

UDOT's Region Four Rural Intersection Conflict Warning Systems (RICWS) Design and Implementation

Presenter

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UDOT Region 4

ATMS Manager/Signal Engineer

RICWS GUIDELINES

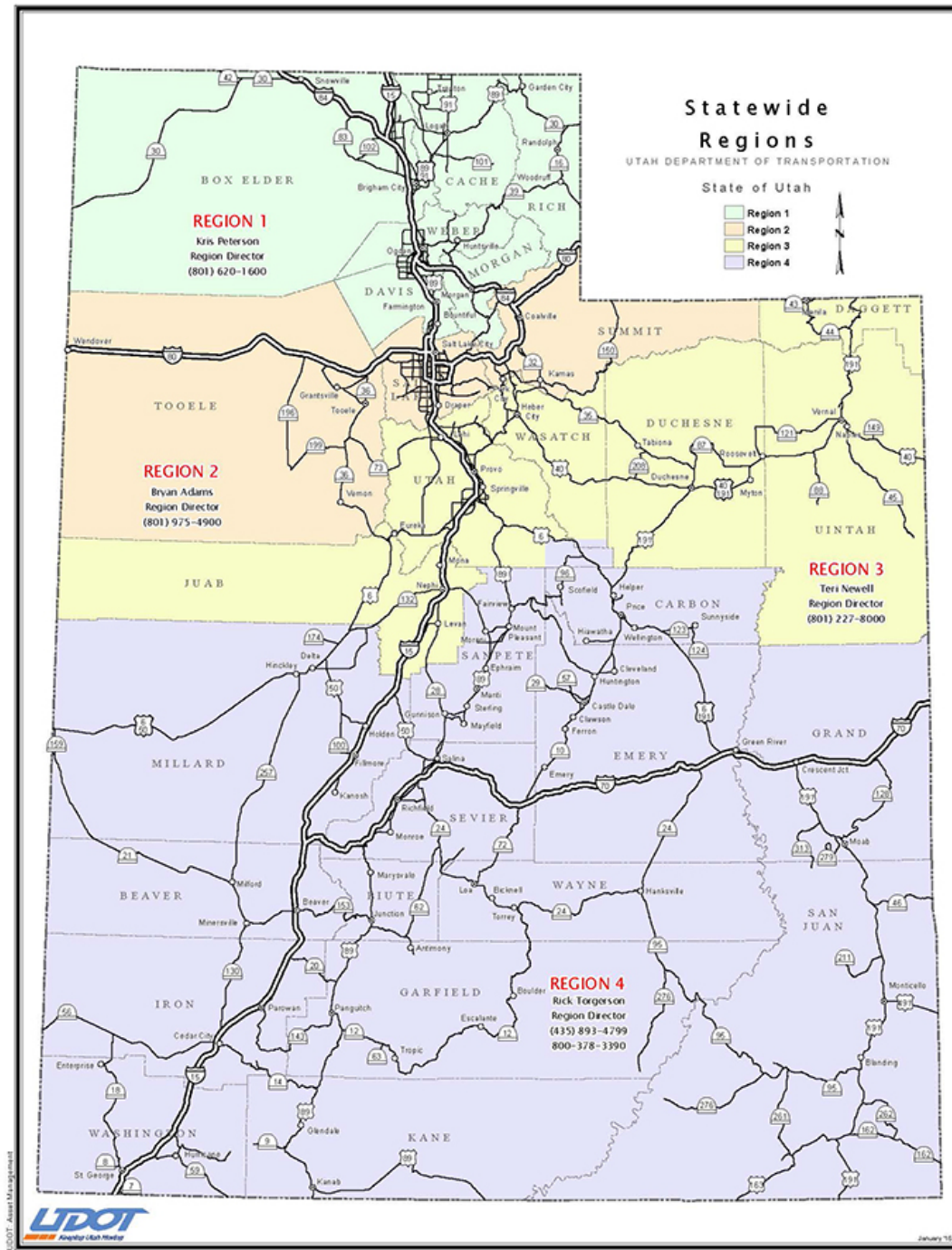
Introduction and Background

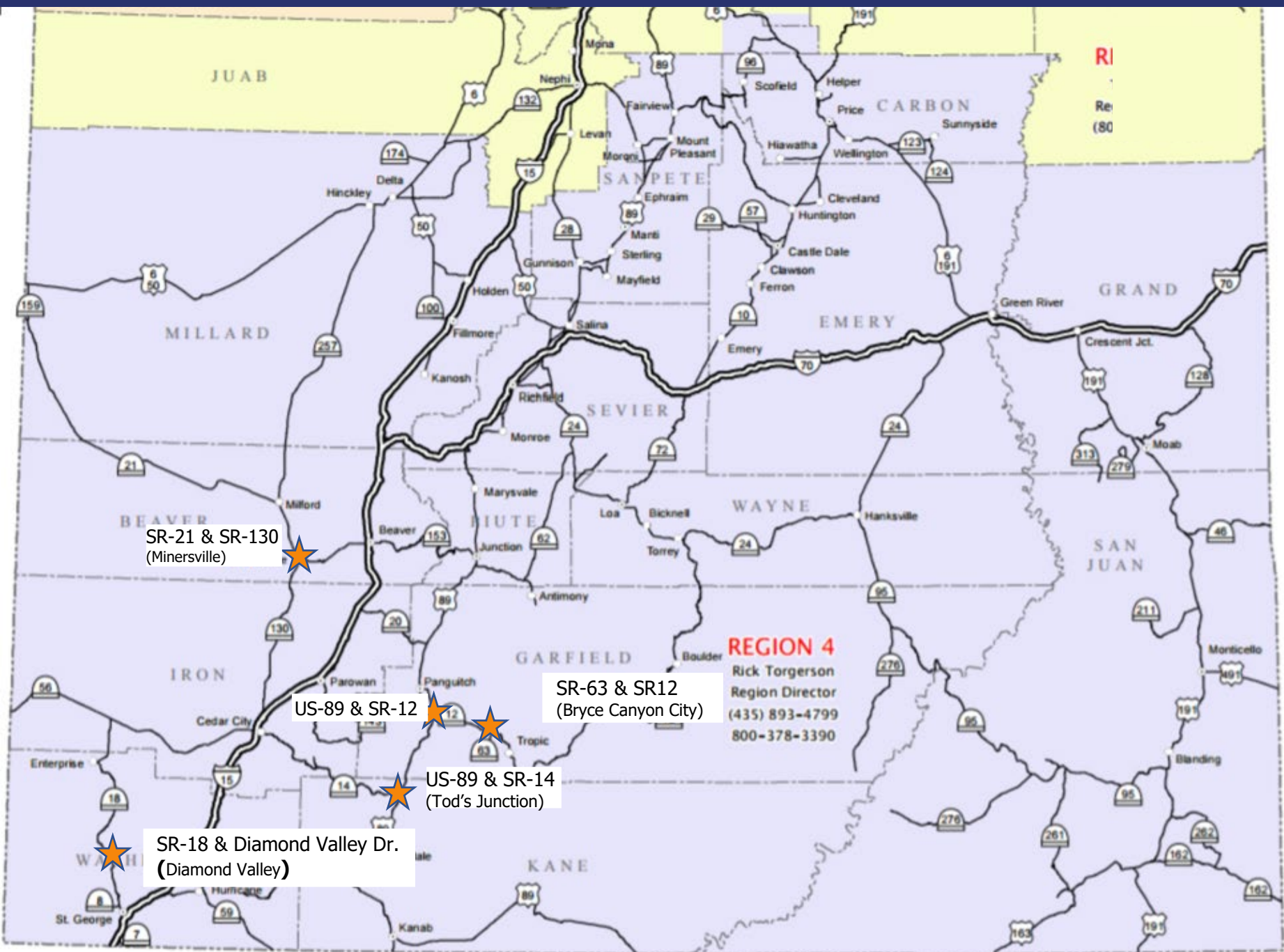
- **Crashes at rural intersections account for a large portion of fatalities and serious injuries across the country.**
- **The Federal Highway Administration reports roughly 40% of all crashes, mostly from left turns, with roughly 20% of fatal crashes occurring at intersections**
- **Much of UDOT's Region Four is rural**
- **UDOT Region 4 decided to research what other state DOT's have implemented to reduce the number of serious crashes at rural intersections.**
- **The research resulted in a report that guided the design and deployment of RICWS for three rural intersections.**

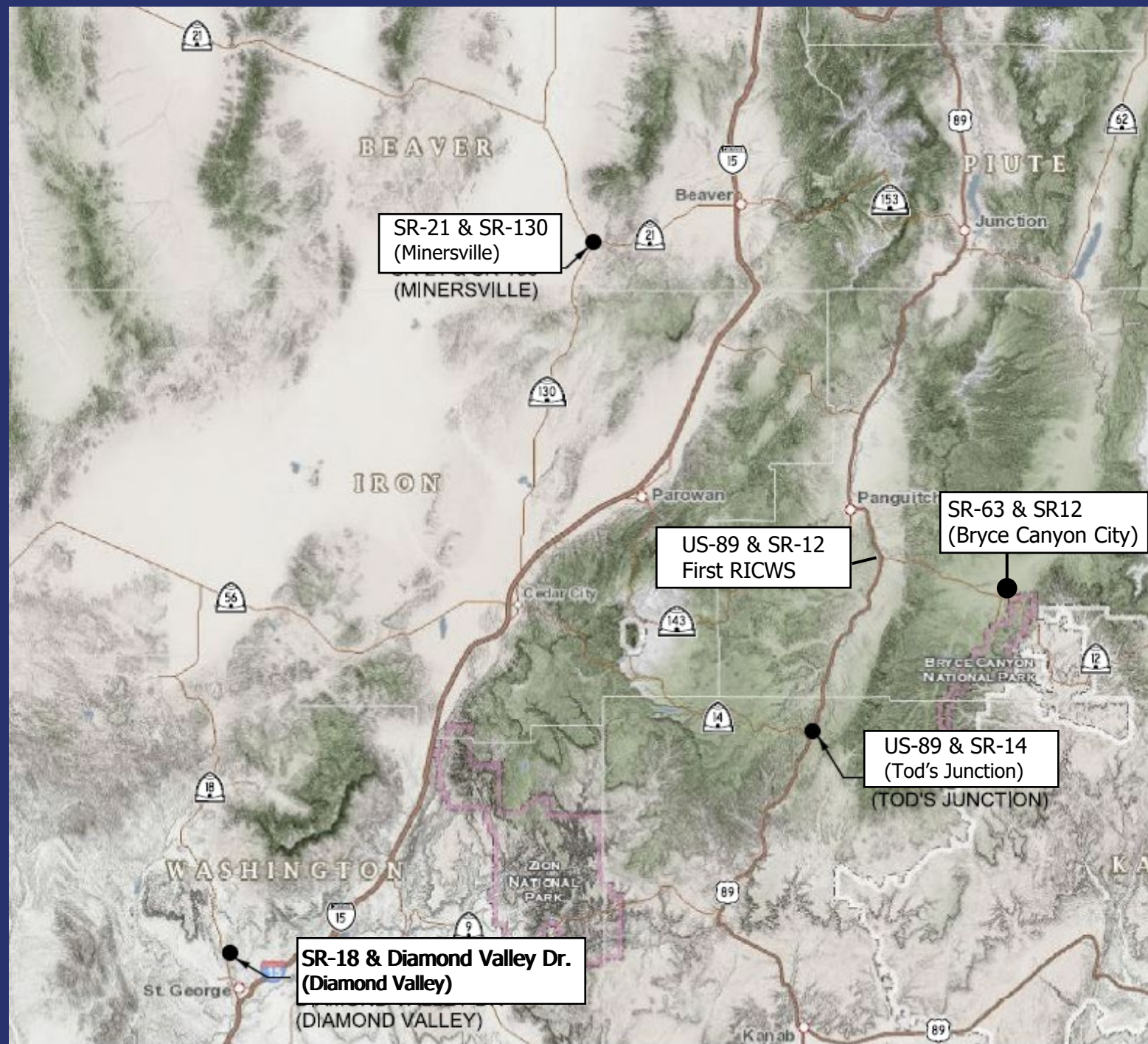


- **Advanced LED Warning System for Rural Intersections: Phase 2 (ALERT-2)**
- **Improving Safety at Rural Intersections: A Guide to Current Technology**
- **ENTERPRISE Intersection Conflict Warning Systems Study**









RICWS WARRANTS

RICWS Warrants

Reactive Approach

Identifies specific intersections with a history of accidents and therefore warrant an immediate remedy to mitigate safety issues.

Proactive Approach

A set of criteria is used to rank an intersection. The proactive approach is a risk assessment of factors related to fatal/serious injury and crash potential, with a focus on low cost mitigation

RICWS Warrants

Proactive Approach

- **Traffic Volumes**
- **Engineering Judgment**
- **Intersection Sight Distance / Gap Acceptance**
- **Intersection Skew**

Angle

- **Horizontal / Vertical Curvature**
- **Railroad Crossings**
- **Adjacent Property Development**
- **High Crash Rate**

RICWS GUIDELINES

RURAL INTERSECTION CONFLICT WARNING SYSTEM GUIDELINES

FINAL REPORT

This report provides conflict warning system selection guidelines for potential conflicts associated with rural high-speed intersections.

2/20/2018

Prepared for:

UDOT REGION 4 TRAFFIC & SAFETY

Prepared by:

CIVIL SCIENCE, INC.



