

Data Sharing from ADS Testing on Rural Roadways in Iowa



ACS60 Truck and Bus Data Subcommittee

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IOWA

Driving Safety
Research Institute

Project Overview



Project Goals



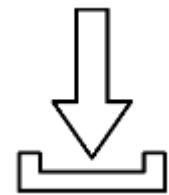
Improve safety on our nation's roadways with ADS



Represent **rural roads** in ADS testing



Enhance mobility



Provide data

Route



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



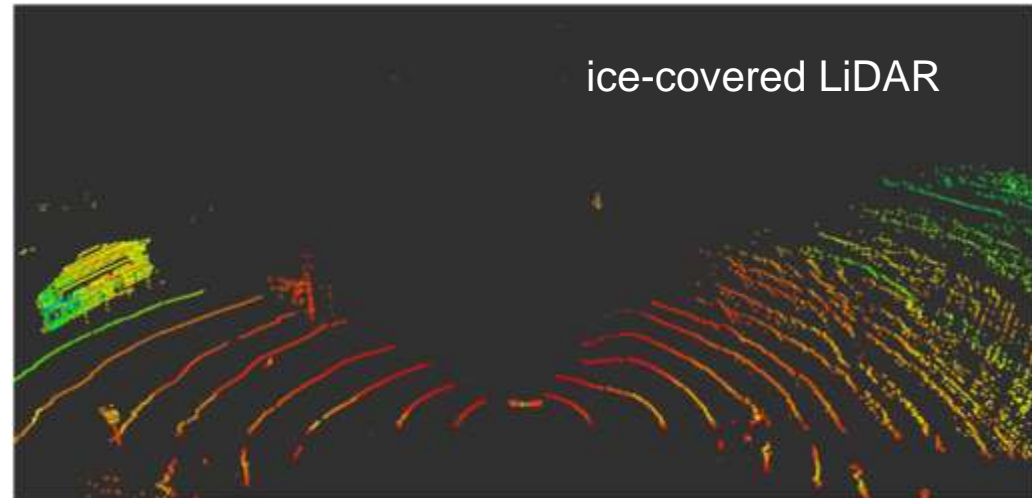
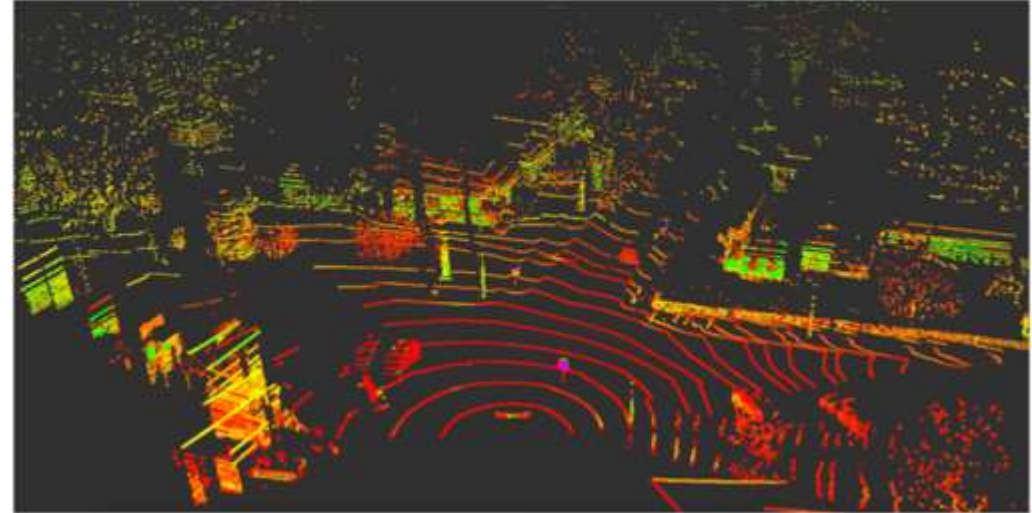
#5: 9 Things to Know When Testing an AV on Rural Roads

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)



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

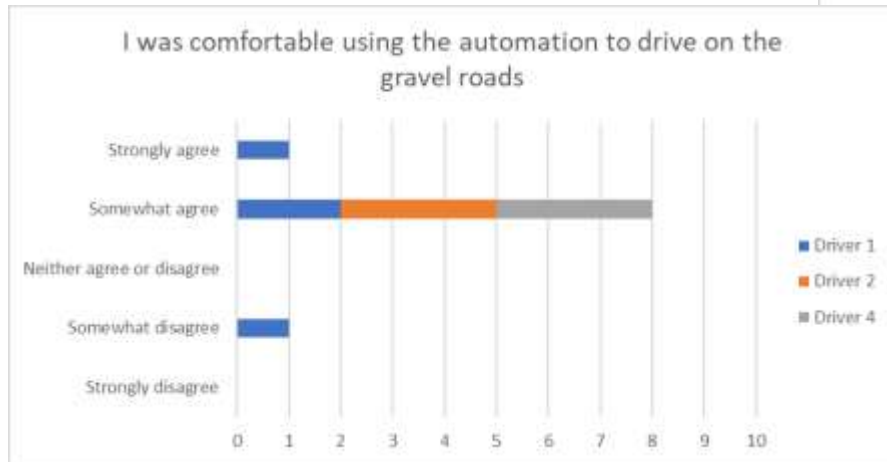
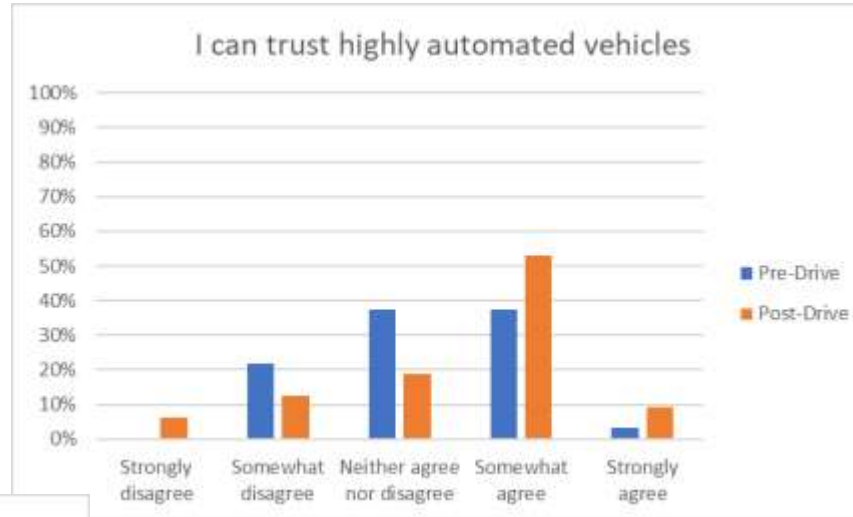
Questionnaire Data

