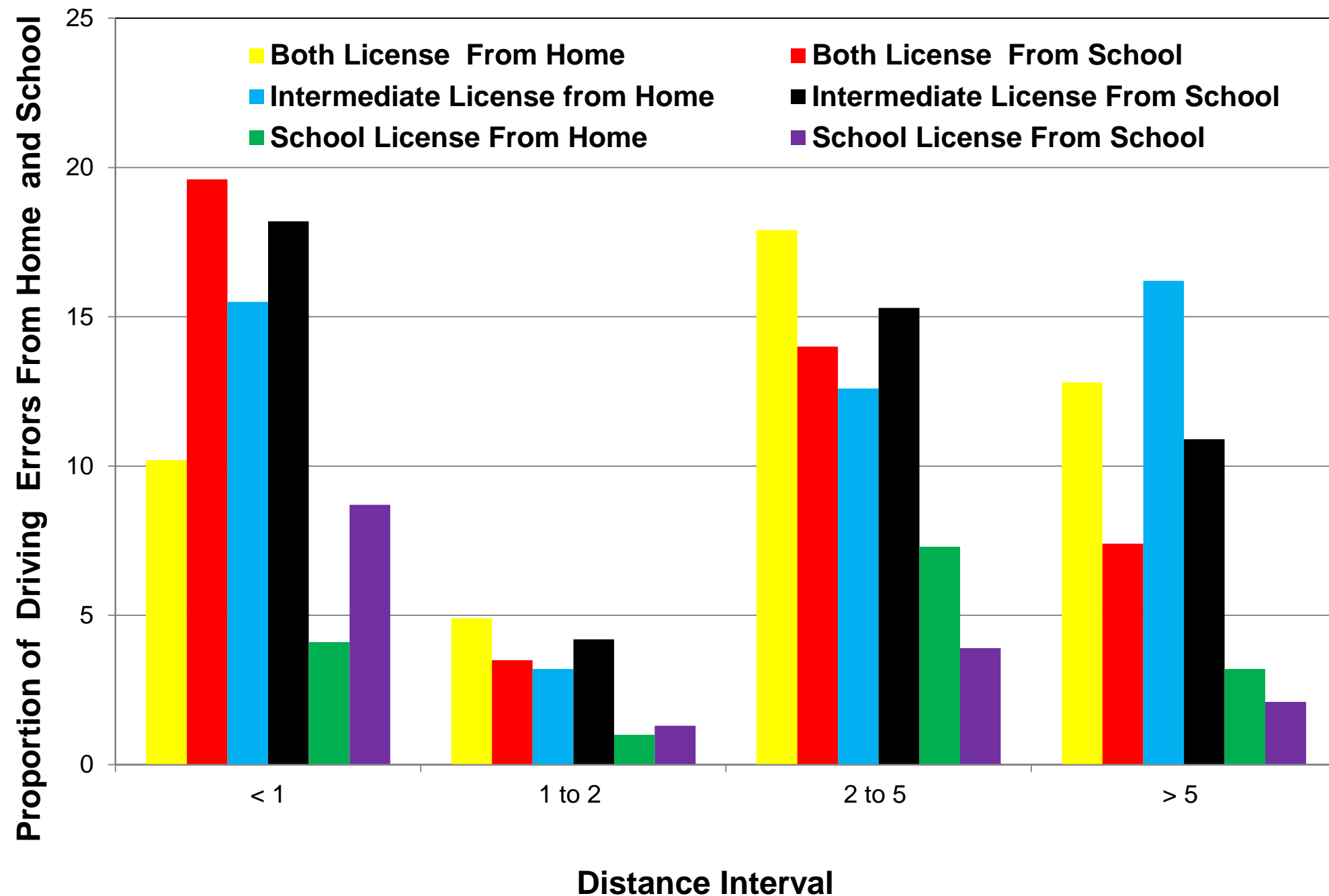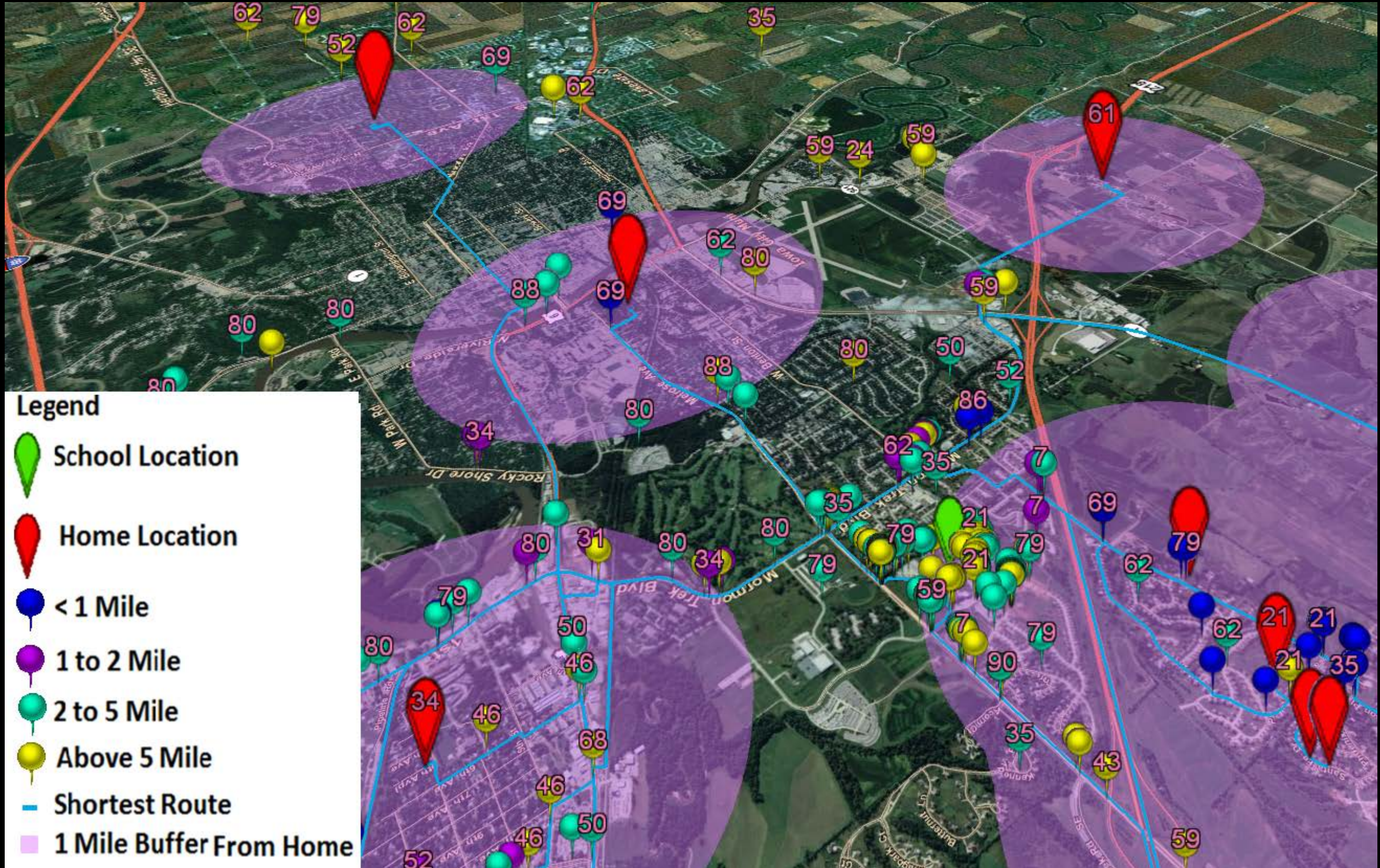Spatial Patterns of Driver Errors by License Types

