



LONE TREE OVERPASS

*SUSTAINABILITY &
INTERSECTION REFINEMENTS
January 13, 2022*





AGENDA

- ✧ **Project Updates**
- ✧ **Sustainability**
- ✧ **Intersection Refinements**





Project Updates



Project Updates

✧ **Coordination with Beautification, Arts & Sciences**

- » Staff meeting held on December 9th, 2021
- » Presentation to the BPAC commission occurred on January 10
- » Planning Outreach for a Community Forum to seek input early 2022

✧ **Pedestrian and Bicycle Advisory Committees**

- » City staff discussed project and permissive / controlled rights at intersections

✧ **Coordination with BNSF and USACE regarding the RDF Flood Control Project**

- » Meeting held on December 8th, 2021

✧ **Additional City staff and Commission Coordination Meetings**

- » Meeting held with Sustainability staff on December 8th, 2021
- » Meeting held with Transportation/Pedestrian/Bicycle Commission on January 13th, 2022



Sustainability



GOALS

- ✧ **Project approach to Vehicle Miles Traveled (VMT)**
- ✧ **Approach to VMT in Public Works**
- ✧ **Alternative look using greenhouse gases**





Sustainability – VMT Goals

✧ City of Flagstaff Goal

- » No increase in Vehicle Miles Traveled (VMT) from 2019 Levels
- » VMT is measured/analyzed using regional network traffic models

✧ Regional tools available for VMT

- » Project used MetroPlan's Regional Model
 - ☑ Developed before formal adoption of the Sustainability Goals
- » Scenarios
 - ☑ 2019 No-Build Scenario (36,004 dwelling units, 12,093 commerce(ksf))
 - ☑ 2026 Build / No-Build Scenario | 37,768 dwelling units | 12,630 commerce(ksf) (~0.7%/yr)
 - ☑ 2040 Build / No-Build Scenario | 46,556 dwelling units | 16,357 commerce(ksf) (~1.3%/yr)



Sustainability – VMT Results

✧ MetroPlan Regional Model Updates

- » Incorporated Land-Use Changes (Hospital, Zoning, Etc.)
- » Incorporated Identified Funded Public Works projects into the 2040 model
- » Evaluated a 2-Lane and 4-Lane Lone Tree Overpass Scenario for Greenhouse Gas (GHG) analysis

✧ Regional VMT Results (Given as per day)

- » No significant change with Build Scenario (Lone Tree Overpass)
- » 2040 Increases due to regional growth projections (standard approach)

Year	No-Build VMT		Build VMT	
2019	2,560,198		--	
2026	2,604,834	+ 2%	2,603,984	+ 2%
2040	3,423,404	+ 34%	3,434,924	+ 34%



Sustainability – Induced Demand

✧ Induced Demand

- » Induced Demand is increase in travel based on additional capacity / improved network
- » RMI "SHIFT" Calculator based on new roadway capacity
- » The City is working on their own calculator, not yet available
- » LTO Project adds 1.8 lane-miles
- » Increase of 2,800 – 5,500 VMT/day
 - ✓ ~0.2% increase in network modeled
 - ✓ Less than the 2026 Build year modeled

RMI Home FAQ

SHIFT Calculator

State Highway Induced Frequency of Travel

The SHIFT calculator enables users to estimate long-run (i.e., after 5 to 10 years) induced vehicle miles traveled (VMT) and emissions impacts from capacity expansions of large roadways in Metropolitan Statistical Areas (MSAs) or urbanized counties, based on existing lane mileage and vehicle miles traveled data from the Federal Highway Administration (FHWA).

[FAQ](#) [Methodology](#)

1 to 2 million additional VMT/year
(Vehicle Miles Travelled)

Coconino County, Arizona currently has **675 lane miles** of class 2 and 3 facilities on which **~629 million** vehicle miles are travelled per year.

A project adding **2 lane miles** would induce an additional **1 to 2 million** vehicle miles travelled per year. Under today's conditions, the annual emissions from this are the same as **~200** passenger cars and light trucks or **~79,000** gallons of gas.



Sustainability – VMT Goals

✧ How can VMT be incorporated into Public Works

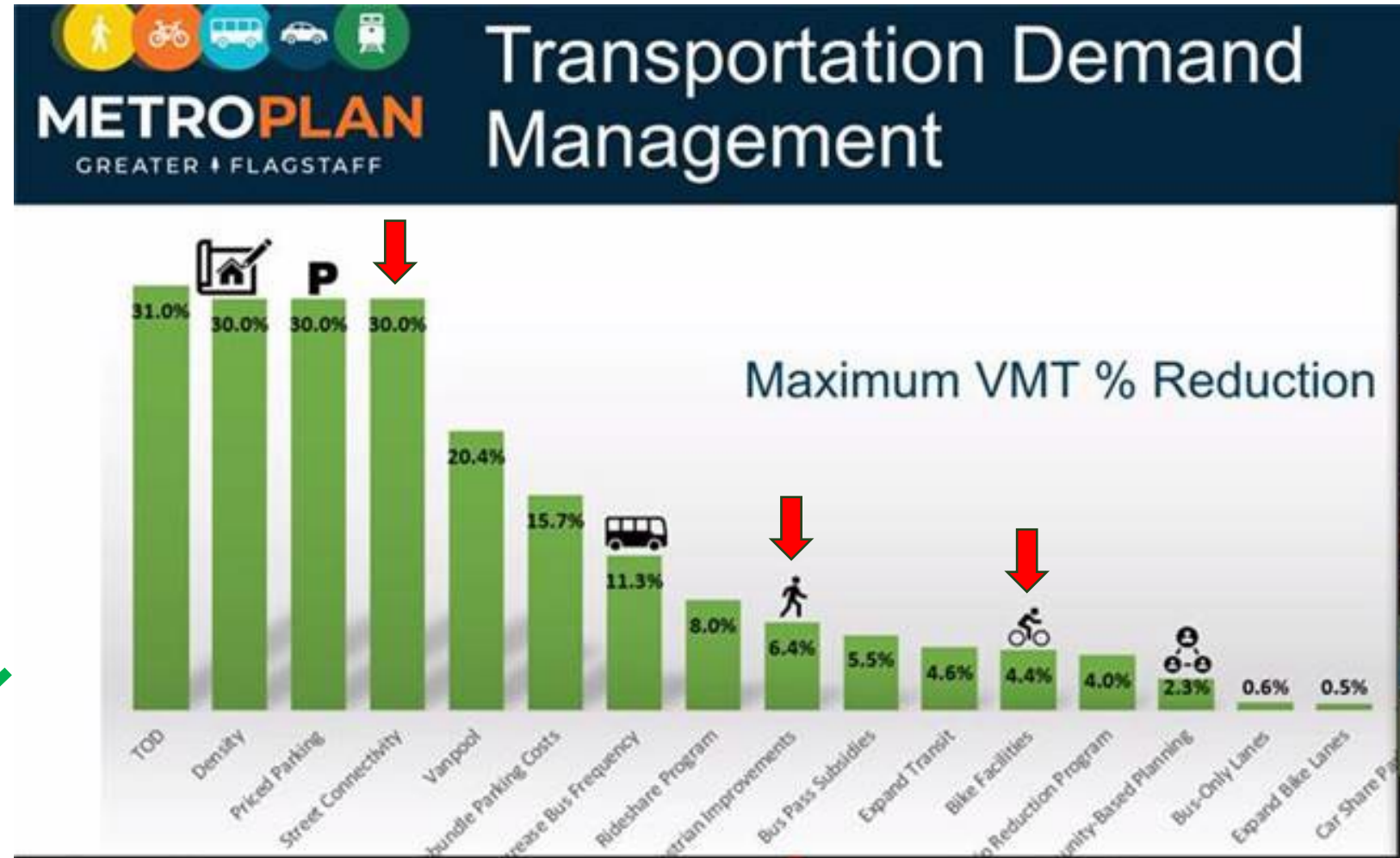
- » Typically, VMT is a PLANNING level decision
- » Public Works projects involving roadway capacity balance new roadways with offsets elsewhere. For example, a new roadway is offset by:
 - ☑ Roadway lane reductions on other street networks
 - ☑ Increased Public Transportation
 - ☑ Carpool and Ride Share Programs
 - ☑ Increase Bicycle and Pedestrian Infrastructure (Reduce Vehicle Trips)
- » At a project level (after planning), it is difficult to reduce VMT impacts on a project.
- » We can still evaluate greenhouse gas impacts at the intersection and network level, a secondary component of the City's Carbon Neutrality Plan.



Sustainability – VMT Reductions

✧ Options to reduce VMT Regionally

- » Increased transit (bus)
- » Increased FUTS connectivity / Pedestrian Improvements / Bike Facilities – **PROJECT GOAL** ✓
- » Street Connectivity ✓
- » Corridor Changes Elsewhere

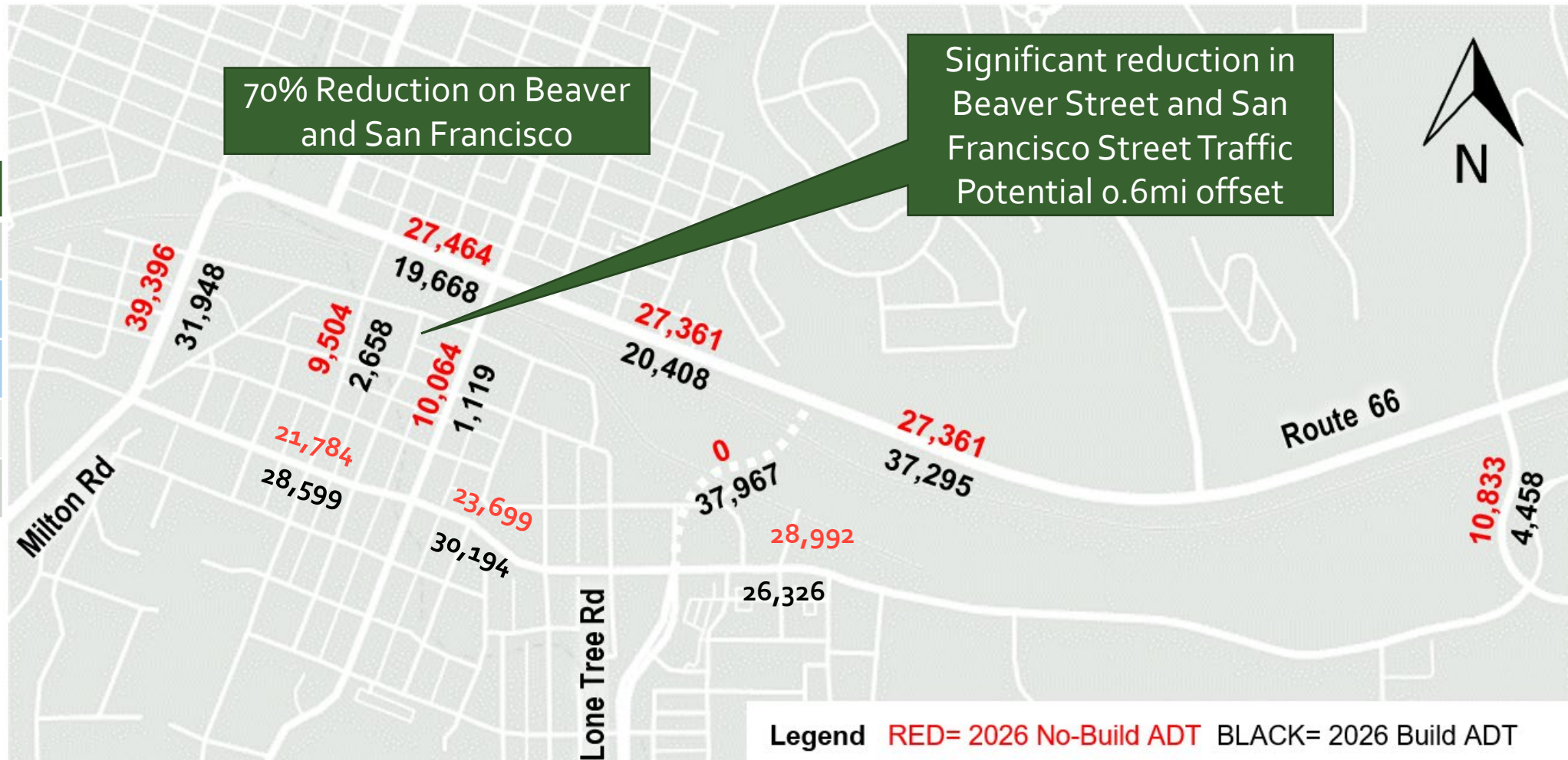




Sustainability – VMT in Network Model

Year	VMT
2019	2,560,000
2026 B	2,605,000
2026 NB	2,604,000
2040 B	3,423,000
2040 NB	3,435,000

