Data Sharing from ADS Testing on Rural Roadways in Iowa

ACS60 Truck and Bus Data Subcommittee

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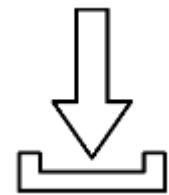
Project Overview

Project Goals

Improve safety on our nation's roadways with ADS

Represent **rural roads** in ADS testing

Enhance mobility

Provide data

Route

Paved and Curvy Road Without Lane Markings

Left Turn Across Traffic

Signalized Intersections

Gravel Road

Iowa City Marketplace

1 h 13 min
46.9 miles

On-Ramp

Divided 2-Lane Highway

Off-Ramp

Hills Community Center

Undivided 2-Lane Highway

Riverside Casino & Golf Resort®

"Main Street"

Soft Shoulders

Kalona Public Library

MANDLI
COMMUNICATIONS

Data Collection Phase Plan

| 6 phases *increasing in complexity* | 10-20 drives each *in varying conditions* |

Phase	Description	# of Drives	Date	Status
1	Controlled Access Roadways	10	11/2021	Complete
2	Highways & Ramps	18	03/2022	Complete
3	Urban Areas	13	07/2022	Complete
4	Unmarked Roads	10	10/2022	Complete
5	V2V	10	01/2023	Complete
6	Parking Areas / Full Route	20	05/2023	Complete

Project Webinars at: ADSforRuralAmerica.uiowa.edu

#1: Safety Management Plan

#2: Vehicle Hardware and Software

#3: Participant and Safety Driver Experience

#4: Data Portal

#5: 9 Things to Know When Testing an AV on Rural Roads

Data Collected

Vehicle Sensor Data

1. GPS antenna
2. DSRC antenna
3. High-definition cameras (2)
4. Velodyne Lidar (front, sides, and rear of vehicle)
5. Webcam video camera (front and rear)
6. Mobileye collision avoidance system
7. Vaisala mobile detector: road, surface, and weather data
8. Long range radar (front and rear)

ice-covered LiDAR
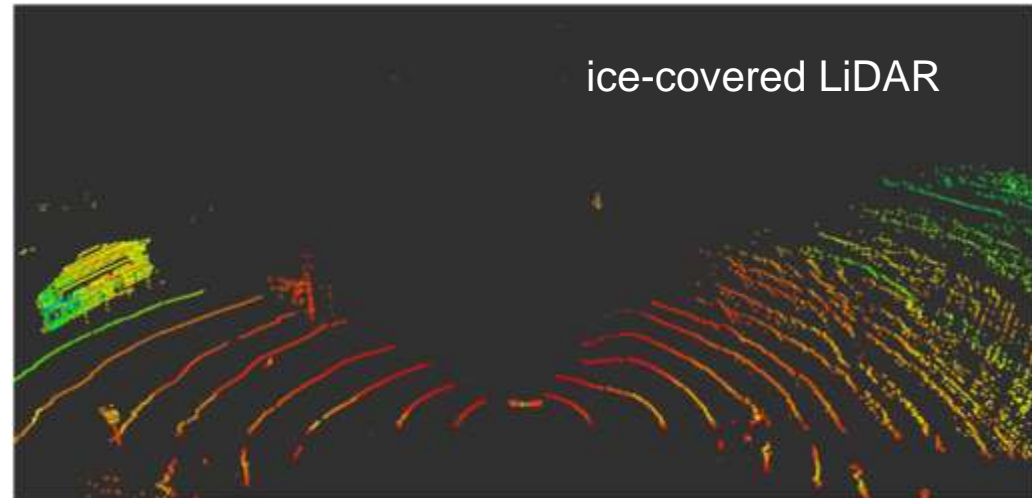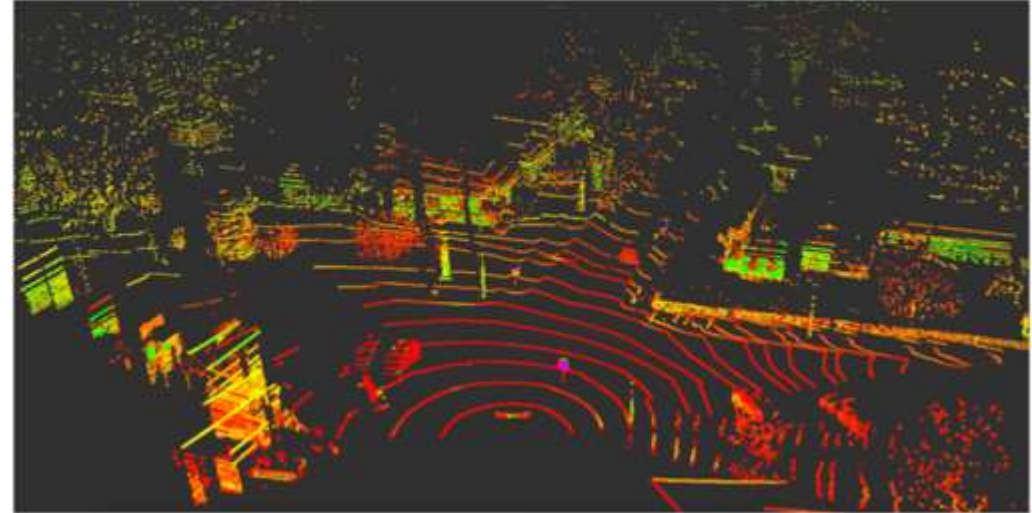
Video Data

