



# **APPENDIX C:**

## **Intersection Control Evaluation**





# INTERSECTION CONTROL EVALUATION

A sequential approach was used to identify and evaluate 9 of the key intersections within the corridor (Hayes Creek Rd, Cochise Dr, Bird Ln, Mormon Creek Rd, Delarka Dr S, Rowan St, Carlton Creek Rd, Chief Looking Glass Rd, and Long Ave). The approach was developed based on FHWA’s *Intersection Control Evaluation (ICE)* process, but tailored to the needs of each location. The ICE process is a data-driven approach developed to objectively evaluate and screen alternatives. For this study, the evaluation process was used to determine fatal flaws that warrant elimination from further consideration. Several options may be appropriate for each intersection and will need to be evaluated in greater detail during future design phases depending on selected corridor improvement strategies.

## Alternatives Identification

A list of improvement alternatives was developed for the major intersections within the corridor. The alternatives include a variety of traffic control options and geometric improvements. The alternatives were identified with the intent to address identified operational and safety concerns. A total of five alternatives were identified. Due to differences in existing intersection characteristics, only the alternatives that were considered applicable to each intersection were evaluated. The alternatives are presented in the table below.

ALTERNATIVE	DESCRIPTION
ENHANCED STOP CONTROL	<ul style="list-style-type: none"><li>• Provide stop control on minor approach legs</li><li>• Provide additional lanes to accommodate turning vehicles as needed</li><li>• Allow all turning movements</li></ul>
TRAFFIC SIGNAL	<ul style="list-style-type: none"><li>• Use a traffic signal to direct and control traffic</li><li>• Provide appropriate turn lanes and signal phasing</li><li>• Allow all turning movements</li></ul>
MULTI-LANE ROUNDABOUT	<ul style="list-style-type: none"><li>• Use a roundabout to direct and control traffic</li><li>• Entering vehicles yield to circulating traffic</li><li>• Allow all turning movements</li></ul>
RCUT	<ul style="list-style-type: none"><li>• Allow right and left turns from mainline to minor approaches</li><li>• Allow only right turns from minor approaches</li><li>• Provide u-turn opportunities at downstream locations</li><li>• Provide unrestricted mainline traffic flow</li></ul>
CONTINUOUS T	<ul style="list-style-type: none"><li>• Use only at three-legged intersections</li><li>• Provide a channelized receiving lane for left-turning vehicles from the minor approach to merge onto the mainline</li><li>• Stop control on minor approach</li></ul>


## Evaluation Criteria

An evaluation was conducted to screen the identified alternatives for each intersection and to eliminate those exhibiting fatal flaws. Four evaluation criteria were selected for the analysis. The criteria were identified based on the issues and concerns identified at the study intersections. The table below lists the evaluation criteria and a description of the elements and evaluation methodology for each, including both qualitative and quantitative components.

CRITERIA	DESCRIPTION	METHODOLOGY
SAFETY	<ul style="list-style-type: none"><li>• Reduce vehicle conflicts</li><li>• Address historic crash trends</li><li>• Provide adequate visibility and sight distance</li></ul>	<ul style="list-style-type: none"><li>• Reviewed relevant Crash Modification Factors (CMFs) to understand how changes in traffic control and roadway configuration may affect safety</li><li>• Compared to the crashes that occurred between 2012 and 2021 within 250 feet of each intersection</li></ul>
OPERATIONS	<ul style="list-style-type: none"><li>• Improve intersection performance</li><li>• Reduce vehicle delay</li><li>• Accommodate all users</li><li>• Facilitate efficient highway operations</li></ul>	<ul style="list-style-type: none"><li>• Used the FHWA <i>Capacity Analysis for Planning of Junctions (Cap-X)</i> tool which offers a planning-level assessment of the overall performance of various intersection configurations based on the volume to capacity (V/C) ratio</li><li>• Assessed operations under existing conditions using traffic volumes collected in 2022 and 2023 and long-term (2045) conditions using a 1.0% annual growth rate</li><li>• Considered potential for signal warrants to be met under existing and projected conditions</li><li>• Qualitatively assessed the ability of each alternative to facilitate efficient US 93 highway operations for mainline traffic including large trucks and emergency personnel</li></ul>
IMPACTS	<ul style="list-style-type: none"><li>• Minimize impacts to the environment</li><li>• Minimize impacts to adjacent land</li><li>• Minimize construction impacts</li></ul>	<ul style="list-style-type: none"><li>• Assessed the relative level of impact of each alternative to the environment and adjacent land uses including the potential acquisition of right-of-way or conversion of open space to developed land</li><li>• Considered the constructability and traffic impacts that may be experienced during construction</li></ul>
IMPLEMENTATION	<ul style="list-style-type: none"><li>• Balance improvement benefits and costs</li><li>• Enable reasonable project delivery timeframe</li></ul>	<ul style="list-style-type: none"><li>• Considered the relationship between relative implementation costs and anticipated project benefits</li><li>• Considered overall project cost as a potentially prohibitive factor. High-cost projects may take a longer time to implement while low-cost improvements are generally easier to implement in the short term</li></ul>

## Evaluation Scale



All intersection alternatives were evaluated on a qualitative scale based on their respective performance compared to other intersection alternatives. Lower scores represent poor performance and/or high impacts while higher scores represent exceptional performance and/or low impacts. Any alternative receiving a  for any of the four evaluation criteria was considered to exhibit fatal flaws and was automatically removed from further consideration.



