LAWTON BIKE PLAN

Phase 1 Route Analysis and Feasibility Study
On-Street Route Segments

Lawton, Oklahoma

January 2010

JACOBS

Introduction and Background

On June 10, 2008, the Lawton City Council adopted the Lawton Metropolitan Planning Area Bicycle and Pedestrian Plan (the "Master Plan" – see below) to support multi-modal transportation and guide the development of bicycle, pedestrian routes throughout Lawton. The plan indicated a number of "on-street" and "trail" or off-street routes and provided prioritization of these routes. The Master Plan placed an emphasis on the development of on-street facilities in order to maximize the length of the routes that can be provided with the limited funding. On-street routes focus on lower speed local and collector streets and consist primarily of the addition of striping and signage and avoid the costs of concrete and asphalt.

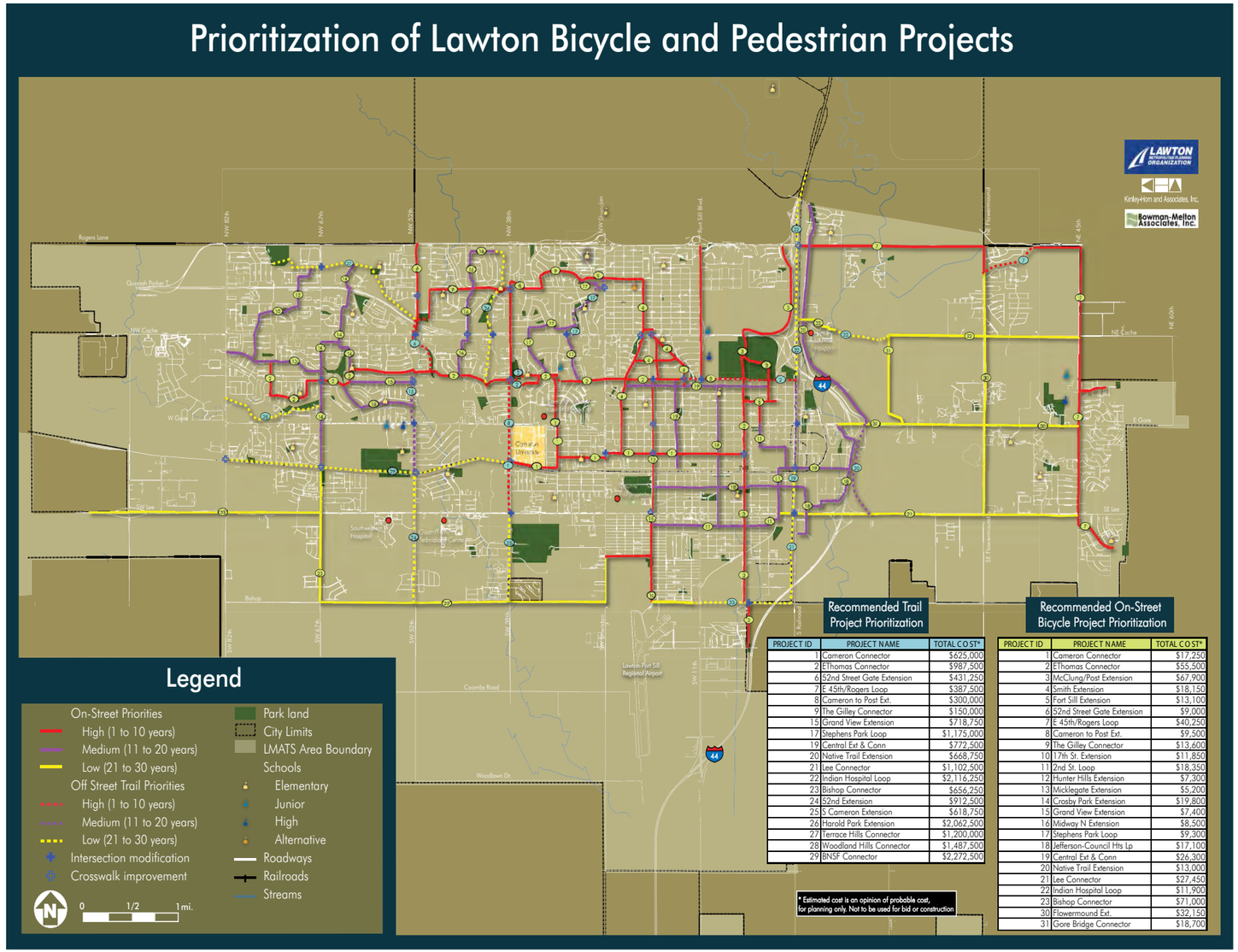
Following adoption of the Plan, the City applied for and received a $500,000 Transportation Enhancement Grant to design and construct the first several segments of the proposed system of "on-street" bicycle and pedestrian paths. In an attempt to jump-start the implementation process, the LMPO also allocated $40,000 of their annual CMAQ funding to begin the very first segment, the Cameron Connector, commencing at Cameron University and continuing to the downtown area. However, when design of the initial route began, the City realized that the crossing of Sheridan Road could not safely be accomplished without additional construction. Furthermore, as the City reviewed the other on-street priority routes more closely, it became evident that each of them had some kind of barrier or other impediment that precluded the simple "signage and striping" concept. Solutions to these barriers and impediments could involve more costly construction measures, obtaining additional easements, and even rerouting.