→ **Forward view**

→ **Rear view**

→ **Drivers' face/hands**
- Eye glances

→ **Passengers' head/torso**
- Secondary task engagement

* Processed image

Note: Access to passenger video data requires data usage agreement

Data from Passengers and Safety Driver

Questionnaire Data

Passenger
- Demographic
- Pre-drive questionnaire
- Post-drive questionnaire

Safety Driver
- Post-drive questionnaire

I can trust highly automated vehicles

I was comfortable using the automation to drive on the gravel roads
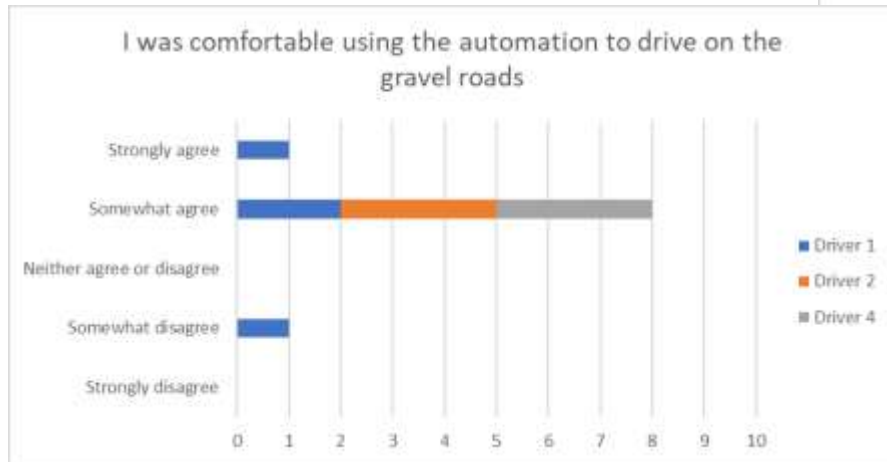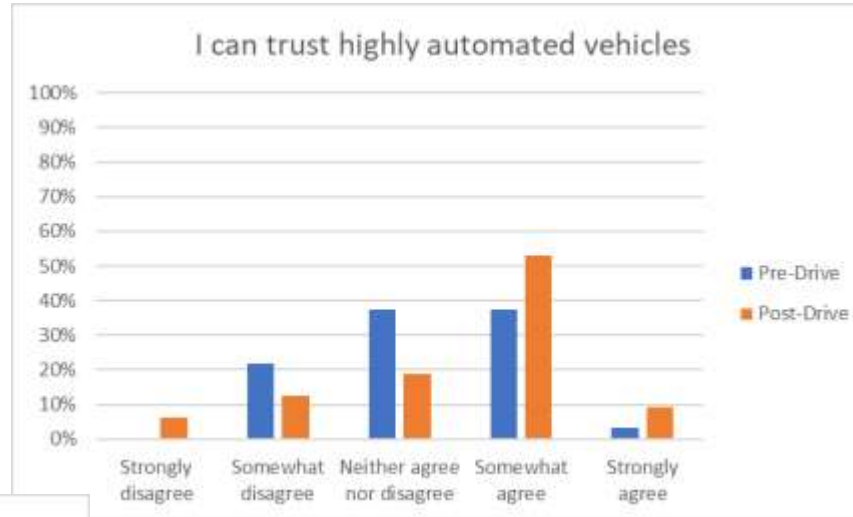
Biometric Data

Empatica
Worn by Passenger and Safety driver
Collects heart rate variability (HRV) and electrodermal activity

Anxiety Ratings

Locations:

A. Hwy 6 in Iowa City
B. After merge onto Hwy 218
C. After turn onto Hwy 22
D. Business district of Riverside
E. Downton Kalona

F. Hwy 1 rural
G. Gravel road
H. Unmarked blacktop road
I. Hwy 1 intersection

Average rating of anxiety by location on route
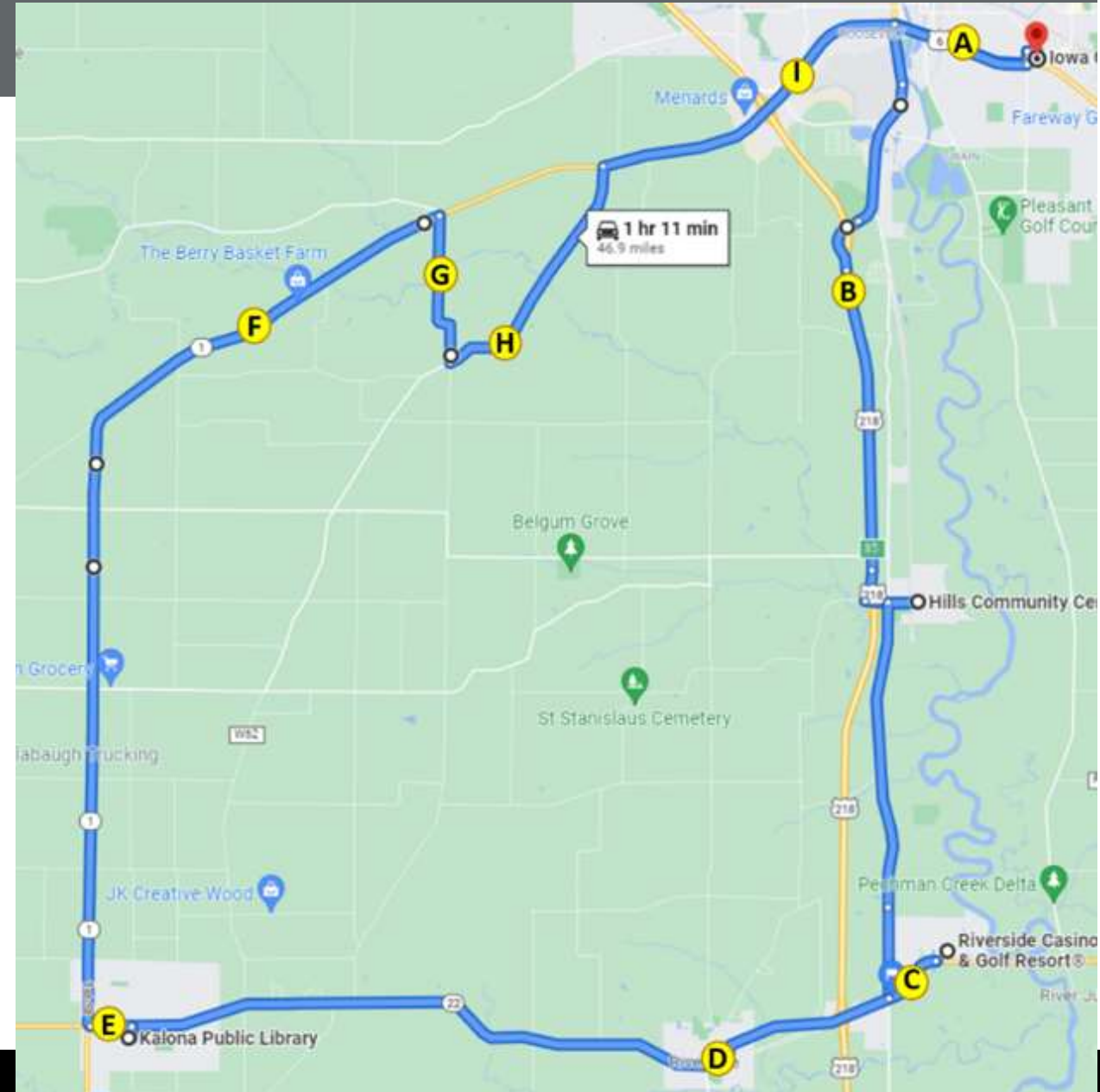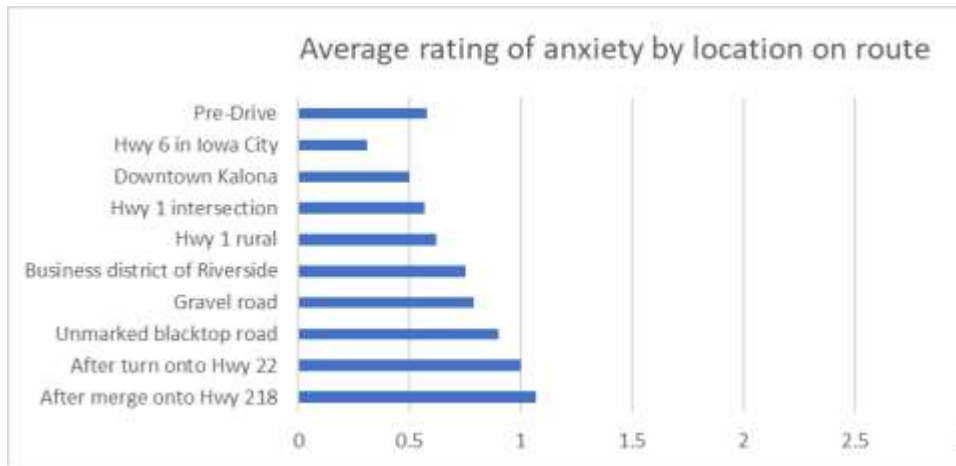
Co-Pilot Data Flags

