



## Wrong-Way Driving Detection Systems Update

Kent Thurston  
Adam Lough, P.E.

June 2024

# WWD Task Force

## Task Force Members:

- Robert Miles & Lisa Zundel (Leadership Advisors)
- Adam Lough & Tyler Laing (Co-Chairs)
- Grant Farnsworth & Mark Taylor (Traffic Management)
- Matt Luker (Traffic & Safety)
- Dan Snell & Kent Thurston (Consultant Support)

# Outline

## Wrong-Way Driving Update:

- How we got where we're at today?
- System Selection
- Carmanah System
- Current and Future Installations
- Safety Benefits
- Next Steps



## UDOT WWD Presentation at WSRTC 2021

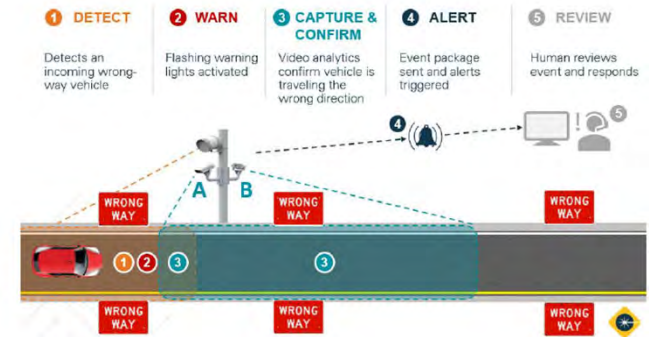
- UDOT spent \$500K to install thermal imaging equipment at 37 locations statewide.
- This equipment was for wrong way data collection only.
- This system did not trigger driver feedback devices.
- The data led to many signing, striping, and signal head adjustments.
- Detection had way too many false calls for accurate alerting.
- There were a lot of lessons learned from the deployment of these cameras.



# Task Force Outreach

- State of Florida DOT
- State of Arizona DOT
- State of Texas DOT
- Product Presentations

TAPCO System Details



The screenshot shows the FLIR camera manager interface. On the left, there are controls for 'MOUNTING HEIGHT (m)' (set to 7), 'ROTATE CAMERA' (set to 96 deg), 'SET CAMERA RANGE' (set to 231 M), and 'SURVEILLANCE DETAILS' (Johnson Criteria Reference: <math>D^503</math>). The main view shows a live feed of a road intersection with a camera view overlay. The overlay shows a red car in the wrong-way lane. The interface includes a 'CAMERA MANAGER' sidebar, a zoom control, and a 'Report a map error' button. The bottom of the interface shows the copyright information: '© 1999-2021 FLIR Systems, Inc.' and links for 'Privacy Policy | Copyright Policy | Terms of Use'.

# WWD Detection & Alert Systems Tests



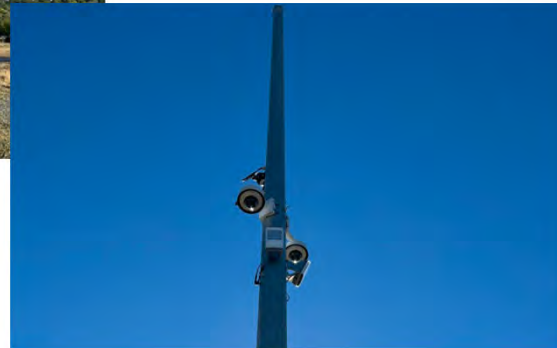


# WWD Detection & Alert Systems Tests



Carmanah Devices  
Installed at  
Legacy Pkwy & Park Ln

# WWD Detection & Alert Systems Tests



Tapco Devices  
Installed at  
State St & Park Ln



# WWD Detection & Alert Systems Tests Results

## Winner between systems

	Tapco	Carmanah
Install Ease	Y	Y
Fine Tuning		Y
Maintenance		Y
Sensitivity	Y	
Less False calls		Y

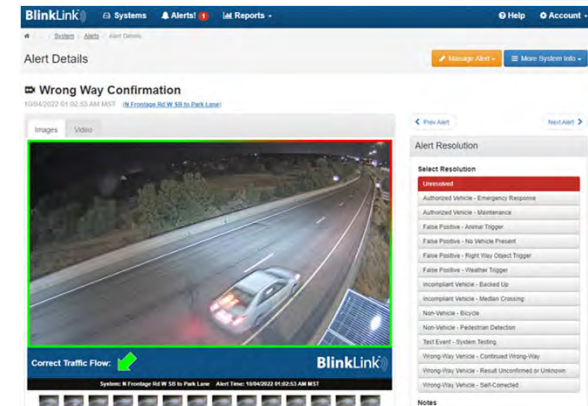
# WWD Detection & Alert Systems Tests

## TAPCO Pros:

- LegendViz backlit signs
- TAPCO does all setup
- Cloud-based alert software (BlinkLink)
- Product support
- V2X capability

## TAPCO Cons:

- Maintenance package \$\$\$
- Very proprietary, not modular



# WWD Detection & Alert Systems Tests

## Carmanah Pros:

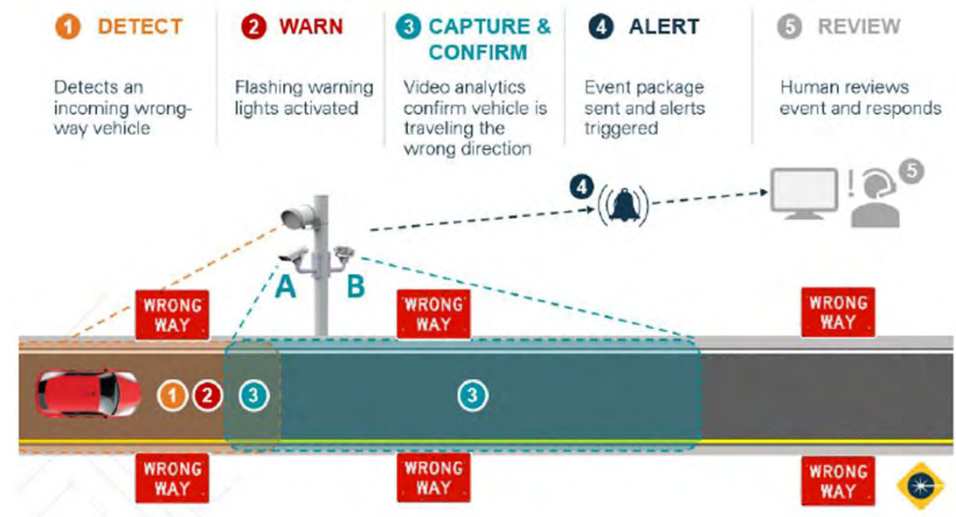
- No Licensing Fees
- Device configuration flexibility
- Dual mode detection (radar & IR)
- V2X capability



## Carmanah Cons:

- UDOT network/server reliant
- Solar sizing by location
- Limited maintenance package

### WW400 System Operation



# Status of \$2.5M approved by Commission

## Operating

- 22 locations fully operational
- 1 locations in construction
- 7 locations in design