It was determined that the best approach to begin implementation of the Phase I on-street routes was to retain a consultant to perform a Phase I Route Study. The study examines the proposed routes and provides more detailed conceptual designs and comprehensive cost estimates. If required, the recommendations and conclusions contained within the study could be adopted as amendments to the Bicycle and Pedestrian Master Plan and be used for future planning and grant applications. In addition, the more detailed analysis and design efforts would pave the way for the final design and construction work that would be possible with future funding.

Format of this Report

This report represents the culmination of the field investigations and design analysis conducted for the priority on-street bike routes included in the Master Plan. The Table of Contents (see box) lists the information included in the report, and the following is a summary of each of the major elements:

- **Introduction and Background**: provides a background of and need for this study and the nature of the issues to be addressed.
- **Executive Summary of Phase I Route Recommendations**: provides a summary description of the priority bike routes and types of bike facilities to be included in the Phase I implementation of the Master Plan, including costs and limits of specific Phase I routes.
- **Feasibility Analysis of Individual Routes**: presents graphics, tables and narratives summarizing the detailed field investigations and analyses conducted for each proposed Phase I route, including the general rules and criteria used to evaluate and the potential route options, solutions and potential costs and recommendations.
- **Design Standards and Criteria**: provides tables, graphics and narratives that describe the proposed design criteria and standards that should be applied to future planning and design of bike facilities.



PROJECT ID	PROJECT NAME	TOTAL COST*
1	Cameron Connector	$625,000
2	EThomas Connector	$987,500
6	52nd Street Gate Extension	$431,250
7	E 45th/Rogers Loop	$387,500
8	Cameron to Post Ext.	$300,000
9	The Gilley Connector	$150,000
15	Grand View Extension	$718,750
17	Stephens Park Loop	$1,175,000
19	Central Ext & Conn	$772,500
20	Native Trail Extension	$668,750
21	Lee Connector	$1,102,500
22	Indian Hospital Loop	$2,116,250
23	Bishop Connector	$656,250
24	52nd Extension	$912,500
25	S Cameron Extension	$618,750
26	Harold Park Extension	$2,062,500
27	Terrace Hills Connector	$1,200,000
28	Woodland Hills Connector	$1,487,500
29	BNSF Connector	$2,272,500