RICWS Guideline Sections

- 1. Intersection Scenario Identification**
- 2. Sign Type, Placement, and Message Selection**
- 3. Detection Type**
- 4. Power Supply Assessment**
- 5. System Monitoring, Communication, & Data Management**

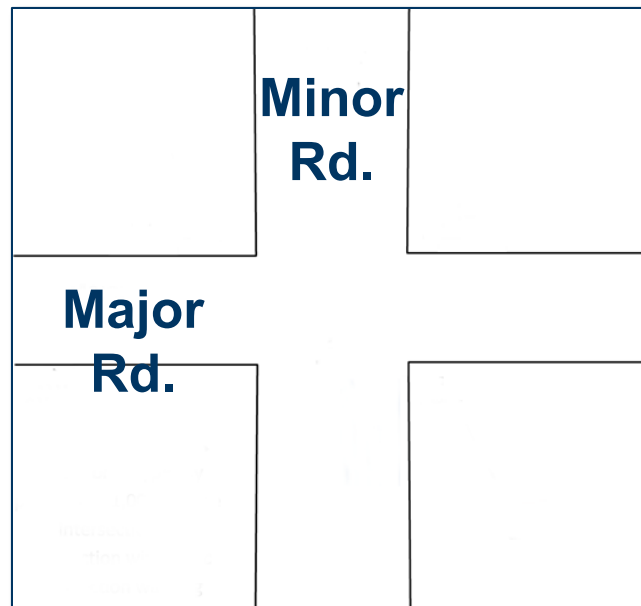
1. Intersection Scenarios

Scenario 1 – Minor Road Alert Only

Scenario 2 – Minor Road Alert Only (Divided)

Scenario 3 – Major Road Alert Only

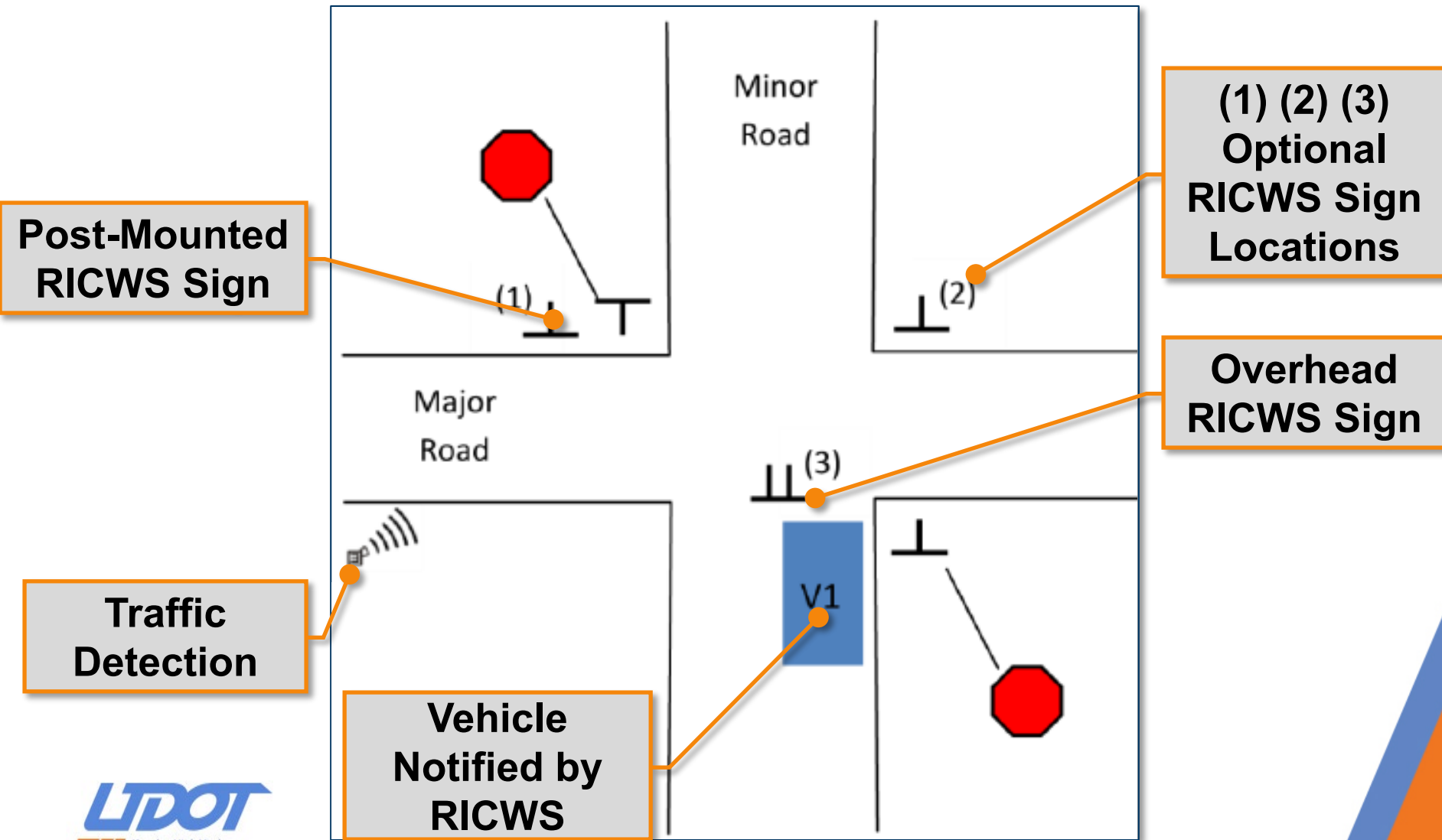
Scenario 4 – Minor and Major Alert



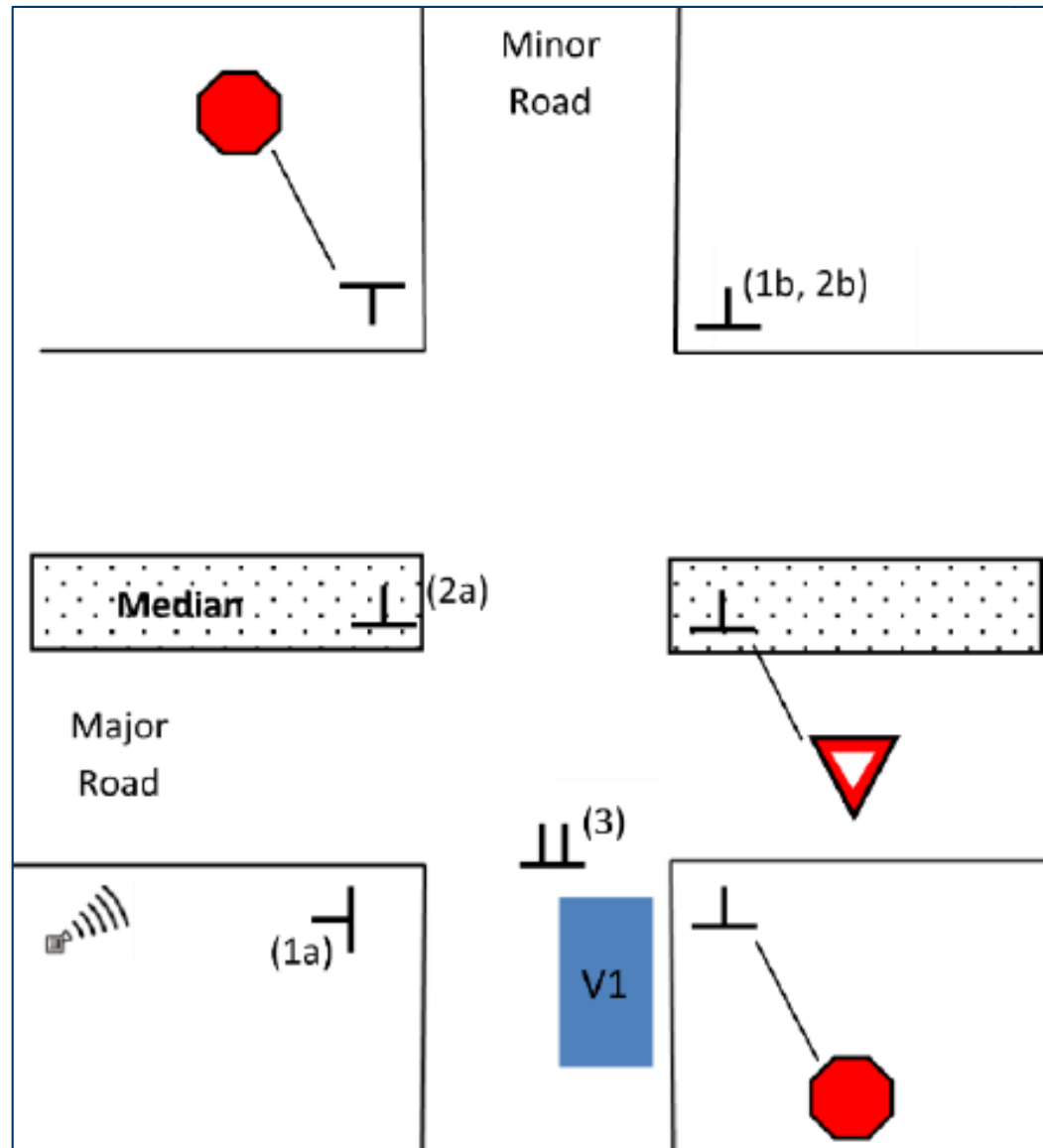
1. Intersection Scenarios

- Minor road ONLY alert may be most effective where major road volumes are less than 3,000 AADT.
- Major road ONLY alert most effective where major road volumes are above 3,000 AADT and less than 10,000 AADT.
- Major AND minor road alerts most effective where major road volumes are above 10,000 AADT and less than 12,000 AADT.

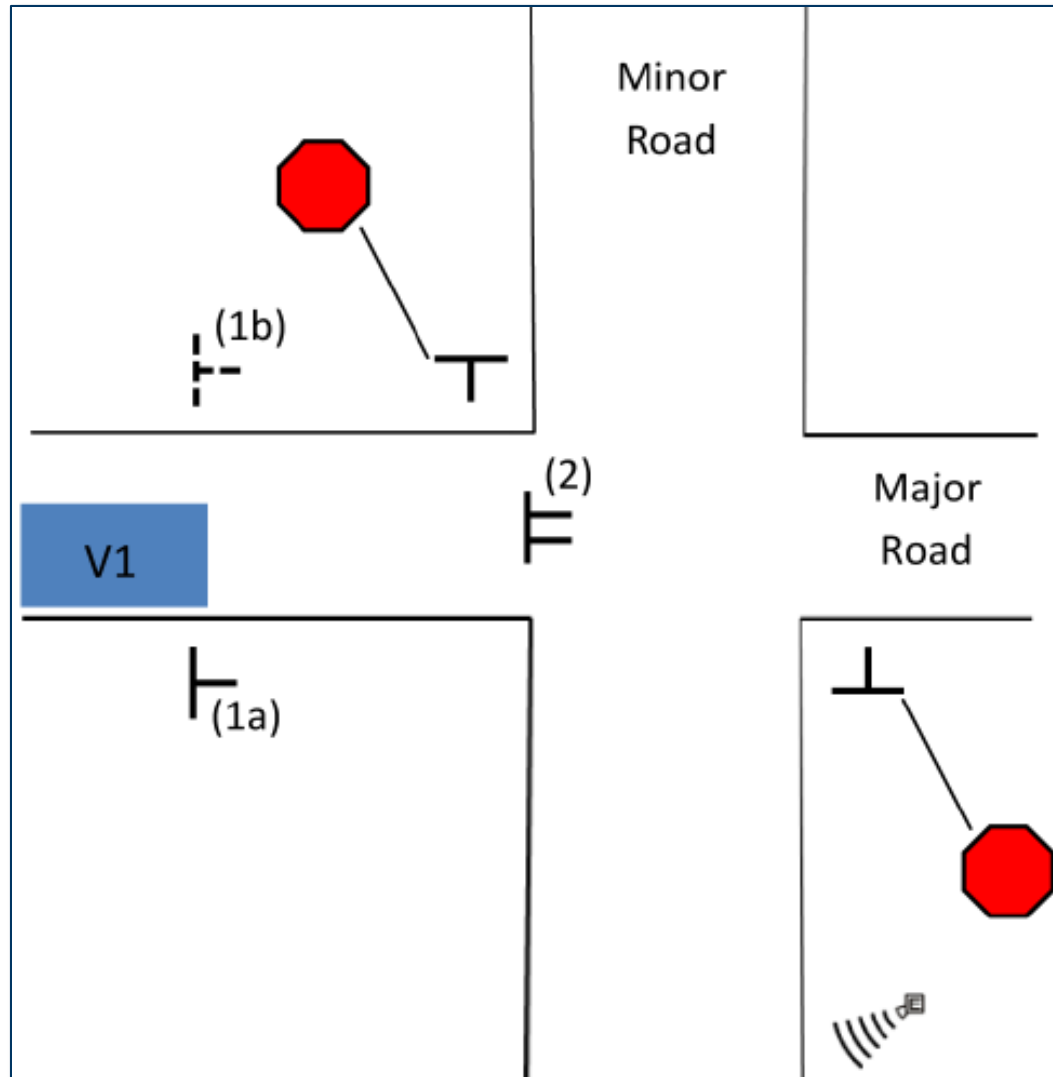
Scenario 1 - Minor Road Only



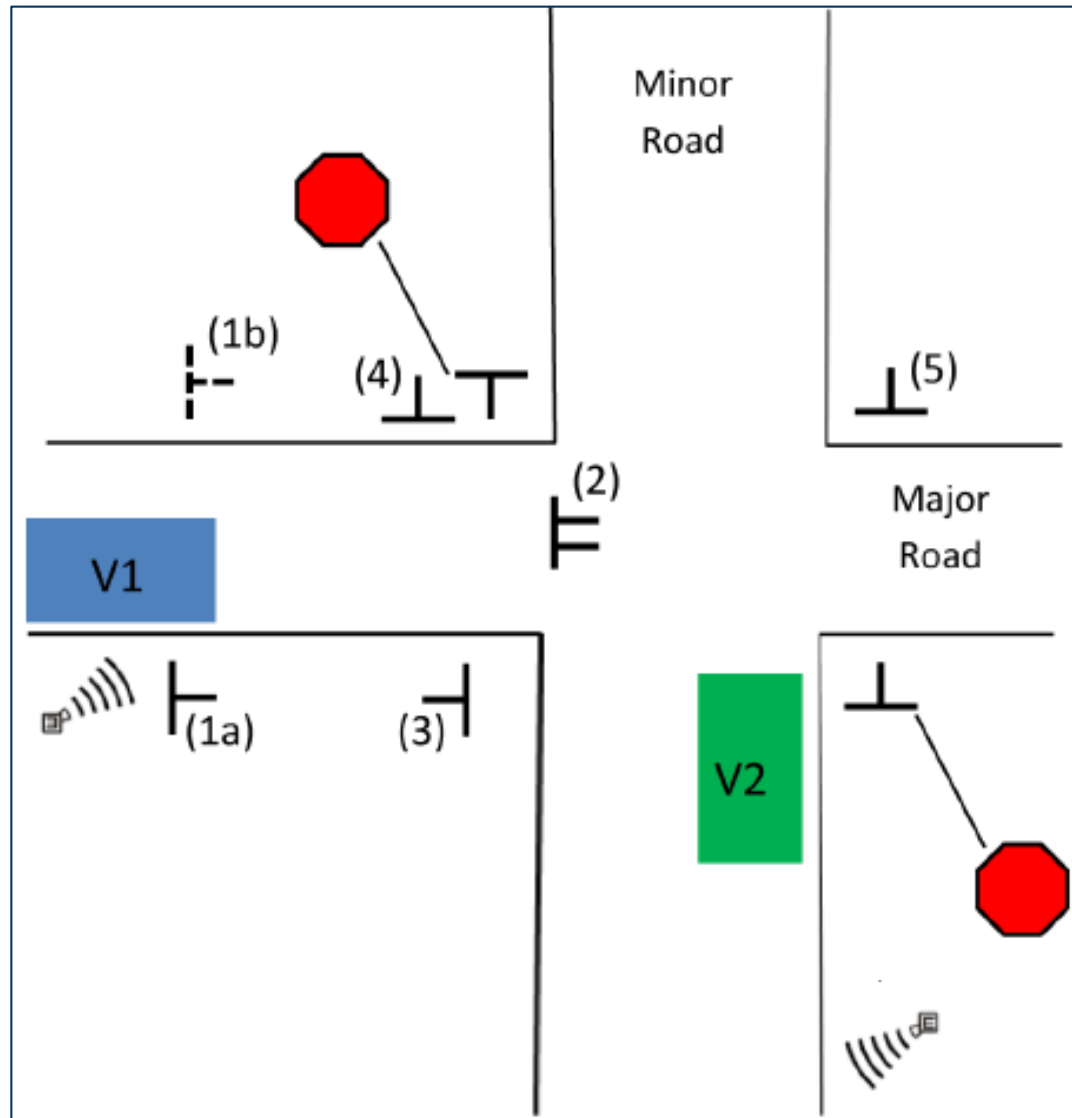
Scenario 2 - Minor Road (Divided)



Scenario 3 - Major Road Only



Scenario 4 – Major & Minor Road



2. Sign Type, Placement, and Message Selection

Sign Type and Placement

Static vs. Dynamic Blank-out

- Crash reduction numbers don't appear to differentiate between static and blank-out signs
- Blank-out sign reliability appears to still be an issue
- Blank-out signs in theory capture the attention of motorists more so than static signs

Post Mounted vs. Overhead

- Overhead signs are not as effective on the major road
- Overhead signs are more expensive to install and maintain
- Post mounted signs appear to achieve positive crash reduction numbers

System Redundancy and Malfunction

A key component of the signing and notification system needs to include a level of redundancy if the system is not functioning properly, and an active warning protocol should the system malfunction.