Passenger

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

Safety Driver

- Post-drive questionnaire



Biometric Data

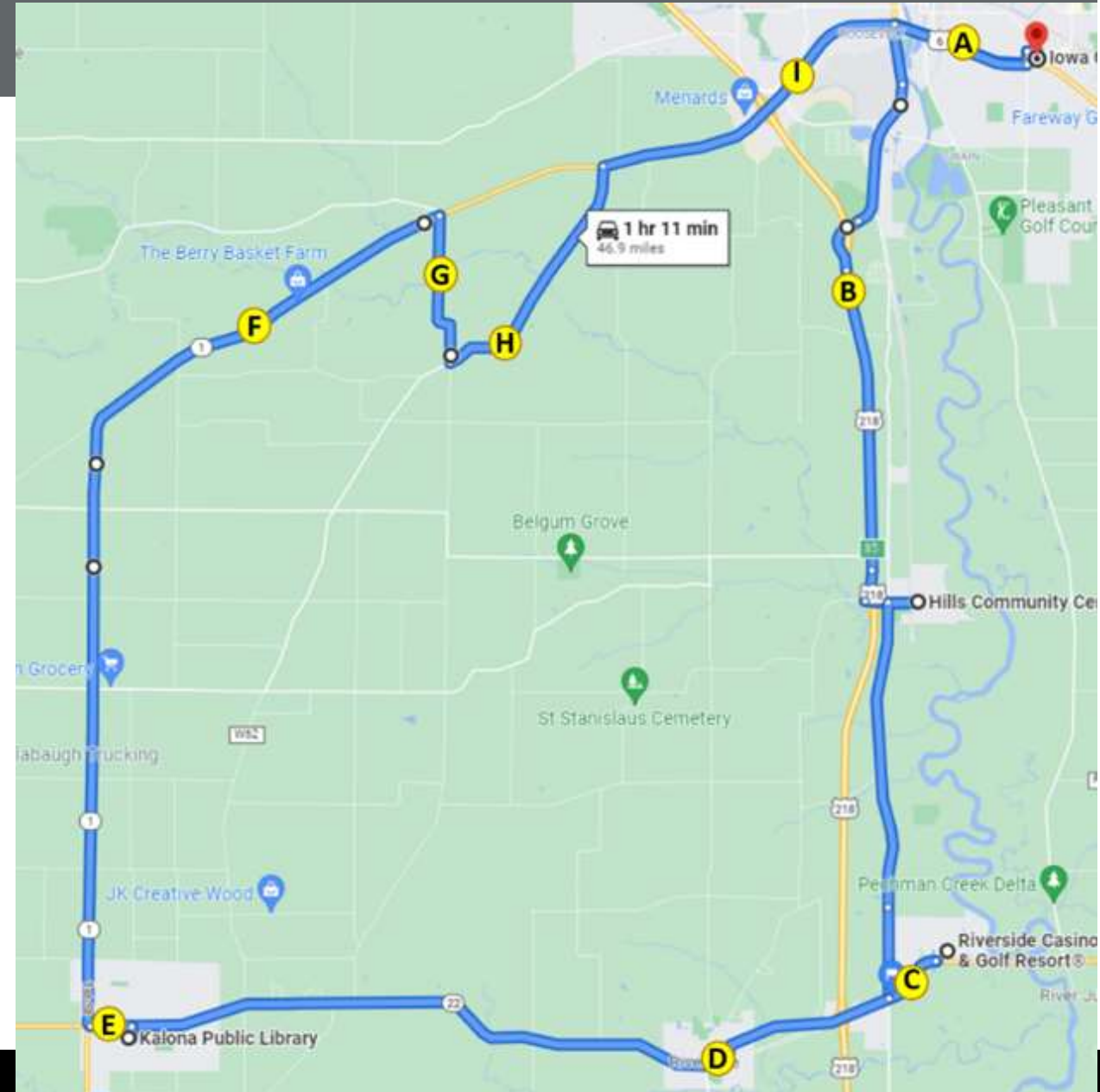
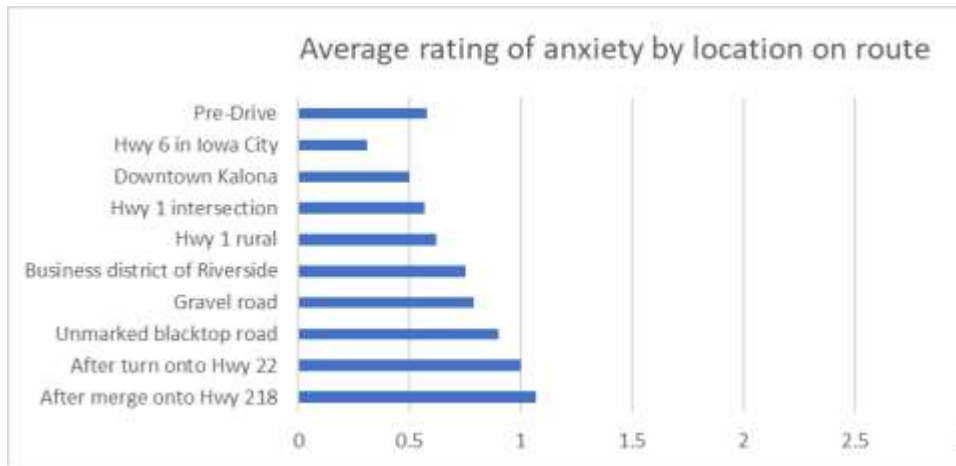