B = Build
NB = No-Build

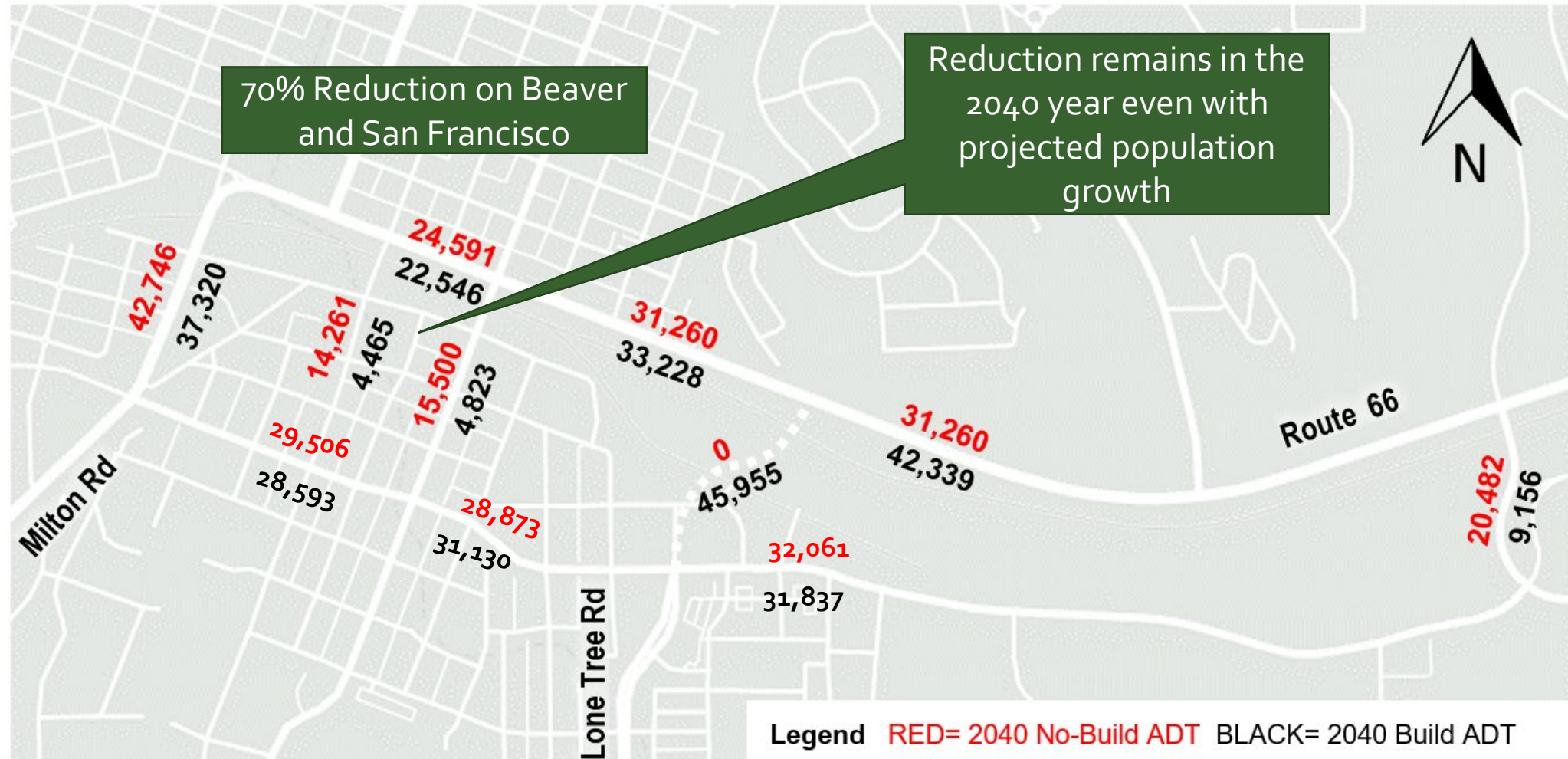




Sustainability – VMT in Network Model

Year	VMT
2019	2,560,000
2026 B	2,605,000
2026 NB	2,604,000
2040 B	3,423,000
2040 NB	3,435,000

B = Build
NB = No-Build





Sustainability – GHG Emissions

✧ Greenhouse Gas (GHG) Emissions Evaluation

- » Compared 2-Lane LTO and 4-Lane LTO options
- » Fuel consumption and emissions based on volume and congestion
- » Based on MetroPlan Regional Model outputs

Estimated Yearly Savings – 2026 Build Year				
2026 Year	2-Lane LTO	4-Lane LTO	2-Lane LTO	4-Lane LTO
Fuel Used (Gallons)	122,100	285,900	43,100	206,900
CO ₂ Emissions (Tons)	1,100	2,600	390	1,860
			With Induced Demand GHG Impacts Included	



Sustainability – Takeaways

- ✧ 2026 VMT is approximately the same to 2019 VMT numbers (2% change overall)
- ✧ Lone Tree Overpass project has a minimal impact on VMT compared to regional growth assumptions (0.2% vs 2% 2026 VMT growth)
- ✧ There are offsets that are difficult to quantify that reduce impacts and others that can be taken to further reduce VMT impacts
 - » Project provides FUTS connectivity, Pedestrian and Bike facilities
- ✧ 4-Lane Lone Tree Overpass project potentially reduces greenhouse gas emissions compared to no-build or 2-Lane scenarios even with a conservative Induced Demand assumption



✧ Intersection Refinements and Analysis

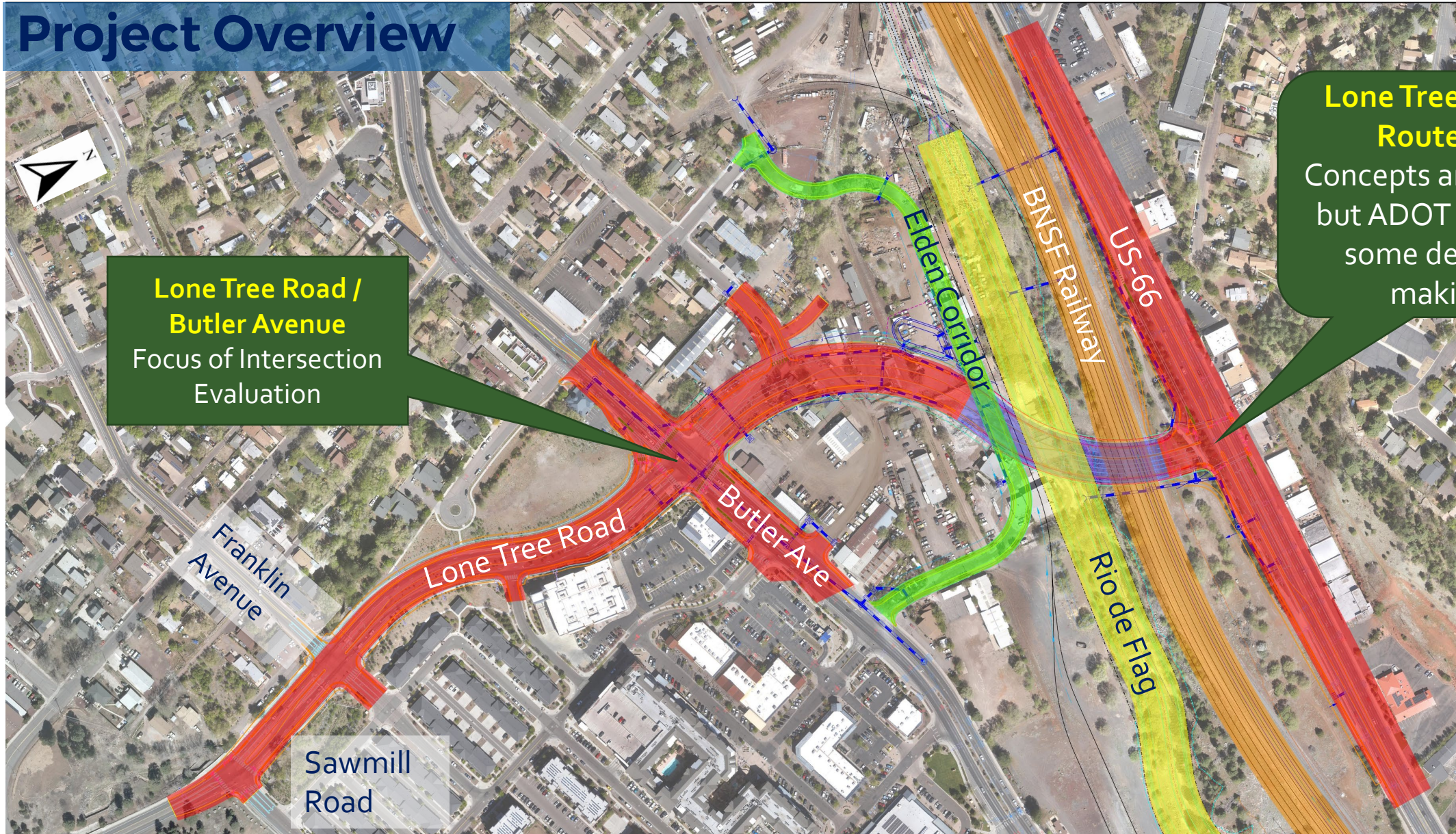
GOALS

- ✧ **Review 4 refined intersection alternatives at Butler**
- ✧ **Identify Pedestrian/Cyclist User Impacts**
- ✧ **Identify Driver Impacts**
- ✧ **Identify Cost Impacts**





Project Overview



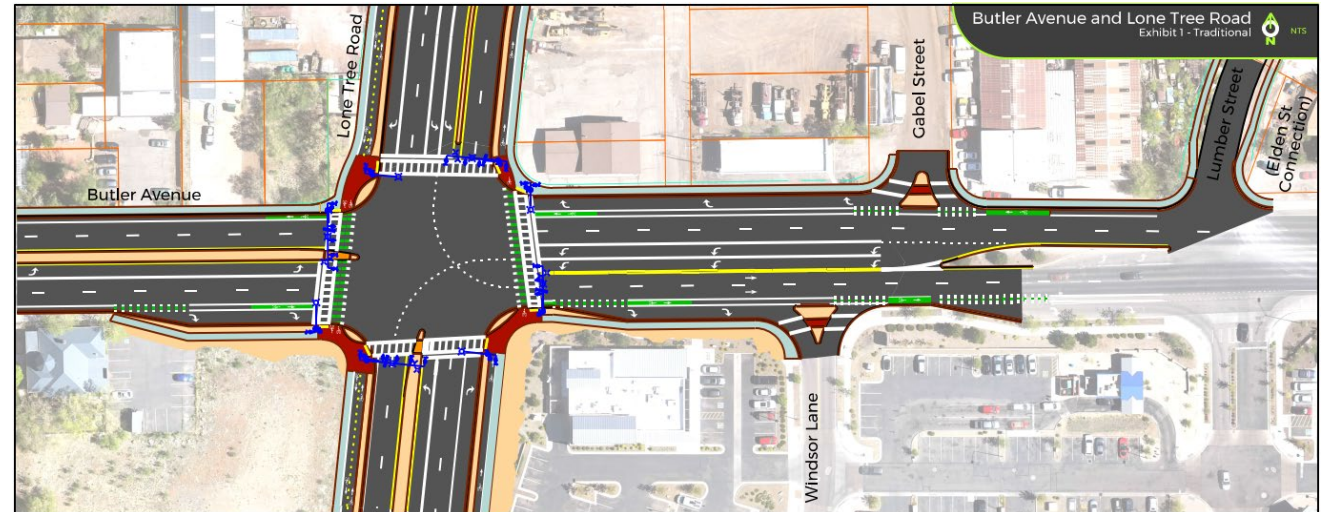
**Lone Tree Road /
Butler Avenue**
Focus of Intersection
Evaluation

**Lone Tree Road /
Route 66**
Concepts are similar
but ADOT impacts
some decision
making

LTO & Butler – Intersection Options

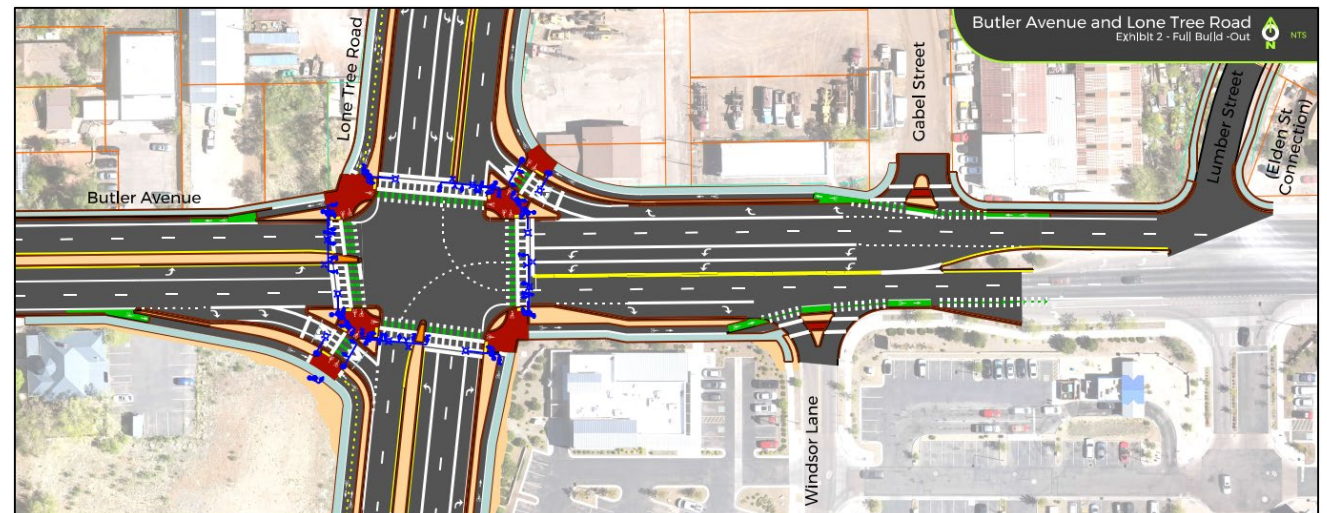
Traditional

- Two left-turn lanes (SB, WB)
- Channelized right-turn lanes (None)
- Separated bike lanes (LTO)
- Raised median (S, W)