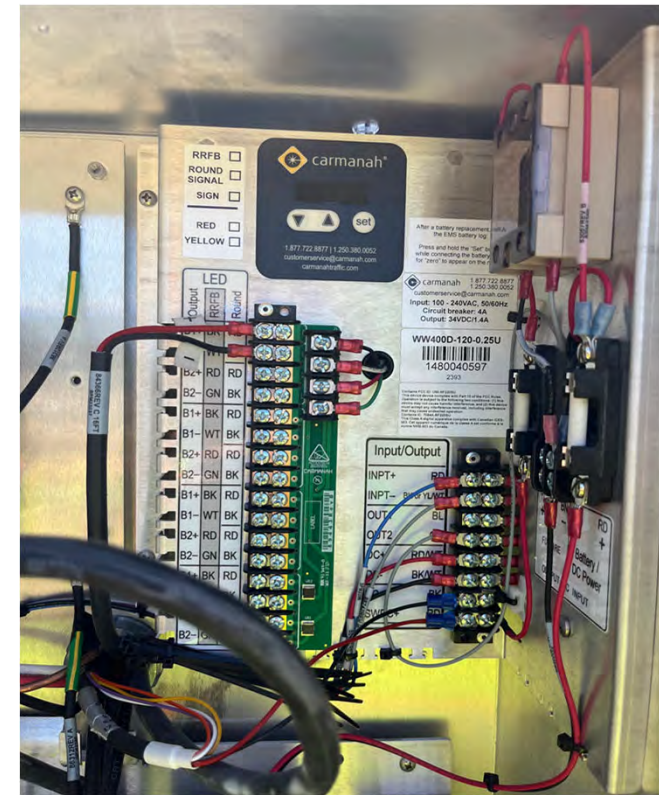
# Equipment



Cabinet



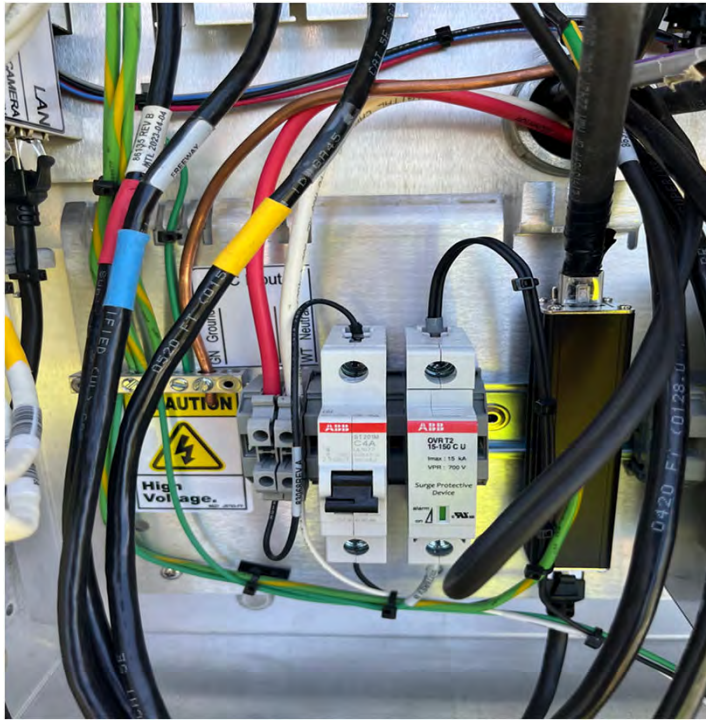
POE Surge



LED Sign Board



# Equipment



Breaker



A/C to D/C Transformer



DC Fuses

# Equipment



Detection pole (front)



Detection pole (front)



Detection pole  
(Detection)



## Equipment



Radar and Intersection  
Camera



Flood light and LED  
flashing sign



Freeway Camera

# Equipment



Solar flashing sign  
with RRFB



Flashing sign with  
RRFB



RRFB and LED Solar  
cabinet

## Equipment Setup (580)



Kent Thurston



## Equipment Setup (Camera)



Kent Thurston

## Equipment Setup (Radar)



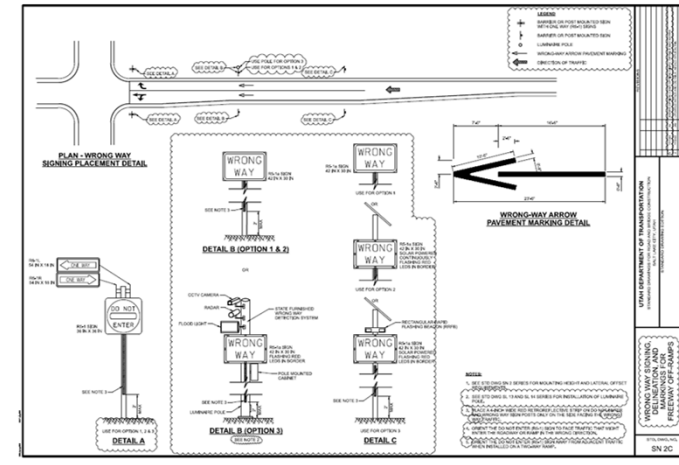
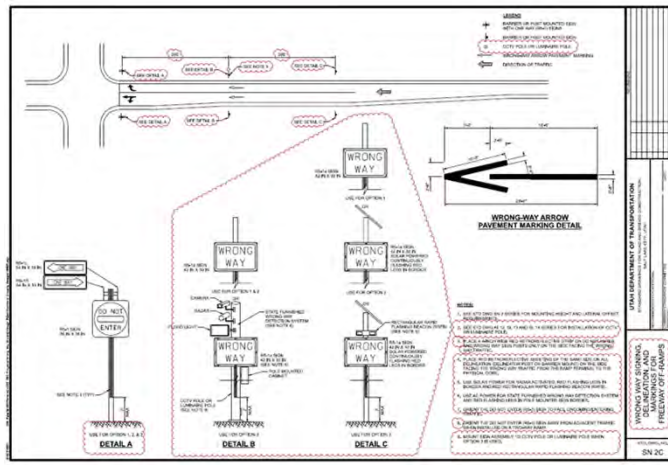
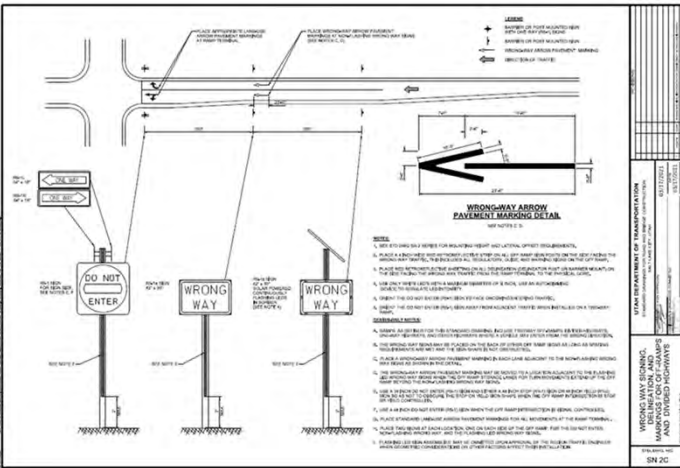
Kent Thurston