Empatica
Worn by Passenger and Safety driver
Collects heart rate variability (HRV) and electrodermal activity

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



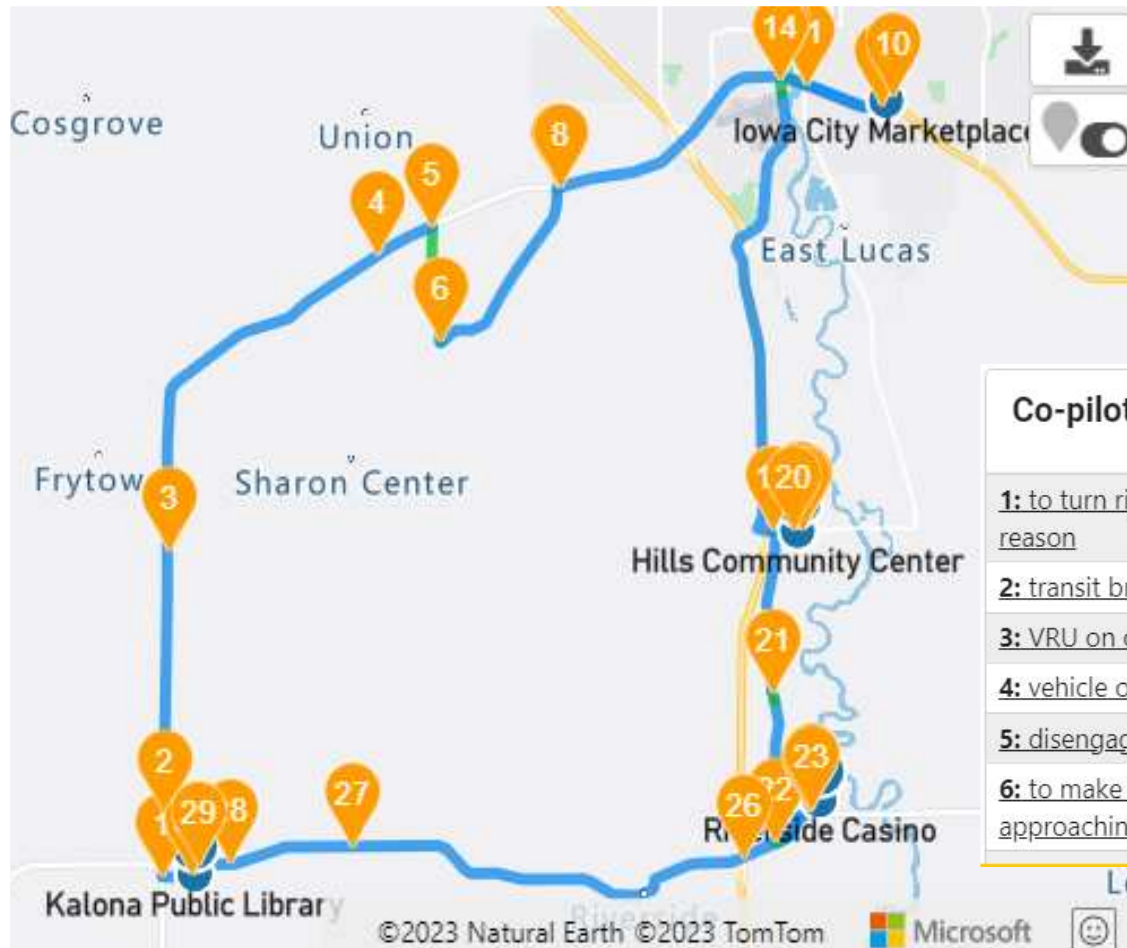
Co-Pilot Data Flags

Vulnerable road users

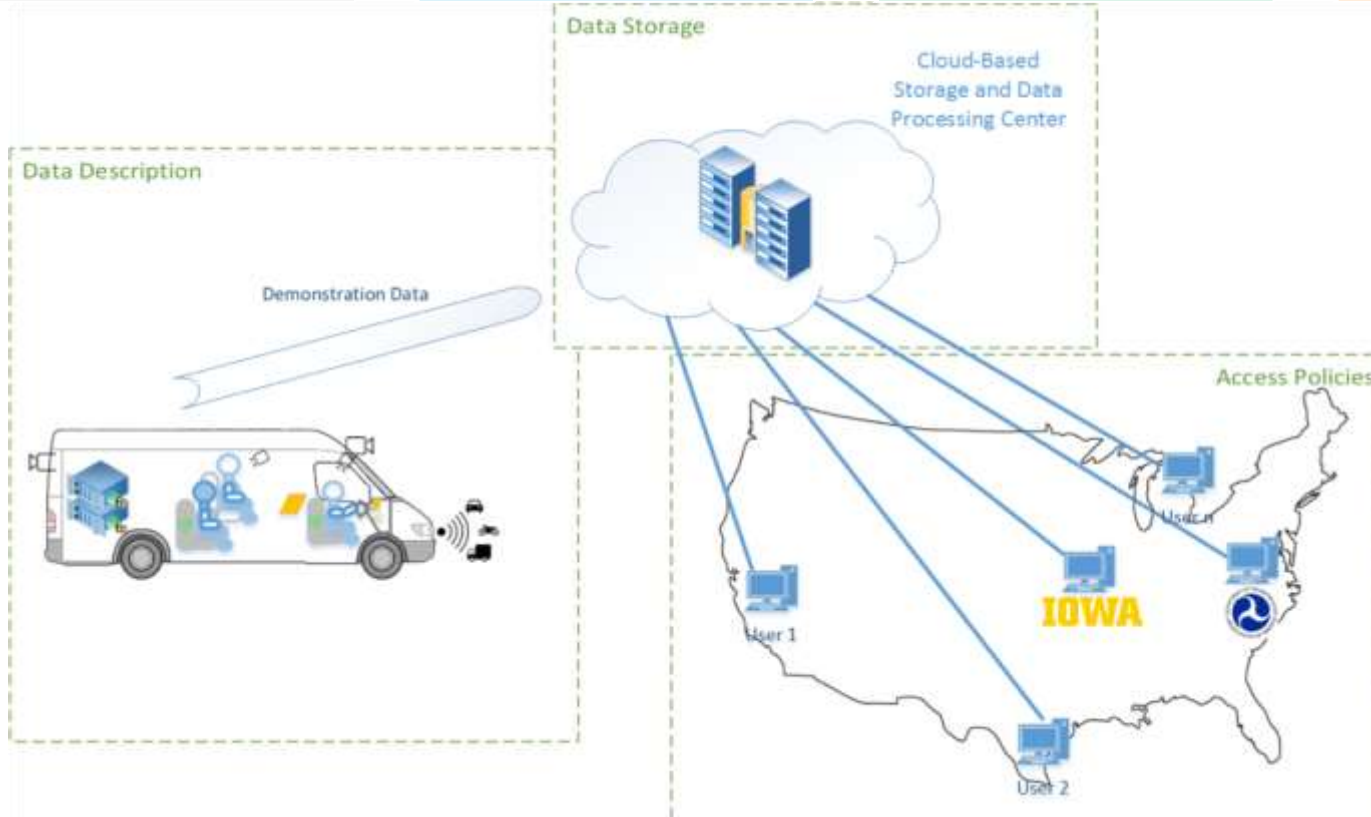
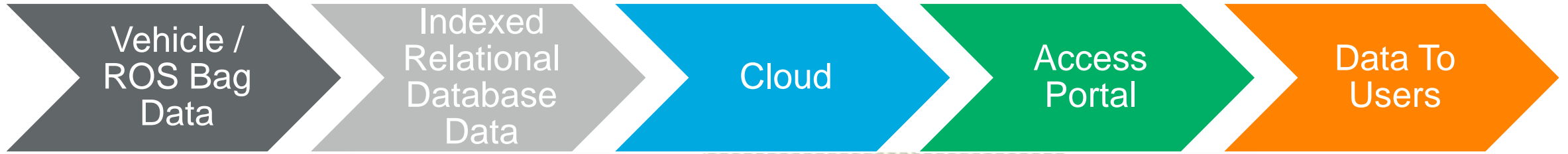
Voluntary takeovers