Full Build-Out

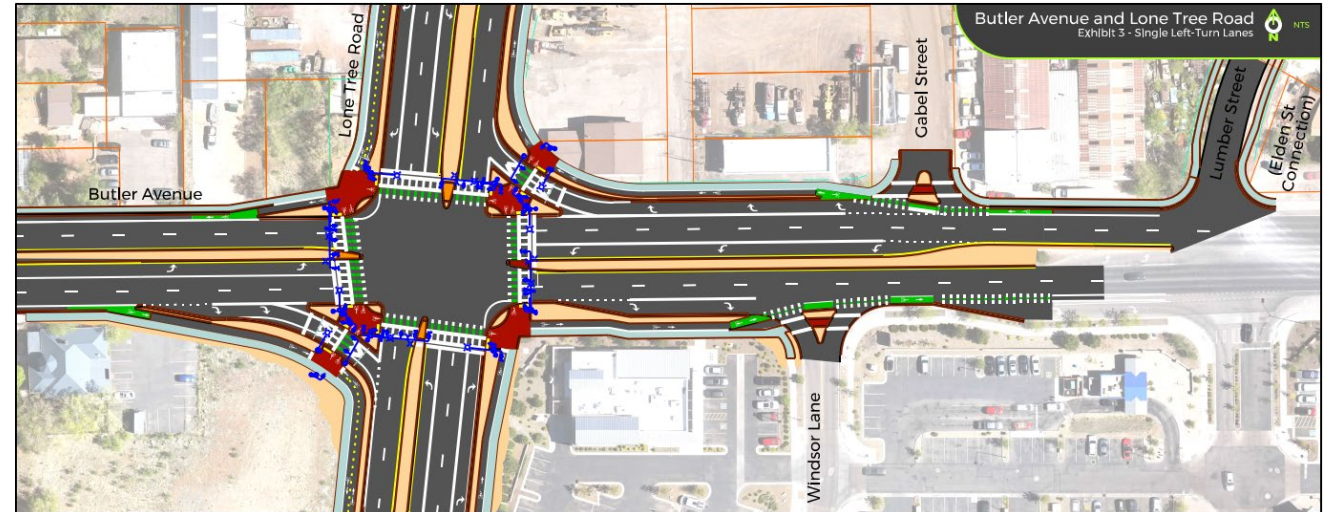
- Two left-turn lanes (SB, WB)
- Channelized right-turn (EB, WB)
- Separated bike lanes (LTO & Butler)
- Raised median (S, W)



LTO & Butler – Intersection Options

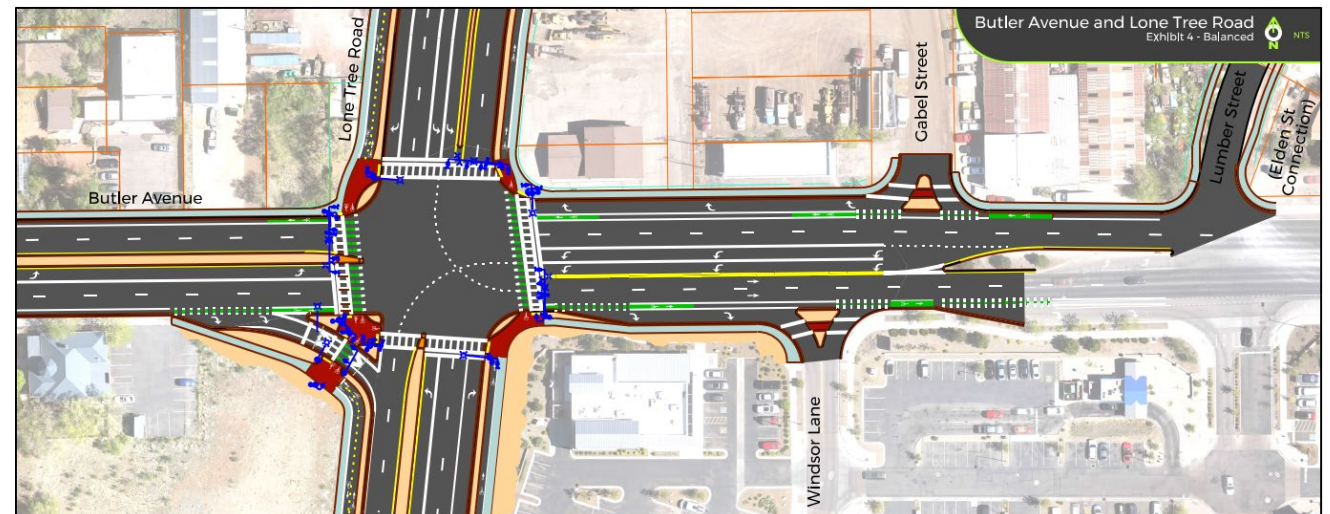
Single Left-Turn Lanes

- One left-turn lane (All)
- Channelized right-turn (EB, WB)
- Separated bike lanes (LTO & Butler)
- Raised median (All)



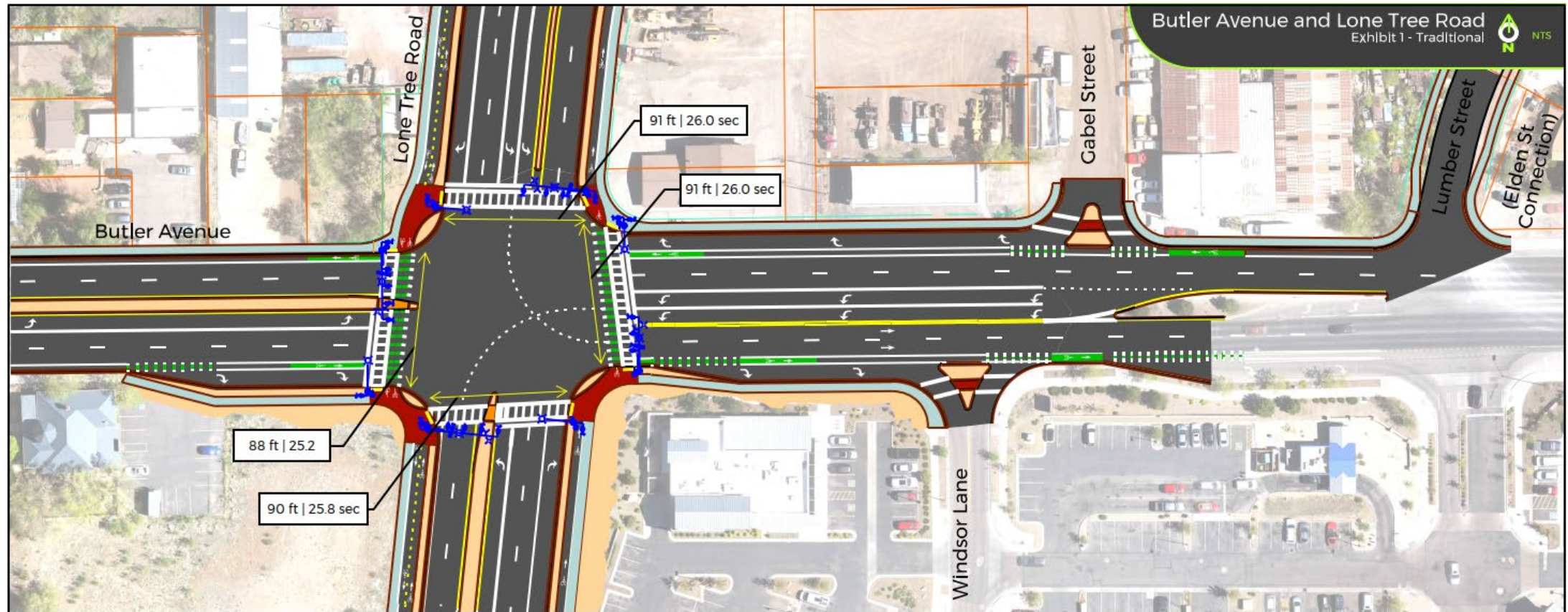
Balanced

- Two left-turn lanes (SB, WB)
- Channelized right-turn (EB)
- Separated bike lanes (LTO)
- Raised median (S, W)





LTO & Butler – Traditional Intersection



Vehicle Features

- Two left-turn lanes (SB, WB)
- Channelized right-turn lanes (None)

Bicycle Features

- Separated bike lanes (LTO)

Pedestrian Features

- Raised median (S, W)



LTO & Butler – Traditional Intersection | Looking NE



LTO & Butler – Traditional Intersection



Facing West | EB Approach



Facing East | WB Approach



Walking Speed
2.4 mph
Riding Speed
12.4 mph

Pedestrian / Cyclist Crossing	Distance (ft)	Walking Time (sec)	Riding Time (sec)
East Leg	91	26.0	5.0
West Leg	88	25.2	4.8

Refuge Island only on Eastbound Approach.
Protected Cyclist Crossing.



LTO & Butler – Traditional Intersection



Facing North | SB Approach



Facing South | NB Approach



Walking Speed
2.4 mph
Riding Speed
12.4 mph

Pedestrian / Cyclist Crossing	Distance (ft)	Walking Time (sec)	Riding Time (sec)
North Leg	91	26.0	5.0
South Leg	90	25.8	4.9

Refuge Island only on Northbound Approach.
Cyclist Crossing on roadway or with
pedestrians.



LTO & Butler – Traditional Intersection

✧ Design Feature

- » Pedestrian longest crossing distance 91 ft
- » Pedestrian longest crossing time 26.0 s
- » Bike longest crossing time 5.0 s
- » Available Green Time 33.7s (EB/WB Thru-PM)

Ped /Bike Crossing	Distance (ft)	Ped Time (sec)	Min. Bike Time (sec)
North Leg	91	26.0	5.0
South Leg	90	25.8	4.9
East Leg	91	26.0	5.0
West Leg	88	25.2	4.8

✧ Pedestrian crossing times are based on 3.5 ft/s | 2.4 mph

- » Per the Manual for Uniform Traffic Control
- » Assumes complete crossing during one single green phase
- » For reference: Wheelchair 3.55 ft/s (FHWA – University Course on Bicycle and Pedestrian Transportation)

✧ <https://view.mylumion.com/?p=bjlavl98egj4eceb>



LTO & Butler – Traditional Intersection

✧ Performance (2026 PM Peak)

- » Overall Level of Service D
- » Average Vehicle Delay: 46.9 sec
- » Queuing: Longest queue 599 ft

✧ Performance (2040 PM Peak)

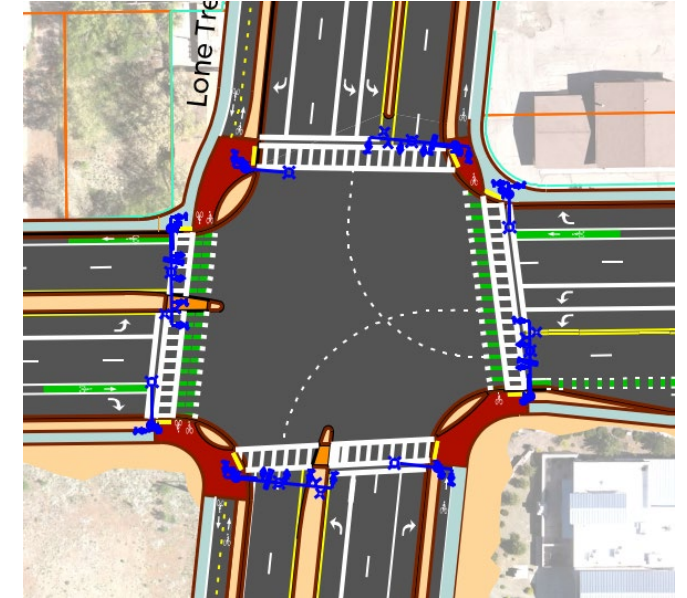
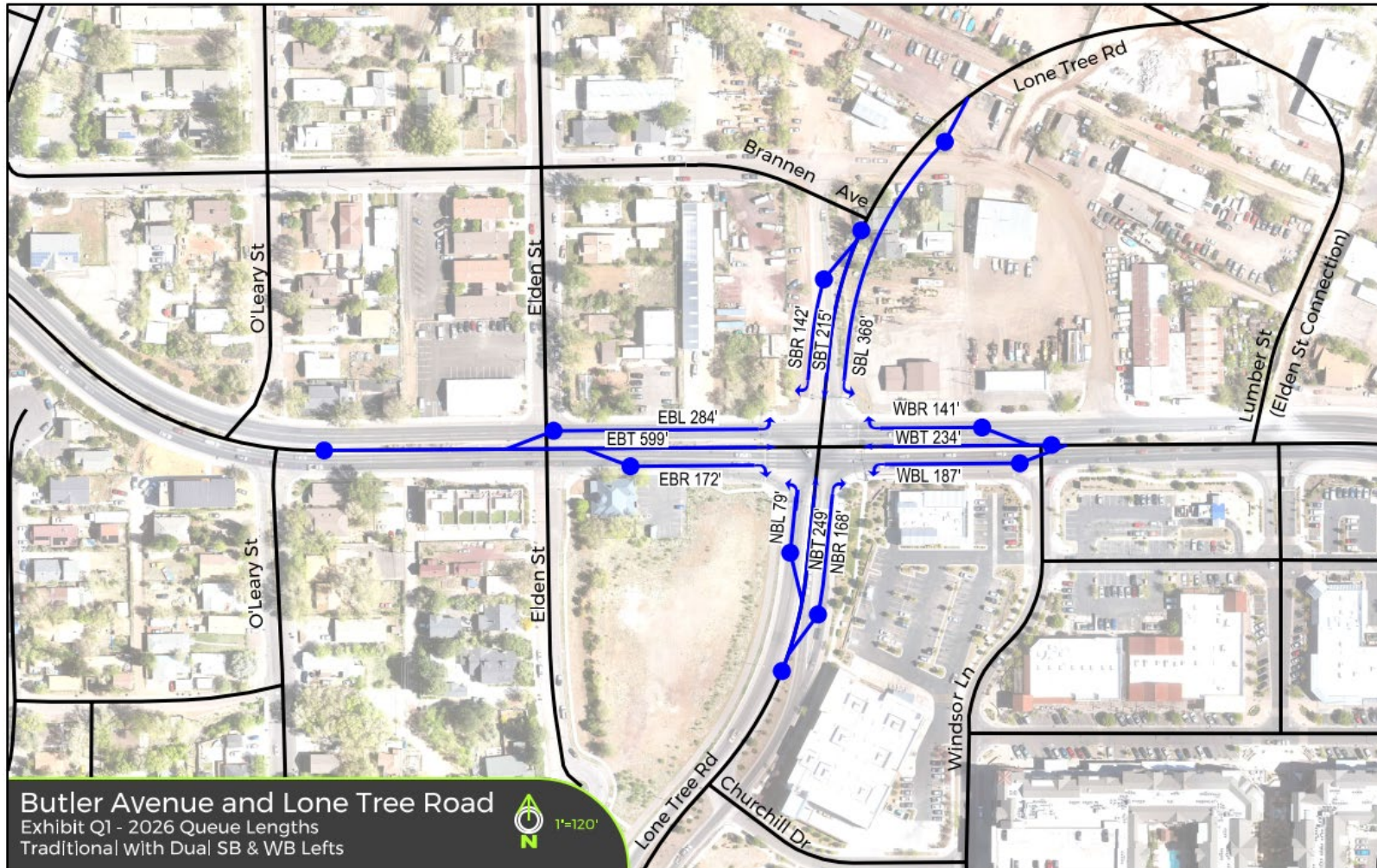
- » Overall Level of Service E
- » Average Vehicle Delay: 70.7 sec
- » Queuing: Longest queue 772 ft