# Designs

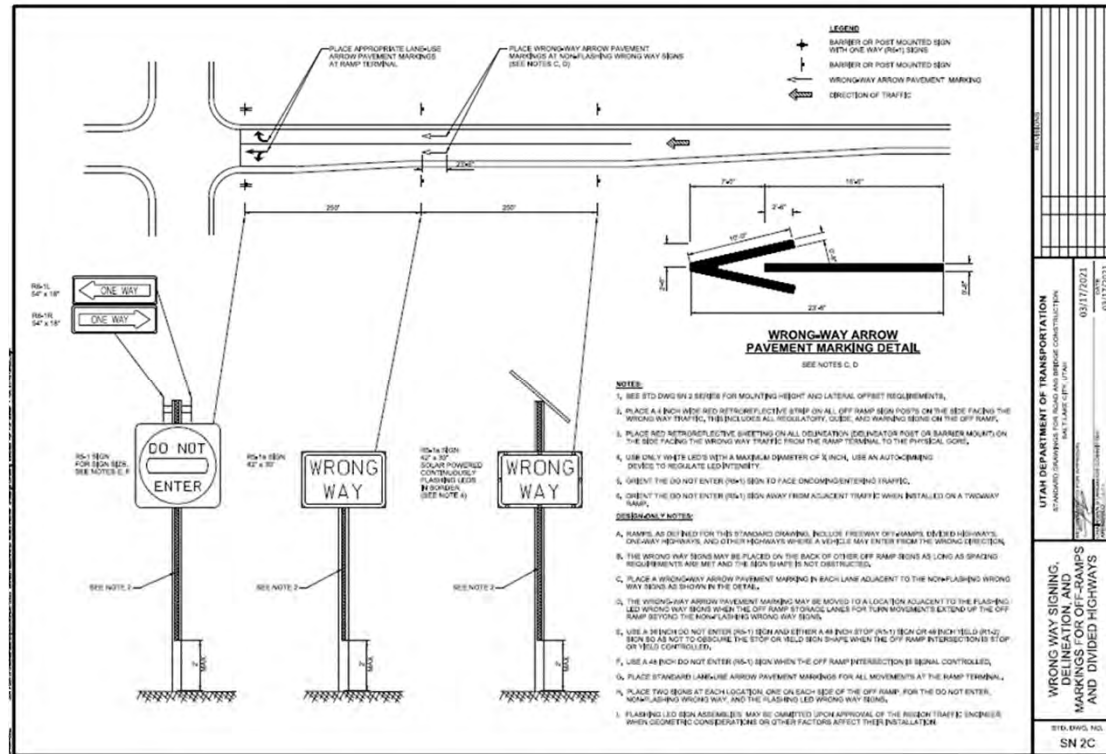
## First draft

## Prior to field installs

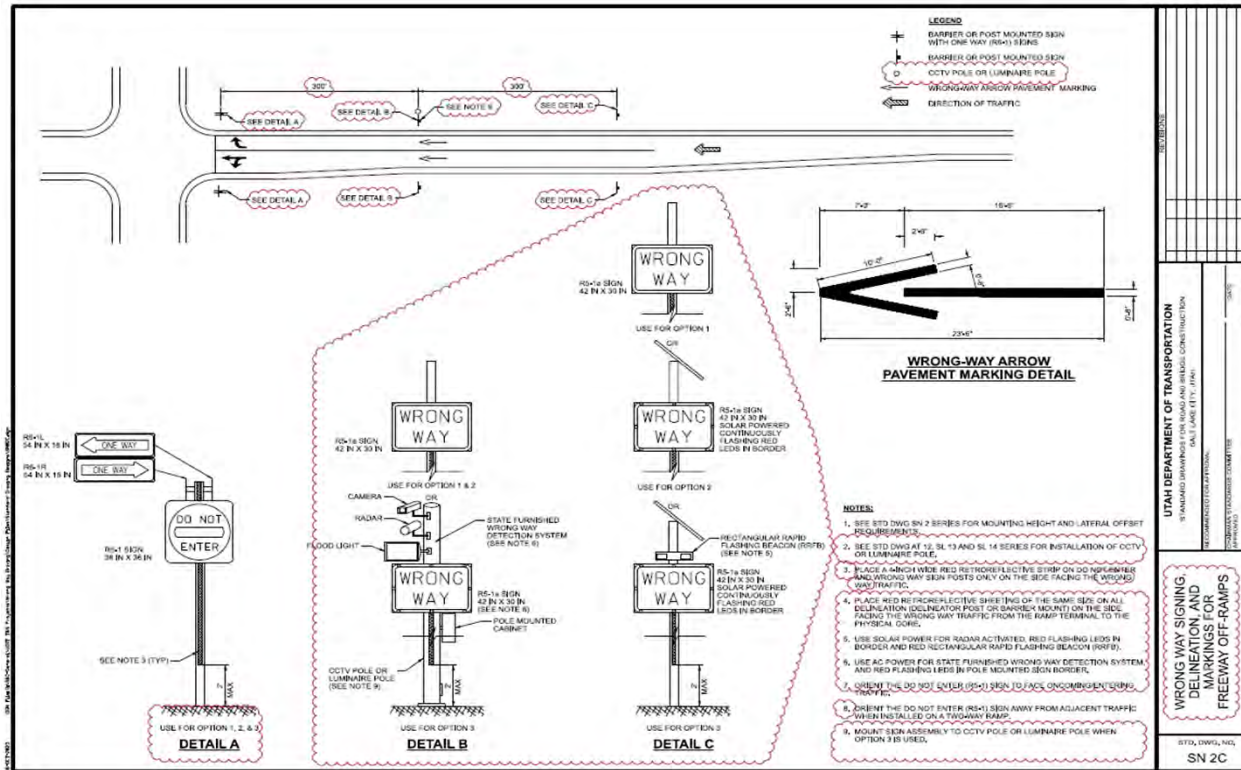
## After field lessons



## First draft

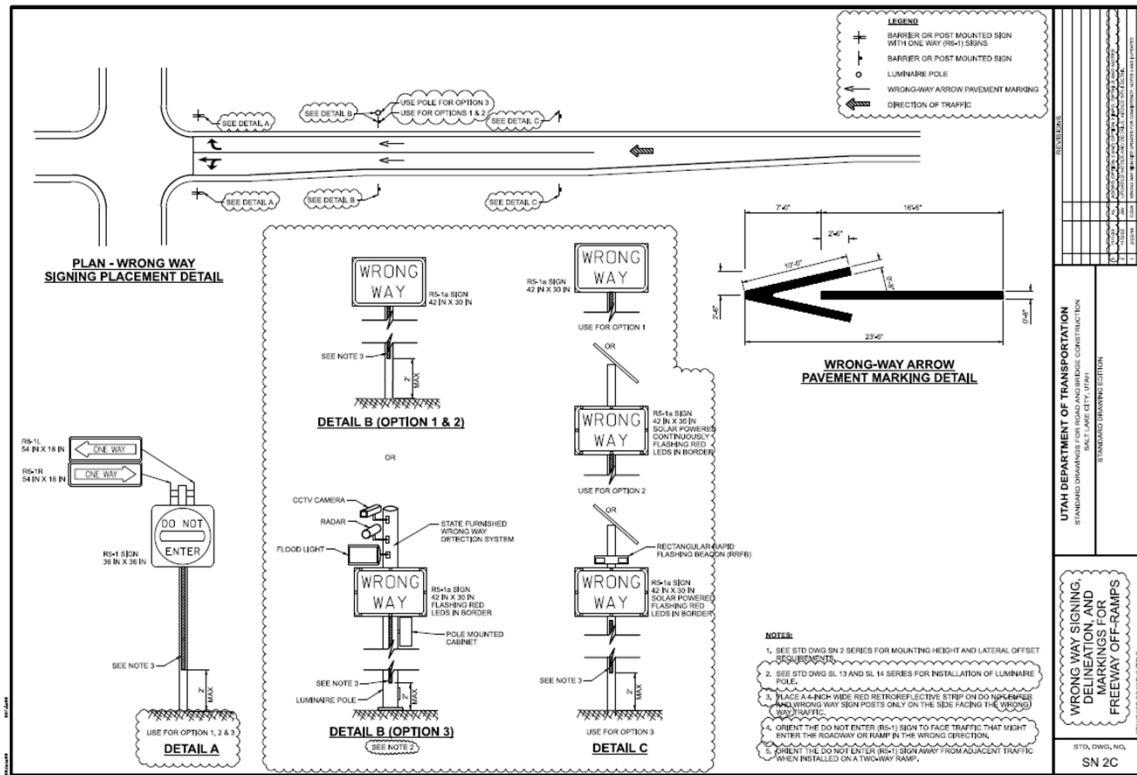


## Prior to Field Installs





## After Field Lessons



# Design Differences





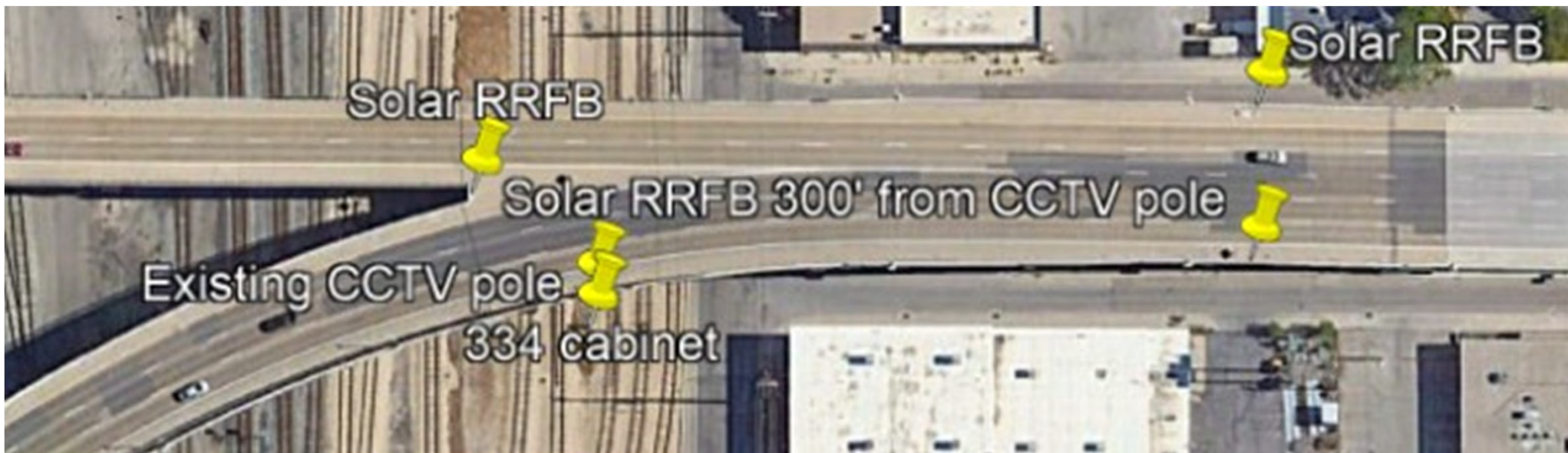
# Design Differences



<https://maps.app.goo.gl/wS-CzQJqXn2JFbSdT8>