Forced takeovers

Safety critical events,
near crashes or crashes



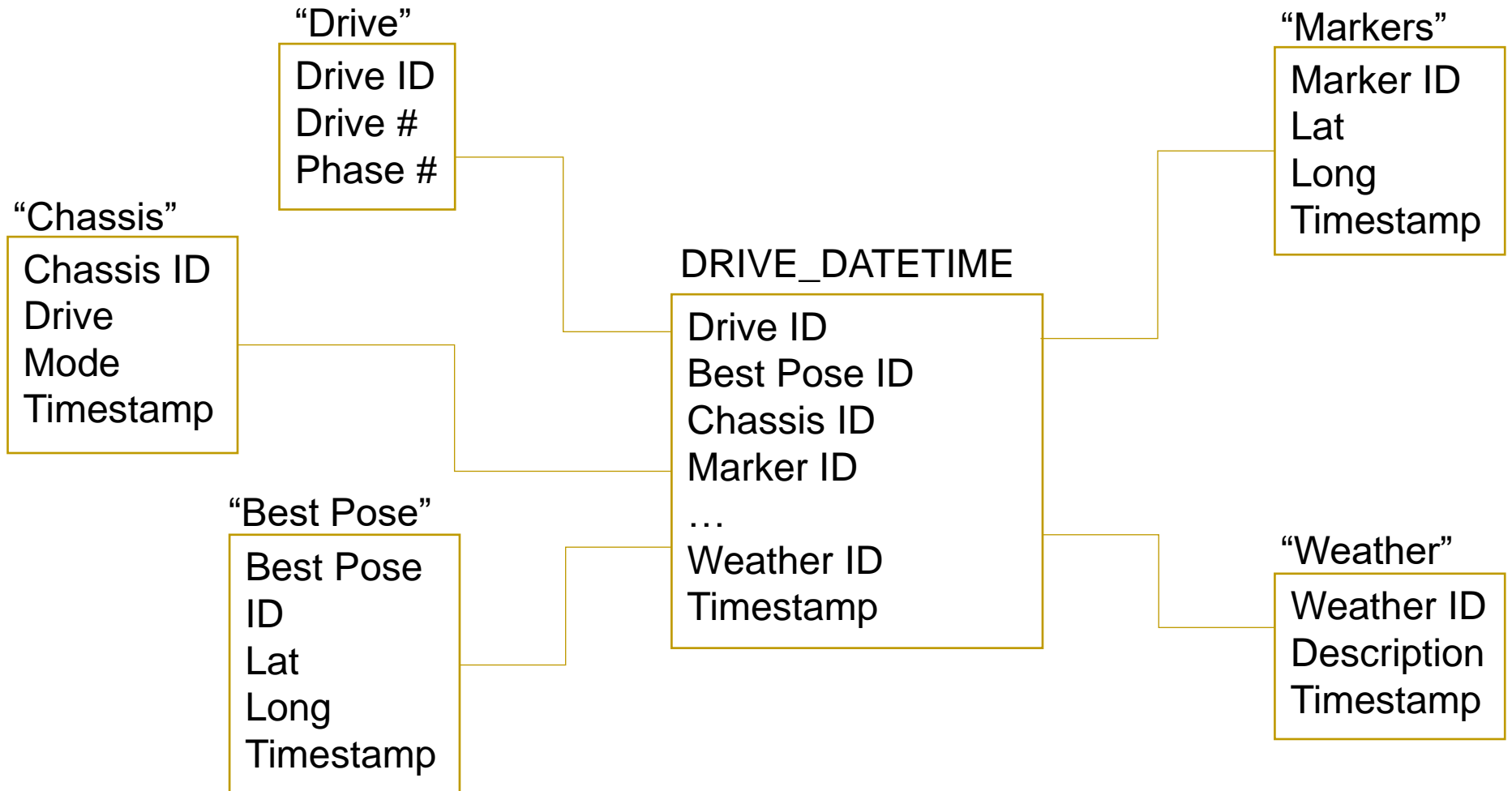
Data Sharing Approach



Database Design

Snowflake Structure

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



Data Portal Design

Overview

The screenshot shows the 'Data Dictionary' page for the topic 'apollo_ros_bridge/cybert_ros/chassis'. It displays a table with columns for 'name', 'data_type', 'units', and 'description'. The table lists various sensors such as 'accelerometer', 'gyro', 'steering_rate', and 'steering_torque'.

name	data_type	units	description
accelerometer	float[3]	m/s ²	Vehicle acceleration
gyro	float[3]	rad/s	Vehicle angular velocity
steering_rate	float32	rad/s	Steering rate
steering_torque	float32	Nm	Steering torque

Data Dictionary

The screenshot shows the 'Dashboard' page for 'Phase 3'. It features a 'V2X' section with a description of the phase, 'Automation performance (mi)' with a donut chart showing 472 (98%) automated and 10 (2%) manual miles, and 'Takeovers: 166'. Below this are sections for 'Weather' (Clouds, Clear, Haze, Mist) and 'Road' (Distance by Road conditions and Federal Functional Code).

Dashboard
(Summary Details)

The screenshot shows the 'Drive Explorer' page, displaying a map of a drive route in Iowa City. The route is marked with various data points and a video inset showing the driver's perspective. The interface includes a legend for different data points and a video player.

Drive Explorer
(Registration required)

The screenshot shows the 'Playground' page, which allows users to select data and define criteria. It includes a 'DATA SELECTION' section and a table for defining criteria.

Topic	Columns	delete
apollo_ros_bridge/cybert_ros/land_pos	lon, lat	[X]
road	water_layer_thickness	[X]

Playground
(Registration required)

Data Dictionary

Defines all recorded data points
Project / Phase / Drive

- Searchable
 - By topic name
 - By keyword

The screenshot shows a web browser displaying the ADS Data Dictionary interface. The page title is "/apollo_ros_bridge/cybert/ros/chassis". The left sidebar shows a search bar and a list of vehicle sensors. The main content area displays the details for the selected topic, including its name, database table name, ROS topic name, ROS data type, and description. Below this, a table lists the data points for this topic.

name	data type	units	description
header	sub-table		
engine_on	bool		false = ENGINE_OFF true = ENGINE_ON
drive_mode	sub-table		
gear	sub-table		
brake	float32	(0-100) %	0.0 - 100.0 (pedal fully depressed)
steering_rate	float32	rad / s	
steering	float32	%	(0-100) or (-100) from centered position (100% being approximate steering wheel limit)
steering_rad	float32	rad	(0-100) or (-100) from centered position
speed	float32	m / s	
yaw_rate	float32	rad / s	
turn_signal	sub-table		
error_code	sub-table		

Dashboard

Summary detail filterable by...

