

Quick-Build Roundabouts

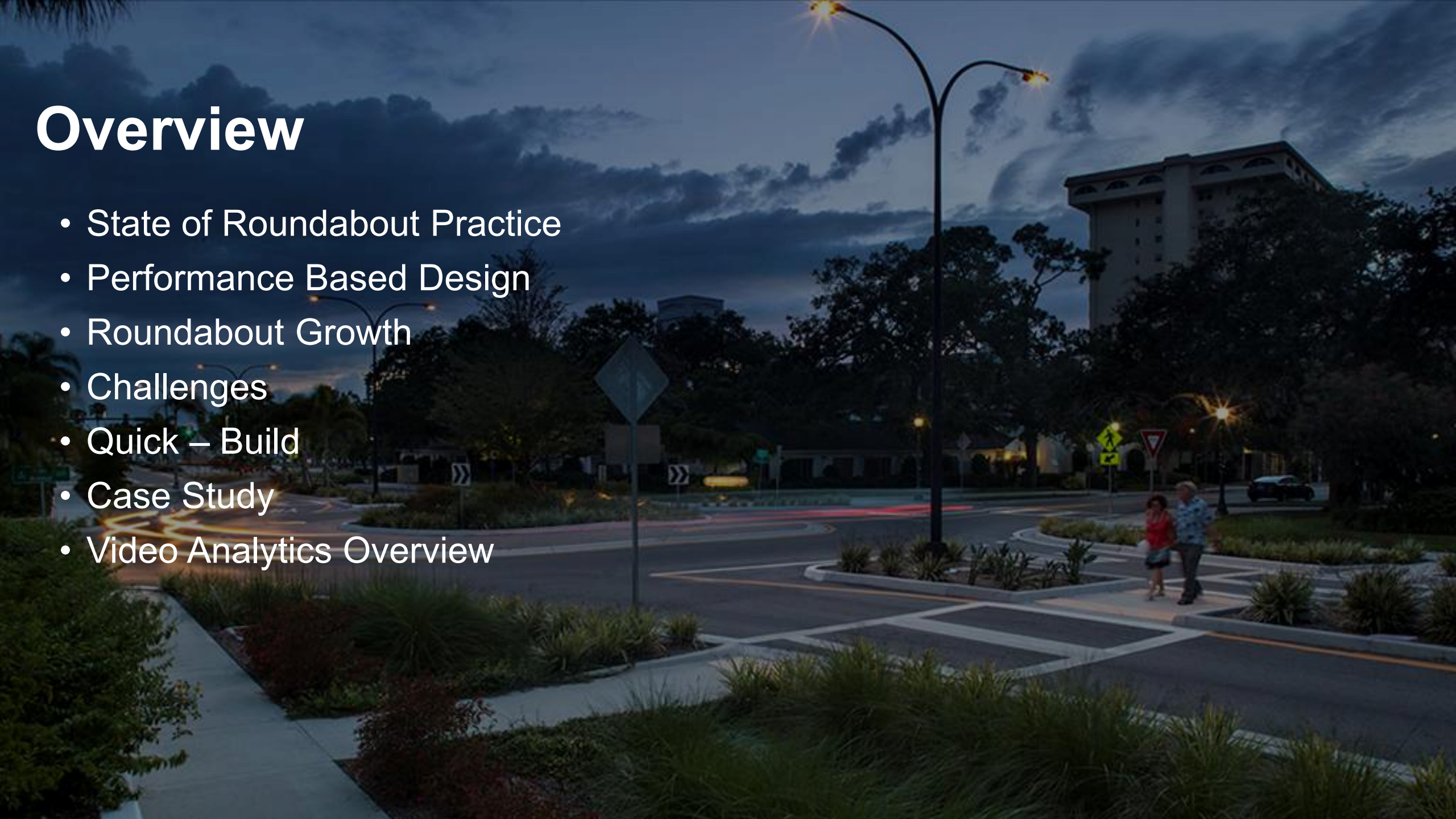
How Vehicle Kinematics derived from Drone Video are Used to Analyze Roundabout Performance, Mitigations, and Best Practices for Roundabout Design

Sean Houck, P.E. (CA) | Kimley-Horn

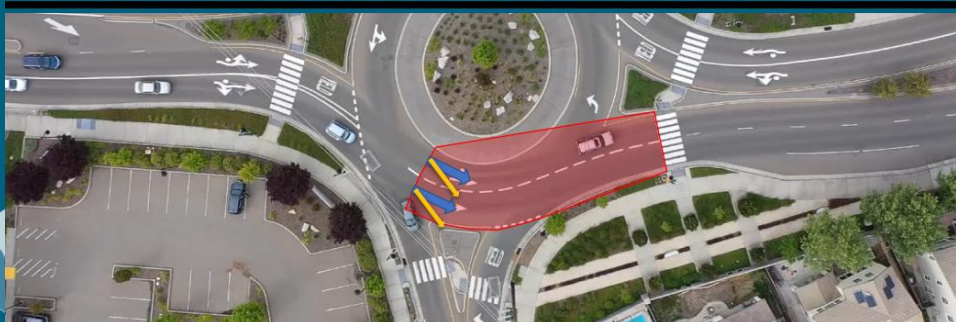
Sean.houck@kimley-horn.com

Overview

- State of Roundabout Practice
- Performance Based Design
- Roundabout Growth
- Challenges
- Quick – Build
- Case Study
- Video Analytics Overview



Phases of Roundabout Implementation



Video Analytic Library

Post Construction Review

In-Service Review

Knowledge Transfer

Research

State of Roundabout Practice

Kimley-Horn Focus

Informed
Practitioner

FHWA Pooled Study

- Multi-Lane RAB Research
- (In Progress)

Video Analytics

- Library
- Driver Behavior
- Before/After Studies

Research for Next Guide

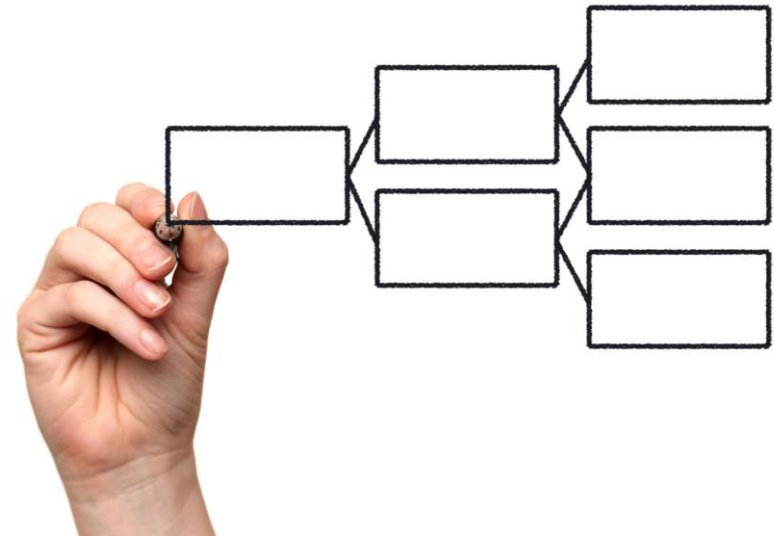
NCHRP 672
2nd Edition
Roundabout
Guide (2010)