Vulnerable road users

Voluntary takeovers

Forced takeovers
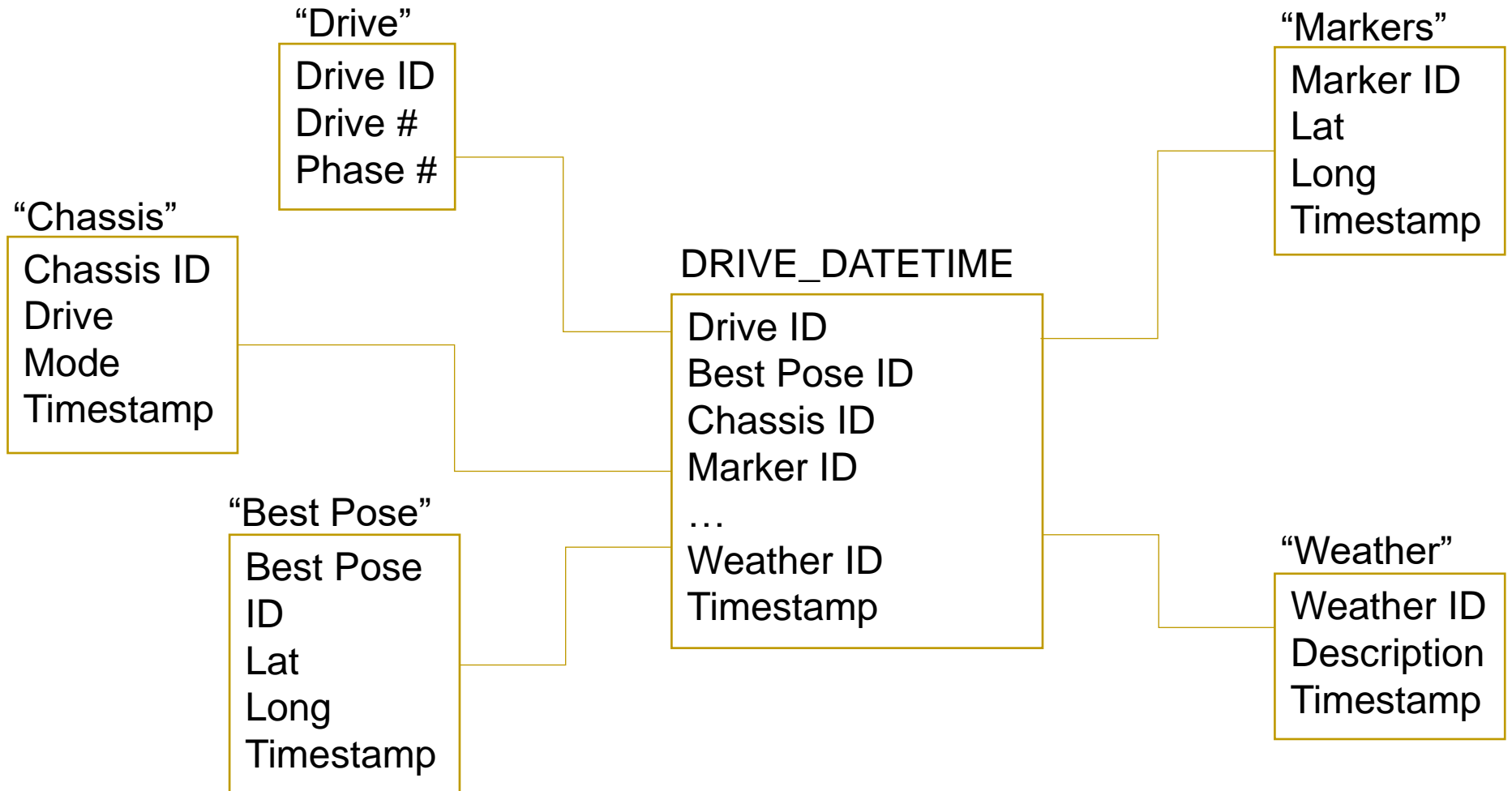
Safety critical events, near crashes or crashes

