

UDOT's Statewide Wrong-Way Detection Project

Western States Rural Transportation Technology Implementers Forum

Yreka, California

October 5-7, 2021

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Region 4 ITS Project Manager/Signals Engineer

LTDOT

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LOCHNER



Wrong-Way Driving Data



Interstate Wrong-Way Crash Severity

Crash Severity		Crashes
No injury/PDO	105	42.34%
Suspected Minor Injury	47	18.95%
Possible injury	39	15.73%
Suspected Serious Injury	34	13.71%
Fatal	23	9.27%

UDOT Wrong-Way Driver Mitigation Approach

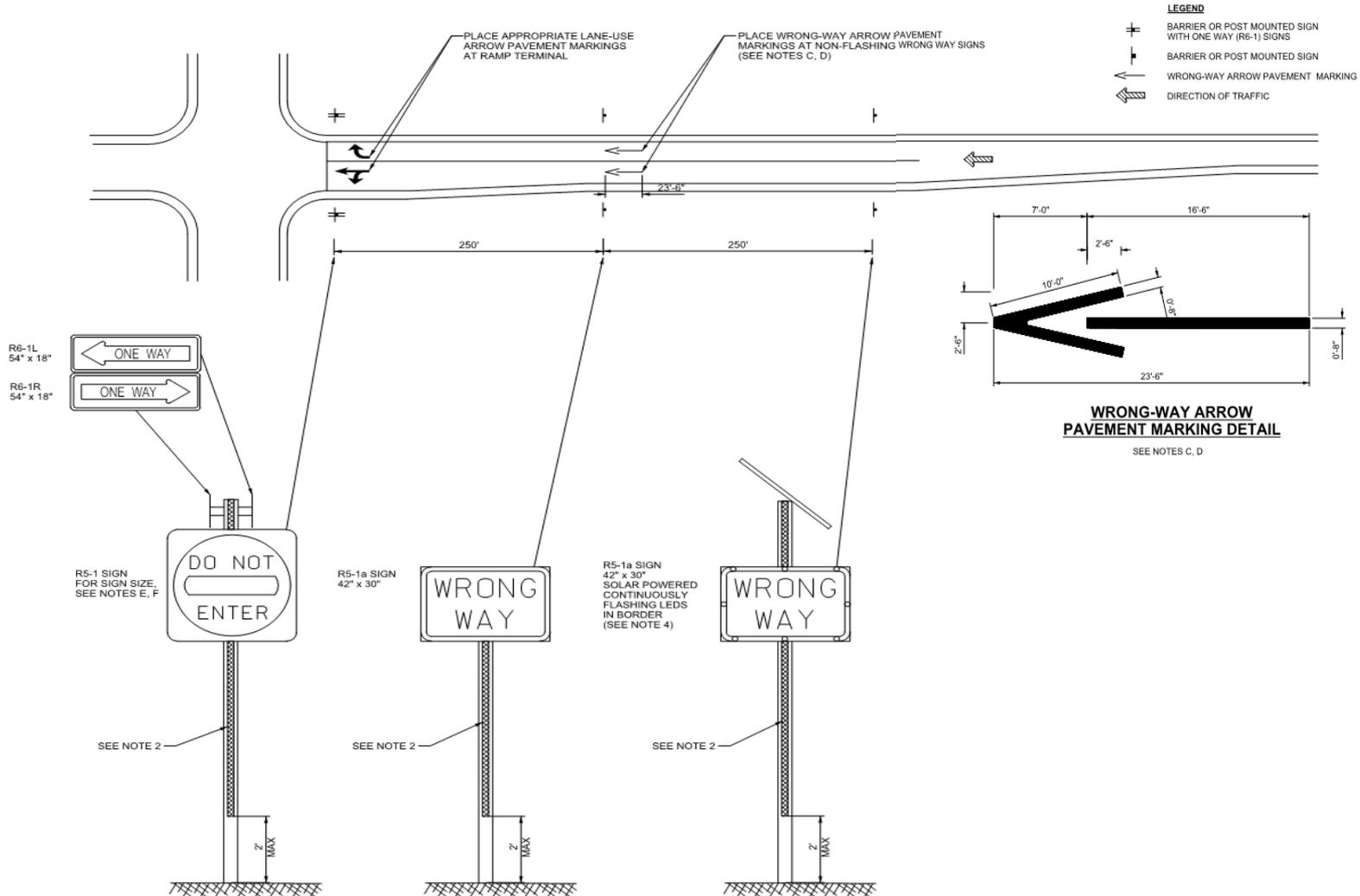
1. Identify locations with wrong-way driver history
2. Install wrong-way detection ←
3. Study wrong-way incidents ←
4. Upgrade roadway to current standards
5. Install real-time driver feedback/alert system

Wrong-Way Driving Mitigations - Passive

- Additional signs
- Lowered/Raised signs
- Flashing Signs (full time)
- Red Tape (retro-reflective)
- Pavement Markings
- UDOT's current standard



UDOT Std. Dwg. Wrong-Way Signing & Striping



UDOT WWD Pilot Study Locations



- I-15 Northbound & 2100 South Interchange
Mountain View Corridor (SR-85) & 12600 S
- Park Lane (SR-225) & US-89 Southbound



I-15 NB / 2100 S SLC



Mtn. View Corridor (SR-85) & 12600 South



Park Lane (SR-225) & US-89 Southbound



Park Lane (SR-225) & US-89 Southbound

7/18 10:45 PM and

7/20 7:46 PM

7/20 8:39 PM

7/21 12:32 AM

7/26 10:25 AM

7/27 12:29 AM

7/27 10:20 PM

7/28 11:27 PM

7/28 11:42 PM

7/30 10:05 AM

7/30 8:23 PM

Etc.



Pilot Study Results

I-15 & 2100 South NB Interchange – No WWD Recorded

Mountain View – one WWD Video Captured - 8/11/2018 7:53 PM



Park Lane (SR-225) & US-89 Southbound









Add direction & route pavement messages

Replace green balls with arrows





Results from Park Lane & US-89 improvements:

- Wrong-way incidents reduced roughly from 1/day to 1/month



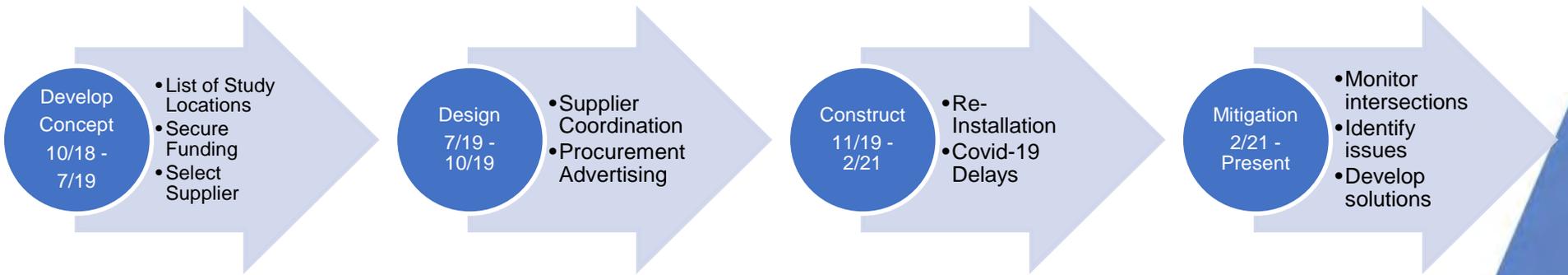
UDOT's Next Steps

- Funded a \$500,000 Project to place equipment at selected intersections throughout the State
- The purpose of the additional locations is data collection
- UDOT will only pursue active countermeasures if we can't correct the issues with static signing
- Develop a Document Outlining Goals of Project

UDOT Kickoff Meeting



Project Phases



FW: Wrong way pilot project lessons learned

2 messages

Carrick, Natalie <CarrickNatalie@stanleygroup.com>
To: Troy Torgersen <ttorgersen@utah.gov>
Cc: "Tappendorf, Don" <TappendorfDon@stanleygroup.com>

Mon, Nov 5, 2018 at 8:59 AM

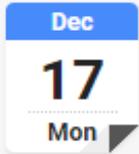
Hi Troy,

I hope you had a nice weekend. Below is a list of lessons learned from the design perspective on the ADOT Wrong way driver detection project

First and foremost, there is not a cookie cutter application to deploy at every interchange. Each location required its own analysis as far as:

- Which camera lens to use
- Type of pole the camera is to be installed on matters
 - If installed on mast arms, shaking could result in false calls
 - Pole stability is important
- Connection to the network
 - Be aware of conduit fill connecting to the cabinet
- Cabinet considerations
 - Ensure there is enough room in the cabinet to accommodate the additional components
 - Media converters
 - TI x-stream and up to 2 expansion cards for the TrafiSense thermal cameras
 - Ethernet switch
 - Fiber termination unit
 - DC isolator
 - Additional circuit breakers
 - Time extend relay for the flashing wrong way sign
- If installing the thermal cameras at the top of the ramp (near the exit gore) and connecting to the traffic signal cabinet the distance of the cable run needs to be evaluated. It may require Ethernet cameras, media converter, new fiber connections, etc. This will also require a fiber patch panel in the cabinet so space management in the cabinet is important. The placement of the camera at the top of the ramp and number of lanes to detect are also important in determining the lens to use.

WWD Camera Location Meeting



Wrong-Way Driving Thermal Camera Loca...

[View on Google Calendar](#)

When Mon Dec 17, 2018 13:30 – 14:50 (MST)

Where UDOT_RM-TC Room 133

Who Corey Coulam, tfinlinson@utah.gov, UDOT_RM-TC Room 133, jamiemackey@utah.gov, jleonard@utah.gov...

Wrong-Way Driving Thermal Camera Locations

Region TOEs - please delegate this to the staff you'd like to have involved.

We are going to produce the initial list of WWD thermal camera locations - we have 40-43 locations and will discuss as follows:

1:30-1:45 - overview, conference call setup, etc.

1:45-2:00 - Region 1 locations

2:00-2:15 - Region 2 locations

2:15-2:30 - Region 3 locations

2:30-2:45 - Region 4 locations

2:45-3:00 - Review list and finalize.

Region staff may choose whether they want to sit through the whole meeting or just sign in for their time.

Please come prepared to identify locations where you want to look for wrong-way driving.



UDOT is planning to install roughly 40 thermal imaging cameras to detect wrong-way driving. This document lays out the plan for data collection and evaluation

Key Questions

These are the questions that we expect to answer with the 40 camera test installation:

- **Data analysis Questions**

- What is the incidence of wrong-way incursions on UDOT ramps?
- What are the characteristics of ramps and cross streets with high numbers of wrong-way incursions?
- What percentage of observed wrong-way detections are reduced by roadway feature changes?

• **Signals Questions:**

- Can the thermal imaging camera be effective for ramp signal detection at the same time as it checks for wrong-way drivers?
- Are there weaknesses in signal designs with WWD occurrences? (Mast arm signing/signal indications, etc.)

• **Control Room Question:**

- Can the wrong-way detection be integrated into the TOC control room - and if so, what are the best practices that should be adopted?
- Manpower requirements?
- Triage/priority requirements if we have multiple WWD incidents
- Software requirements
- Cost-benefit for control room software/hardware/manpower

- **Control Room Question cont.:**

- Software requirements
- Cost-benefit for control room software/hardware/manpower

- **Test Conclusions:**

- Given the answers to the above - recommend what system, if any, should be made standard on UDOT ramps.

These are the questions that will not be answered with the 40 camera test:

- Do thermal imaging cameras reduce wrong-way crashes? Sample size is too small.
- Do thermal imaging cameras miss wrong-way detections - we might find this out, but only if we have a major crash on a missed detection

Scope:

- Kickoff Meeting
- Identify locations
- 37 Cameras
- Install equipment
- Monitor intersections
- Identify issues
- Develop solutions



Proposed Sites from Kickoff Meeting

- Region 1 – 11 locations
- Region 2 – 11 locations
- Region 3 – 9 locations
- Region 4 – 6 locations



Additional WWD Project Goals Cont.

Wanted to include the following:

- Unconventional Interchange
- Diverging Diamond Interchange (DDI)
- Single Point Urban Interchange (SPUI)
- Continuous Flow Intersection (CFI)



Unconventional Interchange – Spanish Frk.



Diverging Diamond – St. George



Southern Parkway SPUI – St. George



University Parkway CFI - Orem



WWD Project Equipment



FLIR Thermal Imaging Sensors

Can be used for:

- Vehicle and bicycle presence detection
- Vehicle and bicycle counting,
- Pedestrian presence detection,
- Pedestrian counts
- Traffic data collection
- Traffic flow monitoring
- Wrong-way driver detection
(requires extra license)



Thermal Traffic Detector - TrafiSense

- Doesn't need light to operate
- Uses thermal energy emitted from vehicles and bicyclists
- Several models available
- Maintenance – Clean Lens every 3-5 years

TrafiSense Model – Pilot Sites Model

- Model: TrafiSense BPL 317
- Compression H.264, MPEG-4, MJPEG (dual stream)
- Resolution QVGA (336x256)
- FOV: Horizontal: 17° Vertical: 13°
- Frame Rate 30 FPS
- Number of Detection Zones:
 - 24 Vehicle presence zones
 - 4 Bike presence
 - 8 Inverse direction zones



TrafiSense vs. TrafiSense 2 Comparison

Features	TrafiSense	TrafiSense2
System architecture	2 Different hardware versions, BPL & ETH	An all in one hardware for BPL2 and PoE
Processor	Single core	Quad core
Presence detection	Yes	Yes with added basic AI
Bicycle detection	No	Yes
Pedestrian detection	No	Yes
Wifi for travel time & delay	No	Yes
Acyclica platform integration	Yes	Yes
Cyber security features	Yes	Yes
Interface (optional)	TI X-stream BPL / TI Xp	TI X-stream BPL2 / PoE
Direct outputs	3	2

Compare Products



TRAFISENSE

Model: FLIR TrafiSense BPL 317

[Learn More »](#)



TRAFISENSE2

Model: TrafiSense2 632

[Learn More »](#)

OVERVIEW

Detection Functionalities

Vehicle and bike presence, counting, inverse direction

Vehicle and bicycle presence detection, vehicle and bicycle counting, pedestrian presence detection, pedestrian counting, traffic data collection, traffic flow monitoring, wrong way driver detection (requires extra license)

Dimensions (incl mounting bracket)

Vertically mounted 45cm x 16cm x 12cm (17.7 x 6.3 x 4.7 inch) Horizontally mounted 41cm x 18cm x 12cm (16.1 x 7.1 x 4.7 inch)

Vertically mounted 45 cm x 16 cm x 12 cm (9.8 in x 6.3 in x 4.7 in) / Horizontally mounted 41 cm x 18 cm x 12 cm (16.2 in x 7.1 in x 4.7 in)

Functionality

Vehicle presence Bike presence

Vehicle presence, Bicycle presence, Vehicle and bicycle counting, Pedestrian presence, Traffic data, wrong-way driver detection

Sunshield

Optional

Integrated



ELECTRICAL & MECHANICAL

Contact Closures	3 for ETH versions, direct or via optional ETH interface (PN 10-6075) 4 for TI x-stream EDGE (PN 10-6055), 12 extra outputs via 4/Os xp expansion boards	2 direct, 4 via TI BPL2 EDGE interface (PN 10-7013), extra via 4/O USB expansion board(s) (PN 10-467)
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ENVIRONMENTAL & APPROVALS

EU Directives	EMC 2004/108/EC	EMC 2014/30/EU, RoHS 2011/65/EU
FCC	FCC part 15 class A	FCC part 15 Class A
Protection Grade	Housing = IP68, Connectors = IP67	Housing = IP68, Connectors = IP67
Shock & Vibration	NEMA II specs	NEMA TS2
Temperature Range	From -34°C to +80°C (-29°F to 165°F)	NEMA TS2. From -34°C to +74°C (-29°F to 165°F)

IMAGING & OPTICAL

Type	Long wave Infrared (7 – 14 μm)	Long wave Infrared (7 – 14 μm)
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POWER

Input Power	12-42VDC, 12-30VAC	12-42VAC, 12-60VDC
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TrafiSense Camera View





TRAFISENSE2

Model: TrafiSense2 632

[Learn More »](#)



TRAFISENSE2

Model: TrafiSense2 645

[Learn More »](#)



TRAFISENSE2

Model: TrafiSense2 690

[Learn More »](#)

Functionality	Vehicle presence, Bicycle presence, Vehicle and bicycle counting, Pedestrian presence, Traffic data, wrong-way driver detection	Vehicle presence, Bicycle presence, Vehicle and bicycle counting, Pedestrian presence, Traffic data, wrong-way driver detection	Vehicle presence, Bicycle presence, Vehicle and bicycle counting, Pedestrian presence, Traffic data, wrong-way driver detection
Number Detection Zones	24 vehicle presence zones \ 8 bicycle presence regions \ 8 pedestrian zones \ 6 traffic data zones \ 6 wrong way driver zones	24 vehicle presence zones \ 8 bicycle presence regions \ 8 pedestrian zones \ 6 traffic data zones \ 6 wrong way driver zones	24 vehicle presence zones \ 8 bicycle presence regions \ 8 pedestrian zones \ 6 traffic data zones \ 6 wrong way driver zones

SYSTEM OVERVIEW

Resolution	VGA (640x480)	VGA (640x480)	VGA (640x480)
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CONNECTIONS & COMMUNICATIONS

SDLC	Up to 16 output channels via TI BPL2 EDGE B & SUI (PN 10-7018) or via TI BPL2 EDGE (PN 10-7013) and Port-1 Interface Module (PIM)	Up to 16 output channels via TI BPL2 EDGE B & SUI (PN 10-7018) or via TI BPL2 EDGE (PN 10-7013) and Port-1 Interface Module (PIM)	Up to 16 output channels via TI BPL2 EDGE B & SUI (PN 10-7018) or via TI BPL2 EDGE (PN 10-7013) and Port-1 Interface Module (PIM)
Setup Commands	Web interface	Web interface	Web interface
Traffic monitoring (event and data reporting)	TMS FLUX. Public API for 3rd party integration.	TMS FLUX. Public API for 3rd party integration.	TMS FLUX. Public API for 3rd party integration.



TRAFISENSE2

Model: TrafiSense2 632

[Learn More »](#)



TRAFISENSE2

Model: TrafiSense2 645

[Learn More »](#)



TRAFISENSE2

Model: TrafiSense2 690

[Learn More »](#)

ELECTRICAL & MECHANICAL

Contact Closures

2 direct, 4 via TI BPL2 EDGE interface (PN 10-7013), extra via 4I/O USB expansion board(s) (PN 10-467)

2 direct, 4 via TI BPL2 EDGE interface (PN 10-7013), extra via 4I/O USB expansion board(s) (PN 10-467)

2 direct, 4 via TI BPL2 EDGE interface (PN 10-7013), extra via 4I/O USB expansion board(s) (PN 10-467)

GENERAL

Compression

H.264, MPEG-4, MJPEG

H.264, MPEG-4, MJPEG

H.264, MPEG-4, MJPEG

Power Consumption

<10.5W (<15W peak at startup)

<10.5W (<15W peak at startup)

<10.5W (<15W peak at startup)

Power over Ethernet (PoE)

For communication of output state events, configuration & monitoring (streaming video)

For communication of output state events, configuration & monitoring (streaming video)

For communication of output state events, configuration & monitoring (streaming video)

PERFORMANCE

Detection Distance

15-90 m / 100-300 ft

10-75 m / 32-245 ft

2-30 m / 6-100 ft

THERMAL IMAGING

Field of View

Horizontal: 32° Vertical: 26°

Horizontal: 45° Vertical: 35°

Horizontal: 90° Vertical: 69°



TRAFISENSE2

Model: TrafiSense2 632

[Learn More »](#)



TRAFISENSE2

Model: TrafiSense2 645

[Learn More »](#)



TRAFISENSE2

Model: TrafiSense2 690

[Learn More »](#)

Functionality	Vehicle presence, Bicycle presence, Vehicle and bicycle counting, Pedestrian presence, Traffic data, wrong-way driver detection	Vehicle presence, Bicycle presence, Vehicle and bicycle counting, Pedestrian presence, Traffic data, wrong-way driver detection	Vehicle presence, Bicycle presence, Vehicle and bicycle counting, Pedestrian presence, Traffic data, wrong-way driver detection
Number Detection Zones	24 vehicle presence zones \ 8 bicycle presence regions \ 8 pedestrian zones \ 6 traffic data zones \ 6 wrong way driver zones	24 vehicle presence zones \ 8 bicycle presence regions \ 8 pedestrian zones \ 6 traffic data zones \ 6 wrong way driver zones	24 vehicle presence zones \ 8 bicycle presence regions \ 8 pedestrian zones \ 6 traffic data zones \ 6 wrong way driver zones

SYSTEM OVERVIEW

Resolution	VGA (640x480)	VGA (640x480)	VGA (640x480)
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CONNECTIONS & COMMUNICATIONS

SDLC	Up to 16 output channels via TI BPL2 EDGE B & SUI (PN 10-7018) or via TI BPL2 EDGE (PN 10-7013) and Port-1 Interface Module (PIM)	Up to 16 output channels via TI BPL2 EDGE B & SUI (PN 10-7018) or via TI BPL2 EDGE (PN 10-7013) and Port-1 Interface Module (PIM)	Up to 16 output channels via TI BPL2 EDGE B & SUI (PN 10-7018) or via TI BPL2 EDGE (PN 10-7013) and Port-1 Interface Module (PIM)
Setup Commands	Web interface	Web interface	Web interface
Traffic monitoring (event and data reporting)	TMS FLUX. Public API for 3rd party integration.	TMS FLUX. Public API for 3rd party integration.	TMS FLUX. Public API for 3rd party integration.