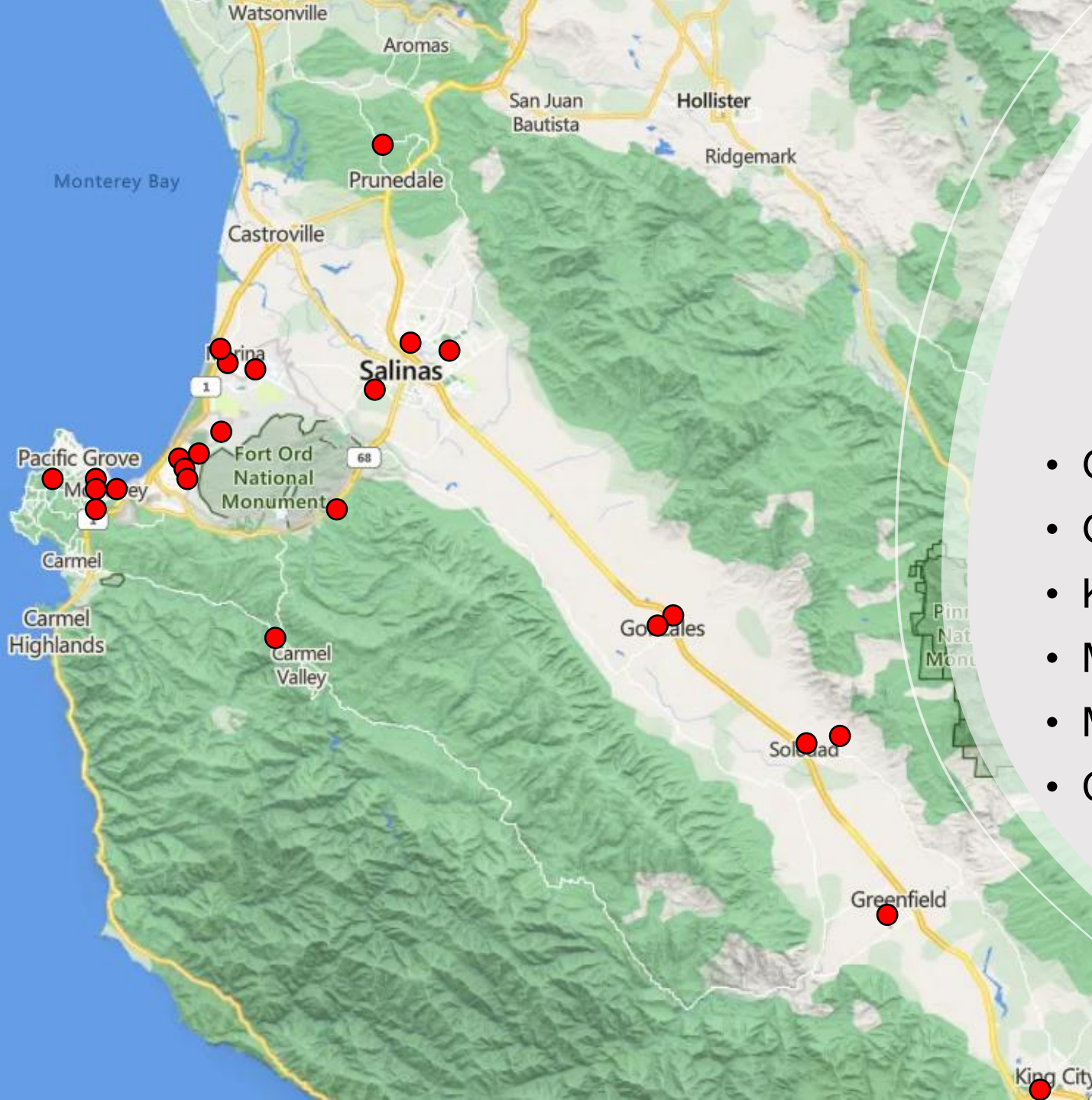
**Highway
Design
Manual**
Based on
NCHRP 672

**NCHRP
1043**
3rd Edition
Roundabout
Guide
(2023)

The Essentials of Performance-Based Design

- Focuses on **achieving specific outcomes** rather than prescriptive solutions
- Incorporates **data-driven** methods to optimize design performance
- Allows **flexibility** to adapt to diverse project requirements
- Enhances safety, efficiency, and user experience through **targeted metrics**
- Uses continuous monitoring to refine and **improve designs over time**

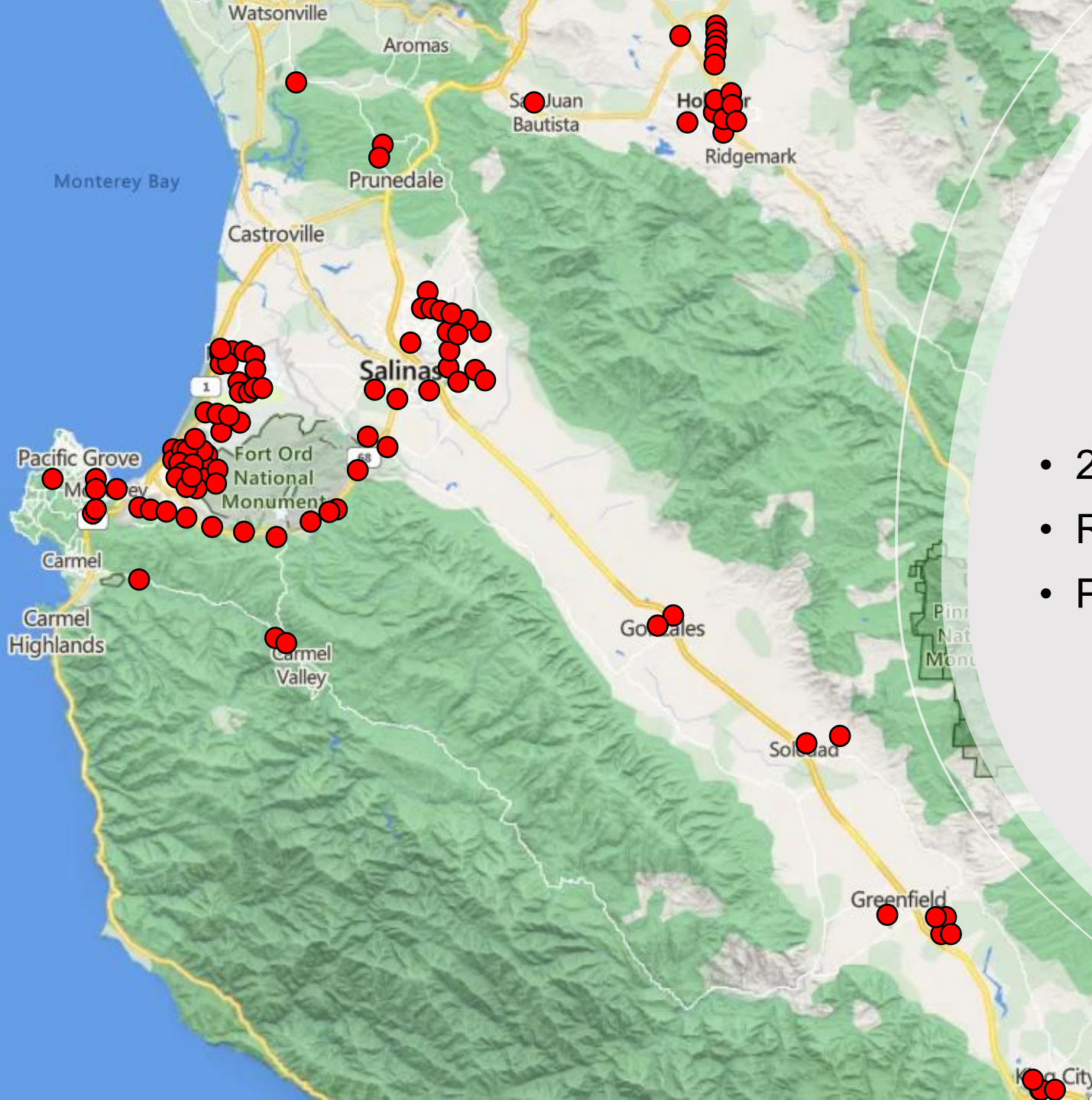




Regional Study

11 Jurisdictions
26 Intersections

- Greenfield
- Gonzalez
- King City
- Marina
- Monterey County
- City of Monterey
- Pacific Grove
- Salinas
- Sand City
- Seaside
- Soledad

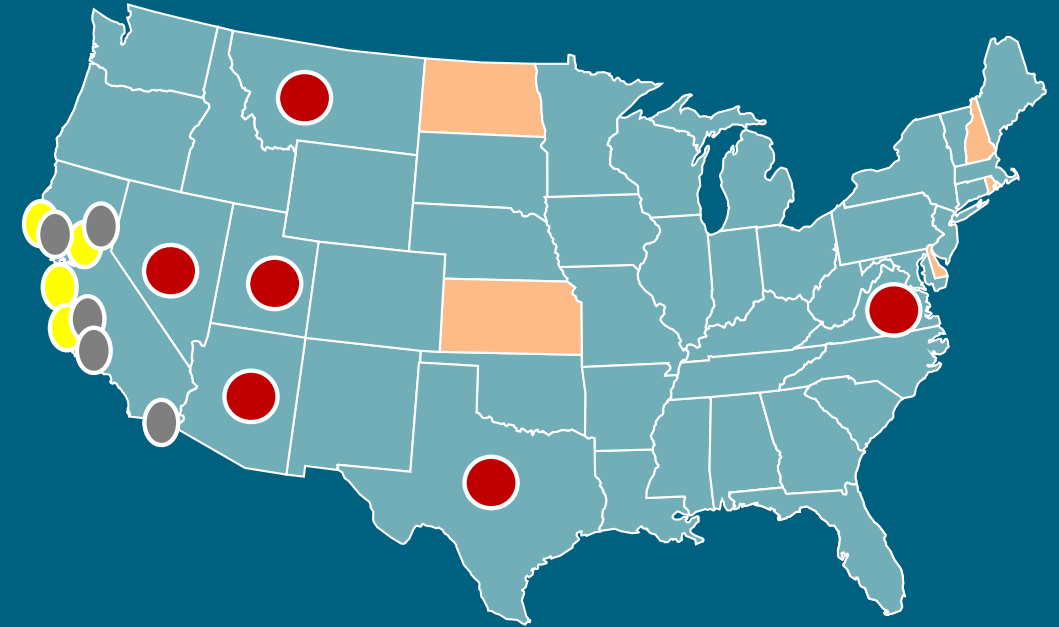


The Growth of Roundabouts in Monterey County

- 2012
- Regional Roundabout Study
- Post Study to 2022

Intersection Control Evaluations

- **Statewide Program Development**
 - Montana DOT , Arizona DOT
 - Nevada DOT, Utah DOT, Texas DOT, Virginia DOT
 - Developed Vjust and ICAP
- **Regional / Citywide Program Development**
 - Folsom, **Seaside, TAMC**, Rohnert Park
- **On-Call Programs**
 - **Salinas, King City, Marina**, Oceanside, Lincoln, Sonoma Co.



