# NM 14/NM 536/Frost Rd Intersection Reconstruction CN A301442

TransCon 2023

Bohannan Huston

U.S. Department of Transportation
Federal Highway Administration

New Mexico DEPARTMENT OF TRANSPORTATION
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# Presenters

1. Luke Smith, PE – Project Development Engineer, NMDOT CRD
2. Logan Brandenburg, PE – Vice President, Bohannan Huston, Inc.
3. Joseph Kaberlein, EI – Roadway and Drainage Design Engineer, Bohannan Huston, Inc.

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# AGENDA

1. **Project Location**
2. **Project History**
3. **Site Conditions**
4. **Proposed Intersection Layout**
5. **Capstone Course**
6. **Drive-Thru Simulation Video**

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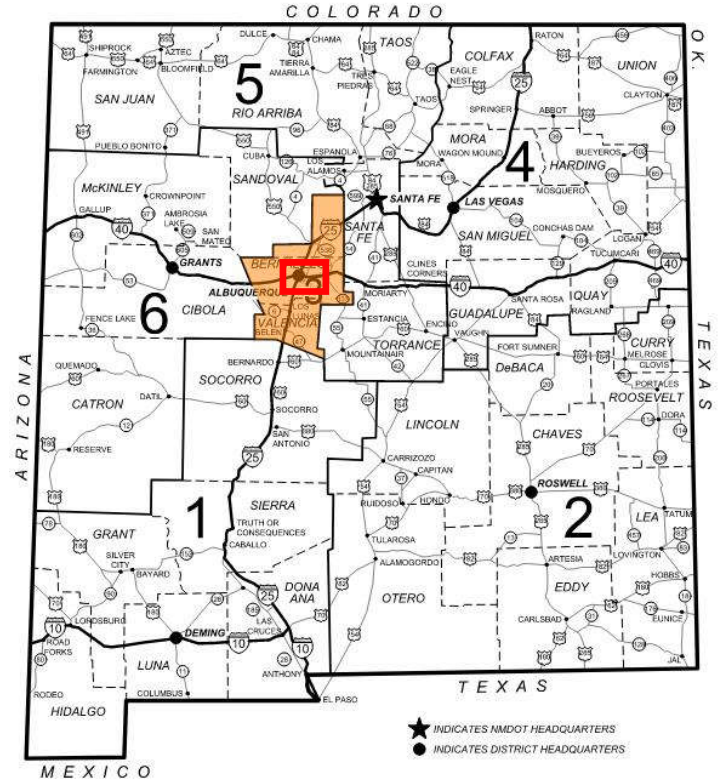
# Project Location

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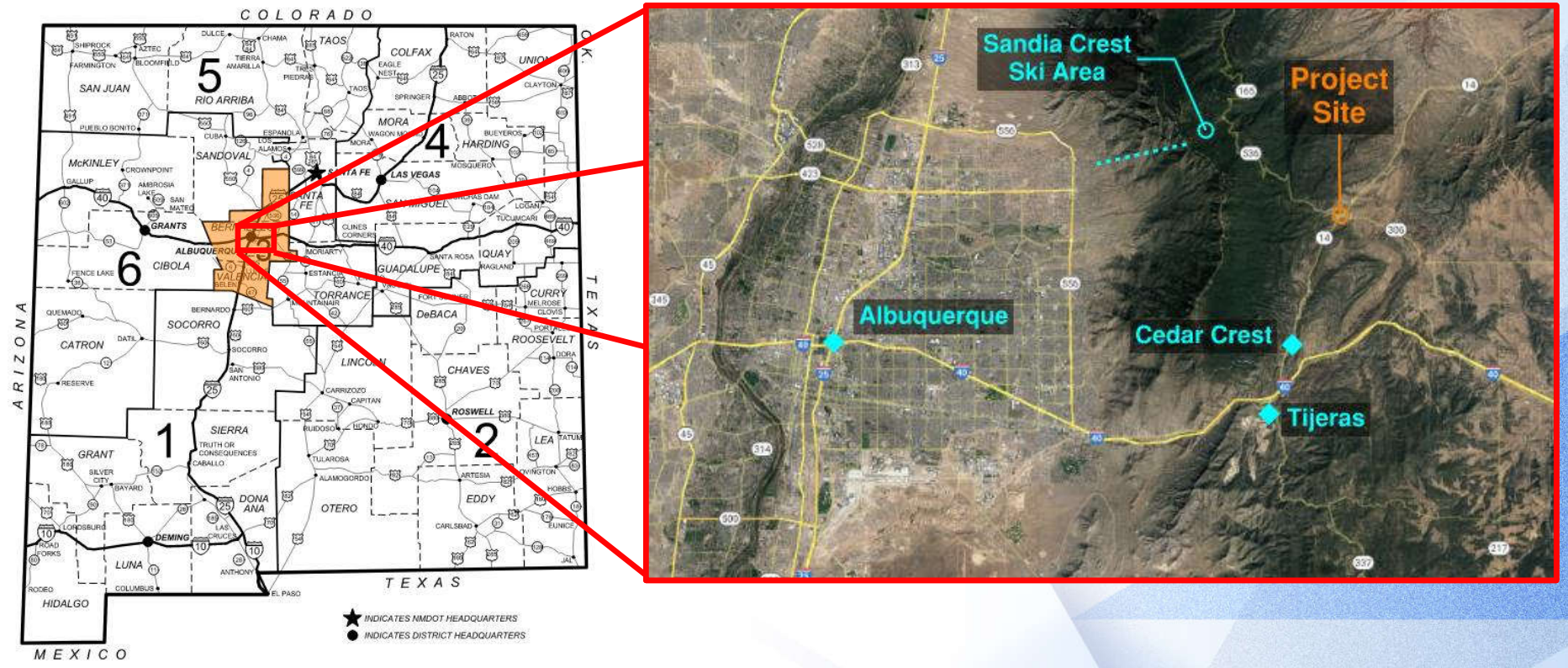
# Project Location

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# Existing Intersection


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# Project History

## Phase 1A/B Study Completed Spring 2018


Purpose of the study was to:

- Reduce congestion
- Improve driver expectation
- Improve access spacing
- Consider multi-modal opportunities

6 intersection alternatives were evaluated

- No Build
- Split Intersection
- Split Intersection with High-T
- South Realignment
- North Realignment
- Roundabout

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# Site Conditions


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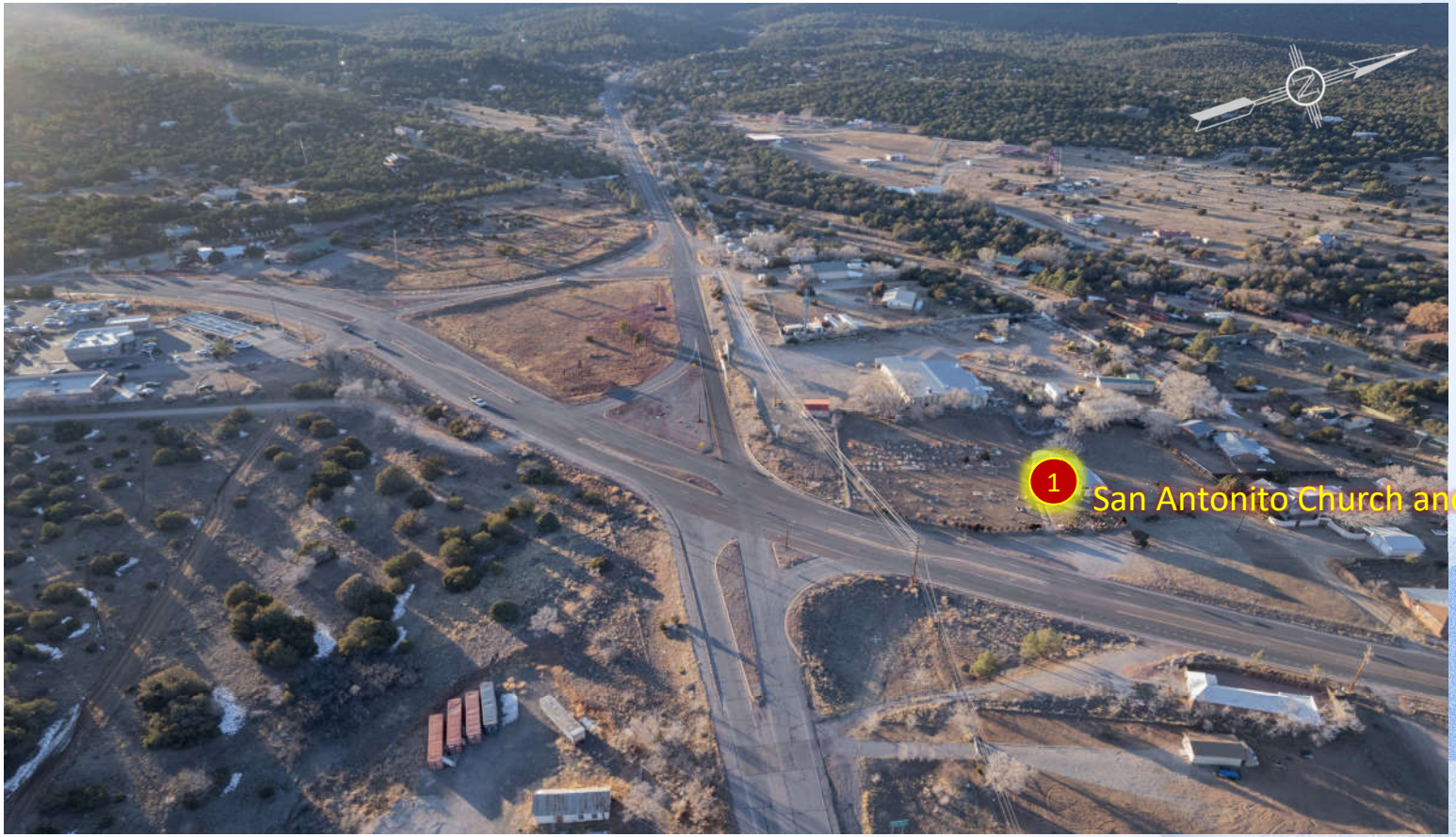
# Site Conditions

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# Site Conditions

## San Antonito Church and Cemetery

- Church was built in 1886
- Earliest dated grave marker is dated 1895
- Corner of cemetery is 5ft from NM 14 pavement
- Satisfies NRHP Criterion A (historical and cultural significance) and Criterion C (distinctive architecture)

