

A semi-truck is driving on a highway during sunset. The sun is low on the horizon, creating a warm, golden glow over the road and the truck. The truck is a blue semi-truck with a white trailer, and it is moving away from the viewer. The road has a white line on the left side, and there are trees and a utility pole in the background.

**Maven Machines**

**Zackary Knoll**

**March 22, 2017**



# Background

- **Around 35,000 road deaths per year**
- **12% of these deaths involve a large truck or bus**
- **It is estimated that as high as 20% of accidents involve fatigue**



# Fatigue and Distraction

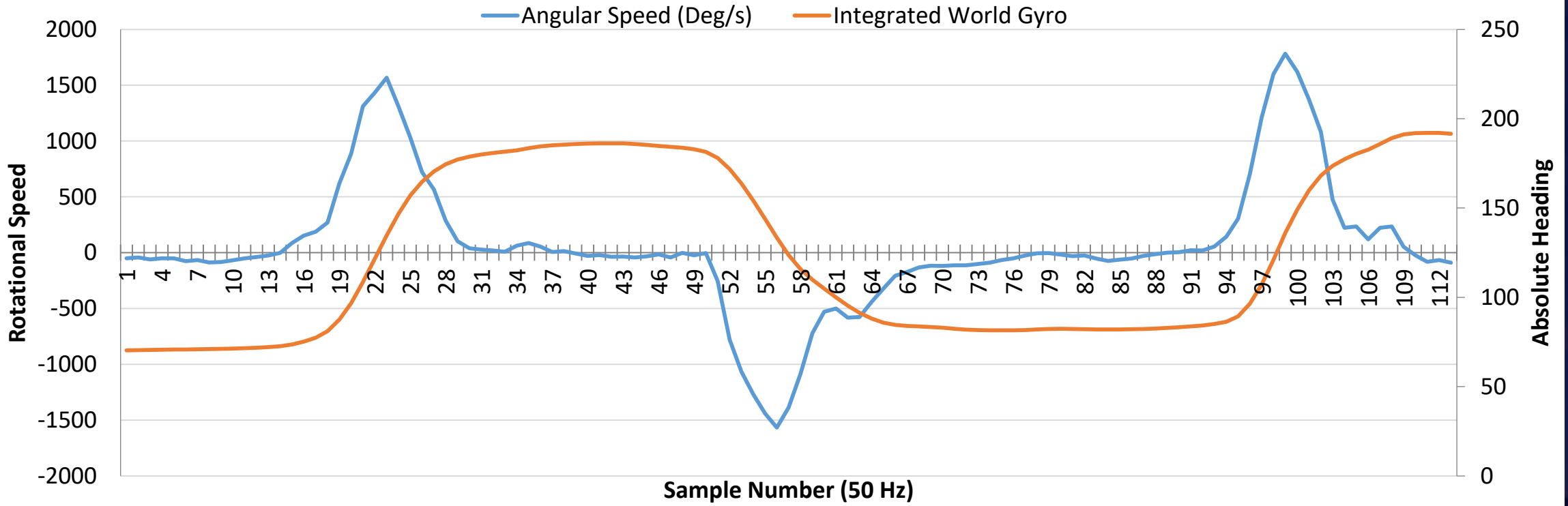
- **Ongoing**
- **Unavoidable**
- **Require constant management**
  
- **“Fatigue on the road is like injury for athletes, it's not if, but when and how you're prepared to manage it.” – *Professional Driver***

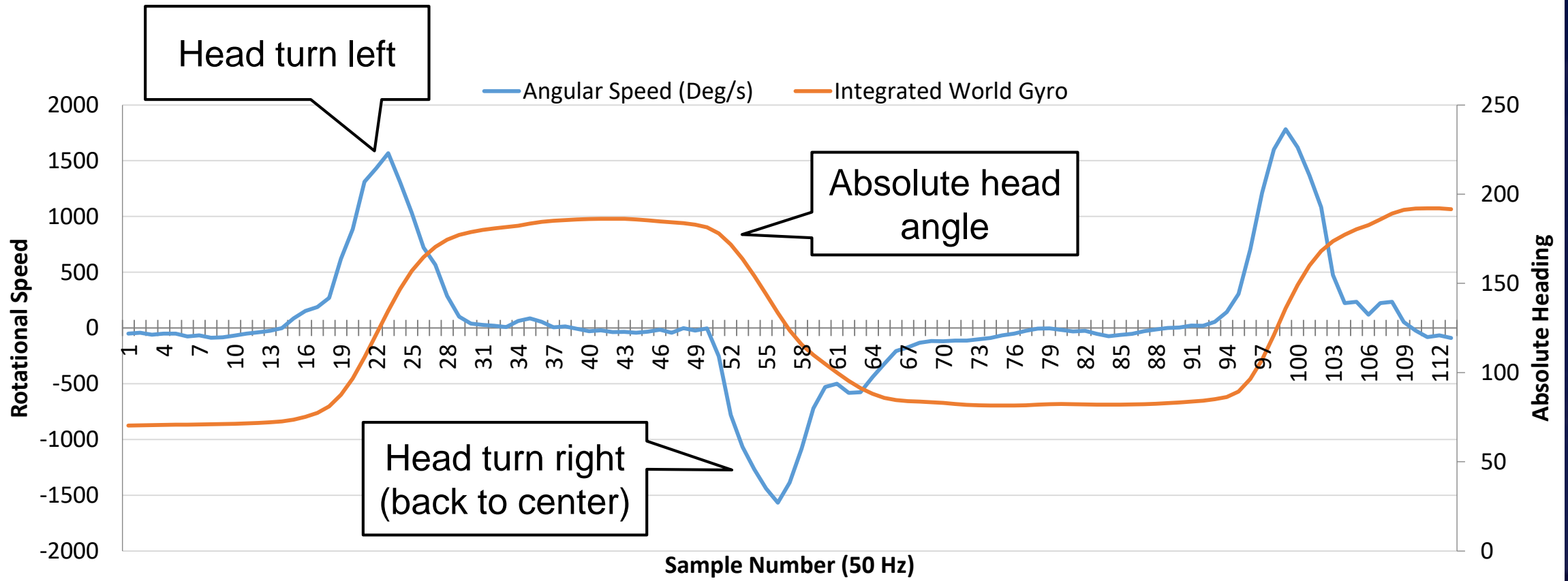


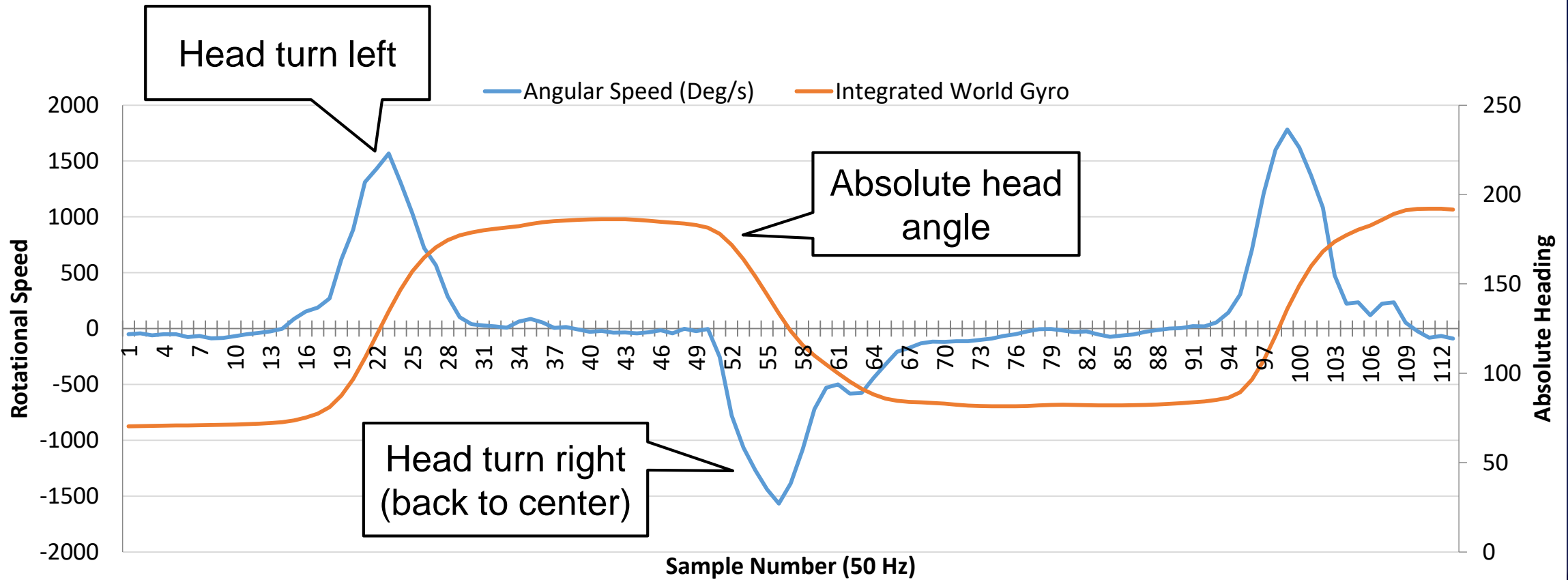
# Technology

- **Smart Bluetooth Hands-Free Headset**
- **High quality 6 DoF motion sensing**
- **Mobile, real-time processing**