TrafiSense2 Camera View



TrafiSense2 Equipment

Description

POE / Power Supply Interface (NON-STOCK)

Commodity Code

NONSTOCK033



Category

Video Detection (NON-STOCK)

Model #

SDR-120-48

Unit Price

\$714

Compatible with...

Notes

Non-Stock. 48V Output.

Lead Time: 4-6 weeks

Desired Stock: N/A

Reorder Threshold: N/A

Spec Sheet: <https://www.meanwell-web.com/en-cb/ac-dc-industrial-din-rail-power-supply-output-sdr-120-48>

Vendor: AM Signal

Contract: [199795](#)

Contract Expiration Date: November 13, 2023

TrafiSense2 Equipment

Description

TI BPL2 EDGE Card (Rack Interface) (NON-STOCK)

Commodity Code

NONSTOCK032



Category	Video Detection (NON-STOCK)
Model #	TI BPL2 EDGE (PN 10-7013)
Unit Price	\$1,142
Compatible with...	
Notes	Non-Stock

Lead Time: 4-6 weeks
Desired Stock: N/A
Reorder Threshold: N/A
Spec Sheet: <https://www.flir.com/products/trafisense-2/>

Vendor: AM Signal
Contract: [199795](#)
Contract Expiration Date: November 13, 2023

TrafiSense2 Equipment

Description

BPL Expansion (PIM Card / SDLC Interface) (NON-STOCK)

Commodity Code

NONSTOCK034



Category | Video Detection (NON-STOCK)
Model # | 10-6044
Unit Price | \$571
Compatible with...
Notes | Non-Stock. TI xp BPL Expansion Board.

Lead Time: 4-6 weeks
Desired Stock: N/A
Reorder Threshold: N/A

Vendor: AM Signal
Contract: [199795](#)
Contract Expiration Date: November 13, 2023



TrafiSense2 Equipment

Description

Wrong-Way Driver (Software Module License) (NON-STOCK)

Commodity Code

NONSTOCK035



**IMAGE
UNAVAILABLE
(NON-STOCK ITEM)**

Category	Video Detection (NON-STOCK)
Model #	—
Unit Price	\$750
Compatible with...	
Notes	Non-Stock

Lead Time: 4-6 weeks
Desired Stock: N/A
Reorder Threshold: N/A

Vendor: AM Signal
Contract: [199795](#)
Contract Expiration Date: November 13, 2023

Vibration Mitigator

Description	Commodity Code
Vibration Mitigator	55085000485
	<p>Category: Traffic Signal Steel</p> <p>Model #: J276848</p> <p>Unit Price: \$1,050</p> <p>Compatible with...</p> <ul style="list-style-type: none"> • 45' Curved Mast Arm • 50' Curved Mast Arm End Section • 55' Curved Mast Arm End Section • 60' Straight Mast Arm End Section • 65' Straight Mast Arm End Section • 70' Straight Mast Arm End Section • 75' Straight Mast Arm End Section • 80' Straight Mast Arm End Section • 85' Straight Mast Arm End Section • 45' Straight Mast Arm Base Section - one piece design (NON-STOCK) • 50' Straight Mast Arm End Section (NON-STOCK) <p>Notes: Required for all 45' or longer mast arms. Held in place on the mast arm by two stainless steel bands across the coupling plate.</p>
<p>Lead Time: 100 days</p> <p>Desired Stock: 50</p> <p>Reorder Threshold: 33</p> <p>Spec Sheet: https://utah-das-contract-search.s3.amazonaws.com/addl_doc/MA507_Valmont_Drawings%20DB01270%20DB01067.pdf</p>	<p>Vendor: Valmont</p> <p>Contract: MA507</p> <p>Contract Expiration Date: October 7, 2023</p>

Installed Vibration Mitigator



Consultant Kickoff Meeting



Kickoff/Scoping Meeting Agenda

Project: Wrong Way/Incident Detection System

Pin: 16723

Meeting Date: 7/29/2019 9:00 AM

Location: Conference Call

1. Introductions
2. Procurement Design Process
 - a. Design
 - b. PS&E Review
 - c. Incorporate Comments
 - d. Design Resolution
 - e. Develop Advertising Package
3. Schedule
 - a. Design
 - b. Construction
4. Budget - \$500,000 Current Funding
5. Environmental Documentation – Not Needed
6. Scope Review (See spreadsheet for details)
 - a. Region 1 - 8 Intersections
 - b. Region 2 – 10 Intersections
 - c. Region 3 – 7 Intersections
 - d. Region 4 – 5 Intersections

Vendor Provided Camera Site Design



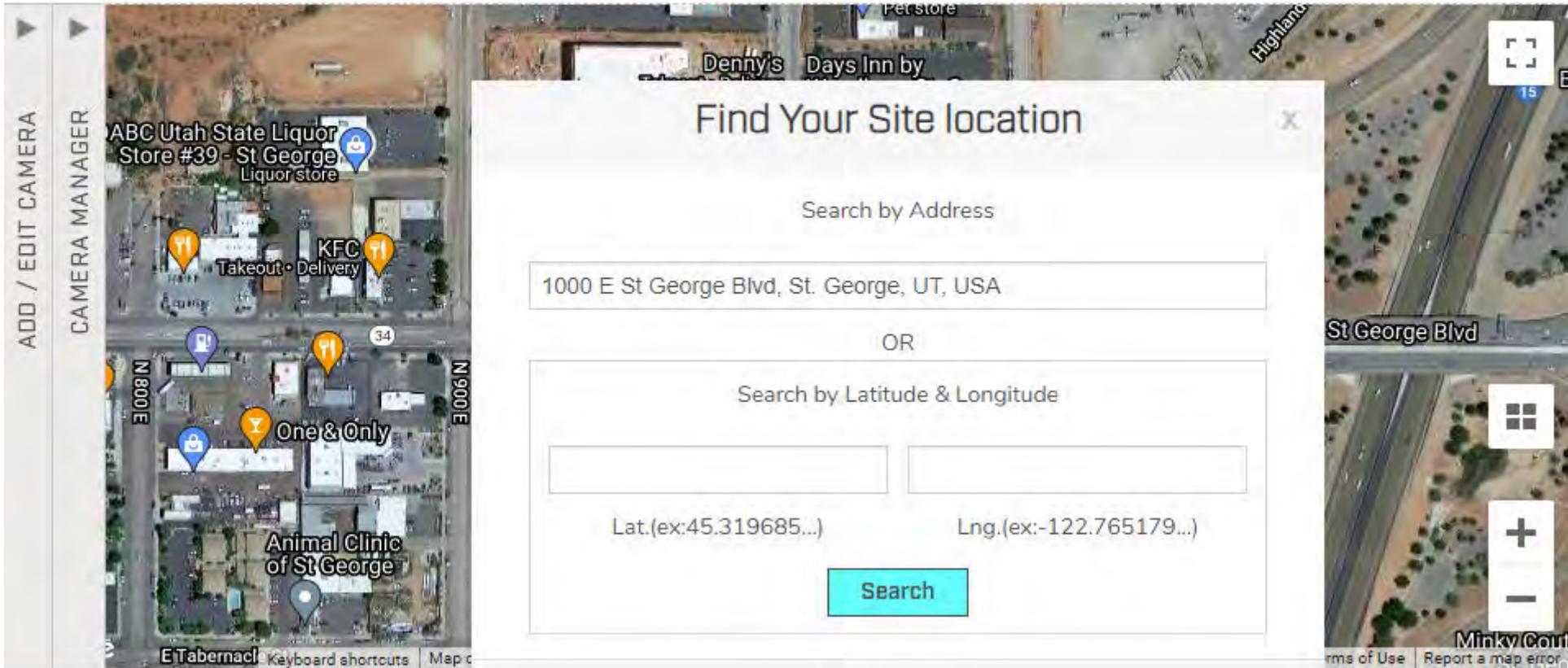
Concept Design Using Raven Tool

  TROY TORGERSEN ▾ RETURN TO DASHBOARD NEW PROJECT OPEN PROJECT CONTACT SUPPORT

ADD CAMERA SAVE NOW CLONE PROJECT INSERT IMAGE ADD KML FILE CREATE REPORT



PROJECT NOT YET SAVED



Find Your Site location

Search by Address

1000 E St George Blvd, St. George, UT, USA

OR

Search by Latitude & Longitude

Lat.(ex:45.319685...) Lng.(ex:-122.765179...)

Search

Close

Concept Design Using Raven Tool

The screenshot displays the FLIR Raven software interface. At the top, the navigation bar includes the FLIR logo, the user name 'TROY TORGERSEN', and several menu items: 'RETURN TO DASHBOARD', 'NEW PROJECT', 'OPEN PROJECT', and 'CONTACT SUPPORT'. Below this, a secondary bar contains 'ADD CAMERA', 'SAVE NOW', 'CLONE PROJECT', 'INSERT IMAGE', 'ADD KML FILE', and 'CREATE REPORT'. The 'RAVEN' logo with a bird icon is in the top right corner, next to the text 'PROJECT NOT YET SAVED'.

The main interface is divided into several sections. On the left, a 'SELECT / EDIT CAMERA' panel contains three dropdown menus for 'SELECT CAMERA TYPE', 'SELECT CAMERA SERIES', and 'SELECT CAMERA', followed by a blue 'Add to map' button. Below this is an 'ADD NEW / NAME / UPDATE CAMERA' section with a 'DISPLAY CAMERA SPECS' button and an image of a camera unit. A vertical 'CAMERA MANAGER' sidebar is positioned between the left panel and the main map.

The central map shows an aerial view of a street intersection labeled 'E St George Blvd' and '100 N'. A camera icon is placed at the intersection, with a black line indicating its field of view. The map includes a scale bar for 5 meters and various control icons like zoom in (+) and zoom out (-). At the bottom of the map, there is a footer with 'Keyboard shortcuts', 'Map data ©2021 Imagery ©2021, Maxar Technologies, State of Utah', and links for 'Terms of Use' and 'Report a map error'.

Concept Design Using Raven Tool

DISPLAY CAMERA SPECS



TrafiSense 325 [25° x 19°]

Resolution: 336 X 256 pixels

Horizontal FOV : 336

vertical FOV : 256

Focal Length : 13

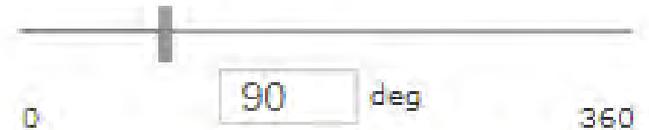
Zoom:

On-Board Analytics: Yes

MOUNTING HEIGHT [m]



ROTATE CAMERA



SET CAMERA RANGE



SURVEILLANCE DETAILS

Johnson Criteria Reference* [>50%]

	ID PERSON	48.46m
	ID VEHICLE	90m
	DETECT PERSON	90m

Concept Design Using Raven Tool

DETECT VEHICLE 90m

OBJECT OF INTEREST [meters]

Man [0.5 X 1.8] Vehicle [2.3 X 5.0]

User Defined [h] 0.5 x [v] 1.8

MONITOR REFERENCE SIZE

DEAD ZONE	17.1m
MOUNTING ANGLE	77.2 deg
VERTICAL RESOLUTION	15.3px
HORIZONTAL RESOLUTION	4.2px
AREA RESOLUTION	65.0px
% OF MONITOR VERTICALLY	6.0%
% OF MONITOR HORIZONTALLY	1.3%

CAMERA LOCATION

LATITUDE	45.320071341199
LONGITUDE	-122.76633110977

SELECT / EDIT CAMERA

Traffic Unit

TrafiSense 2

TrafiSense 2 645 [45° x 35°]

Add to map

ADD NEW / NAME / UPDATE CAMERA

DISPLAY CAMERA SPECS



Concept Design Using Raven Tool

Traffic Unit ▼
TrafSense 2 ▼
TrafSense 2 645 [45° x 35°] ▼

Add to map

ADD NEW / NAME / UPDATE CAMERA

DISPLAY CAMERA SPECS



TrafSense 2 645 [45° x 35°]



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Concept Design Using Raven Tool

The screenshot displays the Raven Tool interface for configuring a camera. On the left, the 'CAMERA MANAGER' panel includes three sliders: 'MOUNTING HEIGHT (m)' set to 7, 'ROTATE CAMERA' set to 96 degrees, and 'SET CAMERA RANGE' set to 231 meters. Below these is the 'SURVEILLANCE DETAILS' section, which lists detection capabilities based on Johnson Criteria Reference* (>50%):

■ ID PERSON	50.09m
■ ID VEHICLE	230.43m
■ DETECT PERSON	231m

The main view shows an aerial map of an intersection with a 3D camera model and a teal-colored field of view (FOV) cone extending from the camera location. The camera is positioned on a building at the intersection of E-St George Blvd and St George Blvd. The FOV cone covers the intersection and extends down St George Blvd. The map includes labels for 'E-St George Blvd', 'St George Blvd', and 'E-St George Blvd'. A red square with the number '1' is placed on the camera model. The map also shows a highway labeled '15' and a parking lot with several vehicles. The bottom of the map displays copyright information: '©2021 Imagery ©2021, Maxar Technologies, State of Utah, USDA Farm Service Agency' and a scale bar for '20 m'. There are also links for 'Terms of Use' and 'Report a map error'.

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Concept Design Using Raven Tool

DETECT PERSON 231m
 DETECT VEHICLE 231m

OBJECT OF INTEREST [meters]

Man [0.5 X 1.8] Vehicle [2.3 X 5.0]
 User Defined [h] 0.5 X [v] 1.8

MONITOR REFERENCE SIZE

DEAD ZONE 9.6m
MOUNTING ANGLE 71.4 deg
VERTICAL RESOLUTION 7.6px
HORIZONTAL RESOLUTION 16.6px
AREA RESOLUTION 126.0px
% OF MONITOR VERTICALLY 1.6%
% OF MONITOR HORIZONTALLY 2.6%

CAMERA LOCATION

LATITUDE 37.1098086470532



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Concept Design Using Raven Tool

The screenshot displays the Raven Tool interface, which is used for configuring and managing traffic cameras. On the left side, there is a 'SELECT / EDIT CAMERA' panel with three dropdown menus: 'Traffic Unit', 'TrafiSense 2', and 'TrafiSense 2 632 [32° x 26°]'. Below these is a cyan 'Add to map' button. Underneath is an 'ADD NEW / NAME / UPDATE CAMERA' section with a 'DISPLAY CAMERA SPECS' button and an image of a camera. The main area is a map view showing an aerial view of a road intersection. A teal-colored camera field of view is overlaid on the map, centered on 'E St George Blvd'. The map includes labels for 'Highland Dr', 'St George Blvd', and '15'. A red '2' icon is visible on the map. The bottom of the map shows copyright information: '©2021 Imagery ©2021, Maxar Technologies, State of Utah, USDA Farm Service Agency | 20 m | Terms of Use | Report a map error'.

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Summarize Field Data and Concept Design

Camera No.	Region	Project Location	Camera Located on Mast Arm	Position of Camera on Mast Arm	Cabinet Location	Is there a Raven Camera View?	TrafiSense2 632 FOV Horizontal: 32° Vertical:	TrafiSense2 645 FOV Horizontal: 45° Vertical:	TrafiSense2 690 FOV Horizontal: 90° Vertical:	Notes
1	1	NB I-15/Legacy Pkwy Ramp to Park Lane	Yes		Cabinet in NW Corner of intersection	Yes	1			Install camera between the 2 signal heads over the NB Entrance Ramp to I-15.
2	1	NB Exit Ramp from NB I-15 to Riverdale Road	Yes	Light pole on north side of intersection	Located at SB I-15 Exit Ramp location in the NW Corner.	Yes		1		Install on light pole on north side of intersection. Align camera to view NBL movement.
3	1	SB Exit Ramp from SB I-15 to 2600 South, via 800 West	Yes	Middle of Mast Arm	NE Corner of 2600 South and 800 W intersection.	Yes		1		Install camera directly centered on mast arm on 800 West so it looks directly at the exit lanes. Cabling will go from cabinet to the mast arm. Current Matrix is mounted on NE luminaire Extension. Probably best to keep cabling for radar in case we pull camera. Have open load switches and ports available on the RuggedCom. Have a port on the Digi available. Do have fiber at the intersection.
4	1	NB Exit Ramp from NB I-15 to 21st Street	Yes	Left of left most head - Centered to approach	SE Corner of intersection	Yes	1			Install camera left of left most head, over NB Entrance Ramp, and centered to the approach lane.
5	1	SB Exit Ramp from SB I-15 to 21st Street	Yes	Center to the approach	SE Corner of intersection	Yes	1			Will need to be installed on the mast arm, over SB Entrance Ramp, to detect SB Exit Ramp.
6	1	NB Exit Ramp from NB I-15 to 12th Street	Yes	Center to the approach	SW Corner of intersection	Yes	1			Install camera on mast arm over NB Entrance Ramp.

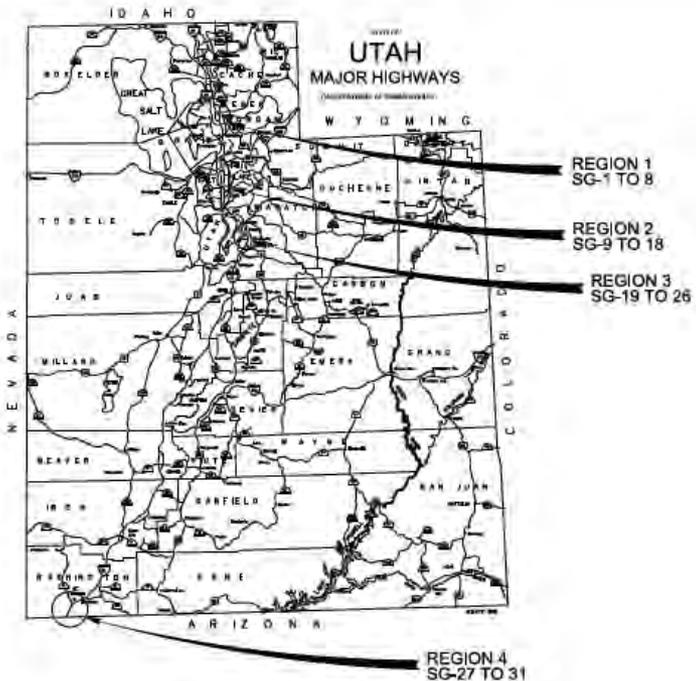
UTAH

DEPARTMENT OF TRANSPORTATION

SHEET NO.
1

U.S. Standard Units
(Inch-Pound Units)

ALL UNITS IN FEET UNLESS OTHERWISE NOTED



FEDERAL AID PROJECT
F-ST99(523) PIN: 16723
 WRONG WAY/INCIDENT DETECTION SYSTEM
 OTHER - TRAFFIC MANAGEMENT & ITS PROJECTS
 STATEWIDE PROJECT

ATTACHMENT C PLANS OF PROPOSED PROJECT

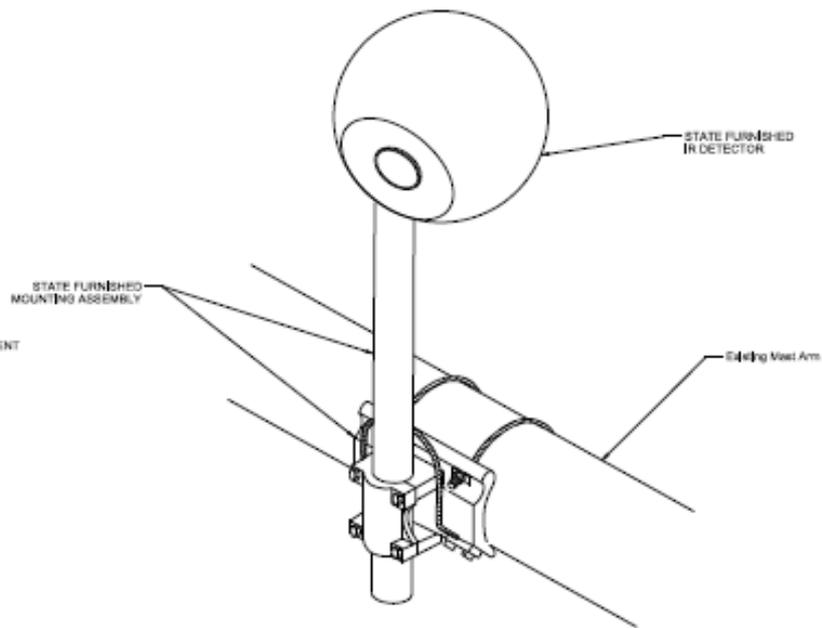


THIS SEAL APPLIES TO ALL SHEETS CONTAINING THIS SIGNATURE

INDEX TO SHEETS		
SHEET NUMBER	NUMBER OF SHEETS	DESCRIPTION
1	1	TITLE/INDEX TO SHEETS
SG-01 TO SG-31	31	SIGNAL
SG-301 TO SG-302	2	SIGNAL SCHEDULE