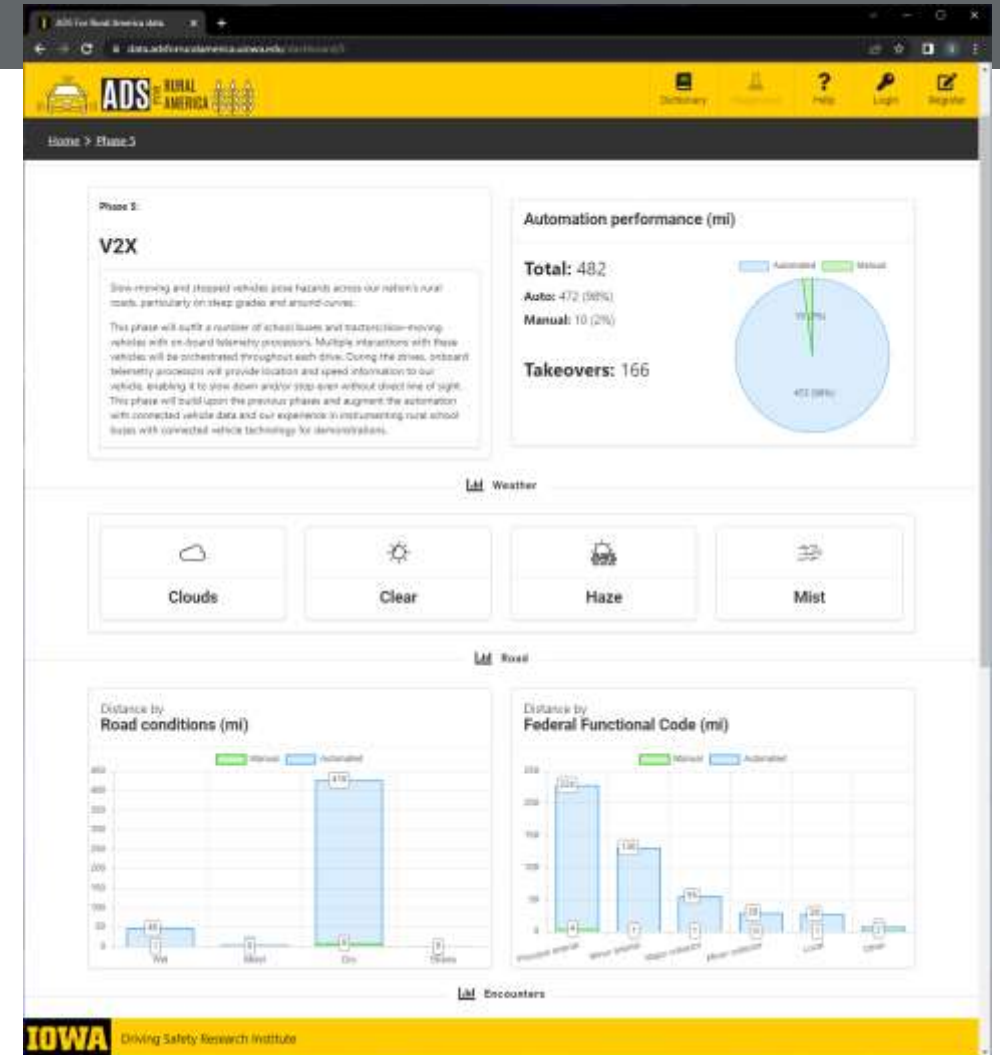
- Project / Phase / Drive

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

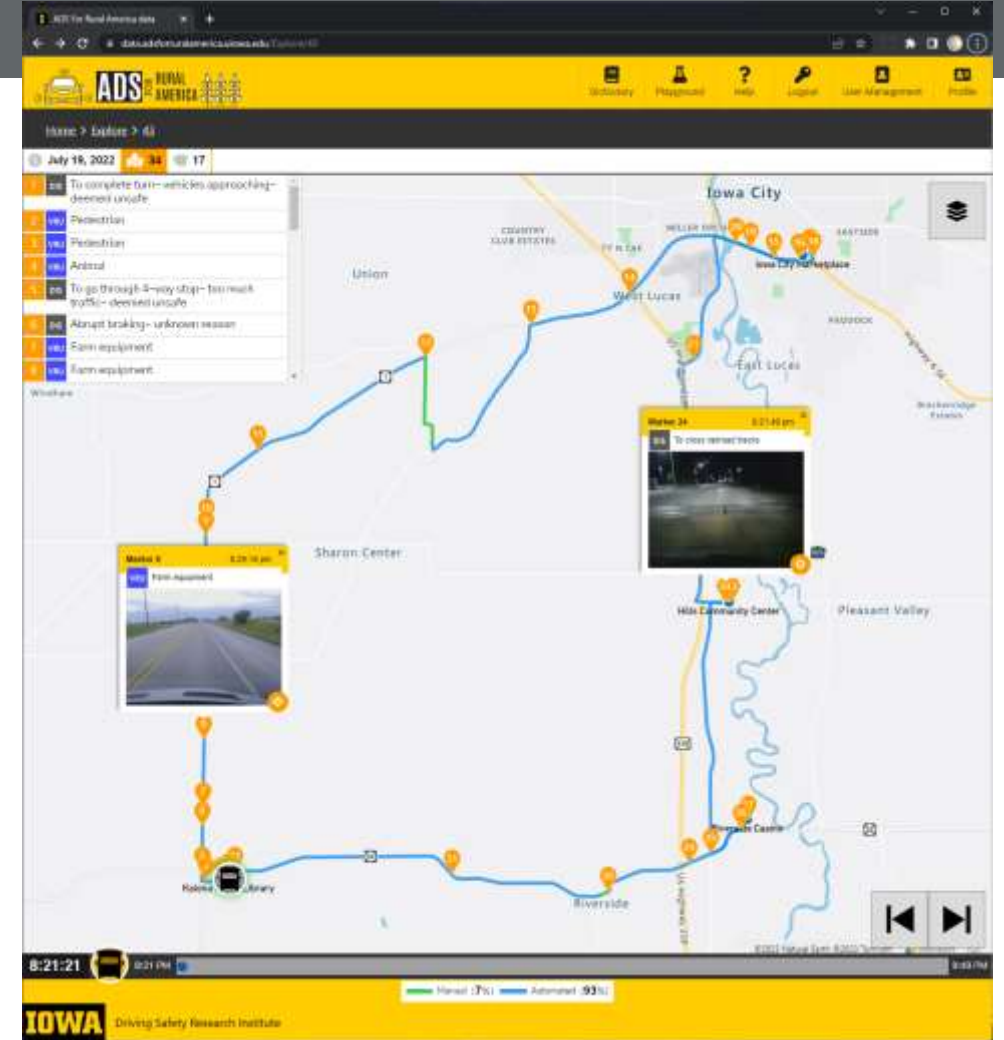
Quick, searchable, annotated timeline of a given drive, helpful in finding areas for further study