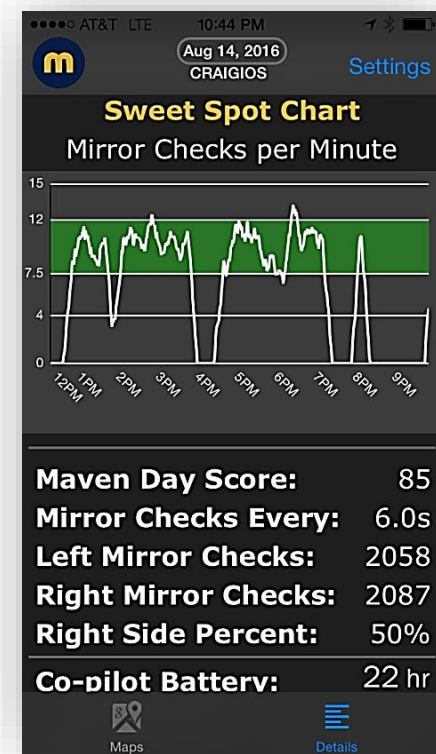




Combine with GPS from the mobile device to obtain a spatiotemporally continuous event stream



# Real-Time Data Recording





# Alerting Platform

- **Real time alerts can be delivered directly to the driver through the headset**
- **Text-to-speech alerts can be used to deliver descriptive alerts**
- **High potential for integration**