Monterey County
\$68M+ in grant funding
ATP, RSTP, SS4A, etc.



Roundabout Concerns



Public Perception



Cost



tion



Maintenance

Kimley»Horn



NO WASTEFUL SPENDING

NO ROUNDAABOUT

NO TAKING PRIVATE PROPERTY

\$3 MILLION PRICE TAG
UNSAFE & UNECESSARY

Quick Build

Implementable

Fits within Existing Pavement

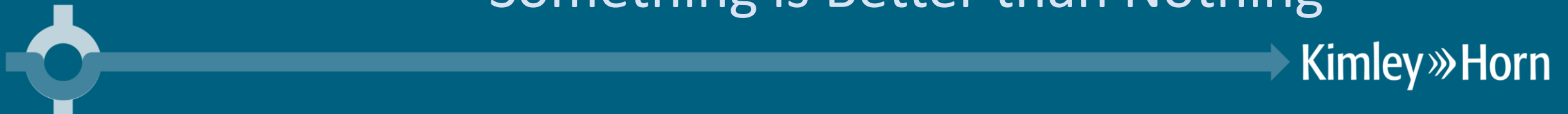
Inexpensive

Quick Construction

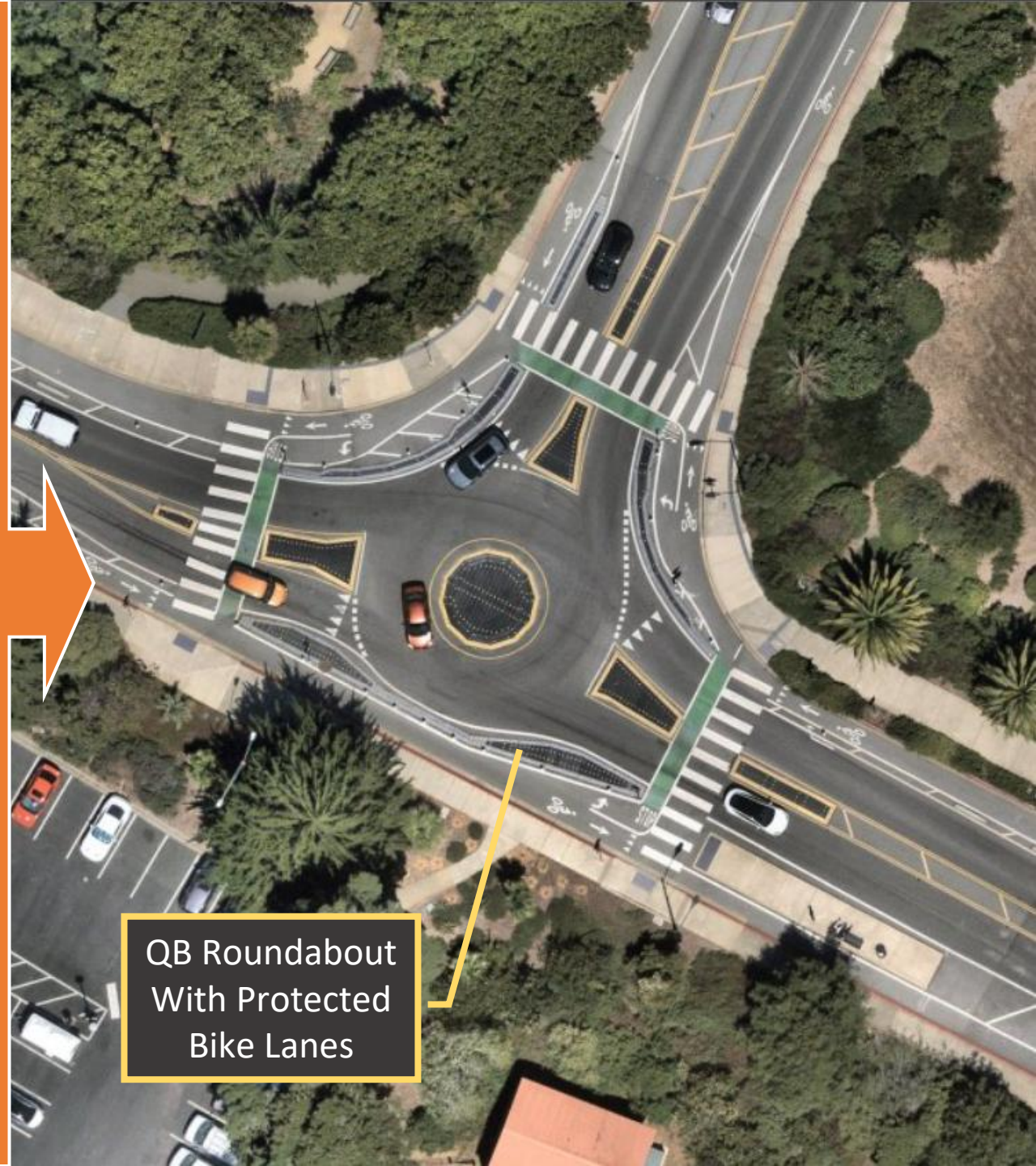
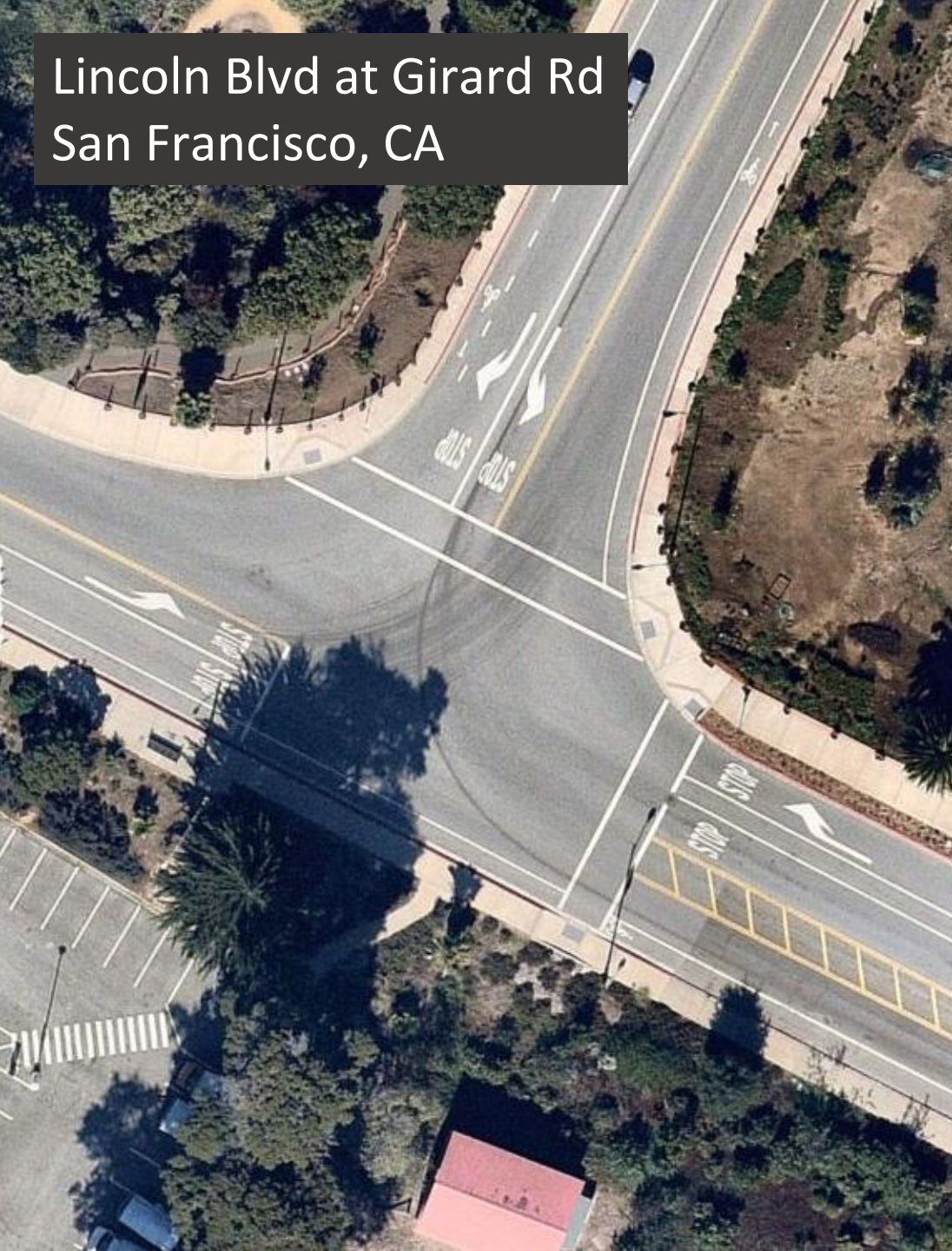
Effective