Year	Total Vehicle Delay (hours)	Fuel Used (gallons)
2026 (PM)	58	57.0
2040 (PM)	111	91.8



LTO & Butler – Traditional Intersection

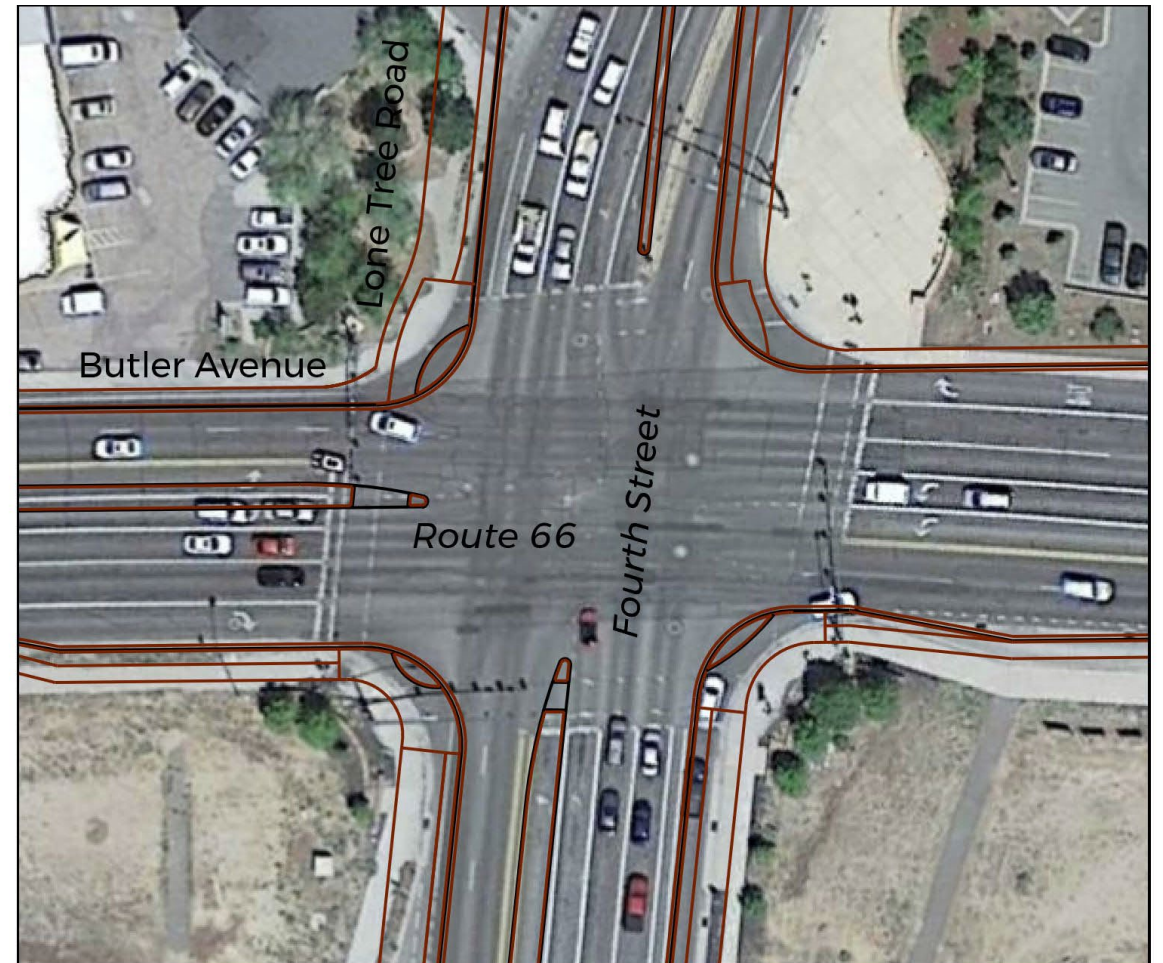
» Maximum Queues - 2026





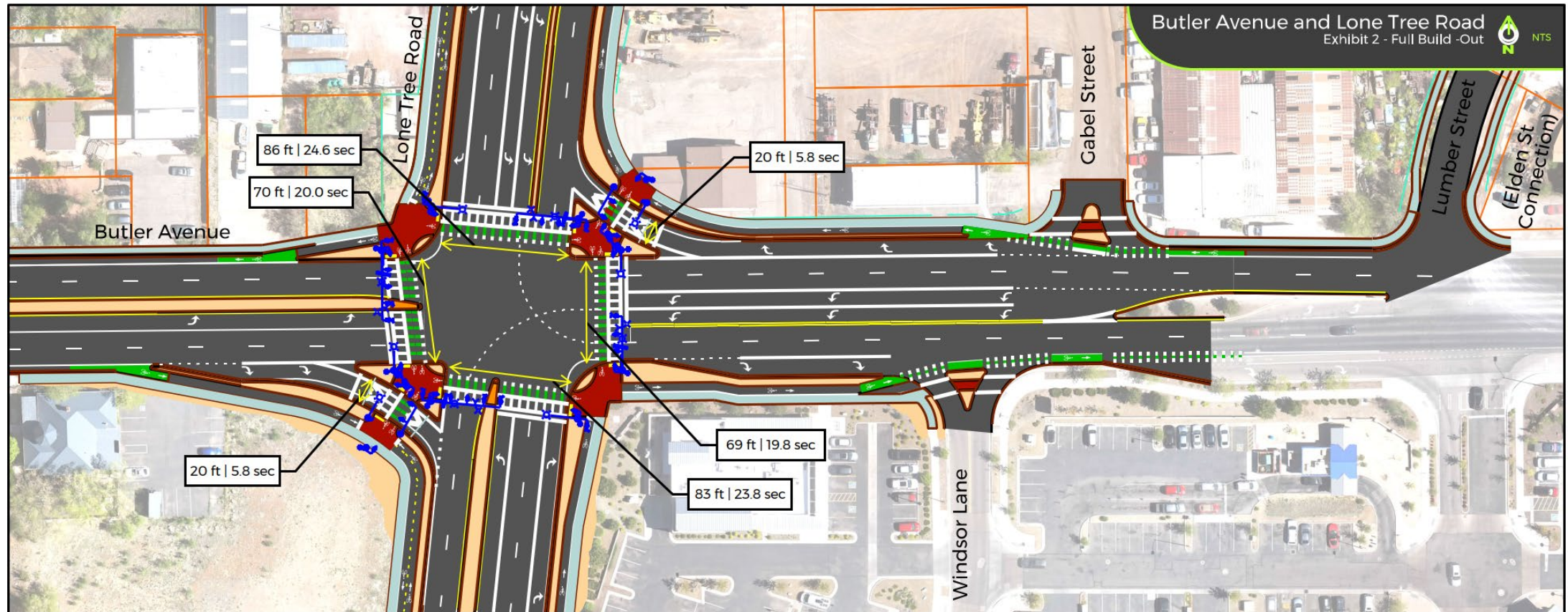
LTO & Butler – Traditional Intersection

- ✧ Comparison to Existing Intersection: Rte 66 & Fourth Street
 - » Smaller roadway footprint
 - » Shorter crossing distances
 - » LTO & Butler has median refuge on West and South legs





LTO & Butler – Full Build-Out Intersection



Vehicle Features

- Two left-turn lanes (SB, WB)
- Channelized right-turn lanes (SW, NE)

Bicycle Features

- Separated bike lanes (LTO) and Butler at the intersection

Pedestrian Features

- Raised median (S, W)



LTO & Butler – Full Build-Out Intersection | Looking NE





LTO & Butler – Full Build-Out Intersection



Facing West | EB Approach



Facing East | WB Approach



Walking Speed
2.4 mph
Riding Speed
12.4 mph

Pedestrian / Cyclist Crossing	Distance (ft)	Walking Time (sec)	Riding Time (sec)
East Leg	69	19.8	3.8
West Leg	70	20.0	3.8

Refuge Island only on Eastbound Approach.
Protected Cyclist Crossing.



LTO & Butler – Full Build-Out Intersection



Facing North | SB Approach



Facing South | NB Approach



Walking Speed
2.4 mph
Riding Speed
12.4 mph

Pedestrian / Cyclist Crossing	Distance (ft)	Walking Time (sec)	Riding Time (sec)
North Leg	86	24.6	4.7
South Leg	83	23.8	4.6

Refuge Island only on Northbound Approach.
Cyclist Crossing on roadway or with
pedestrians.



LTO & Butler – Full Build-Out Intersection

✧ Design Feature

- » Pedestrian longest crossing distance 86 ft
- » Pedestrian longest crossing time 26.4 s
- » Bike longest crossing time 4.7 s
- » Available Green Time 32.1s (EB/WB Thru-AM)

Ped /Bike Crossing	Distance (ft)	Ped Time (sec)	Min. Bike Time (sec)
North Leg*	86	24.6	4.7
South Leg*	83	23.8	4.6
East Leg*	69	19.8	3.8
West Leg*	70	20.0	3.8

* Not including distance/time to channelization island

✧ Pedestrian crossing times are based on 3.5 ft/s | 2.4 mph

- » Per the Manual for Uniform Traffic Control
- » Assumes complete crossing during one single green phase
- » For reference: Wheelchair 3.55 ft/s (FHWA – University Course on Bicycle and Pedestrian Transportation)

✧ <https://view.mylumion.com/?p=xymsfnxcg95isya>



LTO & Butler – Full Build-Out Intersection

✧ Performance (2026 PM Peak)

- » Overall Level of Service D
- » Average Vehicle Delay: 47.8 sec
- » Queuing: Longest queue 526 ft

✧ Performance (2040 PM Peak)

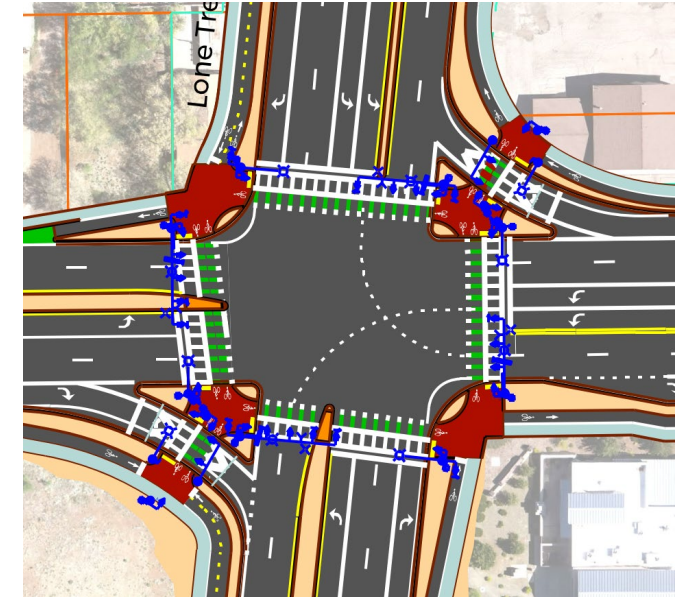
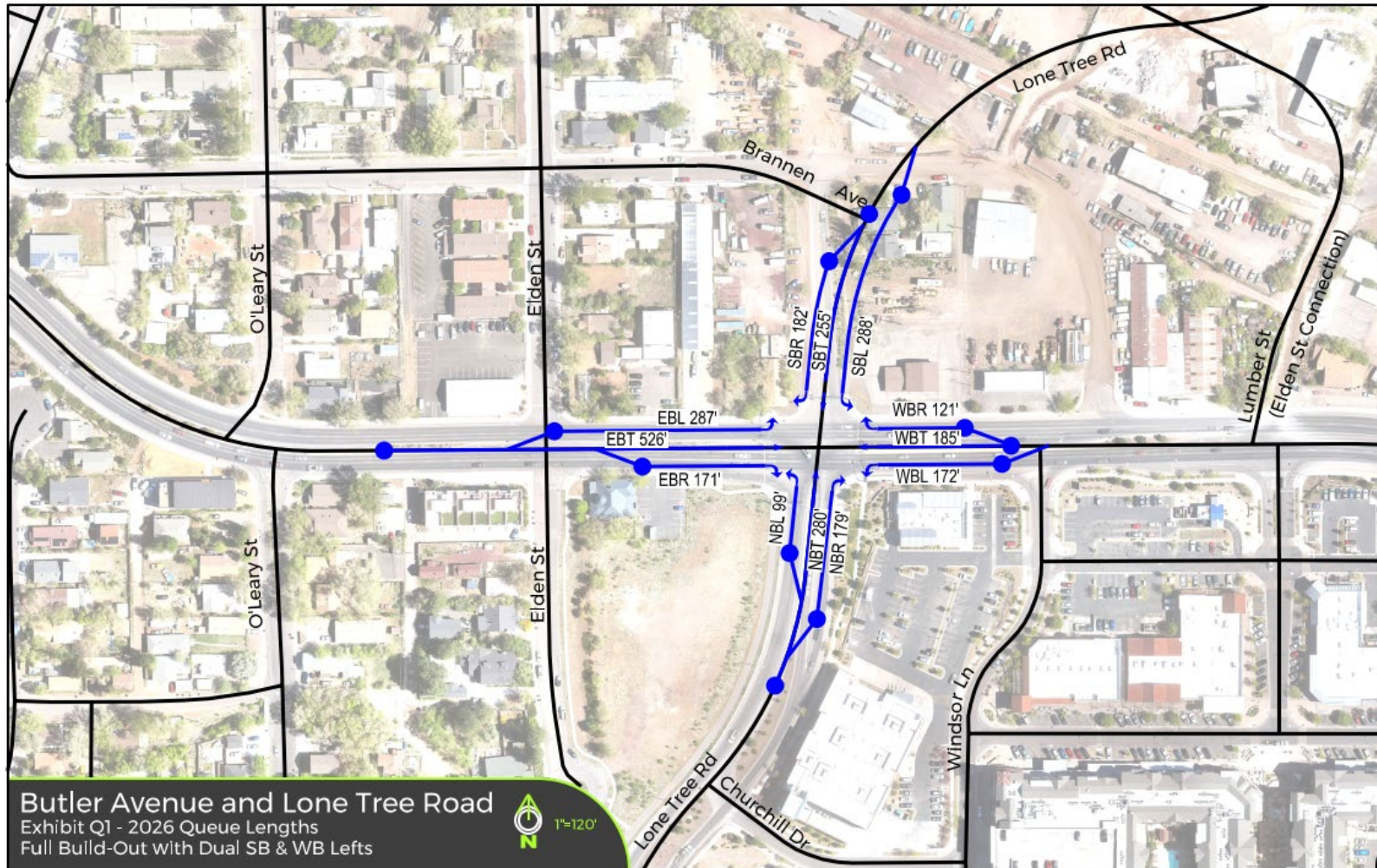
- » Overall Level of Service E
- » Average Vehicle Delay: 70.7 sec
- » Queuing: Longest queue 800 ft