LEGEND

EXISTING	PROPOSED	
— Pw —	— Pw —	POWER SOURCE CIRCUIT CONDUIT
— Pst —	— Pst —	SIGNAL CIRCUIT CONDUIT
— Ppd —	— Ppd —	PEDESTRIAN SIGNAL CIRCUIT CONDUIT
— Ppb —	— Ppb —	PEDESTRIAN PUSH BUTTON CIRCUIT CONDUIT
— Prd —	— Prd —	RADAR DETECTION CIRCUIT CONDUIT
— Ltg —	— Ltg —	LIGHTING CIRCUIT CONDUIT
— Fut —	— Fut —	FUTURE USE CONDUIT
⊙	⊙	SIGNAL POLE IDENTIFICATION
⊕	⊕	DUAL MAST ARM SIGNAL POLE
⊕	⊕	MAST ARM SIGNAL POLE
⊕	⊕	SIGNAL POLE LUMINAIRE EXTENSION WITH ARM
⊕	⊕	SIGNAL POLE LUMINAIRE EXTENSION WITH VERTICAL ATTACHMENT
⊕	⊕	MAST ARM MOUNTED SIGN
⊕	⊕	POWER SOURCE
⊕	⊕	TRAFFIC SIGNAL POLE
⊕	⊕	TYPE G, 12'-1 SECTION SIGNAL HEAD ASSEMBLY
⊕	⊕	TYPE I, 12'-3 SECTION SIGNAL HEAD ASSEMBLY
⊕	⊕	TYPE IM, 12'-3 SECTION SIGNAL WITH ALL UP ARROWS
⊕	⊕	TYPE II, 12'-3 SECTION SIGNAL HEAD ASSEMBLY
⊕	⊕	TYPE III, 12'-3 SECTION WITH ALL ARROWS
⊕	⊕	TYPE IV, 12'-4 SECTION SIGNAL HEAD ASSEMBLY
⊕	⊕	TYPE V, 12'-5 SECTION SIGNAL HEAD ASSEMBLY
⊕	⊕	TYPE VI, 12'-4 SECTION WITH ALL ARROWS
⊕	⊕	TYPE VII, 12'-4 SECTION SIGNAL HEAD ASSEMBLY
⊕	⊕	PEDESTRIAN HYBRID BEACON, 12'-3 SECTION SIGNAL HEAD ASSEMBLY
⊕	⊕	VIBRATION MITIGATOR
⊕	⊕	RED CONFIRMATION LIGHT
⊕	⊕	TRAFFIC SIGNAL CONTROLLER CABINET
⊕	⊕	TYPE A-PC JUNCTION BOX
⊕	⊕	TYPE B-PC JUNCTION BOX
⊕	⊕	TYPE B DIVIDED JUNCTION BOX (FOR SIGNAL & LIGHTING)
⊕	⊕	TYPE C-PC JUNCTION BOX
⊕	⊕	TYPE D-PC JUNCTION BOX (ATMS)
⊕	⊕	SAME JUNCTION BOX USED FOR SIGNAL CIRCUIT
⊕	⊕	PEDESTRIAN SIGNAL HEAD WITH PUSH BUTTON
⊕	⊕	AUDIBLE PEDESTRIAN SIGNAL HEAD
⊕	⊕	UNDERGROUND SERVICE PEDESTAL (USP)
⊕	⊕	PREEMPTION CONTROL SYSTEM DETECTOR
⊕	⊕	DIRECTIONAL ANTENNA
⊕	⊕	VIDEO DETECTION CAMERA
⊕	⊕	CCTV CAMERA
⊕	⊕	RADAR DETECTION, DILEMMA ZONE
⊕	⊕	RADAR DETECTION, STOP BAR
⊕	⊕	IR DETECTOR



WRONG WAY DETECTOR MOUNTING DETAIL

NOTES:

- | REGION | SIGNAL CREW CONTACT | PHONE |
|--------|---------------------|--------------|
| 1 | DAVID TOWNSEND | 801-645-4485 |
| 2 | DAVE MOUNT | 801-335-4448 |
| 3 | ERIC ANDERMAN | 801-630-8857 |
| 4 | TYSON LARSON | 801-630-8558 |
- CONTACT REGION SIGNAL CREW TO SCHEDULE/COORDINATE ON THE FOLLOWING ITEMS:
 - SALVAGED ITEMS:** PROVIDE 2 DAYS NOTICE, ENSURE ALL SALVAGED ITEMS HAVE ALL PARTS AND ASSOCIATED HARDWARE.
 - SIGNAL INSPECTION:** 4 DAYS PRIOR TO TURN-ON CONTACT REGION SIGNAL CREW TO REQUEST AN IN-PROGRESS SIGNAL INSPECTION.
 - SIGNAL TURN-ON:** PROVIDE 5 DAYS NOTICE, COMPLETE UDOT TRAFFIC SIGNAL TURN-ON CHECKLIST PRIOR TO CALLING SIGNAL CREW.
 - CONTRACTOR IS RESPONSIBLE TO DISPOSE OF REMOVAL ITEMS AND ASSUME RESPONSIBILITY THEREAFTER, REUSE MATERIALS ONLY AS SPECIFIED OR AS APPROVED BY THE ENGINEER.
 - REFER TO UDOT 8TD DWG 8L SERIES FOR DETAILS.

PRELIMINARY
NOT FOR CONSTRUCTION

UTAH DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN

DESIGNED BY	ML
CHECKED BY	ML
DATE	
MODIFY	
DATE	

WRONG WAY INCIDENT DETECTION SYSTEM

PROJECT	
DATE	10/23
NUMBER	F-4798(023)
	SIGNAL SCHEDULE

9-8037 REV. 8/04/01

STATE FURNISHED MATERIALS

LOCATION	SHEET NO.	OTHER				
		EA	EA	EA	EA	EA
SR-47 EXIT RAMP AT SR-225, FARMINGTON	SG-01				1	
NB I-15 EXIT RAMP AT SR-26, RIVERDALE	SG-02	1				
SB I-15 EXIT RAMP AT 890 W. WOODS CROSS	SG-03	1			1	
NB I-15 EXIT RAMP AT SR-104, OGDEN	SG-04	1			1	
SB I-15 EXIT RAMP AT SR-104, OGDEN	SG-05	1			1	
NB I-15 EXIT RAMP AT SR-48, OGDEN	SG-06	1			1	
SB I-15 EXIT RAMP AT SR-38, OGDEN	SG-07	1			1	
EB 215T STREET AT SR-204, OGDEN	SG-08	1			1	
SB I-15 EXIT RAMP AT SR-201, SALT LAKE CITY	SG-09	1			1	
WB I-40 EXIT RAMP AT 1300 E. SALT LAKE CITY	SG-10	1			1	
SB SR-46 AT PORTER ROCKWELL BLVD, SALT LAKE COUNTY	SG-11	1			1	
NB SR-46 AT ROSECREST RD, SALT LAKE COUNTY	SG-12	1			1	
SB SR-68 AT SR-200, WEST JORDAN	SG-13	1			1	
EB 829 S. AT SR-68, TAYLORSVILLE	SG-14	1			1	
WB I-215 EXIT RAMP AT SR-48, TAYLORSVILLE	SG-15	1			1	
SB SR-154 EXIT RAMP AT 7000 S. WEST JORDAN	SG-16	1				

STATE FURNISHED MATERIALS

LOCATION	SHEET NO.	OTHER				
		EA	EA	EA	EA	EA
NB SR-154 EXIT RAMP AT 7000 S. WEST JORDAN	SG-17	1			1	
NB I-15 EXIT RAMP AT SR-173, MURRAY	SG-18	2			1	
SB I-15 EXIT RAMP AT SR-114, PROVID	SG-19	1			1	
NB I-15 EXIT RAMP AT SR-114, PROVID	SG-20	1			1	
SB I-15 EXIT RAMP AT SR-189, PROVID	SG-21	1			1	
NB I-15 EXIT RAMP AT SR-189, PROVID	SG-22	2			2	
SB I-15 EXIT RAMP AT SR-136, SPANISH FORK	SG-23	1			1	
SB I-15 EXIT RAMP AT US-6, SPANISH FORK	SG-24	1			1	
NB SANDHILL ROAD AT SR-285, OREM	SG-25	1			1	1
EB SR-145 AT SR-68, SARATOGA SPRINGS	SG-26	1				
SB I-15 EXIT RAMP AT SR-7, ST. GEORGE	SG-27	1	1	1		
NB I-15 EXIT RAMP AT SR-7, ST. GEORGE	SG-28	1	1	1		
SB I-15 EXIT RAMP AT SR-34, ST. GEORGE	SG-29	1			1	
NB I-15 EXIT RAMP AT SR-34, ST. GEORGE	SG-30	1			1	
SR-16 EXIT RAMPS AT SNOW CANYON PKWY, ST. GEORGE	SG-31	2			2	
EMERGENCY REPLACEMENT MATERIALS		4	4			
TOTALS		31	31	13	2	28

CONTRACTOR FURNISHED MATERIALS

LOCATION	SHEET NO.	FT	NO. 14 AWG FOUR CONDUCTOR CABLE			
			EA	EA	EA	EA
SR-47 EXIT RAMP AT SR-225, FARMINGTON	SG-01	95	1			
NB I-15 EXIT RAMP AT SR-26, RIVERDALE	SG-02	650	0.25			
SB I-15 EXIT RAMP AT 890 W. WOODS CROSS	SG-03	595	0.25			
NB I-15 EXIT RAMP AT SR-104, OGDEN	SG-04	255	0.25			
SB I-15 EXIT RAMP AT SR-104, OGDEN	SG-05	110	0.25			
NB I-15 EXIT RAMP AT SR-38, OGDEN	SG-06	330	0.25			
SB I-15 EXIT RAMP AT SR-38, OGDEN	SG-07	170	0.25			
EB 215T STREET AT SR-204, OGDEN	SG-08	255	0.25			
SB I-15 EXIT RAMP AT SR-201, SALT LAKE CITY	SG-09	405		1		
WB I-40 EXIT RAMP AT 1300 E. SALT LAKE CITY	SG-10	240		0.25		
SB SR-46 AT PORTER ROCKWELL BLVD, SALT LAKE COUNTY	SG-11	195		0.25		
NB SR-46 AT ROSECREST RD, SALT LAKE COUNTY	SG-12	240		1		
SB SR-68 AT SR-200, WEST JORDAN	SG-13	390		0.25		
EB 829 S. AT SR-68, TAYLORSVILLE	SG-14	410		0.25		
WB I-215 EXIT RAMP AT SR-48, TAYLORSVILLE	SG-15	90		0.25		
SB SR-154 EXIT RAMP AT 7000 S. WEST JORDAN	SG-16	385		0.25		

CONTRACTOR FURNISHED MATERIALS

LOCATION	SHEET NO.	FT	NO. 14 AWG FOUR CONDUCTOR CABLE			
			EA	EA	EA	EA
NB SR-154 EXIT RAMP AT 7000 S. WEST JORDAN	SG-17	250		0.25		
NB I-15 EXIT RAMP AT SR-173, MURRAY	SG-18	325		0.25		
SB I-15 EXIT RAMP AT SR-114, PROVID	SG-19	175			1	
NB I-15 EXIT RAMP AT SR-114, PROVID	SG-20	360			0.25	
SB I-15 EXIT RAMP AT SR-189, PROVID	SG-21	85			0.25	
NB I-15 EXIT RAMP AT SR-189, PROVID	SG-22	360			0.25	
SB I-15 EXIT RAMP AT SR-136, SPANISH FORK	SG-23	300			0.25	
SB I-15 EXIT RAMP AT US-6, SPANISH FORK	SG-24	180			0.25	
NB SANDHILL ROAD AT SR-285, OREM	SG-25	230			0.25	
EB SR-145 AT SR-68, SARATOGA SPRINGS	SG-26	90			0.25	
SB I-15 EXIT RAMP AT SR-7, ST. GEORGE	SG-27	350				1
NB I-15 EXIT RAMP AT SR-7, ST. GEORGE	SG-28	315				0.25
SB I-15 EXIT RAMP AT SR-34, ST. GEORGE	SG-29	1200				0.25
NB I-15 EXIT RAMP AT SR-34, ST. GEORGE	SG-30	375				0.25
SR-16 EXIT RAMPS AT SNOW CANYON PKWY, ST. GEORGE	SG-31	540				0.25
TOTALS		30	3940	2.75	4	2.75

NOTES

- SEE UDOT STD DWG 8L SERIES AND SECTIONS 02892 AND 16536 FOR ADDITIONAL TRAFFIC SIGNAL AND WIRE REQUIREMENT.
- CONSTRUCT SIGNAL IN A MANNER TO AVOID DAMAGE TO EXISTING UTILITIES, ASSUME RESPONSIBILITY FOR ANY UTILITY DAMAGED BY CONSTRUCTION OPERATIONS. THE PLANS SHOW BURIED UTILITY LOCATIONS IN THEIR APPROXIMATE LOCATION ONLY.
- INSTALL CABLE IN SAME CONDUIT AS EXISTING DETECTOR CIRCUITS USE FUTURE USE CONDUIT IF DETECTOR CONDUIT IS GREATER THAN 40% FULL.
- DO NOT REMOVE OR DAMAGE EXISTING DETECTOR CABLE.

PRELIMINARY
NOT FOR CONSTRUCTION

UTAH DEPARTMENT OF TRANSPORTATION

ROADWAY DESIGN

DRAWN BY

JL

CHECKED BY

GC

DATE

10/11/23

APPROVED BY

JL

PROJECT NUMBER

10/11/23

TRUCK WAY-TO-IDENT DETECTION SYSTEM

PROJECT NUMBER

F-87199(02)

DATE

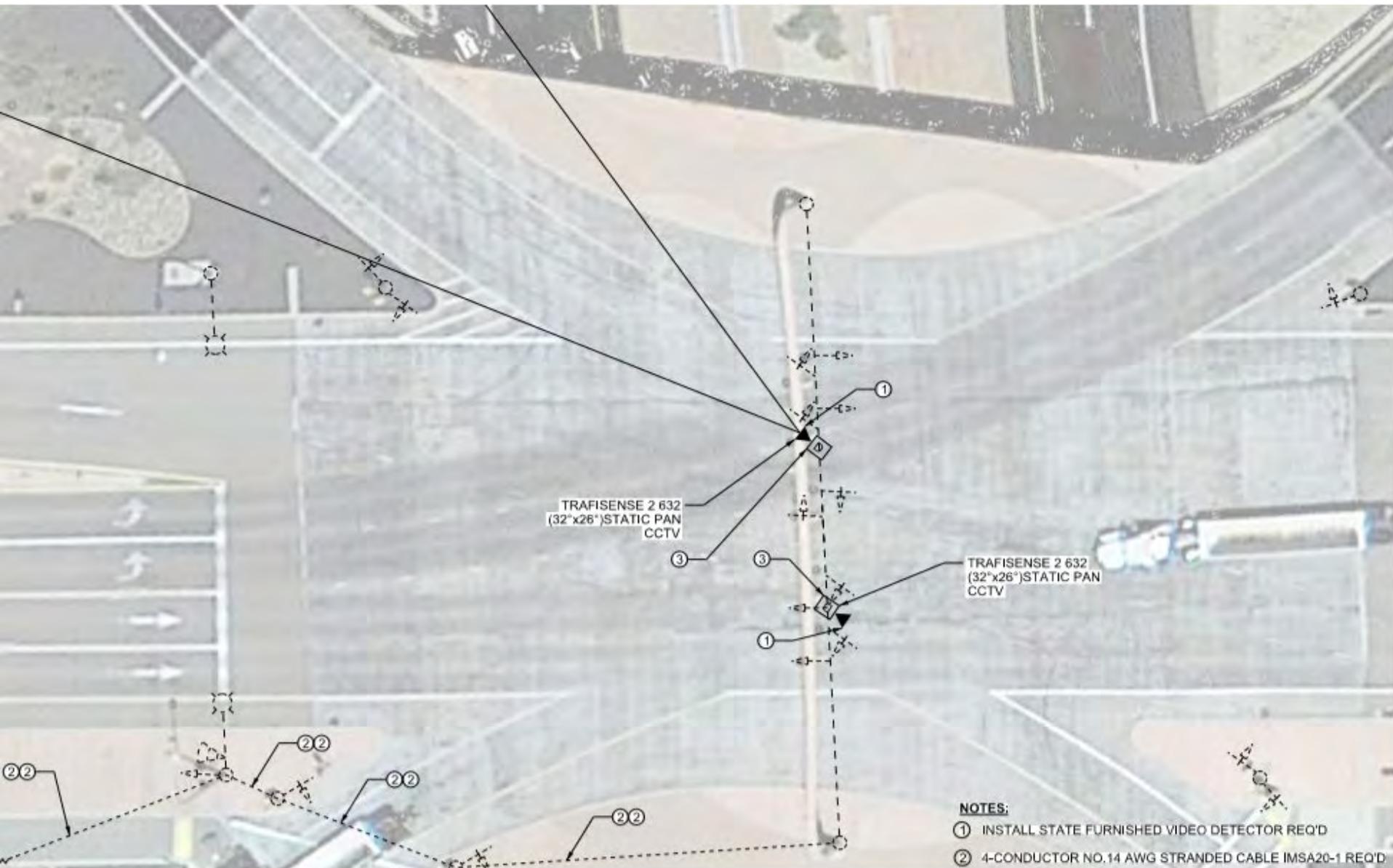
10/11/23

PROJECT NAME

SIGNAL SCHEDULE

SG-502

Typical Notes Associated with Design Layout



SFM Order List for WWD Equipment

Project & Accounting Information		UDOT Contacts		Pickup & Notification	
Pin #:	16723	R.E.:		Notify:	<name>
Date:	26-Aug-19	Ph:		Ph:	
Project #:	F-ST99(523)	Email:		Email:	
Project Name:	Wrong Way/Incident Detection				
Signal Location:	MULTIPLE	P.M.:	Troy Torgersen	Pickup:	<name>
		Ph:	435-896-0711	Ph:	
Unit (Org):	7009	Email:	ttorgersen@utah.gov	Email:	
Approp:	XEC	Special Orders:		OTHER:	
Activity:				Contractor:	
Function:			Powder Coat Finish Poles (Check The Box...)	Ph:	
Program # (CID):		Color:		Email:	
Phase:	12S	Drop Ship Poles / Address			
	OPTIONAL ITEMS:	** 100 Day Lead Time			
	Notify When FULL Order Ready Only	Name:		Designer:	Brad Lucas
	Notify As Items Available (Check Either box)	Street:		Ph:	801-243-9568
Date Needed:		Cty / St		Email:	blucas2@hwlochner.com
SPECIAL NOTES:					ORDER TOTAL:
					\$345,610.24



SFM Order List for WWD Equipment

CUSTOM ORDER ITEMS		Vendor Lead Time: -----				
--	TRAFISENSE 2 632 W/SUNSHIELD (WWD) (S)		EA	30	\$5,071	\$152,142.60
	TRAFISENSE 2 645 W/SUNSHIELD (TFC) (S)		EA	11	\$5,071	\$55,785.62
	TRAFISENSE TI BPL2 EDGE 48VDC (WWD) (S)		EA	39	\$1,142	\$44,538.00
	WRONG WAY LICENSE		EA	41	\$750	\$30,750.00
	TRAFISENSE 48V PS ASSY		EA	39	\$99	\$3,861.00
	TRAFISENSE BIU PORT INTERFACE MODULE (PIM)		EA	39	\$769	\$29,991.00
--	GUSSETED TUBE W/VINYL INSERT, 1-1/2" TOE X 58", ALUM	AB-2003-58-PNC	EA	33	\$41	\$1,353.00
--	ASTRO-BRAC STELLAR CLAMP KIT, 29" BAND MOUNT, ALUM	AS-3004-29-PNC	EA	33	\$79	\$2,607.00
55081000621	CISCO 8-PORT ETHERNET SWITCH	IE-2000-8TC-G-B- HDDT	EA	1	\$750	\$750.00
55081000616	FIBER JUMPER, SMF, LC-ST, DUPLEX, 3' (Typical - Order 2 per switch) - Use w/ CISCO		EA	2	\$16.01	\$32.02
--			EA			
--			EA			
STATE FURNISHED MATERIALS TOTAL:						\$321,810.24
55085000485	VIBRATION MITIGATOR (Required For All 60'+ Arms)	J276848	EA	28	\$850	\$23,800.00