## Design Differences

<https://maps.app.goo.gl/ArU2JEE8uVdXd3ax5>



# Design Differences



<https://maps.app.goo.gl/vLSGS7xPvFwsoLma9>



# Design Differences

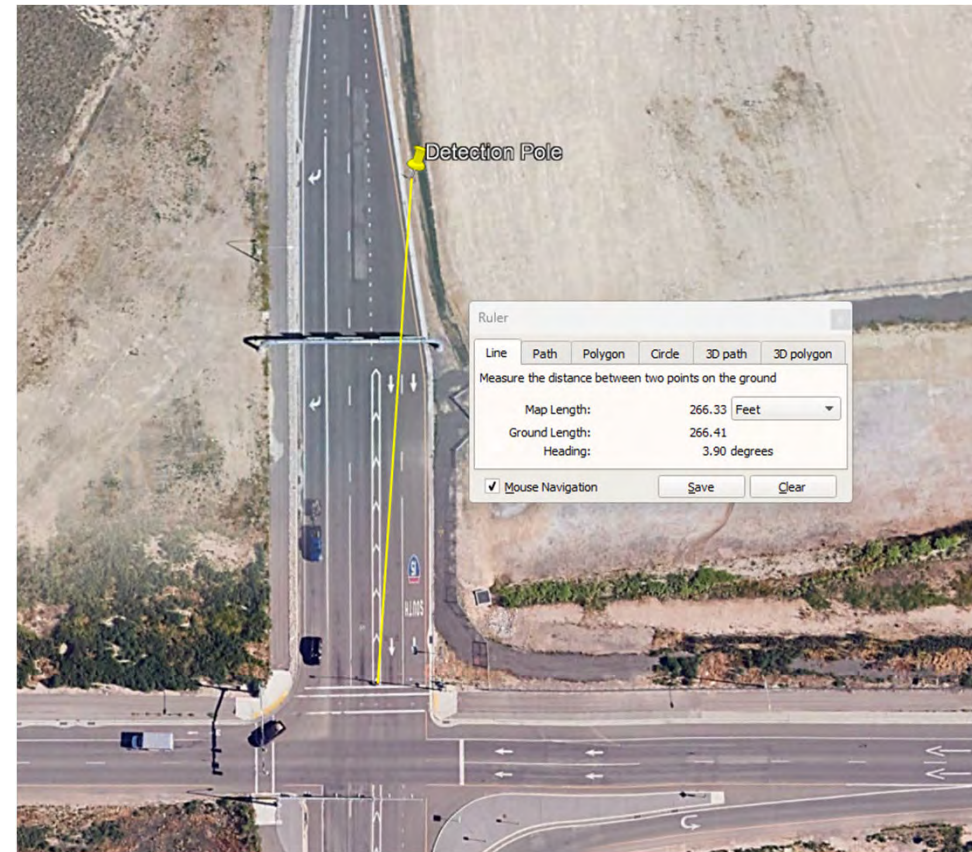


<https://maps.app.goo.gl/ndqDBEn648VEy6GKA>

# Design Differences

## Other design findings

- Grade of ramp
- Horizontal curvature of ramp
- Length of ramp
- Width of ramp
- Trees/brush and signage