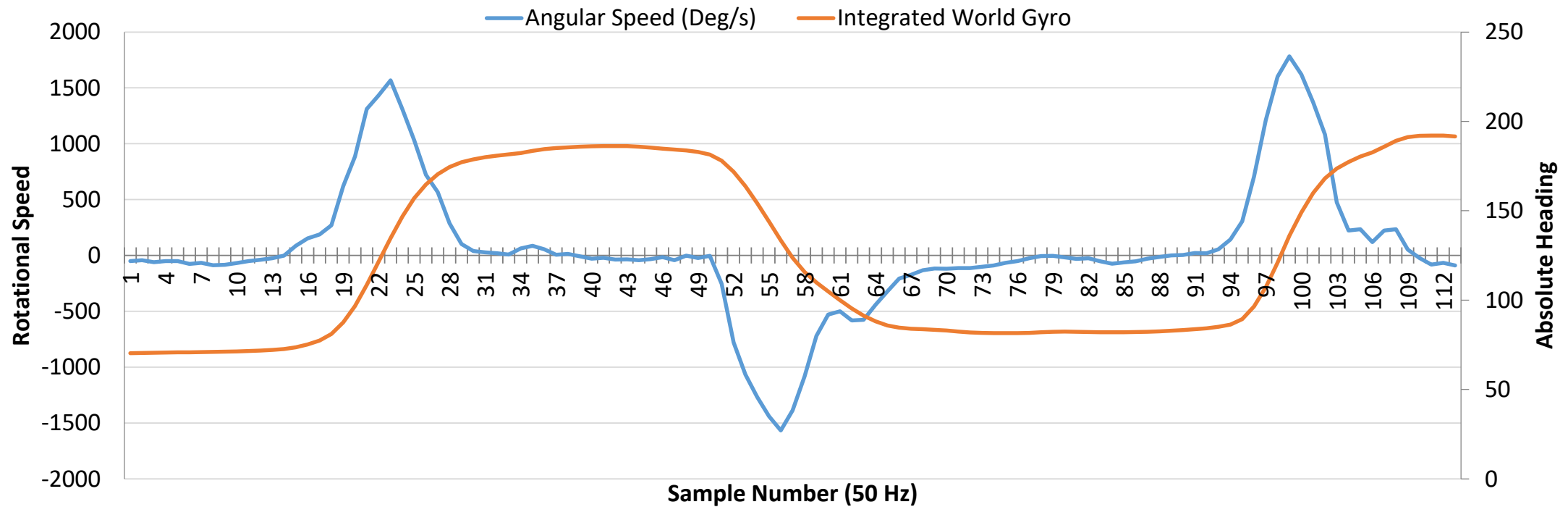
# Mirror Check Monitoring

## FMCSA Guideline

**Drivers should check their mirrors every 5-8 seconds and before lane changes, turns or merges**

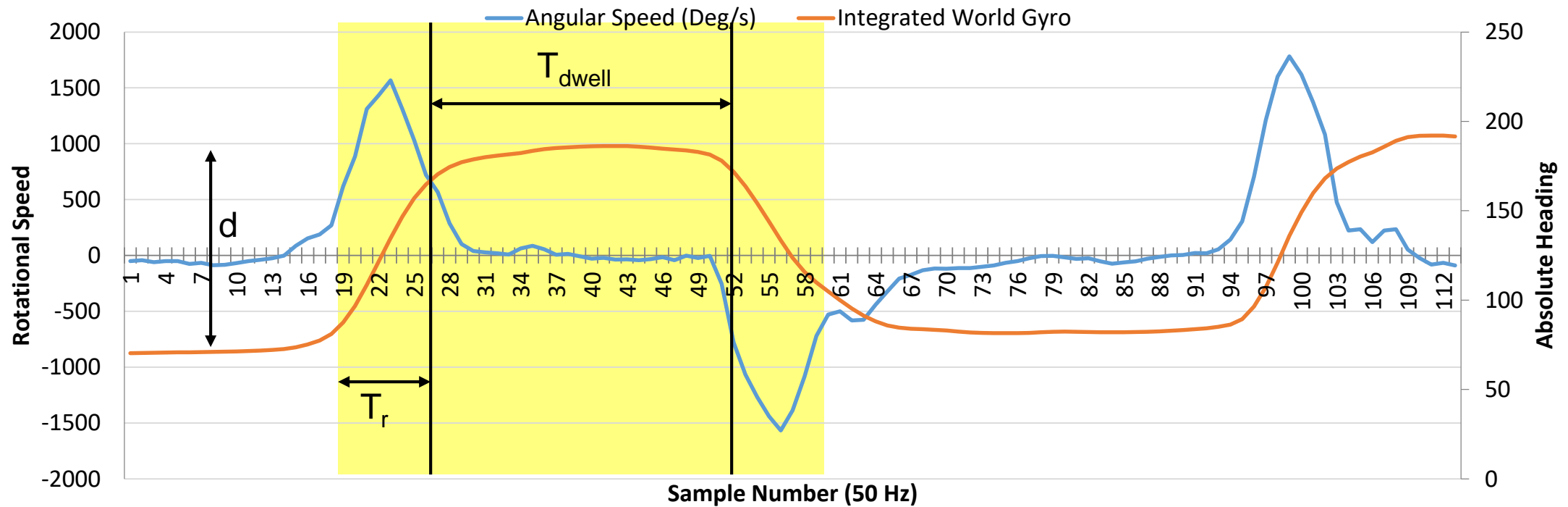


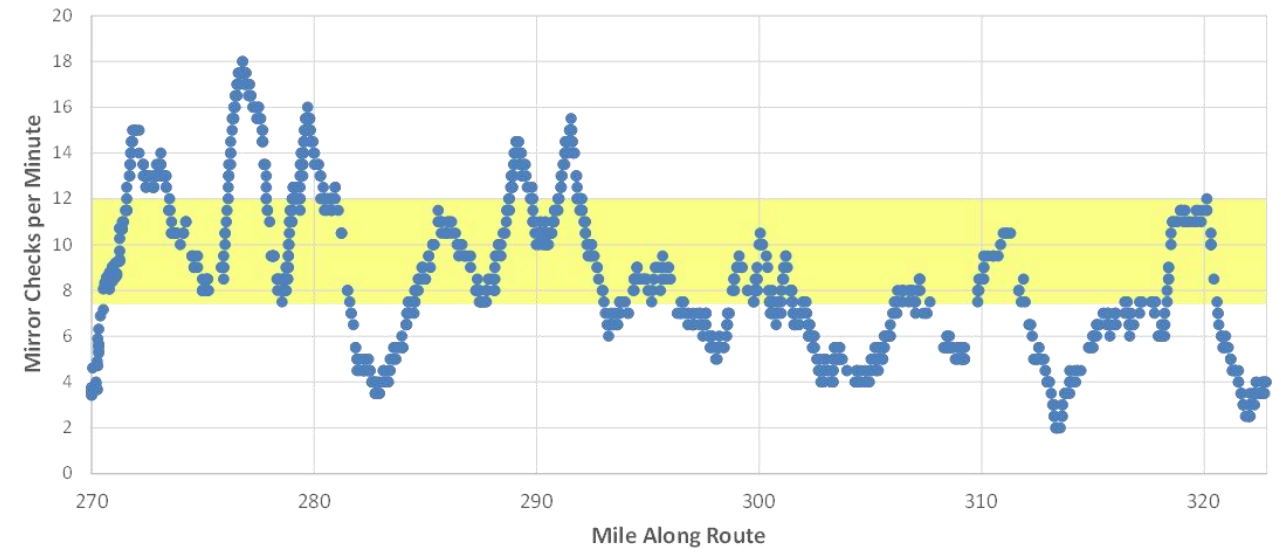
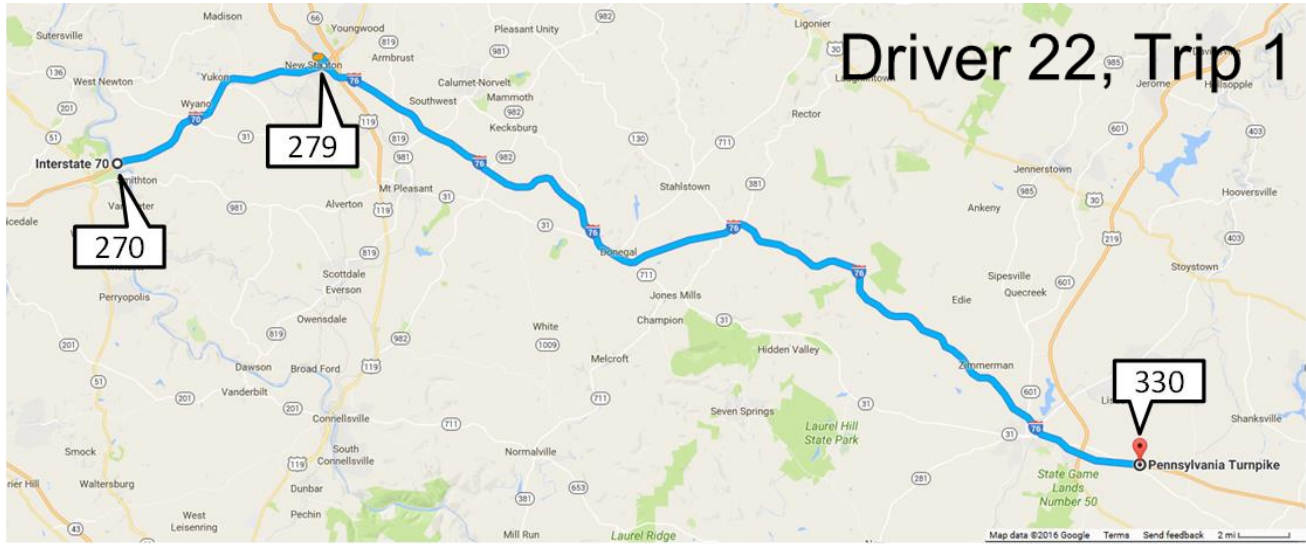
# Mirror Check Monitoring

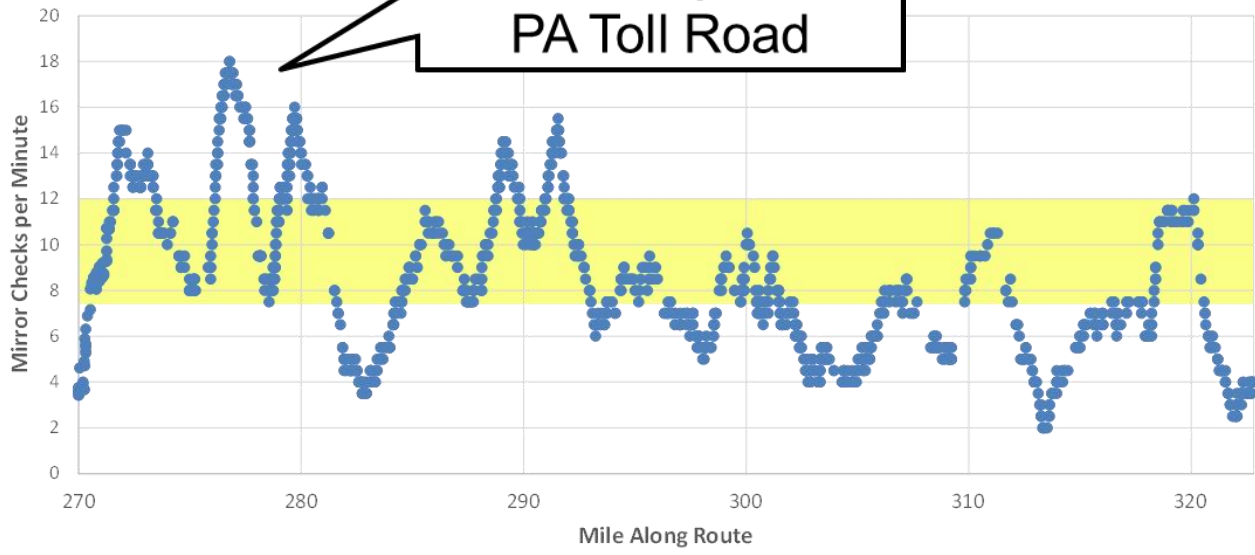
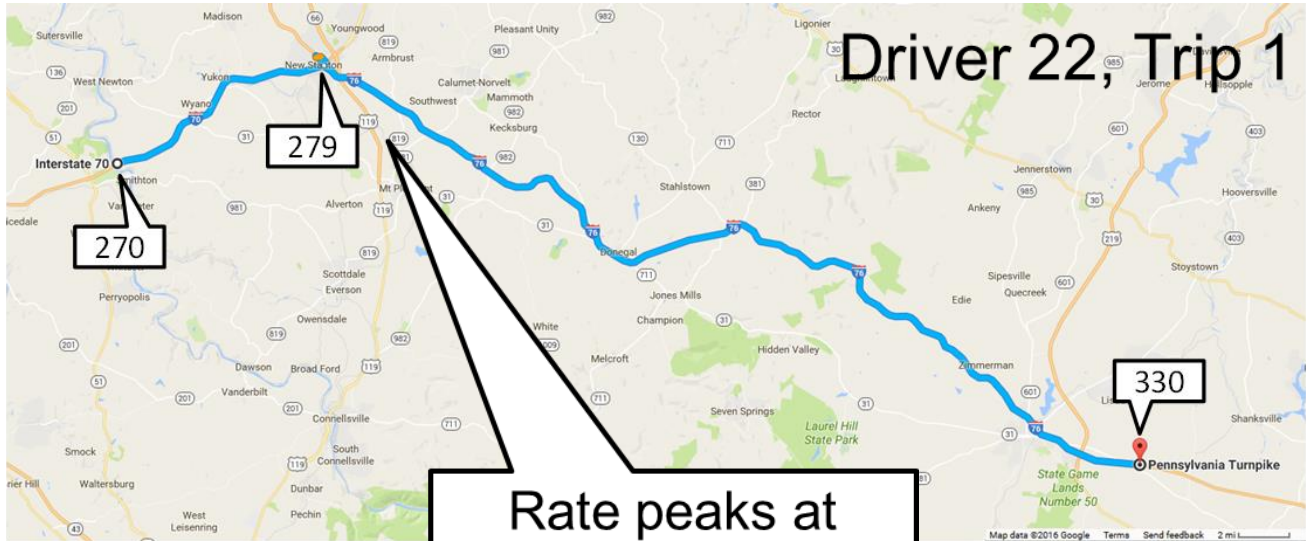