Materials Order List for WWD Equipment

Item #	Qty	Units	Item	Description	Unit Price	Amount
1	30	Each	TRAFISENSE 2 632 W/SUNSHIELD (WWD) (S)	Trafisense 2 632 w/Sunshield, Integrated Thermal Sensor and Video Detector, FOV: 32 Degree Horizontal; 26 Degree Vertical, WWD License	5,071.00	152,130.00
2	11	Each	TRAFISENSE 2 645 W/SUNSHIELD (WWD) (S)	Trafisense 2 645 w/Sunshield, Integrated Thermal Sensor and Video Detector, FOV: 45 Degree Horizontal; 35 Degree Vertical, WWD License	5,071.00	55,781.00
3	39	Each	TrafiSense TI BPL2 EDGE 48VDC (WWD) (S)	Connects zone outputs from BPL2 sensor(s) or Power Line (PL) sensor(s) to controller. Provides power to BPL2 or PL sensor(s). Connects PC to BPL2 or PL sensor(s) for system configuration & viewing. **Rack mount**	1,142.00	44,538.00

Materials Order List for WWD Equipment

Item #	Qty	Units	Item	Description	Unit Price	Amount
4	41		TRAFISENSE WRONG WAY DETECTION LICENSE (TFC)	Trafisense Wrong Way Detection (Driver) License	750.00	30,750.00
5	39	Each	TrafiSense 48V PS Assy	AC-DC; 48V@2.5A; 100-264V In; ENCLOSED; DIN RAIL MOUNT; PFC; SDR SERIES, with DIN RAIL	99.00	3,861.00
6	39	Each	Trafisense BIU Port Interface Module (PIM)	BIU Port Interface Module (PIM)	769.00	29,991.00
7	33	Each	AB-2003-58-PNC	Gusseted Tube W/Vinyl Insert, 1-1/2" Toe X 58", Alum	41.00	1,353.00
8	33	Each	AS-3004-29-PNC	Astro-Brac Stellar Clamp Kit, 29" Band Mount, Alum	79.00	2,607.00
9	2	Each	AB-0509-84-SS	Band Assy, 84" Set Of 2 W/Clamps, Set Screws & Groove Pin, Stainless	37.00	74.00
10	41	4" Post	Trafisense Alum Mount Post Std Wall, 1/2" O.D.	Alum Pipe Std Wall (.088), 0.540" O.D., 0.364 I.D., 4" Long, Not Threaded	0.00	0.00



Subtotal	321,085.00
Shipping Cost (Best Way)	0.00
Total	\$321,085.00

Email sent to Procurement

Lucas, Brad <blucas@hwlochner.com>

Wed, Oct 9, 2019, 6:35 PM



to Penni, me ▾

Penni,

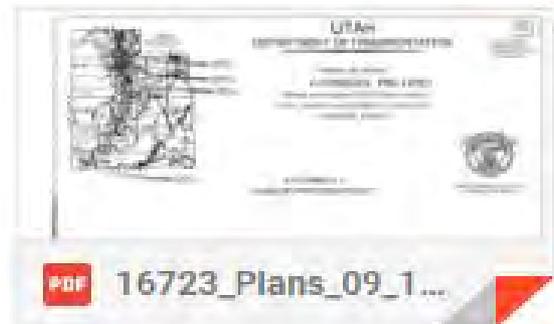
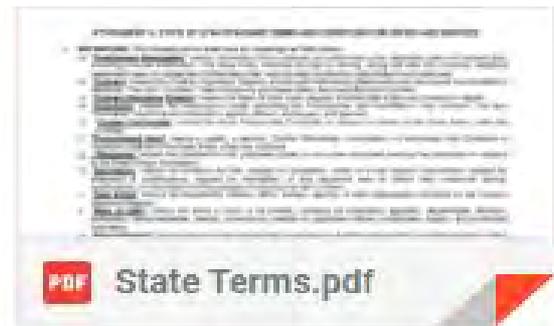
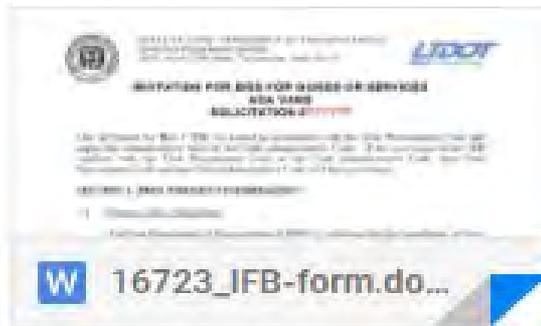
Here are the files for advertisement. Will you add the Solicitation number? Please let me know if we need to make any changes or you need additional information.

Thanks,

Brad

Brad Lucas, PE, PTOE

Project Manager/Traffic Engineer



Attachment E - Bidding items

A	Pricing for the items below must include all materials/labor/equipment to complete the work in accordance with current UDOT Standard Drawings & Specifications.
B	Unless specifically stated for an item, all materials and equipment are to be contractor furnished.
C	Mobilization will be paid as defined in the IFB; (1) full site mob value per area, per project, with all other sites in that area paid at (1/4) mob for that project. No additional mobilization payments will be made for return trips to the same site. A "site" is defined as and intersection or freeway interchange
D	Traffic control will be paid as defined in the IFB; pre-approval and inspection are required for payment of any TC item.

	DESCRIPTION	Unit	Qty	Conditions & Definitions	Unit Price	Total
	Mobilization - By Area					
1	Ogden North Area	Lump	2.25	Includes all of Northern Utah past the Weber/Davis county line; Weber, Morgan, Box Elder, Cache, Rich counties, etc.	\$ 800.00	\$ 1,800.00
2	Salt Lake Area	Lump	3.75	Includes Davis, Salt Lake, Summit, Tooele counties, as well as surrounding areas on the same latitude.	\$ 800.00	\$ 3,000.00
3	Provo Area	Lump	2.25	Includes Utah and Wasatch counties, Heber valley, US-6 to Soldier Summit, Nephi, and surrounding areas.	\$ 800.00	\$ 1,800.00
4	Southwestern Utah	Lump	1.50	Includes the Cedar City area, Washington County, Kanab, the south end of the US-89 corridor, and surrounding areas.	\$ 3,500.00	\$ 5,250.00
	Traffic Control (TC)					\$ -
5	Project Traffic Control	Lump	1.00	Includes providing and transport of all traffic control materials to/from project site as required for a UDOT Standard-Drawing compliant TC setup; signs, barrels, VMS, etc. Includes set up, maintain, and remove a specified lane or shoulder closure. No "Maintain" items may be charged here for removal of the devices. Includes preparation of traffic control plans.	\$ 4,500.00	\$ 4,500.00
	Wire / Electrical					\$ -
6	IMSA 20-1, 4 wire, AWG 14 gage (Signal cable)	Foot	9,630.00	Includes landing of wires in the cabinet and at the device.	\$ 1.50	\$ 14,445.00
	Devices					\$ -
7	Vibration Mitigator - State Furnished	Each	28.00	Installation only.	\$ 300.00	\$ 8,400.00
8	IR Detector - State Furnished	Each	33.00	Includes mounting, installing astro bracket, drilling access hole, and all detector wire camera and cabinet terminations. Includes aiming as required to make unit work.	\$ 500.00	\$ 16,500.00
	If uniformed police officer is required it will be pass through cost					
					Bid Total	\$ 55,695.00



STATE OF UTAH

Purchase Order

Bill To:
STATE OF UTAH

Date Of Order: 03/03/21
Date Required:
FOB:

THIS NUMBER MUST APPEAR ON ALL
INVOICES, PACKING LISTS, PACKAGE
LABELS AND BILLS OF LADING.
PURCHASE ORDER NUMBER
PD 810 2060000055
Version: 3

Vendor Number: 16784AG
CACHE VALLEY ELECTRIC CO
1414 SOUTH GUSTIN RD

Salt Lake City UT 84104

For Questions Contact: Troy Torgersen 435-896-1303

Grand Total: \$89,790.00

Item	Quantity	Unit	Description	Warehouse/ Commodity	Unit Price	Amount
1	89,790.0	EA	Generic Commodity Code Wrong Way /Incident detection installation Bid number DOT20-174PT See documents for required SOW Change Order #! \$34,095 New Total \$89,790	00000	\$1.00	\$89,790.00



Ship To:
STATE OF UTAH



Construction Kickoff Meeting



Construction Kickoff Meeting Summary Notes

PIN 16723 Construction Kickoff Meeting 11-25-19

1. When does CVE plan on starting on the project?

CVE plans on starting the project on Dec. 2, 2019. They will start in Region One with one crew only and work their way south until they are finished. The one running the CVE's Crew is named Josh. CVE has a requirement to be completed by the end of the year with their project.

Eric will provide a detailed schedule showing the starting intersection and each intersection thereafter in order so the Timing Group can plan their efforts to integrate each location.

- 
3. The Timing Group will begin integrating the FLIR System into the controller starting one week behind CVE, so they will begin Dec. 9, 2019. They will be verifying the camera setup, Field of View (FOV), assigning detection to channels etc.
 4. Adam, a representative from AM Signal, will fly out and help as needed to assist the Timing Group on December 9, 2019. He will be there to train the Timing Group to ensure that the integration of the zones, channel assignment etc. are setup correctly for each of the locations. He will be on-site for at least 2-days to help them with the training of how to setup each location.

Then, after the cameras are setup, AM Signal will need to help bring the cameras into the FLUX system (FLUX Integration) which is the system that gathers the information from the cameras and there is a server at the TOC reserved for this.

An option is to wait until all the cameras are setup and do it at one time, which may take up to one day, or wait until a group of cameras are setup, say 10, to work through in small increments until they are all integrated was discussed. No decision was made today but will wait to see how it is going in the field to make a decision.

5. Does the signal timing group know what they are responsible to do?

Roy's group will setup the cameras to: 1) Place detection zones to replace the existing Stop Line Detection using Wavetronix Matrix, if present, 2) create zones to detect wrong-way driving, 3) create zones to detect and count bicycles.



As discussed before and in my opinion, I wouldn't remove the detection cabling for the Wavetronix System in case the FLIR System doesn't work as we want it to.

FLUX Software Camera Setup





Server Wrong-Way Driving Server

User name admin

Password *****

Log on

Change Configuration

Operational mode: to edit the Flux configuration, activate configuration editing.

 [Activate configuration editing](#)



Detectors



Groups



Camera Relations



Offline Networks



Scenarios



Event Filters



Traffic Maps



Dashboards



Security



System Preferences



System Restore



Plug-in Configurations

Live stream video of detection setup

The screenshot shows a web application interface for a live stream video of a detection setup. The interface is divided into a navigation menu on the left and a video feed on the right.

Navigation Menu (Left):

- Apps
- UtahID
- Imported
- UDOT Fiber
- UDOT TRAFFIC
- UDOT Mile Posts M...
- UPlan Map Center
- Sage-grouse Mana...
- ATMS Master Plan
- Reading list

Video Feed (Right):

- Video Title: Sig.#8123: SR-34 (St. George Blvd) Looking at EB Dir. - St. George
- Timestamp: 08/30/21 07:33:09 AM
- Video Content: A live stream video showing a road scene. A detection zone is overlaid on the road, labeled with numbers 1, 2, and 3. The zone is a rectangular area with a hatched pattern, indicating the detection area.

Reporting

- Event report
- Integrated Data Report
- Flow Data Report
- Presence Data Report
- Bicycle Data Report
- Pedestrian Data Report

Event report 1

Event sources	1 source
Traffic events	1 type
Technical events	0 types
Time span	Absolute
<input type="radio"/> Relative: Last 7 days	
<input checked="" type="radio"/> Absolute: From: 08/02/2021 8:39 To: 08/30/2021 8:39	
Characteristics	0 specifications
Extra	

Time stamp	Event source	Type	Com...	Fr...
Sunday Aug. 8 at 6:34:24 PM - Sun	Sig.#8123: SR-34 (St. Ge	Wrong-way Incident		
Saturday Aug. 7 at 10:03:36 PM - !	Sig.#8123: SR-34 (St. Ge	Wrong-way Incident		

2 Events (0 open, 2 closed)



REAL-TIME



REPORTING



STATUS



CONFIGURATION

admin | Log off

Maximize

Image from Sig.#8123: SR-34 (St. George Blvd) Looking at EB Dir. - St. George



08/08/21 06:34:21 PM

Sig.#8123: SR-34 (St. George Blvd) Looking at EB Dir. - St. George
V2.03.P02



Reporting

Event report

Event report

Event sources

Traffic events

Technical events

Time span

Relative:

Last Hour

Absolute:

From: 08/01/

To: 08/30/

Characteristics

Extra

Export

Data Report

Fre...

Reporting

 Event report

 Integrated Data Report

 Flow Data Report

 Presence Data Report

 Bicycle Data Report

 Pedestrian Data Report

 Event report 1

Event sources 1 source

Traffic events 1 type

Technical events 0 types

Time span Absolute

 Relative:

Last 7 days

 Absolute:

From: 08/02/2021 8 39

To: 08/30/2021 8 39

Characteristics 0 specifications

Extra

Export

View

Time stamp	Event source	Type		Com...	Fr...
Sunday Aug. 8 at 6:34:24 PM - Sun	Sig.#8123: SR-34 (St. Ge	Wrong-way Incident			
Saturday Aug. 7 at 10:03:36 PM - !	Sig.#8123: SR-34 (St. Ge	Wrong-way Incident			

2 Events (0 open, 2 closed)

Recorded Video of WWD incident

08/08/21 06:34:21 PM

Sig.#8123: SR-34 (St. George Blvd) Looking at EB Dir. - St. George

V2.03.P02

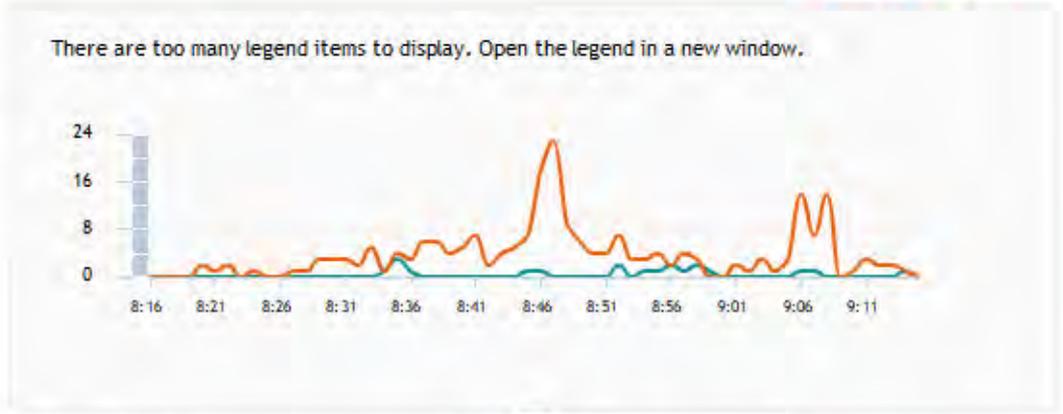


Reporting

- Event report
- Integrated Data Report
- Flow Data Report
- Presence Data Report
- Bicycle Data Report
- Pedestrian Data Report

- Event report 1
- Flow Data Repor...
- Flow Data Repor...
- Presence Data R...
- Bicycle Data Re...
- Pedestrian Data...

Data sources	1 source
Integration interval	1 Minute
Time span	Relative: Last hour
Data type	1 type
<input checked="" type="checkbox"/> Pedestrian count	
Characteristics	0 specifications
Extra	



Time	Source	Pedestrian count
Monday Aug. 30 at 8:16:00 AM	UVU Bridge Deck - Pedestrian Cor	0
Monday Aug. 30 at 8:16:00 AM	UVU Bridge Deck - Pedestrian Cor	0
Monday Aug. 30 at 8:17:00 AM	UVU Bridge Deck - Pedestrian Cor	0
Monday Aug. 30 at 8:17:00 AM	UVU Bridge Deck - Pedestrian Cor	0
Monday Aug. 30 at 8:18:00 AM	UVU Bridge Deck - Pedestrian Cor	0

120 data records

Export

View

Overview of Technical Events

- Communication Error (7)

-   SIG#7270 2100S & 1-15NB RA
-   Sig.#5201:US-89 SB to Park I
-   Sig.#6457: I-15 NB Exit Ramp
-   Sig.#8223: I-15 SB Exit Ramp
-   Triumph Blvd & Thanksgiving
-   Triumph Blvd @ Digital Dr/N
-   Triumph Bridge S/N:352153

+ Detector Error (8)

+ Last Image Failed (1)

+ Unknown Configuration (36)

+ User Logged On (3)

Select a source (device, group, server or database) for more information.

Currently 0 filters active

- Comment Library
- Data Integration
- Device communication
- Event names**
- Event storage
- Event Time on
- Image
- Image sequence
- Licensing
- MMS servers
- Password
- Real-time
- Recorded video
- Sounds
- Streaming video
- User defaults

Event names

- Traffic events
- Technical events**

Event	Use customised name	Customised name
Animal - large	<input type="checkbox"/>	
Animal - small	<input type="checkbox"/>	
Day Night	<input type="checkbox"/>	
Fallen Object	<input type="checkbox"/>	
Fire Alert	<input type="checkbox"/>	
Inverse Direction	<input checked="" type="checkbox"/>	Wrong-way Incident
Level of Service 1	<input type="checkbox"/>	
Level of Service 2	<input type="checkbox"/>	
Level of Service 3	<input type="checkbox"/>	
Level of Service 4	<input type="checkbox"/>	
Pedestrian	<input checked="" type="checkbox"/>	Ped Counts
Pedestrian Occupancy 1	<input type="checkbox"/>	
Pedestrian Occupancy 2	<input type="checkbox"/>	

OK Cancel



- Comment Library
- Data Integration
- Device communication
- Event names
- Event storage
- Event Time on
- Image
- Image sequence**
- Licensing
- MMS servers
- Password
- Real-time
- Recorded video
- Sounds
- Streaming video
- User defaults

Image sequence

- General settings**
- Traffic events
- Technical events

Maximum number of days to store image sequences

Maximum amount of disk space (GB)

Download images sequences

Download images sequences only on demand

Recording time *(Applies to VIP-IP and selected OEM detectors only)*

Default pre incident time (s)

Default post incident time (s)

Allow pre and post incident time per event type

(Only applies for some detector types, check detector manual)

Default video type

Default video type for all dual cameras (no OEM)

Allow video type configuration per event type

OK Cancel



Change Configuration
Plug-in Configurations

E-mail Plugin

E-MAIL PLUGIN

SMTP server Email format Email distribution groups

Individual email settings

Email format HTML

Include image Max time to wait for image (sec) 59

Include image sequence Max time to wait for image sequence (sec) 59

Digest email settings

Email interval 1 day

OK Cancel

Plug-in Configurations

E-mail Plugin

E-MAIL PLUGIN

SMTP server Email format Email distribution groups

Email addresses	Event types
udotwvd@amsignalinc.com;wes@amsigna	Wrong-way Incident
wes@amsignalinc.com;lee@amsignalinc.c	Ped Counts

- Add...
- Edit...
- Delete
- Send test email

OK Cancel

Change Configuration
Plug-in Configurations

Distribution group editor

To email addresses (; separated) *

Event type	Digest	Individual	Delay
Spot meter Level 3	<input type="checkbox"/>	<input type="checkbox"/>	Immediately
Stopped Vehicle	<input type="checkbox"/>	<input type="checkbox"/>	Immediately
Temperature	<input type="checkbox"/>	<input type="checkbox"/>	Immediately
Too Many Servers Down	<input type="checkbox"/>	<input type="checkbox"/>	Immediately
Underspeed	<input type="checkbox"/>	<input type="checkbox"/>	Immediately
Unknown Configuration	<input type="checkbox"/>	<input type="checkbox"/>	Immediately
User Logged On	<input type="checkbox"/>	<input type="checkbox"/>	Immediately
Vehicle class 5	<input type="checkbox"/>	<input type="checkbox"/>	Immediately
Virtual IP Address Changed	<input type="checkbox"/>	<input type="checkbox"/>	Immediately
Wrong-way Incident	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1 minute

