

The Effects of CEVMS on Driver Eye Glance Behavior

Office of Safety R&D

Federal Highway Administration

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Study Objectives

Determine whether:

- Drivers look at Commercial Electronic Variable Message Signs (CEVMSs) for periods of time that exceed suggested safety criteria
- Drivers look at CEVMSs more frequently or for longer durations than they do when viewing standard billboards



Research Approach

- Field Research
Vehicle equipped with an **eye-tracking** system



This Field Research

Can Tell Us About:

- Driver visual behavior in the presence of CEVMS and Standard Billboards
 - Where drivers look and how often
 - How long they spend looking (by each glance and overall)
- If drivers did anything that can be considered risky

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Cannot Tell Us About:

- Safety, as defined by crashes
- Vehicle control performance
- Signs or other issues not tested or controlled
 - No animated CEVMS
 - Brightness measured but not controlled
 - Placement recorded but not controlled

Locations



- City 1...
 - Reading, PA

Locations



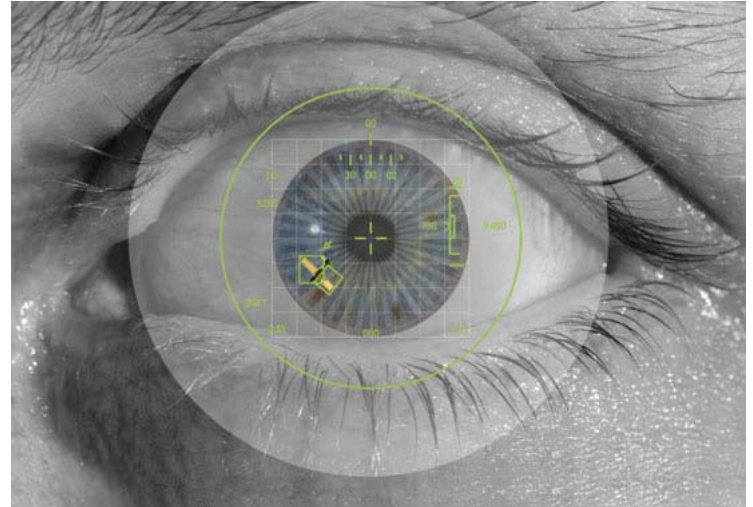
- City 1...
 - Reading, PA
- City 2...
 - Richmond, VA

Experimental Design

- 2 Locations
 - Included urban and suburban areas
- 2 Routes per location
- 2 Drives per participant
 - One in each route
- 2 Drive Times
 - About half of the participants drove in the daytime and the other half at nighttime
- The participants' task was to follow route guidance directions that were presented aloud

Measures

- Frequency of eye glances toward defined objects and areas (proportion)
- Rate of fixations to objects
- Duration of eye glances
- Frequency of potentially unsafe driving behaviors
 - as recorded by experimenter



Characteristics of the Routes

- Roughly 30-minute duration
- Mixtures of urban and suburban areas
- Combination of both freeway and non-freeway roadways
- 5 to 7 CEVMSs per route
- 5 to 7 SBBs per route



SBB Example

Other Recorded Variables

- Driver Characteristics
 - Age, gender, familiarity with route, driving experience
- Weather
- Route Characteristics
 - Traffic, access control, roadway configuration



Billboard Characteristics

- Location, orientation, distance from roadway
- Size, change rate for CEVMSs
- Brightness and contrast



CEVMS Example

Glance Target Category definitions

- **CEVMS** – pre-determined digital billboard defining data collection zone
- **Standard Billboard** – pre-determined standard billboard defining data collection zone
- **Standard Billboard (Other)** – other standard billboards present in the data collection zone