PROJECT ID	PROJECT NAME	TOTAL COST*
1	Cameron Connector	$17,250
2	EThomas Connector	$55,500
3	McClung/Post Extension	$67,900
4	Smith Extension	$18,150
5	Fort Sill Extension	$13,100
6	52nd Street Gate Extension	$9,000
7	E 45th/Rogers Loop	$40,250
8	Cameron to Post Ext.	$9,500
9	The Gilley Connector	$13,600
10	17th St. Extension	$11,850
11	2nd St. Loop	$18,350
12	Hunter Hills Extension	$7,300
13	Micklegate Extension	$5,200
14	Crosby Park Extension	$19,800
15	Grand View Extension	$7,400
16	Midway N Extension	$8,500
17	Stephens Park Loop	$9,300
18	Jefferson-Council Hts Lp	$17,100
19	Central Ext & Conn	$26,300
20	Native Trail Extension	$13,000
21	Lee Connector	$27,450
22	Indian Hospital Loop	$11,900
23	Bishop Connector	$71,000
30	Flowermound Ext.	$32,150
31	Gore Bridge Connector	$18,700

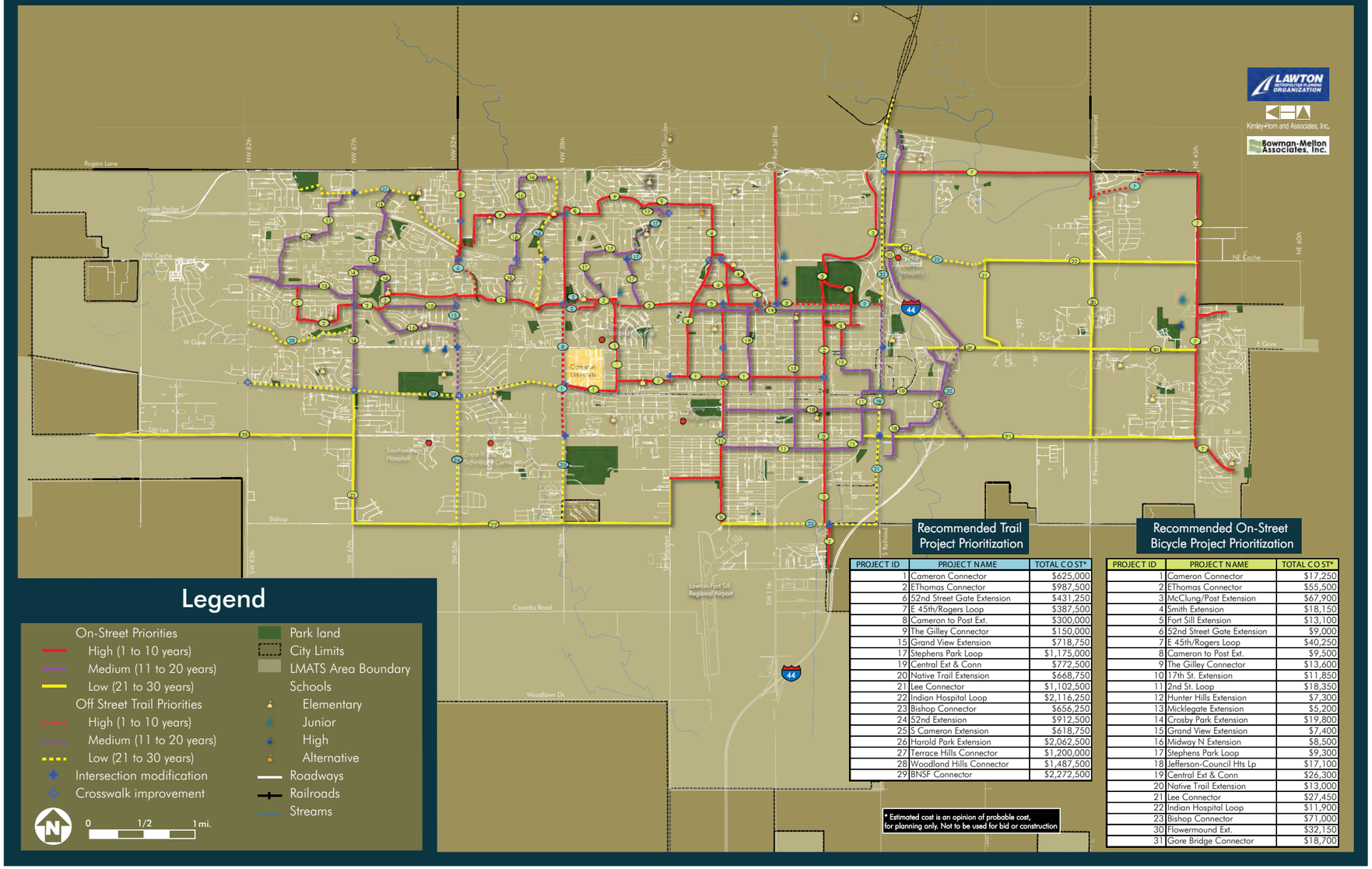
Summary of Field Investigations and Findings