Warning systems that do not function fail to alert the traveling public to potential dangers, and limit confidence and willingness to comply with the warning system.

Minor Road Signing Options



Minor Road Signing Options



Major Road Signing Options



3. Detection Type

Timed Detection

- **Single detection component placed at a determined distance away from the intersection**
- **Does not account for speed changes after initial detection (higher than the posted speed limit), and the system must be replaced when posted speed limits change**

Speed & Distance Detection

- **Dual detection system placed further back to better detect traffic and to accommodate changes to speed**
- **Dual functionality allows the system to better track accurate speeds and distance from the intersection**

Detection System Options

Type of Detection	Intended Use	Remarks
1. Inductive Loop: 6-ft x 6-ft square or 6-ft diameter circle under the pavement for vehicle detection.	Loops, along with radar, are the most common type of detection system. May be used on either major or minor road.	The most accurate among detection technologies. Requires underground wiring. UDOT recommends installation only in new pavement applications.
2. Wireless Magnetometer (Puck): In-pavement-mounted magnetic sensors to detect vehicles using low-power radio technology.	Use for roads in place of saw cutting. Allows for easy installation and can be used for other types of detection.	Has the same detection characteristics as a 6-ft x 6-ft induction loop. No longer recommended by UDOT for new construction.
3. Wireless Radar: Radar unit is mounted and will detect vehicles on approach to provide feedback to warning system.	Radar, along with loops, is the most common type of detection system. May be used on either major or minor road.	The location of radar detectors upstream of the intersection and in relation to the stop bar on the minor road varies greatly between different example sites. Radar provides for greater system flexibility.

4. Power Supply Assessment

AC Power



Solar (PV) Power



Remember

A warning system that does not function consistently loses effectiveness and user confidence.



5. System Monitoring, Communication, & Data Mgmt.

System Monitoring and Communication

- The ability to monitor the systems operation, especially in a remote location, allows for timely and efficient maintenance
- Options range from simple low maintenance/low complexity systems to more complex, real-time monitoring systems
- Consider accessibility, available telecommunication infrastructure, and power source

Data Management

- **Collection of system data should be considered for various reasons including system optimization, upgrades, and research**
- **Provide the ability to run diagnostics and identify system failures and malfunctions in a timely manner, to keep the overall system functioning in a consistent way that fosters confidence in the traveling public**

STATE FURNISHED
RECTANGULAR BLANKOUT SIGN
(SEE SHEET DT-02)

TRAFFIC
APPROACHING

11' TRAFFIC SIGNAL / PED
POLE AND BASE PER
STANDARD DRAWING SL 1E

2 INCH CONDUIT

TYPE A JUNCTION BOX

TRAFFIC SIGNAL / PED POLE
FOUNDATION - 2'X3' PER
STANDARD DRAWING SL 1E

RECTANGULAR BLANKOUT SIGN ASSEMBLY
FRONT ELEVATION

MOUNT STATE FURNISHED
RECTANGULAR BLANKOUT SIGN
WITH Z-BAR TO POLES BY ASTRO
BRACKET ASSEMBLY PER OPTION
B FOR LARGE SIGNS ON
STANDARD DRAWING SL 3D.
INSTALL THREADED CONNECTOR
AT BOTTOM OF ASTRO BRACKET
TUBE AND USE LIQUID TIGHT
FLEXIBLE METAL CONDUIT TO
CONNECT FROM THE CONNECTOR
TO THE BLANKOUT SIGN
POWER ENTRY CONNECTOR.

STATE FURNISHED
RECTANGULAR BLANKOUT SIGN
(SEE SHEET DT-02)

7' MIN

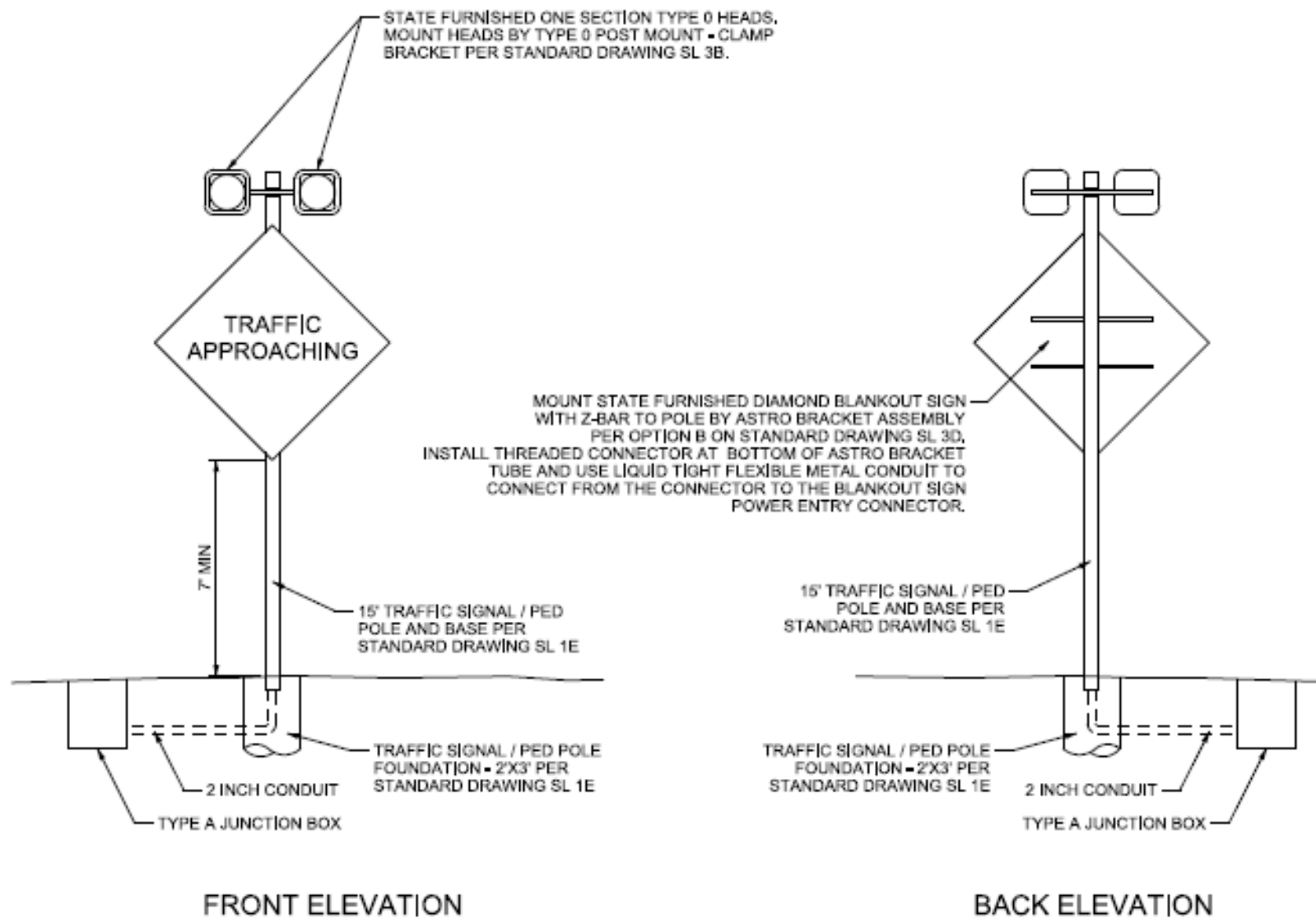
TRAFFIC SIGNAL / PED POLE
FOUNDATION - 2'X3' PER
STANDARD DRAWING SL 1E

2 INCH CONDUIT

TYPE A JUNCTION BOX

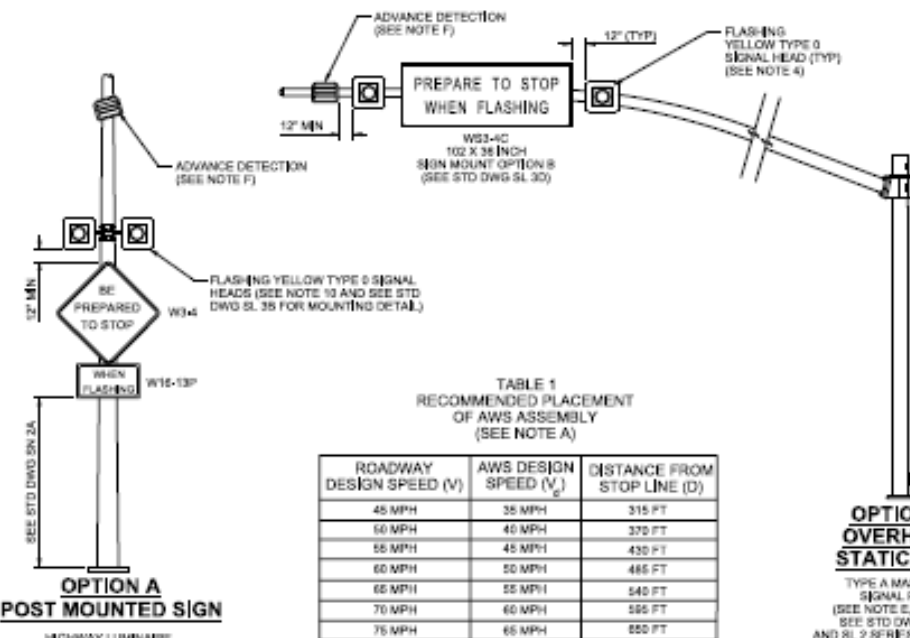
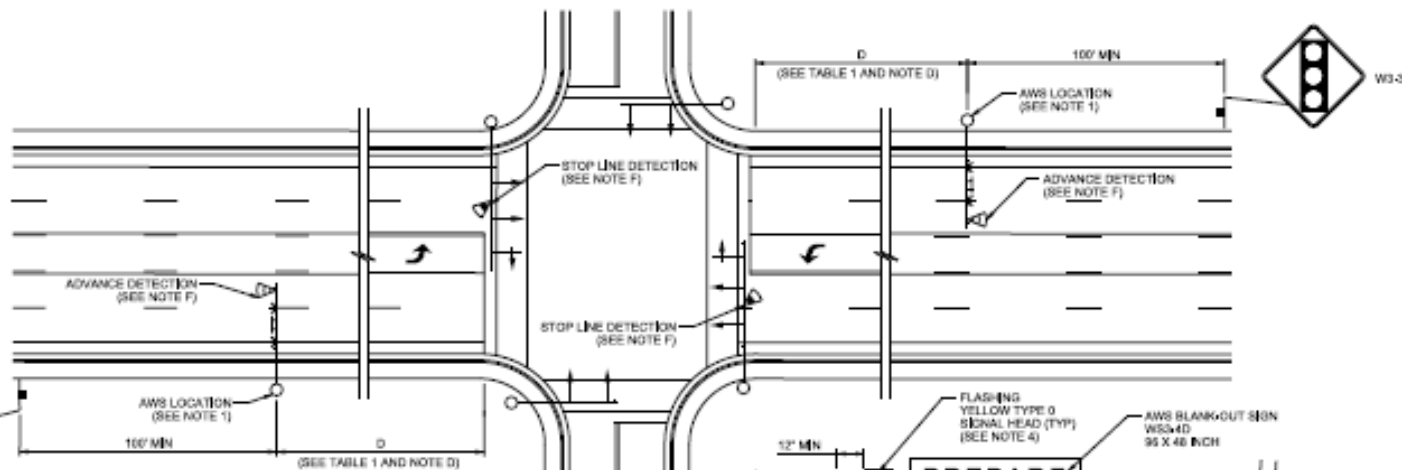
RECTANGULAR BLANKOUT SIGN ASSEMBLY
BACK ELEVATION

STATE FURNISHED RECTANGULAR BLANKOUT SIGN DETAIL



STATE FURNISHED DIAMOND BLANKOUT SIGN DETAIL

- LEGEND**
- SIGNAL HEAD
 - + SIGNAL HEAD
 - * YELLOW TYPE 0 SIGNAL HEAD
 - MAST ARM SIGNAL POLE
 - MAST ARM OR SIGNAL POLE MOUNTED SIGN
 - ADVANCED RADAR DETECTION
 - STOP LINE RADAR DETECTION
 - GROUND MOUNT SIGN



**TABLE 1
RECOMMENDED PLACEMENT
OF AWS ASSEMBLY
(SEE NOTE A)**

ROADWAY DESIGN SPEED (V)	AWS DESIGN SPEED (V _a)	DISTANCE FROM STOP LINE (D)
45 MPH	35 MPH	315 FT
50 MPH	40 MPH	370 FT
55 MPH	45 MPH	430 FT
60 MPH	50 MPH	485 FT
65 MPH	55 MPH	540 FT
70 MPH	60 MPH	595 FT
75 MPH	65 MPH	650 FT

**OPTION B
OVERHEAD
STATIC SIGN**

TYPE A MAST ARM
SIGNAL POLE
(SEE NOTE E, 5, AND G
SEE STD DWG SL 1A
AND SL 2-SERIES STD DWGS)

NOTES:

1. LOCATE RIGHT SIDE MOUNTED AWS ASSEMBLY SUCH THAT RIGHT BEACON IS LOCATED DIRECTLY OVER RIGHT EDGE LINE, ADJUST THE PLACEMENT OF THE OVERHEAD AWS ASSEMBLY IF AN OBSTRUCTION BLOCKS THE VIEW OF BEACONS, LOCATE LEFT SIDE MOUNTED OVERHEAD AWS ASSEMBLIES SUCH THAT LEFT BEACON IS LOCATED DIRECTLY OVER LEFT EDGE LINE.
2. BEACONS FLASH YELLOW ALTERNATELY, LEFT AND RIGHT.
3. USE A TYPE C POLE WITH A COMPATIBLE FOUNDATION WHEN OPTION C OVERHEAD BLANK-OUT SIGN IS INSTALLED, FIELD CUT TYPE C COMPATIBLE MAST ARM TO REQUIRED LENGTH AND CAP END, PROVIDE SUFFICIENT MAST ARM LENGTH FOR AWS ASSEMBLY AND DETECTION EQUIPMENT PLACEMENT, THE MAXIMUM OPTION C MAST ARM LENGTH IS 50 FT.
4. DO NOT PLACE RETROREFLECTIVE TAPE ON FLASHING BEACON BACKPLATES.
5. PROVIDE 18 FT 6 INCH CLEARANCE BETWEEN BOTTOM OF AWS STATIC SIGN OR AWS BLANK-OUT SIGN, INCLUDING BRACKETS, AND HIGHEST POINT OF ROADWAY SURFACE UNDER THE SIGN. PROVIDE 17 FT 6 INCH MINIMUM CLEARANCE WITH APPROVAL FROM THE ENGINEER, PROVIDE 19 FT 6 INCH MINIMUM CLEARANCE ON APPROVED HIGH LOAD ROUTES, SIGN W53-4D IS STATE TURNISHED.