Co-pilot markers (30)

1: to turn right onto Hwy 1, vehicle braked abruptly for no apparent reason

2: transit braked for slow moving vehicle on right shoulder

3: VRU on oncoming shoulder

4: vehicle overtook our transit

5: disengaged for gravel road

6: to make left turn onto Sharon Center Rd from gravel road, vehicle approaching from right

Data Sharing Approach

Vehicle / ROS Bag Data → Indexed Relational Database Data → Cloud → Access Portal → Data To Users

Database Design

Snowflake Structure

Data from various data entities and sensors are joined by drive id & nearest timestamp.

"Drive"
- Drive ID
- Drive #
- Phase #

"Chassis"
- Chassis ID
- Drive
- Mode
- Timestamp

"Best Pose"
- Best Pose ID
- Lat
- Long
- Timestamp

DRIVE_DATETIME
- Drive ID
- Best Pose ID
- Chassis ID
- Marker ID
- …
- Weather ID
- Timestamp

"Markers"
- Marker ID
- Lat
- Long
- Timestamp

"Weather"
- Weather ID
- Description
- Timestamp

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Data Portal Design

Overview

Data Dictionary

**Dashboard
(Summary Details)**

Drive Explorer
(Registration required)

Playground
(Registration required)

Data Dictionary

Defines all recorded data points
Project / Phase / Drive

- Searchable
  - By topic name
  - By keyword

Dashboard

Summary detail filterable by…
- Project / Phase / Drive

Automation performance
- Total miles driven
- By Federal Functional Code
- By road condition