Driving Errors of Individual Teens

Driving Errors by License Types

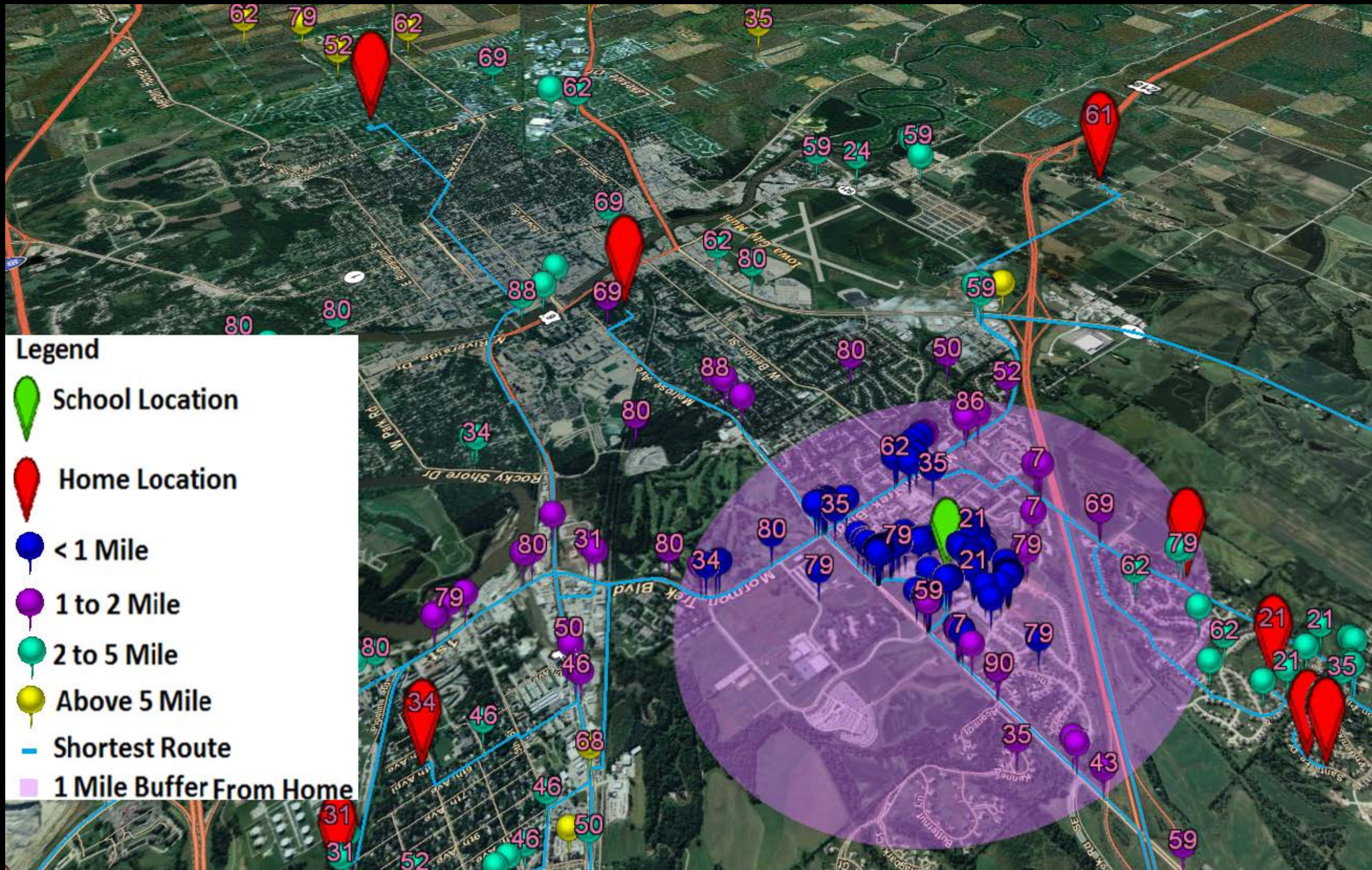| License Type	Number of Subjects	Number of Driver Errors	Average Number of Driver errors
Both	14	316	23
Intermediate License	14	342	24
School License	6	113	19