Points of interest

- Co-pilot markers
- Automation disengagements
- ... future additions

Playback includes

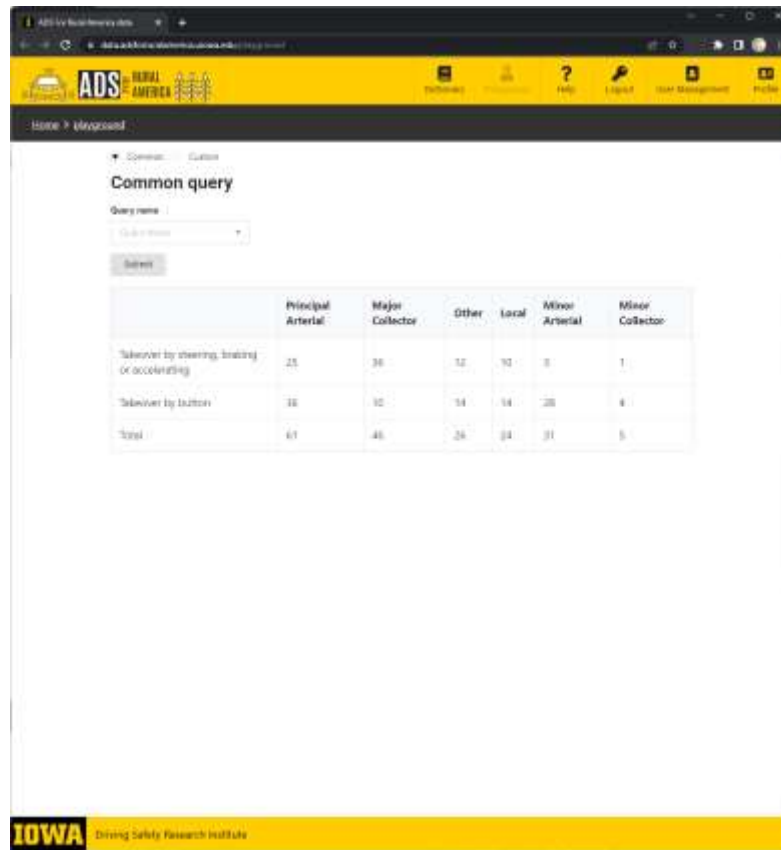
- Forward / rear video
- Speed / throttle / braking
- Road condition



Playground

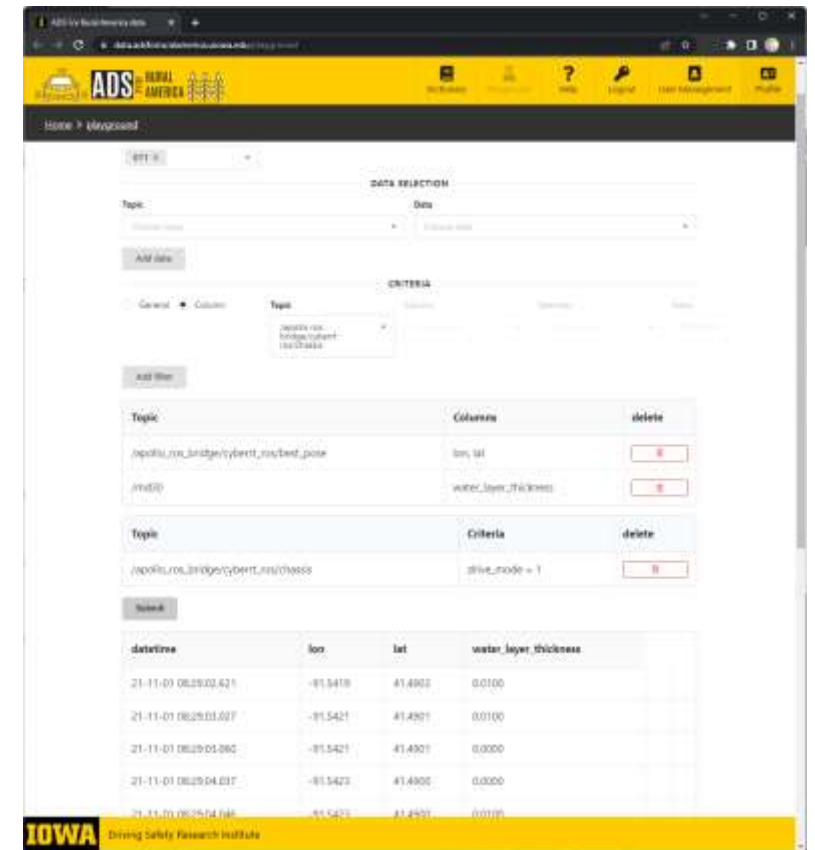
Types of searches:

- Common:



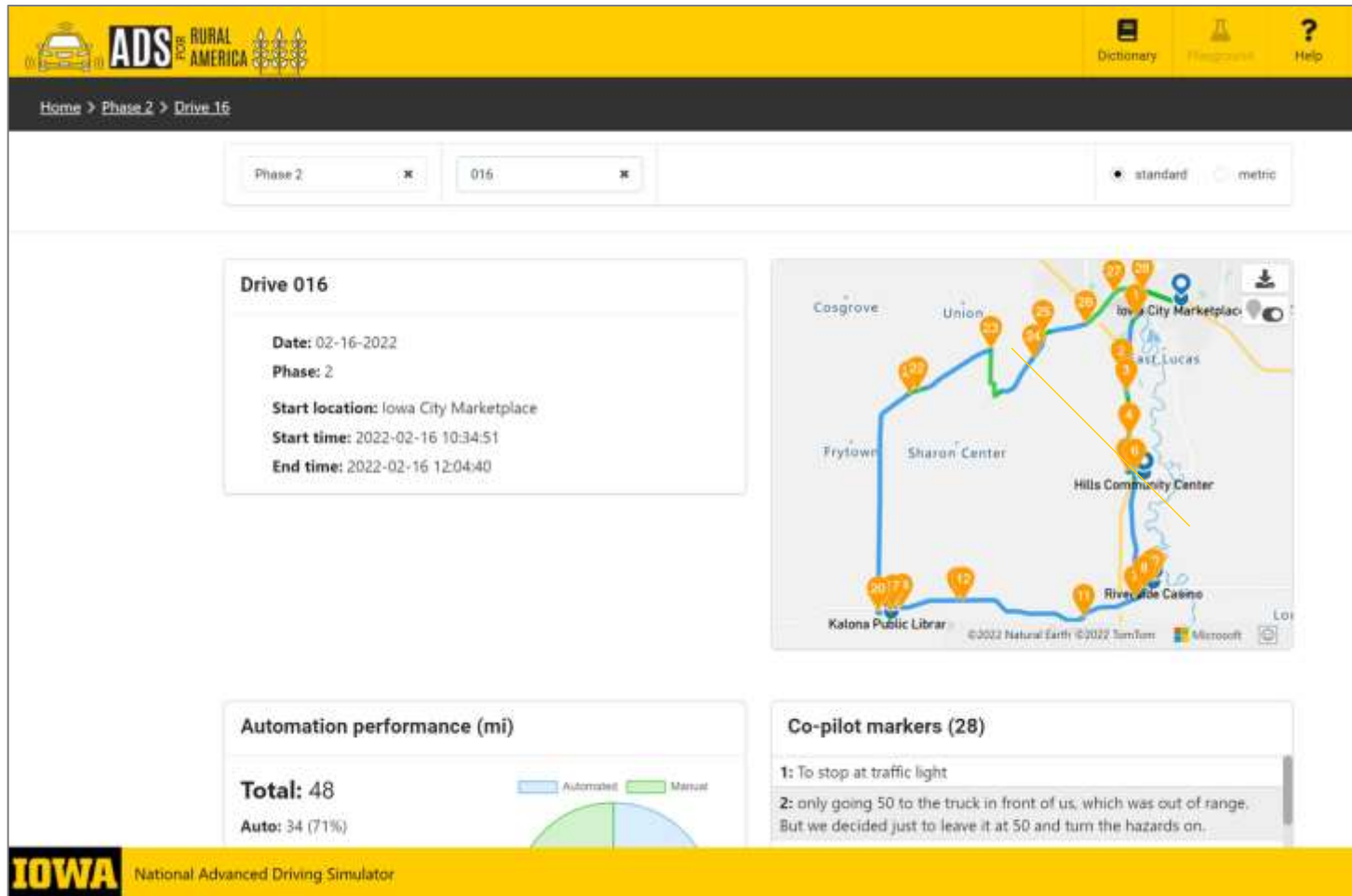
	Principal Arterial	Major Collector	Other	Local	Minor Arterial	Minor Collector
Takeover by steering, braking or accelerating	25	36	12	10	8	1
Takeover by button	38	10	14	14	28	4
Total	63	46	26	24	31	5

- Custom:



datetime	lon	lat	water_layer_thickness
21-11-01 08:29:02.621	-91.5419	41.4902	0.0100
21-11-01 08:29:03.027	-91.5421	41.4901	0.0100
21-11-01 08:29:05.080	-91.5421	41.4901	0.0000
21-11-01 08:29:04.037	-91.5423	41.4900	0.0000
21-11-01 08:29:04.186	-91.5421	41.4901	0.0100

Data Portal: bit.ly/ADS-data



Or scan:



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For more information:
ADSforRuralAmerica.uiowa.edu