The Master Plan identified a list of 31on-street bicycle facilities and routes that were needed in Lawton, but the City prioritized eight (8) particular routes that should be Phase I implementation priorities, including Cameron Connector, Elmer Thomas Connector, McClung Post Extension, Smith Extension, Fort Sill Extension, 52nd Street Extension, Cameron to Post Connector and the Gilley Connector (see map this page). Field investigations and design analyses of the priority "on-street" routes concluded that the majority of these routes are feasible and can be implemented as proposed in the Plan. The detailed field work and investigations indicated, however, multiple conflict points within individual routes that required a review of potential options. Most of these conflicts arise at or near intersections along each route and all of them pose significant safety concerns for future bicyclists. In most instances, these conflicts are manageable with on-street solutions, but in some cases, an off-street facility is needed to assure overall safety. Section III of this report provides the detailed analyses associated with the individual priority routes and the recommended solutions.

Connectivity of Phase I Routes

When constructed and in operation, the eight (8) Phase I priority routes (see map) will provide on-street bicycle facilities and connectivity throughout the majority of the City. East-west circulation is provided through the Cameron, Elmer Thomas and Gilley Connector routes and north-south links are available via the others. In addition, these Phase I routes provide two direct connections to Fort Sill (Fort Sill Blvd. and 52nd Street Gate) in order to link the city's system to the bike trails that are planned or in place on the post. Finally, the City's proposed Rogers Lane extension road project (east of Interstate 44) will provide a critical east west bicycle connection to the eastern portions of the City when it is constructed. With the addition of this link to the other Phase I routes, a bicyclist will be able to traverse the entire community on designated bike routes, from East 45th Street to West 67th Street and from Fort Sill to the airport.

Prioritization of Lawton Bicycle and Pedestrian Projects



Recommended Trail Project Prioritization

PROJECT ID	PROJECT NAME	TOTAL COST*
1	Cameron Connector	$625,000
2	EThomas Connector	$987,500
6	52nd Street Gate Extension	$431,250
7	E 45th/Rogers Loop	$387,500
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26	Harold Park Extension	$2,062,500
27	Terrace Hills Connector	$1,200,000
28	Woodland Hills Connector	$1,487,500
29	BNSF Connector	$2,272,500

Recommended On-Street Bicycle Project Prioritization

PROJECT ID	PROJECT NAME	TOTAL COST*
1	Cameron Connector	$17,250
2	EThomas Connector	$55,500
3	McClung/Post Extension	$67,900
4	Smith Extension	$18,150
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22	Indian Hospital Loop	$11,900
23	Bishop Connector	$71,000
30	Flowermound Ext.	$32,150
31	Gore Bridge Connector	$18,700

* Estimated cost is an opinion of probable cost, for planning only. Not to be used for bid or construction

Phase I Implementation – Recommended and Postponed Routes

The Phase I routes are particularly important to the overall system due to their relative ease to construct and their ability to provide a fairly comprehensive network of bike routes throughout the City. In almost all instances, the proposed bike facilities are complimentary to the vehicular operations of the existing street system. Most of the routes are located on low volume, low speed residential streets, thus their impact on the traffic operations of the street are minimal.