# Operation of the system

WWD Driver Incident Management by Vicon Systems

168.170.127.25

I-15 NB Off, 2100 S - Freeway Camera Color

Live Feed Intersection Camera

I-80 EB Off, State St - Intersection Camera

Locations

I-15 NB Off, 2100 S	I-15 NB Off, 2100 S	I-15 NB Off, 2100 S
I-15 NB Off, 2100 S	I-15 NB Off, 2100 S	I-15 NB Off, 2100 S
I-15 NB Off, 2100 S	I-15 NB Off, 2100 S	I-15 NB Off, 2100 S
I-15 NB Off, 2100 S	I-15 NB Off, 2100 S	I-15 NB Off, 2100 S
I-15 NB Off, 2100 S	I-15 NB Off, 2100 S	I-15 NB Off, 2100 S
I-15 NB Off, 2100 S	I-15 NB Off, 2100 S	I-15 NB Off, 2100 S
I-15 NB Off, 2100 S	I-15 NB Off, 2100 S	I-15 NB Off, 2100 S
I-15 NB Off, 2100 S	I-15 NB Off, 2100 S	I-15 NB Off, 2100 S

I-15 NB Off, 2100 S

WWD580

IP Address: 10.205.12.147  
Mac Address: 88ac29a60862  
Last Connection: 2024-Mar-11 09:14:21  
Radar Address: 10.205.12.148  
Last Connection: 2024-Mar-11 09:14:21

Freeway Camera

IP Address: 10.205.12.146  
Mac Address: 88ac29a60862  
Last Connection: 2024-Mar-11 09:13:35

Intersection Camera

IP Address: 10.205.12.150  
Mac Address: 88ac29a60862  
Last Connection: 2024-Mar-11 09:13:35

WWD Events

Location: I-80 EB Off, State St

Date/Time: 2024-Mar-06 09:42:33

Source: Camera Validated

Display

23/965

Kent Thurston



# Operation of the system

The screenshot displays the 'Wrong Way Driver Incident Management by Vion Systems' interface. It features several key components:

- Top Panel:** Shows the application title, IP address (168.178.127.85), and window controls.
- Camera Feeds:**
  - I-15 NB Off; 2100 S - Freeway Camera Color:** A night-time view of a freeway exit.
  - Live Feed Intersection Camera:** A placeholder for an intersection camera feed.
  - US-89 SB Off; Park Lane - Intersection Camera:** A daytime view of a highway intersection with a white car and a truck.
- Locations Grid:** A 10x3 grid of location tiles. The tile for 'I-15 SB Off; 2100 N' is highlighted in pink, indicating an active event. Other tiles are green.
- Event Details (I-15 NB Off; 2100 S):**
  - WWD580:** IP: 10.205.12.147, Mac: f8dc7a9c40b2, Last Connection: 2024-Mar-11 07:12:57.
  - Freeway Camera:** IP: 10.205.12.149, Mac: f8dc7a9c40c4, Last Connection: 2024-Mar-11 07:12:34.
  - Intersection Camera:** IP: 10.205.12.150, Mac: f8dc7a9c40bf, Last Connection: 2024-Mar-11 07:12:34.
- WWD Events (US-89 SB Off; Park Lane):**
  - Location: US-89 SB Off; Park Lane
  - Date/Time: 2024-Mar-07 14:17:58
  - Source: Radar Detect
  - Count: 19/965
  - Display options: Fwy Video, Int. Video, Fwy Image, Int. Image.
- Taskbar:** Shows system tray icons and the time 7:13 AM on 3/11/2024.



# Operation of the system

Wrong Way Driver Incident Management by Vision Systems | 168.178.127.85

Live Feed Freeway Camera

Live Feed Intersection Camera

Video Playback

Locations

I-15 NB Off: 1300 S	I-15 SB Off: 1300 S	I-80 EB Off: 1300 E
I-15 NB Off: 200 N	I-15 SB Off: 200 N	I-80 EB Off: State St
I-15 NB Off: 200 W	I-15 SB Off: 200 N	I-80 WB Off: 1300 E
I-15 NB Off: 2100 S	I-15 SB Off: 2100 N	I-80 WB Off: 700 E
I-15 NB Off: 600 S	I-15 SB Off: 2100 S	I-80 WB Off: State St
I-15 NB Off: University Ave	I-15 SB Off: 2600 S	Legacy Pkwy NB Off: Park Lane
I-15 NB Off: West Temple Rd	I-15 SB Off: University Ave	US-89 SB Off: Park Lane
I-15 NB Off: West Temple St	I-80 EB Off: 1300 E	

WWD580

IP Address:  
Mac Address:  
Last Connection:  
Radar Address:  
Last Connection:

Alarm

Freeway Camera

IP Address:  
Mac Address:  
Last Connection:

Play IR    Play Color

Intersection Camera

IP Address:  
Mac Address:  
Last Connection:

Play IR    Play Color

WWD Events

Location: I-15 SB Off: 1300 S

Date/Time: 2024-Mar-11 05:48:01

Source: Camera Validated

Display

Fwy Video    Int. Video

Fwy Image    Int. Image

1/965

7:05 AM 3/11/2024

## Operation of the system



Kent Thurston

# Operation of the system

The screenshot displays the 'Wong Way Driver Incident Management by Vion Systems' interface. It features three main camera feed windows at the top: 'Live Feed Freeway Camera', 'Live Feed Intersection Camera', and 'Legacy Pkwy NB Off: Park Lane - Freeway Video'. Below these are several panels:

- Locations:** A grid of 12 location cards, each with a color-coded status (green or red) and a location name. One card, 'I-15 NB Off: 200 W', is highlighted in red.
- WWDS80:** A configuration panel for a WWDS80 device, showing fields for IP Address, Mac Address, Radar Address, and Last Connection, along with 'Play ID' and 'Play Color' buttons.
- Freeway Camera:** A configuration panel for a Freeway Camera, showing fields for IP Address, Mac Address, and Last Connection, along with 'Play ID' and 'Play Color' buttons.
- Intersection Camera:** A configuration panel for an Intersection Camera, showing fields for IP Address, Mac Address, and Last Connection, along with 'Play ID' and 'Play Color' buttons.
- WWD Events:** A panel showing event details for 'Location: I-15 NE Off: 2100 S', 'Date/Time: 2024-Mar-08 00:05:50', and 'Source: Camera Validated'. It includes 'Display' buttons for 'Play Video' and 'Play Image'.