# BASELINE CONDITIONS

HAYES CREEK RD

- Stop-controlled, 4-leg intersection
- Center two-way left-turn lane (TWLTL) on US 93
- Primarily residential land use
- 65 mph - US 93 speed limit
- 10 crashes, 0 severe injuries (2012 - 2021)

COCHISE DR

- Stop-controlled, 3-leg intersection
- Dedicated NB left-turn and SB right-turn lanes
- Pullout on east side of highway
- Residential and commercial land use
- 65 mph - US 93 speed limit
- 8 crashes, 1 fatality (2012 - 2021)

BIRD LN

- Stop-controlled, 3-leg intersection
- Two driveways make up minor approach leg
- Center TWLTL on US 93
- Primarily residential land use
- 65 mph - US 93 speed limit
- 10 crashes, 0 severe injuries (2012 - 2021)

MORMON CREEK RD

- Stop-controlled, 3-leg intersection
- Dedicated SB right-turn lane
- Center TWLTL on US 93
- Residential, commercial, light industrial land use
- 45 mph - US 93 speed limit
- 7 crashes, 0 severe injuries (2012 - 2021)

DELARKA DR S

- Stop-controlled, 3-leg intersection
- Center TWLTL on US 93
- Primarily residential land use
- 45 mph - US 93 speed limit
- 5 crashes, 0 severe injuries (2012 - 2021)

ROWAN ST

- Stop-controlled, 3-leg intersection with intersecting driveway on east side of highway
- Dedicated NB left-turn and SB right-turn lanes
- Residential and commercial land use
- Access to Old Hwy 93 and Park & Ride lot
- 70 mph - US 93 speed limit
- 9 crashes, 1 suspected serious injury (2012 - 2021)

CARLTON CREEK RD

- Stop-controlled, 4-leg intersection with slight skew
- Dedicated left-turn lanes on US 93
- Primarily residential land use
- Access to Old Hwy 93 and Park & Ride lot
- 70 mph - US 93 speed limit
- 8 crashes, 2 suspected serious injuries (2012 - 2021)

CHIEF LOOKING GLASS RD

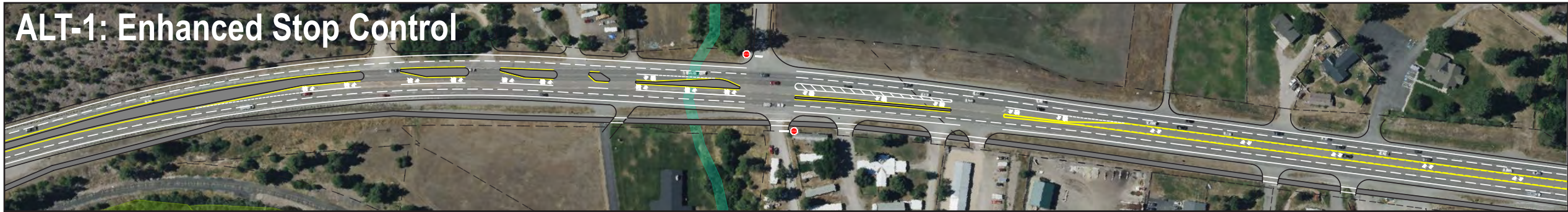
- Stop-controlled, 4-leg intersection
- Dedicated left-turn lanes on US 93
- Primarily residential land use
- Access to Old Hwy 93 and Park & Ride lot
- 70 mph - US 93 speed limit
- 13 crashes, 1 fatality, 7 suspected serious injuries (2012 - 2021)

LONG AVE

- Stop-controlled, 3-leg intersection with intersecting driveway on east side of highway
- Dedicated left-turn lanes on US 93 with SB right-turn lane
- Residential and commercial land use
- Access to Old Hwy 93 and Florence-Carlton Schools
- 45 mph - US 93 speed limit
- 2 crashes, 0 severe injuries (2012 - 2021)