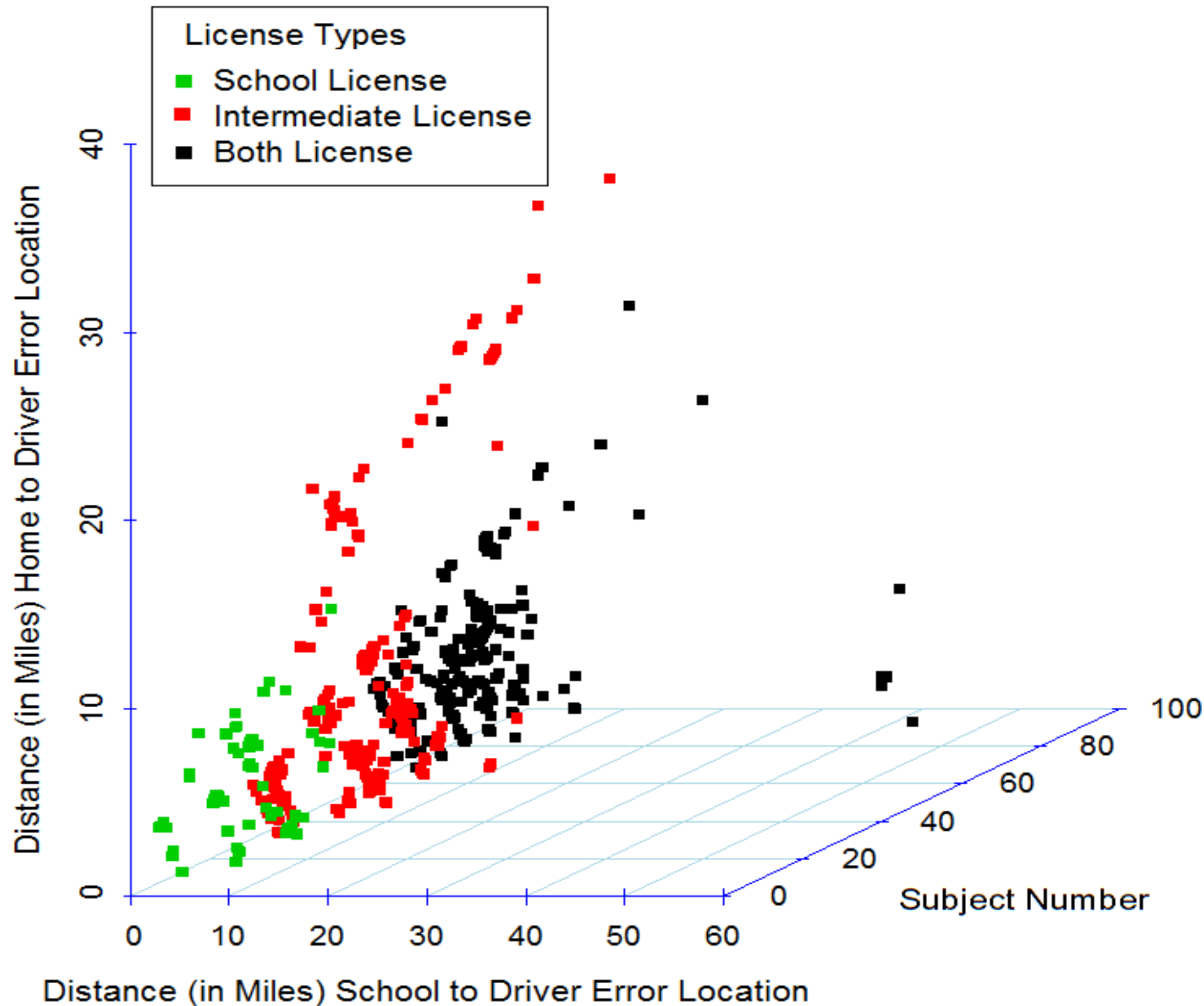# Driving Errors by License Types and Distance