DESIGN-ONLY NOTES:

- A. TABLE 1 IS BASED ON A 5-SECOND LEAD FLASH TIME, THE DISTANCE (D) MAY BE ADJUSTED TO PROVIDE A 5-SECOND MINIMUM TO A 6-SECOND MAXIMUM LEAD FLASH TIME USING THE FORMULA: $D = (V_a + 2.5) \times 1.47 \times T$ WHERE: D = LEAD FLASH TIME (SEC.) V_a = AWS DESIGN SPEED (MPH)

FOR DOWNGRADE APPROACHES OF 2 PERCENT OR GREATER ADD DISTANCE D_0 TO D : $D_0 = \frac{V_a^2}{9.32 \times 300} \times \frac{V_a^2}{9.32}$ WHERE: D = PERCENT GRADE DIVIDED BY 100

- B. AWS DESIGN SPEED (V_a) IS 10 MPH SLOWER THAN ROADWAY DESIGN SPEED.
- C. PLACE AWS TO PROVIDE 2 SECONDS MINIMUM SIGHT DISTANCE ON APPROACH.
- D. INSTALL AWS ASSEMBLY THE SAME DISTANCE FROM THE STOP BAR IN BOTH DIRECTIONS IF AWS WARRANT CRITERIA ARE MET FOR BOTH DIRECTIONS OR AS DIRECTED BY THE REGION TRAFFIC OPERATIONS ENGINEER, PROVIDE DETECTION IN BOTH DIRECTIONS AT A MINIMUM ACCORDING TO NOTE F.
- E. COORDINATE WITH THE REGION TRAFFIC OPERATIONS ENGINEER TO DETERMINE WHICH OPTION TO USE, DO NOT INSTALL POST-MOUNTED AWS ON MULTILANE APPROACH WITHOUT APPROVAL FROM REGION TRAFFIC OPERATIONS ENGINEER.
- F. INSTALL ADVANCE DETECTION THE SAME DISTANCE FROM THE STOP BAR IN BOTH DIRECTIONS, STOP LINE DETECTION REQUIRED AT INTERSECTION IN BOTH DIRECTIONS FOR ALL LANES, PLACE ADVANCE DETECTION AS CLOSE TO CENTER OF THRU LANES AS POSSIBLE WHILE MAINTAINING SPACING AS SHOWN.
- G. PROTECT WITH AN APPROVED BARRIER OR GUARDRAIL SYSTEM WHEN POLE PLACEMENT IS WITHIN ROADSIDE CLEAR ZONE.

**OPTION C
OVERHEAD
BLANK-OUT
SIGN**

TYPE C MAST ARM
SIGNAL POLE
(SEE NOTE E, 3, 5, AND G
SEE STD DWG SL 1C)

UTAH DEPARTMENT OF TRANSPORTATION
STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION
RECOMMENDED FOR USE ON: SALT LAKE CITY, UTAH
APPROVED: *[Signature]* JAN 11 2017
DATE: JAN 11 2017
DESIGNED BY: *[Signature]*
CHECKED BY: *[Signature]*
DRAWN BY: *[Signature]*
SCALE: 1" = 10'

ADVANCE WARNING
SIGNAL (AWS) SYSTEM

STD. DWG. NO.
SL 8

Model
225

v 0.5

SmartSensor Matrix



SmartSensor Matrix

Model 225





Mounting location, height and offset

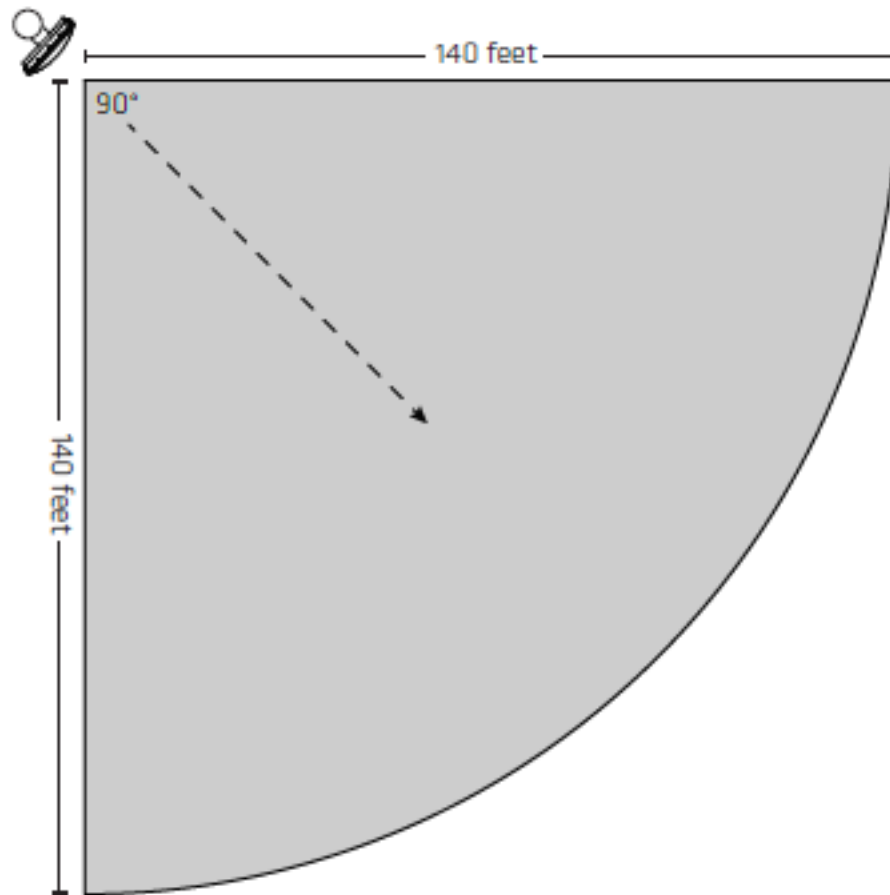


Figure 2. SmartSensor Matrix footprint (quarter circle with a 140 ft range)





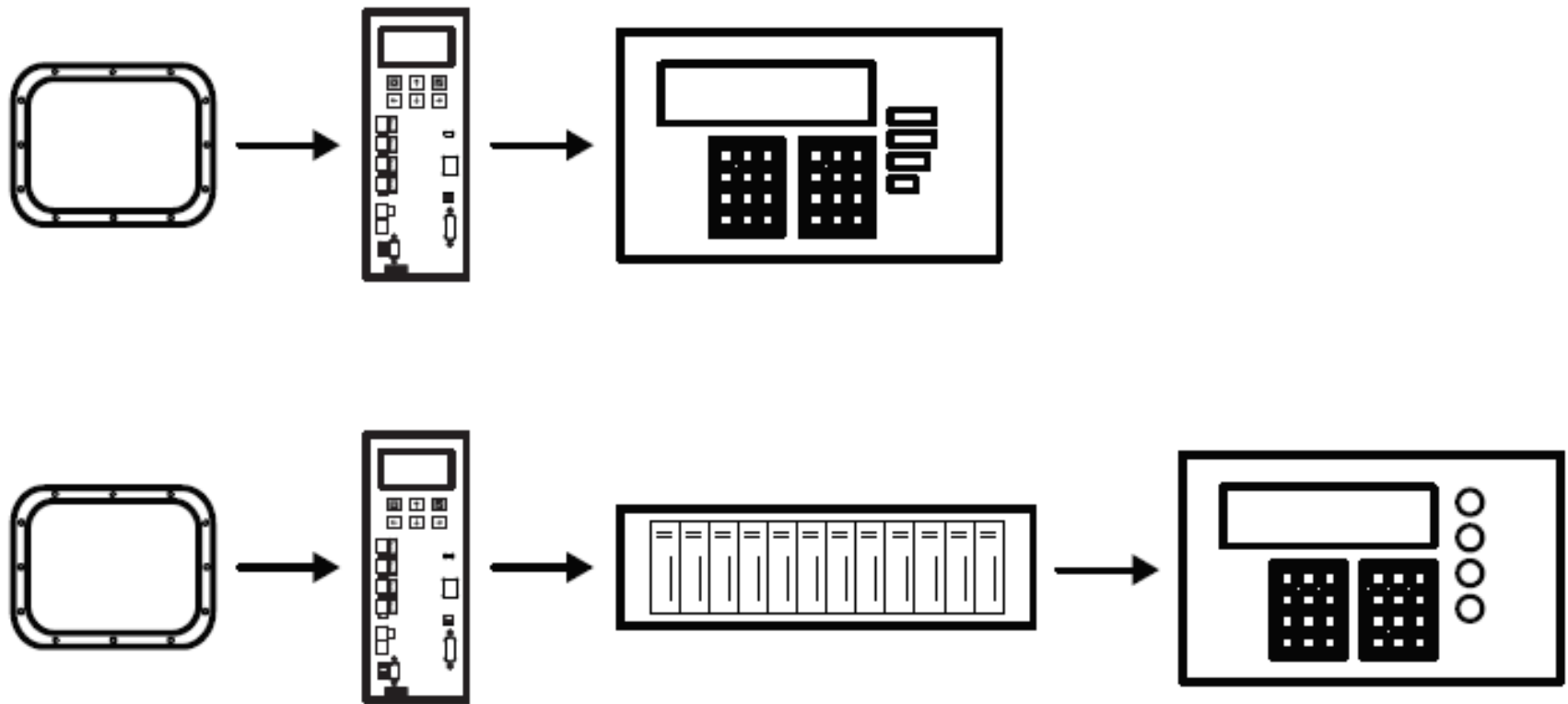
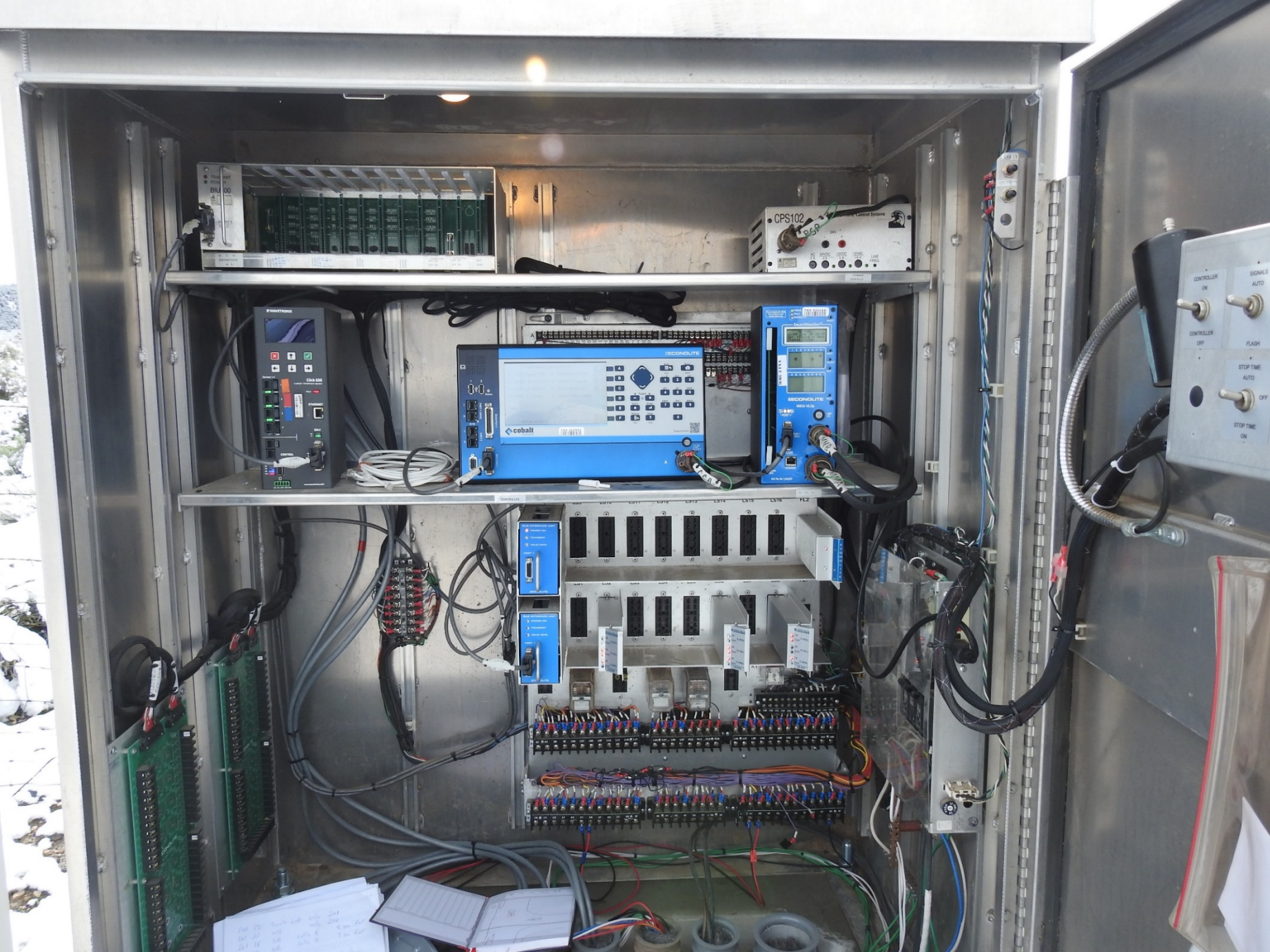


Figure 19. Click 650/656 using SDLC (above) and contact closures (below)



STATE FURNISHED MATERIALS / **SIGNAL** ** Submit signal orders to the Region Signal Engineer and to sfmaterials@utah.gov

Commodity Code	Description	Model #	Unit	Order Qty	Unit Price	Amount
RADAR DETECTION		Vendor Lead Time: 8 Weeks				
55082000015	ADVANCE SENSOR / EXTENDED RANGE	SS-200E	EA		\$3,572	
55082000032	MATRIX STOPBAR SENSOR	SS-225	EA		\$3,560	
??	MATRIX VISOR (Required for each new Matrix unit)	??	EA		\$1	
55082000080	SENSOR MOUNT	SS-611	EA		\$179	
55082000043	100' RADAR CABLE W/ CONNECTOR	SS-704-100	EA		\$352	
55082000044	120' RADAR CABLE W/ CONNECTOR (use for 70'-85' mast arms)	SS-704-120	EA		\$400	
55082000045	1,000' SPOOL - BULK RADAR CABLE (For Maintenance Use Only)	SS-705-001	EA		\$800	
55082000050	BURIED SERVICE SPLICING KIT (Ura Seal Epoxy Canister)	CK-200-BSV	EA		\$14.00	
55082000078	2 CHANNEL RACK CARD (Click-112)	CLK-112	EA	2	\$328	\$656.00
55082000164	4 CHANNEL RACK CARD (Click-114)	CLK-114	EA		\$347	
55082000067	RADAR 2 SENSOR BACKPLATE (use when deploying 1 or 2 radar units)	SS-B01-003	EA		\$1,180	
55082000069	RADAR 4 SENSOR BACKPLATE (Use for long cable runs - higher amp power supply)	SS-B01-005	EA	1	\$1,833	\$1,833.00
55082000085	CLICK-656 / 6-PORT RADAR INTERFACE (use for 4-Matrix + 2-Advance)	102-0451	EA		\$3,660	
55082000166	CLICK-650 / 4-PORT RADAR INTERFACE (use for only 3 or 4 radar units)	102-0416	EA		\$2,505	
STATE FURNISHED MATERIALS TOTAL:						\$2,489.00