In one instance, however, the traffic carrying capacity of a local roadway may be compromised by the inclusion of the proposed bike facility. The conversion of Ferris Avenue from 4 lanes to 3 lanes (w/ designated bike lanes), from Fort Sill Blvd. to Sheridan Road, is proposed in Phase I as the most economical and safe bike option for this critical, east-west, midtown link. The City's Engineering Department has determined that the traffic level-of-service will be diminished if the 4 lane section is reduced in favor of 3 lanes with bike lanes. Ultimately, the City's Planning Commission and City Council must determine the final disposition of this particular segment, but the opportunity to create a multimodal facility through the heart of Lawton would be a strong statement of the City's support and acceptance of multimodal transportation solutions in their rights-of-way into the future.

Table 2.1 presents a summary description and cost estimate of the Phase I bike routes and recommendations in Lawton. The signage, striping and other miscellaneous construction work items and costs associated with the implementation of these routes were derived based on field investigations and review of current bid pricing for similar projects. Table 2.1 provides a total cost for the recommended portions of each priority route ($926,547) and then an additional cost for those portions of the Phase I routes that are "postponed" to subsequent phases of implementation for various reasons ($406,200). In most instances, the postponed portions are those segments of individual routes that were planned as a connector to another future route. In the interest of lowering short term capital costs, these segments are postponed until future phases when the connecting routes are built.

Finally, since the City has received ODOT funding for implementing the routes identified in Phase I, Table 2.2 provides a breakdown of the recommended routes to be funded by ODOT funds. It is anticipated that total construction funds available in the ODOT grant is in the range of $400,000 - $500,000, thus not all Phase I routes will be constructed immediately. Additionally, based on input received from local bicycling advocacy group, Friends of the Trail, the Fort Sill Extension route has been prioritized over the Smith Extension route and is consequently included in the construction effort for ODOT funding. This change would likely represent an amendment to the approved Plan and corresponding TIP. The total estimated construction costs of $552,876 exceeds the available funding, thus more detailed budgeting will be required during final design.

Table 2.1
Summary of Estimated Construction Costs
Recommended and Postponed Portions of Phase I Routes

Route	Name	Purpose	"Recommended" Portion Costs	"Postponed" Portion Costs	Comments
1	Cameron Connector	East/west connectivity through midtown area of Lawton	$100,614	$81,360	Shared roadway improvements with intersection improvements at Sheridan Road and Gore Blvd. Postpone westernmost portion of route (along Dr. Hamm Drive) until connection at 38th St. is built.
2	Elmer Thomas Connector	East/west connectivity through northcentral areas of Lawton	$215,532	NA	Re-striping of Ferris to include new bike lanes and conversion of 4 lanes to 3 lanes and shared roadway improvements. Proposed use of existing 5' sidewalk rights-of-way at Greer Park at western end to link with Cameron to Post Extension are recommended.
3	McClung Post Extension	North/south connectivity through downtown Lawton, west of I-44.	$73,290	$248,580	Shared roadway improvements proposed with minor re-striping at Gore Blvd. Propose to postpone segments north of Cache until the Rogers Lane east segments are funded and built.
4	Smith Extension	North/south connectivity through midtown Lawton near Sheridan Road.	$64,020	NA	Primarily a shared roadway route. Recommend minor route changes (i.e. delete the 17th Street crossing at Cache and reroute the Morford segment over to 17th Street due to unsafe crossing at Gore) to maintain north-south connectivity in feasible locations.
5	Fort Sill Extension	North/South connector to Fort Sill linking to the Elmer Thomas Connector	$163,800	NA	Creates a signature bike lane facility (lanes on the shoulder) that connects to Fort Sill. Costs include $$ for rehab of shoulder paving in select areas along the route as needed.
6	52nd Street Extension	Westernmost north/south connector to Fort Sill for northwest portion of City	$249,621	$76,260	High volume roadway that demands bike lanes or off street path. Utilize shared use path along east side of 52nd (in existing powerline easement) from south of Cache to Cheyenne Drive.
8	Cameron to Post (38th Street)	Midtown north/south route linking the Gilley and Elmer Thomas Connectors	$12,630	NA	Difficult conditions and limited opportunities in the Cache/38th Street intersection area renders bike facilites along 38th infeasible. Recommend alternative 40th Street route to bypass costly and unsafe 38th Street @ Gore intersection area.
9	Gilley Connector	East/west connectivity through northern portions of the City	$47,400	NA	Implement this shared roadway facility per Master Plan. Primary improvements are striping and signage along the route.
		TOTALS	**$926,907**	**$406,200**	**See detailed cost estimates in Section Three for each route**