On the right side of the interface, there is a large blue circle containing the letter 'K' and the name 'Kent Thurston' below it. The system tray at the bottom shows the time as 7:09 AM on 3/11/2024.

## Operation of the system



Kent Thurston



## Operation of the system



Kent Thurston

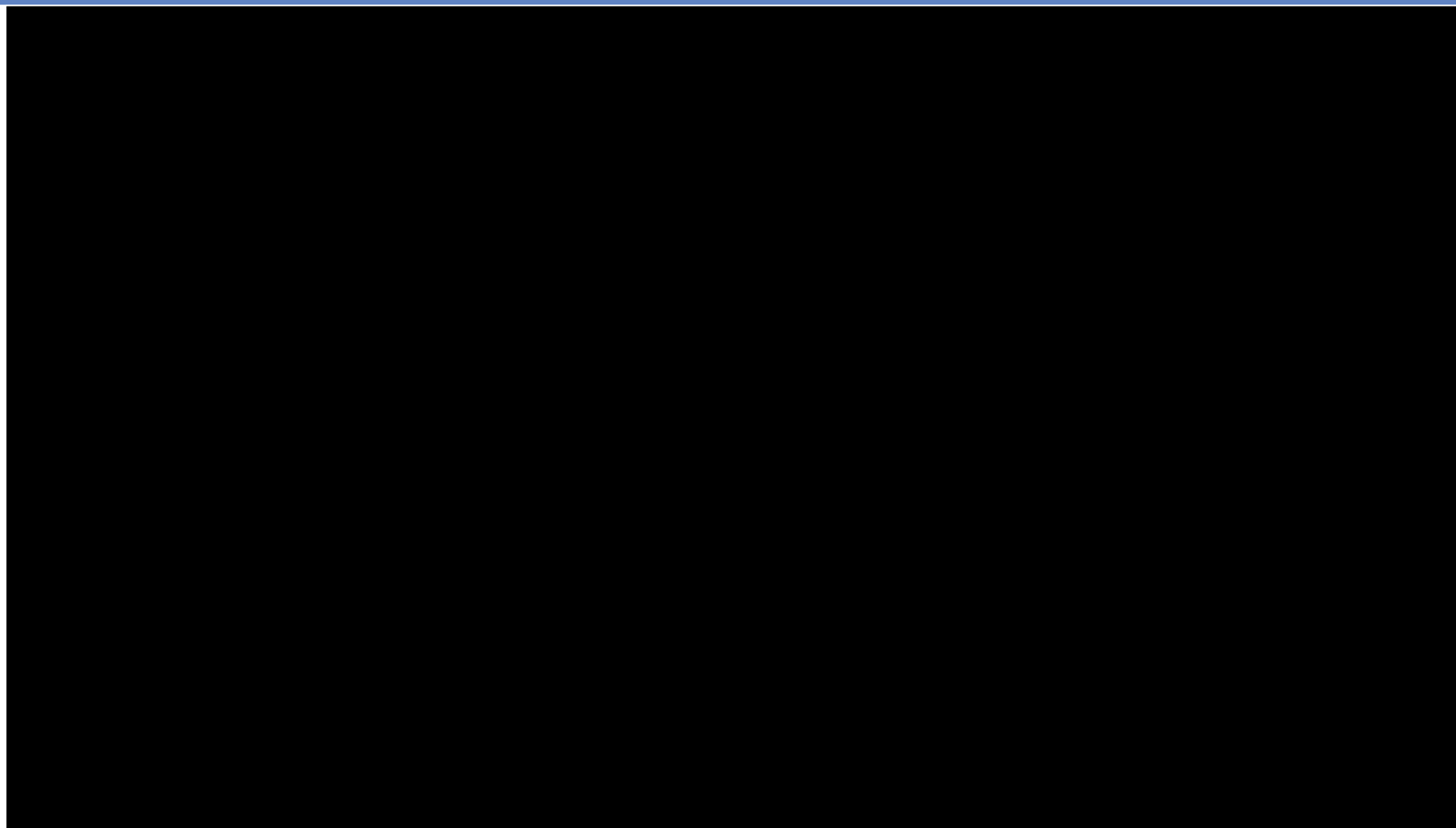
# Operation of the system

The screenshot displays the WWD Driver Incident Management System interface. At the top, the browser window title is 'Wong Way Driver Incident Management by Ytisc Systems' with the IP address '105.178.127.85'. The interface is divided into several sections:

- Live Feed Intersection Camera:** Three video feeds showing traffic at an intersection.
- Locations:** A grid of 12 location tiles, each representing a specific camera location with its address and status.
- WWD Events:** A panel showing event details for 'Legacy Pkwy NB Off; Park Lane' on '2024-Mar-09 20:35:51', with the source 'Camera Validated'.
- Configuration Panels:** Two panels for 'Freeway Camera' and 'Intersection Camera' with fields for IP Address, Mac Address, and Last Connection, along with 'Refresh' and 'Play' buttons.

On the right side of the interface, there is a large blue circle containing the letter 'K' and the name 'Kent Thurston' below it. The system tray at the bottom right shows the time '7:07 AM' and date '3/11/2024'.

## Operation of the system



# Operation of the system

The screenshot displays a software interface for traffic management. At the top, there are three main sections: 'Live Feed Freeway Camera', 'Live Feed Intersection Camera', and 'Video Playback'. Below these are several panels:

- Locations:** A grid of 12 location cards, each with a color-coded background (green or red) and text indicating location and camera ID. One card is highlighted in red.
- WWDS80:** A panel showing details for a specific location, including IP Address, Mac Address, Last Connection, Radar Address, and Last Connection. It includes 'Play IP' and 'Play Color' buttons.
- Freeway Camera:** A panel showing details for a freeway camera, including IP Address, Mac Address, and Last Connection. It includes 'Play IP' and 'Play Color' buttons.
- Intersection Camera:** A panel showing details for an intersection camera, including IP Address, Mac Address, and Last Connection. It includes 'Play IP' and 'Play Color' buttons.
- WWD Events:** A panel showing event details for a specific location and time, including Date/Time, Source, and Display options (Play Image, Play Image).

On the right side of the interface, there is a large blue circle containing the letter 'K' and the name 'Kent Thurston' below it. The bottom of the screenshot shows a Windows taskbar with various icons and the system clock showing 7:05 AM on 3/11/2024.



# Operation of the system

The screenshot displays a web-based interface for managing camera feeds. The browser window title is "Wrong Way Driver Incident Management by Vision Systems" and the address bar shows "168.178.127.85".