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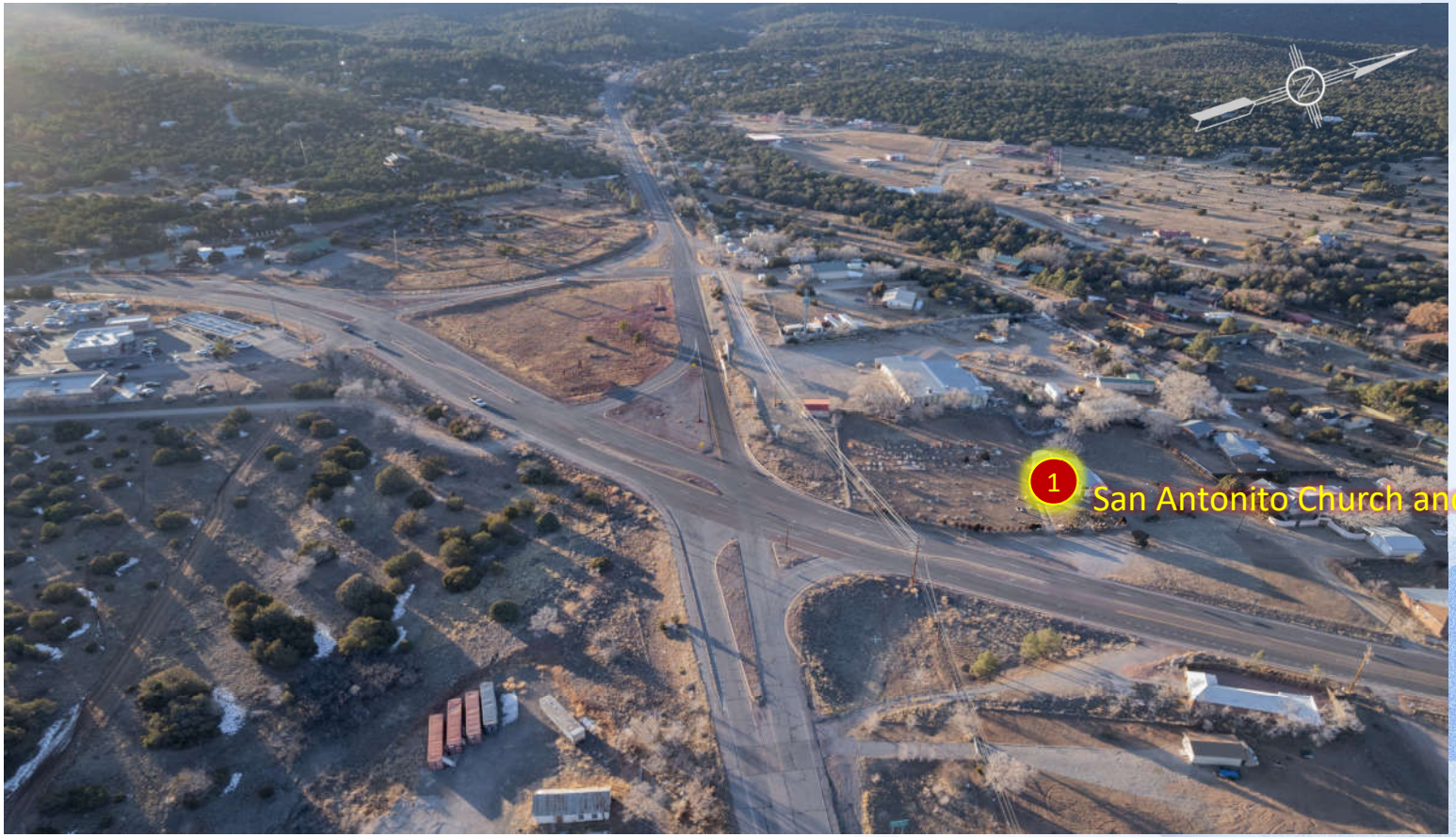
# Site Conditions

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# Site Conditions


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# Site Conditions

## Texaco Gas Station (1960s – 1980s)

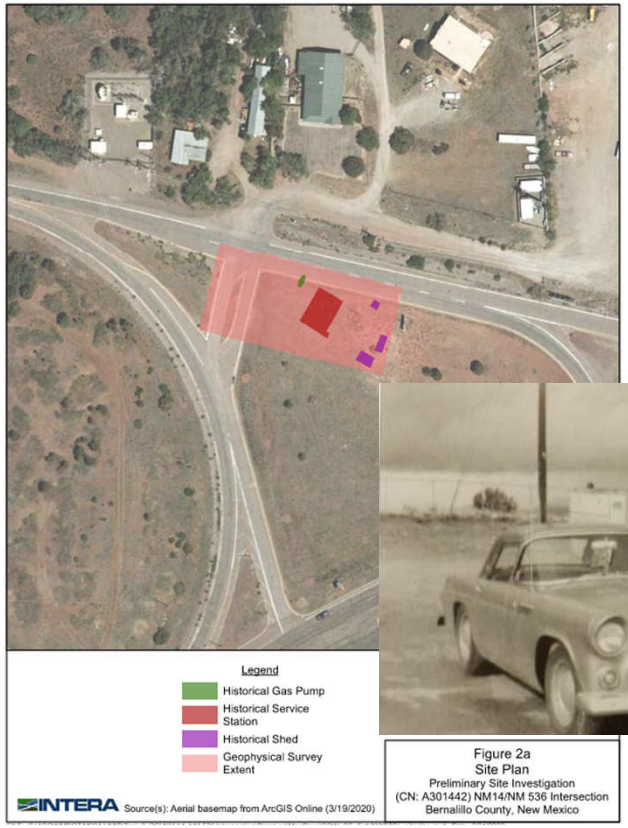


Figure 2a
Site Plan
Preliminary Site Investigation
(CN: A301442) NM14/NM 536 Intersection
Bernalillo County, New Mexico

- Because history of underground storage tanks (UST's) was unknown, HMIB conducted a Preliminary Site Investigation (PSI)
- Included geophysical survey to locate relic UST's and 13 soil borings to identify potential contaminants
- No evidence of UST's or soil contamination was found

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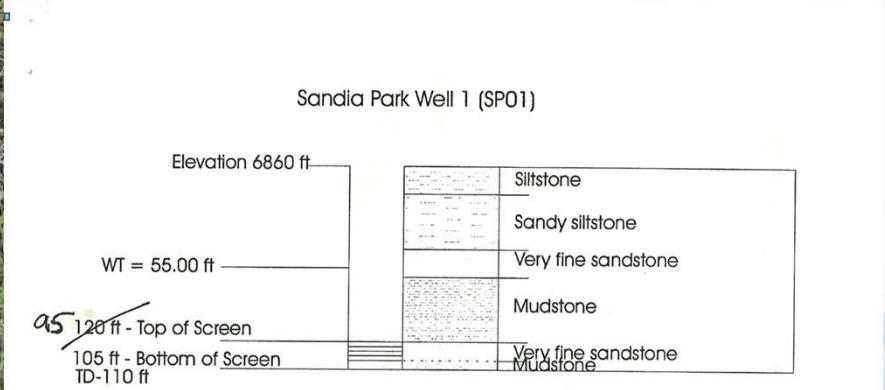
# Site Conditions

## Monitoring Well


- Well installed as part of a nitrate study conducted by Bruce Thomson (UNM)
- As water levels decreased, it was assumed the well went dry but needed confirmation
- Used rope, an old bolt, and sidewalk chalk to verify bottom of well was dry

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# Site Conditions


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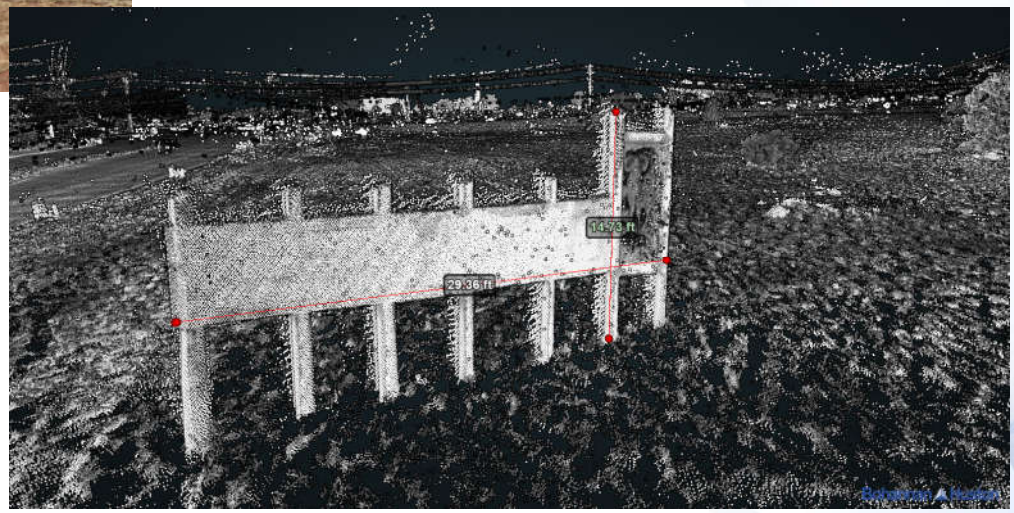
# Site Conditions

## Sandia Crest Sign


- Sign was built by a consortium of State Highway Department, Turquoise Trail Association, Sandia Ranger District of Cibola National Forest, PNM, and Tinkertown Museum
- Currently maintained by nonprofit group The Friends of the Sandia Mountains
- Highly significant for local community
- Used in-house LiDAR data to get accurate measurements of sign

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# Site Conditions


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# Site Conditions

## Old Spanish Store (1920s – 1950s)

- Newspapers affixed to the interior walls date back from early 1920s to 1954 (around the time Frost Road alignment was moved)
- Satisfies NRHP Criterion C (likely to produce additional important information concerning the early twentieth century history in Bernalillo County)

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# Site Conditions


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# Proposed Intersection Layout