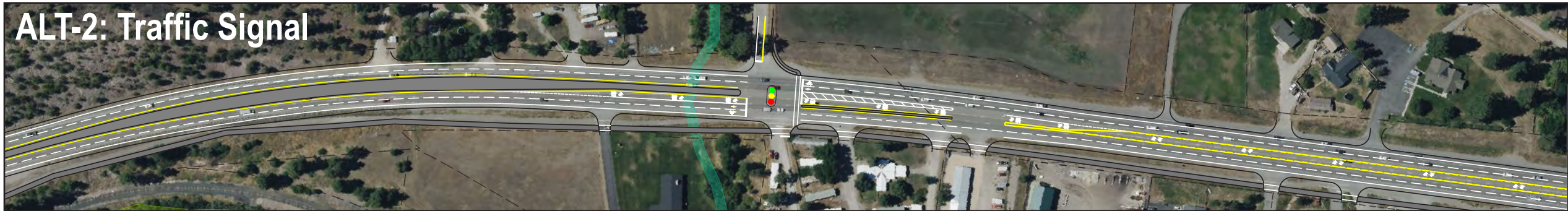


ALT-1: Enhanced Stop Control



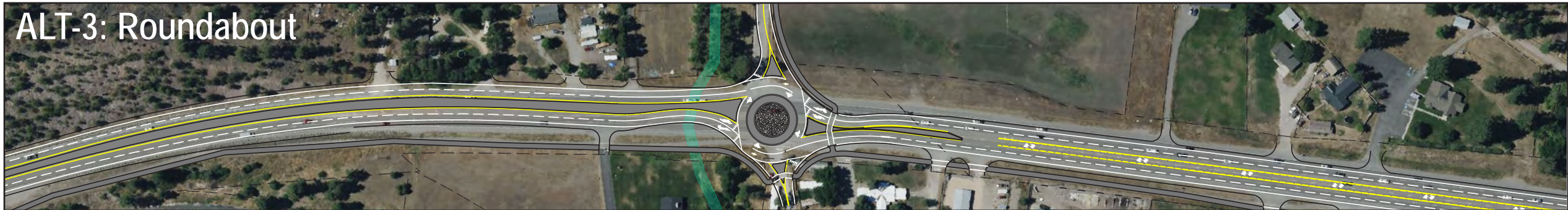
ADVANCE	SAFETY	✓
	OPERATIONS	✓
	IMPACTS	—
	IMPLEMENTATION	✓

ALT-2: Traffic Signal



DO NOT ADVANCE	SAFETY	—
	OPERATIONS	—
	IMPACTS	—
	IMPLEMENTATION	⚡

ALT-3: Roundabout



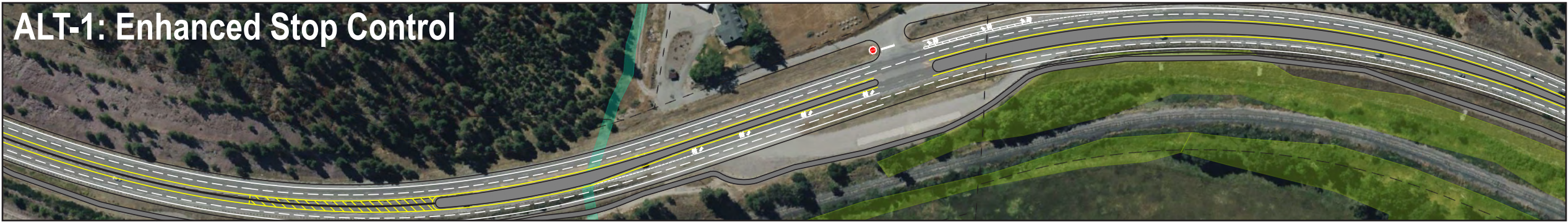
DO NOT ADVANCE	SAFETY	⬆
	OPERATIONS	—
	IMPACTS	⚡
	IMPLEMENTATION	✓





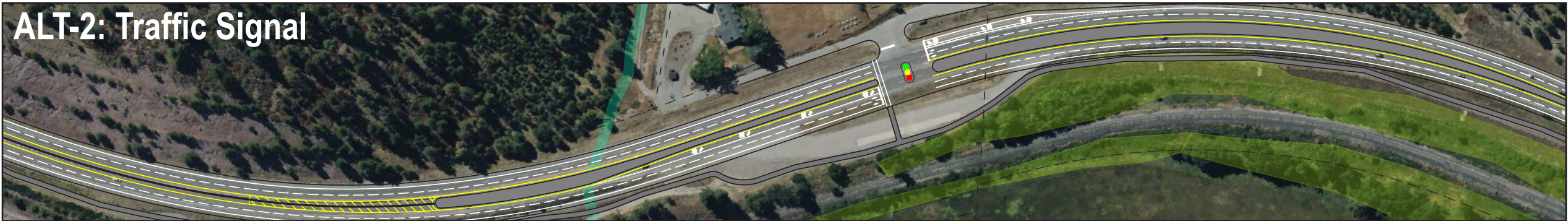
# COCHISE DR

ALT-1: Enhanced Stop Control



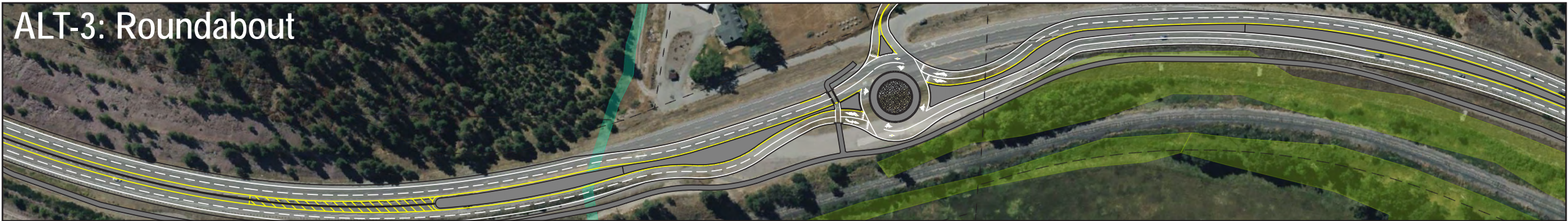
DO NOT ADVANCE	SAFETY	⏸
	OPERATIONS	⏸
	IMPACTS	⏸
	IMPLEMENTATION	⏸

ALT-2: Traffic Signal



DO NOT ADVANCE	SAFETY	⏸
	OPERATIONS	⏸
	IMPACTS	⏸
	IMPLEMENTATION	⏸

ALT-3: Roundabout



ADVANCE	SAFETY	⏸
	OPERATIONS	⏸