Counts
- Safety critical events
- Obstacles (perception)
- Vulnerable road users
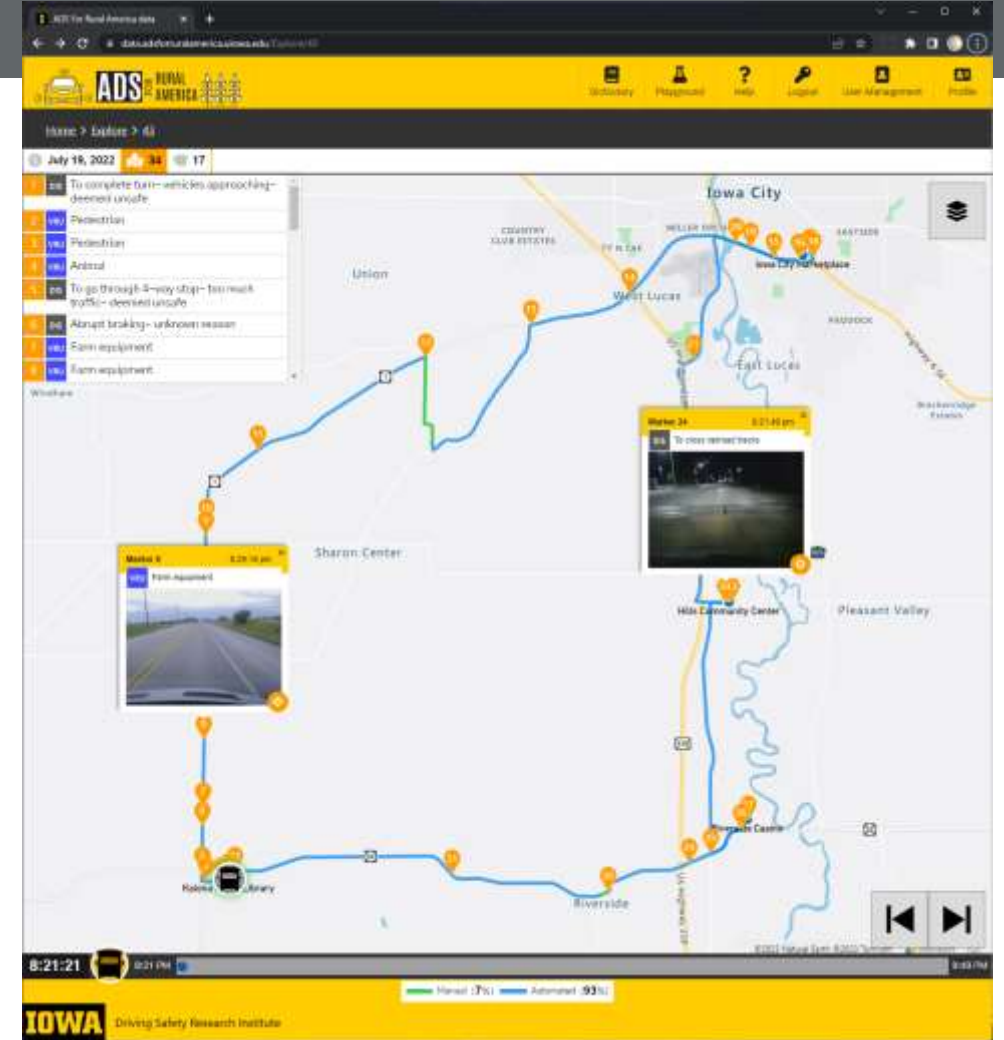- V2X encounters
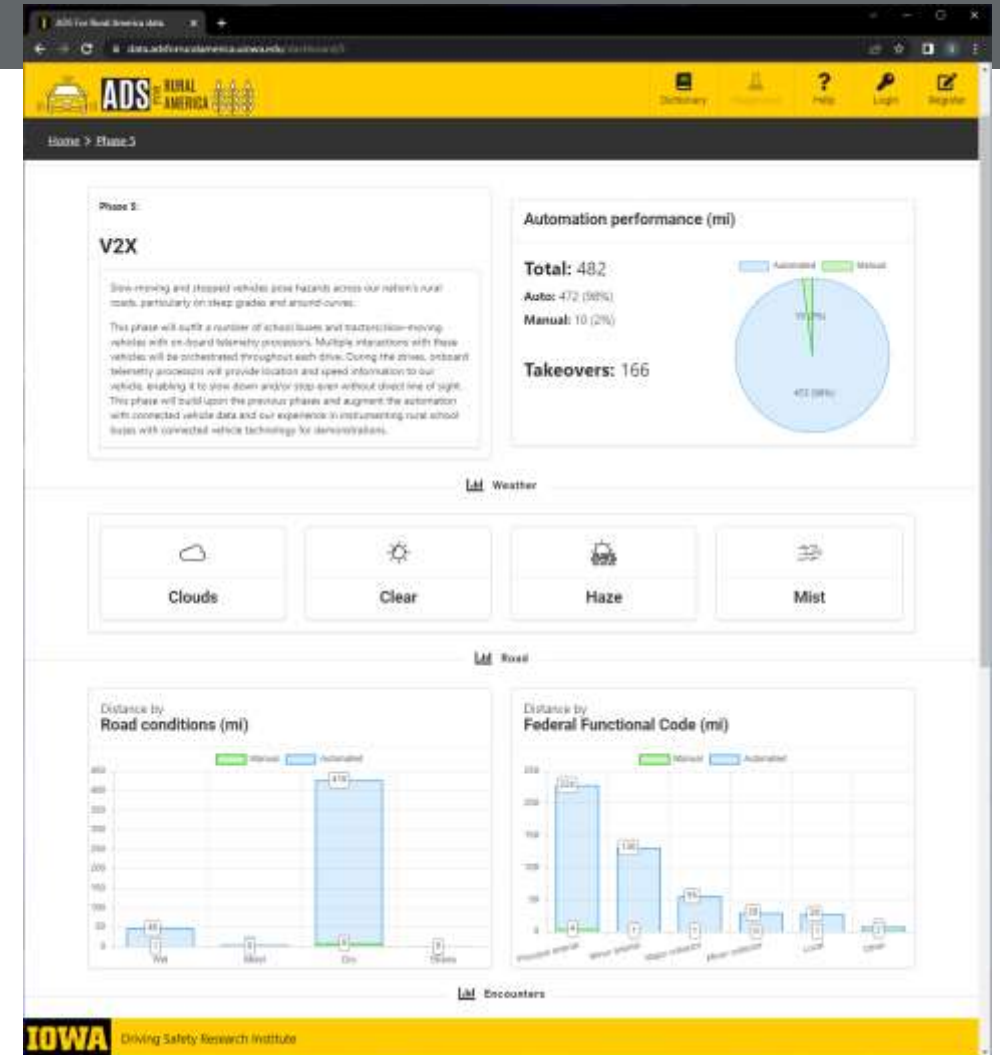
Drive Explorer