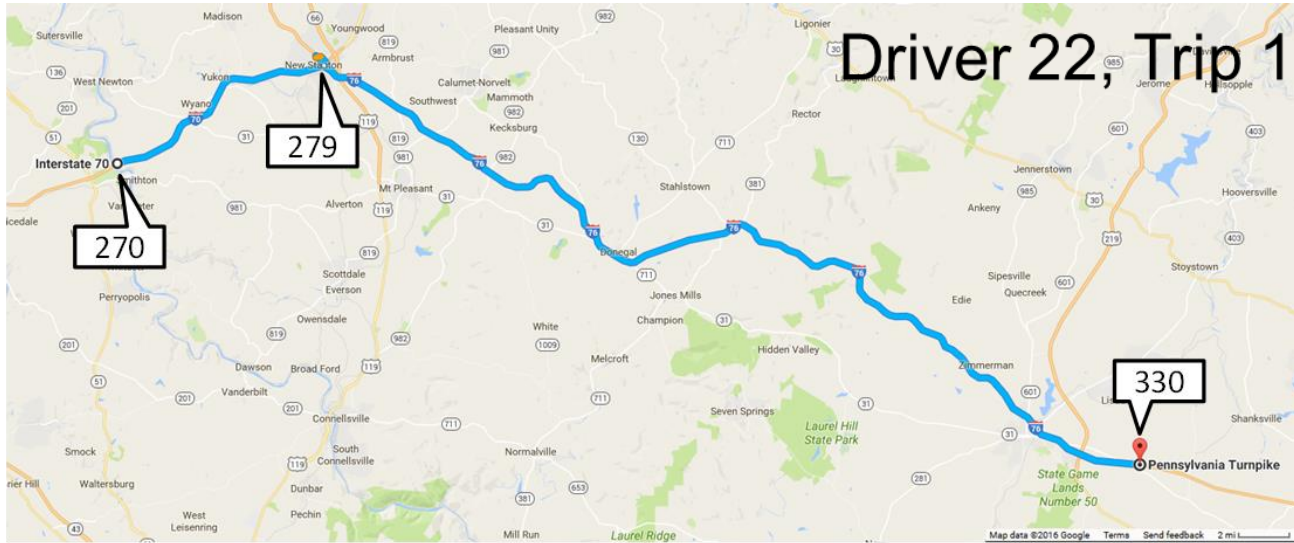
# Mirror Check Monitoring

$T_{\text{dwell}}$  = Dwell Time  
 $d$  = Depth of Motion  
 $T_r$  = Rise Time



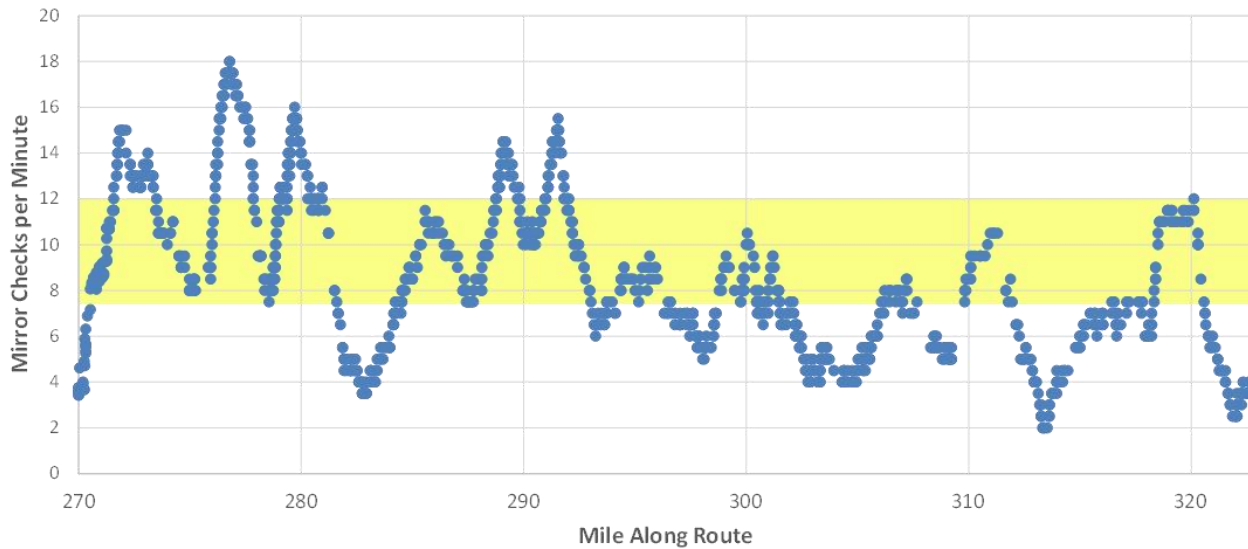




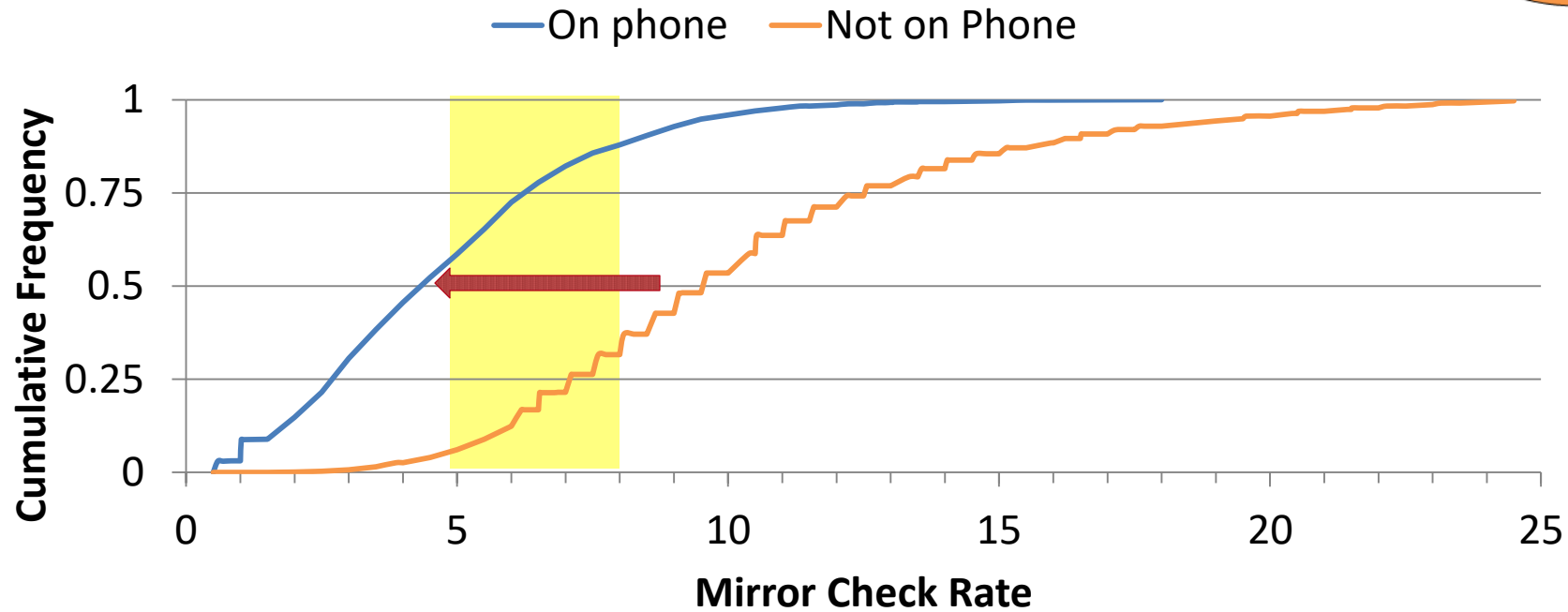
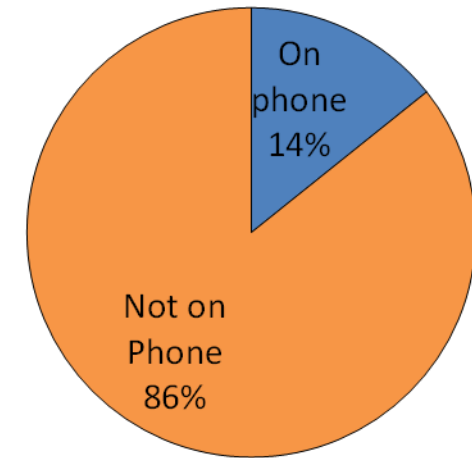