Temporary

Something is Better than Nothing



Lincoln Blvd at Girard Rd
San Francisco, CA



QB Roundabout
With Protected
Bike Lanes

15 at Slater Road
Bellingham, WA

QB Roundabout

QB Roundabout

QB Roundabout

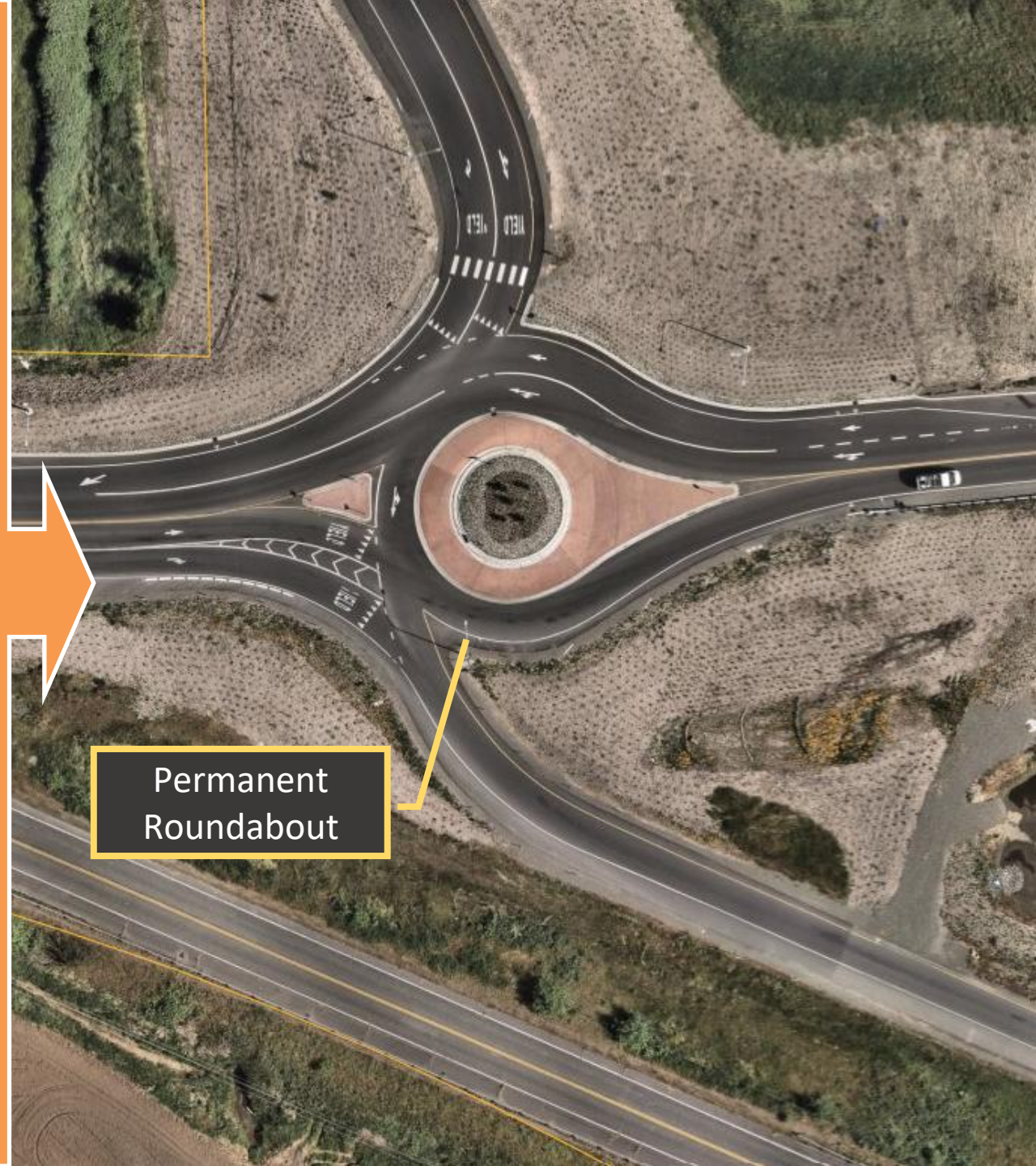


15 at Slater Road
Bellingham, WA

QB Roundabout



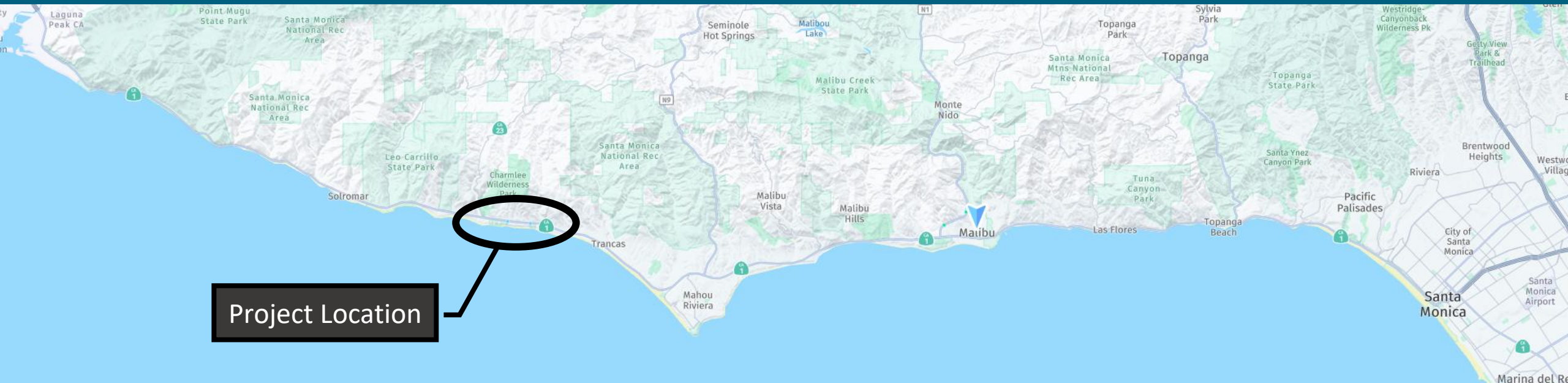
Permanent
Roundabout



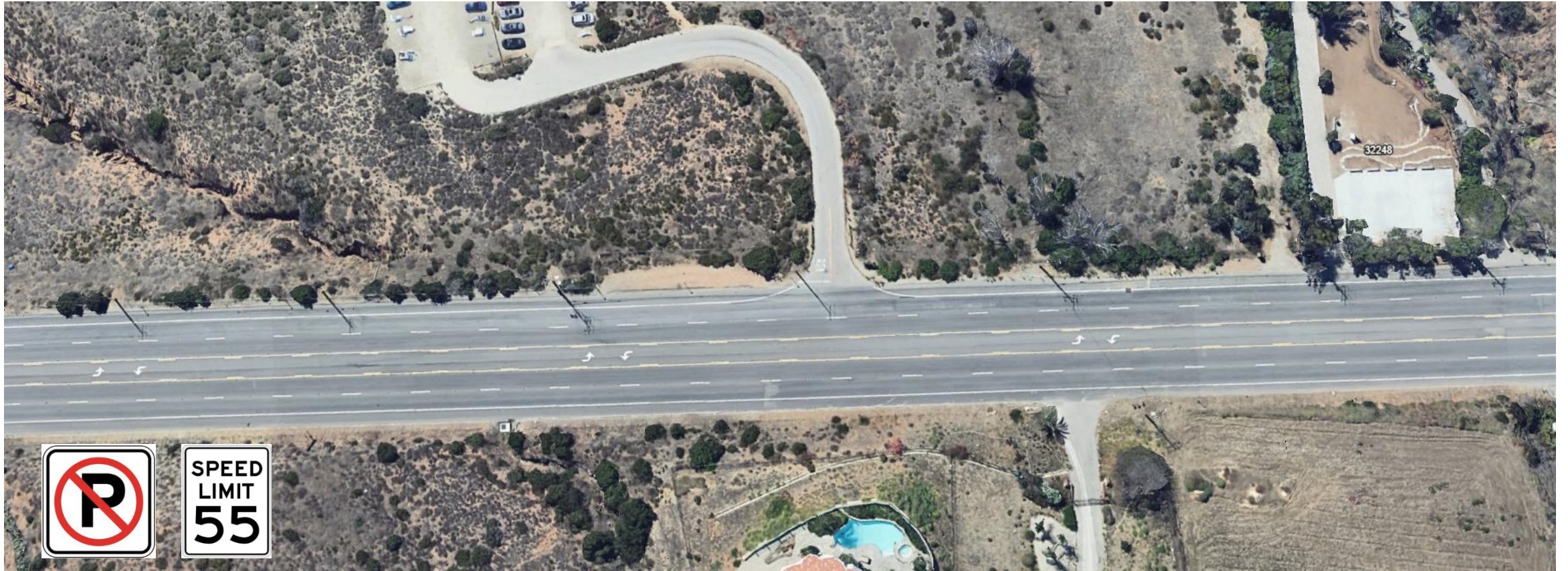
Case Study: Malibu, CA

- Pacific Coast Highway (SR 1)
- City of Malibu
- Quick Build / Demonstration Project
- Project Approval: DEER
- Funding: LA Metro Measure M \$2M