The interface is divided into several sections:

- Live Feed Intersection Camera:** A large central area for viewing camera feeds. The top-left feed shows "I-15 NB Off: 2100 S - Freeway Camera Color" with a night-time view of a highway. The top-right feed is labeled "I-80 WB Off: State St - Intersection Camera" and shows a "Loading..." status.
- Locations:** A grid of 12 camera locations, each with a color-coded status indicator (green for active, red for offline). One location, "I-15 NB Off: 2100 S", is highlighted in red.
- WWD Events:** A panel showing event details for "I-80 WB Off: State St".
  - Location: I-80 WB Off: State St
  - Date/Time: 2024-Mar-08 12:18:07
  - Source: Camera Validated
  - Display: Includes buttons for "Play Stream", "Off Video", "Full Image", and "Off Image".
  - Count: 13/965
- Device Information Panels:** Two panels provide details for specific cameras:
  - WWDS80:** IP Address: 10.205.12.147, Mac Address: 08:00:7a:9c:40:82, Last Connection: 2024-Mar-11 07:11:12, Radar Address: 10.205.12.148, Last Connection: 2024-Mar-11 07:11:12. Includes "Play IP" and "Play Radar" buttons.
  - Freeway Camera:** IP Address: 10.205.12.149, Mac Address: 08:00:7a:9c:40:84, Last Connection: 2024-Mar-11 07:10:32. Includes "Play IP" and "Play Radar" buttons.
  - Intersection Camera:** IP Address: 10.205.12.150, Mac Address: 08:00:7a:9c:40:89, Last Connection: 2024-Mar-11 07:10:32. Includes "Play IP" and "Play Radar" buttons.

The Windows taskbar at the bottom shows the system time as 7:11 AM on 3/11/2024.



Kent Thurston

## Lesson learned

- Vendor cables vs contractor cables
- Access to pole cabinet
- Pole type
- Height and angle of devices



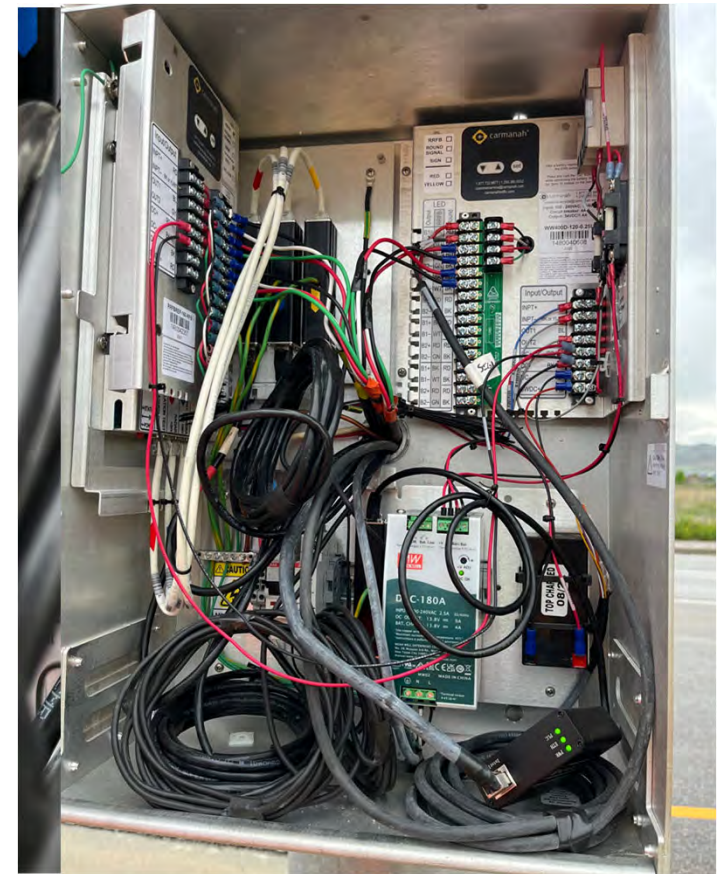
## Lesson learned

- Vendor cables vs Contractor Cables
  - Vendor cables
    - Comes as a set
    - Set cost
  - Contractor cables
    - Adjustable length
    - Faster repair (no finger pointing on failure)
    - Pay for what is used



## Lesson learned

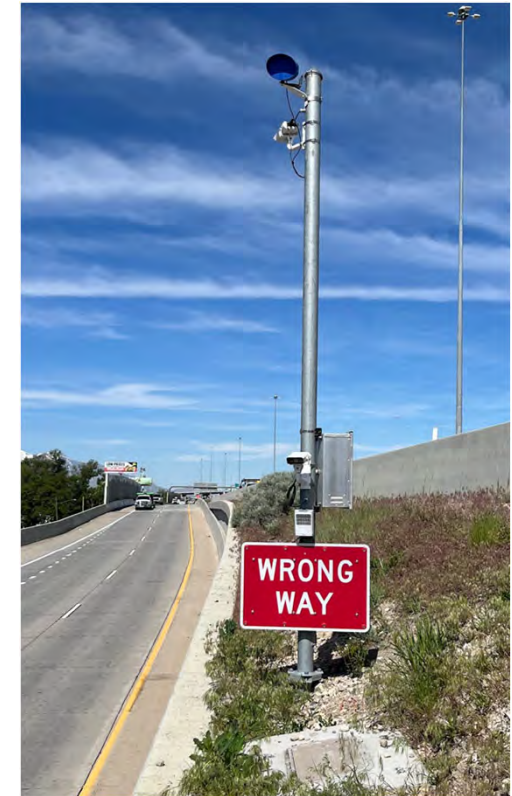
- Access to pole cabinet
  - Back of cabinet
  - Bottom of cabinet running two conduits





## Lesson learned

- Pole type
  - Luminaire vs Ped



## Setup on a ped pole



## Lesson learned

- Pole type
  - Luminaire vs Ped



## Lesson learned

- Height and angle of devices
  - Height
    - Started at 16' above stopbar
    - Ended 30' above roadway by pole
  - Angle (moving pole back to 450')
    - Started at parallel with stopbar
    - Ended -2 degree parallel with roadway
      - exceptions (overhead signs and things that reflect oncoming traffic)