Quick, searchable, annotated timeline of a given drive, helpful in finding areas for further study

Points of interest
- Co-pilot markers
- Automation disengagements
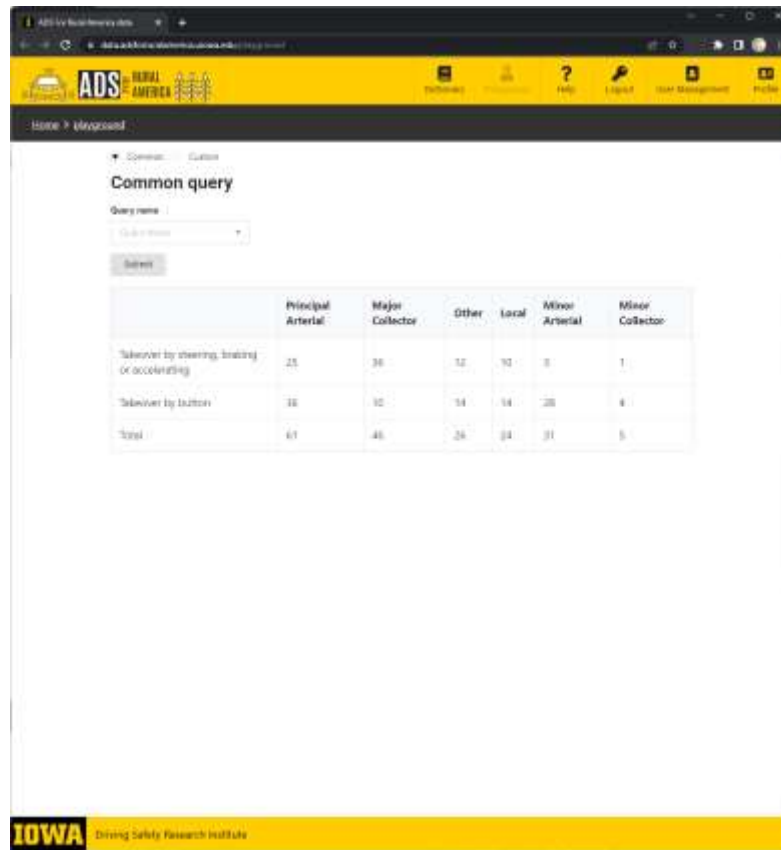- … future additions

Playback includes
- Forward / rear video
- Speed / throttle / braking
- Road condition

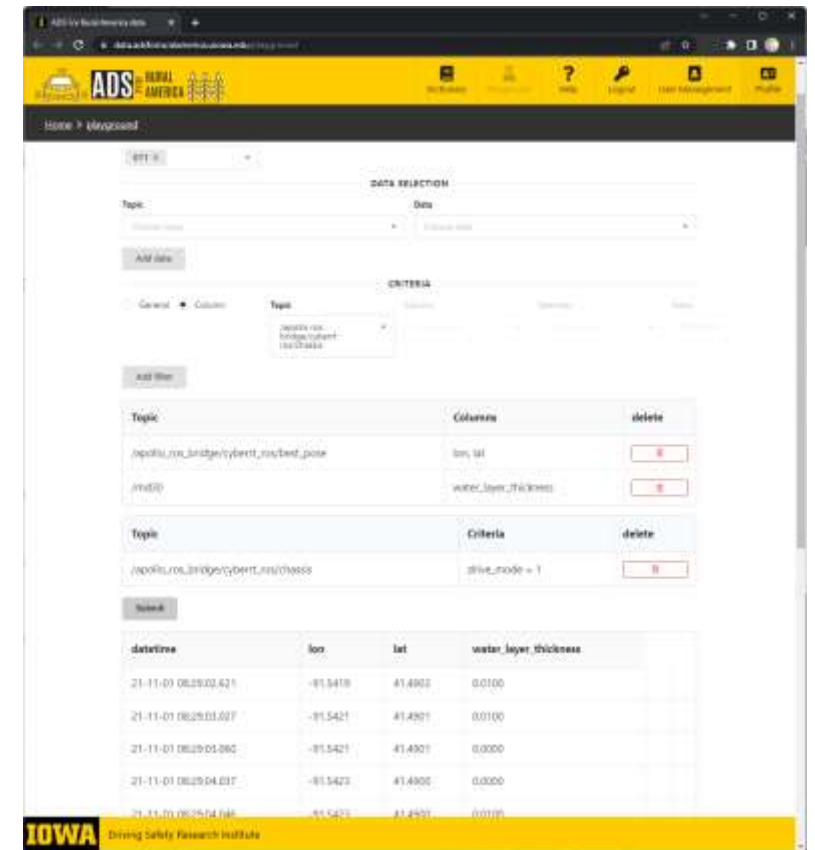**IOWA** Driving Safety Research Institute