**General downward trend may be caused by:**

- Fatigue
- Decreased Cognitive Load
- Traffic
- Weather



# Coaching



Driver 18



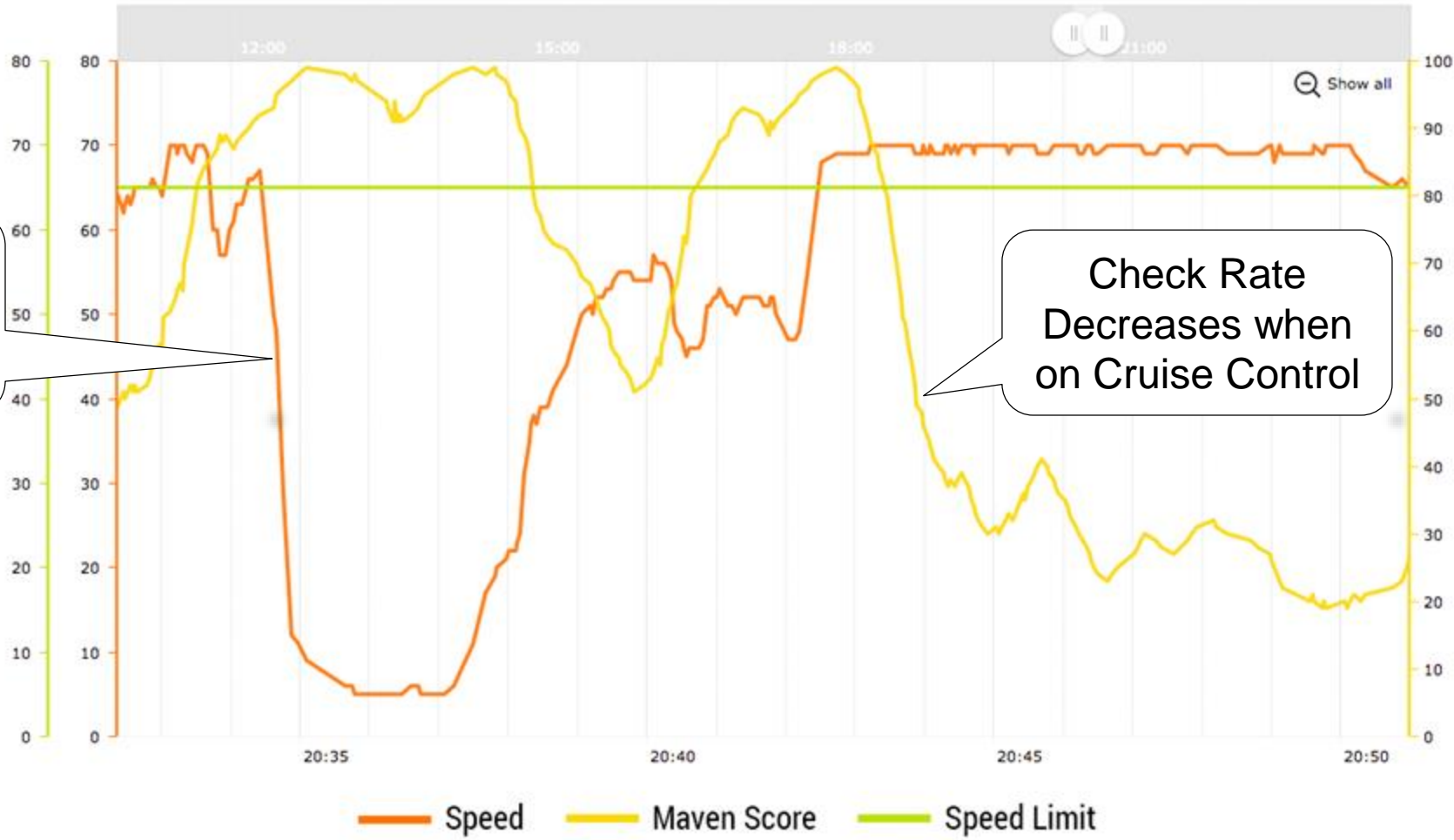


Score Based off  
of 2 Minute  
Mirror Check  
Average

65 MPH  
Speed Limit

Vehicle  
Speed

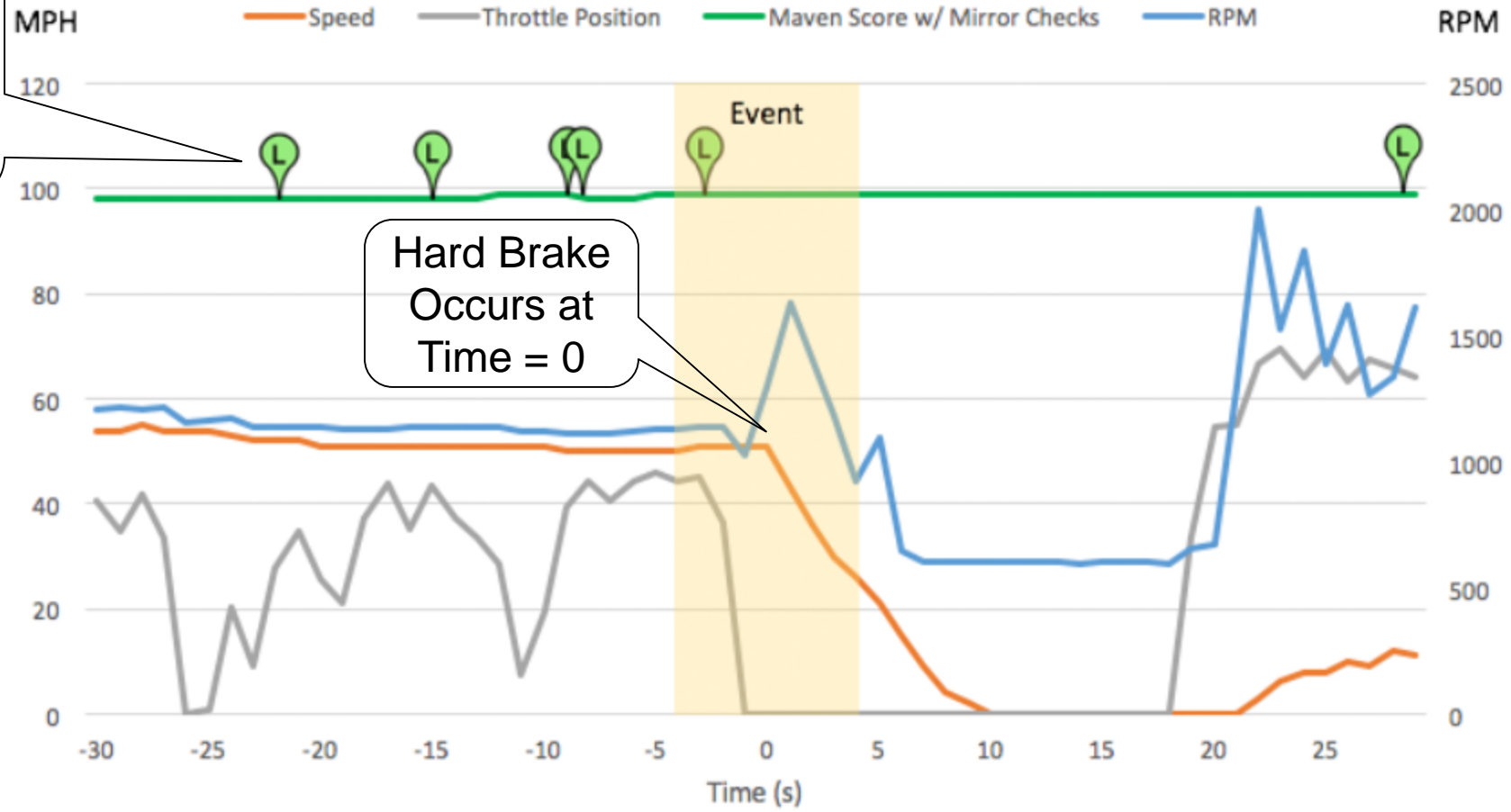




Check Rate Increases as Traffic Slows

Check Rate Decreases when on Cruise Control