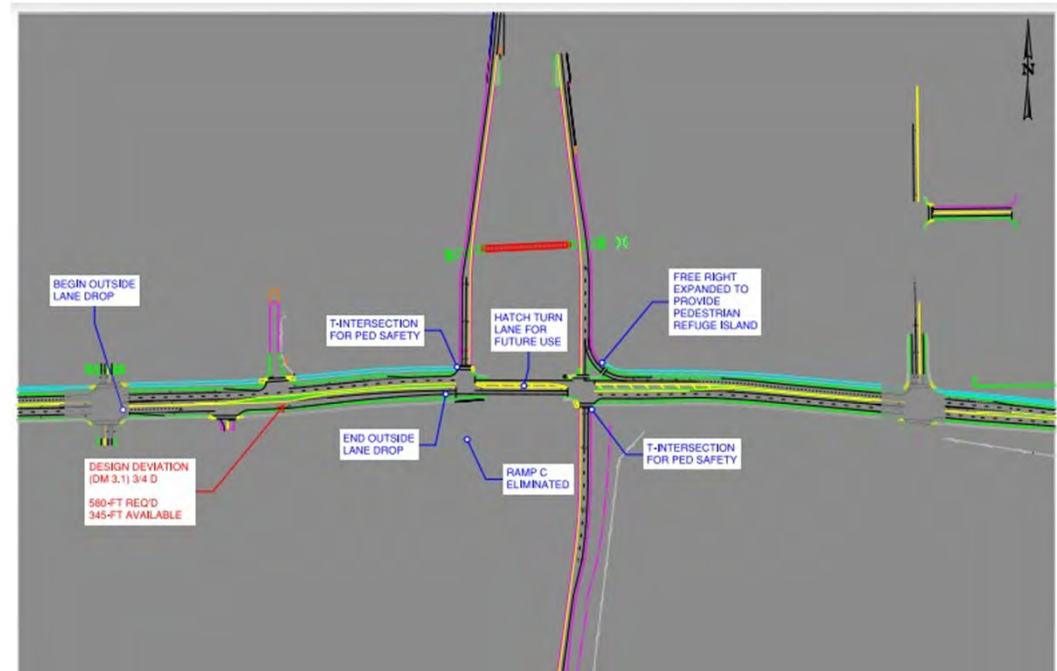
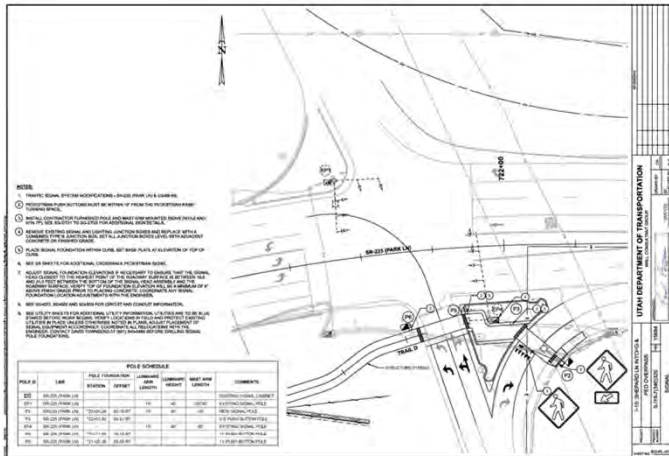
<https://maps.app.goo.gl/J6D2mkcqktCQ9o757>



# Current UDOT Projects Installing WWD Detection

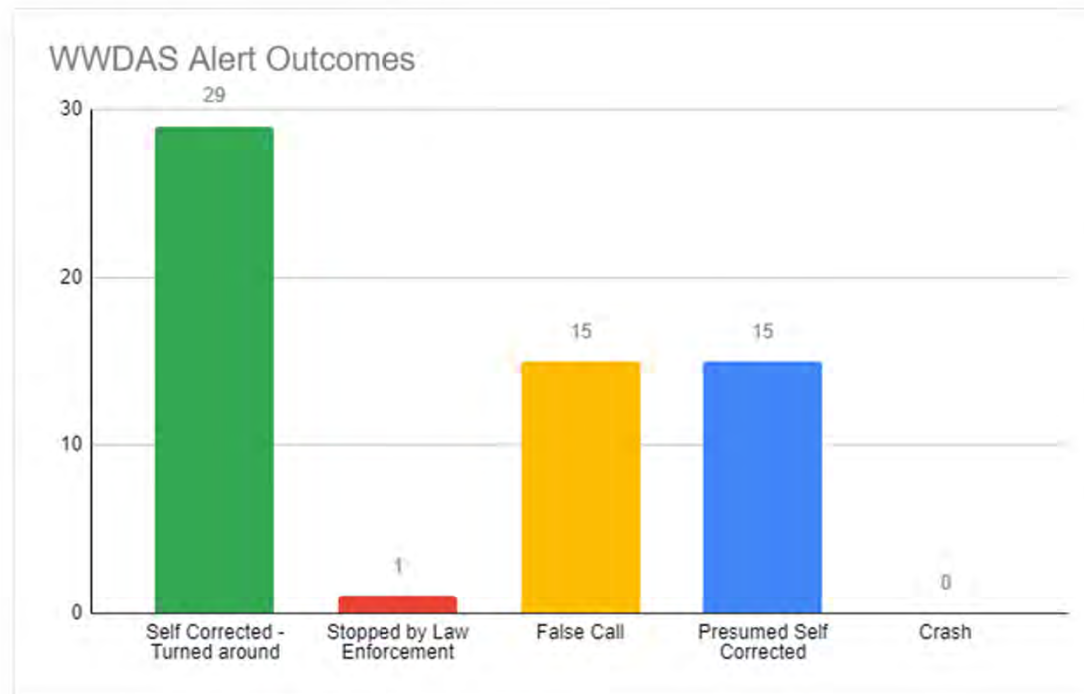
## Current UDOT Projects

- PIN 15684 Shepard Ln Interchange rebuild
- PIN 15153 Dry Creek Parkway Interchange



# Safety Benefits

## 3 month result chart



# Safety Benefits

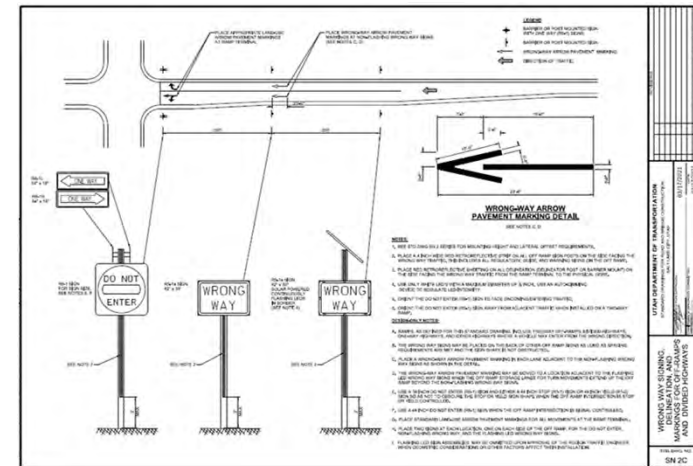
## Safety Analysis at 23 Locations

- 32 WWD Crashes (6 severe) between Jan 2010 - Jun 2023
- New systems estimated to avoid 30 WWD crashes in 20 years
- Total benefit: \$20 million
- Benefit/Cost Ratio: 4.5



# Next Steps

- Adopt New Standard Drawing & Specs
- Continue Deployment of Carmanah Systems
- Transition Maintenance to Fwy Ops Group
- Integrate Alerts into Active ITS ATMS
- Gather Results/Data of Effectiveness
- Pursue Additional Funding for Deployments







---

## Questions

Adam Lough (alough@utah.gov)  
Kent Thurston (kthurston@utah.gov)