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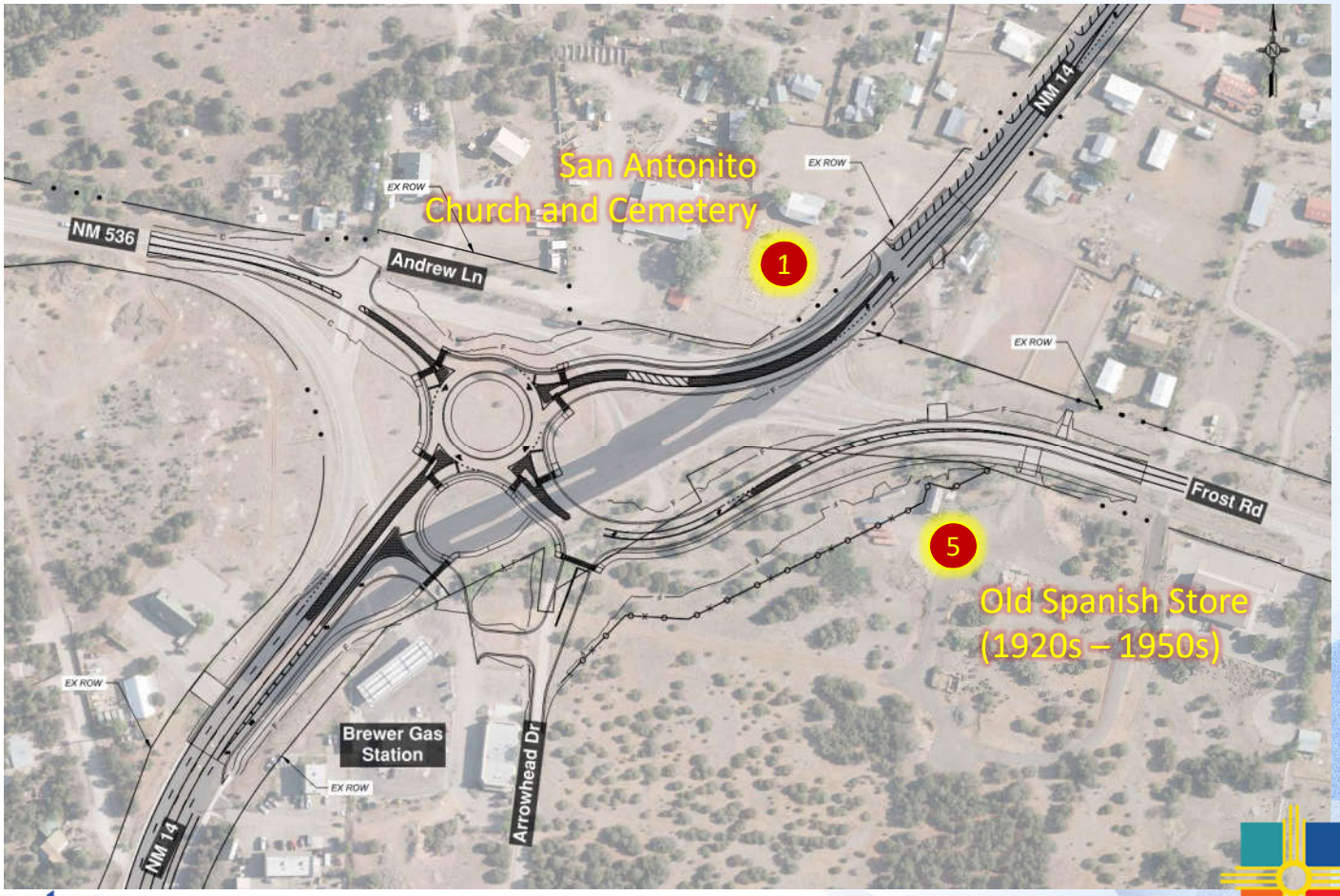


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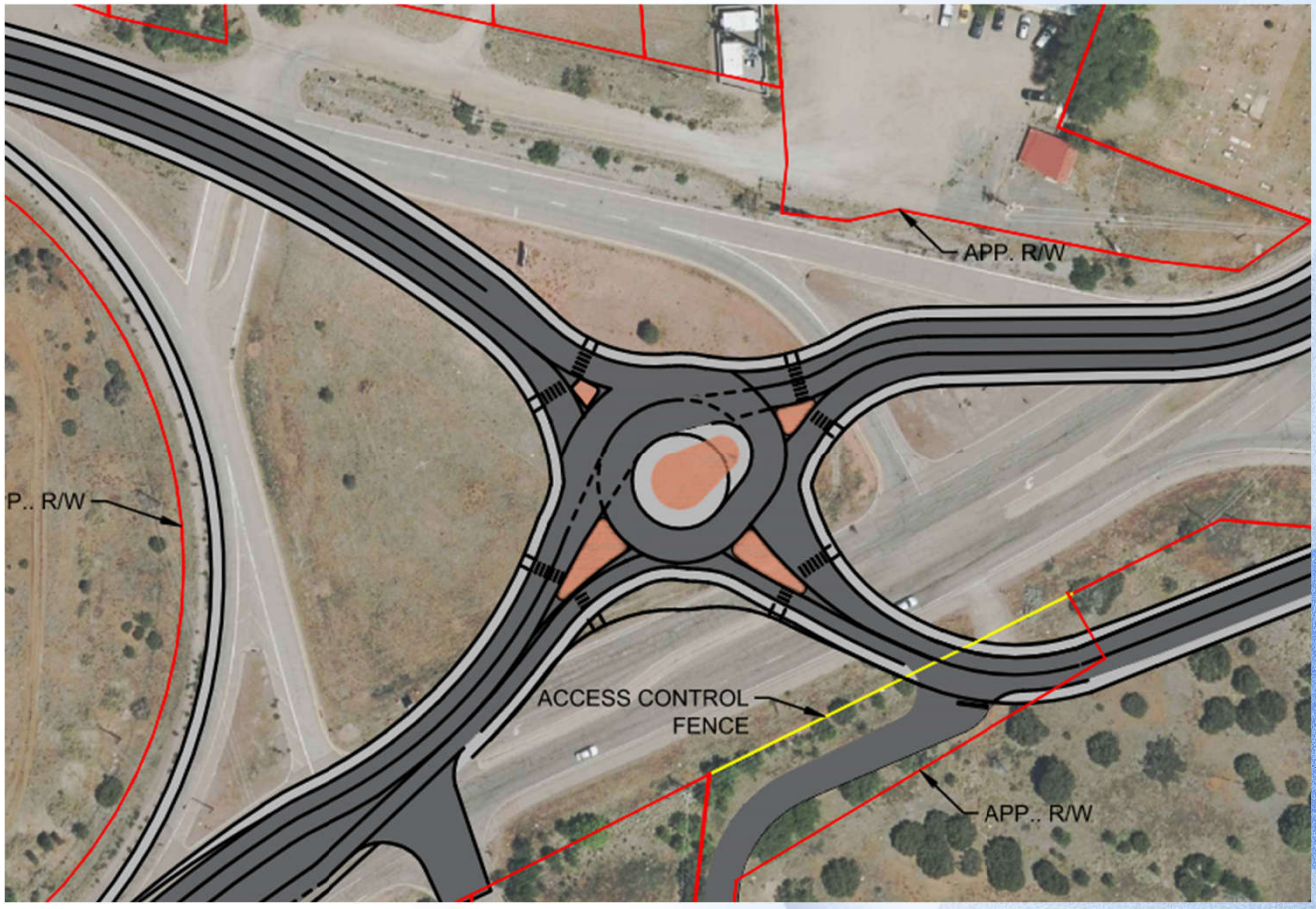
**Previous Iterations**

- Did not provide good lane separation.
- Very early design, but similar layout to final configuration.
- Constructability could be further improved.

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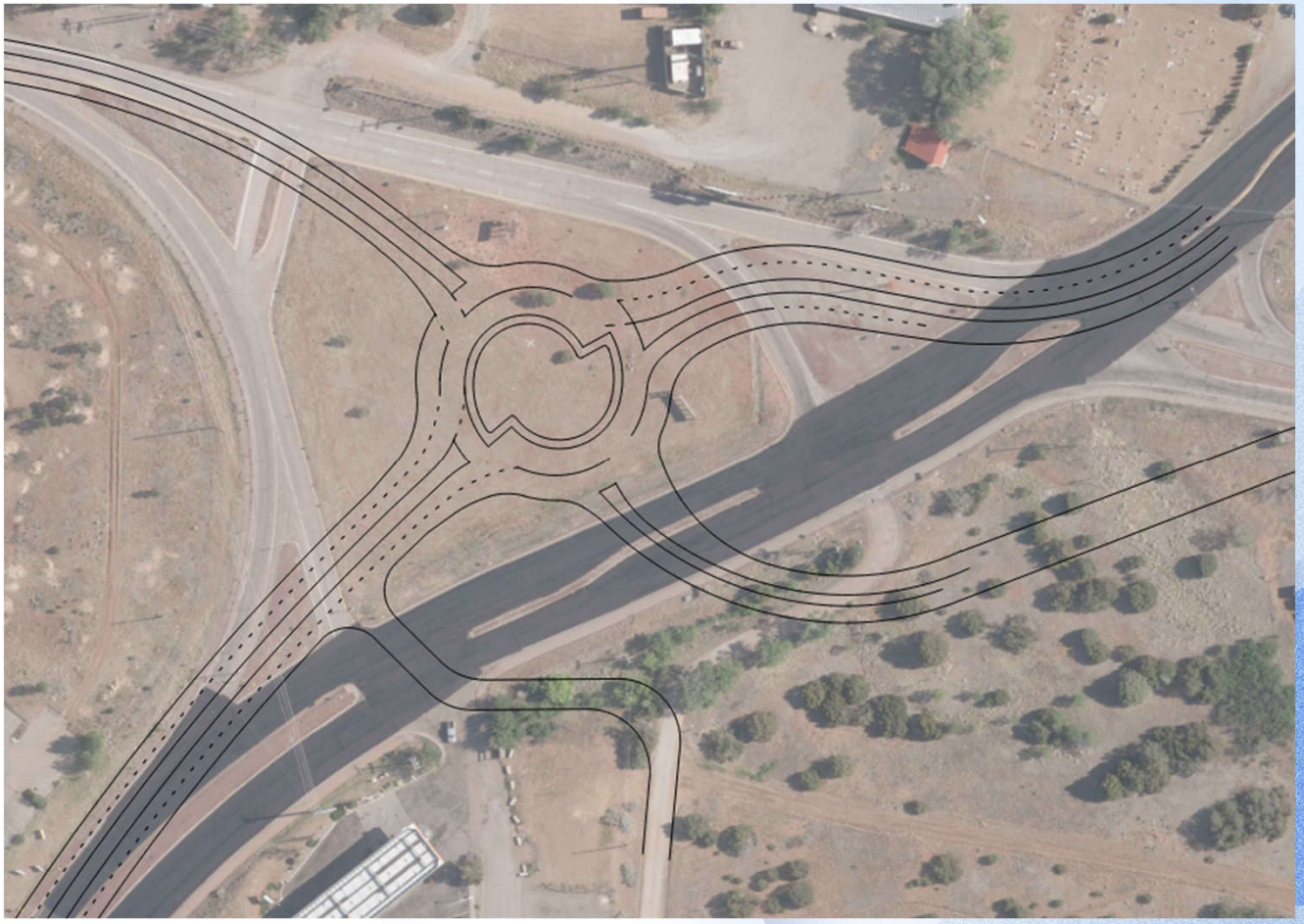
**Previous Iterations**

- Additional capacity for NM 14 traffic.
- Proposed to use additional turbo roundabout elements.
- Extra capacity was not necessary.