Glance Target

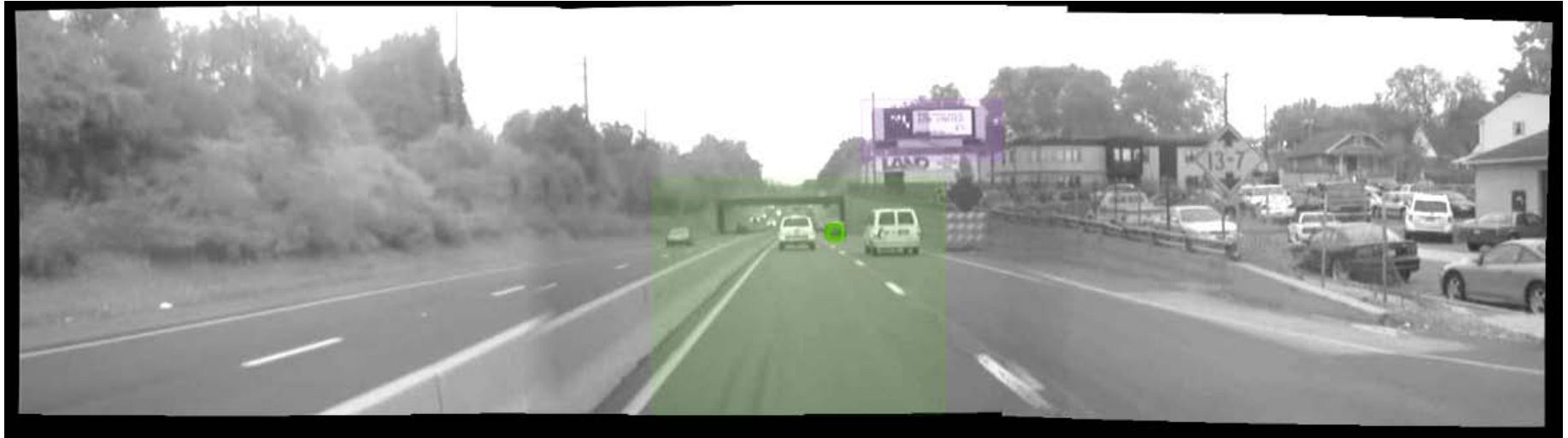
Category definitions

- **Road Ahead** – roadway surface from edge of shoulder to edge of shoulder or curb to curb, i.e. the physical roadway (for both directions of travel) between the research vehicle and the vanishing point of the roadway.
 - Also includes distant trees and buildings defining the path of the roadway ahead, as well as bridges, guard rails, embankments, etc.).
 - Also includes traffic control devices, vehicles and pedestrians that could potentially cause the participant to alter driving behavior to avoid collisions.