OK Cancel

Web Based Camera Setup

FLIR Live View Setup



Order	Map	SIG	TrafiSense Camera Naming Convention	Signal Location Naming Convention in System	Done	Additional Notes
Region 1 Camera Locations						
1	7	5176	Sig.#5176: I-15 SB Exit Ramp to 12th St (1200 S / SR-39) -Marriott	12th St (1200 S / SR-39) & I-15 SB Ramps - Marriott-Slaterville	X	
2	6	5159	Sig.#5159:I-15 NB Exit Ramp to 12th St (1200 S / SR-39) - Marriott	12th St (1200 S / SR-39) & I-15 NB Ramps - Marriott-Slaterville	X	
3	4	5143	Sig.#5143:I-15 NB Exit Ramp to 21st St (SR-104) - West Haven	21st St (SR-104) & I-15 NB Ramps - West Haven	X	
4	8	5045	Sig.#5045: 21st St (SR-104) EB Dir. @ Wall Ave (SR-204) - Ogden	21st St (SR-104) & Wall Ave (SR-204) - Ogden	X	
5	5	5145	Sig.#5145:I-15 SB Exit Ramp to 21st St (SR-104) - West Haven	2100 S (21st St / SR-104) & I-15 SB Ramps - West Haven	X	
6	2	5026	Sig.#5026:I-15 NB Exit Ramp to Riverdale Rd (SR-26) - Riverdale/Roy	Riverdale Rd (SR-26) & NB I-15 Exit Ramp - Riverdale/Roy	X	
7	3	5346	Sig.#5346:I-15 SB Exit Ramp to 2600 S (SR-93) Via 800 W - Woods Cross	2600 S (SR-93) & I-15 SB Ramps (Via 800 West) Woods Cross/North Salt Lake	X	
8	1	5212	Sig.#5212:I-15 NB Exit Ramp to Park Lane (SR-225) - Farmington	Park Lane (SR-225) & NB On-ramp / Legacy (SR-67) NB Off-ramp - Farmington	X	
9	1	5201	Sig.#5201:US-89 SB to Park Lane - Farmington	Park Lane (SR-225) & US-89 SB Ramps - Farmington	X	One of original three locations. Older camera. Upgrade to new camera? Will update to newer TrafiSense 2 Camera.
Total locations	9					
Region 2 Camera Locations						
10	10	7230	Sig.#7230:I-80 WB Exit Ramp to 1300 East, SLC	I-80 WB Off-ramp / 2290 S & 1300 E - Salt Lake City	X	
11	9	7617	Sig.#7616:I-15 SB Exit Ramp to 2100 South (SR-201) @ 600 West - SLC	2100 S (SR-201) & I-15 SB Ramps / 600 W	X	
12	18	7074	Sig.#7074: I-15 NB Exit Ramp to 5300 S (SR-173): EB MVMT - Murray	5300 S (SR-173) & I-15 SPUI (NB Exit Ramp)	X	IP address correct as of June 1, 2020.
13	18	7074	Sig.#7074: I-15 NB Exit Ramp to 5300 S (SR-173): WB MVMT - Murray	5300 S (SR-173) & I-15 SPUI (NB Exit Ramp)		
14	15	7112	Sig.#7112: I-215 WB Exit Ramp to Redwood Rd (SR-68) - Taylorsville	I-215 S WB Off-ramp/Shopko & Redwood Rd (SR-68) - Taylorsville	X	
15	14	7114	n/a	6200 S & Redwood Rd (SR-68) (South approach to Redwood Road) - Taylorsville		Will we be getting a port available? We cannot record any WWD with out this. Note: No room in the cabinet as it presently sits without major rewiring and getting new IP assignments. Cabinet is already full. Pulled out of project for this reason.
16	16	7065	Sig.#7065: NB Bangerter Hwy. Exit Ramp to 7000 South - West Jordan	7000 S & Bangerter Hwy (SR-154) SPUI (SB Exit) - West Jordan	X	
17	16	7065	Sig.#7065: SB Bangerter Exit Ramp to 7000 South - West Jordan	7000 S & Bangerter Hwy (SR-154) SPUI (SB Exit) - West Jordan	X	
18	11	7508	Sig.#7508: SB Mtn. View Corridor (SR-85) to Porter Rockwell Blvd.	Porter Rockwell Blvd & SR-85 SB (Mountain View Corridor) - Herriman	X	
19	12	7509	Sig.#7509: NB Mtn. View Corridor (SR-85) to Rosecrest Rd. (14400 S)	Rosecrest Rd (14400 S) & SR-85 NB (Mountain View Corridor) - Herriman	X	
20	13	7522	Sig.#7522: SB Mtn. View Corridor (SR-85) to 9000 South (SR-209)	9000 S (SR-209) & SR-85 SB (Mountain View Corridor) - West Jordan	X	
21	2	7270	Sig.#7270:	2100 S (SR-201) & I-15 NB Ramps / 400 W - Salt Lake City/South Salt Lake		Not getting video stream. Possible incorrect IP address
22	3	7514	Sig.#7514: SB MVC to 12600 South	12600 South & SR-85 SB (Mountain View Corridor) - Riverton/Herriman	X	One of the 3 original cameras. Will update to newer TrafiSense 2 Camera

Region 1 Camera Locations

1	7	5176	Sig.#5176: I-15 SB Exit Ramp to 12th St (1200 S / SR-39) -Marriott
2	6	5159	Sig.#5159:I-15 NB Exit Ramp to 12th St (1200 S / SR-39) - Marriott
3	4	5143	Sig.#5143:I-15 NB Exit Ramp to 21st St (SR-104) - West Haven
4	8	5045	Sig.#5045: 21st St (SR-104) EB Dir. @ Wall Ave (SR-204) - Ogden
5	5	5145	Sig.#5145:I-15 SB Exit Ramp to 21st St (SR-104) - West Haven
6	2	5026	Sig.#5026:I-15 NB Exit Ramp to Riverdale Rd (SR-26) - Riverdale/Roy
7	3	5346	Sig.#5346:I-15 SB Exit Ramp to 2600 S (SR-93) Via 800 W - Woods Cross
8	1	5212	Sig.#5212:I-15 NB Exit Ramp to Park Lane (SR-225) - Farmington
9	1	5201	Sig.#5201:US-89 SB to Park Lane - Farmington
Total locations	9		

Region 2 Camera Locations

10	10	7230	Sig.#7230:I-80 WB Exit Ramp to 1300 East, SLC
11	9	7617	Sig.#7616:I-15 SB Exit Ramp to 2100 South (SR-201) @ 600 West - SLC
12	18	7074	Sig.#7074: I-15 NB Exit Ramp to 5300 S (SR-173): EB MVMT - Murray
13	18	7074	Sig.#7074: I-15 NB Exit Ramp to 5300 S (SR-173): WB MVMT - Murray
14	15	7112	Sig.#7112: I-215 WB Exit Ramp to Redwood Rd (SR-68) - Taylorsville
15	14	7114	n/a
16	16	7065	Sig.#7065: NB Bangerter Hwy. Exit Ramp to 7000 South - West Jordan
17	16	7065	Sig.#7065: SB Bangerter Exit Ramp to 7000 South - West Jordan
18	11	7508	Sig.#7508: SB Mtn. View Corridor (SR-85) to Porter Rockwell Blvd.
19	12	7509	Sig.#7509: NB Mtn. View Corridor (SR-85) to Rosecrest Rd. (14400 S)
20	13	7522	Sig.#7522: SB Mtn. View Corridor (SR-85) to 9000 South (SR-209)
21	2	7270	Sig.#7270:
22	3	7514	Sig.#7514: SB MVC to 12600 South

12th St (1200 S / SR-39) & I-15 SB Ramps - Marriott-Slaterville	X	
12th St (1200 S / SR-39) & I-15 NB Ramps - Marriott-Slaterville	X	
21st St (SR-104) & I-15 NB Ramps - West Haven	X	
21st St (SR-104) & Wall Ave (SR-204) - Ogden	X	
2100 S (21st St / SR-104) & I-15 SB Ramps - West Haven	X	
Riverdale Rd (SR-26) & NB I-15 Exit Ramp - Riverdale/Roy	X	
2600 S (SR-93) & I-15 SB Ramps (Via 800 West) Woods Cross/North Salt Lake	X	
Park Lane (SR-225) & NB On-ramp / Legacy (SR-67) NB Off-ramp - Farmington	X	
Park Lane (SR-225) & US-89 SB Ramps - Farmington	X	One of original three locations. Older camera. Upgrade to new camera? Will update to newer TrafiSense 2 Camera.
I-80 WB Off-ramp / 2290 S & 1300 E - Salt Lake City	X	
2100 S (SR-201) & I-15 SB Ramps / 600 W	X	
5300 S (SR-173) & I-15 SPUI (NB Exit Ramp)	X	IP address correct as of June 1, 2020.
5300 S (SR-173) & I-15 SPUI (NB Exit Ramp)		
I-215 S WB Off-ramp/Shopko & Redwood Rd (SR-68) - Taylorsville	X	
6200 S & Redwood Rd (SR-68) (South approach to Redwood Road) - Taylorsville		Will we be getting a port available? We cannot record any WWD with out this. Note: No room in the cabinet as it presently sits without major rewiring and getting new IP assignments. Cabinet is already full. Pulled out of project for this reason.
7000 S & Bangerter Hwy (SR-154) SPUI (SB Exit) - West Jordan	X	
7000 S & Bangerter Hwy (SR-154) SPUI (SB Exit) - West Jordan	X	
Porter Rockwell Blvd & SR-85 SB (Mountain View Corridor) - Herriman	X	
Rosecrest Rd (14400 S) & SR-85 NB (Mountain View Corridor) - Herriman	X	
9000 S (SR-209) & SR-85 SB (Mountain View Corridor) - West Jordan	X	
2100 S (SR-201) & I-15 NB Ramps / 400 W -Salt Lake City/South Salt Lake		Not getting video stream. Possible incorrect IP address
12600 South & SR-85 SB (Mountain View Corridor) - Riverton/Herriman	X	One of the 3 original cameras. Will update to newer TrafiSense 2 Camera



Region	Location No.	Signal No.	Wrong-way Driving Camera Location
Region 1 Locations			
	1	5201	US-89 SB Exit Ramp to Park Lane (SR-225) - Farmington
	2	5212	I-15 NB Exit Ramp to Park Lane (SR-225) - Farmington
	3	5346	I-15 SB Exit Ramp to 2600 S (SR-93) Via 800 W - Woods Cross
	4	5026	I-15 NB Exit Ramp to Riverdale Rd (SR-26) - Riverdale/Roy
	5	5145	I-15 SB Exit Ramp to 21st St (SR-104) - West Haven
	6	5045	21st St (SR-104) EB Dir. @ Wall Ave (SR-204) - Ogden
	7	5143	I-15 NB Exit Ramp to 21st St (SR-104) - West Haven
	8	5159	I-15 NB Exit Ramp to 12th St (1200 S / SR-39) - Marriott
	9	5176	I-15 SB Exit Ramp to 12th St (1200 S / SR-39) - Marriott
Total Locations for Region 1	9		
Region 2 Locations			
	10	7230	I-80 WB Exit Ramp to 1300 East, SLC
	11	7617	I-15 SB Exit Ramp to 2100 South (SR-201) @ 600 West - SLC
	12	7074	I-15 NB Exit Ramp to 5300 S (SR-173): EB MVMT - Murray
	13	7074	I-15 NB Exit Ramp to 5300 S (SR-173): WB MVMT - Murray
	14	7112	I-215 WB Exit Ramp to Redwood Rd (SR-68) - Taylorsville
	15	7065	NB Bangerter Hwy. Exit Ramp to 7000 South - West Jordan
	16	7065	SB Bangerter Exit Ramp to 7000 South - West Jordan
	17	7508	SB Mtn. View Corridor (SR-85) to Porter Rockwell Blvd. - Herriman
	18	7509	NB Mtn. View Corridor (SR-85) to Rosecrest Rd. (14400 S) - Herriman
	19	7522	SB Mtn. View Corridor (SR-85) to 9000 South (SR-209) - West Jordan
	20	7270	SB 500 W Collector Ramp to 2100 South (SR-201) - SLC
	21	7514	SB Mtn. View Corridor (SR-85) to 12600 South - Riverton/Herriman
Total Locations for Region 2	12		
Region 3 Locations			
	22	6318	WB University Pkwy (SR-265) to Sandhill Rd. Orem (CFI)
	23	6401	I-15 NB Exit Ramp to 1860 S (Start of Univ. Pkwy) - Provo
	24	6460	I-15 SB Entrance Ramp @ 1860 S/Lakeview Pkwy. - Provo
	25	6006	I-15 SB Exit Ramp to Main St. (SR-156) - Spanish Fork
	26	6077	I-15 SB Exit to US-6 EB Ramp - Spanish Fork
	27	6457	I-15 NB Exit Ramp to Center Street (SR-114) - Provo
	28	6458	I-15 SB Exit Ramp to Center Street (SR-114) - Provo
Total Locations for Region 3	7		
Region 4 Locations			
	29	8131	I-15 SB Exit Ramp to Southern Pkwy (SR-7) EB Dir. (SPUI) St. George
	30	8131	I-15 NB Exit Ramp to Southern Pkwy (SR-7) WB Dir. (SPUI) St. George
	31	8123	SR-34 (St. George Blvd) Looking at WB Dir. - (DDI) St. George
	32	8123	SR-34 (St. George Blvd) Looking at EB Dir. - (DDI) St. George
	33	8222	I-15 NB Exit Ramp to 200 N (SR-56) 1225 W - Cedar City
	34	8223	I-15 SB Exit Ramp to 200 N (SR-56) 1400 W - Cedar City
	35	8108	SR-18 SB (Bluff St.) to Redhills Pkwy - St. George
	36	8108	SR-18 NB (Bluff St.) to Redhills Pkwy - St. George
Total Locations for Region 4	8		
No. of Locations Statewide	36		

Live View

Configuration

Outputs

Error Outputs

Network

Communication

Administration





Sig.#7074: I-15 NB Exit Ramp to 5300 S (SR-173): WB MVMT - Murray

Live View

Detection ^

Zones

Settings

Calibration

Configuration ^

Outputs

Video

Camera

Network

Display

Administration v

Live View



Live View

Detection

Zones

Settings

Calibration

Configuration

Outputs

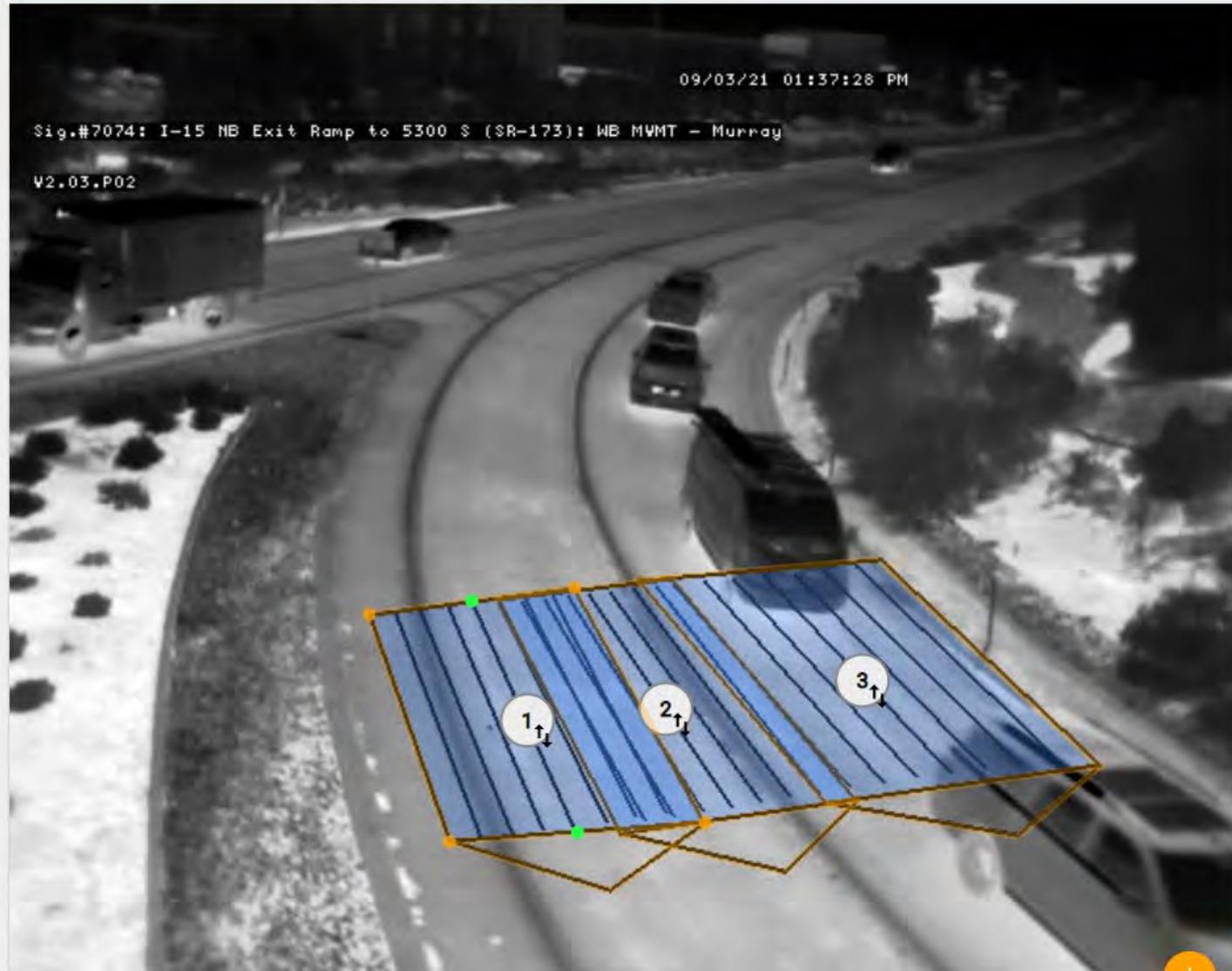
Video

Camera

Network

Display

Administration



Sig.#5212:I-15 NB Exit Ramp to Park Lane (SR-225) - Farmington

V2.03.P02

SHAKE



 request start moving

Live View

Detection

Zones

Settings

Calibration

Configuration

Outputs

Video

Camera

Network

Display

Administration

Settings

BICYCLE PRESENCE

INVERSE DIRECTION

PRESENCE

PEDESTRIAN PRESENCE

THERMAL QUALITY

Activate this algorithm to access its settings

Live View

Detection

Zones

Settings

Calibration

Configuration

Outputs

Video

Camera

Network

Display

Administration



Force



Camera height

26.2 ft.

Tilt

16.7

Roll

-2





Live View

Detection ^

Zones

Settings

Calibration

Configuration ^

Outputs

Video

Camera

Network

Display

Administration v

THERMAL REGION OF INTEREST



Set thermal region of interest Set fullscreen





Live View

Detection ^

Zones

Settings

Calibration

Configuration ^

Outputs

Video

Camera

Network

Display

Administration v



GENERAL SETTINGS

ALGORITHM SETTINGS

Font

Paint type

Medium

Full

Device name display

Clock display

IP address display

Version display

RYG Phase Status



- Live View
- Detection ^
- Zones
- Settings
- Calibration
- Configuration** ^
- Outputs
- Video
- Camera
- Network
- Display**
- Administration v



Clock display 4:28 PM

Device name display Exit Ramp to 5300 S (SR-173): WB MVMT - Murray

Version display

Inverse Direction event manager

GENERAL SETTINGS

ALGORITHM SETTINGS

- Inverse Direction event manager
- Inverse Direction Zone Name
- Thermal Quality display

- Inverse Direction area
- Thermal core ROI



Zones

Settings

Calibration

Configuration

Outputs

Video

Camera

Network

Display

Administration

General

Firmware

Users

Technical Event Log

System Log

Product Security

SETTINGS

TECHNICAL EVENTS

GPS POSITION

IMPORT / EXPORT

ABOUT

Device name

Sig.#7074: I-15 NB Exit Ramp to 5300 S (SR-173)

Language

English

Locale

US

Detection LED



RELOAD CONFIGURATION



RESET TO DEFAULT



REBOOT

General

- Zones
- Settings
- Calibration
- Configuration ^
- Outputs
- Video
- Camera
- Network
- Display
- Administration** ^
- General

- SETTINGS
- TECHNICAL EVENTS
- GPS POSITION**
- IMPORT / EXPORT
- ABOUT

Coordinates and heading

Latitude	Longitude
0	° 0
Heading	°
0	



- Zones
- Settings
- Calibration
- Configuration
- Outputs
- Video
- Camera
- Network
- Display
- Administration
- General

- SETTINGS
- TECHNICAL EVENTS
- GPS POSITION
- IMPORT / EXPORT
- ABOUT

Name

Sig.#7074: I-15 NB Exit Ramp to 5300 S (SR-173): WB MVMT - Murray

Serial Number

402277

Product

TrafiSense2

Firmware Version

V2.03.P02

Technical Event Log

RELOAD EXPORT ALL RESET EVENT LOG

Device	Event Type	State	Timestamp
--------	------------	-------	-----------

Sig.#7074: I-15 NB Exit Ramp to 5300 S (SR-173): WB MVMT - Murray TrafSense2 V2.03.P02	Configuration		9/3/2021 13:04:23 -06:00
---	---------------	--	--------------------------

- Zones
- Settings
- Calibration
- Configuration ^
- Outputs
- Video
- Camera
- Network
- Display
- Administration ^**
- General
- Firmware
- Users
- Technical Event Log