- Project Start: May 2025
- Bid: December 2025
- Construction: January 2026
- Estimated Cost: \$1.1M



EXISTING CONDITIONS – PCH & EL MATADOR

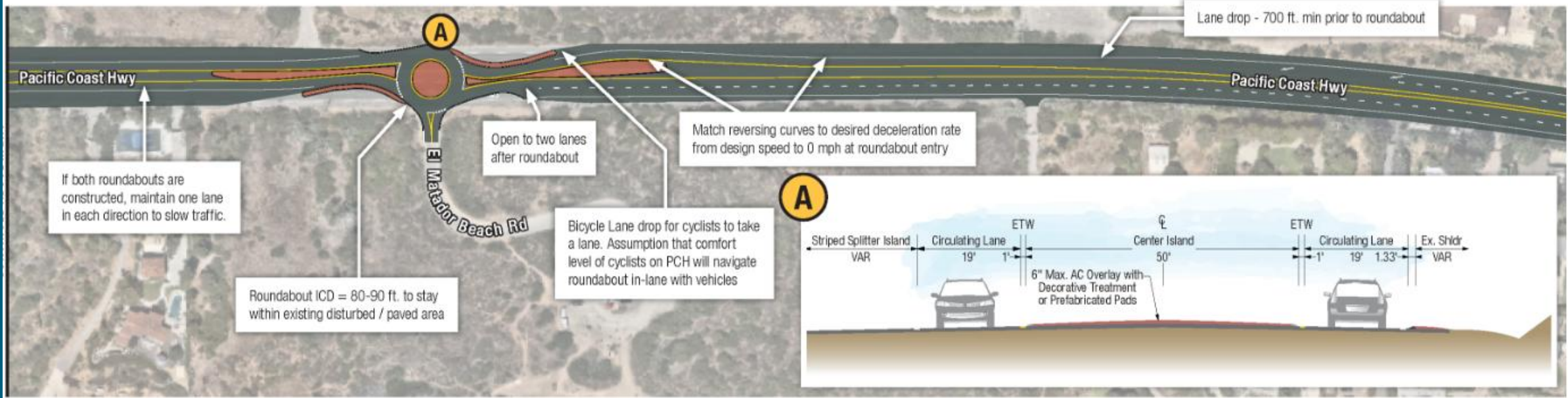
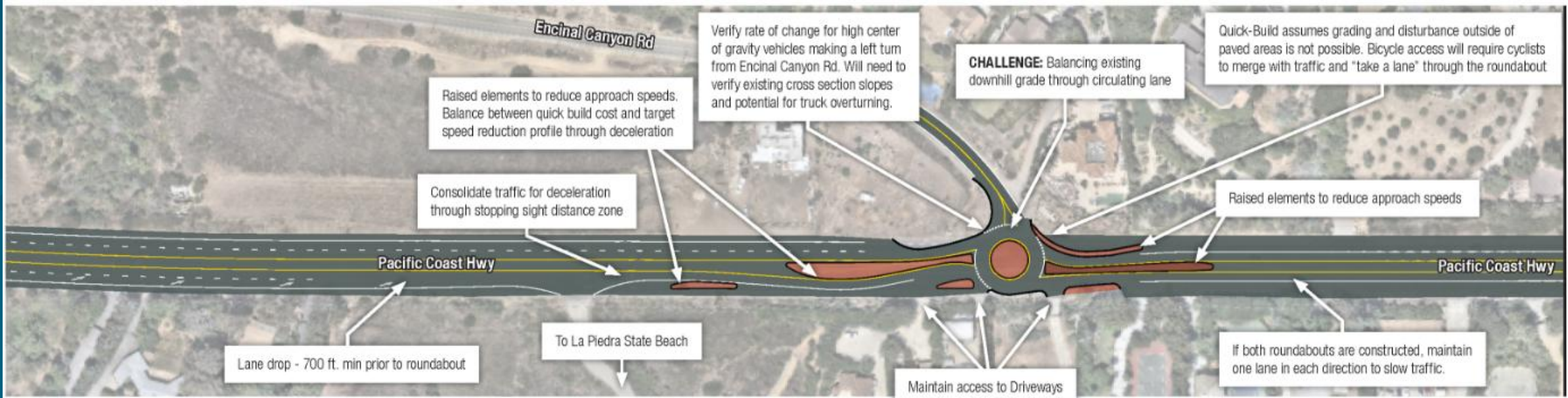


EXISTING CONDITIONS – PCH



EXISTING CONDITIONS – PCH & ENCINAL CYN





Material Choices

Modular

- Plastic Field Panels
- Bolt Down
- Vortex Industries (FHWA Backed)
- Other Manufacturers
- Subject to order / delivery

Traditional Materials

- Asphalt Dike / Backfill
- Delineators / RPM's
- Prefabricated Curb with Delineators (Qwick Kurb)
- Aesthetic Treatments

Lessons Learned

1. Use a curb product that is known to work – it's early in the progress
2. Paint won't do for the geometric speed control normally provided by outside edge concrete curbing.
3. If you're only using striping, use of non-mountable raised pavement markers (sometimes called turtles)
4. Use modular roundabouts temporarily – early problems with anchorage
5. Modular roundabouts can impact other proposed roundabouts due to negative impression by public

Lessons Learned

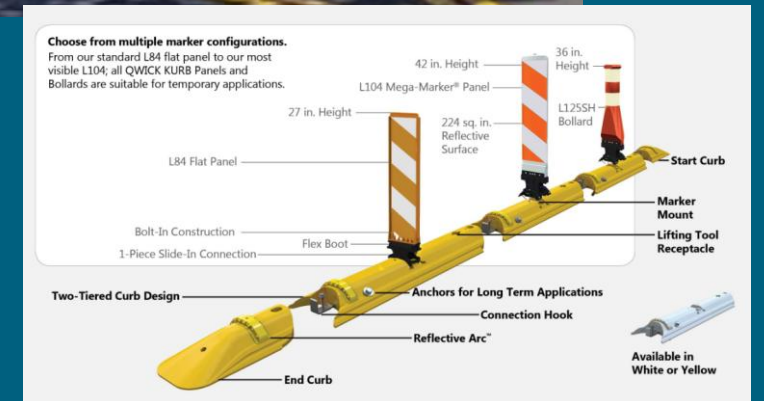
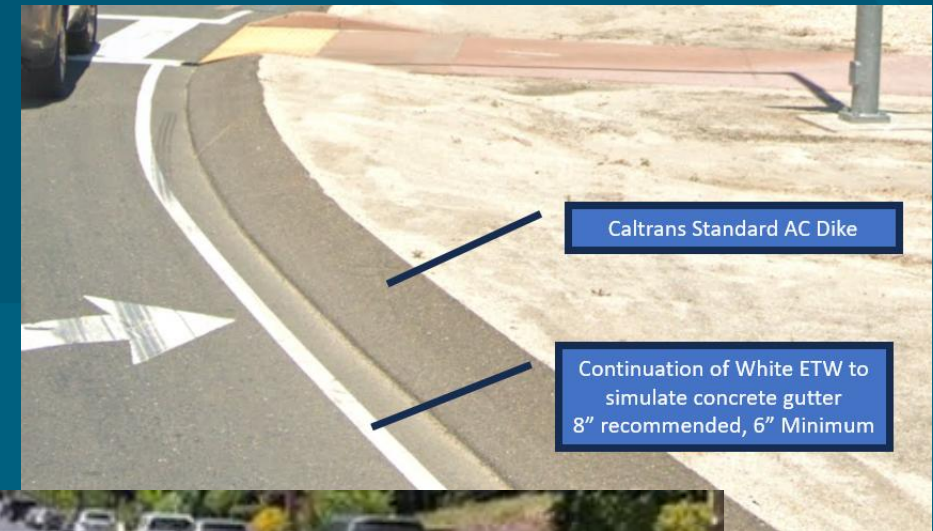
Modular and Temporary Roundabouts

- The materials to construct the roundabout should be chosen once the design is completed based on context, roundabout size, and design vehicle types.
- The low cost “plastic quick build” require the same level of design detail as any other roundabout
 - Material and Construction Costs are about \$150-200k installed (does not include design)
 - Actual Construction times and quality vary widely
- There are several design techniques that can be combined with a wide range of material types and budgets
- For roundabouts less than 90ft in diameter, it is likely that fire ladders and pumpers will need to mount the central island for left turns. Most prefab options have abrupt vertical changes that may “twist” the trucks, especially a pumper with a tank, and may damage the vehicle and/or crack a tank. This is the single biggest complaint from fire departments.