	IMPACTS	⏸
	IMPLEMENTATION	⏸

ALT-4: RCUT



ADVANCE	SAFETY	⏸
	OPERATIONS	⏸
	IMPACTS	⏸
	IMPLEMENTATION	⏸

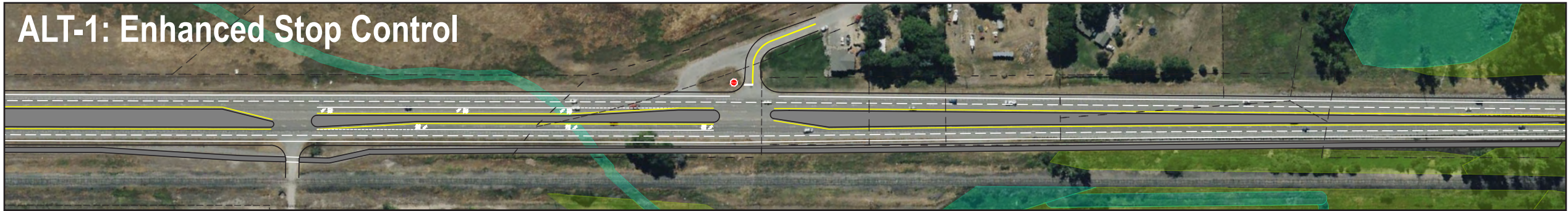
ALT-5: Continuous T



ADVANCE	SAFETY	⏸
	OPERATIONS	⏸
	IMPACTS	⏸
	IMPLEMENTATION	⏸

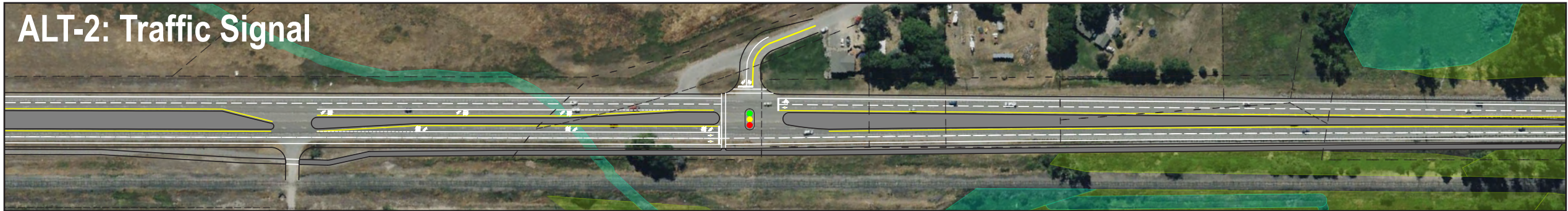


## ALT-1: Enhanced Stop Control



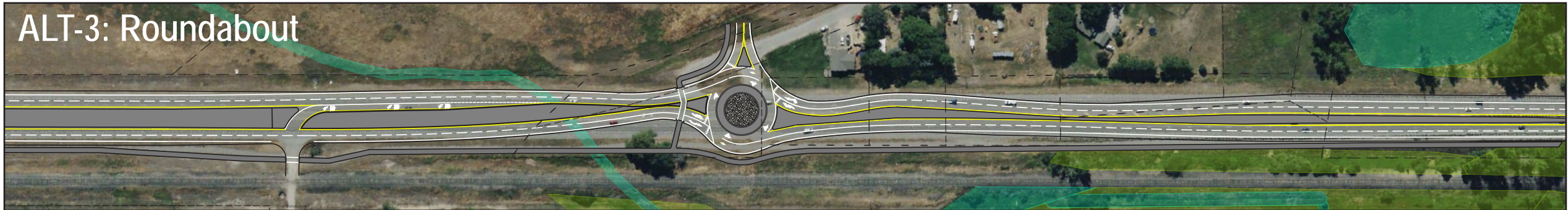
ADVANCE	SAFETY	⬇
	OPERATIONS	⬇
	IMPACTS	⬆
	IMPLEMENTATION	⬇

## ALT-2: Traffic Signal



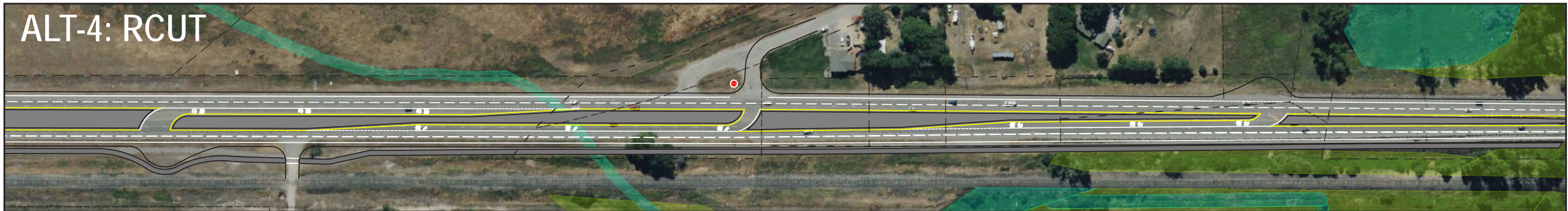
DO NOT ADVANCE	SAFETY	—
	OPERATIONS	⬇
	IMPACTS	⬆
	IMPLEMENTATION	⬇⬇

## ALT-3: Roundabout



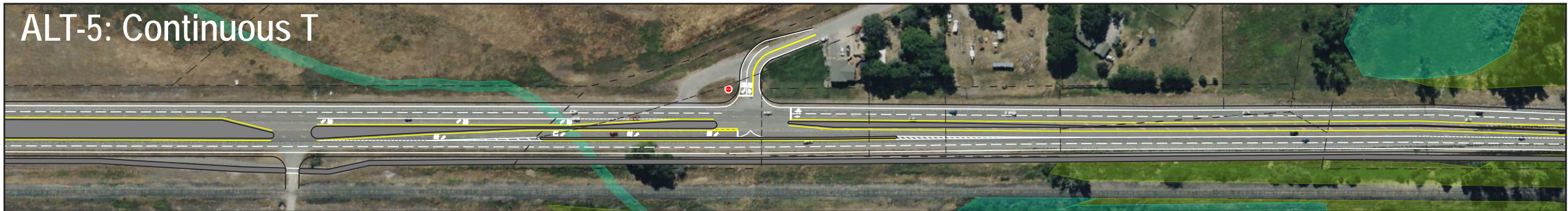
ADVANCE	SAFETY	⬆⬆
	OPERATIONS	⬆
	IMPACTS	⬇
	IMPLEMENTATION	—

## ALT-4: RCUT



ADVANCE	SAFETY	⬆
	OPERATIONS	⬆⬆
	IMPACTS	—