STATE FURNISHED MATERIALS / SIGNAL

** Submit signal orders to the Region Signal Engineer and to sfmaterials@utah.gov

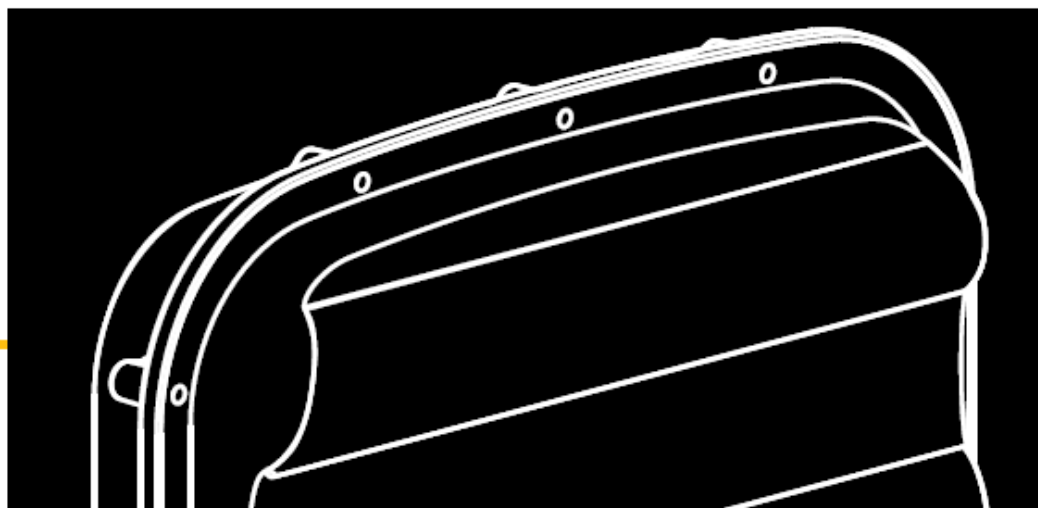
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55082000032	MATRIX STOPBAR SENSOR	SS-225	EA		\$3,560	
??	MATRIX VISOR (Required for each new Matrix unit)	??	EA		\$1	
55082000080	SENSOR MOUNT	SS-611	EA		\$179	
55082000043	100' RADAR CABLE W/ CONNECTOR	SS-704-100	EA		\$352	
55082000044	120' RADAR CABLE W/ CONNECTOR (use for 70'-85' mast arms)	SS-704-120	EA		\$400	
55082000045	1,000' SPOOL - BULK RADAR CABLE (For Maintenance Use Only)	SS-705-001	EA		\$800	
55082000050	BURIED SERVICE SPLICING KIT (Ura Seal Epoxy Canister)	CK-200-BSV	EA		\$14.00	
55082000078	2 CHANNEL RACK CARD (Click-112)	CLK-112	EA	3	\$328	\$984.00
55082000164	4 CHANNEL RACK CARD (Click-114)	CLK-114	EA		\$347	
55082000067	RADAR 2 SENSOR BACKPLATE (use when deploying 1 or 2 radar units)	SS-B01-003	EA		\$1,180	
55082000069	RADAR 4 SENSOR BACKPLATE (Use for long cable runs - higher amp power supply)	SS-B01-005	EA	1	\$1,833	\$1,833.00
55082000085	CLICK-656 / 6-PORT RADAR INTERFACE (use for 4-Matrix + 2-Advance)	102-0451	EA		\$3,660	
55082000166	CLICK-650 / 4-PORT RADAR INTERFACE (use for only 3 or 4 radar units)	102-0416	EA		\$2,505	
STATE FURNISHED MATERIALS TOTAL:						\$2,817.00

STATE FURNISHED MATERIALS / SIGNAL ** Submit signal orders to the Region Signal Engineer and to sfmaterials@utah.gov

Commodity Code	Description	Model #	Unit	Order Qty	Unit Price	Amount
RADAR DETECTION		Vendor Lead Time: 8 Weeks				
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55082000032	MATRIX STOPBAR SENSOR	SS-225	EA		\$3,560	
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55082000080	SENSOR MOUNT	SS-611	EA		\$179	
55082000043	100' RADAR CABLE W/ CONNECTOR	SS-704-100	EA		\$352	
55082000044	120' RADAR CABLE W/ CONNECTOR (use for 70'-85' mast arms)	SS-704-120	EA		\$400	
55082000045	1,000' SPOOL - BULK RADAR CABLE (For Maintenance Use Only)	SS-705-001	EA		\$800	
55082000050	BURIED SERVICE SPLICING KIT (Ura Seal Epoxy Canister)	CK-200-BSV	EA		\$14.00	
55082000078	2 CHANNEL RACK CARD (Click-112)	CLK-112	EA	4	\$328	\$1,312.00
55082000164	4 CHANNEL RACK CARD (Click-114)	CLK-114	EA		\$347	
55082000067	RADAR 2 SENSOR BACKPLATE (use when deploying 1 or 2 radar units)	SS-B01-003	EA		\$1,180	
55082000069	RADAR 4 SENSOR BACKPLATE (Use for long cable runs - higher amp power supply)	SS-B01-005	EA	1	\$1,833	\$1,833.00
55082000085	CLICK-656 / 6-PORT RADAR INTERFACE (use for 4-Matrix + 2-Advance)	102-0451	EA		\$3,660	
55082000166	CLICK-650 / 4-PORT RADAR INTERFACE (use for only 3 or 4 radar units)	102-0416	EA		\$2,505	
STATE FURNISHED MATERIALS TOTAL:						\$3,145.00

STATE FURNISHED MATERIALS / SIGNAL ** Submit signal orders to the Region Signal Engineer and to sfmaterials@utah.gov

Commodity Code	Description	Model #	Unit	Order Qty	Unit Price	Amount
RADAR DETECTION		Vendor Lead Time: 8 Weeks				
55082000015	ADVANCE SENSOR / EXTENDED RANGE	SS-200E	EA		\$3,572	
55082000032	MATRIX STOPBAR SENSOR	SS-225	EA		\$3,560	
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55082000050	BURIED SERVICE SPLICING KIT (Ura Seal Epoxy Canister)	CK-200-BSV	EA		\$14.00	
55082000078	2 CHANNEL RACK CARD (Click-112)	CLK-112	EA		\$328	
55082000164	4 CHANNEL RACK CARD (Click-114)	CLK-114	EA		\$347	
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55082000069	RADAR 4 SENSOR BACKPLATE (Use for long cable runs - higher amp power supply)	SS-B01-005	EA		\$1,833	
55082000085	CLICK-656 / 6-PORT RADAR INTERFACE (use for 4-Matrix + 2-Advance)	102-0451	EA		\$3,660	
55082000166	CLICK-650 / 4-PORT RADAR INTERFACE (use for only 3 or 4 radar units)	102-0416	EA	1	\$2,505	\$2,505.00
STATE FURNISHED MATERIALS TOTAL:						\$2,505.00



SmartSensor Advance

USER GUIDE

SmartSensor Advance

Intersections



SmartSensor Advance



Watch later



Share



Mounting location, height and offset

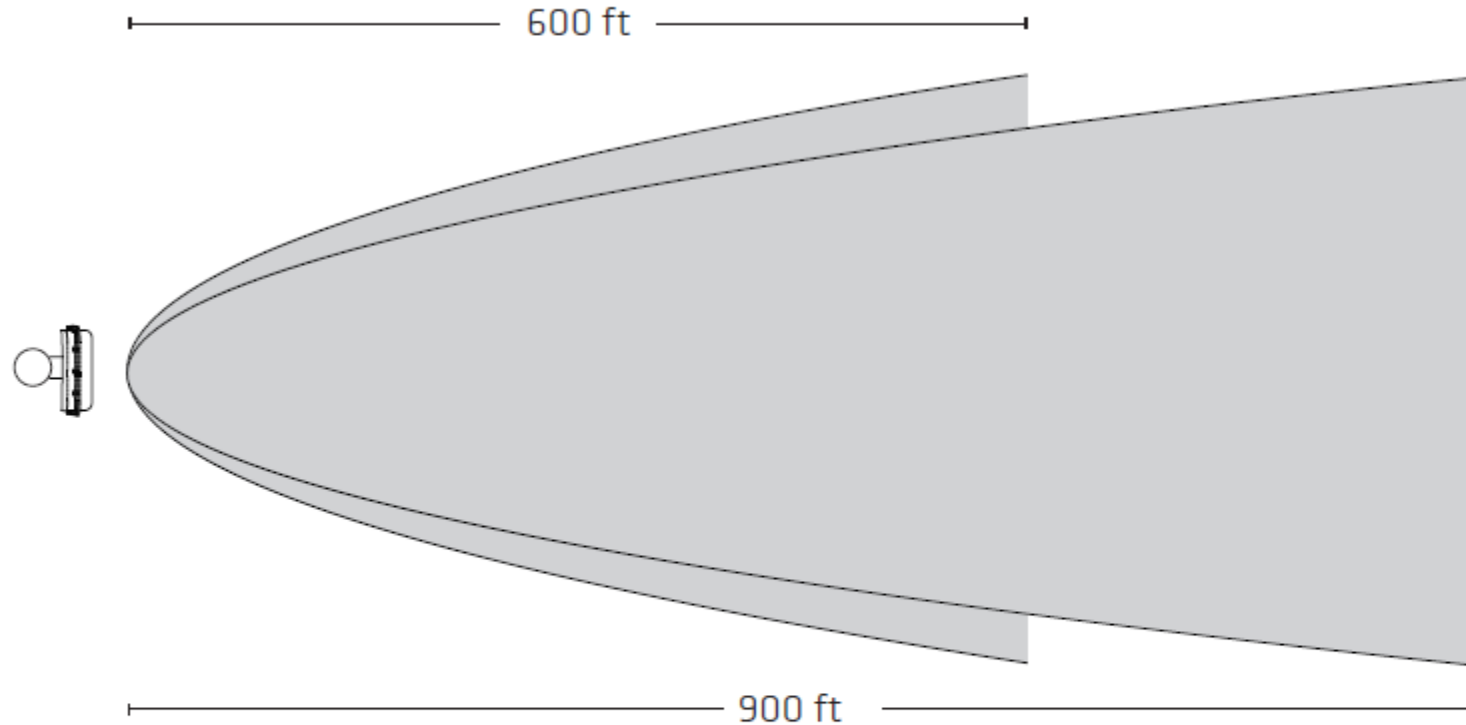


Figure 2. The SmartSensor Advance and Advance Extended Range footprint

- The SmartSensor Advance and SmartSensor Advance Extended Range detect moving traffic out to a maximum range of 600 ft. (182.9 m) and 900 ft. (274.3 m) respectively.
- Make sure the sensor has a clear view of the area you want to detect.

Intersection of US-89 & SR-12



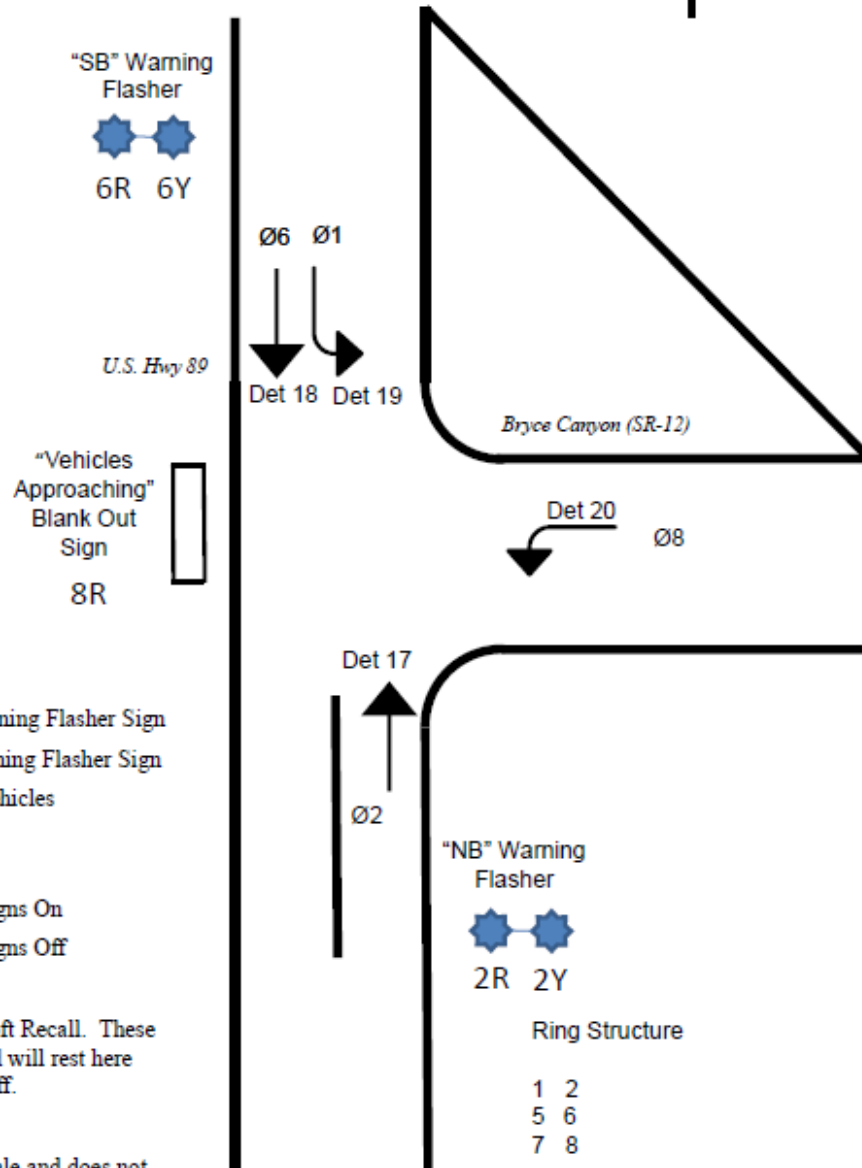
Signal#8277

Bryce Canyon (SR-12)

U.S. Hwy 89 (US-89)

Proposed Phasing Diagram

02/01/18 - T.Noall



Notes:

- Phases 1,2: NB Warning Flasher Sign
- Phases 5,6: SB Warning Flasher Sign
- Phases 7,8: WB "Vehicles Approaching" Sign
- Phases 2, 6 & 8 = Signs On
- Phases 1, 5 & 7 = Signs Off
- Phases 1, 5 & 7 = Soft Recall. These phases are in use and will rest here when the signs are off.
- Diagram is not to scale and does not show number of lanes

US 89 and SR 12 Controller Operation

Detector 17 NB Advance Calls Ø8 EB and has 7 sec extension

Detector 18 SB advance calls Ø8 EB and has 9 sec extension

Detector 19 SBL Matrix calls Ø2 and Ø8 and has 3 sec extension

Detector 20 WB Matrix calls Ø2 and Ø6 and has 1.5 sec extension

Logic 1 flashes one LED through Red 6 output for SB

Logic 2 flashes one LED through Yellow 6 output for SB

Logic 3 flashes one LED through Red 2 output for NB

Logic 4 flashes one LED through Yellow 2 output for NB

Logic 5 controls Ø8 WB LED sign.

NB advance detects from 700 to 1395 ft. and extension time covers the rest of the distance.

SB advance detects from 830 to 1630 ft. and extension time covers the rest of the distance.

Under a MMU or Controller Flash one NB, one SB and one WB sign will flash.

LOAD SWITCH ASSIGNMENT

Write the controller phase assignment in the space provided for each channel. Write the physical connection for each color in the space provided.