System Log

Zones

Settings

Calibration

Configuration

Outputs

Video

Camera

Network

Display

Administration

General

Firmware

Users

Technical Event Log

System Log



DOWNLOAD SYSTEM LOG

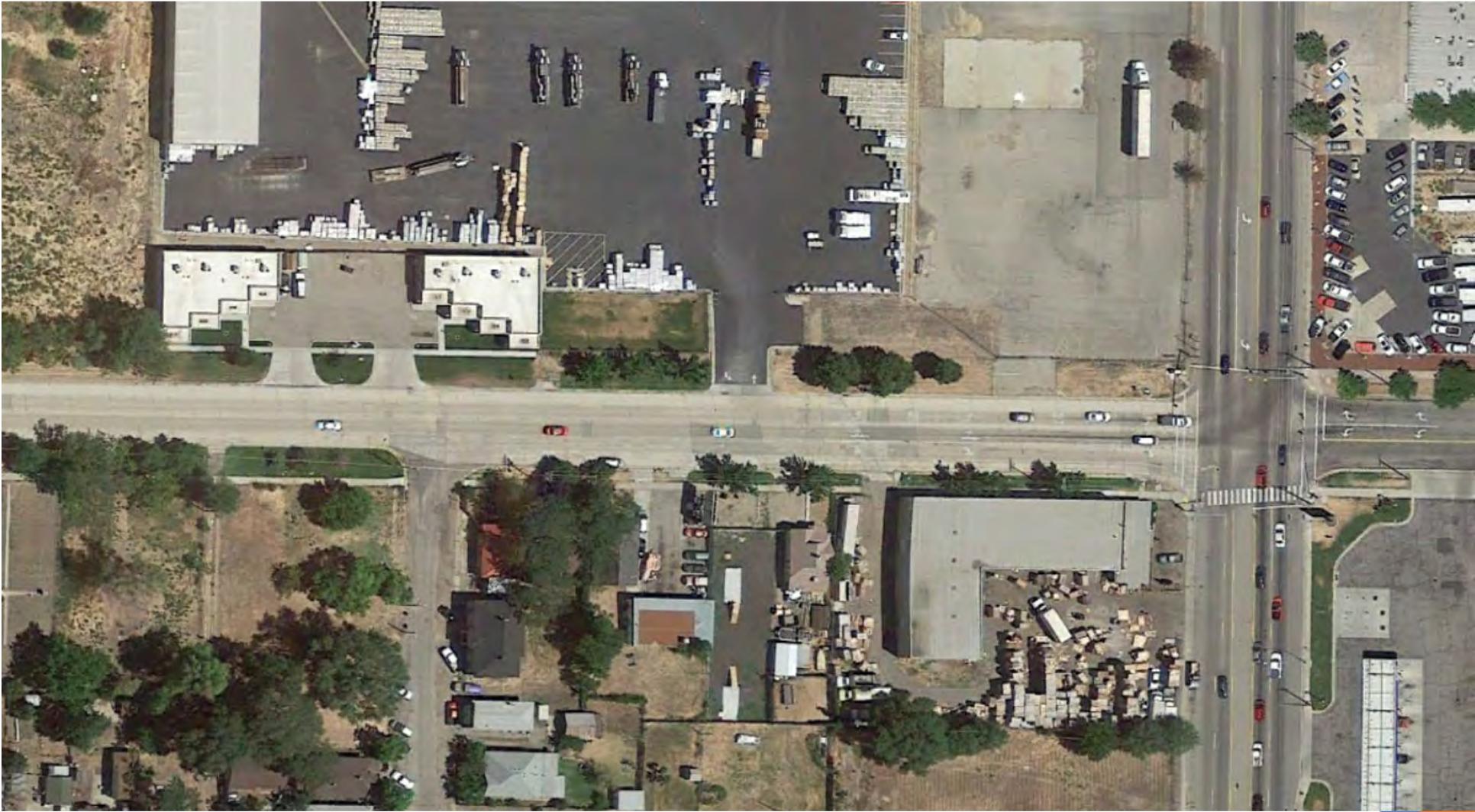


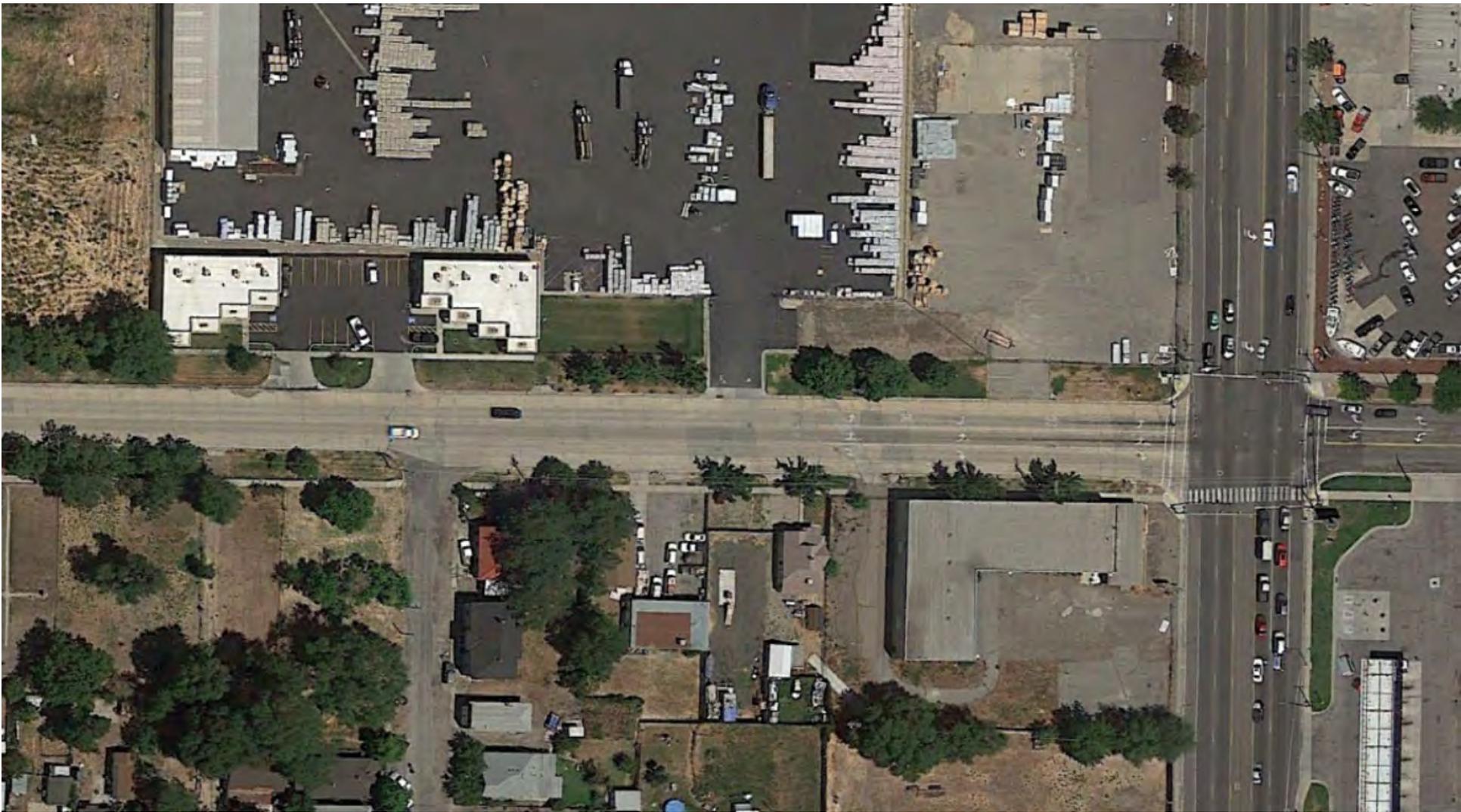
RESET SYSTEM LOG

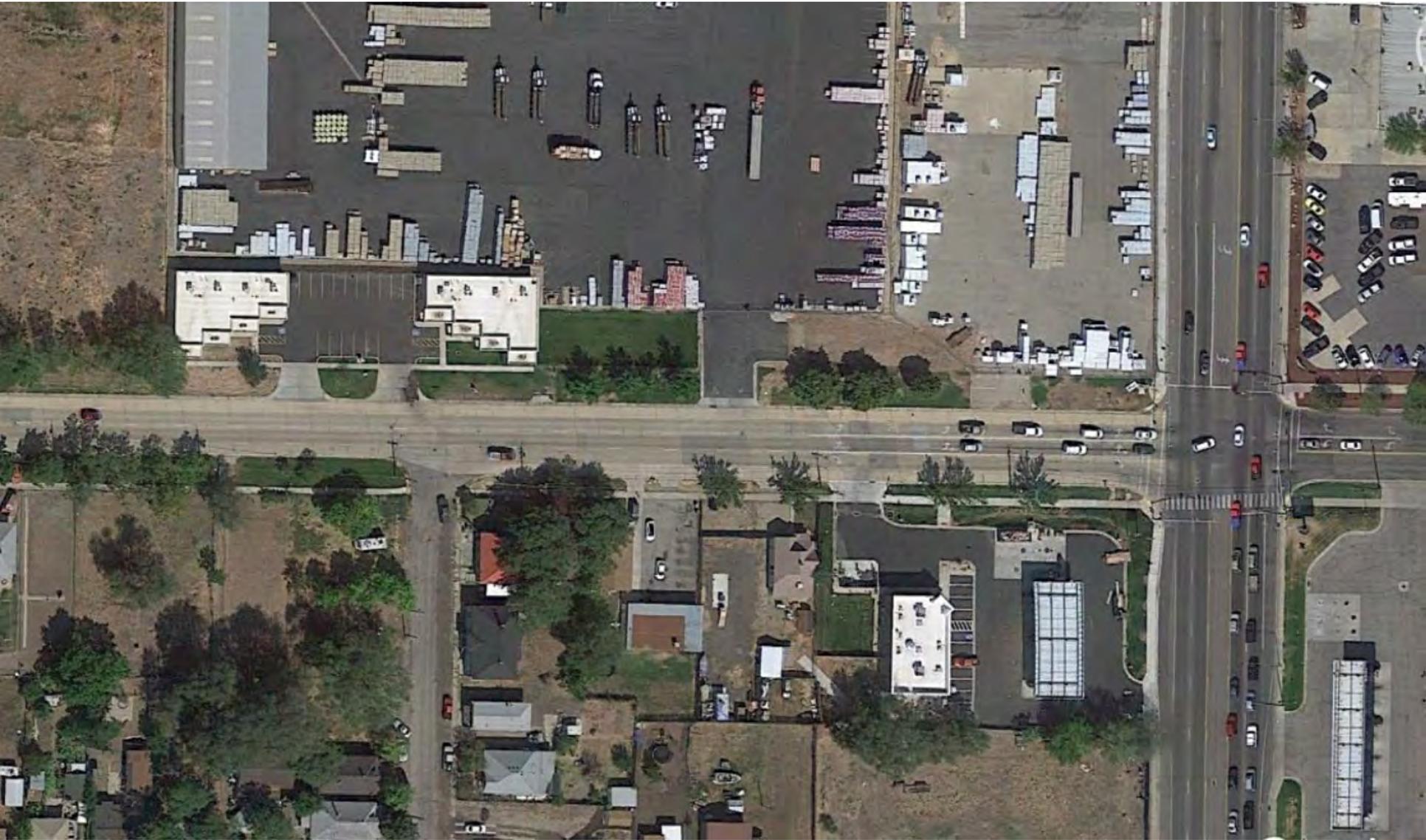
Lessons Learned - Site Layout

21st Street & Wall Avenue - Ogden













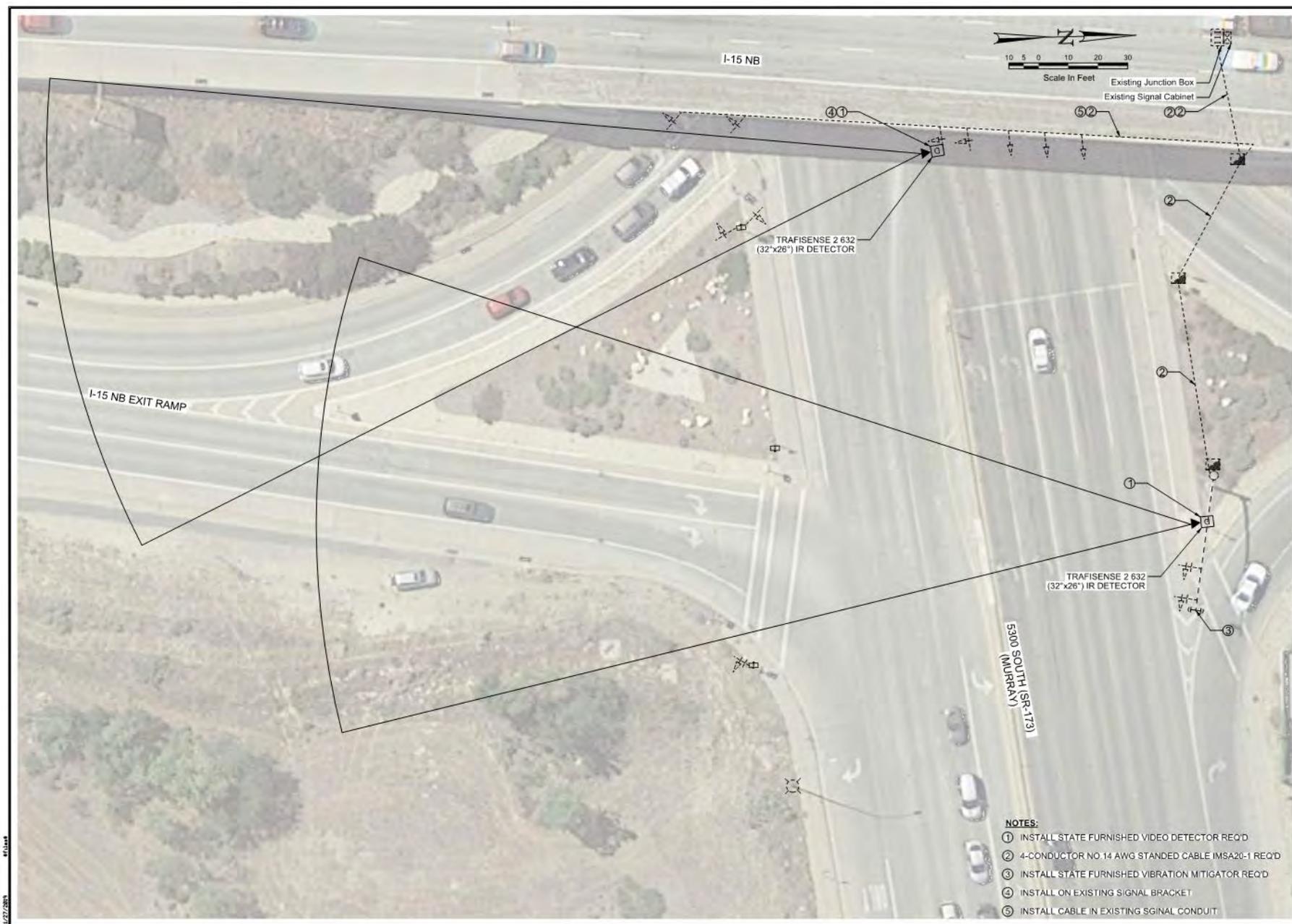
Lessons Learned - Site Layout

5300 South & I-15 NB Ramp - Murray





Google Earth

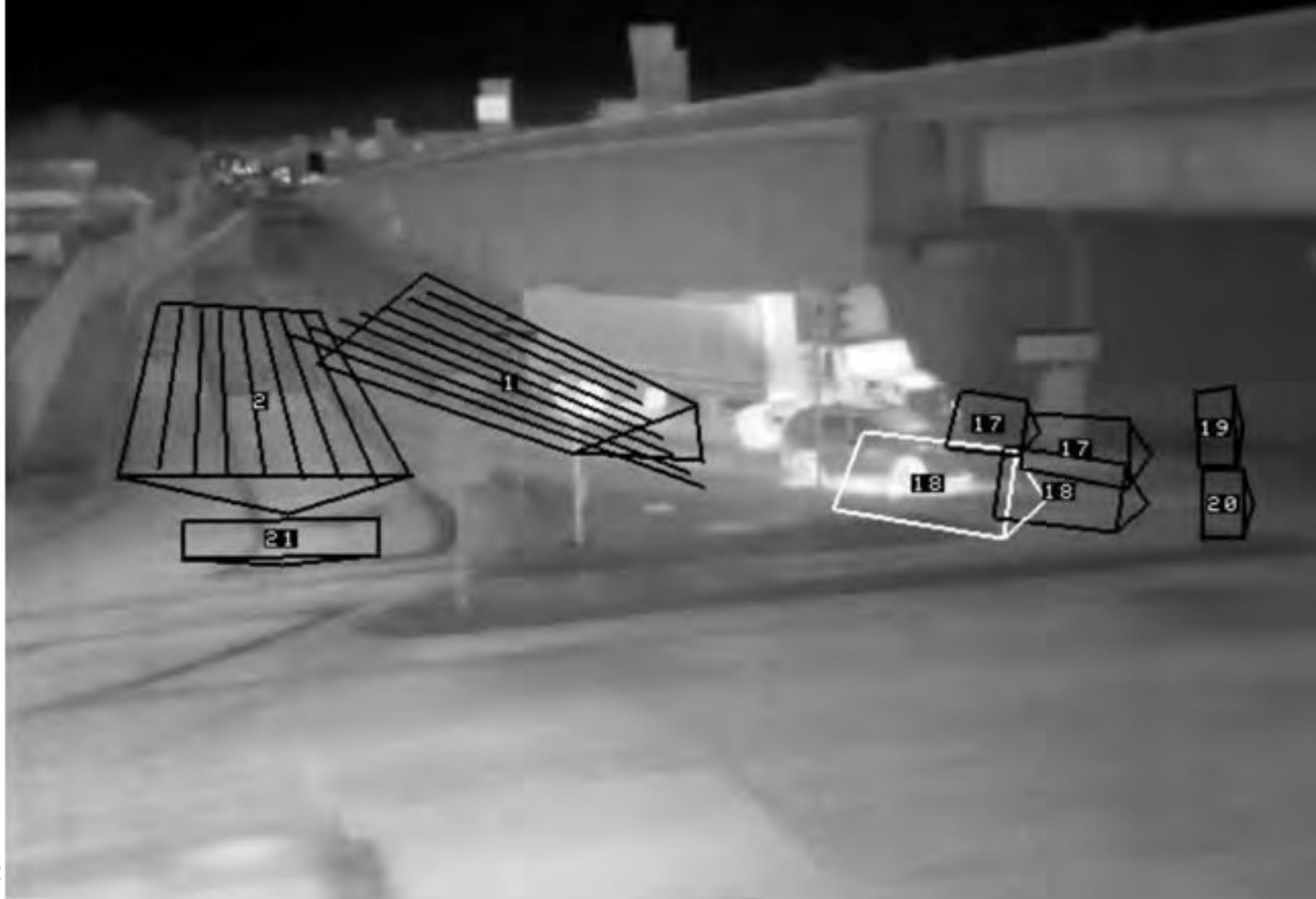


- NOTES:**
- ① INSTALL STATE FURNISHED VIDEO DETECTOR REQ'D
 - ② 4-CONDUCTOR NO.14 AWG STANDED CABLE IMA20-1 REQ'D
 - ③ INSTALL STATE FURNISHED VIBRATION MITIGATOR REQ'D
 - ④ INSTALL ON EXISTING SIGNAL BRACKET
 - ⑤ INSTALL CABLE IN EXISTING SIGNAL CONDUIT

UTAH DEPARTMENT OF TRANSPORTATION		ROADWAY DESIGN	
APPROVED	<i>Paul Hansen</i> PROFESSIONAL ENGINEER	DRAWN BY	ML
		10/09/19	DATE
		OC	CHECKED BY
		NO.	DATE
		APPROVED BY	REVISIONS
WRONG WAY/INCIDENT DETECTION SYSTEM		SIGNAL	
NB I-15 EXIT RAMP AT SR-173, MURRAY		F-ST99(623)	
PROJECT NUMBER	PIN	16723	16723
SHEET NO.		SG-18	