	IMPLEMENTATION	⬆⬆

## ALT-5: Continuous T



ADVANCE	SAFETY	⬆
	OPERATIONS	⬆
	IMPACTS	⬆
	IMPLEMENTATION	⬆⬆



ALT-1: Enhanced Stop Control



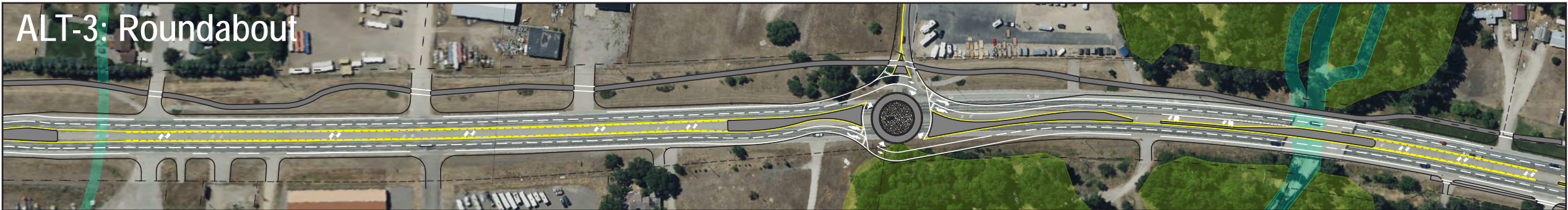
ADVANCE	SAFETY	⬇
	OPERATIONS	⬇
	IMPACTS	⬆
	IMPLEMENTATION	⬇

ALT-2: Traffic Signal



ADVANCE	SAFETY	—
	OPERATIONS	⬇
	IMPACTS	⬆
	IMPLEMENTATION	⬇

ALT-3: Roundabout



DO NOT ADVANCE	SAFETY	⬆⬆
	OPERATIONS	⬆
	IMPACTS	⬇⬇
	IMPLEMENTATION	—

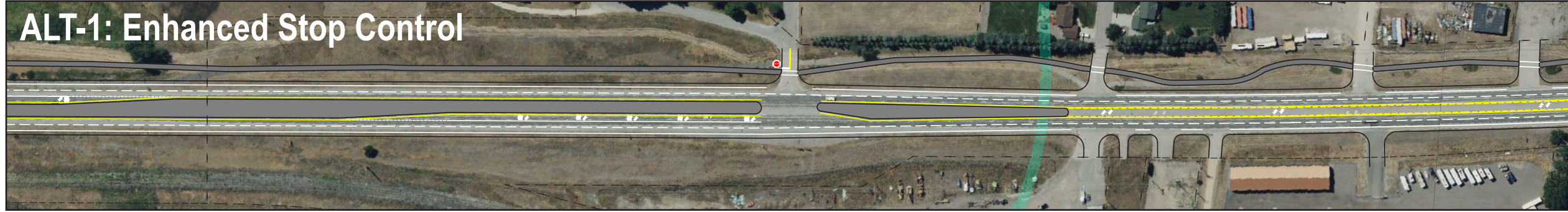
ALT-4: Continuous T



ADVANCE	SAFETY	⬆
	OPERATIONS	⬆
	IMPACTS	⬇
	IMPLEMENTATION	—

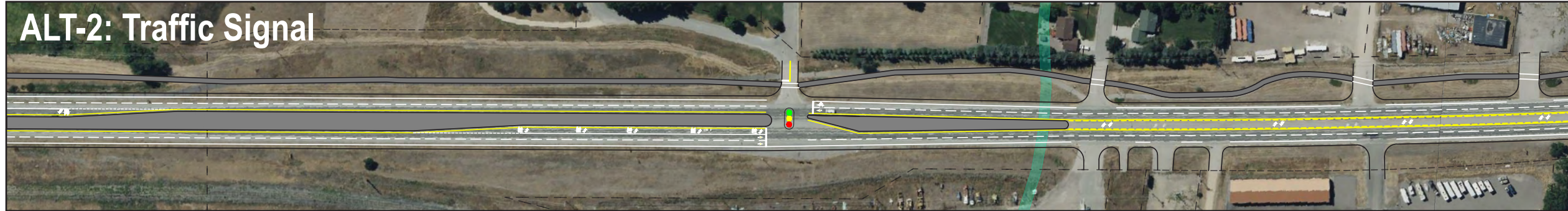


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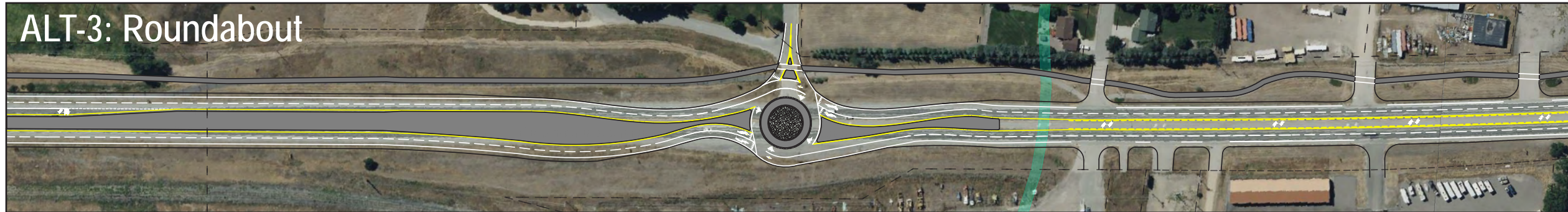
ADVANCE	SAFETY	⬇
	OPERATIONS	⬇
	IMPACTS	⬆
	IMPLEMENTATION	⬇