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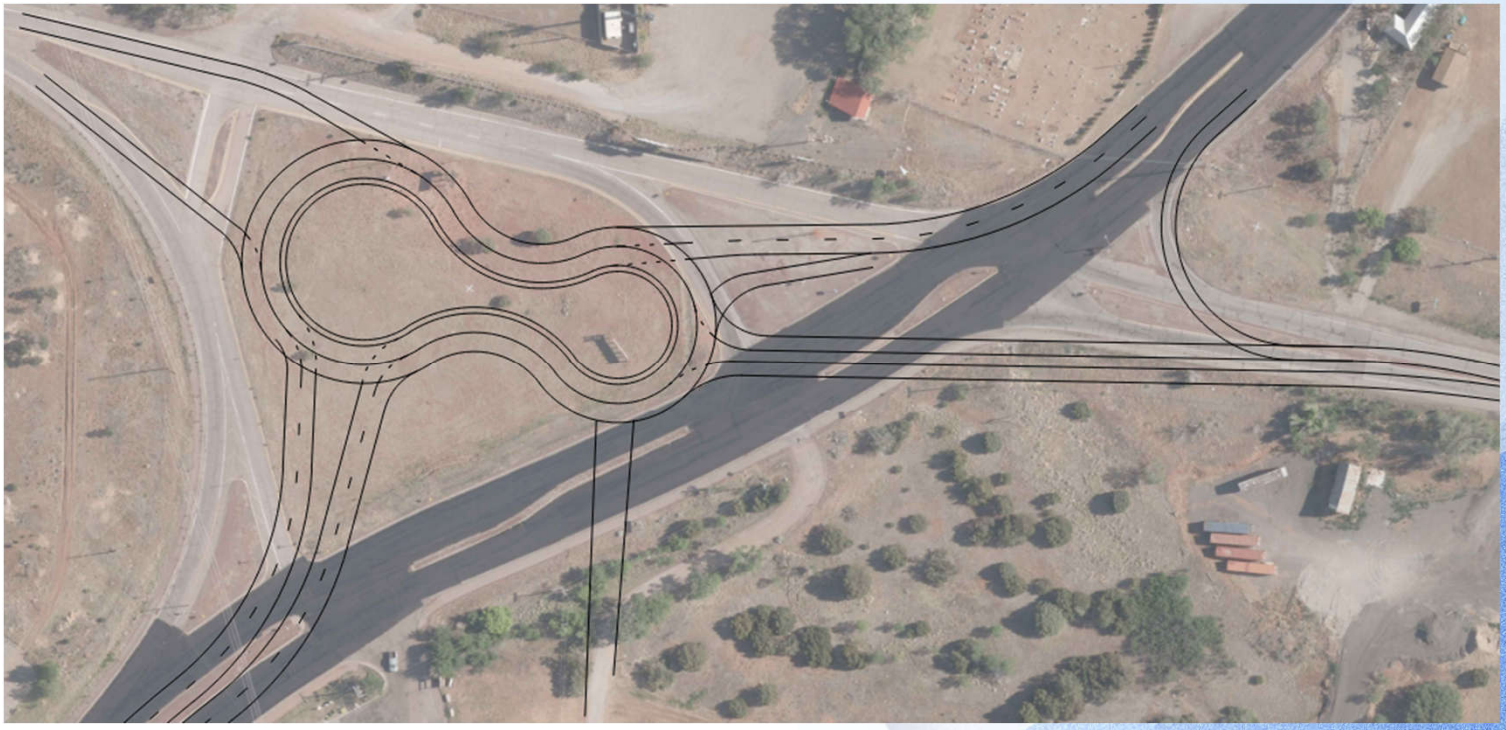
**Previous Iterations**

- A peanut-about provided very favorable horizontal geometry.
- The larger footprint made vertical design much more difficult.
- Created a large amount of out-of-direction travel.



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# Geometrics

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## Approach to Geometry

- Use geometry to lower travel speeds on the approach to the roundabout.
- Accomplished by incrementally reducing the horizontal and vertical design speed.
- Supplemented by permanent signing.
- Intersection lighting will provide additional emphasis overnight.


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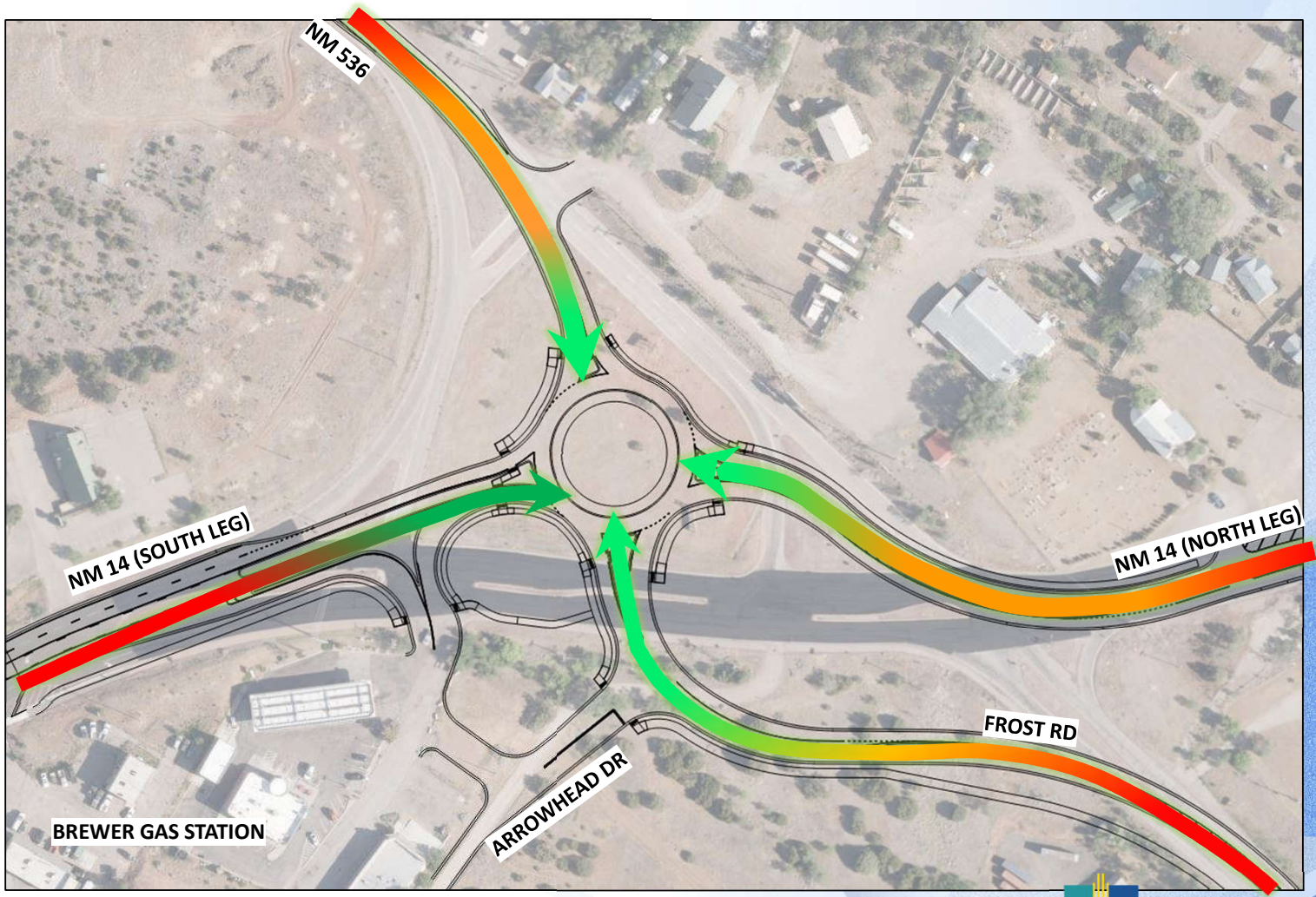
## Horizontal Alignment

- Inscribed circle diameter of 180 feet.
- Accommodates a WB-67 design vehicle.
- High degree of deflection for through movements.
- Splitter islands are mountable, providing additional comfort for large vehicles.
- School busses and emergency vehicles can navigate without the use of the truck apron.

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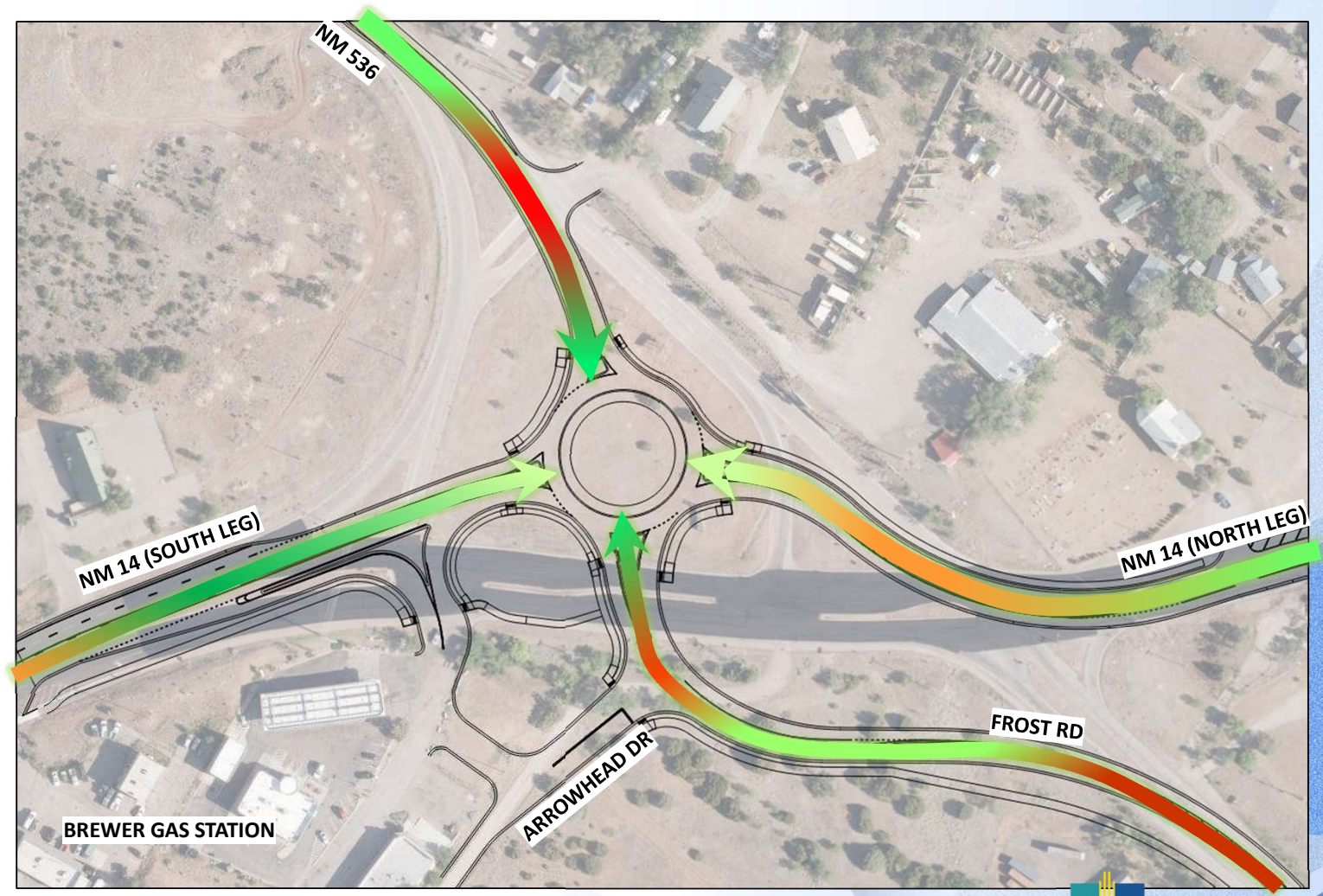
## Vertical Profile

- Total elevation change of 65 feet.
- The maximum grade falls along NM 536 at 6.5%
- Frost Rd ties back at an existing 5.2%
- NM 14's north leg has a maximum grade of 6.0%
- NM 14's south leg is generally less than 1.5% within the reconstructed areas.