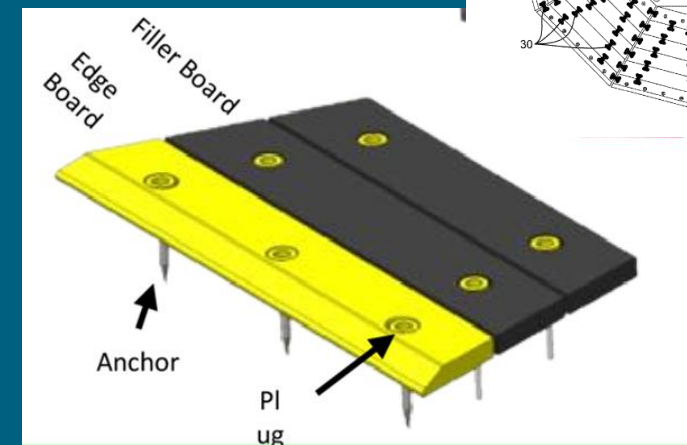
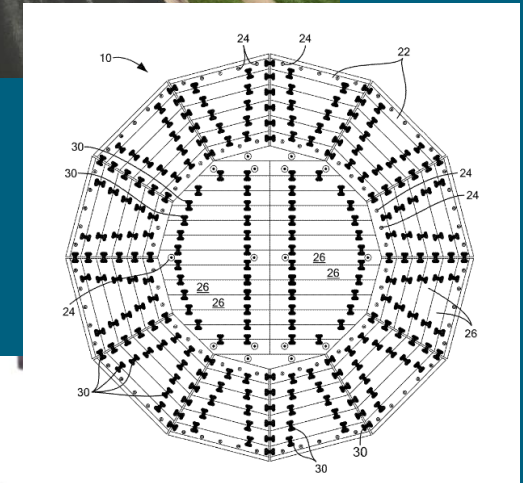
Traditional Materials

- Procurement vs Installation time
- Approved Materials List
- Supplement with Qwick Kurb
- Readily Available and Familiar
- Roadway Excavation Not Required
- HMA can be Milled Away to Remove



Modular Materials

- Procurement vs Installation time
- Verify if on Approved Materials List
- Roadway Excavation Not Required
- Removal Leaves Numerous Holes in Pavement
- If Removed, will Require Grind and Overlay



Material Choices

- Modular

- Plastic Field Panels
- Bolt Down
- Vortex Industries (FHWA Backed)
- Other Manufacturers
- Subject to order / delivery
- **6+ Month Procurement**

- Traditional Materials

- Asphalt Dike / Backfill
- Qwick Kurb Delineators
- Enhanced Striping and RPM's
- Aesthetic Treatments: Colored / Textured Asphalt
- Readily Available Materials
- Caltrans Approved Materials
- Familiarity of Product

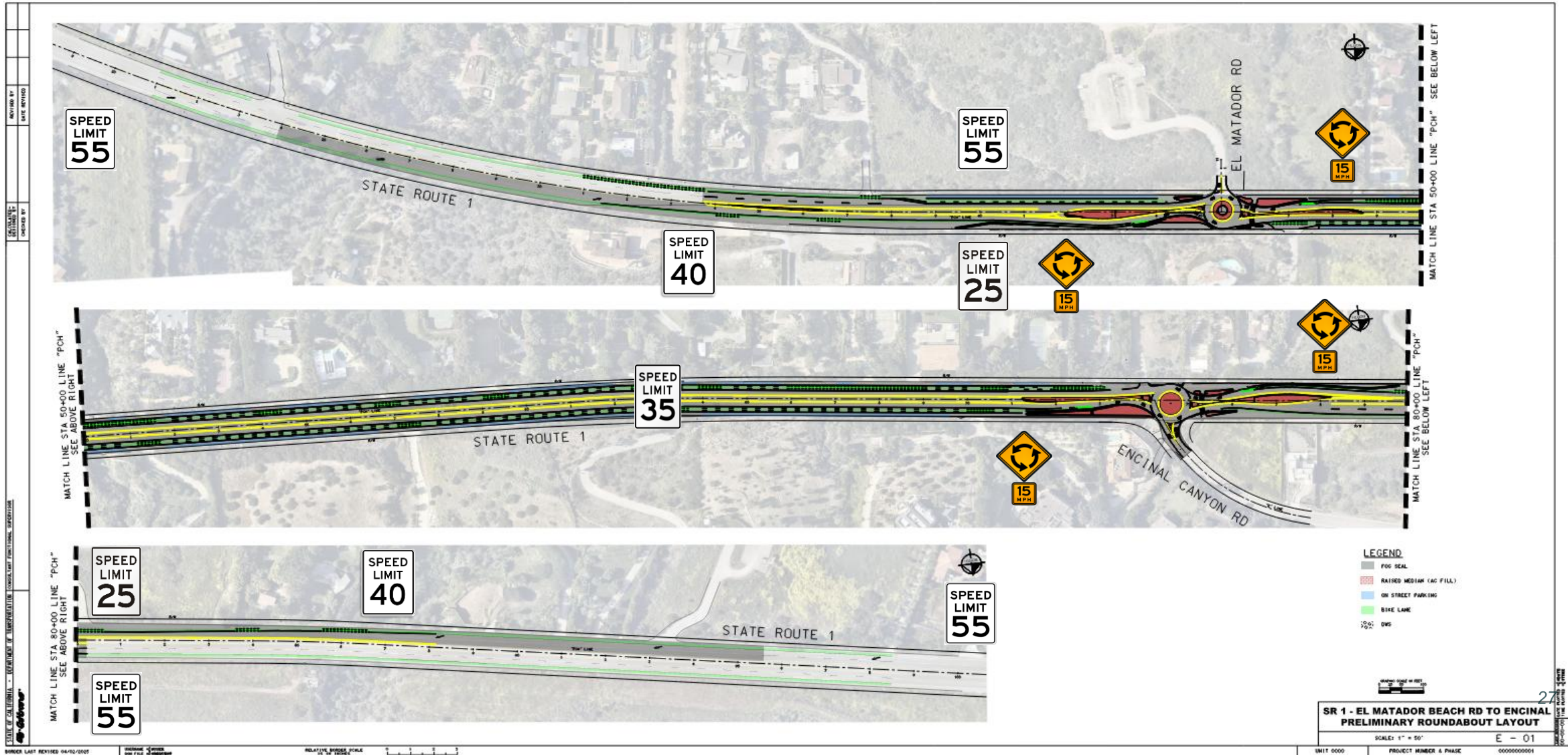


Project Challenges

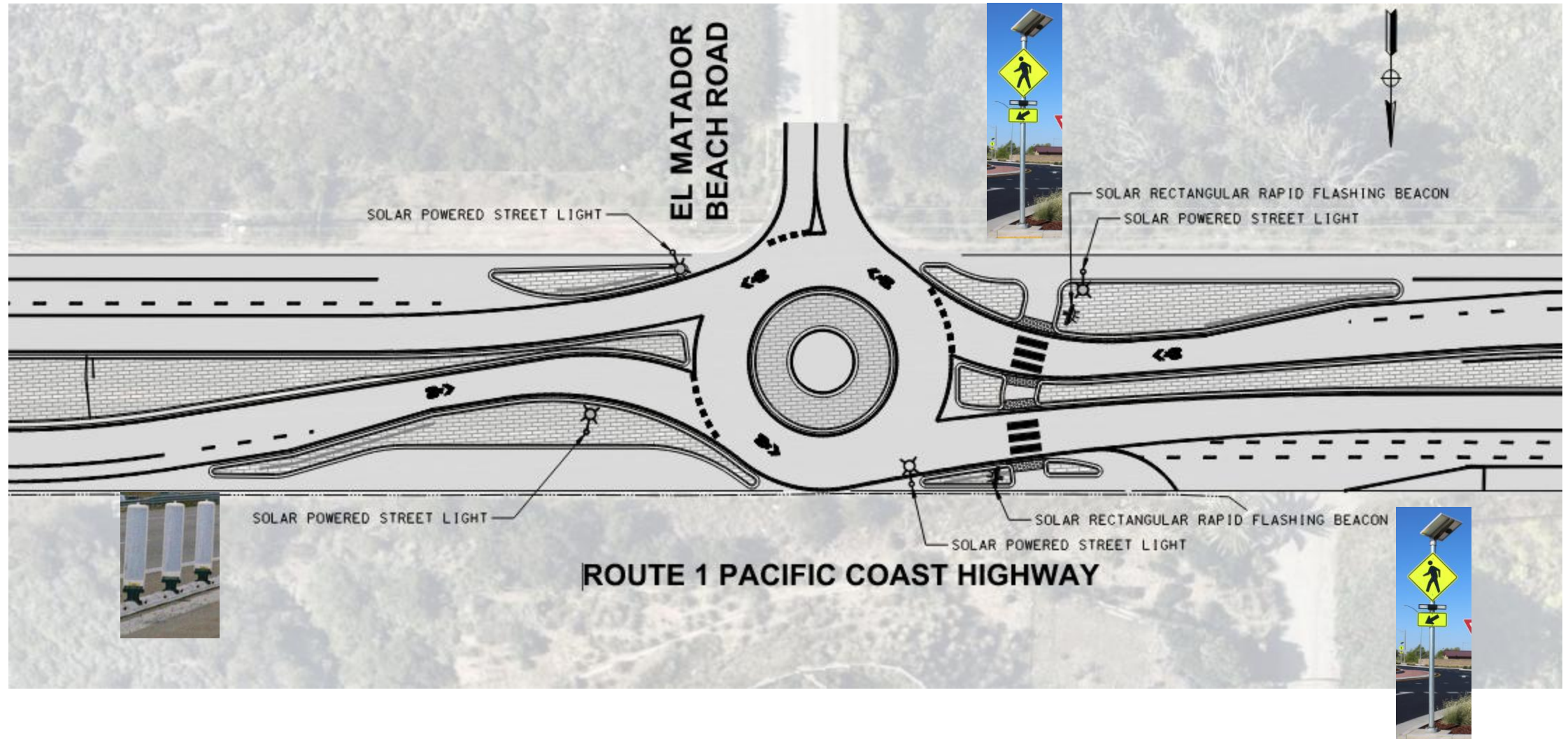
- Schedule
- Caltrans Approval
- Environmental
 - Must stay within limits of existing pavement
 - Must not disturb any soil
 - No New Sign Posts
 - No Light Poles
- Lighting Service Point
- Maintain all Driveways
- Performance Based Design Approval