## ALT-2: Traffic Signal



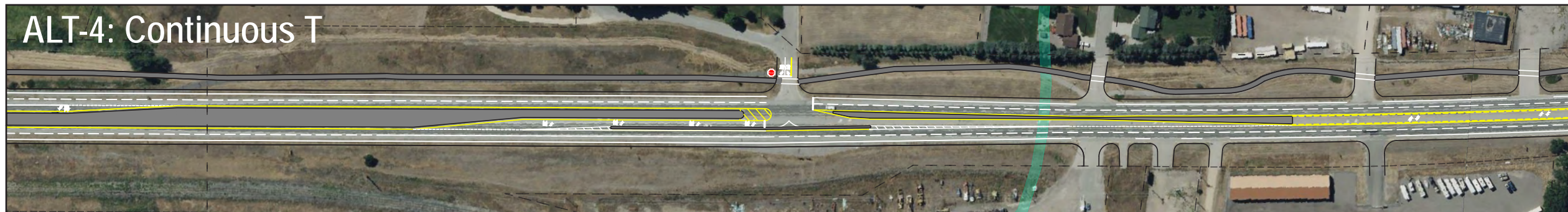
DO NOT ADVANCE	SAFETY	—
	OPERATIONS	⬇
	IMPACTS	⬆
	IMPLEMENTATION	⬇

## ALT-3: Roundabout



ADVANCE	SAFETY	⬆
	OPERATIONS	⬆
	IMPACTS	⬆
	IMPLEMENTATION	⬆

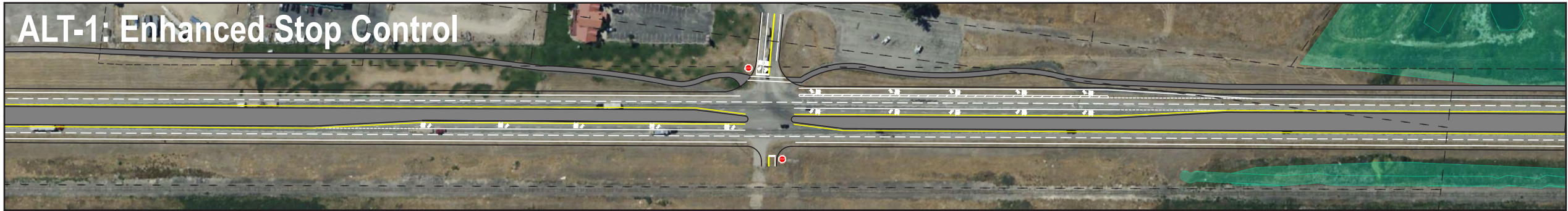
## ALT-4: Continuous T



DO NOT ADVANCE	SAFETY	⬆
	OPERATIONS	⬇
	IMPACTS	⬇
	IMPLEMENTATION	⬇

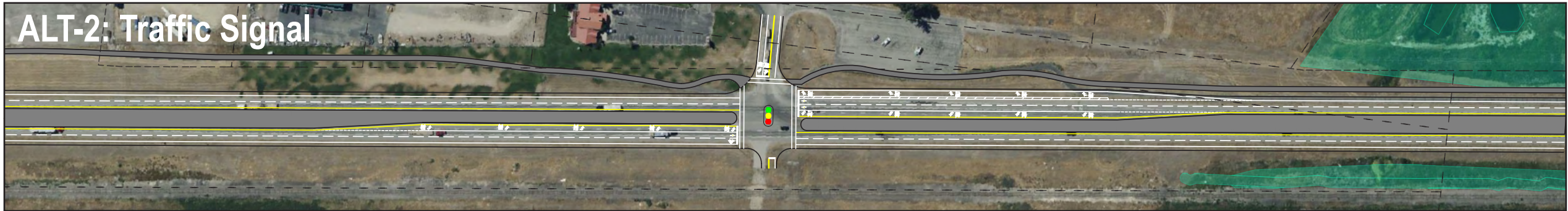


ALT-1: Enhanced Stop Control



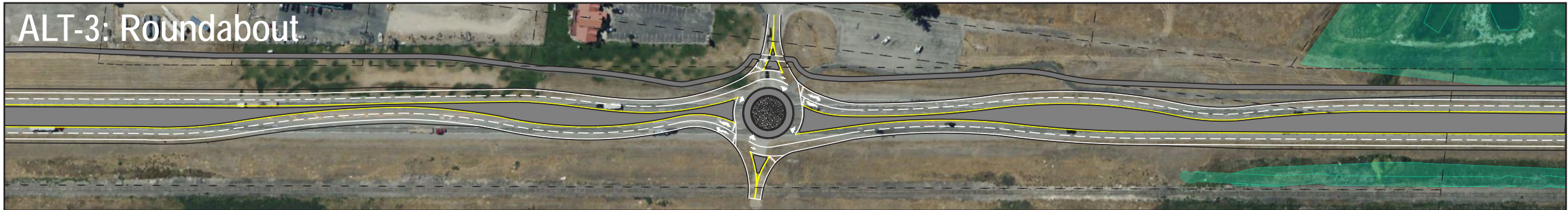
DO NOT ADVANCE	SAFETY	⏸
	OPERATIONS	⏸
	IMPACTS	⬆
	IMPLEMENTATION	⬇

ALT-2: Traffic Signal



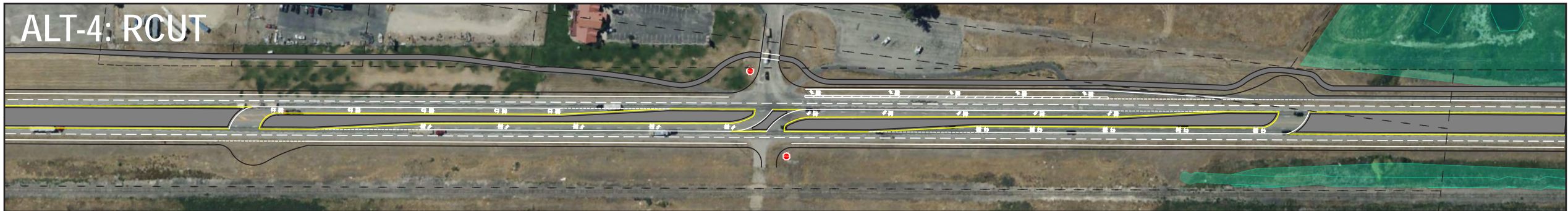
ADVANCE	SAFETY	—
	OPERATIONS	—
	IMPACTS	⬆
	IMPLEMENTATION	—

ALT-3: Roundabout



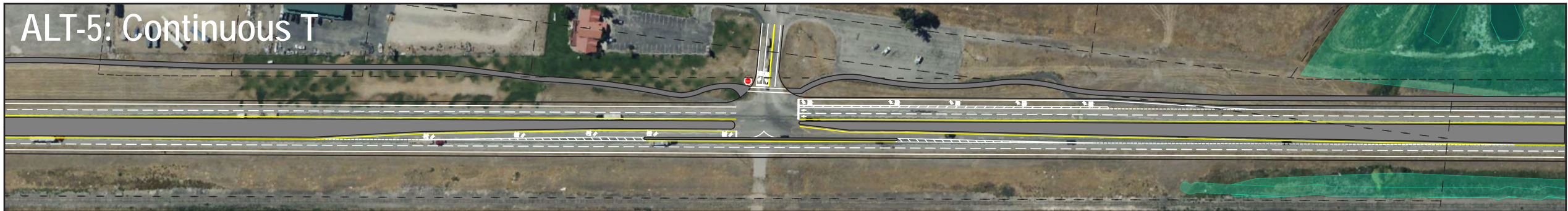
ADVANCE	SAFETY	⬆
	OPERATIONS	—
	IMPACTS	—
	IMPLEMENTATION	—

ALT-4: RCUT



ADVANCE	SAFETY	⏸
	OPERATIONS	⏸
	IMPACTS	—
	IMPLEMENTATION	⬆

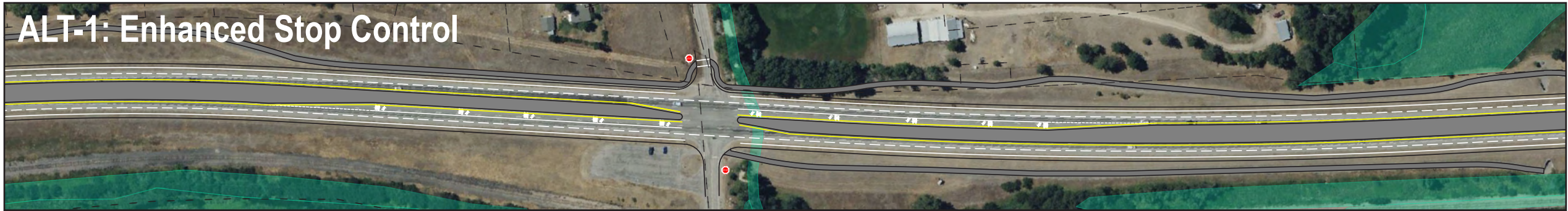