Year	Total Vehicle Delay (hours)	Fuel Used (gallons)
2026 (PM)	59	58.2
2040 (PM)	111	74.7



LTO & Butler – Full Build-Out Intersection

» Maximum Queues - 2026

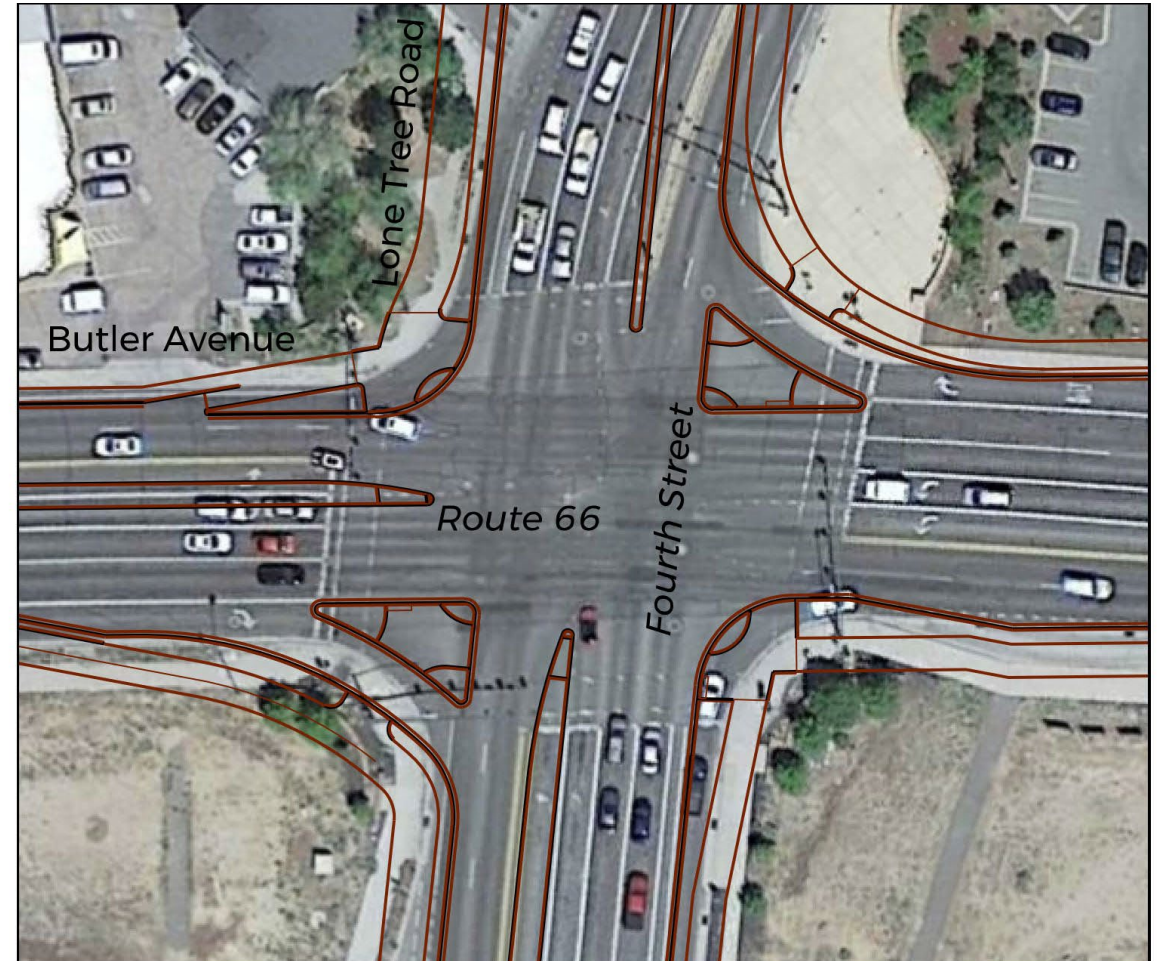


Queues are similar to the
Traditional intersection



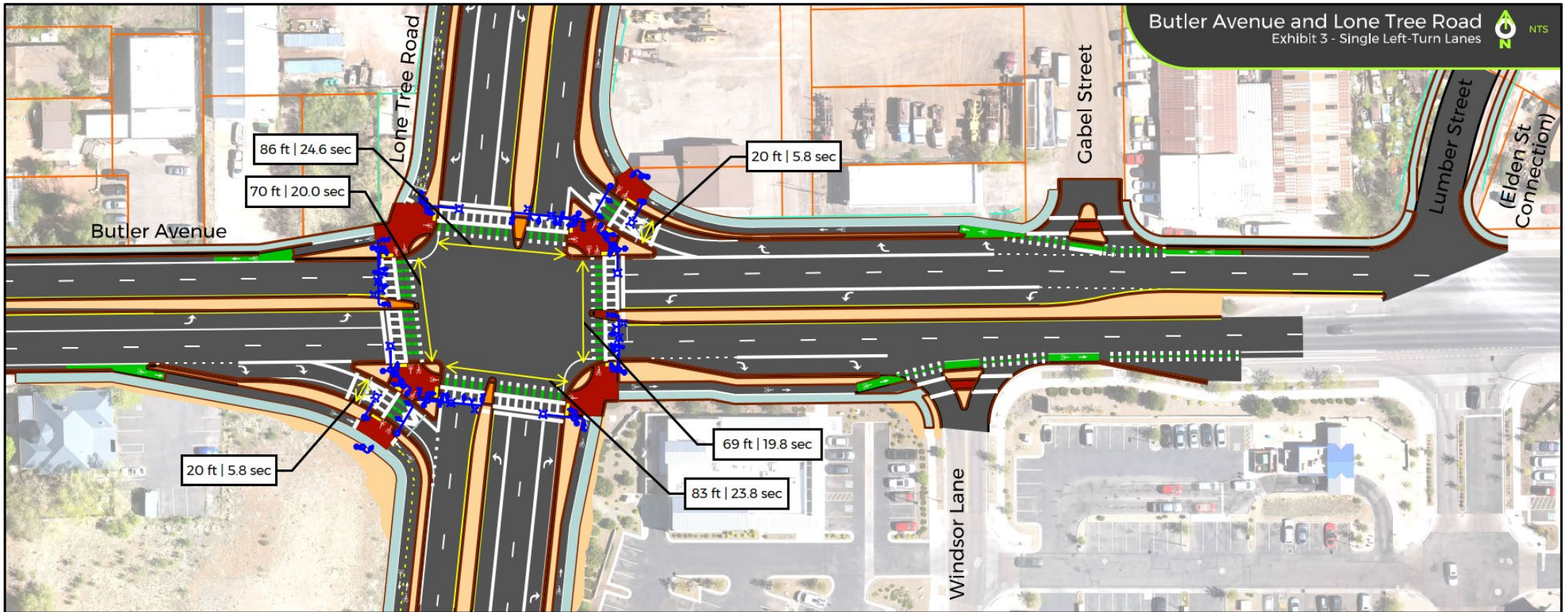
LTO & Butler – Full Build-Out Intersection

- ✧ Comparison to Existing Intersection: Rte 66 & Fourth Street
 - » Smaller roadway footprint
 - » Shorter crossing distances
 - » LTO & Butler has median refuge on West and South approaches
 - » LTO & Butler has (2) Right Turn Channelized Islands to further reduce crossing distances





LTO & Butler – Single Left Intersection



Vehicle Features

- Single left-turn lanes (NB,SB, EB,WB)
- Channelized right-turn lanes (SW, NE)

Bicycle Features

- Separated bike lanes (LTO) and Butler at the intersection

Pedestrian Features

- Raised median (N,S,E, W)



LTO & Butler – Single Left Intersection | Looking NE



LTO & Butler – Single Left Intersection



Facing West | EB Approach



Walking Speed
2.4 mph
Riding Speed
12.4 mph

Facing East | WB Approach

Pedestrian / Cyclist Crossing	Distance (ft)	Walking Time (sec)	Riding Time (sec)
East Leg	69	19.8	3.8
West Leg	70	20.0	3.8

Refuge Island only on Eastbound Approach.
Protected Cyclist Crossing.

LTO & Butler – Single Left Intersection



Facing North | SB Approach



Facing South | NB Approach

Walking Speed
2.4 mph
Riding Speed
12.4 mph

Pedestrian / Cyclist Crossing	Distance (ft)	Walking Time (sec)	Riding Time (sec)
North Leg	86	24.6	4.7
South Leg	83	23.8	4.6

Refuge Island only on Northbound Approach.
Cyclist Crossing on roadway or with
pedestrians.



LTO & Butler – Single Left Intersection

✧ Design Feature

- » Pedestrian longest crossing distance 86 ft
- » Pedestrian longest crossing time 24.6 s
- » Bike longest crossing time 4.7 s
- » Available Green Time 32.1s (EB/WB Thru-AM)

Ped /Bike Crossing	Distance (ft)	Ped Time (sec)	Min. Bike Time (sec)
North Leg*	86	24.6	4.7
South Leg*	83	23.8	4.6
East Leg*	69	19.8	3.8
West Leg*	70	20.0	3.8

* Not including distance/time to channelization island

✧ Pedestrian crossing times are based on 3.5 ft/s | 2.4 mph

- » Per the Manual for Uniform Traffic Control
- » Assumes complete crossing during one single green phase
- » For reference: Wheelchair 3.55 ft/s (FHWA – University Course on Bicycle and Pedestrian Transportation)

✧ <https://view.mylumion.com/?p=8xy2b3nqdztkizwd>



LTO & Butler – Single Left Intersection

✧ Performance (2026 PM Peak)

- » Overall Level of Service E
- » Average Vehicle Delay: 73.9
- » Queuing: Longest queue 1,971 ft

✧ Performance (2040 PM Peak)

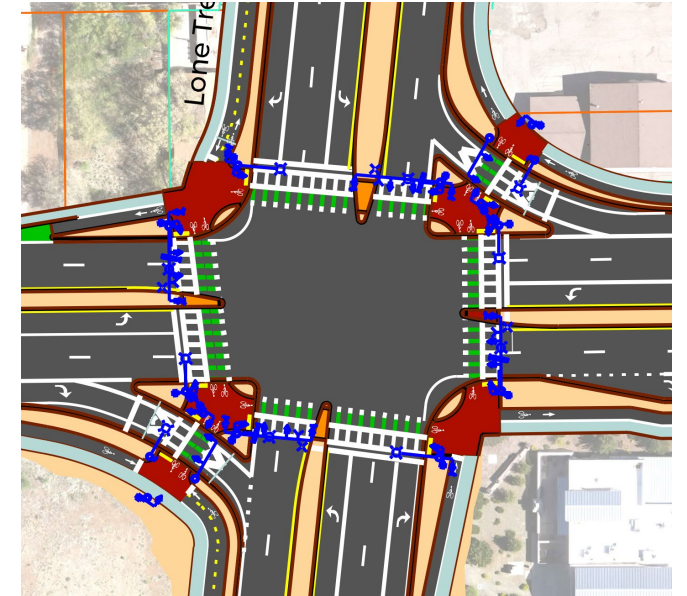
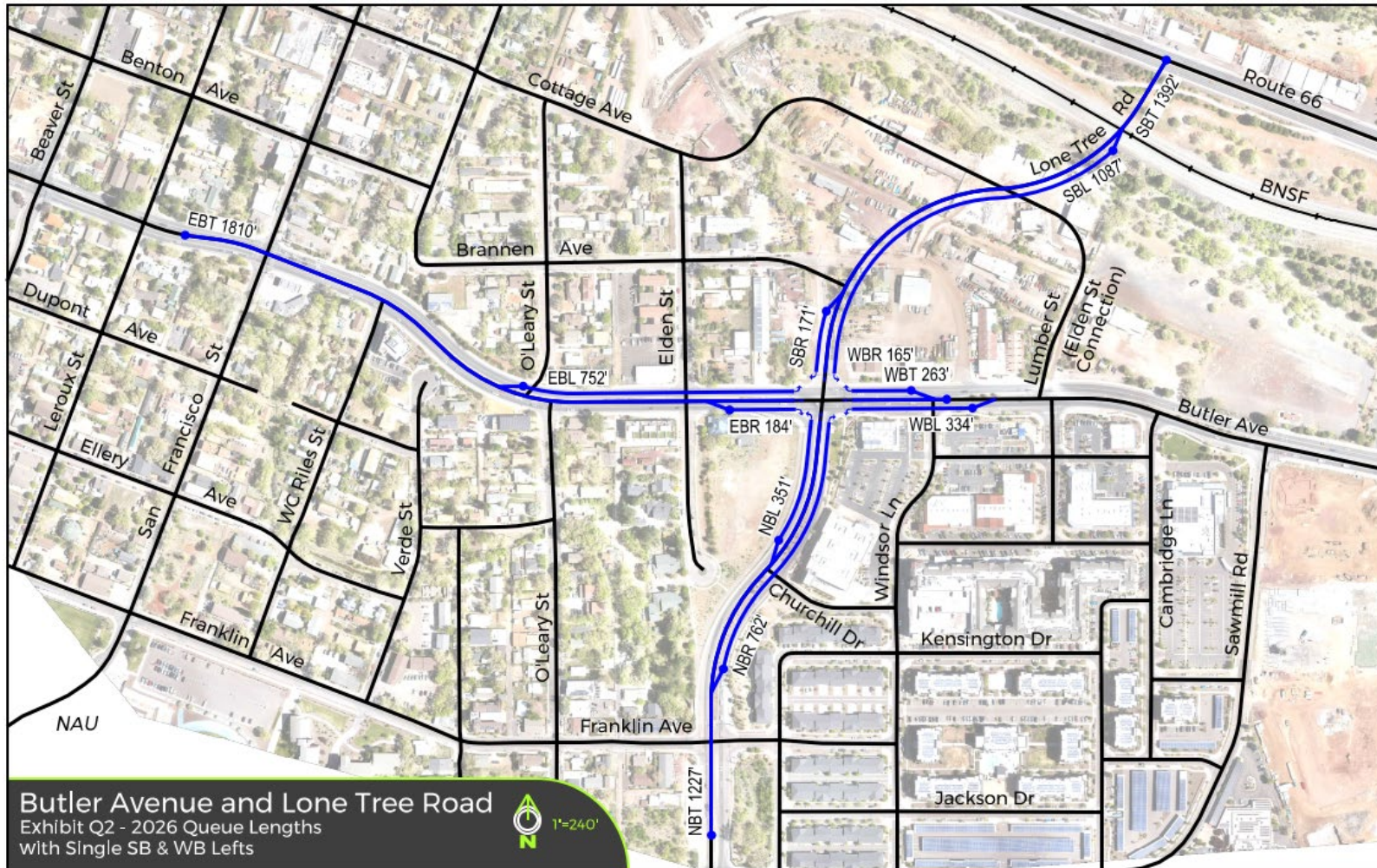
- » Overall Level of Service F
- » Average Vehicle Delay: 135.7
- » Queuing: Longest queue 2,041 ft