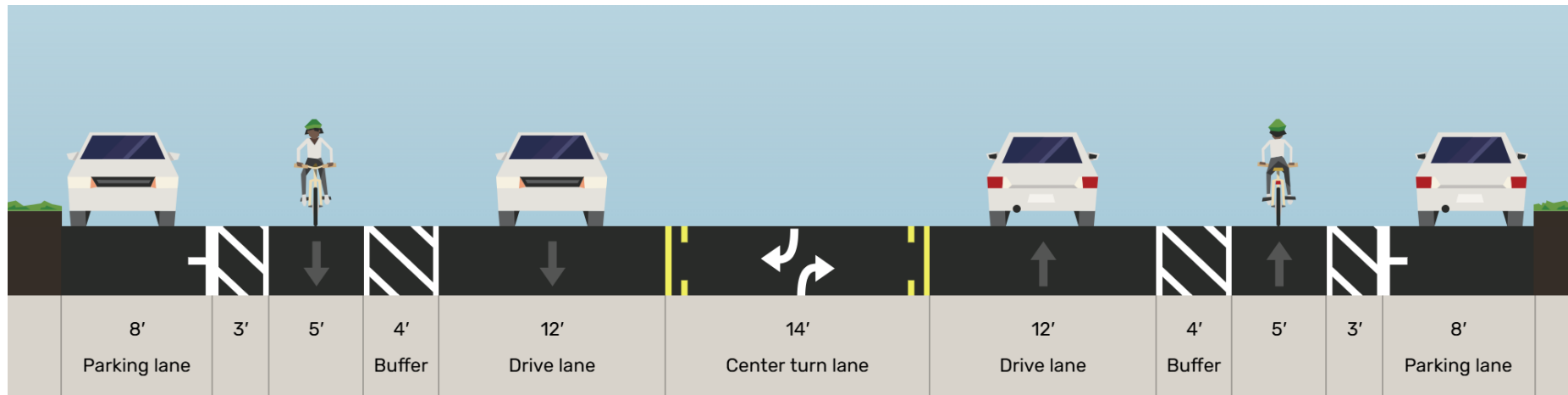
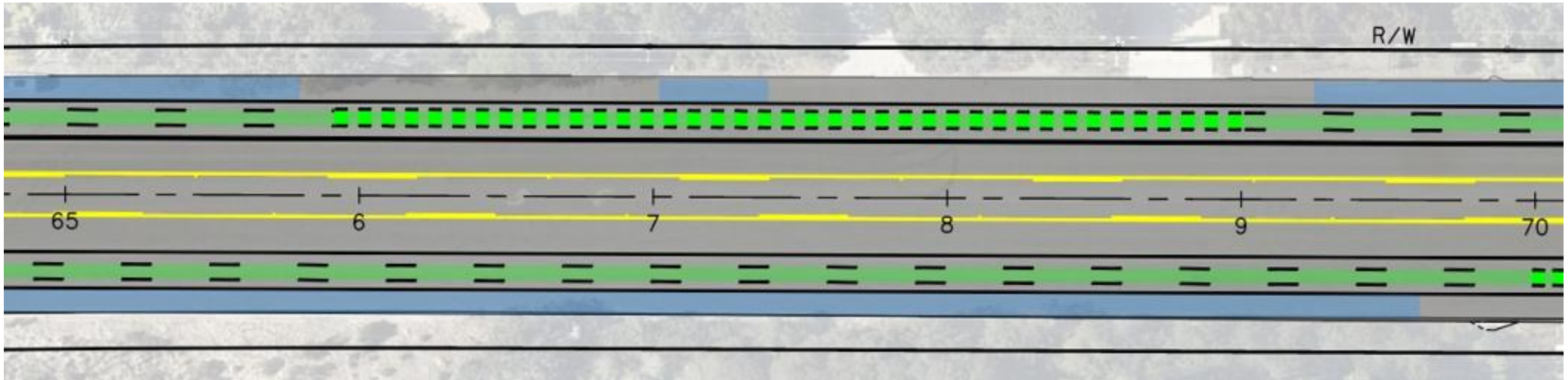
DESIGN - OVERVIEW



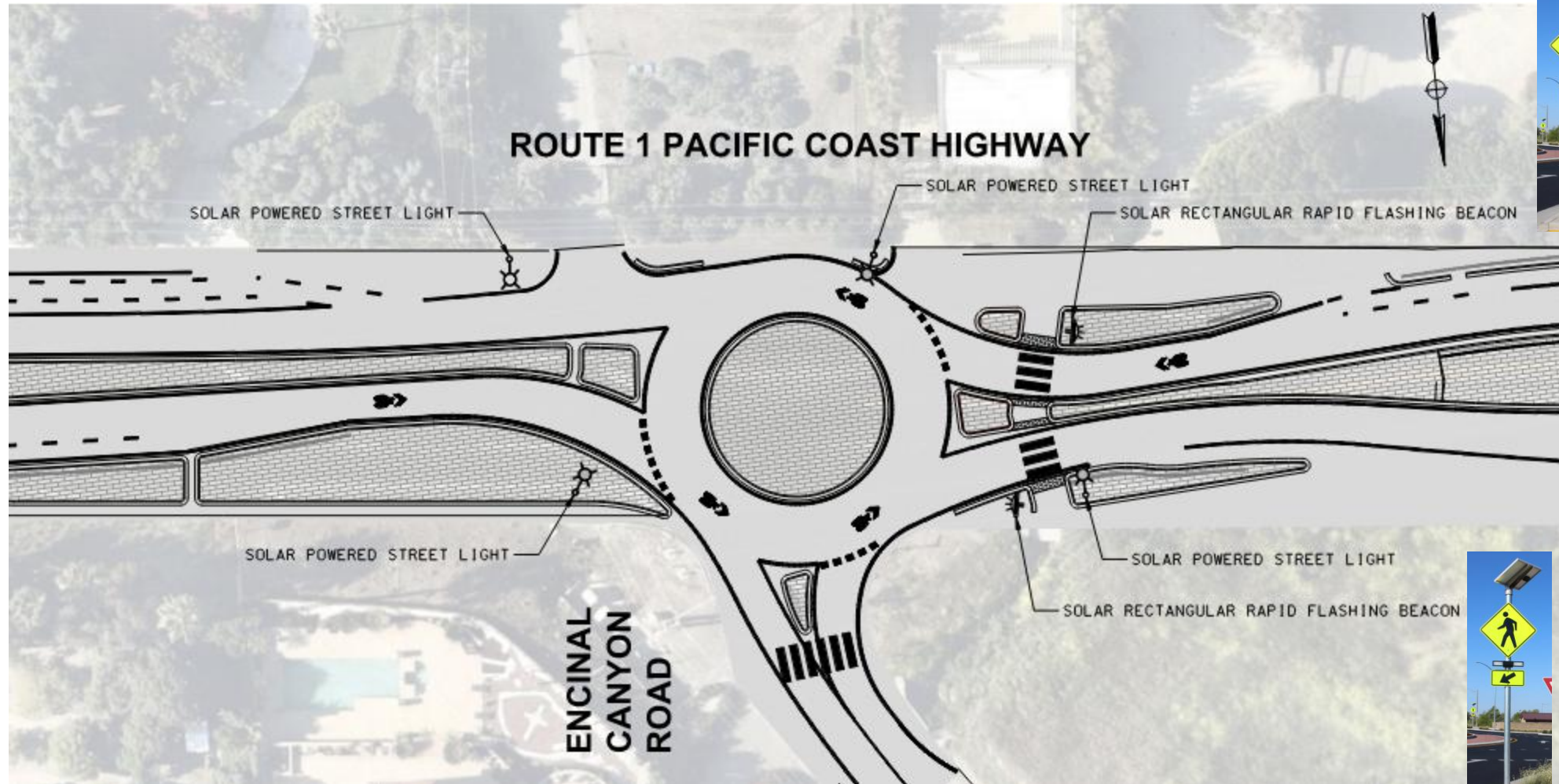
DESIGN – PCH & EL MATADOR



DESIGN – PCH



DESIGN – PCH & ENCINAL CYN



Pre-Post Performance Assessment Monitoring Plan

- Video Analytics
- Pre-Construction
- Post-Construction
 - + 1 Month
 - + 3 Months
 - + 6 Months