Camera 1 Location





Current Zone Setup

09/03/21 12:58:25 PM

Sig.#7074: I-15 NB Exit Ramp to 5300 S (SR-173): EB MVMT - Murray

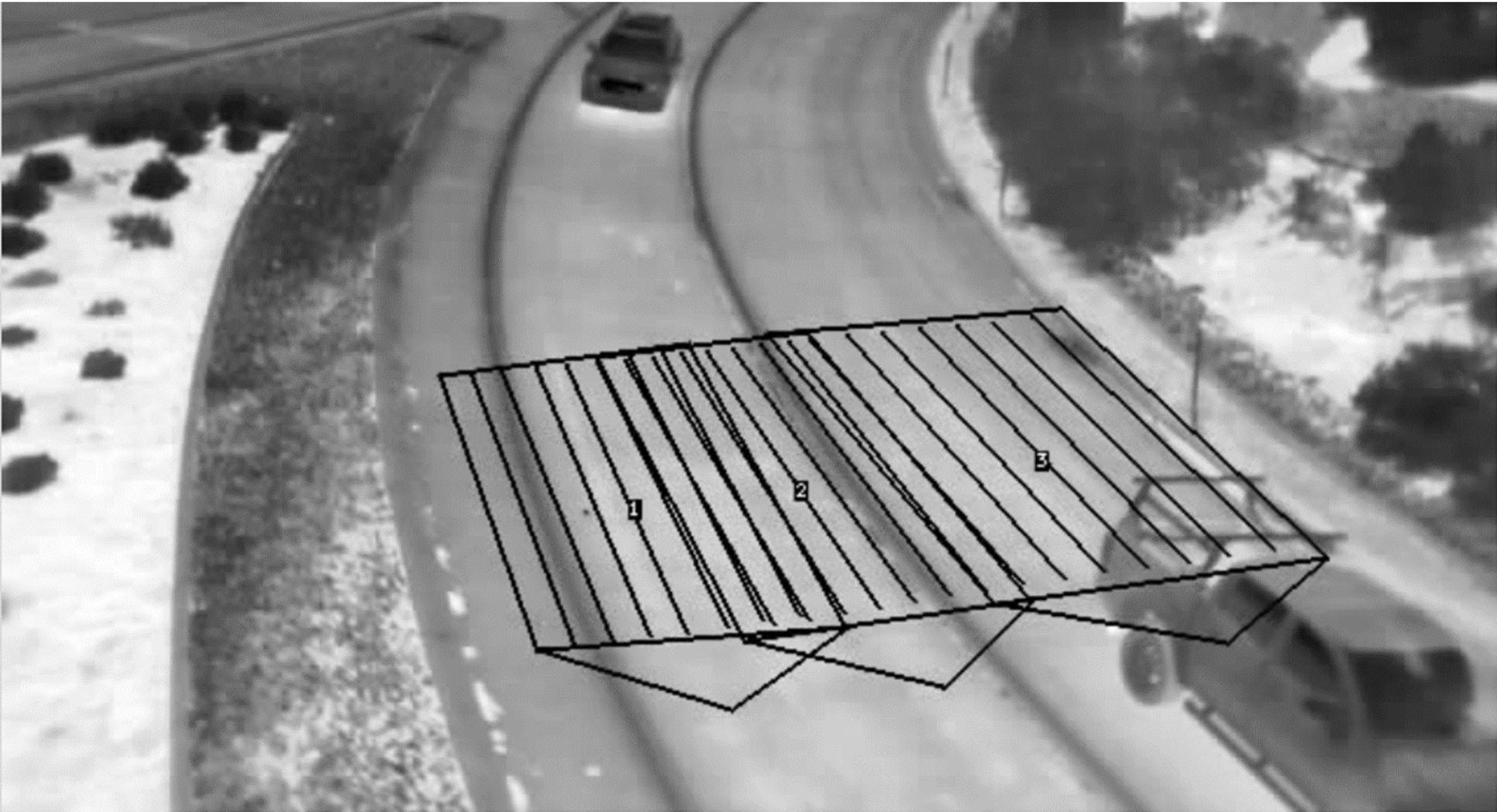
V2.03.P02

SHAKE





Current Zone Setup



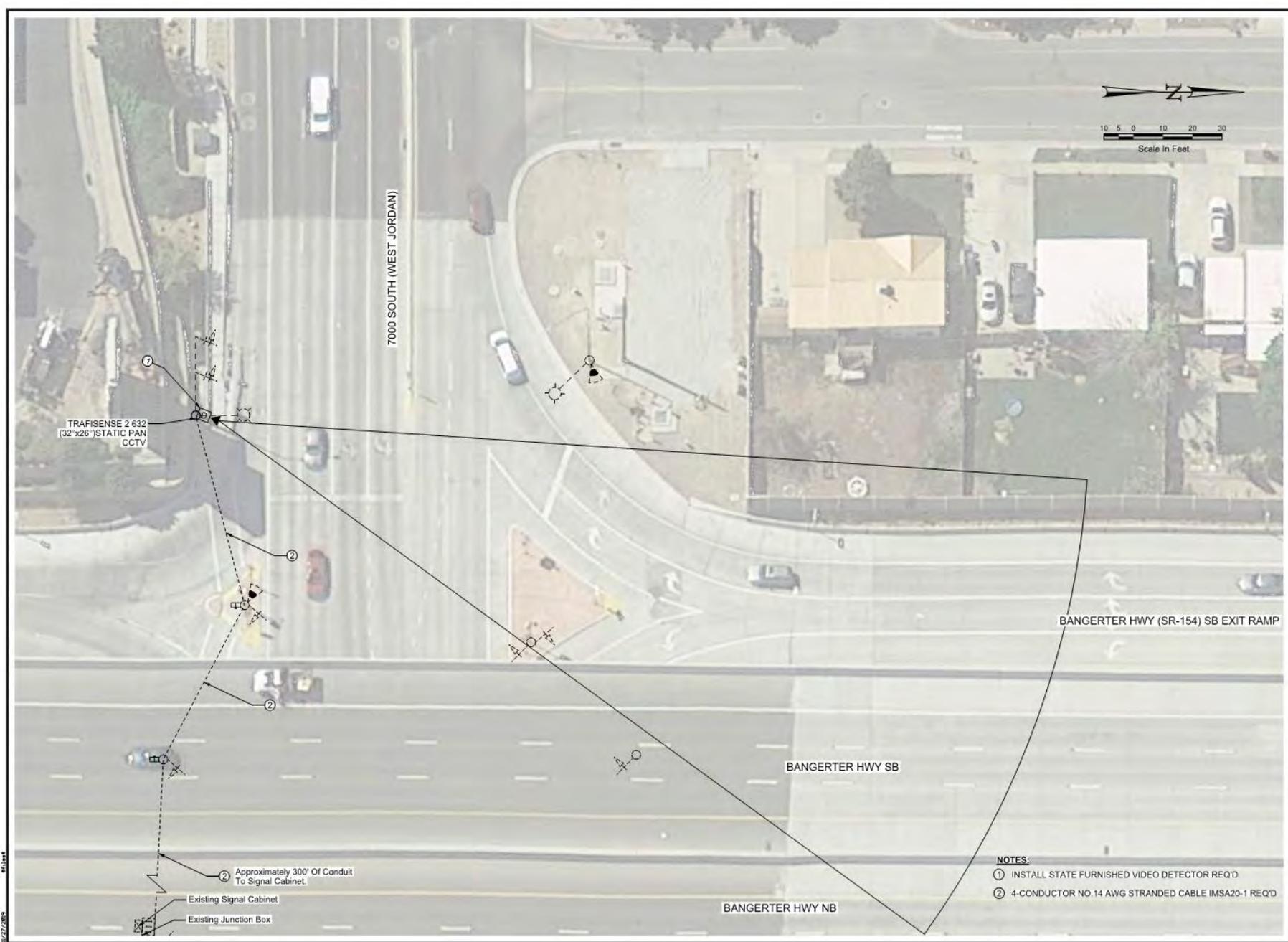
Lessons Learned - Site Layout

7000 South & Bangerter Hwy. SB Ramp – West Jordan



7000 South & Bangerter Hwy. SB Ramp





TRAFISENSE 2 632
(32'x26') STATIC PAN
CCTV

7000 SOUTH (WEST JORDAN)

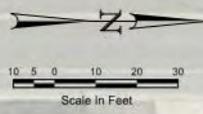
BANGERTER HWY (SR-154) SB EXIT RAMP

BANGERTER HWY SB

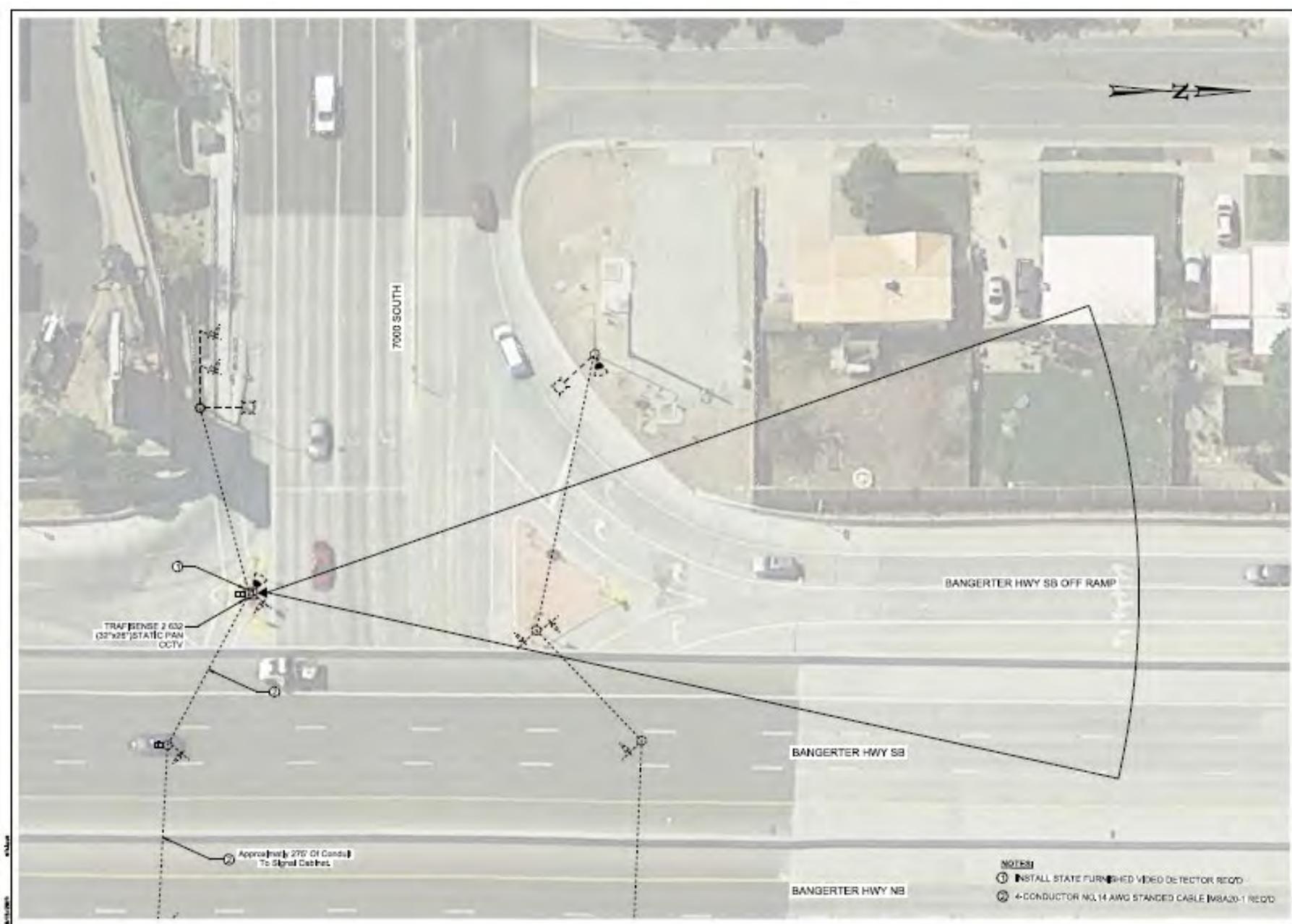
BANGERTER HWY NB

- ② Approximately 300' Of Conduit To Signal Cabinet.
- Existing Signal Cabinet
- Existing Junction Box

- NOTES:**
- ① INSTALL STATE FURNISHED VIDEO DETECTOR REQ'D
 - ② 4-CONDUCTOR NO. 14 AWG STRANDED CABLE IMSA20-1 REQ'D



UTAH DEPARTMENT OF TRANSPORTATION ROADWAY DESIGN		DRAWN BY M.L.	CHECKED BY D.C.	DATE 10/09/19	APPROVED BY B.J.L.	REVISIONS
WRONG WAY/INCIDENT DETECTION SYSTEM SB SR-154 EXIT RAMP AT 7000 S. WEST JORDAN		APPROVED <i>Brian Spencer</i> PROFESSIONAL ENGINEER				
PROJECT NUMBER	F-ST99(523)	PIN	16723	SIGNAL		
				NO.	DATE	APPROVED BY
				REVISIONS		



PRELIMINARY
NOT FOR CONSTRUCTION

UTAH DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN

DESIGNED BY	DATE
MODIFIED BY	DATE
APPROVED	

WYOMING WAY INCIDENT DETECTION SYSTEM

PROJECT NUMBER	16723
PROJECT NAME	F-6199(023)
SIGNAL	

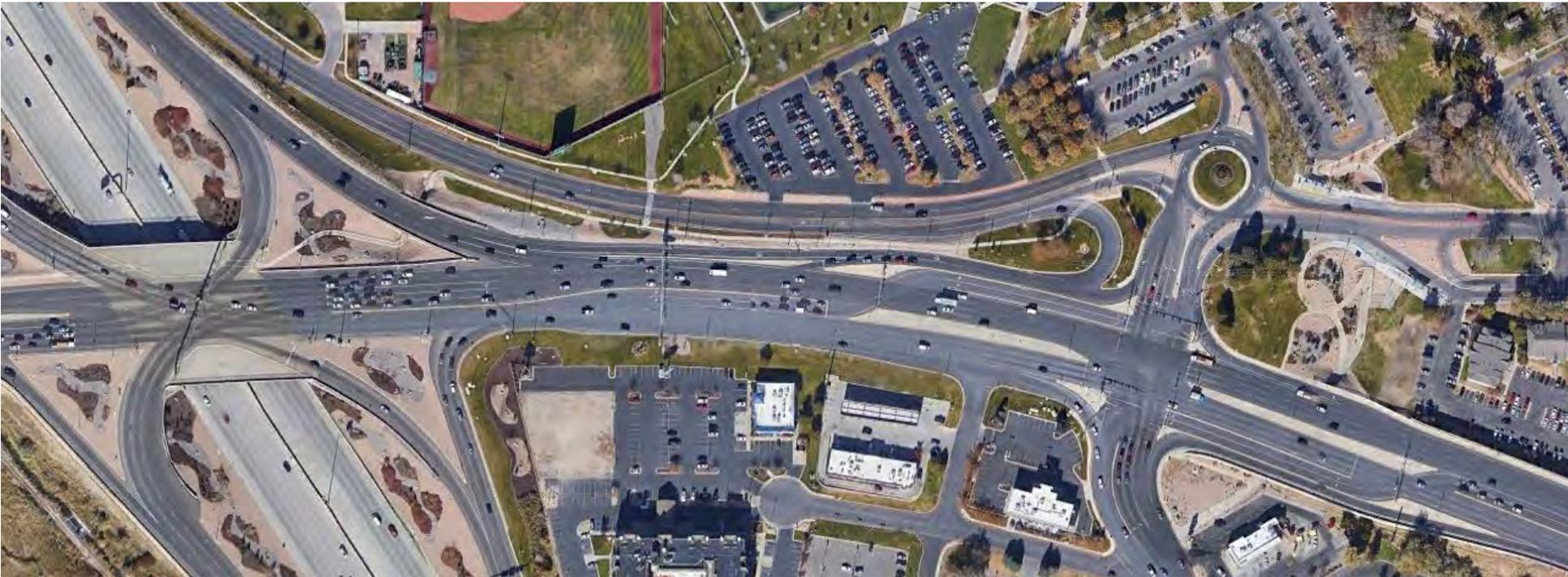
- NOTES**
- ① INSTALL STATE FURNISHED VIDEO DETECTOR RECD
 - ② 4-CONDUCTOR NO. 14 AWG STANDED CABLE (MSA20-1) RECD

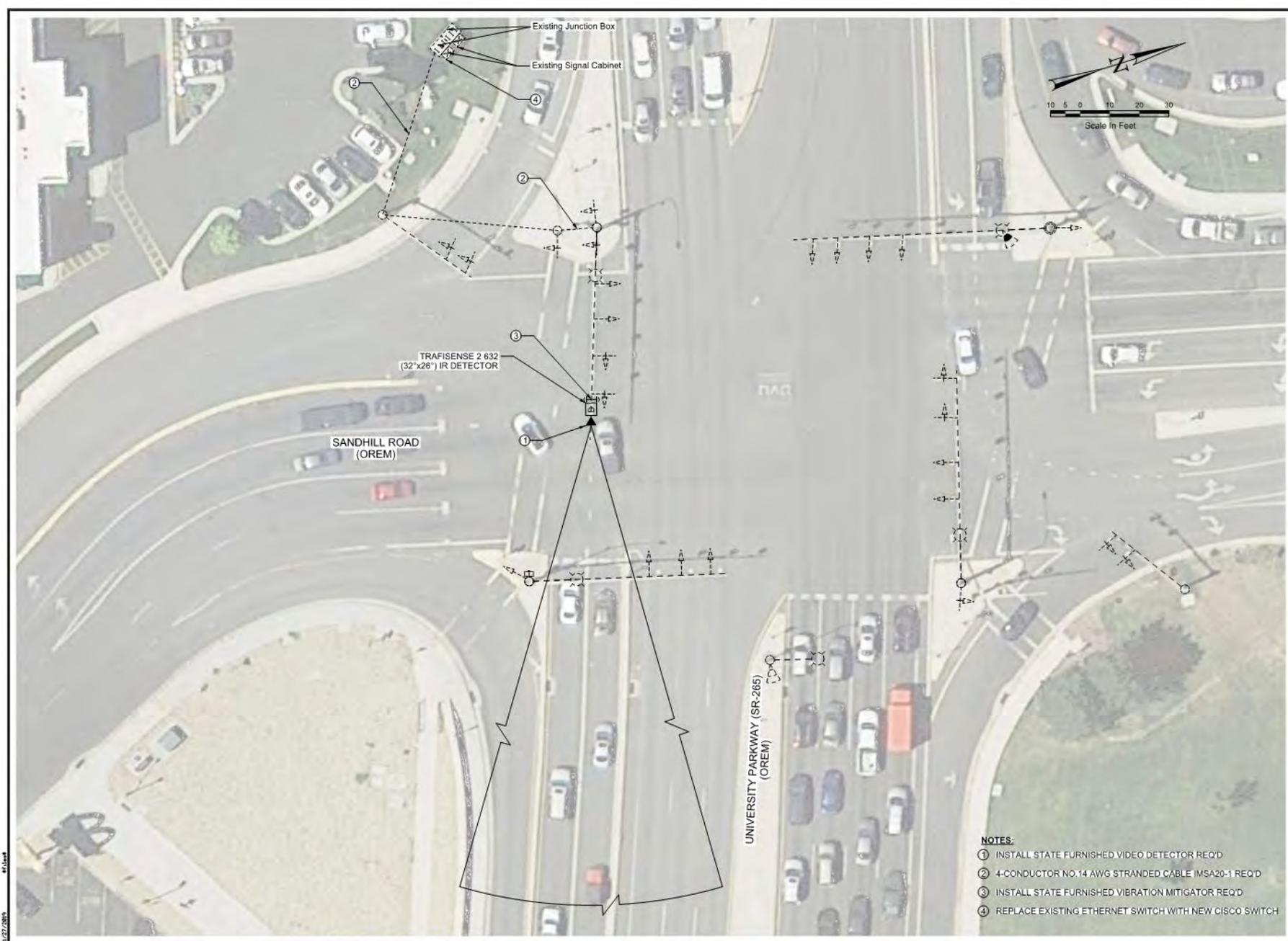


Lessons Learned - Site Layout

Sandhill Road & University Parkway - Orem





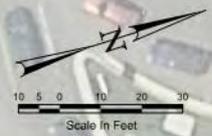


SANDHILL ROAD
(OREM)

UNIVERSITY PARKWAY (SR-265)
(OREM)

TRAFISENSE 2 632
(32'x26') IR DETECTOR

Existing Junction Box
Existing Signal Cabinet



- NOTES:**
- ① INSTALL STATE FURNISHED VIDEO DETECTOR REQ'D
 - ② 4-CONDUCTOR NO.14 AWG STRANDED CABLE IMSA20-1 REQ'D
 - ③ INSTALL STATE FURNISHED VIBRATION MITIGATOR REQ'D
 - ④ REPLACE EXISTING ETHERNET SWITCH WITH NEW CISCO SWITCH

UTAH DEPARTMENT OF TRANSPORTATION		ROADWAY DESIGN	
PROJECT WRONG WAY/INCIDENT DETECTION SYSTEM	APPROVED <i>Brad Johnson</i> PROFESSIONAL ENGINEER	DRAWN BY M	DC CHECKED BY DATE
PROJECT NUMBER NB SAND HILL RD. AT SR-265, OREM	PIN 16723	DATE 10/09/19	APPROVED BY DATE
SIGNAL		REMARKS	
SHEET NO. SG-25		NO. DATE	