Year	Total Vehicle Delay (hours)	Total Emissions (gallons)
2026 (PM)	92	91.8
2040 (PM)	213	139.9



LTO & Butler – Single Left Intersection

» Maximum Queues - 2026



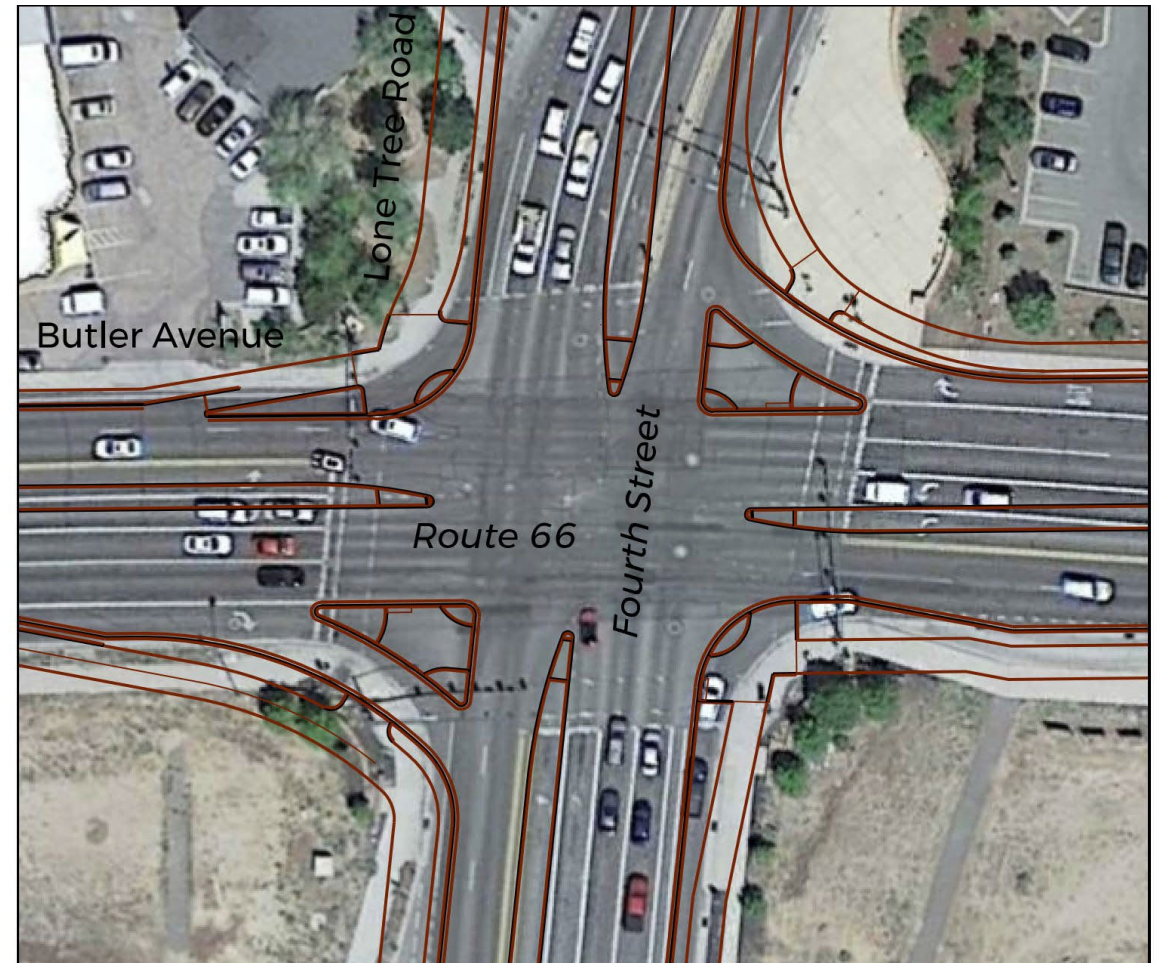
Queues extend back:

- North approach to Rte 66
- South approach past Franklin Ave
- East approach nearly to Beaver St

LTO & Butler – Single Left Intersection

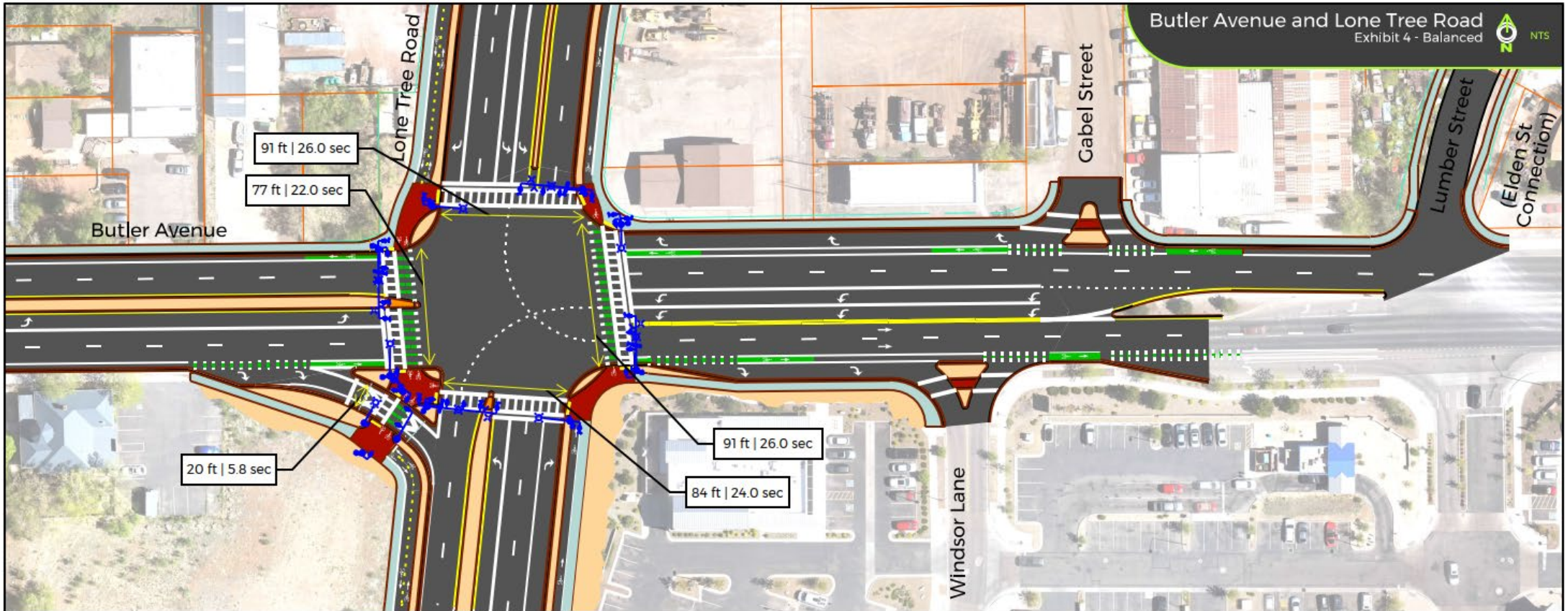
✧ Comparison to Existing Intersection: Rte 66 & Fourth Street

- » Similar to Full Build-Out
- » Smaller roadway footprint
- » Shorter crossing distances
- » LTO & Butler has median refuges on North, South, East and West approaches
- » LTO & Butler has (2) Right Turn Channelized Islands to further reduce crossing distances





LTO & Butler – Balanced Intersection



Vehicle Features

- Single left-turn lanes (NB, EB)
- Channelized right-turn lanes (SW)

Bicycle Features

- Separated bike lanes (LTO)

Pedestrian Features

- Raised median (S, W)

An aerial perspective rendering of a proposed intersection improvement project. The scene is set at a four-way intersection of North and East streets. The North street approaches from the top left, curving slightly to the right. The East street approaches from the top right, curving slightly to the left. The intersection is equipped with traffic lights on all four approaches. Crosswalks with white stripes and bollards are visible on all sides. Green-painted bike lanes are shown on the North and East approaches, with white bicycle symbols and directional arrows. Various vehicles, including cars, trucks, and a motorcycle, are depicted in motion or stopped at the intersection. The surrounding area includes commercial buildings, parking lots, and trees. Labels 'NORTH' and 'EAST' are placed above the respective street approaches to indicate direction. The rendering is a high-quality digital illustration showing the proposed changes to the intersection.



LTO & Butler – Balanced Intersection



Facing West | EB Approach



Facing East | WB Approach



Walking Speed
2.4 mph
Riding Speed
12.4 mph

Pedestrian / Cyclist Crossing	Distance (ft)	Walking Time (sec)	Riding Time (sec)
East Leg	91	26.0	5.0
West Leg	77	22.0	4.2

Refuge Island only on Eastbound Approach.
Protected Cyclist Crossing.



LTO & Butler – Balanced Intersection



Facing North | SB Approach



Facing South | NB Approach



Walking Speed
2.4 mph
Riding Speed
12.4 mph

Pedestrian / Cyclist Crossing	Distance (ft)	Walking Time (sec)	Riding Time (sec)
North Leg	91	26.0	5.0
South Leg	84	24.0	4.6

Refuge Island only on Northbound Approach.
Cyclist Crossing on roadway or with pedestrians.



LTO & Butler – Balanced Intersection

✧ Design Feature

- » Pedestrian longest crossing distance 91 ft
- » Pedestrian longest crossing time 26.0 s
- » Bike longest crossing time 5.0 s
- » Available Green Time 32.1s (EB/WB Thru-PM)

Ped /Bike Crossing	Distance (ft)	Ped Time (sec)	Min. Bike Time (sec)
North Leg	91	26.0	5.0
South Leg*	84	24.0	4.6
East Leg	91	26.0	5.0
West Leg*	77	22.0	4.2

* Not including distance/time to channelization island

✧ Pedestrian crossing times are based on 3.5 ft/s | 2.4 mph

- » Per the Manual for Uniform Traffic Control
- » Assumes complete crossing during one single green phase
- » For reference: Wheelchair 3.55 ft/s (FHWA – University Course on Bicycle and Pedestrian Transportation)

✧ <https://view.mylumion.com/?p=a6f9737rtzjabsq5>



LTO & Butler – Balanced Intersection

✧ Performance (2026 PM Peak)

- » Overall Level of Service D
- » Average Vehicle Delay: 47.9 s
- » Queuing: Longest queue 481 ft

✧ Performance (2040 PM Peak)