[illegible]

MMU PROGRAM CARD JUMPERS

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
															1
				X		X									2
															3
															4
															5
						X									6
															7
															8
															9
															10
															11
															12
															13
															14
															15
															16

Min Yellow Disable							
1	2	3	4	5	6	7	8
	X				X		X
9	10	11	12	13	14	15	16

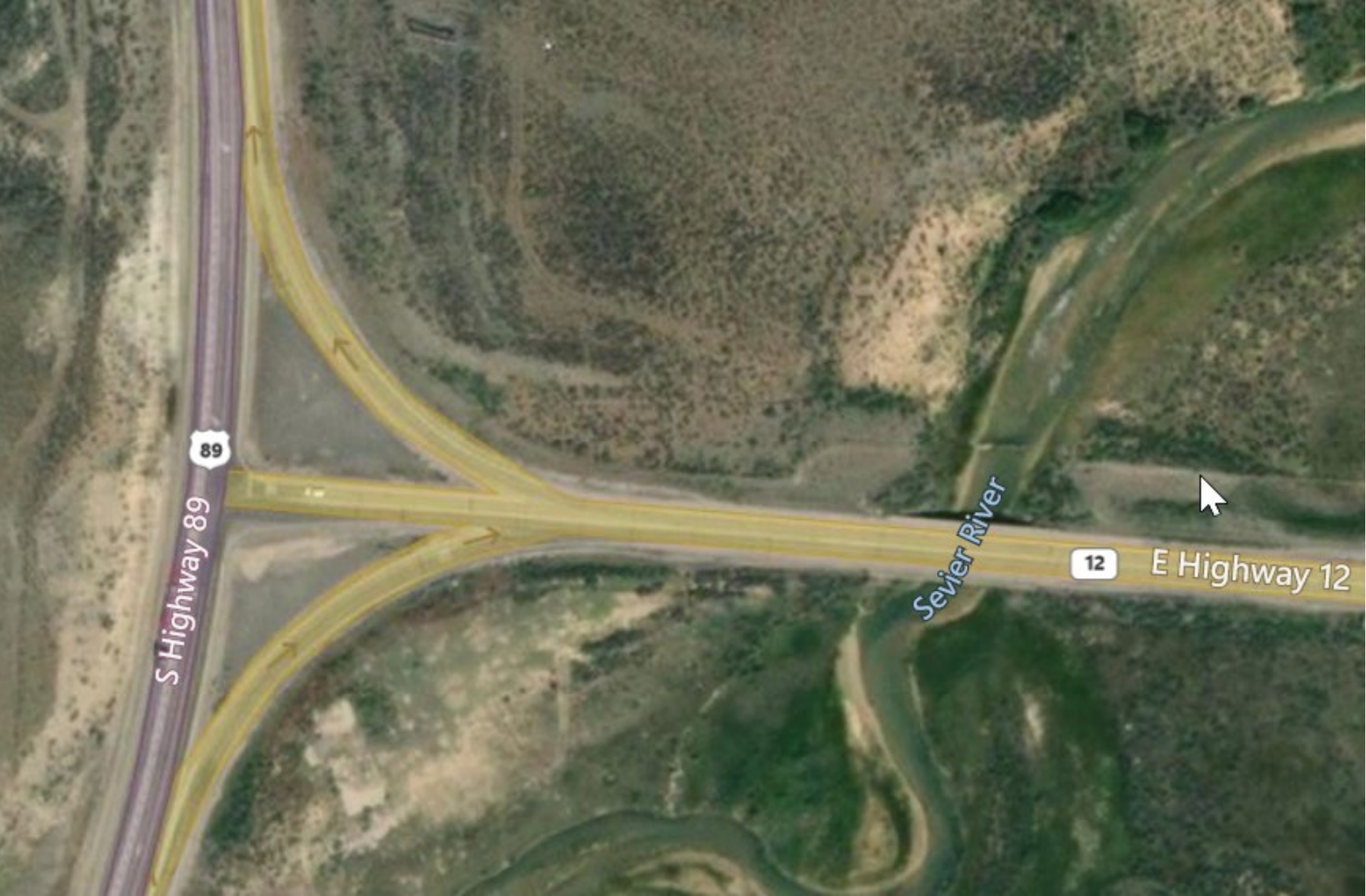
MMU TYPE REQUIRED

- | | |
|-------------------------------------|---|
| ☐ | Any Monitor Will Work |
| ☒ | SmartMonitor MMU-16LE
(EDI or Econolite) |
| ☐ | Reno A&E MMU-1600GE |

CONTROLLER TYPE

- | | |
|-------------------------------------|--------------------------|
| ☐ | Any Controller Will Work |
| ☐ | Econolite ASC/2 |
| ☐ | Econolite ASC/3 |
| ☐ | Siemens/Eagle m50 |
| ☐ | NextPhase on m50 |
| ☒ | Other (see notes) |
| ☐ | Type 1 |
| ☐ | Type 2 |
| ☐ | Other (see notes) |

	DESCRIPTION			IF		THEN		ELSE	
1	Enabling one side of the wig wag portion of the SB flasher.	IF	--	CTR PHASE TIMING	6 ON	SIG SET PHASE RED	6 ON	SIG SET PHASE RED	6 OFF
1		AND	--	LP COB CODE ON	546				
1			--						
1			--						
1			--						
1			--						
1			--						
1			--						
1			--						
2	Enabling the other side of the wig wag portion of the SB flasher.	IF	--	CTR PHASE TIMING	6 ON	SIG SET PHASE YELLOW	6 ON	SIG SET PHASE YELLOW	6 OFF
2		AND	--	LP COB CODE OFF	546				
2			--						
2			--						
2			--						
2			--						
2			--						
2			--						
2			--						
3	Enabling one side of the wig wag portion of the NB flasher.	IF	--	CTR PHASE TIMING	2 ON	SIG SET PHASE RED	2 ON	SIG SET PHASE RED	2 OFF
3		AND	--	LP COB CODE ON	546				
3			--						
3			--						
3			--						
3			--						
3			--						
3			--						
3			--						
4	Enabling the other side of the wig wag portion of the NB flasher.	IF	--	CTR PHASE TIMING	2 ON	SIG SET PHASE YELLOW	2 ON	SIG SET PHASE YELLOW	2 OFF
4		AND	--	LP COB CODE OFF	546				
4			--						
4			--						
4			--						
4			--						
4			--						
4			--						
4			--						
5	Enables the "Vehicles Approaching" sign.	IF	--	CTR PHASE TIMING	8 ON	SIG SET PHASE RED	8 ON	SIG SET PHASE RED	8 OFF
5		OR	--						
5			--						
5			--						
5			--						
5			--						
5			--						
5			--						
5			--						