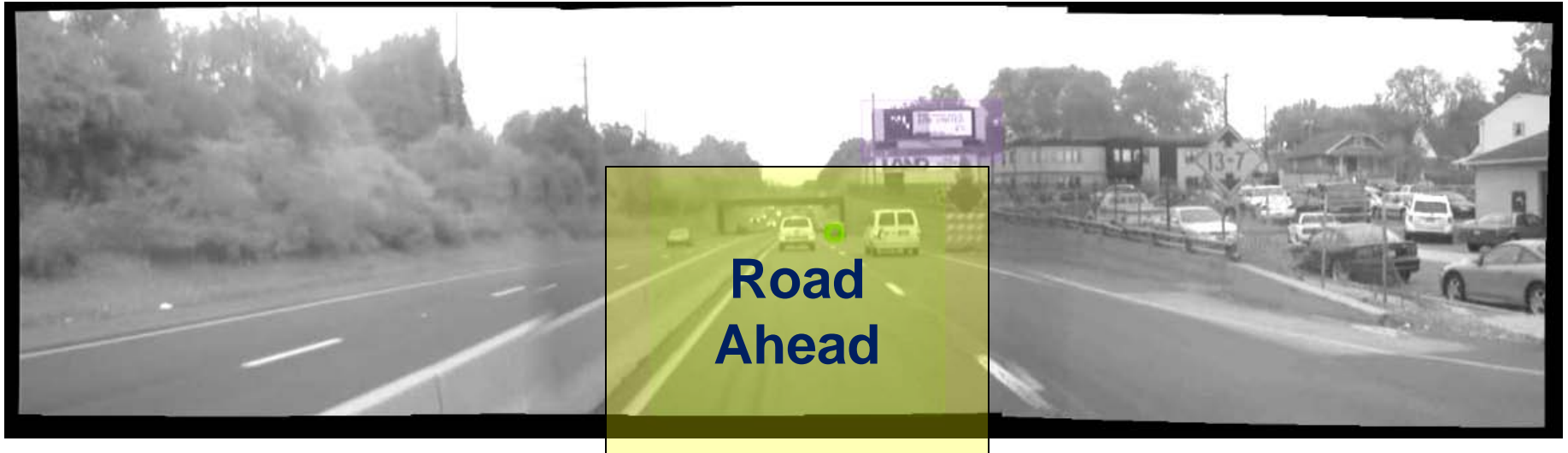
Glance Target Category definitions

- **Miscellaneous** – built environment (such as building structures, houses, hotels, commercial and industrial buildings, malls, parking lots); natural environment fields, forests, foliage, trees, bushes, mountains, lakes, rivers, clouds, sky, etc.); on-premise signs
- **Gauge cluster** – glances to the speedometer, etc.
- **Unknown** – the glances are outside of the field of view of the scene cameras and not to the instrument cluster. These glances may be to the inside or outside of the car.