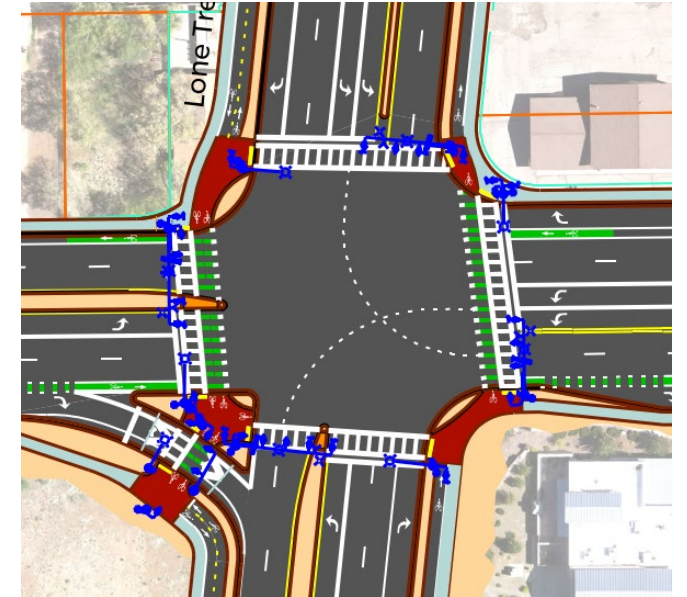
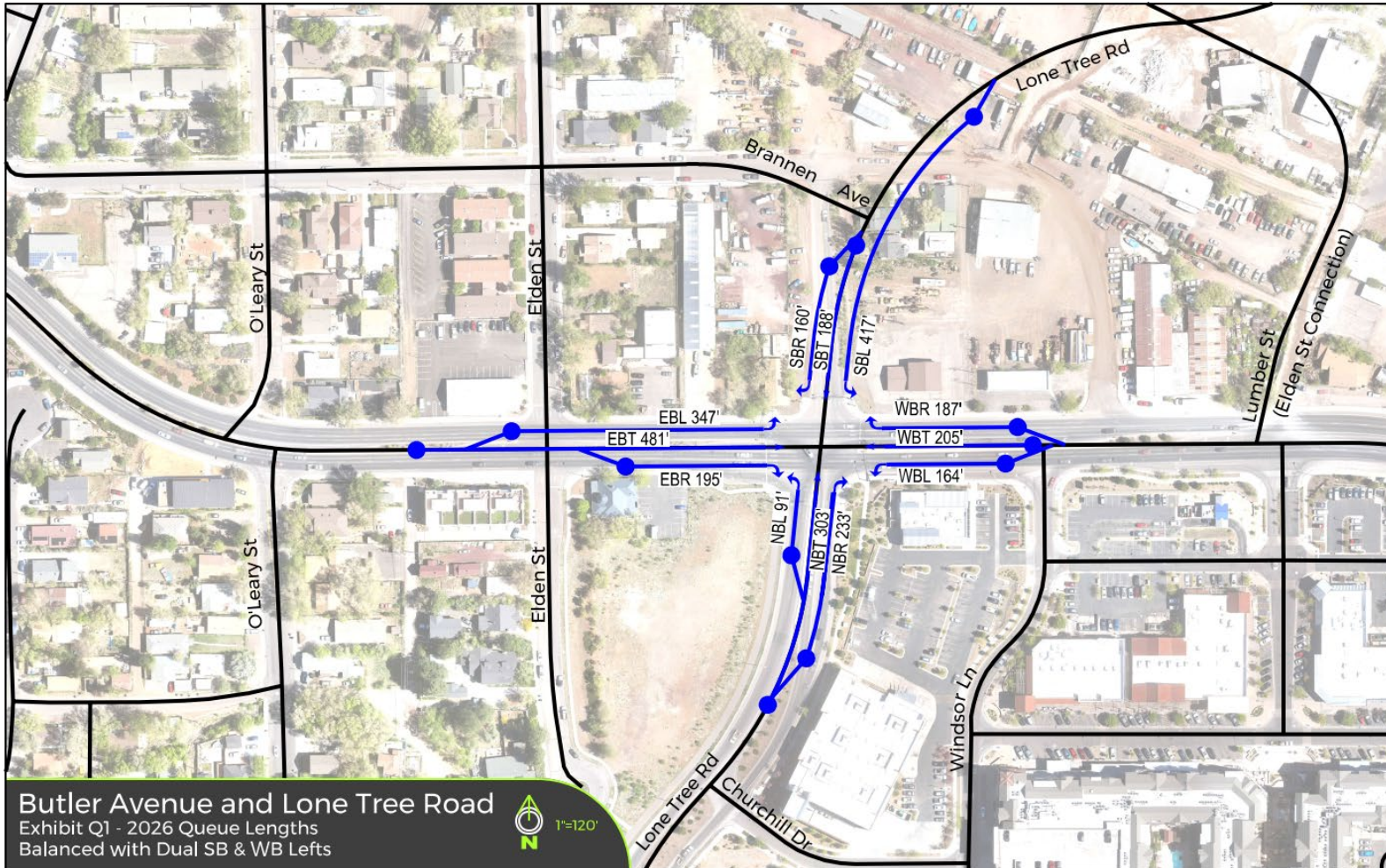
- » Overall Level of Service E
- » Average Vehicle Delay: 70.2
- » Queuing: Longest queue 1,225 ft

Year	Total Vehicle Delay (hours)	Total Emissions (gallons)
2026 (PM)	59	56.3
2040 (PM)	110	78.1



LTO & Butler – Balanced Intersection

» Maximum Queues - 2026



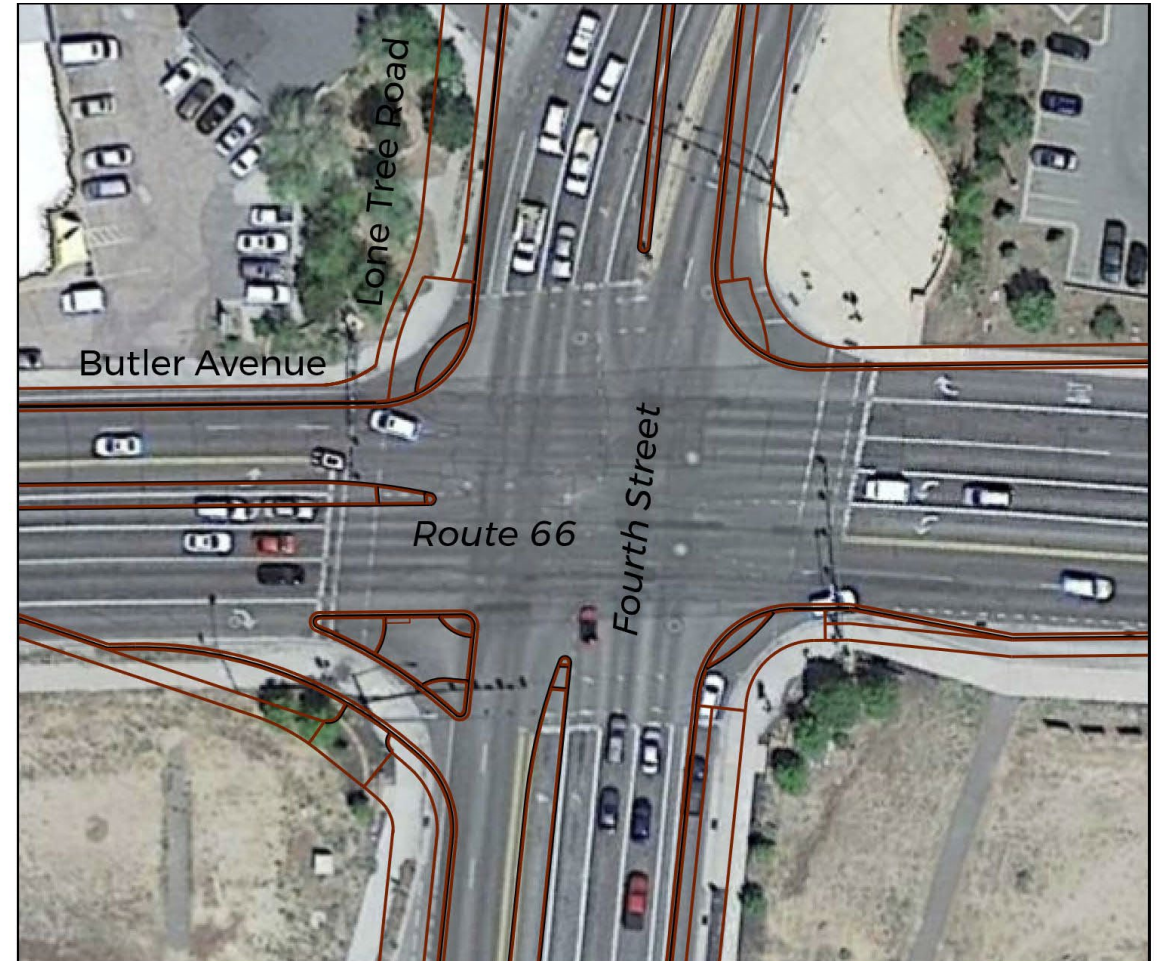
Queues are similar to the
Traditional and Full Build-Out
intersections



LTO & Butler – Balanced Intersection

✧ Comparison to Existing Intersection: Rte 66 & Fourth Street

- » Smaller roadway footprint
- » Shorter crossing distances
- » LTO & Butler has refuge median on West and South approaches
- » LTO & Butler has (1) Right Turn Channelized Islands to further reduce crossing distances



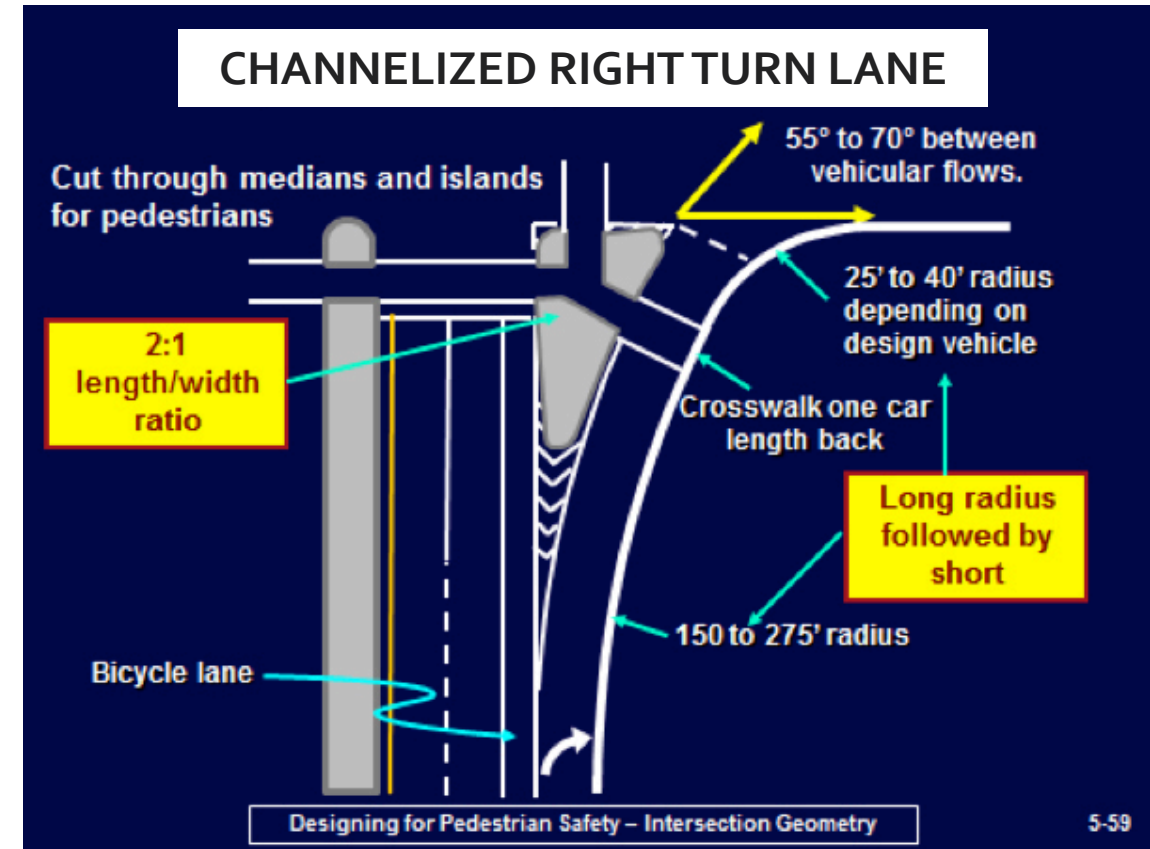
Intersection Alternatives – Channelized Right Lanes

✧ Pedestrian Benefits:

- » Reduces distance for crossing main road
- » Geometric Design limits vehicle speeds
 - Not a Free-Flow Turn Lane
- » Optimizes driver sight line to crosswalk

✧ Pedestrian Challenges:

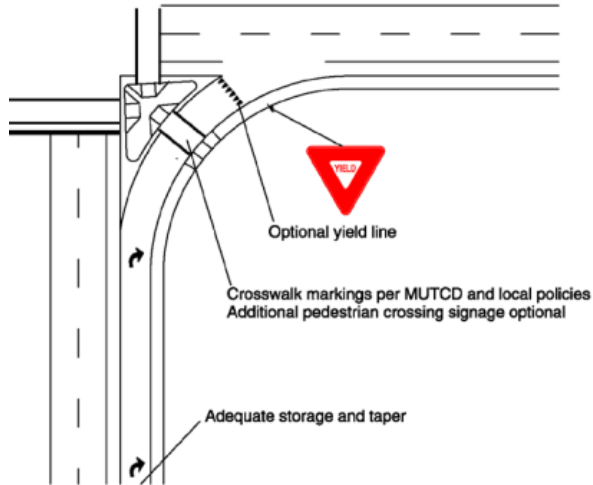
- » Difficulty for visually impaired to detect oncoming traffic



Source: FHWA PEDSAFE Pedestrian Safety Guide and Countermeasure Selection System

Intersection Alternatives – Dedicated Right Lanes

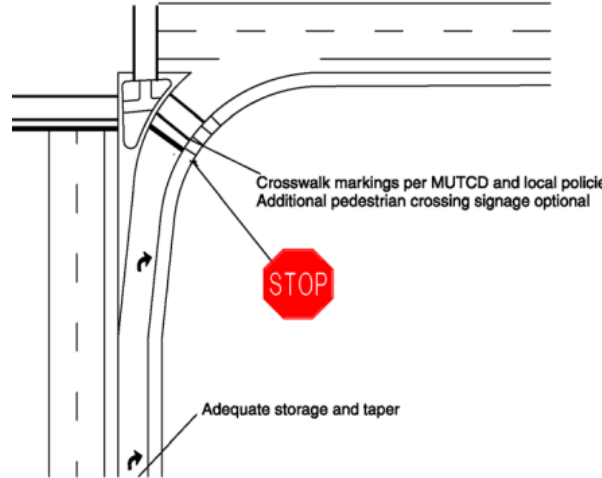
Yield Control



Pros: Minimal delay for pedestrians and vehicles.

Cons: Challenging for visually impaired
Need for additional ped warning signs.