High Score and Check activity indicate attentiveness

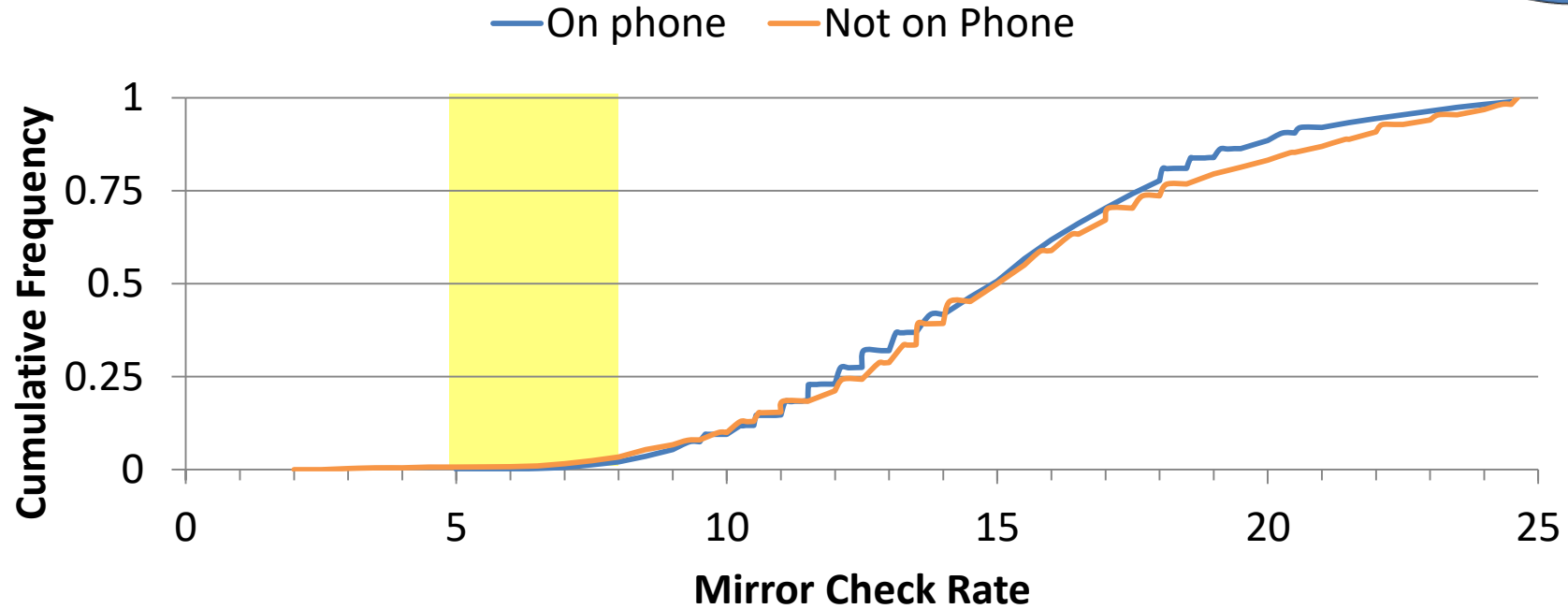
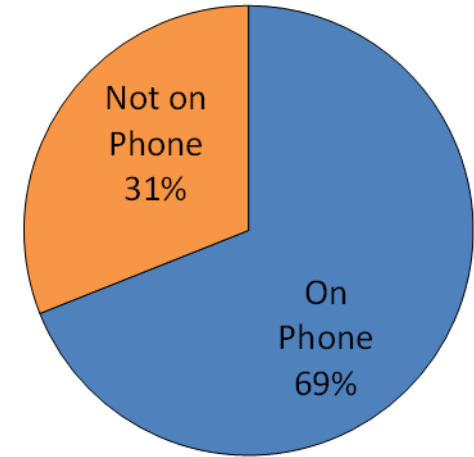


# Future Areas of Study

- **Further investigation into how head motion correlates with fatigue.**
- **Pre-screening for sleep disorders**
- **Discrete distraction event detection**



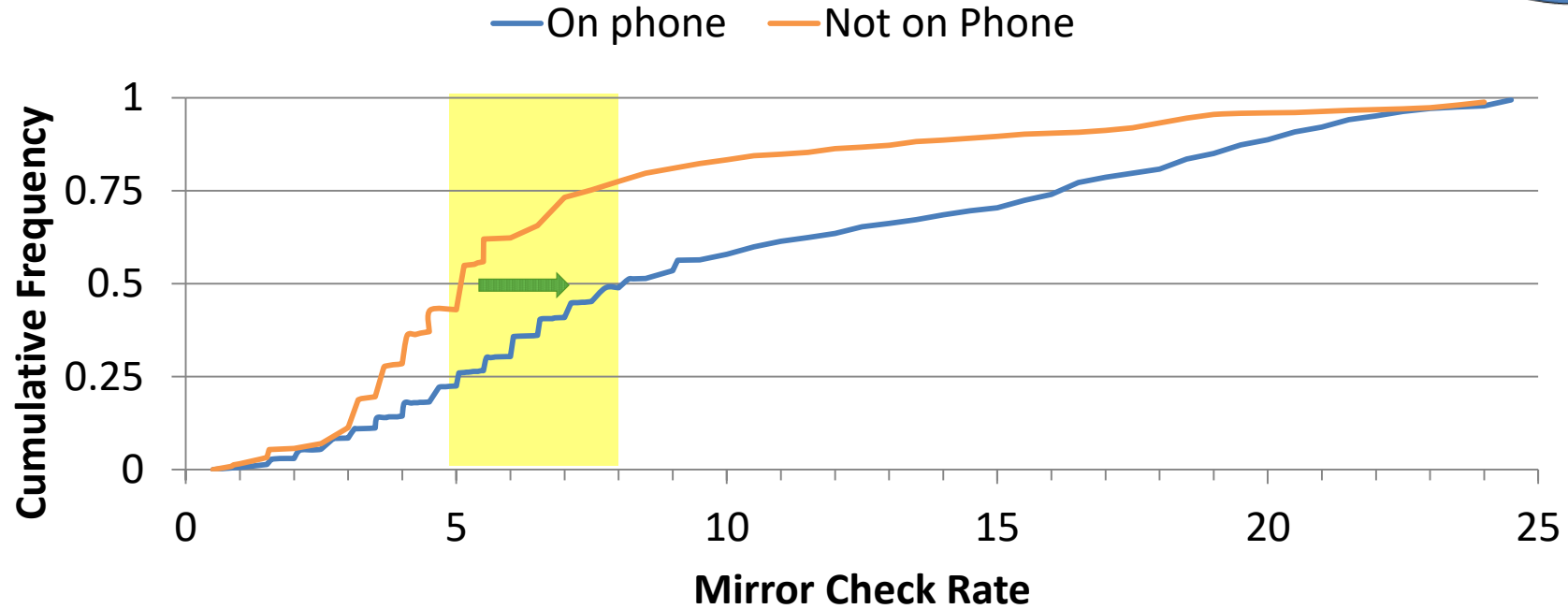
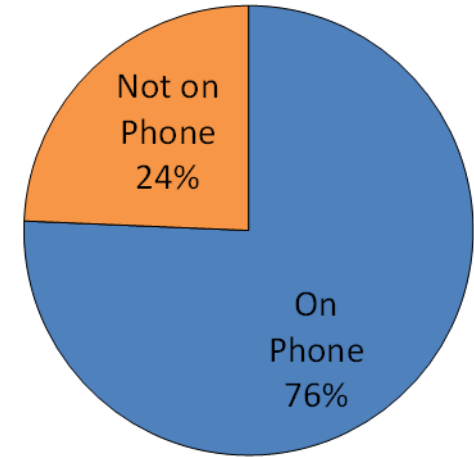
# Cell Phone Usage