Driver Errors in Proximity to Home

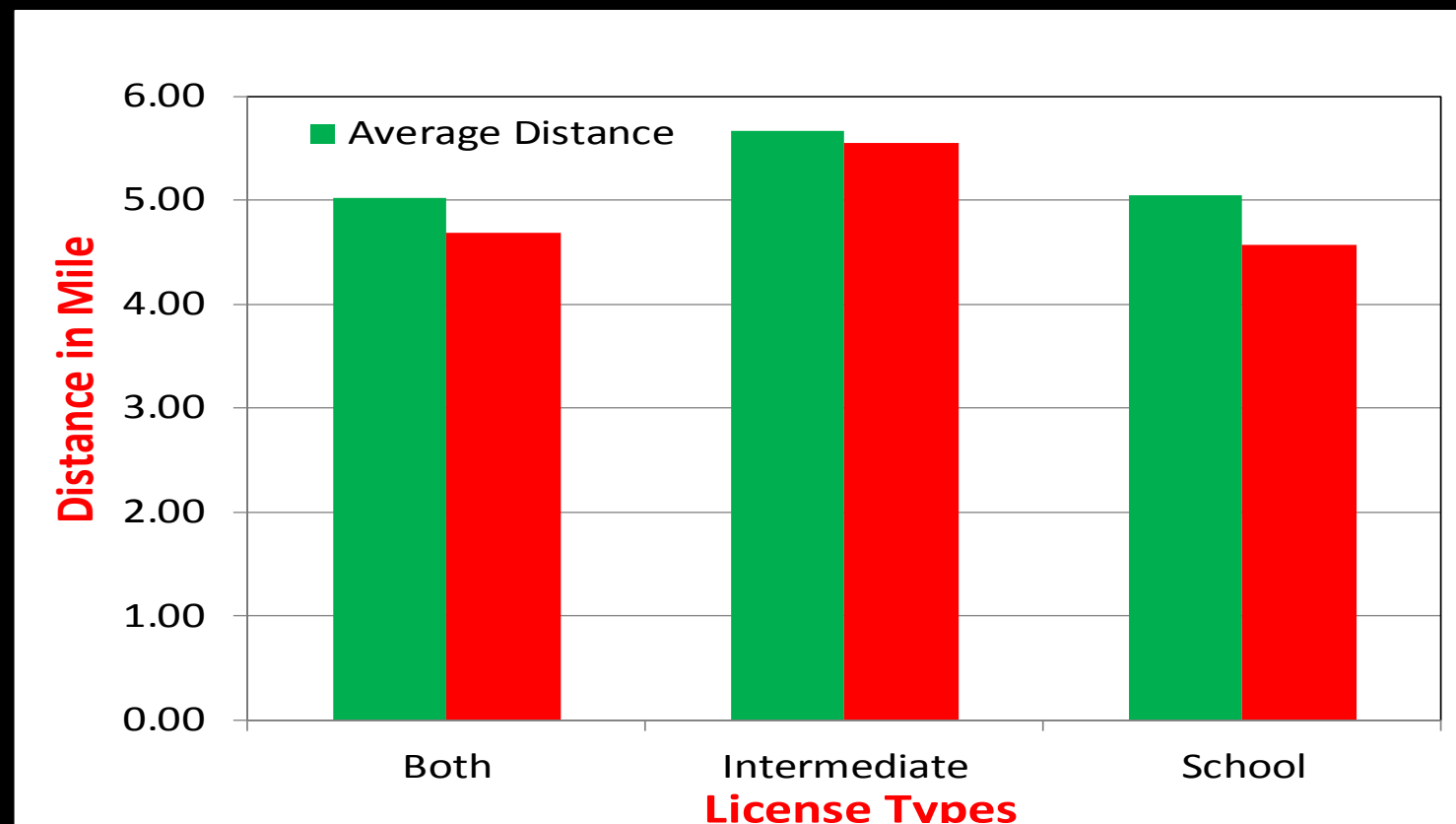# Driver Errors in Proximity to School

Driving Errors by License Types

Results

- The difference for the number of driver errors by the three license types in proximity **(1 Mile)** to home is higher than school p < 0.0001.

- The relative mean distance from home and school location to driver error location is also statistically significant (P < 0.05)

- The proximity of location of driver error is significant by all license types with P < 0.05.

Conclusions

- The number of teen driving errors vary
  - Geographically: proximity to school and home
  - Age: license types difference
  - Age and Proximity: the difference in driver errors is more significant within 1 mile.
- If closer you are from school the higher the driver errors
- The driver errors clustered by license types
- The driver errors within 5 miles from school and home is 79.3% and 73.4% respectively.
- The proportion of driver errors is higher compared to crashes within 5 miles from homes and schools

Thank you

Questions and Comments?