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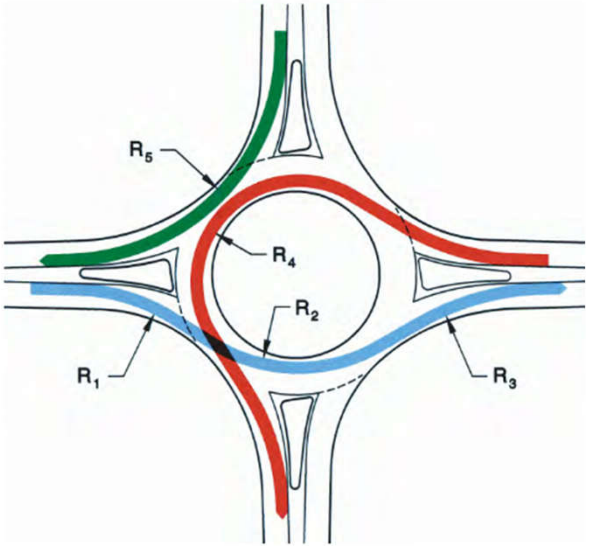
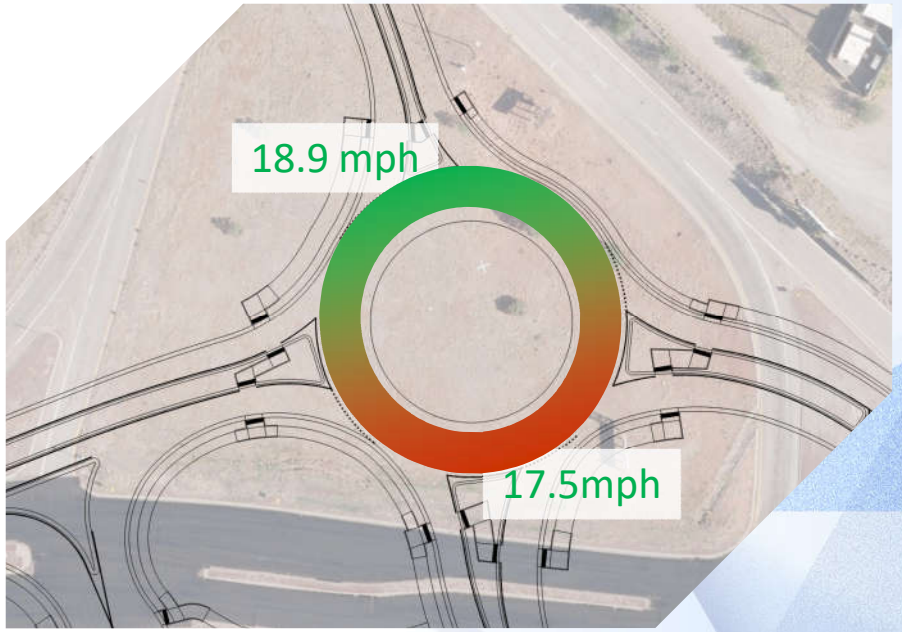
## Fast Path Analysis

- Maximum speed different is just under 10mph.
- Average speed is 20.5mph.

| Fast Path ID | NM 536 | | NM 14(North) | | Frost Rd | | NM 14(South) | |
|---|---|---|---|---|---|---|---|---|
| | Radius (ft) | Velocity (mph) | Radius (ft) | Velocity (mph) | Radius (ft) | Velocity (mph) | Radius (ft) | Velocity (mph) |
| R1/V1 | 138 | 23.13 | 182 | 24.13 | 144 | 23.66 | 105 | 21.33 |
| R2/V2 | 76 | 18.12 | 76 | 18.77 | 76 | 18.1 | 77 | 17.58 |
| R3/V3 | 189 | 26.47 | 156 | 22.69 | 145 | 23 | 141 | 23.76 |
| R4/V4 | 63 | 16.62 | 75 | 18.76 | 77 | 18.4 | 75 | 17.36 |
| R5/V5 | 104 | 19.55 | 109 | 20.59 | 67 | 17.76 | 89 | 19.7 |

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# Drainage

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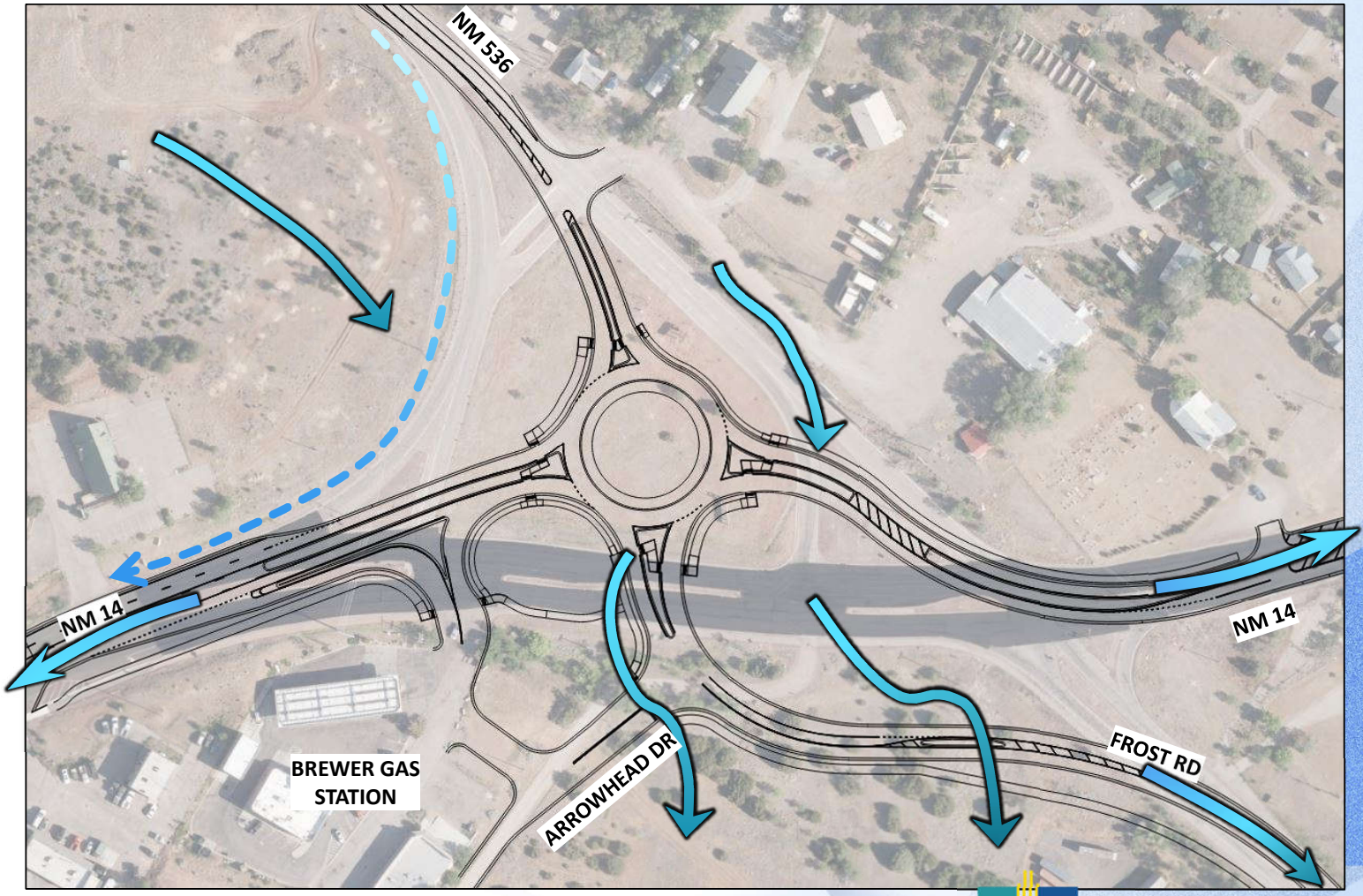
## Proposed Conditions

- Existing storm drain infrastructure will be removed as it will no longer serve the proposed design
- Existing flows are maintained beyond project limits
- Roadway drainage is accommodated with storm drains.