Driver 8



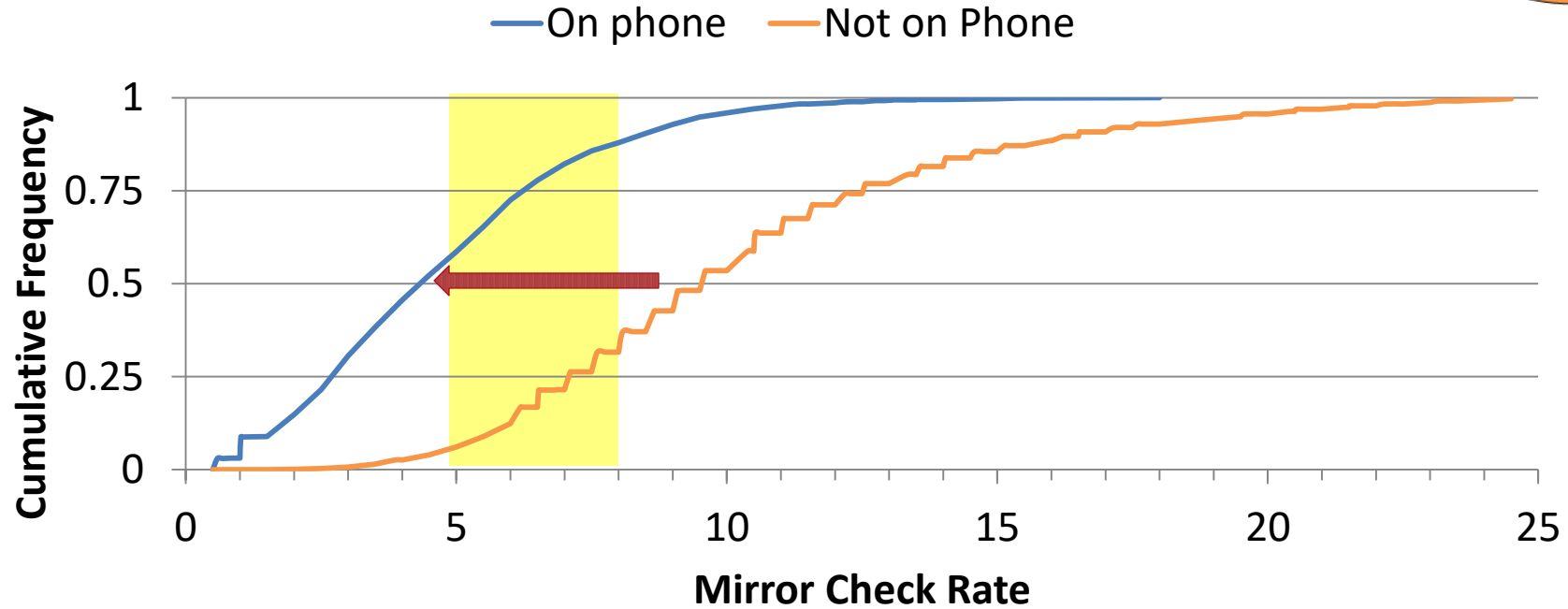
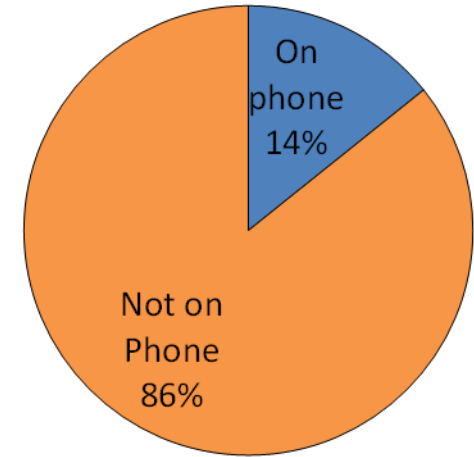
# Cell Phone Usage