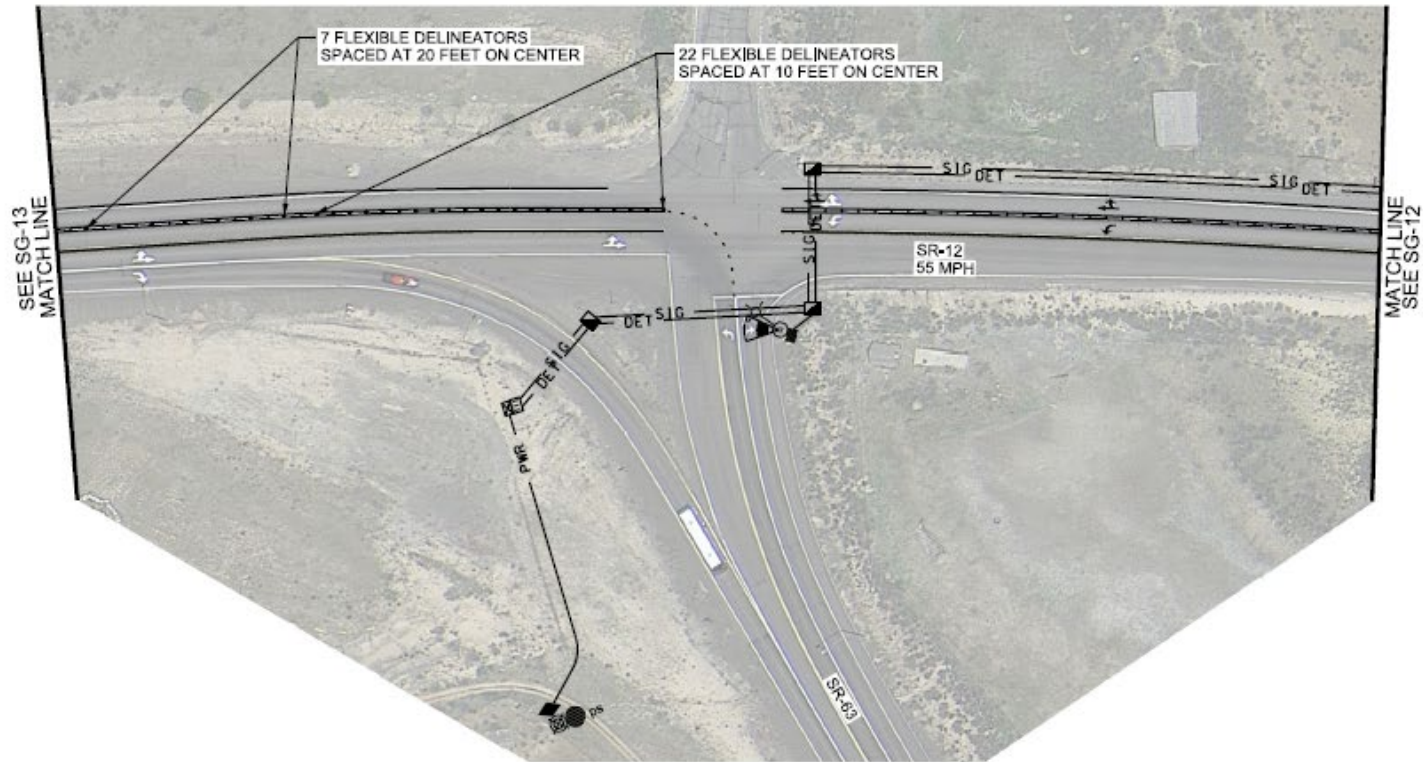






Intersection of SR-12 and SR-63



PIN: 15523
PROJECT NO. S-R499(310)R4 RURAL INTERSECTION TRAFFIC DETECTION
SIGNALSHEET NO.
SG-11

SR-12 & SR-63 INTERSECTION

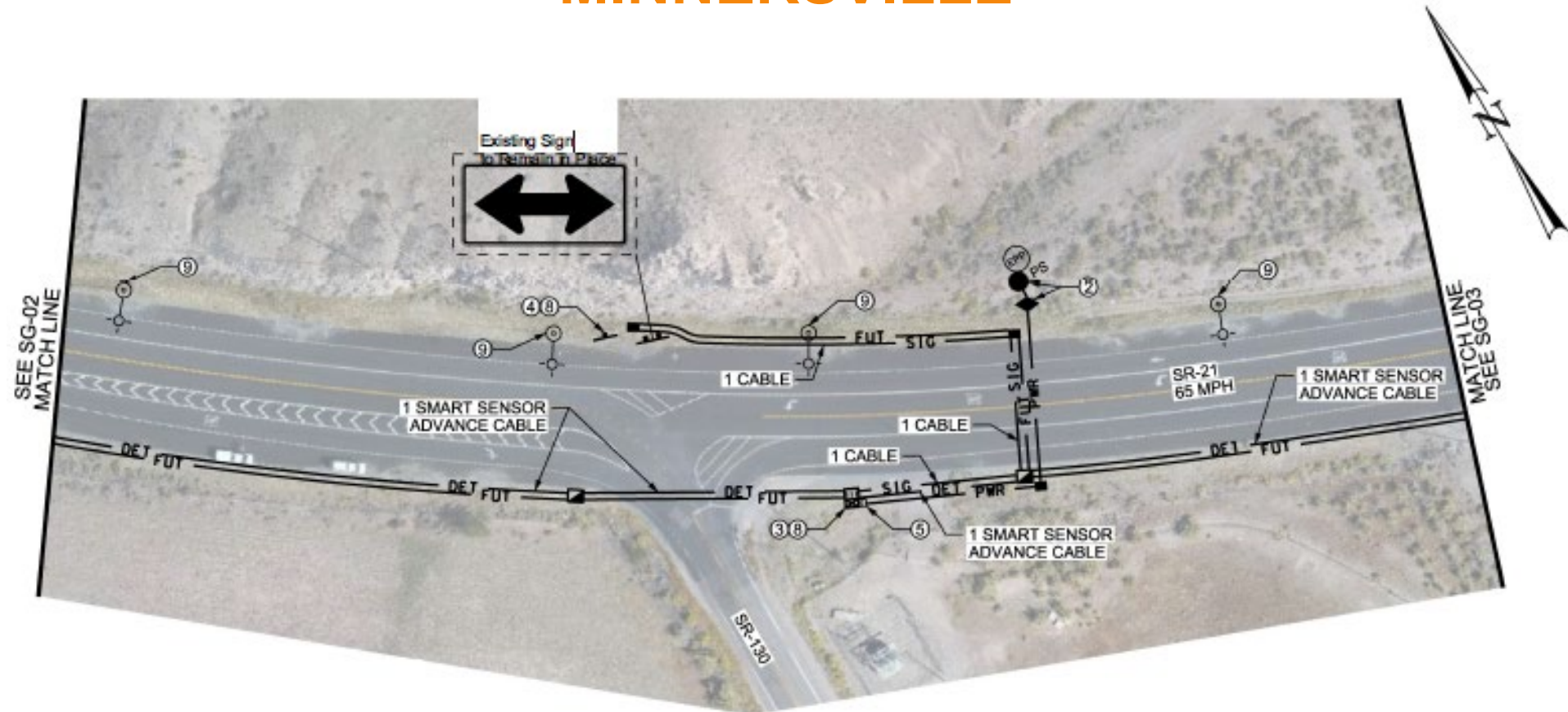
Intersection of SR-21 & SR-130







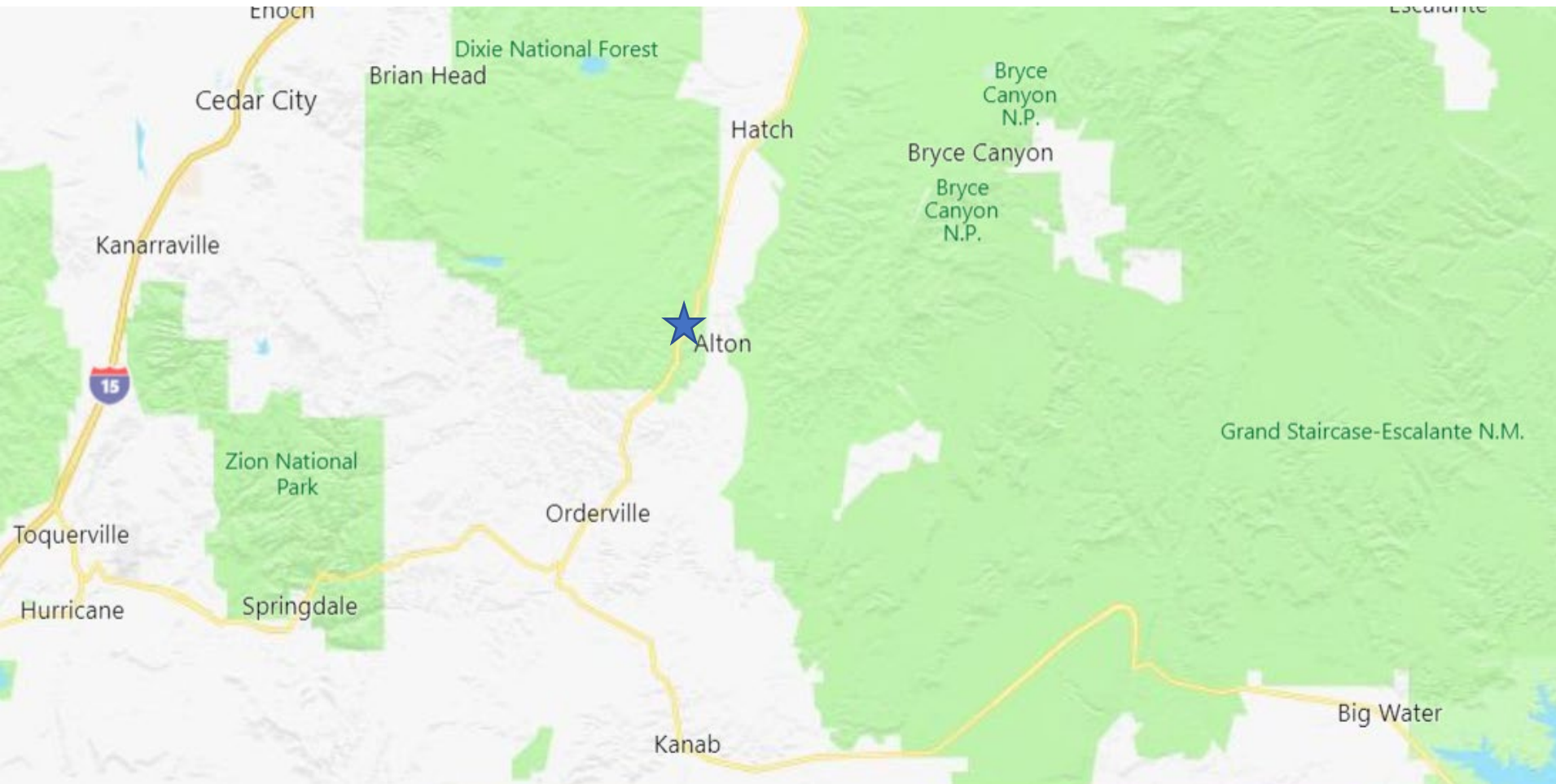
SR-21 & SR-130 INTERSECTION MINNERSVILLE





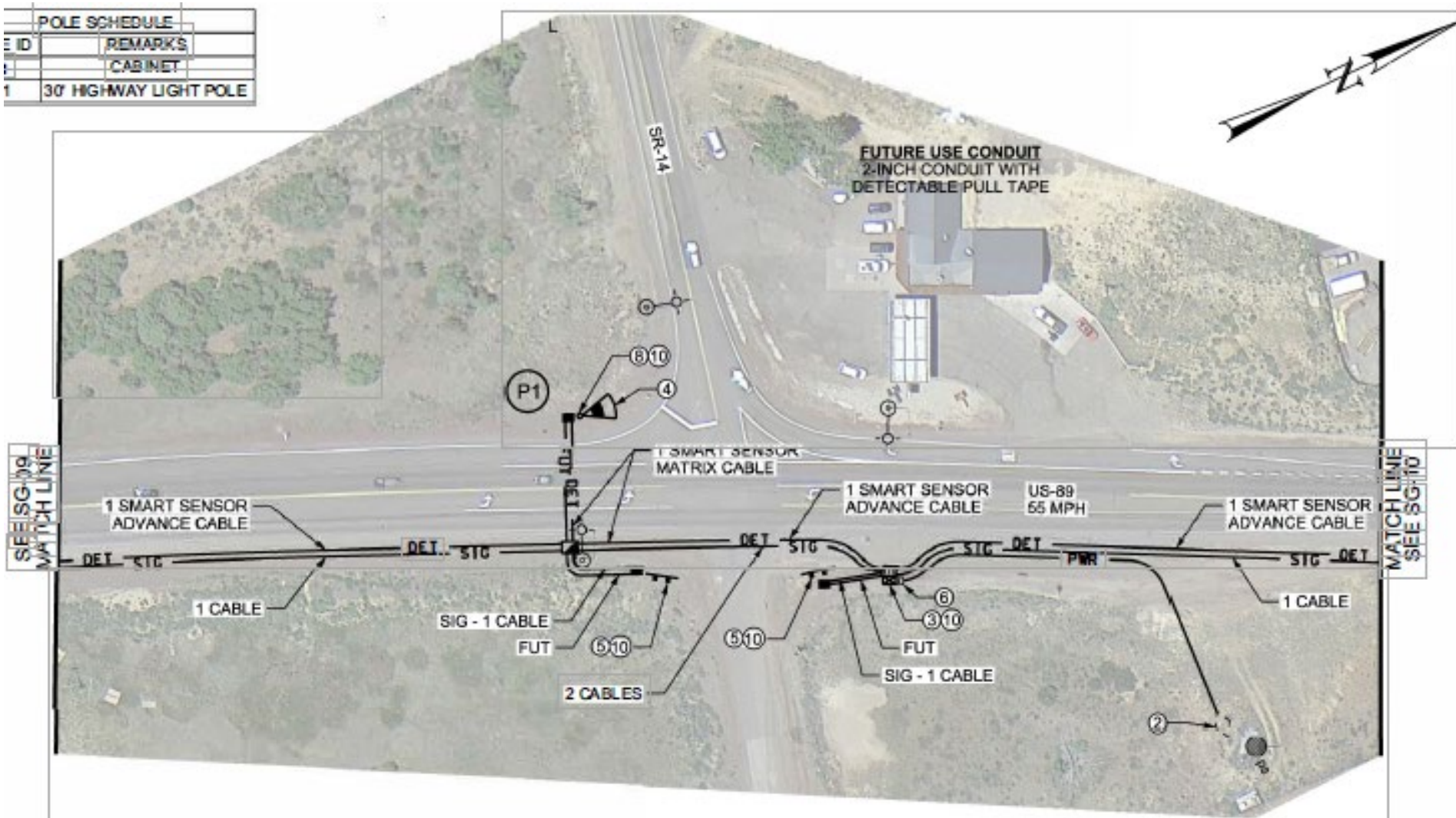


Intersection of US-89 and SR-14



US-89 & SR-14 INTERSECTION

Tod's Junction

















Intersection of SR-18 and Diamond Valley Drive





PIN: 15523
PROJECT NO. S-R499(310)

R4 RURAL INTERSECTION TRAFFIC DETECTION
SIGNAL

SHEET NO.
SG-04



SR-18 & DIAMOND VALLEY INTERSECTION



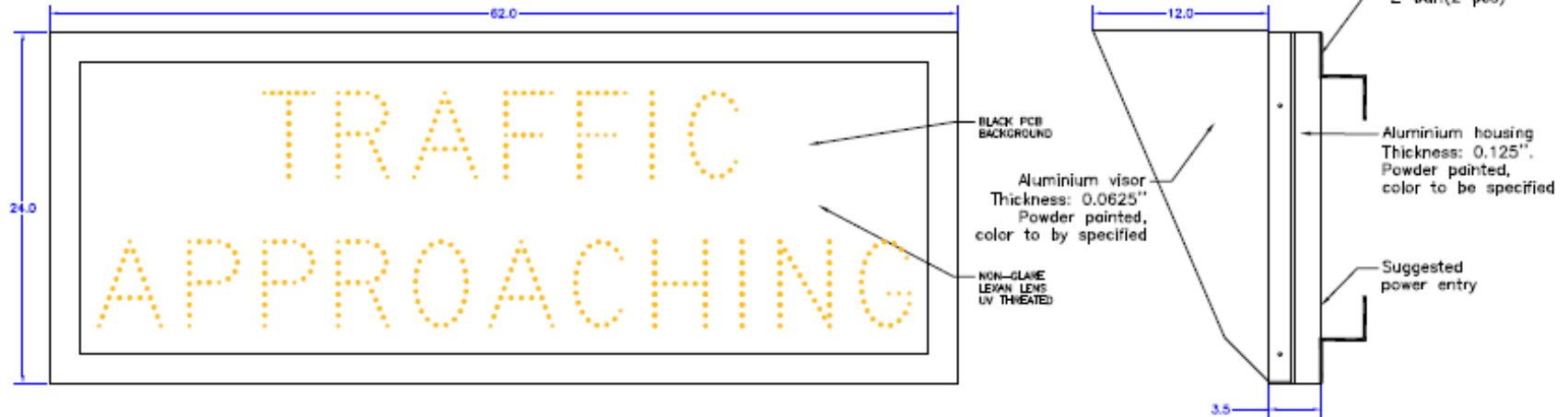
Lessons Learned







REVISION	DESCRIPTION	DATE	INI.
0	FOR SUBMITTALS	10 MAR-17	D.L
1	FOR SUBMITTALS	JUNE 6-18	D.L
2	FOR SUBMITTALS	JULY 24-18	D.L



- 350 AMBER HIGH INTENSITY LED'S
- SINGLE STROKE TEXT
- 6" SERIES D CHARACTERS
- PROGRESSIVE DIMMING IN 1000 STEPS
- ALUMINUM Z-BAR INCLUDED