Stop Control

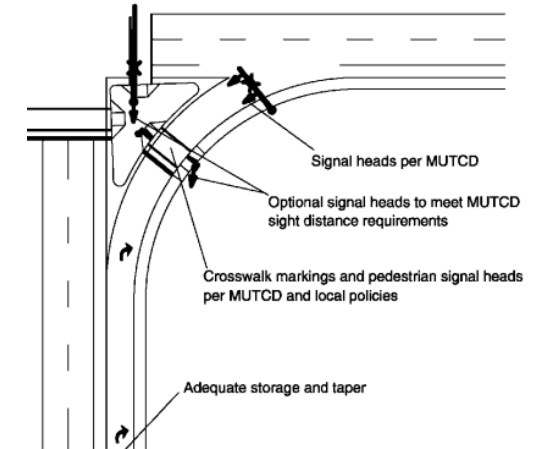


Pros: Vehicles to stop, rather than yield at crosswalk.

Cons: Vehicles potentially stop twice and queues backing across crosswalk.

Signalized

(High Right Turn Volume and Ped Volume)



Pros: Provisions for visually impaired.
Signals to stop vehicles at crossing.

Cons: Pedestrians likely to cross against signal if there are delays to the ped call.

Recommendation for either Yield Control or Signalized Control for Channelized Right Turn Lanes at LTO & Butler

Source: NCHRP Design Guidance for Channelized Right Turn Lanes 2014



Example in Action – Boulder, Colorado



✧ Boulder, Colorado

- » Standard Practice – Yield Control
- » Can use Raised Crossings to further control speeds



Intersection Alternatives – Takeaways

- ✧ All intersection alternatives have sufficient green time to allow pedestrians to cross in one cycle
- ✧ Intersection footprints are all smaller than the comparable 4th and Route 66 intersection in Flagstaff (and Ponderosa with Butler and Route 66)
- ✧ All intersection alternatives have protected pedestrian/cyclist crossings along Lone Tree Road / FUTS across Butler Avenue
- ✧ Channelized right islands and refuge islands decrease crossing distances for pedestrians and improve safety
- ✧ Stop or yield control at channelized right could allow pedestrians to cross to island independent of traffic signal
- ✧ There is significant increase in vehicle delays and queue lengths in single left intersection alternative



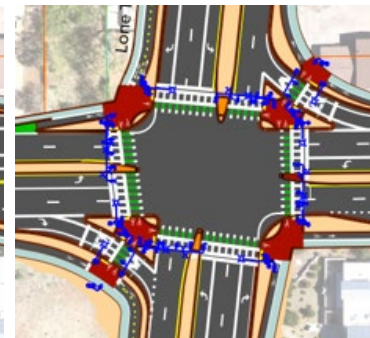
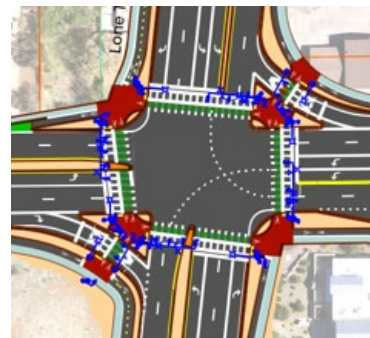
LTO & Butler – Intersection Summary

Evaluation Criteria	Traditional		Full Build-Out		Single Left-Turn Lanes		Balanced	
Protected/Separated Bicycle Facilities	N/S Legs		All Legs		All Legs		N/S Legs	
Pedestrian Crossing Length/Time	26.0 s		24.6 s*		24.6 s*		26.0 s	
Total Fuel Used (Gallons/Hr) (2026)	57.0		58.2		91.8		56.3	
Vehicle User Delays (2026)	46.9 s		47.8 s		73.9 s		47.9 s	
ROW Impacts	None		SW/NE/NW		SW/NE/NW		SW	
Construction Cost**	\$1,800,000		\$2,100,000**		\$2,100,000**		\$1,900,000**	

Legend:

- 5 – Great
- 4 – Good
- 3 – Average

- 2 – Below Average
- 1 - Poor

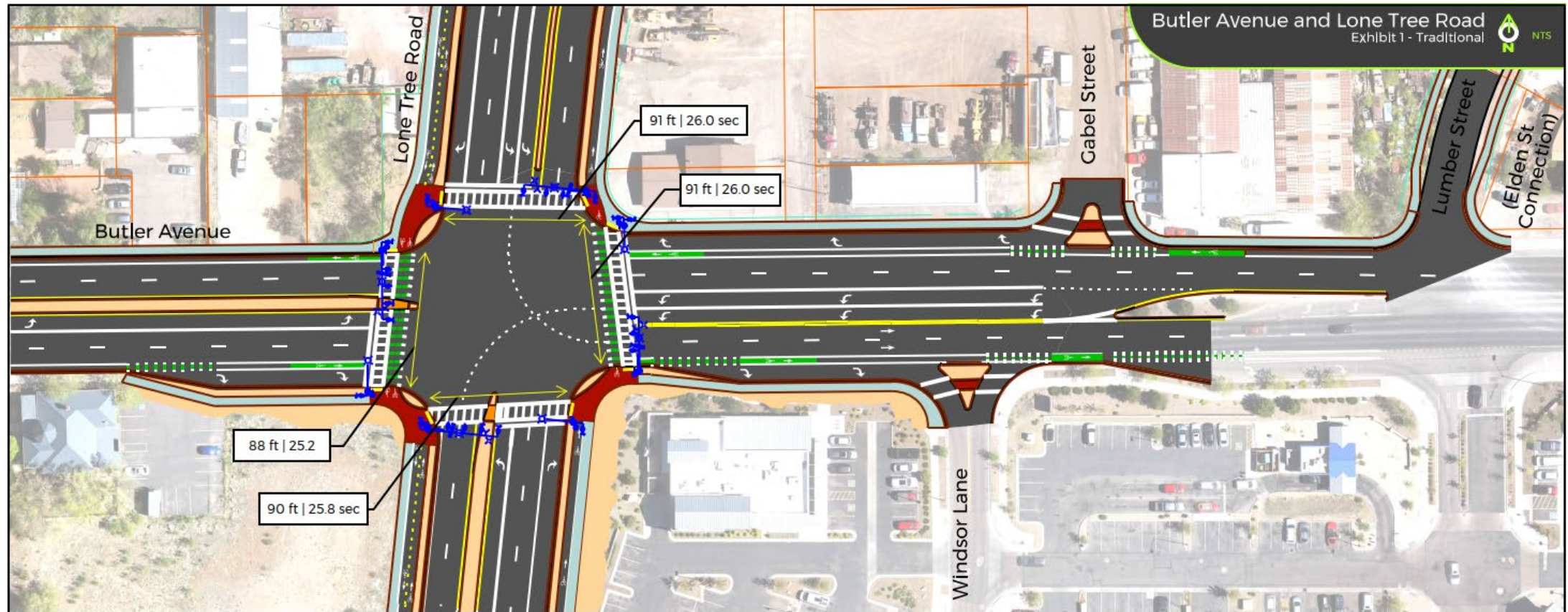


* Time is from channelized island to opposite curb

** Does not include additional right-of-way costs



LTO & Butler – Traditional Intersection



Vehicle Features

- Two left-turn lanes (SB, WB)
- Channelized right-turn lanes (None)

Bicycle Features

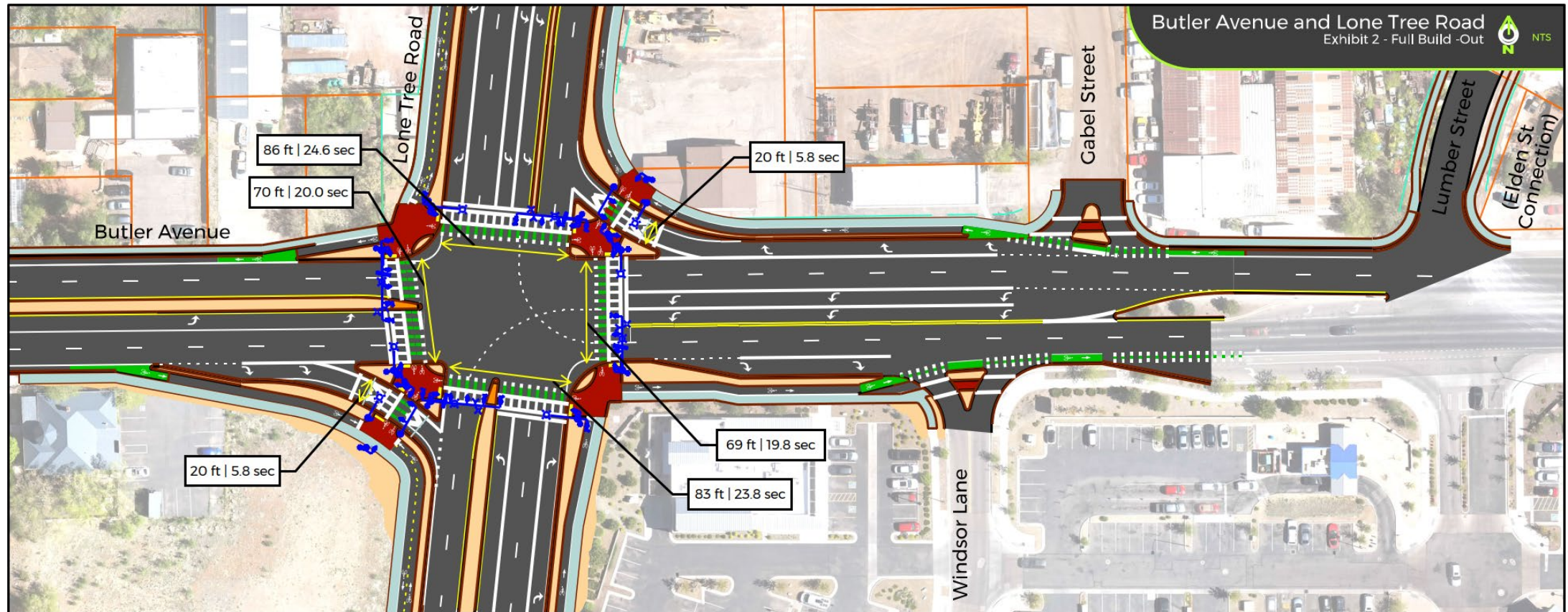
- Separated bike lanes (LTO)

Pedestrian Features

- Raised median (S, W)



LTO & Butler – Full Build-Out Intersection



Vehicle Features

- Two left-turn lanes (SB, WB)
- Channelized right-turn lanes (SW, NE)

Bicycle Features

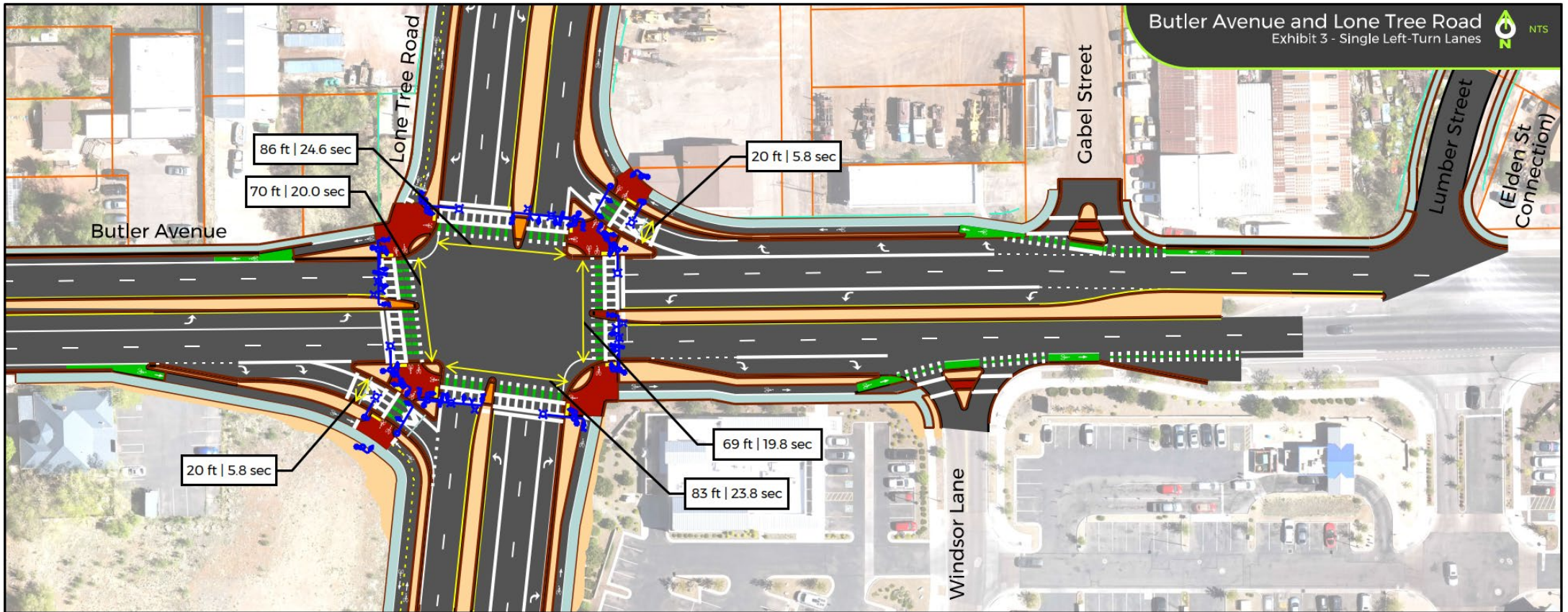
- Separated bike lanes (LTO) and Butler at the intersection

Pedestrian Features

- Raised median (S, W)



LTO & Butler – Single Left Intersection



Vehicle Features

- Single left-turn lanes (NB,SB, EB,WB)
- Channelized right-turn lanes (SW, NE)

Bicycle Features

- Separated bike lanes (LTO) and Butler at the intersection

Pedestrian Features

- Raised median (N,S,E, W)



LTO & Butler – Balanced Intersection | Looking NE





Comments