ALT-5: Continuous T



DO NOT ADVANCE	SAFETY	⬆
	OPERATIONS	—
	IMPACTS	⏸
	IMPLEMENTATION	⬇

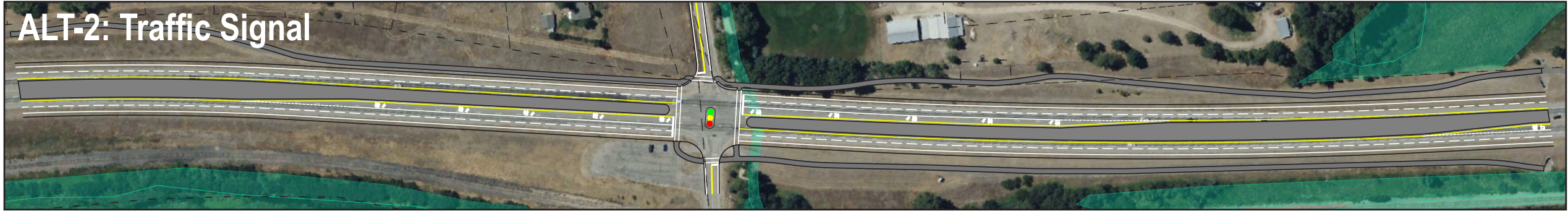


ALT-1: Enhanced Stop Control



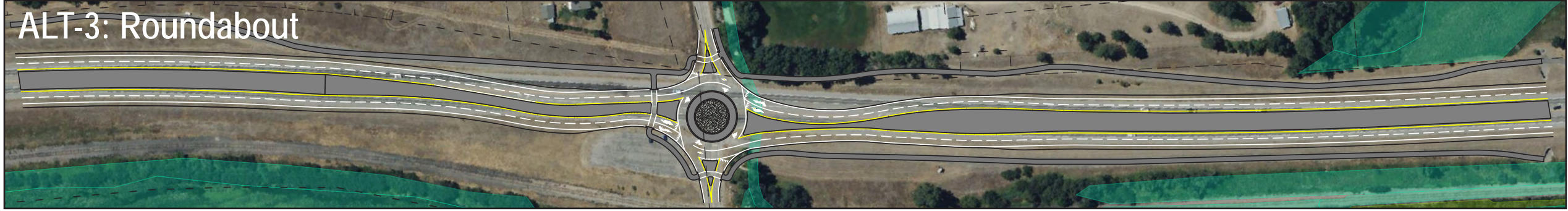
DO NOT ADVANCE	SAFETY	⏸
	OPERATIONS	⏴
	IMPACTS	⏵
	IMPLEMENTATION	⏴

ALT-2: Traffic Signal



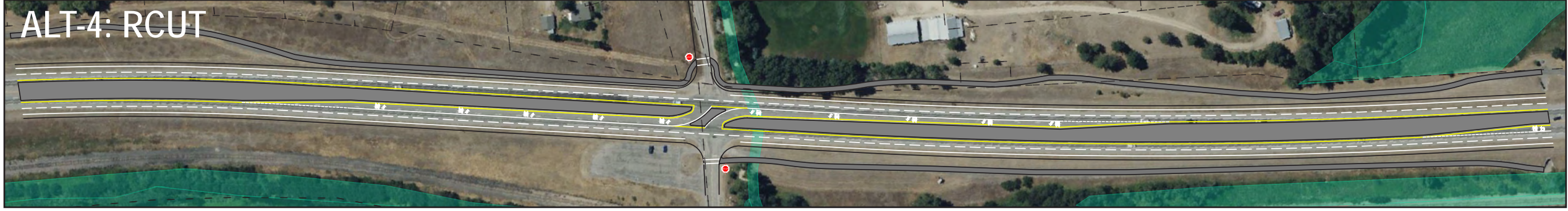
DO NOT ADVANCE	SAFETY	—
	OPERATIONS	—
	IMPACTS	⏵
	IMPLEMENTATION	⏸

ALT-3: Roundabout



ADVANCE	SAFETY	⏵
	OPERATIONS	—
	IMPACTS	⏴
	IMPLEMENTATION	—

ALT-4: RCUT



ADVANCE	SAFETY	⏵
	OPERATIONS	⏵
	IMPACTS	⏵
	IMPLEMENTATION	⏵



ALT-1: Enhanced Stop Control



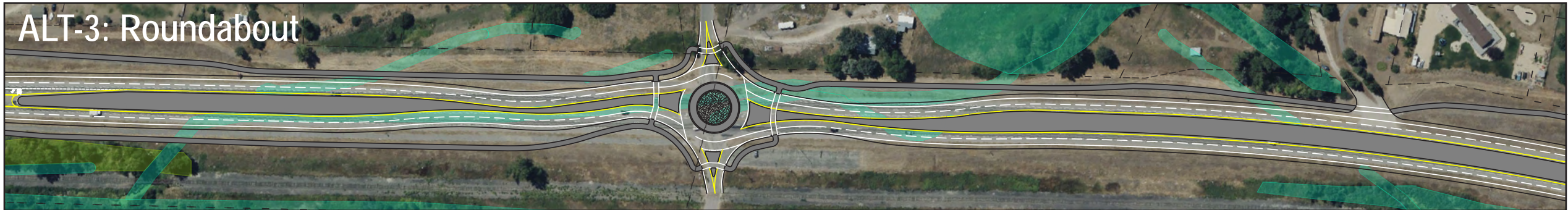
DO NOT ADVANCE	SAFETY	⚡
	OPERATIONS	⬇
	IMPACTS	⬆
	IMPLEMENTATION	⬇

ALT-2: Traffic Signal



DO NOT ADVANCE	SAFETY	—
	OPERATIONS	—
	IMPACTS	⬆
	IMPLEMENTATION	⚡

ALT-3: Roundabout



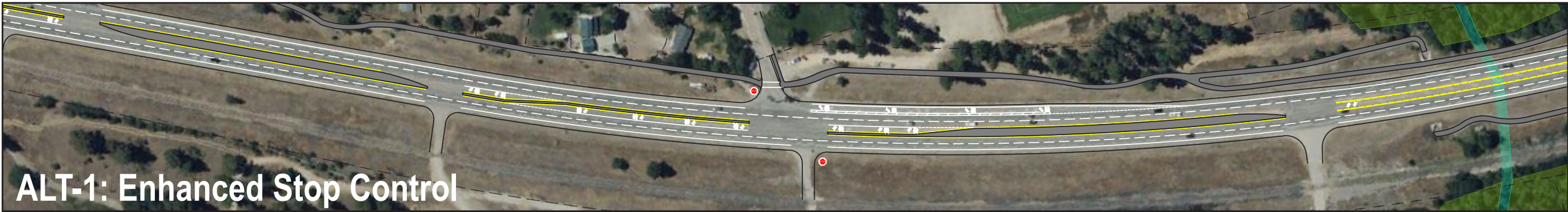
ADVANCE	SAFETY	⬆
	OPERATIONS	—
	IMPACTS	⬇
	IMPLEMENTATION	—