Table 2.2
Recommended Priority Phase I Routes

Route	Name	Purpose	Phase I ODOT Costs
1	Cameron Connector	East/west connectivity through midtown area of Lawton	$100,614
2	Elmer Thomas Connector	East/west connectivity through northcentral areas of Lawton	$215,532
3	McClung Post Extension	North/south connectivity through downtown Lawton, west of I-44.	$73,290
4	Fort Sill Extension	North/South connector to Fort Sill linking to the Elmer Thomas Connector	$163,800
		TOTALS	**$553,236**

Bike Lane Rendering (Fort Sill Boulevard)

Off-Street Shared Path Rendering (52nd Street)

Introduction

As noted in previous sections of this report, the large majority of on-street routes included in the Lawton Metropolitan Bicycle and Pedestrian Plan (LMBPP) Master Plan can be implemented as on-street facilities with little or no obstacles, with shared roadways being the predominant facility type. In the relatively few instances where conflicts do occur, most of these conflicts occur at intersections, where turning movements, high traffic volumes and/or high speeds required a more detailed review and analysis of options beyond the concepts included in the LMBPP.

In order to further define and refine the most feasible and effective solution for each of the Phase I on-street routes, the planning and design team conducted field investigations to review each route, segment and intersection to determine if they were physically feasible, and if not, what options existed to maintain the connectivity and intent of each route as envisioned by the LMBPP. These field investigations and engineering analyses were detailed so that the overall extent and nature of a "workable" solution could be derived, including general design layouts and detailed cost estimates, but they were not so detailed that construction of these routes could occur using these plans. Field investigations and preliminary analyses were conducted to document the location, nature, quantity and general extent of needed improvements to meet the standards set forth in the LMBPP and the guidelines offered by ODOT and other regulating agencies.

How to Use this Information

In order to provide definitive design and planning direction for each Phase I priority route, the following pages provide an overview of the information derived in our field investigations and the analysis completed for each Phase I On-street priority route. This section provides information on each of the Phase I routes (i.e. Cameron Connector, E Thomas Connector, etc.) and reviews whether the route could be constructed and implemented as proposed in the overall Master Plan included in the LMBPP. The baseline assumption of our study was that the LMBPP Plan and its recommendations represented the "best" route to be taken, and the purpose of this work was to ensure that this "best" route was feasible and "construct-able" when actual field conditions were reviewed and analyzed. To this end, this section includes the following information for each of the Phase I, on-street priority routes:

- **"Introduction" sheet** - which provides a summary review and comments of the overall route and the major conflicts encountered along the route and a general description of the recommended solutions for each segment or conflict area;
- **"Segment" sheets -** which provide an overview of particular segments of a proposed route in which conflicts with the route, as proposed in the LMBPP, would occur and optional routes or facility types were reviewed and analyzed in order to maintain this route as a viable and connected portion of the overall Master Plan;
- **"Areas of Detailed Study" sheets** – which identify certain conditions or areas on particular routes that required more detailed design analysis and examination of proposed solutions to these conflict zones. These areas generally occur at major intersections or crossings where the probability of vehicle, pedestrian and bicycle conflicts will occur;
- **"Summary" sheet** – which identifies the recommended facility type (i.e. bike lane, shared roadway, or off-street shared use path) for each route segment, a preferred or recommended option for conflicts occurring within designated "Areas of Study" and an overall cost estimate for the proposed recommendations. In addition, because certain portions of some routes (i.e. the westernmost end of Cameron Connector, the northernmost portion of McClung to Post extension, etc.) do not have a logical linkage to another Phase I route or major generator of bicycle traffic, the Summary sheet may also include information about route segments that should be postponed to a subsequent phase of the overall LMBPP implementation Plan. These routes may represent important connections to future phases of the Master Plan, but our analysis indicates that these particular segments should be postponed until a subsequent phase of the Master Plan is funded and a connecting route is constructed.