Keeping Utah moving





MP 01 P01

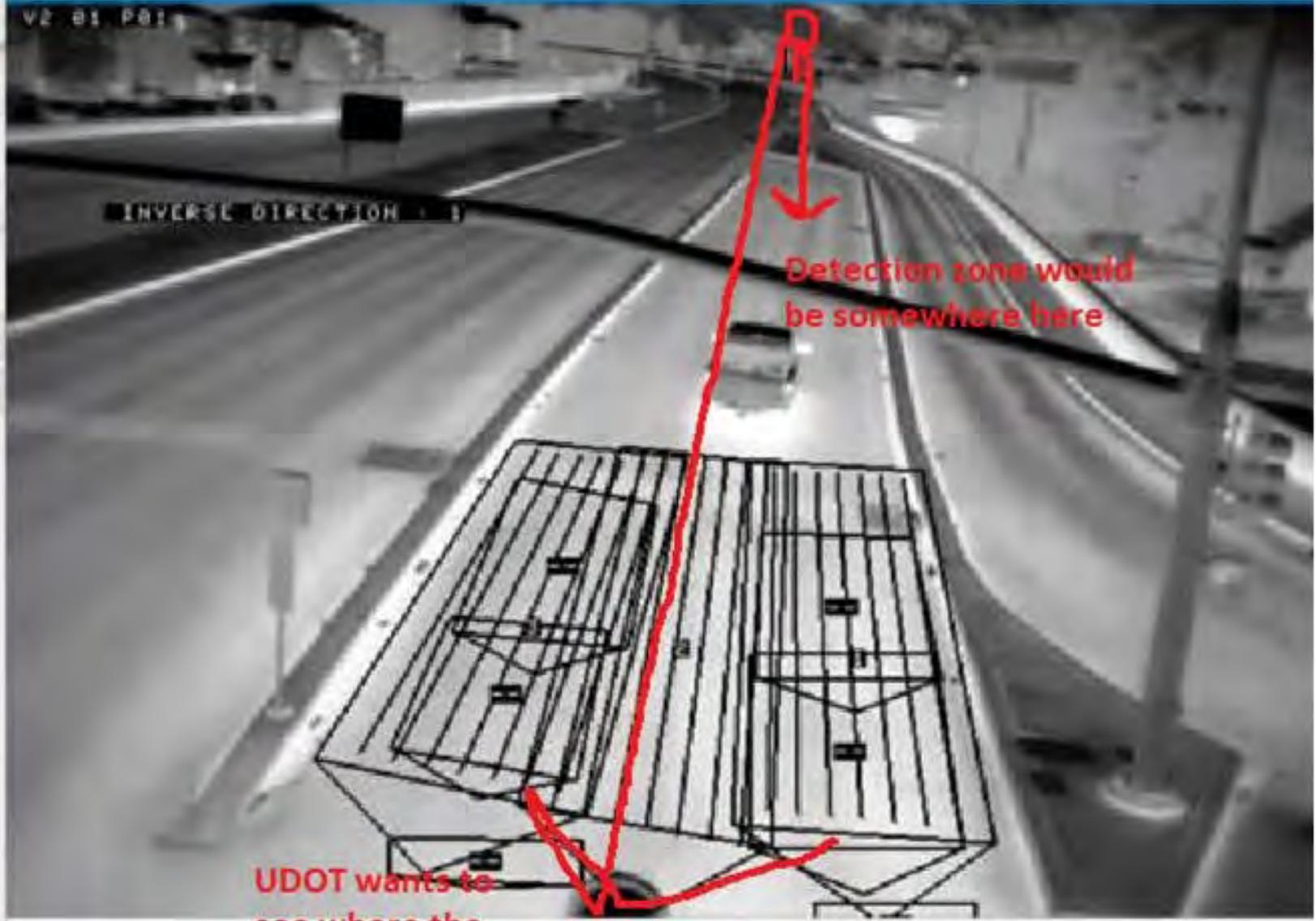


0:03 / 0:19



V2 01 P01

INVERSE DIRECTION - 1



Detection zone would be somewhere here

UDOT wants to see where the cars are coming from here



0:00 / 0:39



03.03.P02



0:00 / 0:39



Lessons Learned - Site Layout

US-6 & I-15 SB Ramp – Spanish Fork





Google Earth

© 2021 Google

Proposed US-6 & I-15 Mitigations



Two 30" x 36"
Left Turn Signs

2nd Set of
Wrong-Way
Signs with
Flashing Borders

Lane Use Arrows &
Wrong Way Arrows

Swap order of arrow
and "Do Not Enter"
sign



Lessons Learned - Site Layout

200 North & 1150 West – Cedar City







Wendy's

Wendy's
HAVE THRU CARS

1225 WEST

15





200 NORTH
FREEDOM BLVD

DO NOT
ENTER

FREWAY
ENTRANCE

7

NO LEFT TURN



ONE WAY

DO NOT ENTER



DO NOT ENTER



Lessons Learned - Site Layout

I-15 & Exit 8 DDI - St. George











WRONG WAY

Los Angeles 20
San Diego 100

WRONG WAY

**WRONG
WAY**



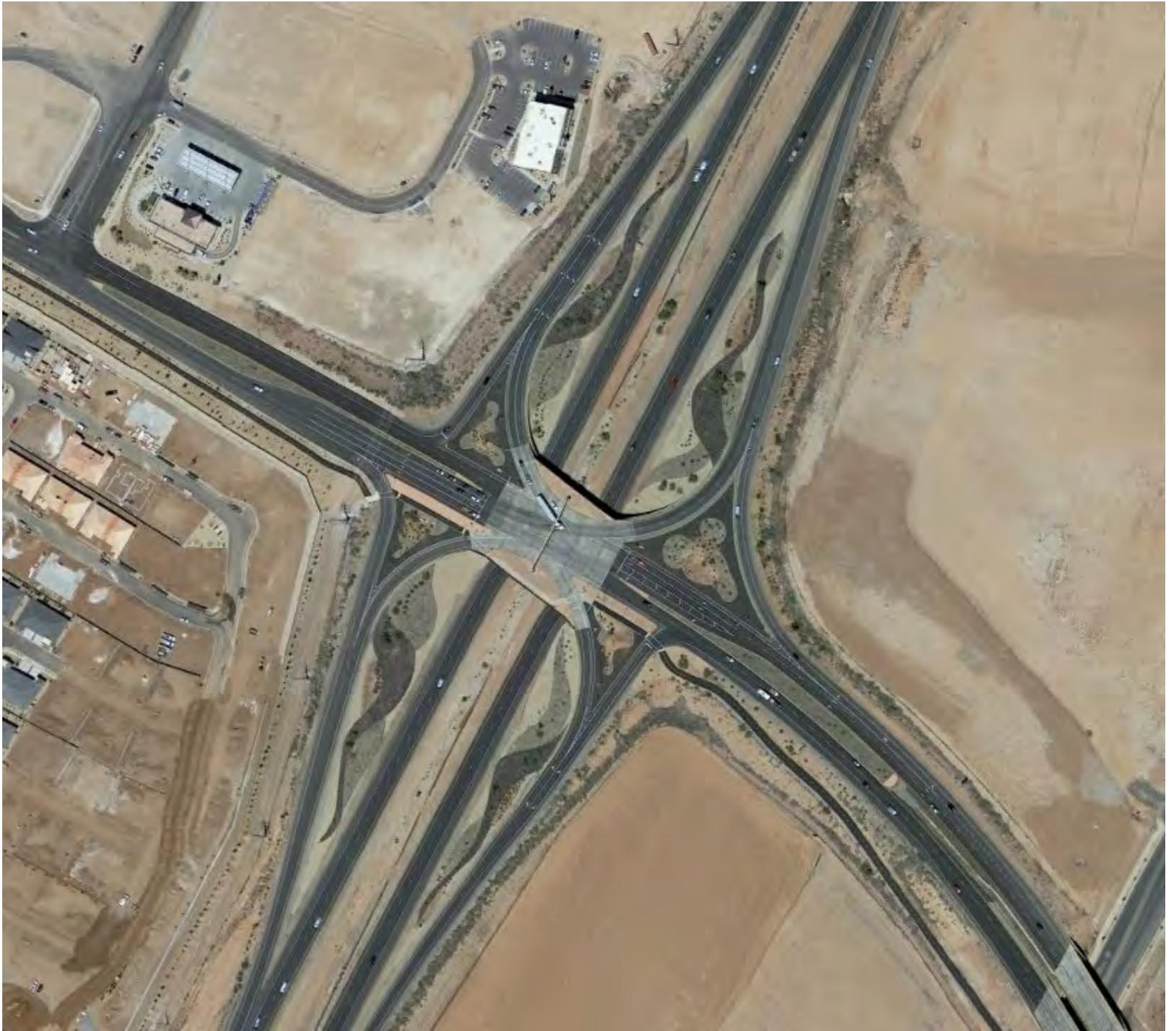
**WRONG
WAY**



Lessons Learned - Site Layout

I-15 & SR-7 Southern Parkway SPUI – St. George









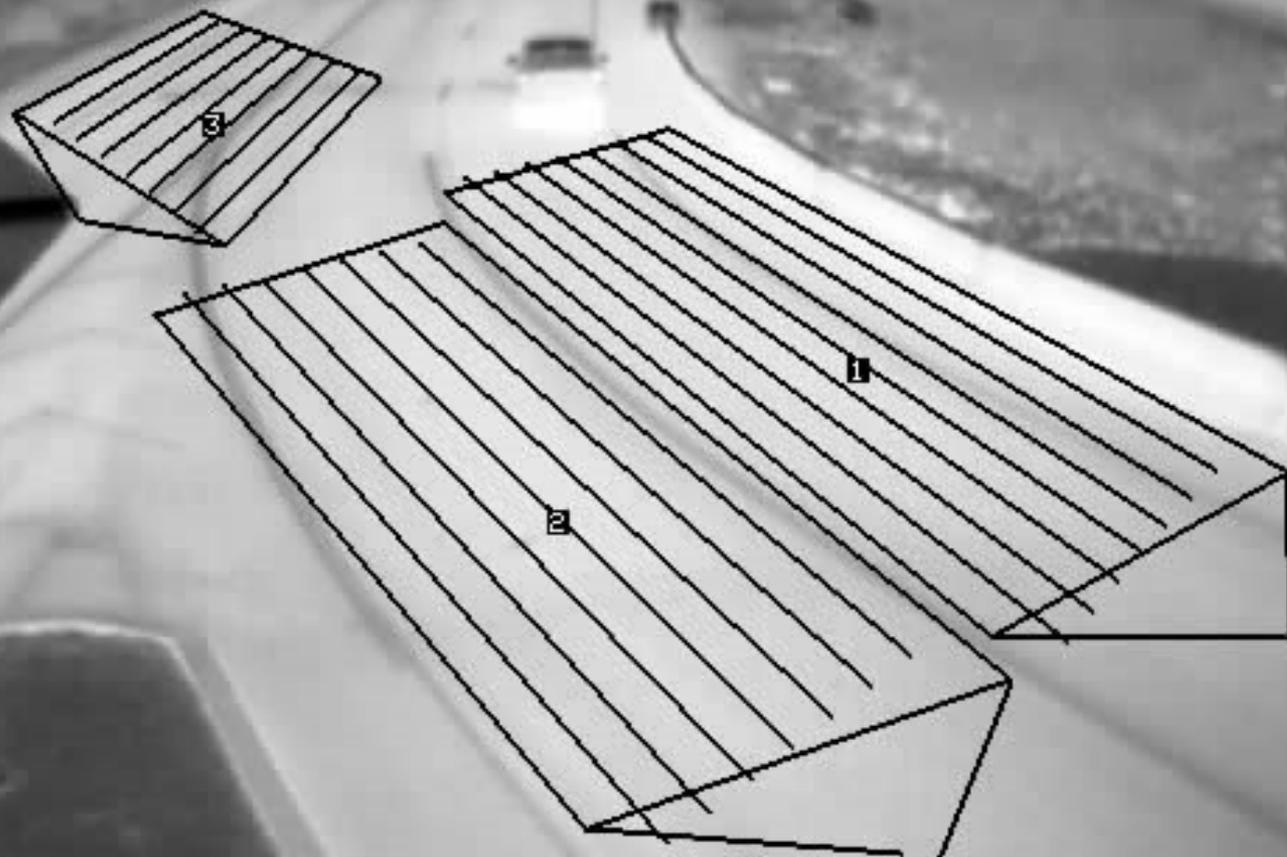








INVERSE DIRECTION : 1

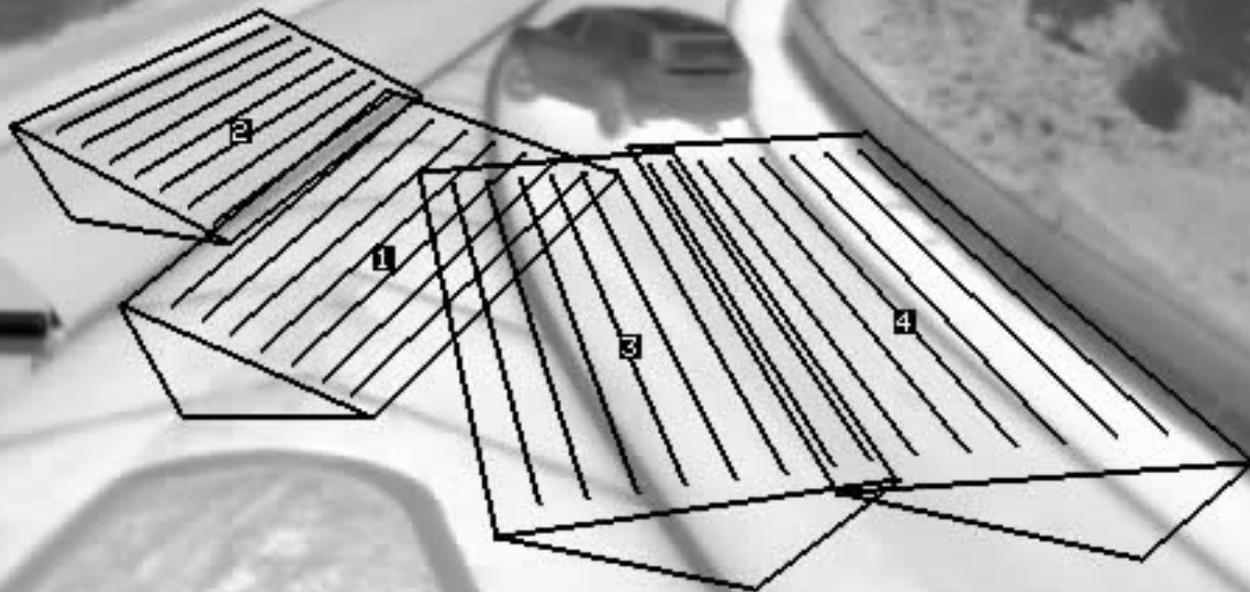






V2.01.P01

INVERSE DIRECTION : 4

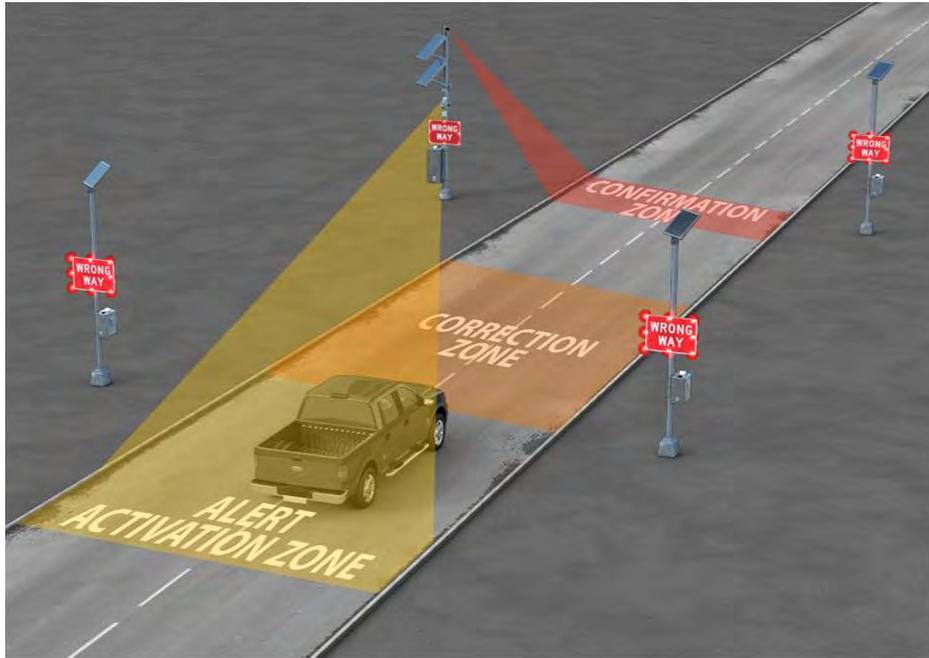


Another WWD System by TAPCO



TAPCO Wrong-Way Alert System

Typical 3 Zone Configuration



1. Alert Activation Zone

Initial wrong way detection triggers alerts to flash

2. Correction Zone

Opportunity for driver self-correct

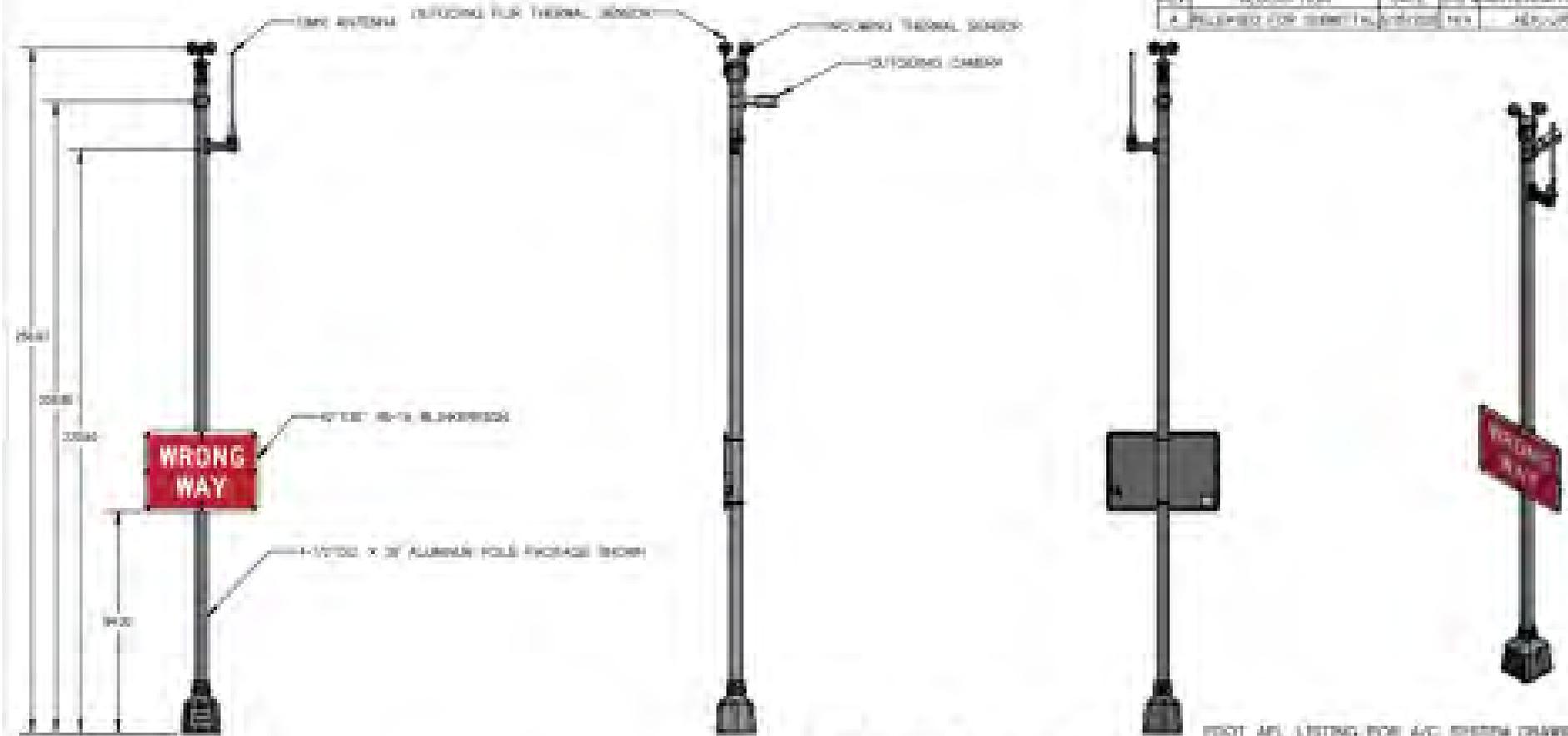
3. Confirmation Zone

Confirming wrong way detection triggers camera and high priority alert sent to the TMC



TAPCO System Details

REVISIONS				
REV.	DESCRIPTION	DATE	CD	APPROVED
A	RELEASED FOR INSTALLATION	5/2/2018	MS	ADDISON



FOOT APL LISTING FOR A/C SYSTEM DRAWING

TAPCO
TRAFFIC & PARKING CONTROL CO., INC.

DATE: _____
SCALE: _____
DRAWN BY: _____
CHECKED BY: _____

FIG. 6
WRONG WAY SYSTEM DETECTOR POLE ARRANGEMENT
W/CAMERA AND DUAL FLIR

DESIGN NO.	DATE	REV.	BY	APP.
37E-1704	5/2/2018	B	MS	ADDISON
37E-1704	5/2/2018	A	MS	ADDISON

NOTES:
1. SIGN SHOULD BE INSTALLED IN ACCORDANCE WITH STANDARD PLANS 89418
2. J-BOLTS NOT SHOWN
3. ALL DIMENSIONS ARE FOR REFERENCE ONLY

Questions?

UDOT R4:

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Region 4 ITS PM/Signals Eng.
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ttorgersen@utah.gov

UDOT TMD:

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TMD Program Manager
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H.W. Lochner:

Brad Lucas
Senior Project Manager
801.243.9568
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