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# Access Spacing

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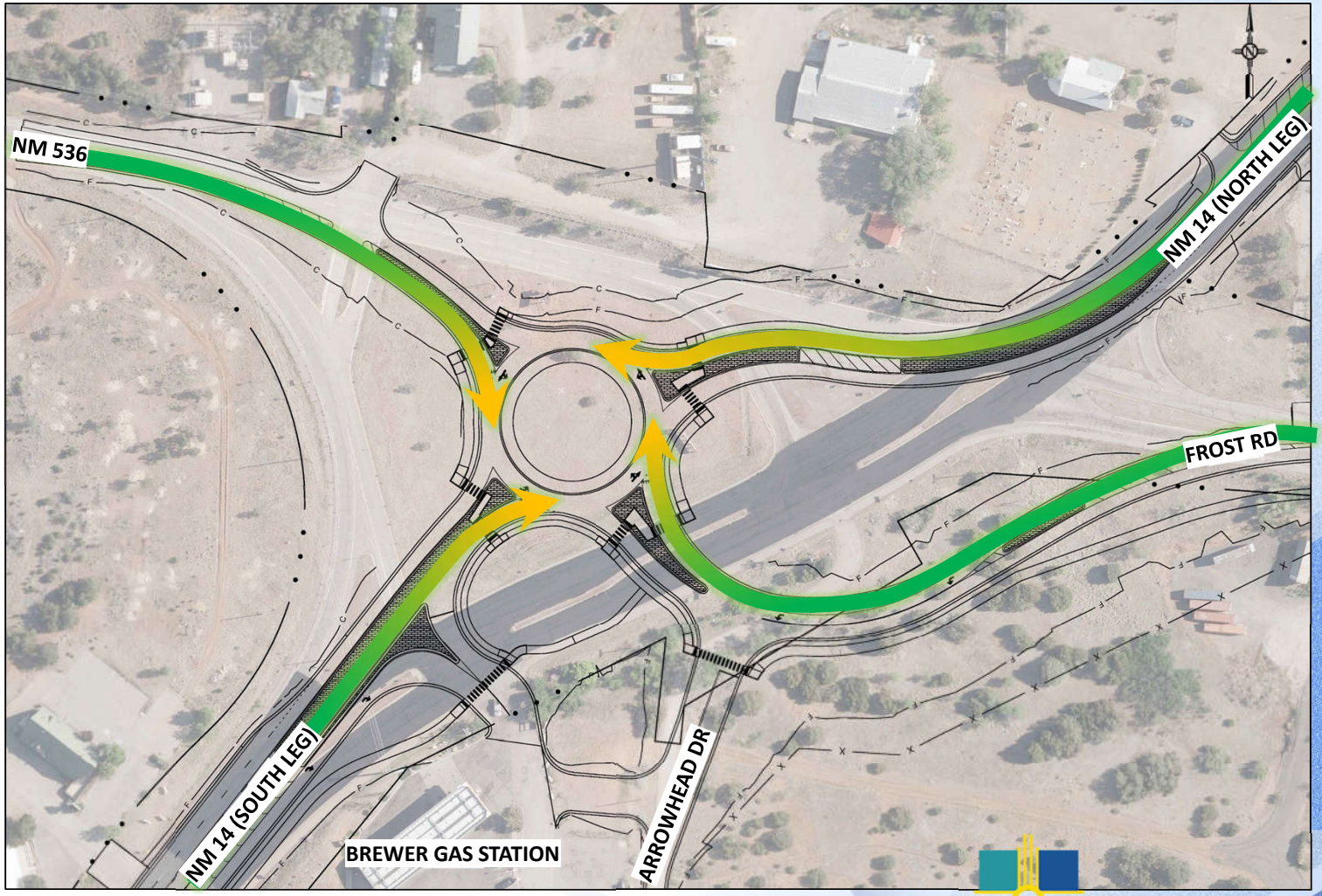
## Proposed Layout

- Consolidated intersection
- Single lane approaches
- Maintain existing driveways
- Arrowhead now connects to Frost Road
- Accommodates WB-67 with apron and S-Bus-40 without apron (including emergency response vehicles)

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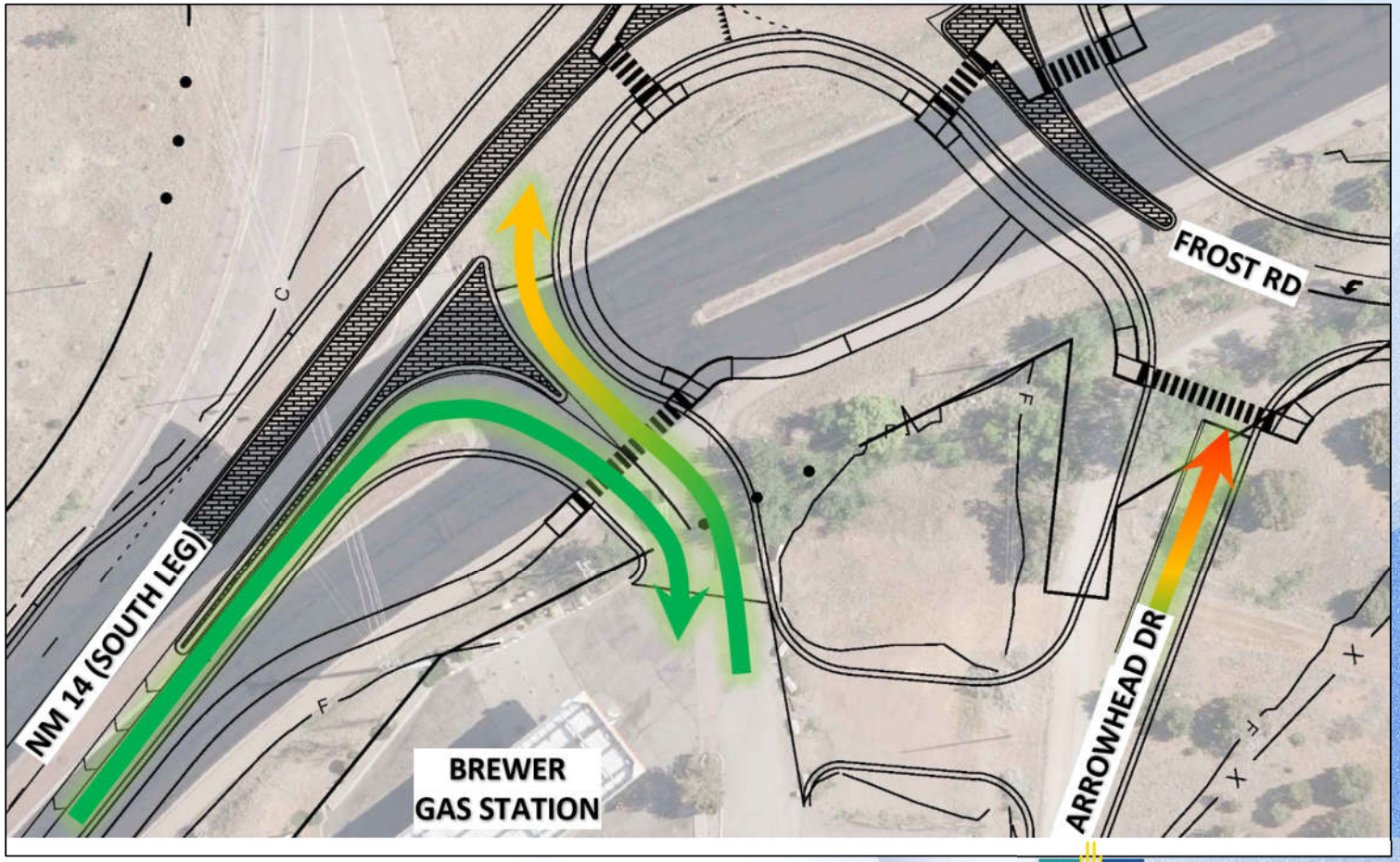
**Business Access**

- Existing access will become a “right-in/right-out” along NM 14
- New full access from Arrowhead Drive

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# Multi-Modal Design

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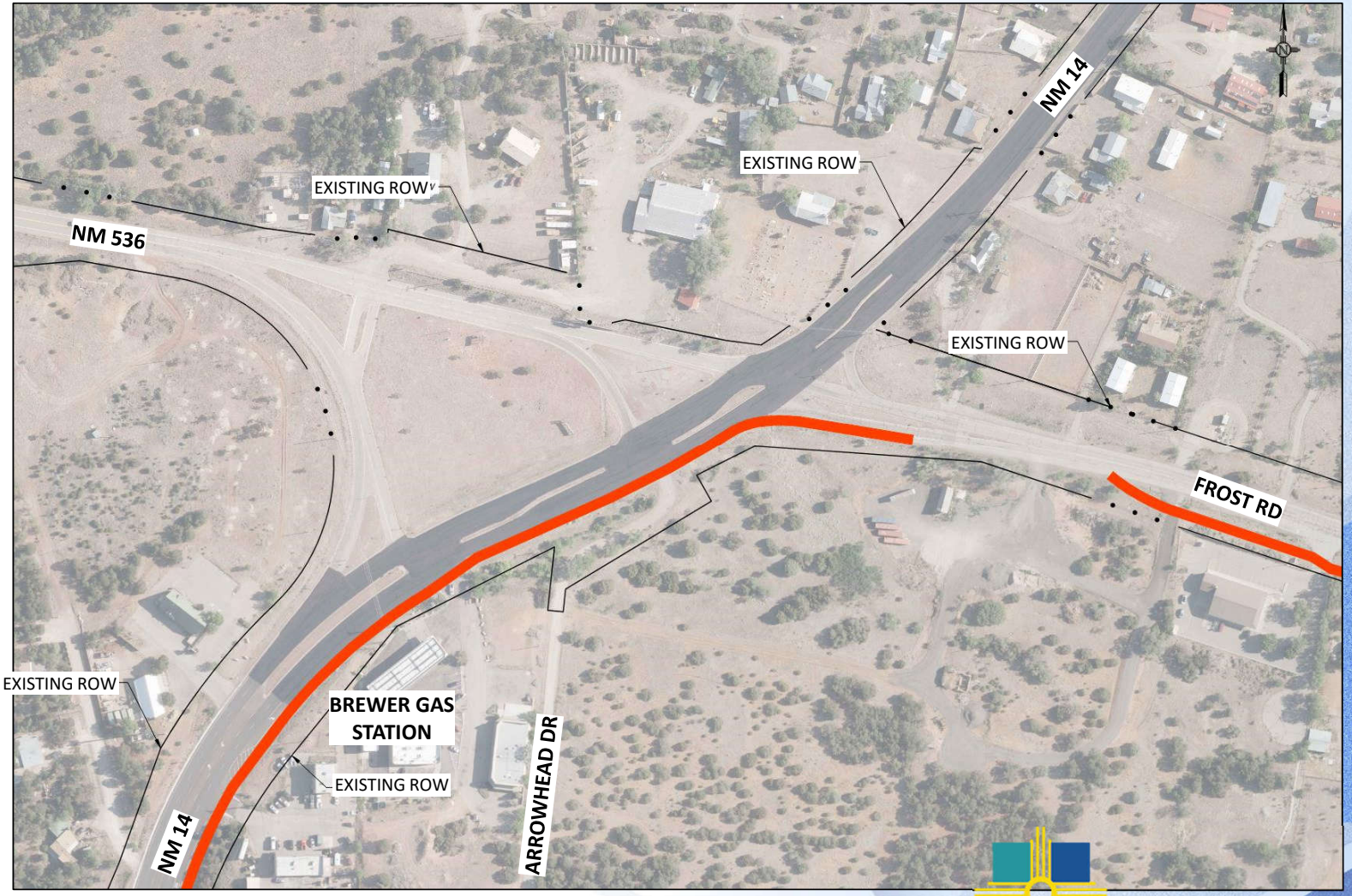
## Existing Pedestrian Access

- Multi-Use Path along east side of NM 14 ends at Frost Rd
- 300’ gap (no path)
- Multi-Use Path picks up again on Frost Rd and continues east