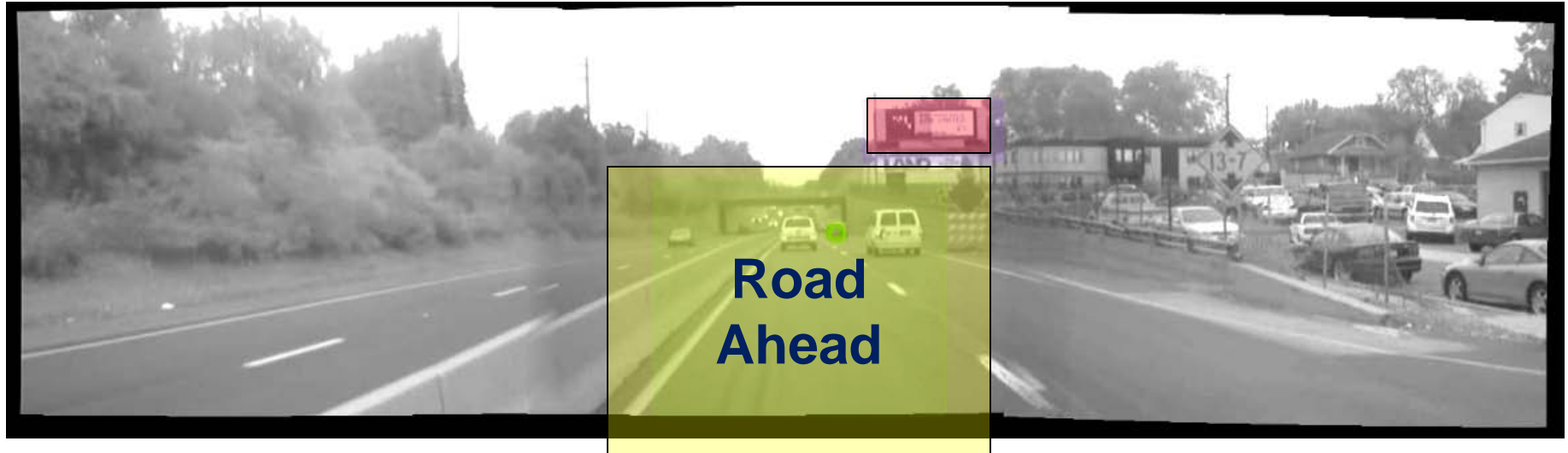
Glance Target Category definitions



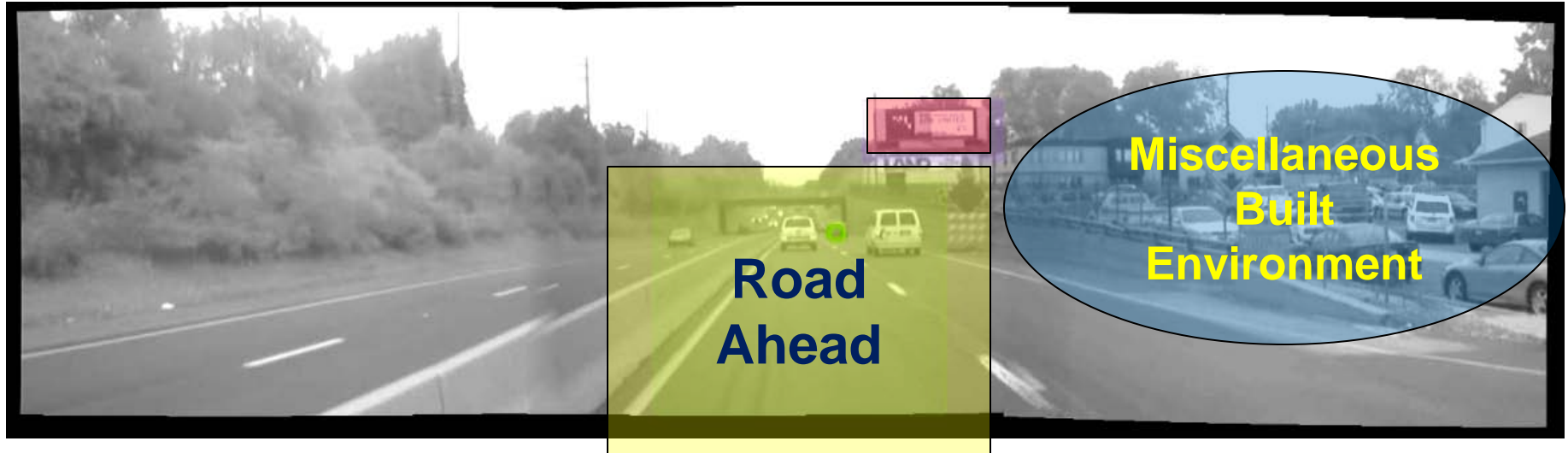
Glance Target Category definitions



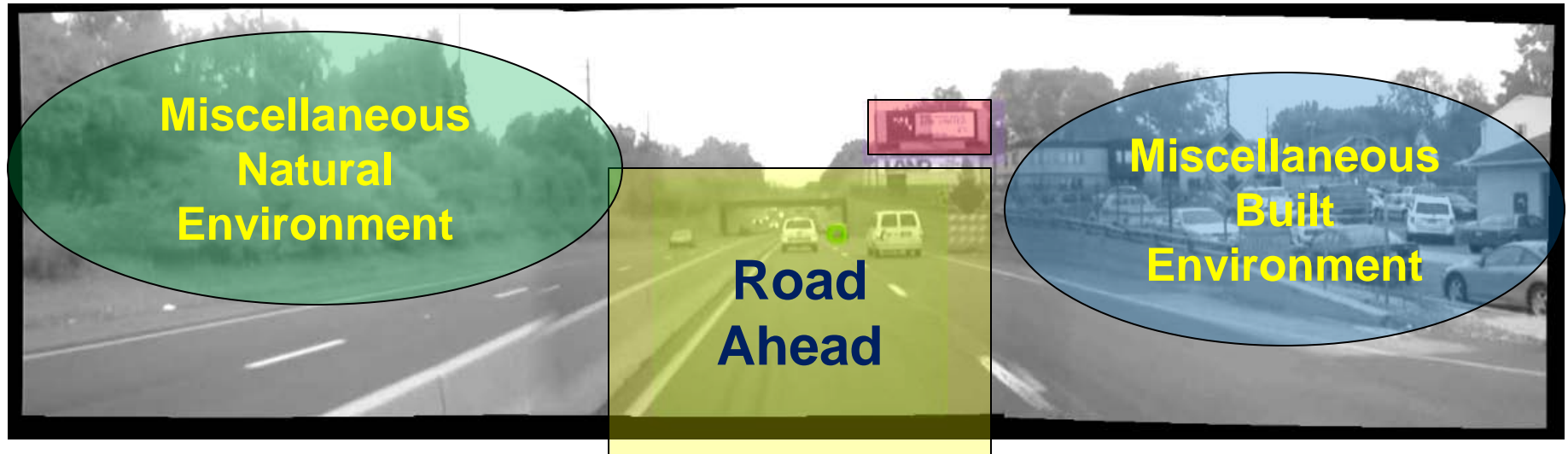
Glance Target Category definitions



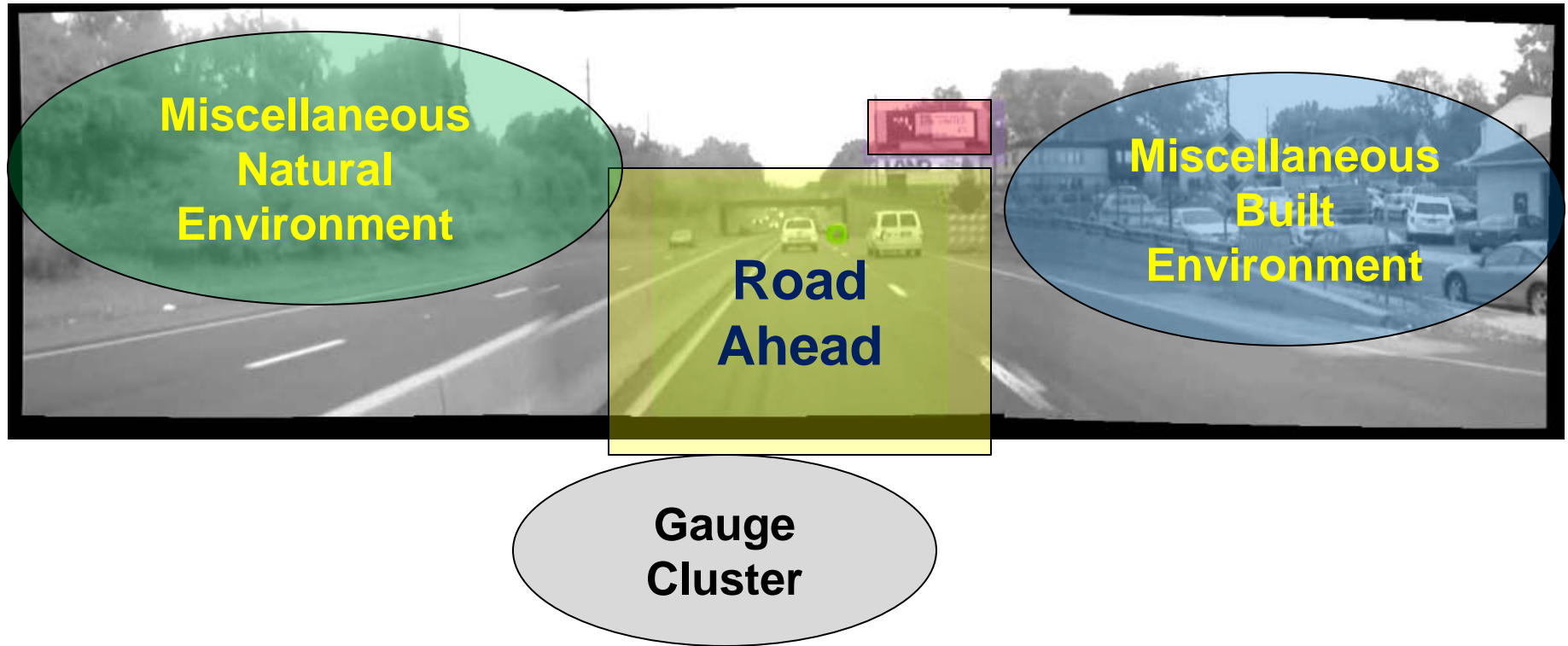