Driver 2



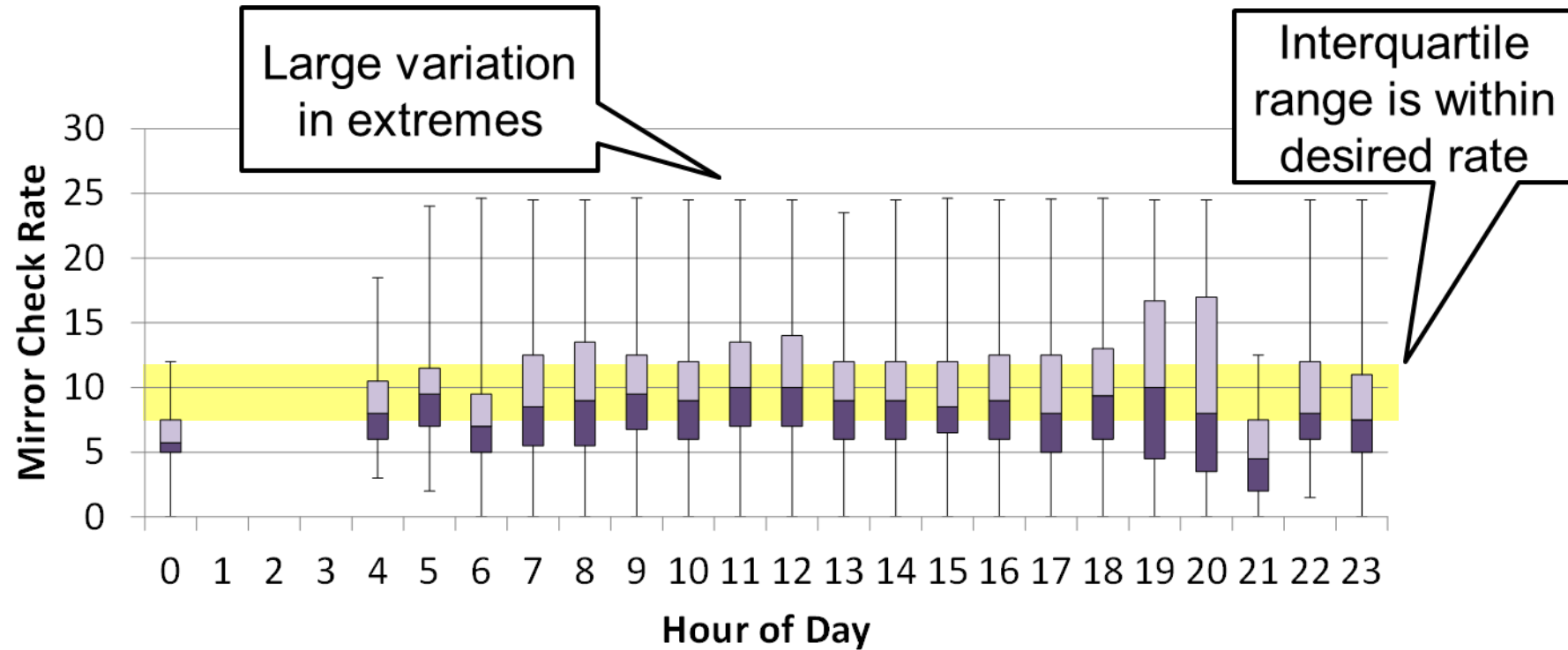
# Cell Phone Usage



Driver 18



# Effects of Time of Day

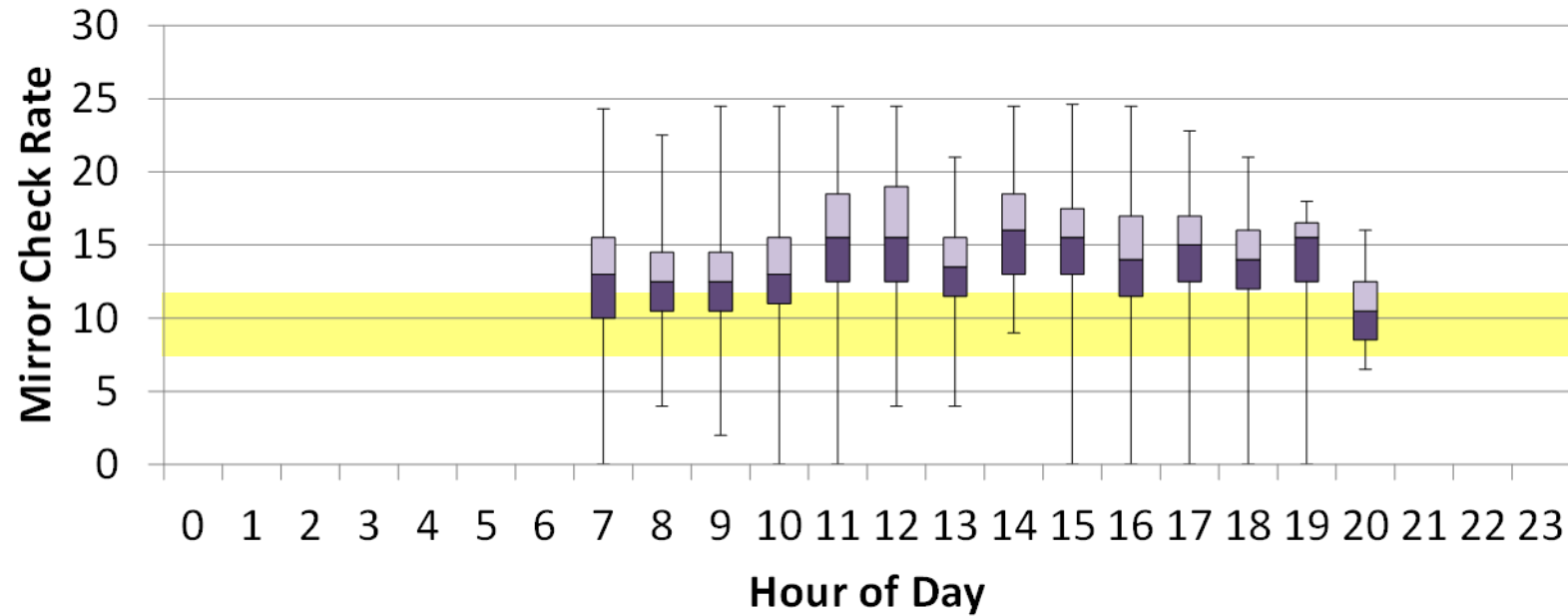


All Drivers





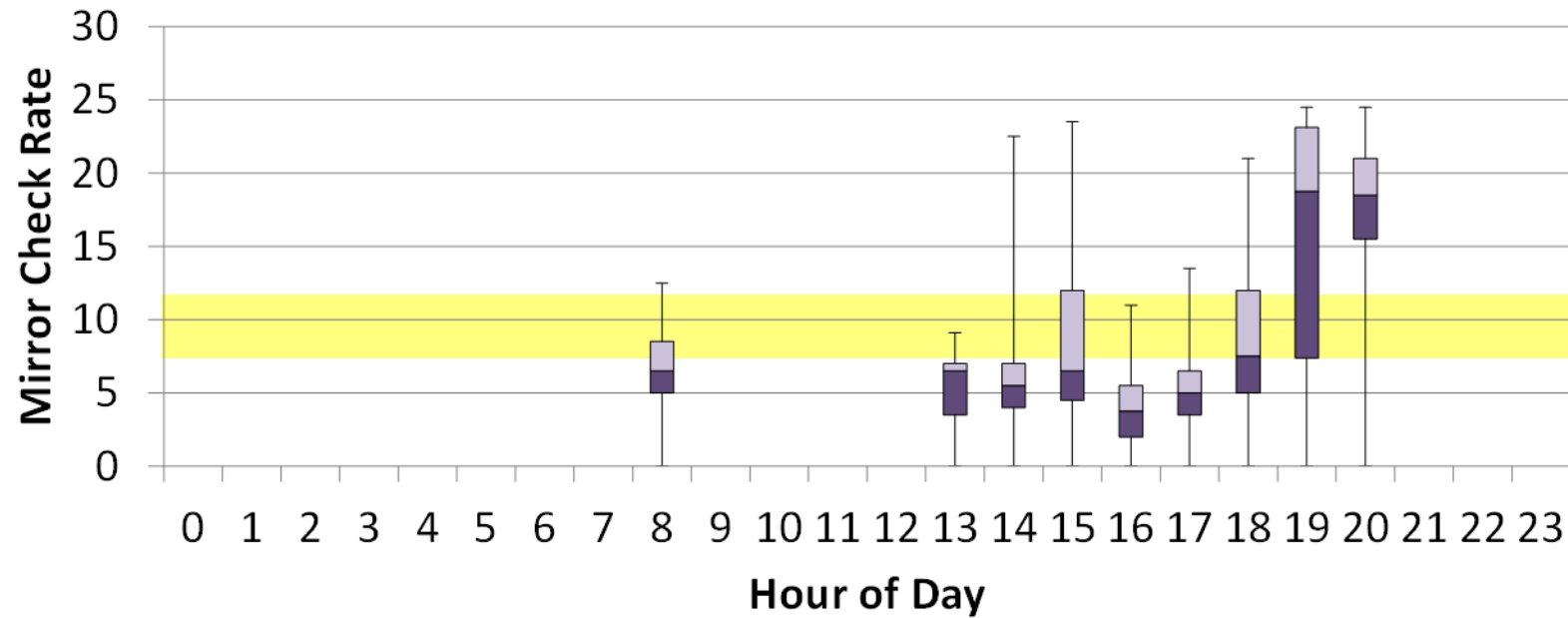
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Driver 8



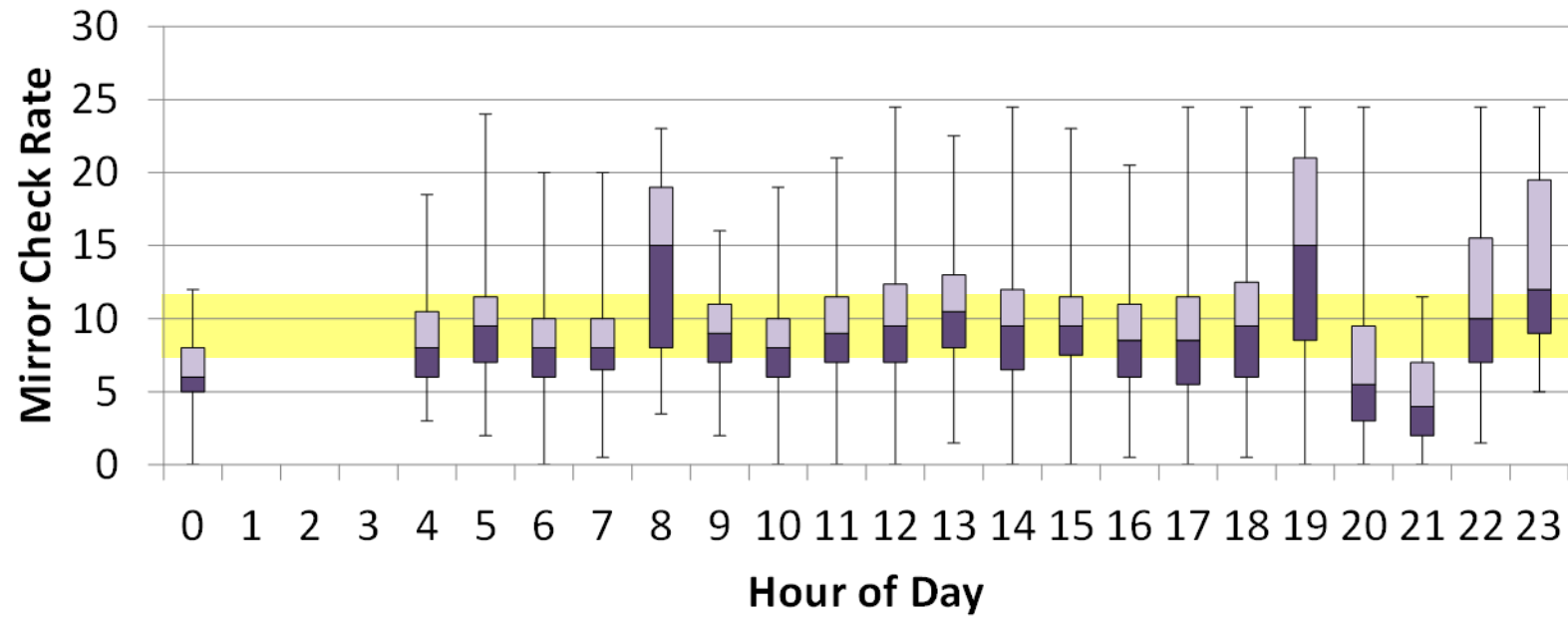
# Effects of Time of Day



Driver 2



# Effects of Time of Day



Driver 18