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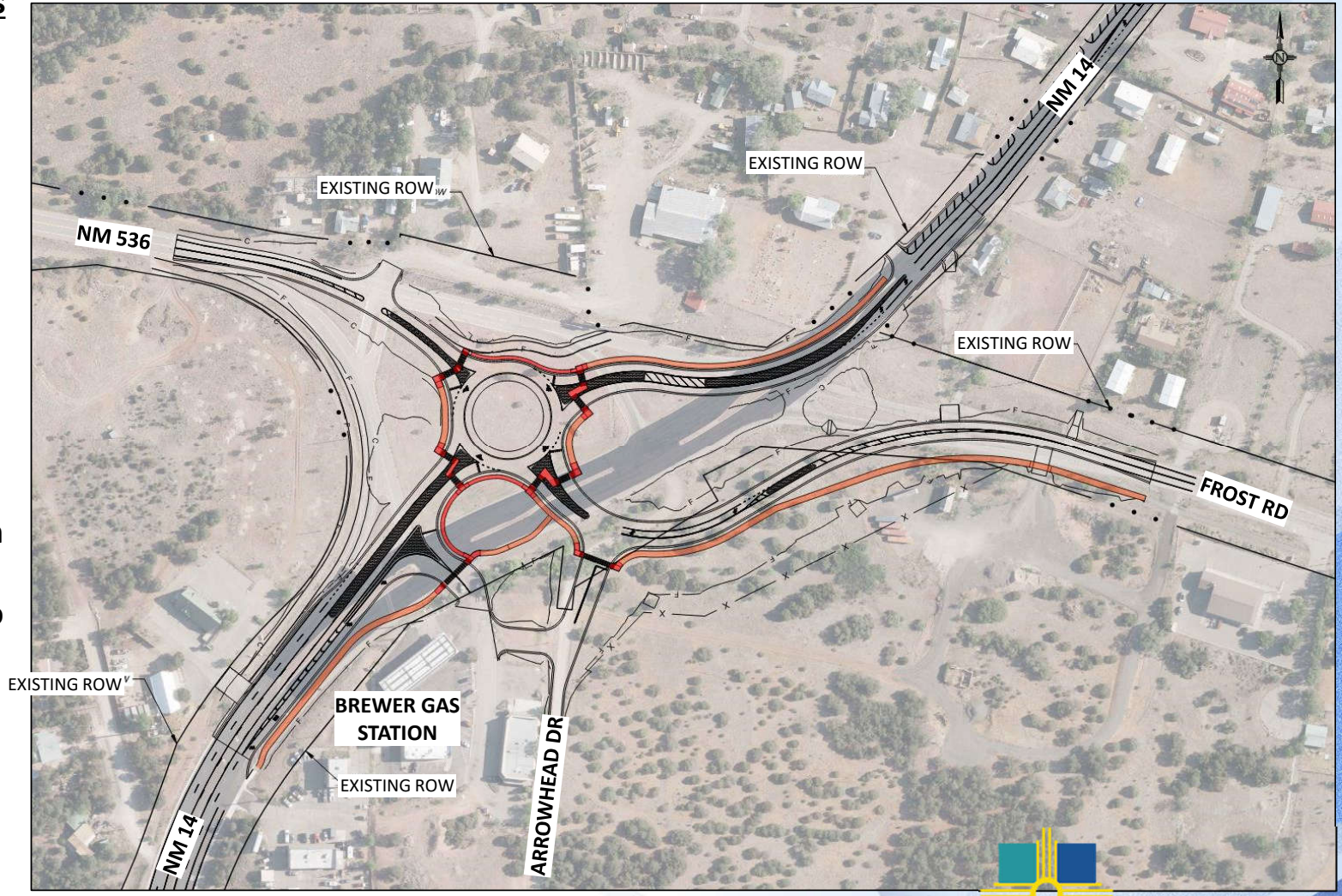
## Proposed Pedestrian Access

- New Multi-Use Path will close gap at Frost Rd
- Pedestrians will have full access throughout the intersection
- New Multi-Use Path connection up to San Antonito Church
- Future connection to San Antonito Elementary School through Bernalillo County Public Works Project
- Bicyclists can utilize new Sidewalk/Multi-Use Path system or share the road

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# Intersection Capacity

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# Intersection Capacity

**2019 Traffic Data:**
8,562 vehicles per day

**2039 Traffic Data:**
11,086 vehicles per day

**Exhibit 1-9**
Roundabout Category Comparison

*Design characteristics of the three roundabout categories.*

NCHRP Report 672 (2nd ed) - Roundabouts: An Informational Guide

| Design Element | Mini-Roundabout | Single-Lane Roundabout | Multilane Roundabout |
|---|---|---|---|
| Desirable maximum entry design speed | 15 to 20 mph (25 to 30 km/h) | 20 to 25 mph (30 to 40 km/h) | 25 to 30 mph (40 to 50 km/h) |
| Maximum number of entering lanes per approach | 1 | 1 | 2+ |
| Typical inscribed circle diameter | 45 to 90 ft (13 to 27 m) | 90 to 180 ft (27 to 55 m) | 150 to 300 ft (46 to 91 m) |
| Central island treatment | Fully traversable | Raised (may have traversable apron) | Raised (may have traversable apron) |
| Typical daily service volumes on 4-leg roundabout below which may be expected to operate without requiring a detailed capacity analysis (veh/day)* | Up to approximately 15,000 | Up to approximately 25,000 | Up to approximately 45,000 for two-lane roundabout |

*Operational analysis needed to verify upper limit for specific applications or for roundabouts with more than two lanes or four legs.

**Intersection Level of Service**

| | | NM 536 | NM 14 (North Leg) | Frost Rd | NM 14 (South Leg) | Overall Intersection |
|---|---|---|---|---|---|---|
| Existing Traffic Volumes | AM | A | A | A | A | A |
| | PM | A | A | A | B | B |
| 20-Year Forecast | AM | B | D | A | A | C |
| | PM | A | B | B | B | B |

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# Safety & Driver Expectancy


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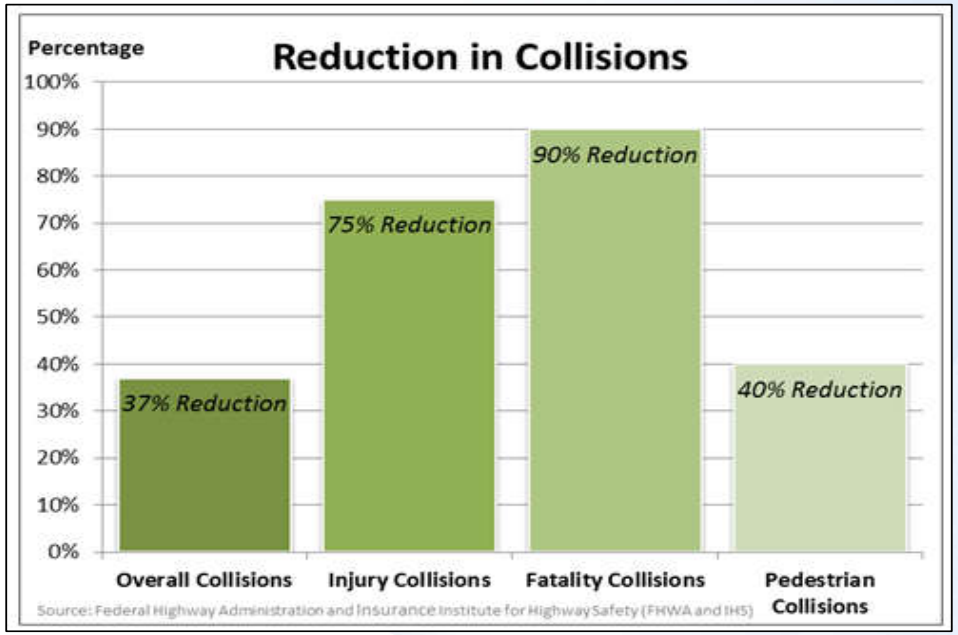
## Collision Reductions

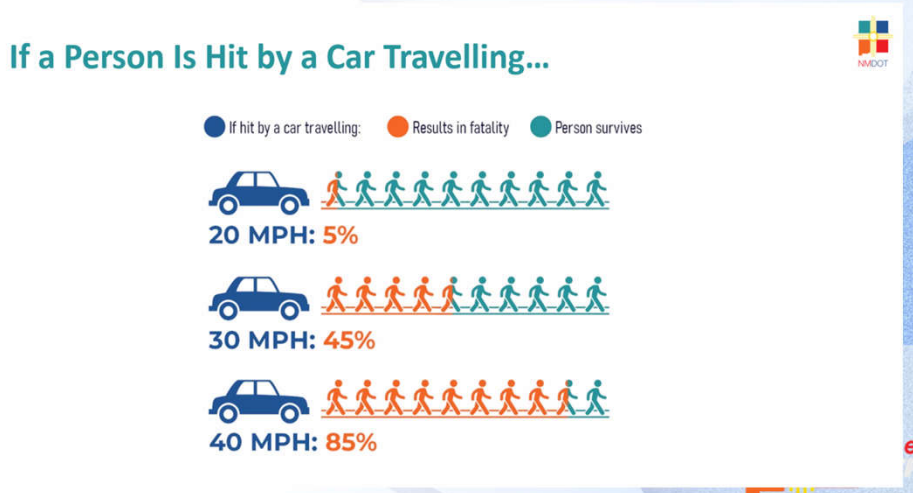
Study conducted by the Insurance Institute for Highway Safety (IIHS) and Federal Highway Administration (FHWA)

Roundabouts in place of a stop-controlled or signalized intersection.




Reasons for these reductions include:

- Lower travel speeds
- No more incentive to “beat the light”
- Gentle crossing angles
- One-way travel

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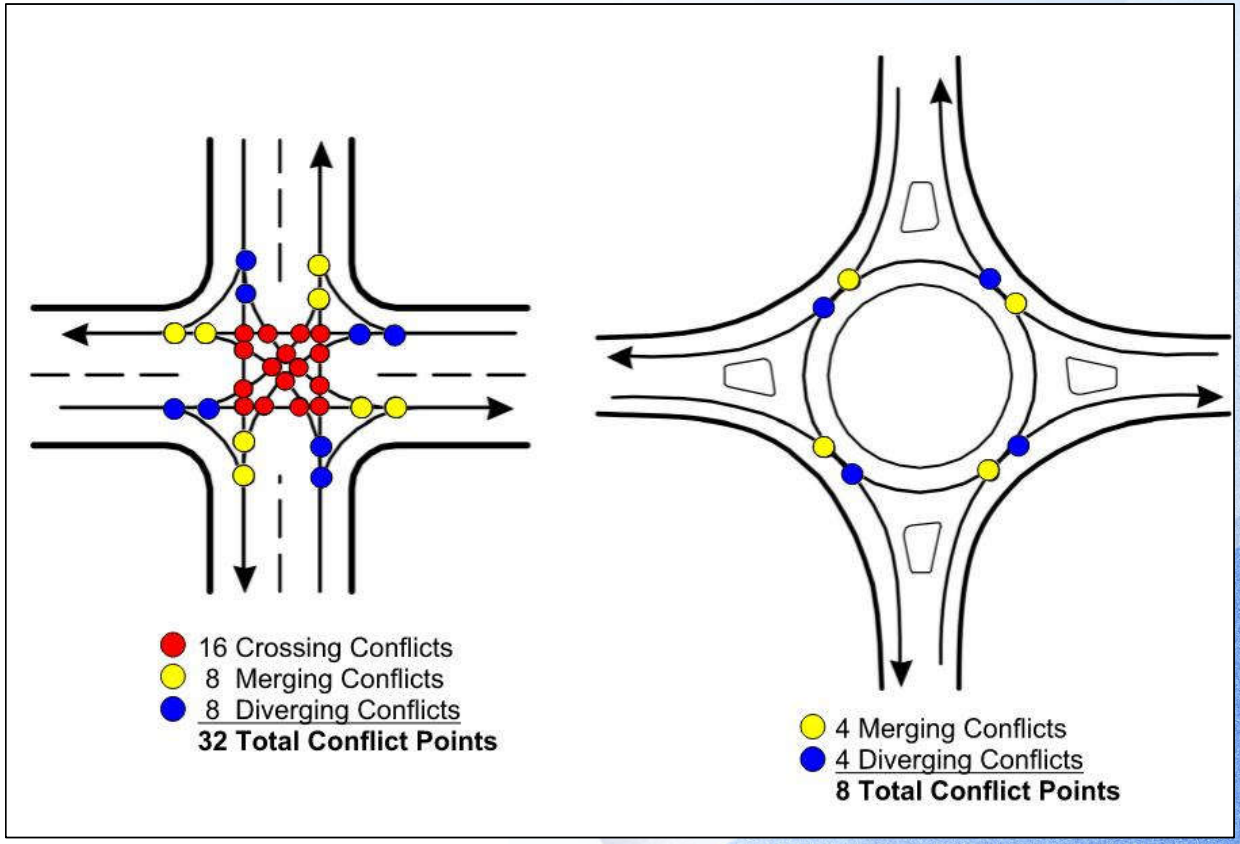
## Vehicle Conflict Points