Playground

Types of searches:

- Common:

- Custom:

Data Portal: bit.ly/ADS-data
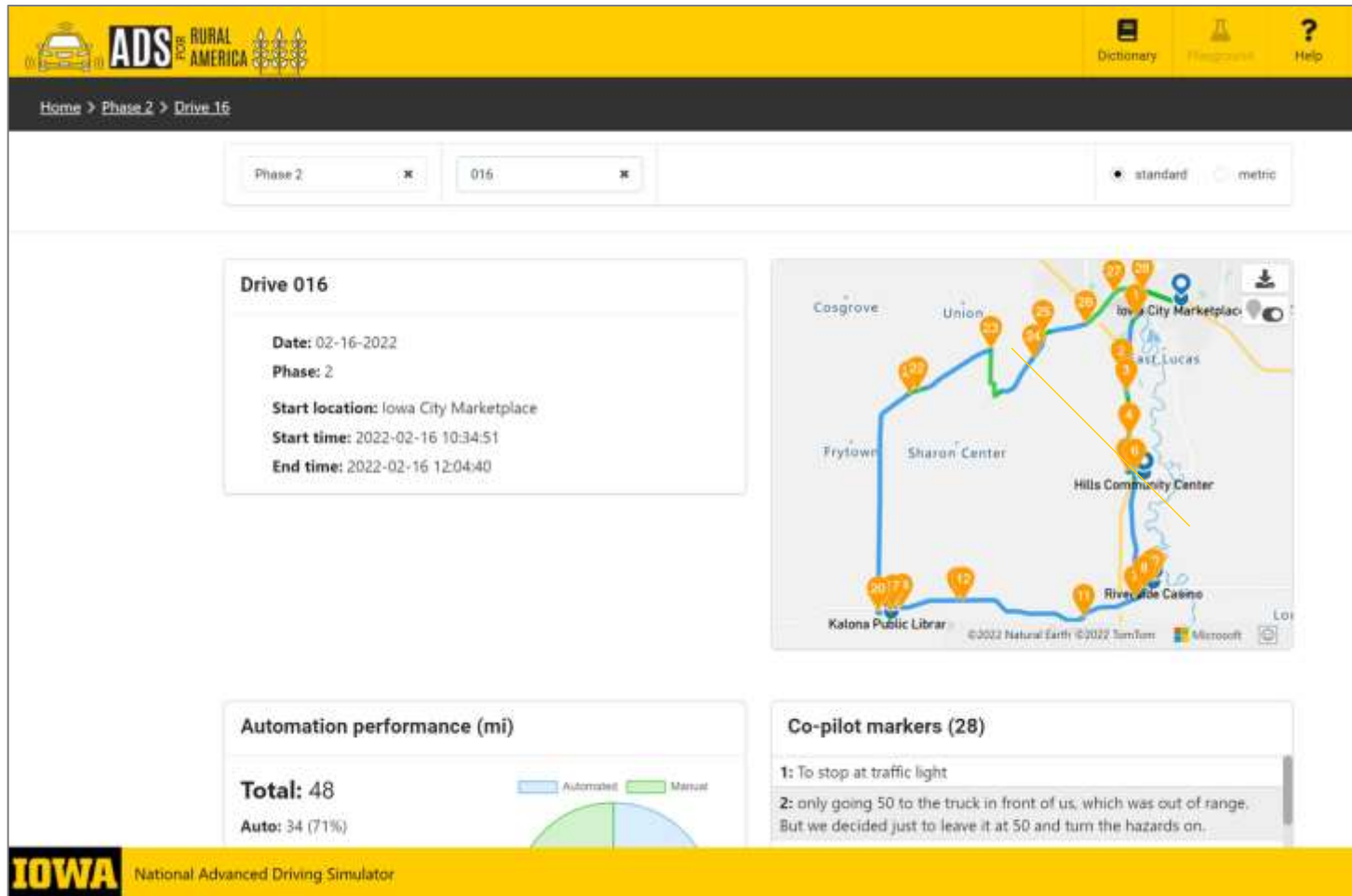
Or scan:

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For more information:
ADSforRuralAmerica.uiowa.edu