Limitations and General Notes

Although the information contained in this study is based on field investigations and engineering analysis, there are still some limitations to the conclusions presented herein. The following general limitations and notes apply to this work:

- **No detailed traffic analysis performed:** the study assumed that any proposed vehicular lane reductions on city streets included in the LMBPP were the result of a review and analysis of the traffic patterns and levels of service (LOS) on affected streets. Specifically, the recommended three lane conversion of Ferris Avenue within the Elmer Thomas Connector should have additional traffic analysis completed by the City's Engineer to ensure adequate LOS on this section of Ferris.
- **Signal modification recommendations need additional study:** the study proposes several existing traffic signals' timings be modified in order to provide additional time for bicyclists to traverse large, complex intersections. Field observations instigated these recommendations, but additional study should be conducted to ensure such modifications can be incorporated into the overall traffic signal system on the various streets.
- **Small scale plans limit amount of graphic detail:** even though every sign, striping or other bicycle amenity or construction detail is not shown in the plans, their frequency, location and general extent are included in the detailed cost estimates for each Phase I route.
- **Cost estimates are based on standard signage, striping and other roadway enhancements per AASHTO and MUTCD:** in addition to the construction items required to build the recommended facilities (i.e. new pavement, grading, signals, etc.), the detailed cost estimates provided in the Appendix include the necessary signage, striping, etc. needed to construct bicycle routes per prevailing local, state and federal guidelines, including AASHTO and MUTCD.

Cameron Connector - Introduction

Recommended Facility Type for Each Segment		
Segment	**Facility Type**	**Comments**
A	Shared Roadway	D Avenue - 6th to 11th
B	Shared Roadway	D Avenue - 11th to Sheridan
Area of Study 1	Off-Street Shared Use Path	install on west side of Sheridan
C	Shared Roadway	E Avenue - Sheridan to 27th St.
D	Shared Roadway w/shoulders	postpone to subsequent phase
E	Shared Roadway	27th Street portion of segment
Area of Study 2	Shared Roadway	add right turn lane at 31st St.
E	Shared Roadway	31st Street portion of segment

Ferris Ave

Segment E

38th Street

University Dr

27th Street

Sheridan Rd

17th Street

Gore Blvd

11th Street

6th Street

Cameron University

D Avenue provides most feasible route option. Crossings at Sheridan Road and Gore Blvd. will require additional improvements beyond street signs and markings.

Segment C

E Avenue

Segment B

D Avenue

Segment A

Lawton Central Mall

Segment D

F Avenue

G Avenue Option

G Avenue Option

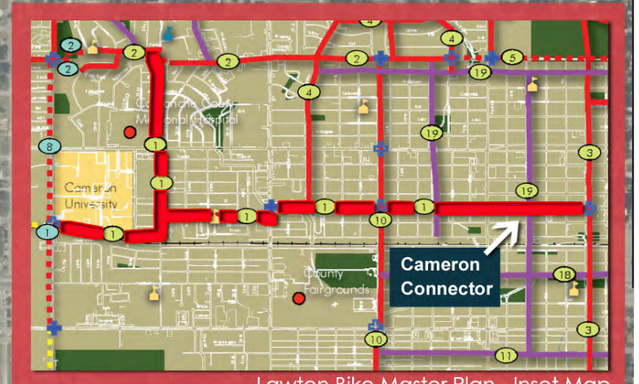
This portion of route to be constructed in subsequent phase when future bike route on 38th Street is developed.