ALT-4: RCUT



ADVANCE	SAFETY	⬆
	OPERATIONS	⬆
	IMPACTS	⬆
	IMPLEMENTATION	⬆





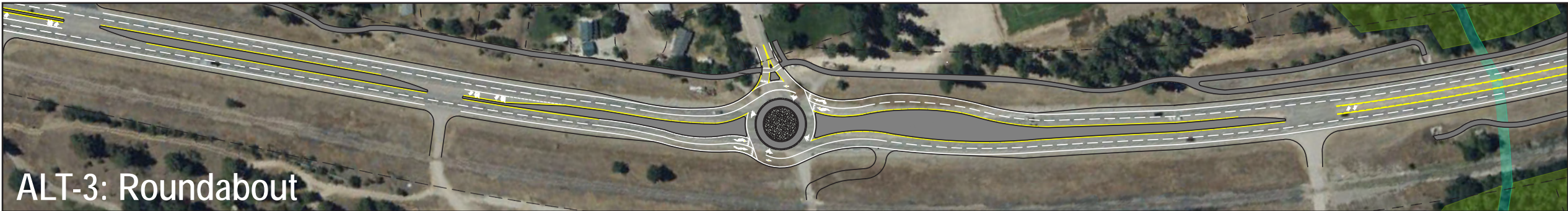
ALT-1: Enhanced Stop Control

DO NOT ADVANCE	SAFETY	⬇
	OPERATIONS	⬇
	IMPACTS	⬆
	IMPLEMENTATION	⬇



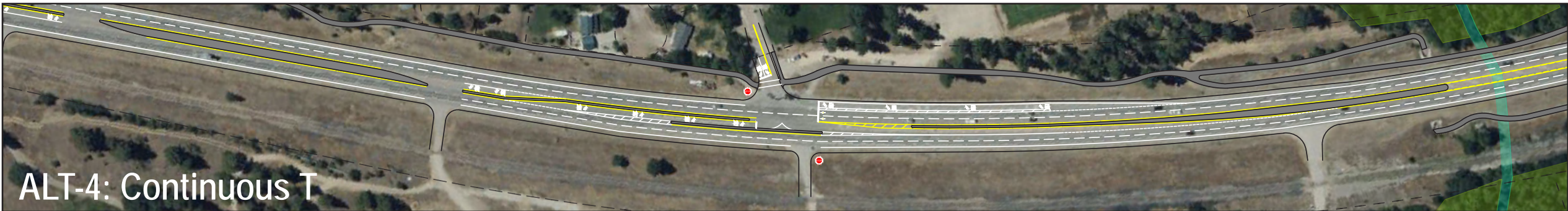
ALT-2: Traffic Signal

ADVANCE	SAFETY	—
	OPERATIONS	—
	IMPACTS	⬆
	IMPLEMENTATION	—



ALT-3: Roundabout

ADVANCE	SAFETY	⬆
	OPERATIONS	⬆
	IMPACTS	⬇
	IMPLEMENTATION	⬆



ALT-4: Continuous T

DO NOT ADVANCE	SAFETY	⬆
	OPERATIONS	⬆
	IMPACTS	⬇
	IMPLEMENTATION	—





# SCORING SUMMARY

	ALTERNATIVE	SAFETY	OPS.	IMPACTS	IMPLEMENT.	SUMMARY
HAYES CREEK	ALT-1: Stop Control					ADVANCE
	ALT-2: Traffic Signal					DO NOT ADVANCE
	ALT-3: Roundabout					DO NOT ADVANCE
COCHISE DR	ALT-1: Stop Control					DO NOT ADVANCE
	ALT-2: Traffic Signal					DO NOT ADVANCE
	ALT-3: Roundabout					ADVANCE
	ALT-4: RCUT					ADVANCE
	ALT-5: Continuous T					ADVANCE
BIRD LN	ALT-1: Stop Control					ADVANCE
	ALT-2: Traffic Signal					DO NOT ADVANCE
	ALT-3: Roundabout					ADVANCE
	ALT-4: RCUT					ADVANCE
	ALT-5: Continuous T					ADVANCE
MORMON CREEK RD	ALT-1: Stop Control					ADVANCE
	ALT-2: Traffic Signal					ADVANCE
	ALT-3: Roundabout					DO NOT ADVANCE
	ALT-4: Continuous T					ADVANCE

	ALTERNATIVE	SAFETY	OPS.	IMPACTS	IMPLEMENT.	SUMMARY
DELARKA DR S	ALT-1: Stop Control					ADVANCE
	ALT-2: Traffic Signal					DO NOT ADVANCE
	ALT-3: Roundabout					ADVANCE
	ALT-4: Continuous T					DO NOT ADVANCE
ROWAN ST	ALT-1: Stop Control					DO NOT ADVANCE
	ALT-2: Traffic Signal					ADVANCE
	ALT-3: Roundabout					ADVANCE
	ALT-4: RCUT					ADVANCE
	ALT-5: Continuous T					DO NOT ADVANCE
CARLTON CREEK RD	ALT-1: Stop Control					DO NOT ADVANCE
	ALT-2: Traffic Signal					DO NOT ADVANCE
	ALT-3: Roundabout					ADVANCE
	ALT-4: RCUT					ADVANCE
CHIEF LOOKING GLASS	ALT-1: Stop Control					DO NOT ADVANCE
	ALT-2: Traffic Signal					DO NOT ADVANCE
	ALT-3: Roundabout					ADVANCE
	ALT-4: RCUT					ADVANCE
LONG AVE	ALT-1: Stop Control					DO NOT ADVANCE
	ALT-2: Traffic Signal					ADVANCE
	ALT-3: Roundabout					ADVANCE
	ALT-4: Continuous T					DO NOT ADVANCE