Comparison of Traditional Intersection vs. Roundabout with single-lane approaches

- Diverging Conflicts:
  - Caused by the separation of two traffic streams
  - Higher speed differentials increase risk of rear-end collision (low severity)
- Merging Conflicts:
  - Caused by the joining of two traffic streams
  - Higher possibility of collision to the side of the vehicle (medium severity)
- Crossing Conflicts:
  - Occur where the path of two streams intersect
  - High risk of right-angle crashes and head-on crashes (most severe)

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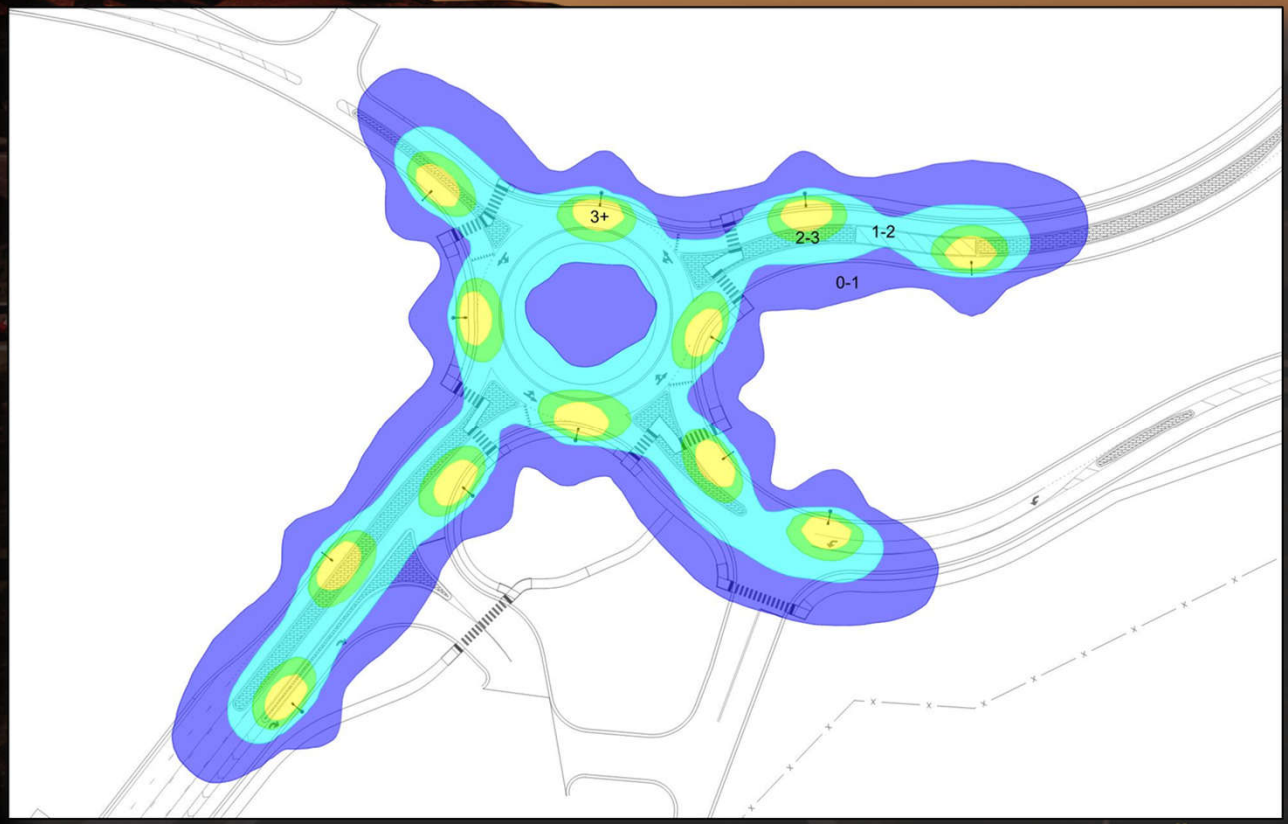
# Intersection Lighting

# Intersection Lighting

- New 30’ light poles will be installed
- Compliant with New Mexico Night Sky Protection Act

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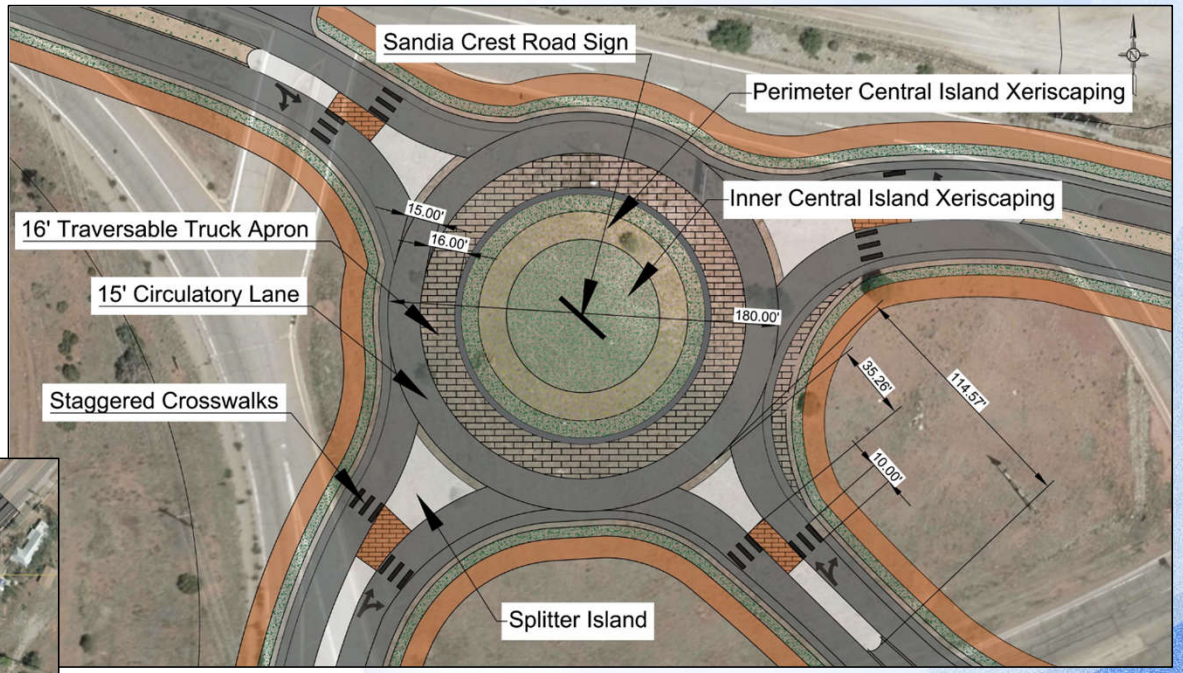
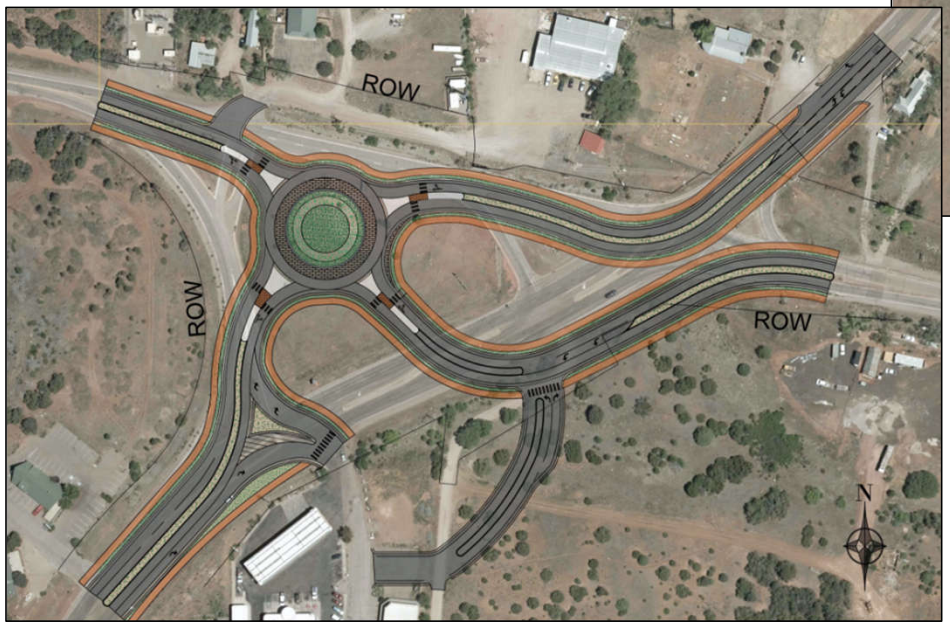
## UNM Capstone

- Mentored a team of Graduating seniors during the Fall 2022 semester.
- Assisted them taking this project through a “Study” Phase and into preliminary Design.




| Radius | Radius (ft) | Speed (MPH) |
|---|---|---|
| R1 | 85.16 | 19.14 |
| R2 | 114.11 | 19.72 |
| R3 | 100.93 | 20.44 |
| R4 | 80.17 | 17.32 |
| R5 | 156.58 | 24.22 |

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# Drive-Thru Simulation Video

https://youtu.be/89t5cz2PePs

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