FIELD DRILLED

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DWG BY:
DL

APP. BY:
DL
14 / 17

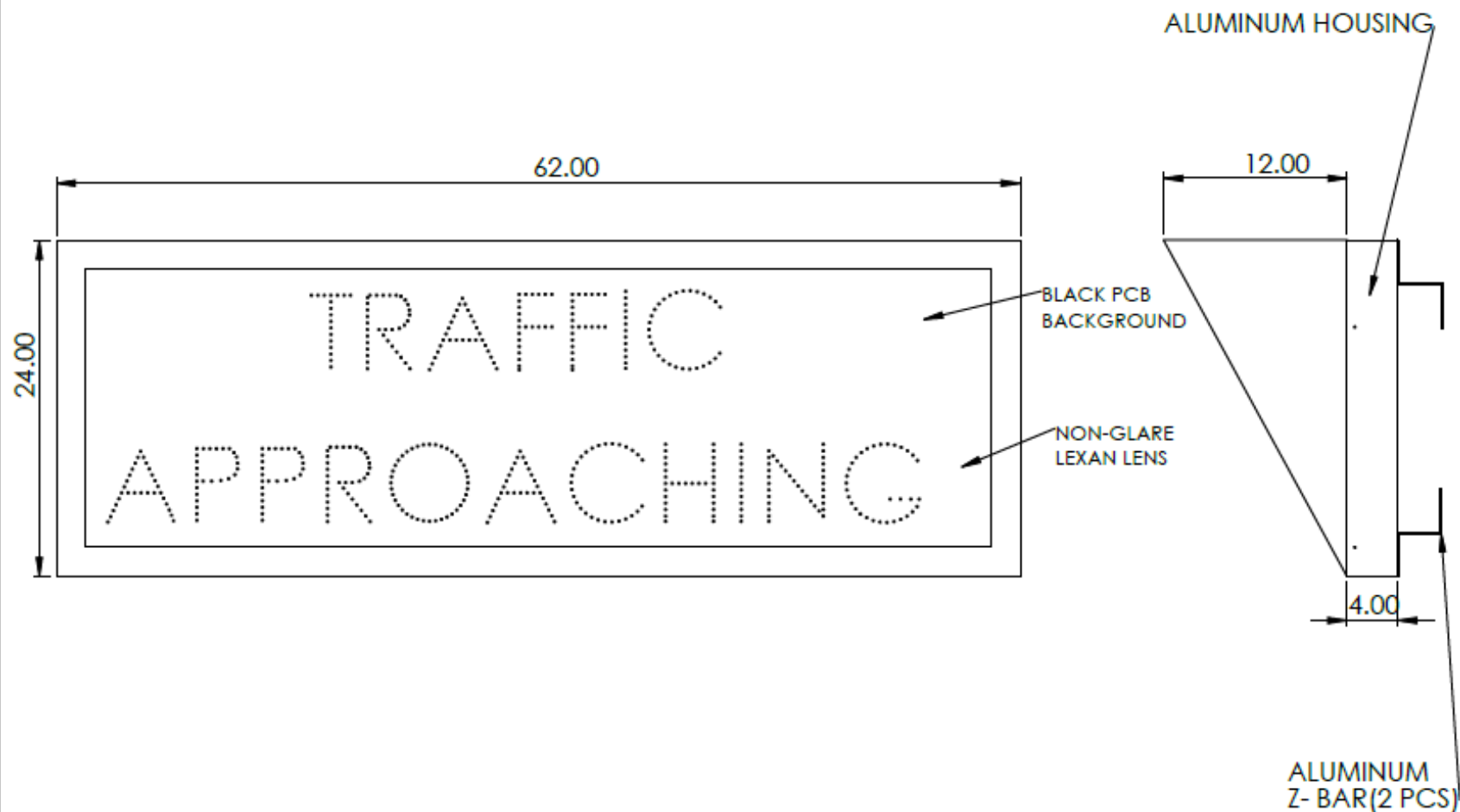
TITLE: LED TRAFFIC APPROACHING BLANK-OUT SIGN,
LIGHT VERSION
EXTERIOR BODY

P/N: LLS 2462-TA5A

REV:
2

DRAWING:
LLS-2052-TA5A

DATE:
MARCH 2017

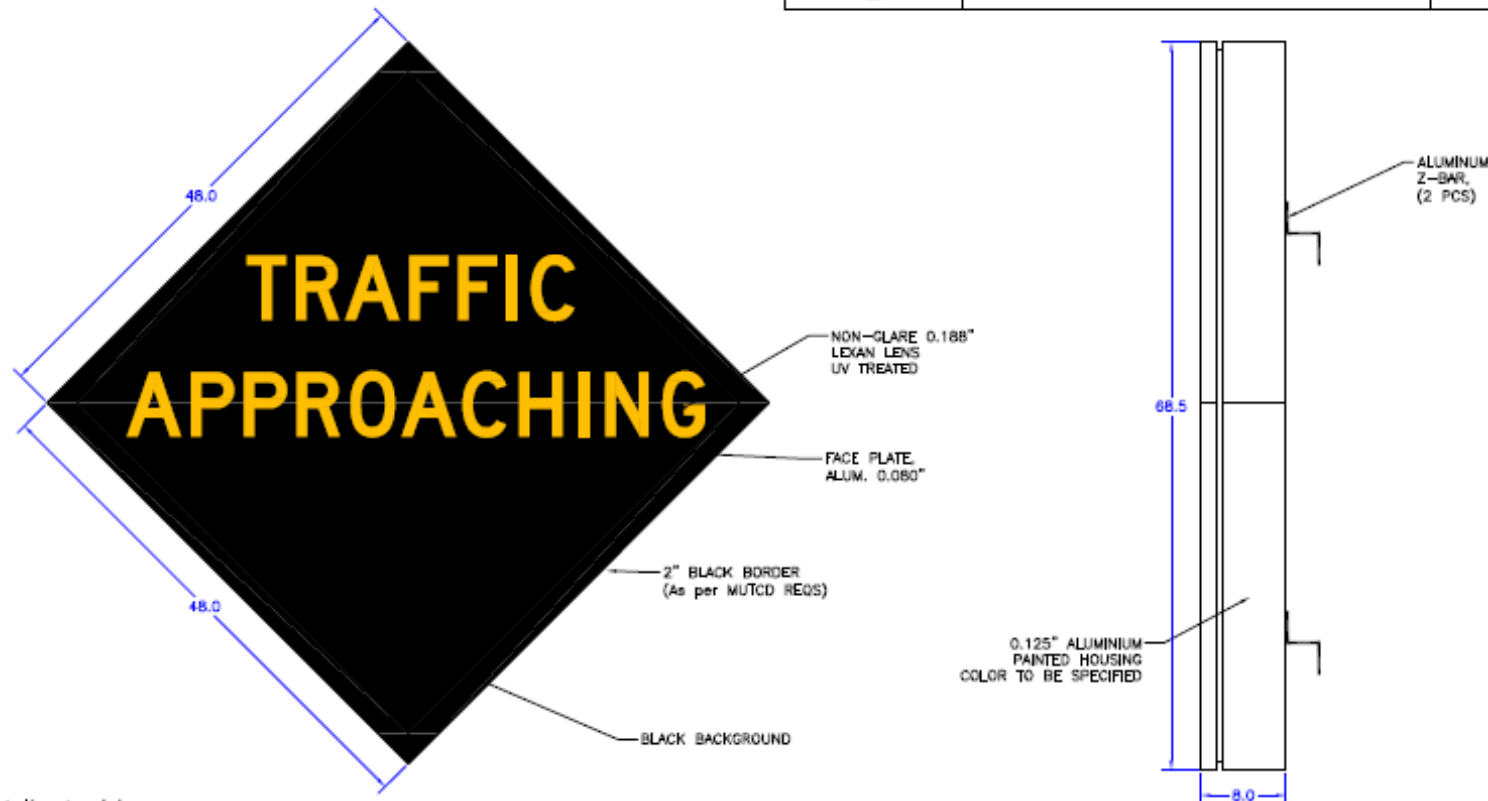


	NAME	DATE	K & K SYSTEMS	Office: (662) 566-2025 www.k-k-systems.com
DRAWN	RAGHS	8/10/2018		
CHECKED	MIKE	8/10/2018	TITLE: Traffic Approaching	DWG. NO.
PROPRIETARY AND CONFIDENTIAL				
The information contained in this drawing is the sole property of K & K Systems. Any reproduction in part or as a whole without the written permission of K & K Systems is prohibited.				
			Stamped Traffic Approaching	
			Scale: 1:1	Size: 8.5 X 11
			Sheet: 1 of 1	

TRAFFIC
APPROACHING



REVISION	DESCRIPTION	DATE	INI.
0	FOR DISCUSSION	APRIL 17-18	D.L.
1	FOR SUBMITTALS	JUNE 6-18	D.L.
2	FOR SUBMITTALS	JULY 24-18	D.L.



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MESSAGE DESCRIPTION

- SINGLE STROKE MESSAGE, 6"-SERIES D CHARACTERS
- HIGH INTENSITY AMBER LED'S
- ONE 120Vdc INPUT;
- PROGRESSIVE DIMMING IN 1000 STEPS
- TWO INTERNAL STIFFENER CHANNELS RUNNING VERTICALLY FROM TOP TO THE BOTTOM OF THE SIGN.
- Z-BARS INCLUDED

ALL DIMENSIONS IN INCHES

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2018/04/17

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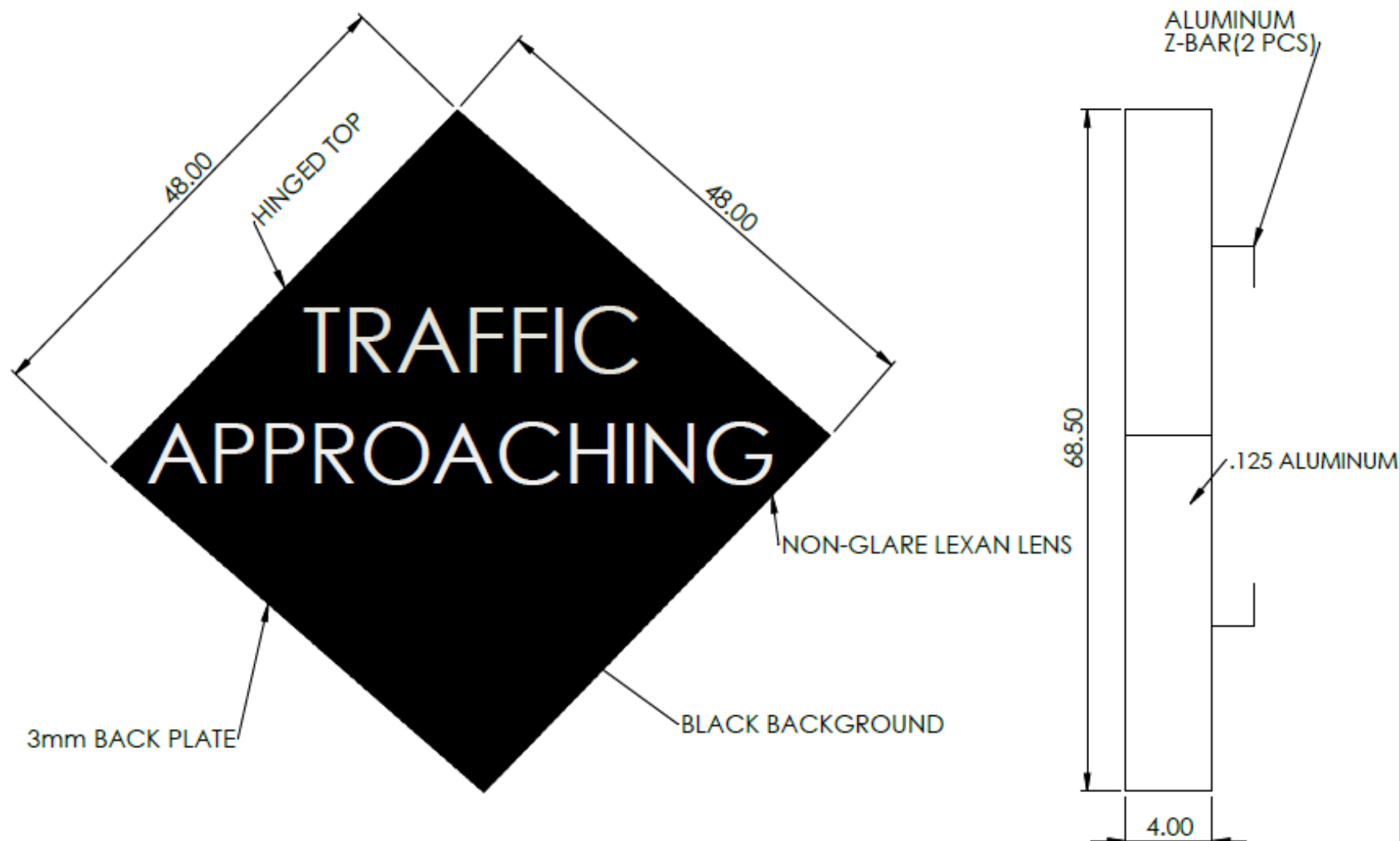
DWG BY:
DL

APP BY:
AM
10 / 17

TITLE: LED TRAFFIC APPROACHING BLANK-OUT SIGN
EXTERIOR BODY AND MESSAGE DESCRIPTION

P/N: LS AWS4848-TA5

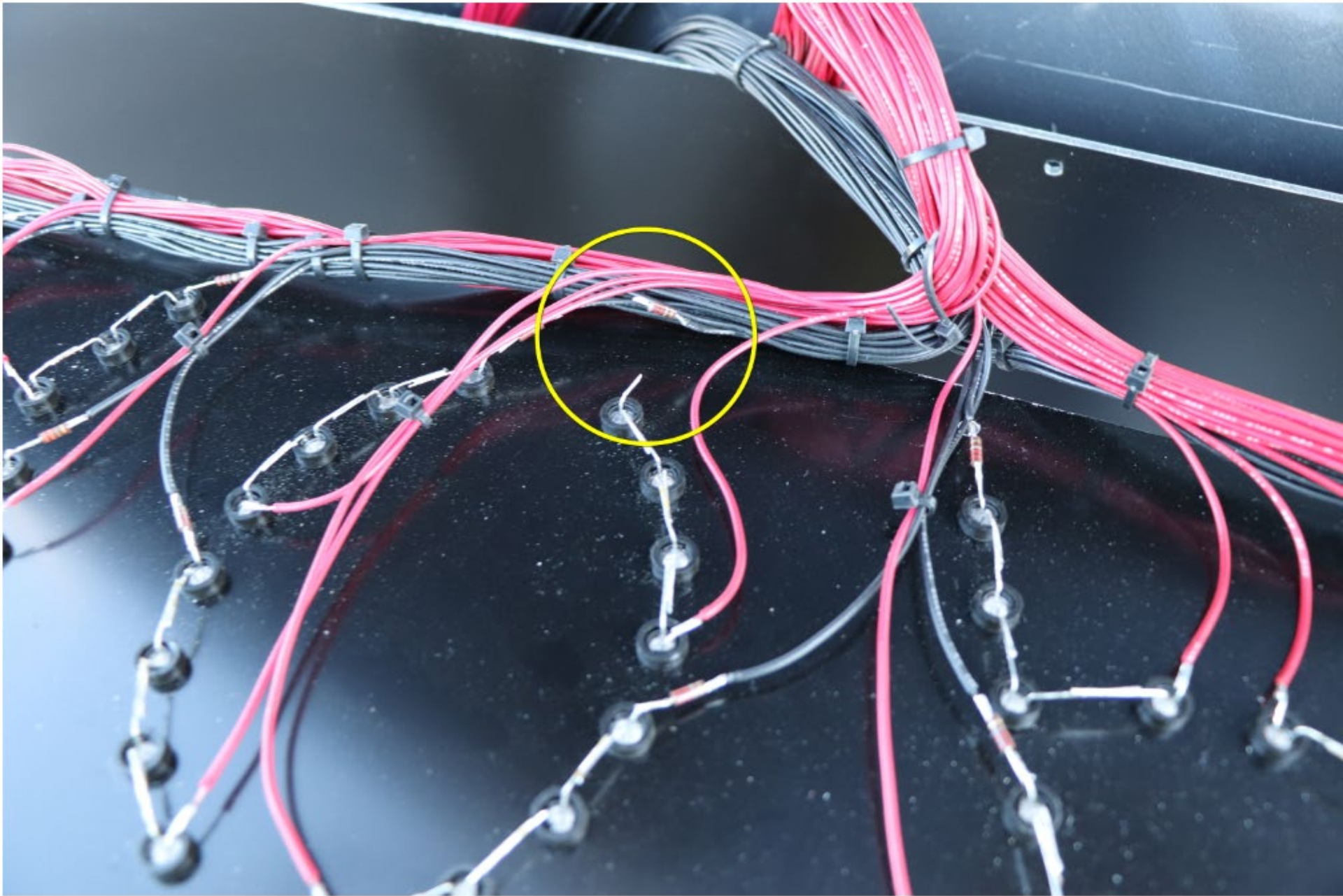
REV: 2	DRAWING: L-LSAWS4848-TA5	DATE: APRIL 2018
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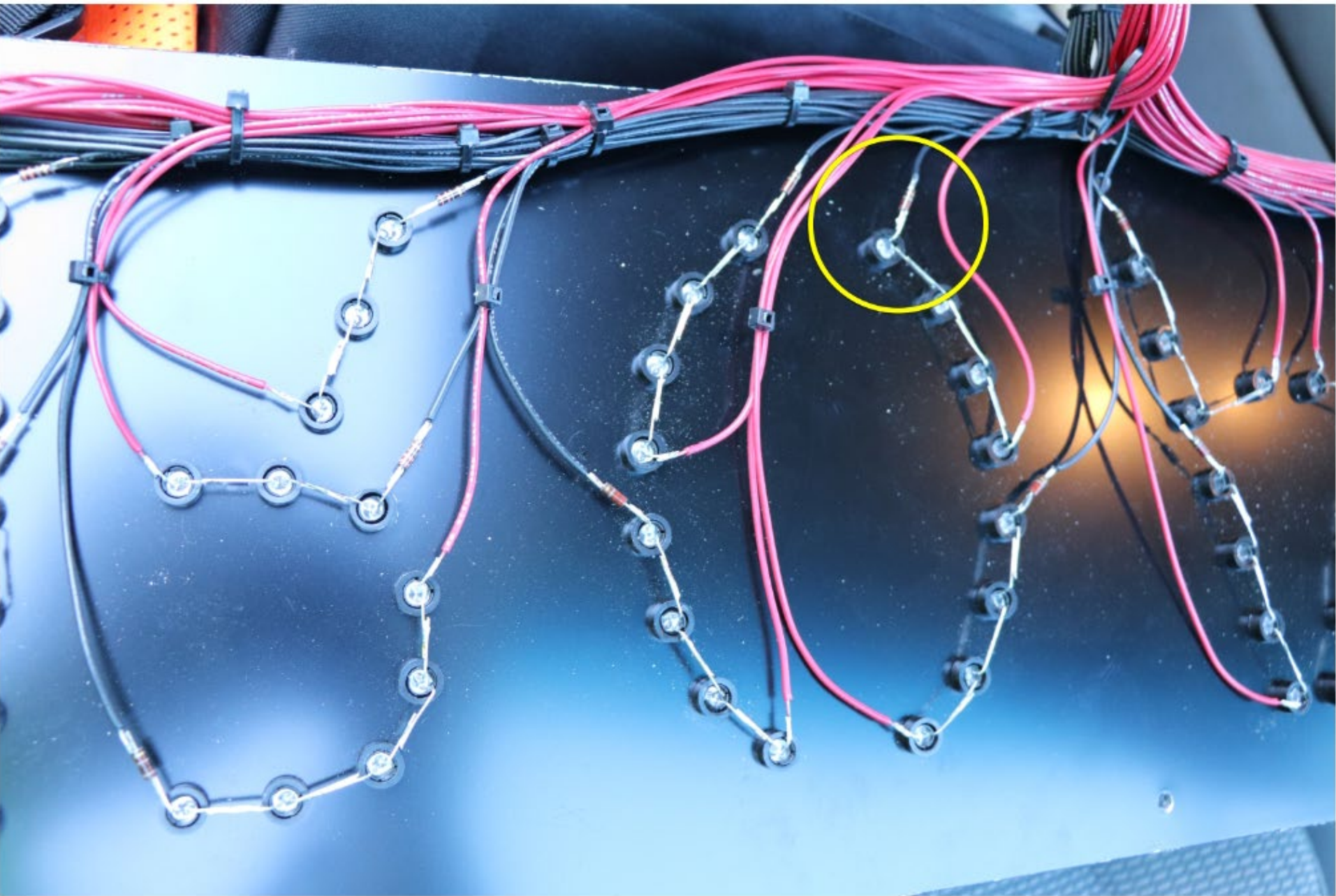


	NAME	DATE	K & K SYSTEMS	Office: (662) 566-2025 www.k-k-systems.com
DRAWN	RAGHS	8/10/2018	TITLE: Traffic Approaching	
CHECKED	MIKE	8/10/2018		
PROPRIETARY AND CONFIDENTIAL The information contained in this drawing is the sole property of K & K Systems. Any reproduction in part or as a whole without the written permission of K & K Systems is prohibited.			DWG. NO.	Backlit Traffic Approaching
			Scale: 1:1	Size: 8.5 X 11 Sheet: 1 of 1











SUMMARY / QUESTIONS

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