Glance Target Category definitions



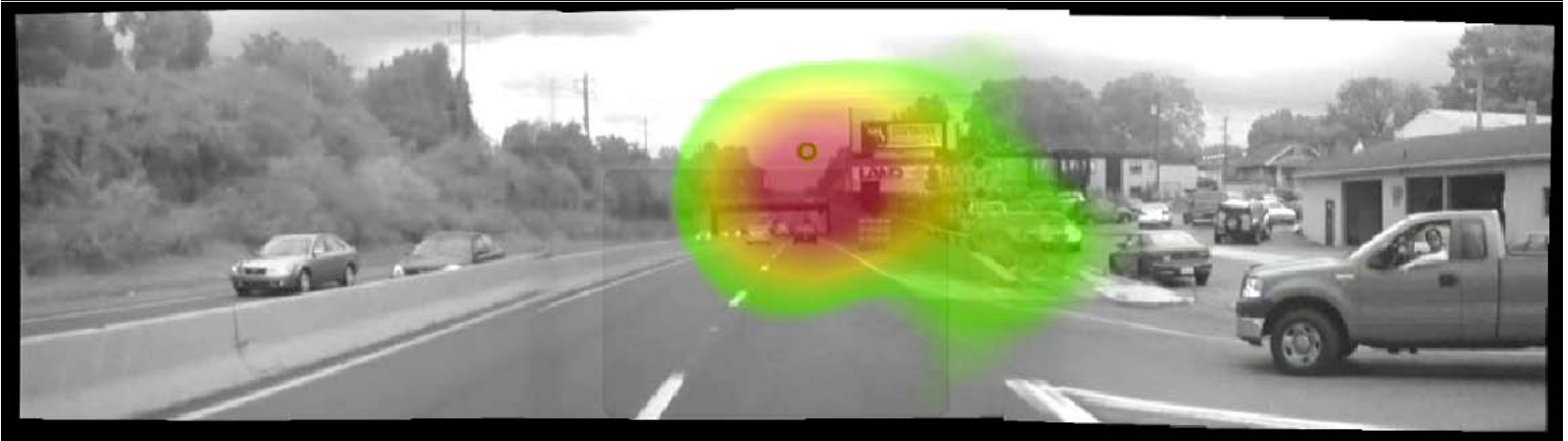
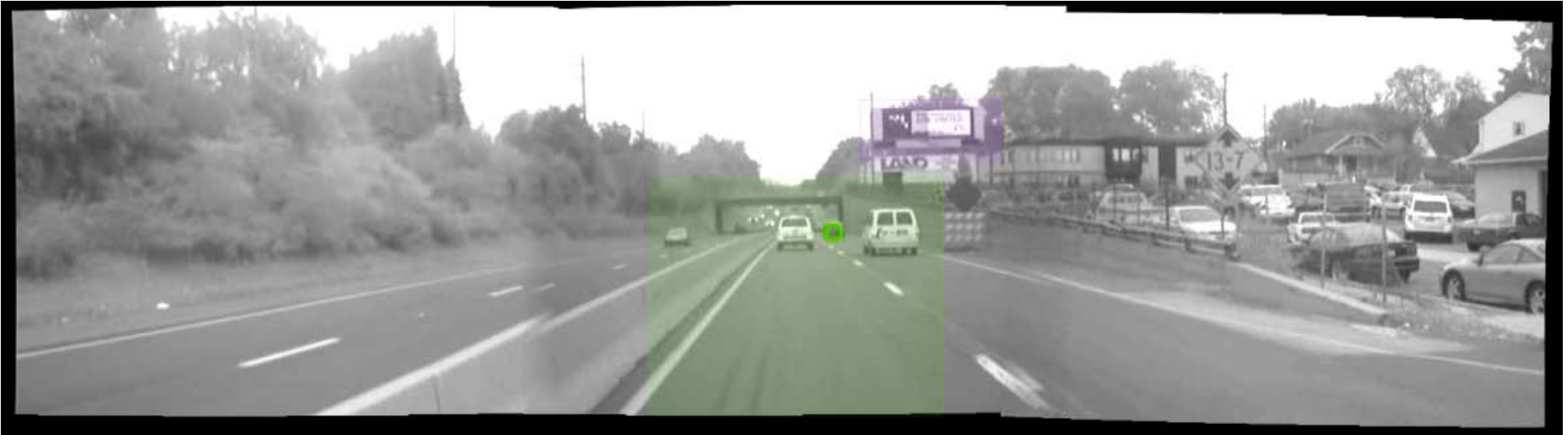
Glance Target Category definitions



Glance Target Category definitions



Sample Videos



Participant Samples

- City 1
 - 17 subjects drove in the daytime and 14 at nighttime (N = 31; all under age 65)
- City 2
 - 14 subjects drove in the daytime and 13 at nighttime (N = 27; all under age 65)

Status

- Data collection completed
- Data reduction completed
- Data analysis nearly complete
- Final Report – coming soon

Thank You

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