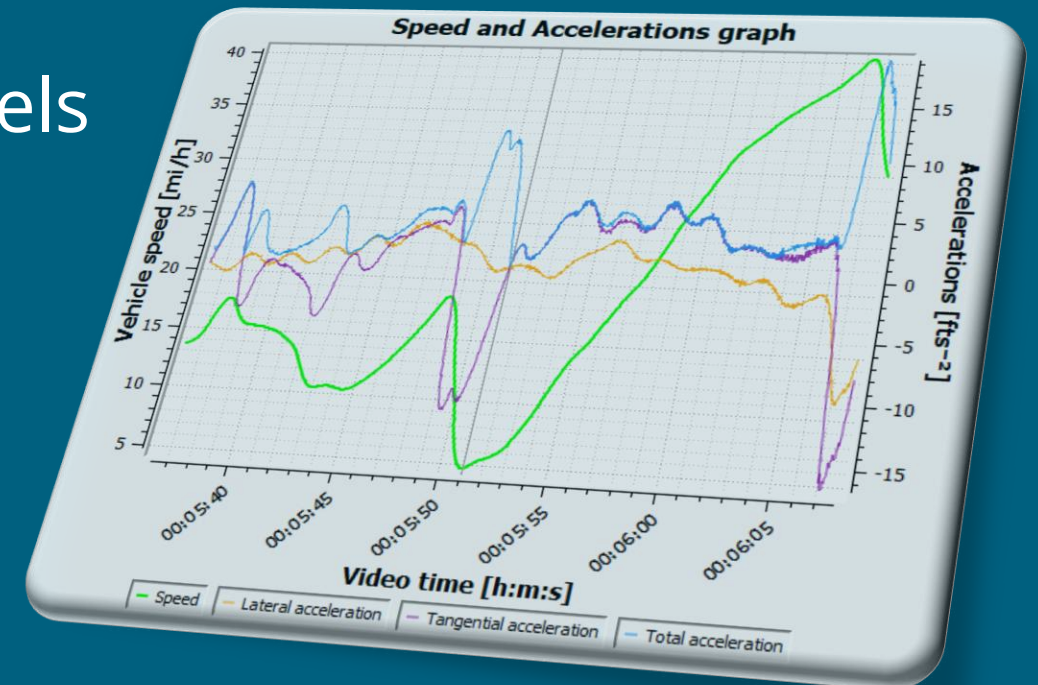
Project Performance Assessment Criteria				
	Performance Assessment	Segment	Data Collection Method	Analysis Method
1	Crashes	All	Caltrans provided crash data	Summary TBD
2	Corridor Speed	3	Tube	Table Summary
3	AADT	3	Tube	Table Summary
4	Vehicle Movement Data	2,4	Drone Video	Video Analytics
5	Pedestrian Movement Data	2,4	Drone Video	Video Analytics
6	Bicycle Movement Data	2,4	Drone Video	Video Analytics
7	Yield Violations	2, 4	Drone Video	Video Analytics
8	Stop Violations	2, 4	Drone Video	Video Analytics
9	Conflict, near miss	2, 4	Drone Video	Video Analytics
10	Conflict, hard deceleration	2, 4	Drone Video	Video Analytics
11	In-Lane Speed	2, 4	Drone Video	Video Analytics
12	User Path Trends (vehicle, pedestrian, bicycle)	2, 4	Drone Video	Video Analytics
13	Dwell Time	2, 4	Drone Video	Video Analytics
14	Follow-up Headway (roundabout)	2, 4	Drone Video	Video Analytics
15	Damage	2, 4	Site Inspection	Visual Observation
16	Minor crash debris	2, 4	Site Inspection	Visual Observation



What are Video Analytics?

Video Analytics is the process of applying AI to define **vehicle kinematics** in video for the purpose of:

- Extracting time-spatial data
- Applying predictive kinematic models
- Visualizing driver behavior trends



Quick –Build Potential in Monterey

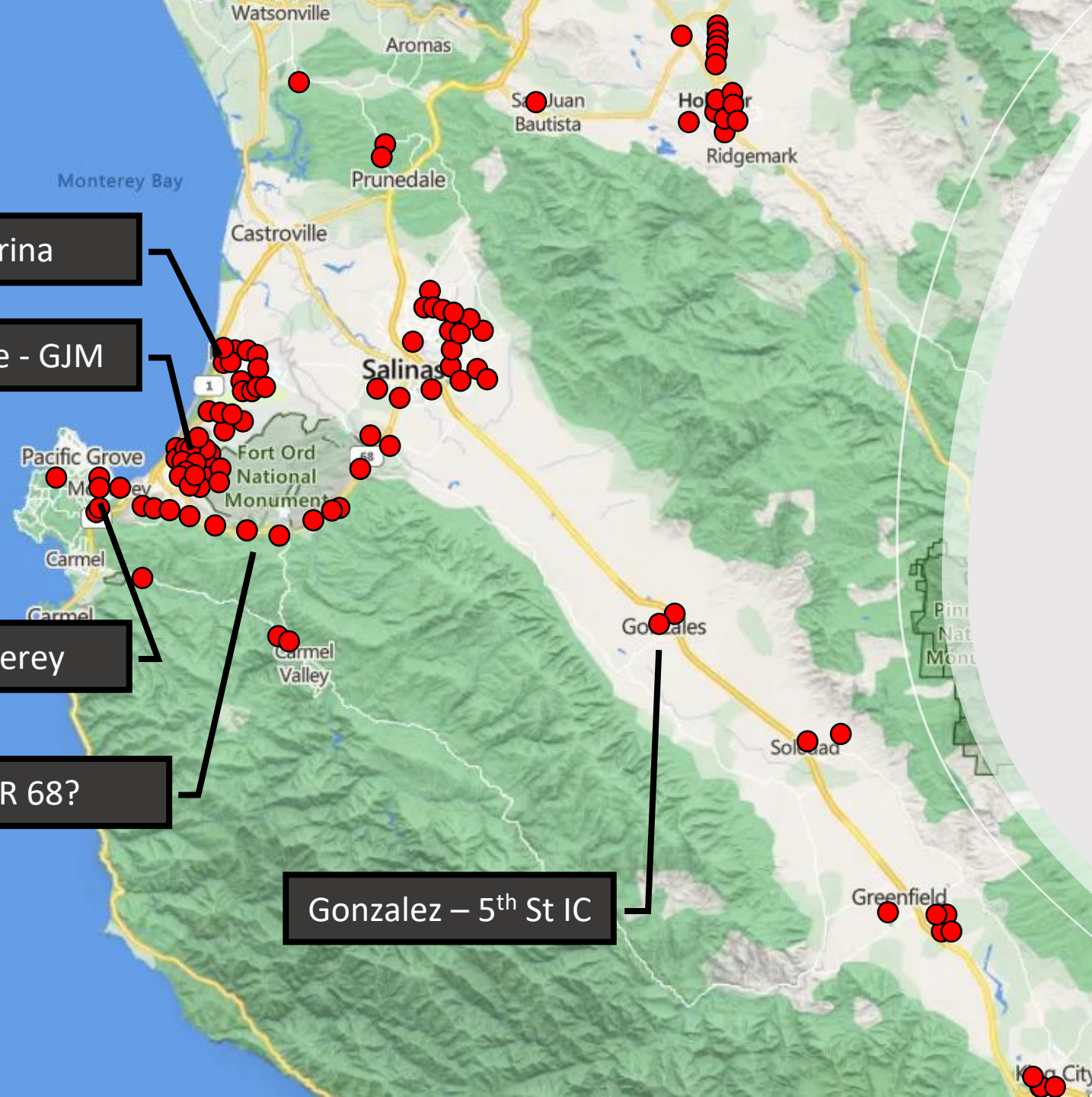
Marina

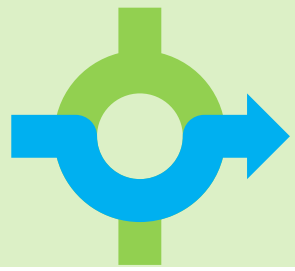
Seaside - GJM

Monterey

SR 68?

Gonzalez – 5th St IC

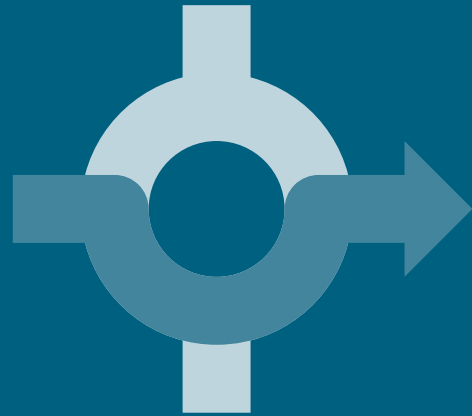




Closing Thoughts and Conclusion

- Low Cost “Quick Build” Roundabouts can be Effective
- Safety is a key driver to implementation
- Performance Based Design Knowledge is a Must Have
- Design First, Select Materials Second
- Facility and Speed Context Shouldn't Discourage Quick Builds
- Evidence Based Assessment is Coming!





Thank You!

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