The G Avenue optional route was deemed infeasible due to the difficult crossing conditions at the 11th Street, 17th Street and Sheridan Road intersections. These intersections are unsignalized, and in most instances,there are significant traffic volumes and high vehicle speeds at the intersection

Legend

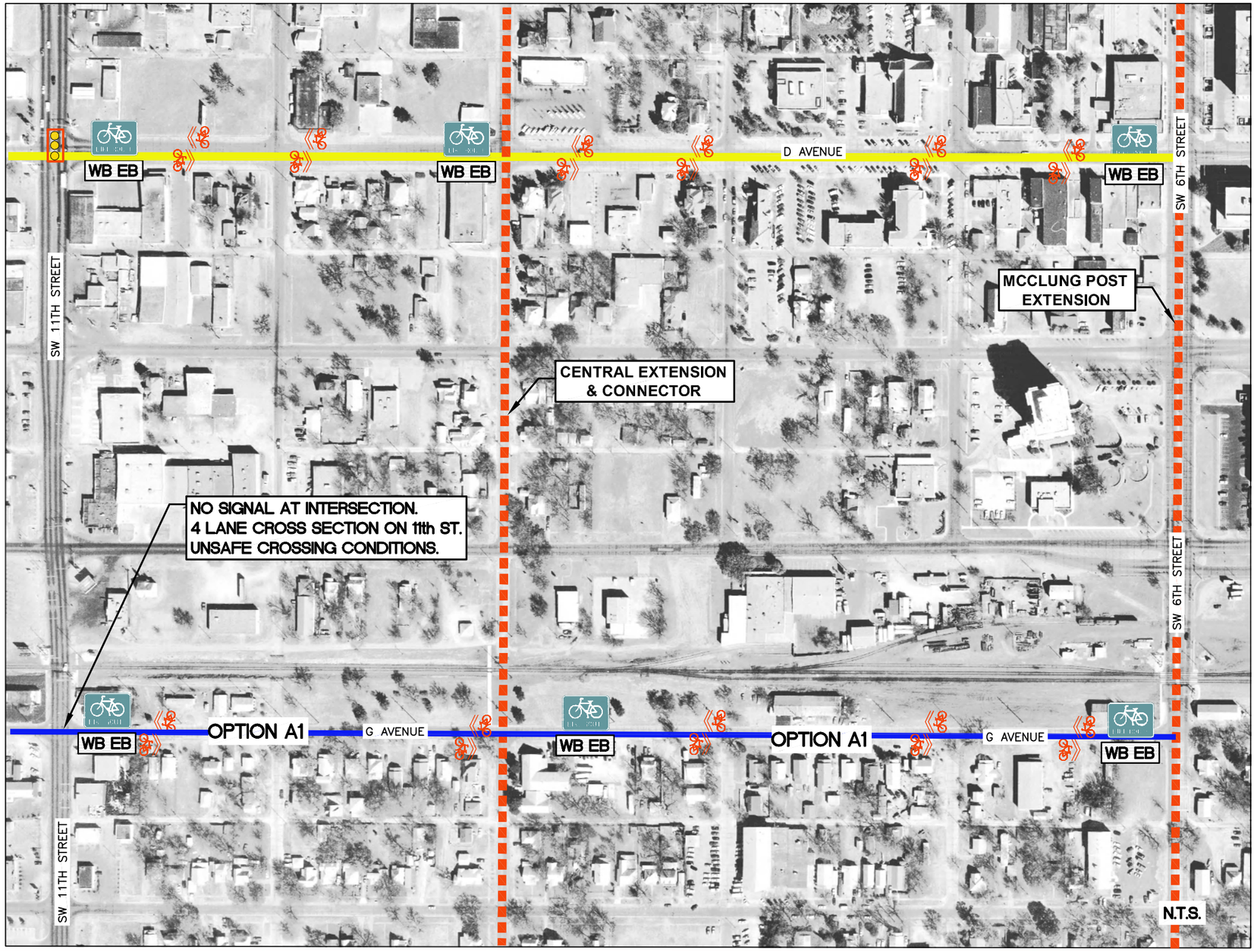
- Shared Lane
- Bike Lane with Three Lane Conversion
- Segment Sections and Identification
- Potential Alternative Route
- Areas of Detailed Study

N.T.S.



Lawton Bike Master Plan - Inset Map
Route 1 - Cameron Connector

Cameron Connector Segment A



LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH

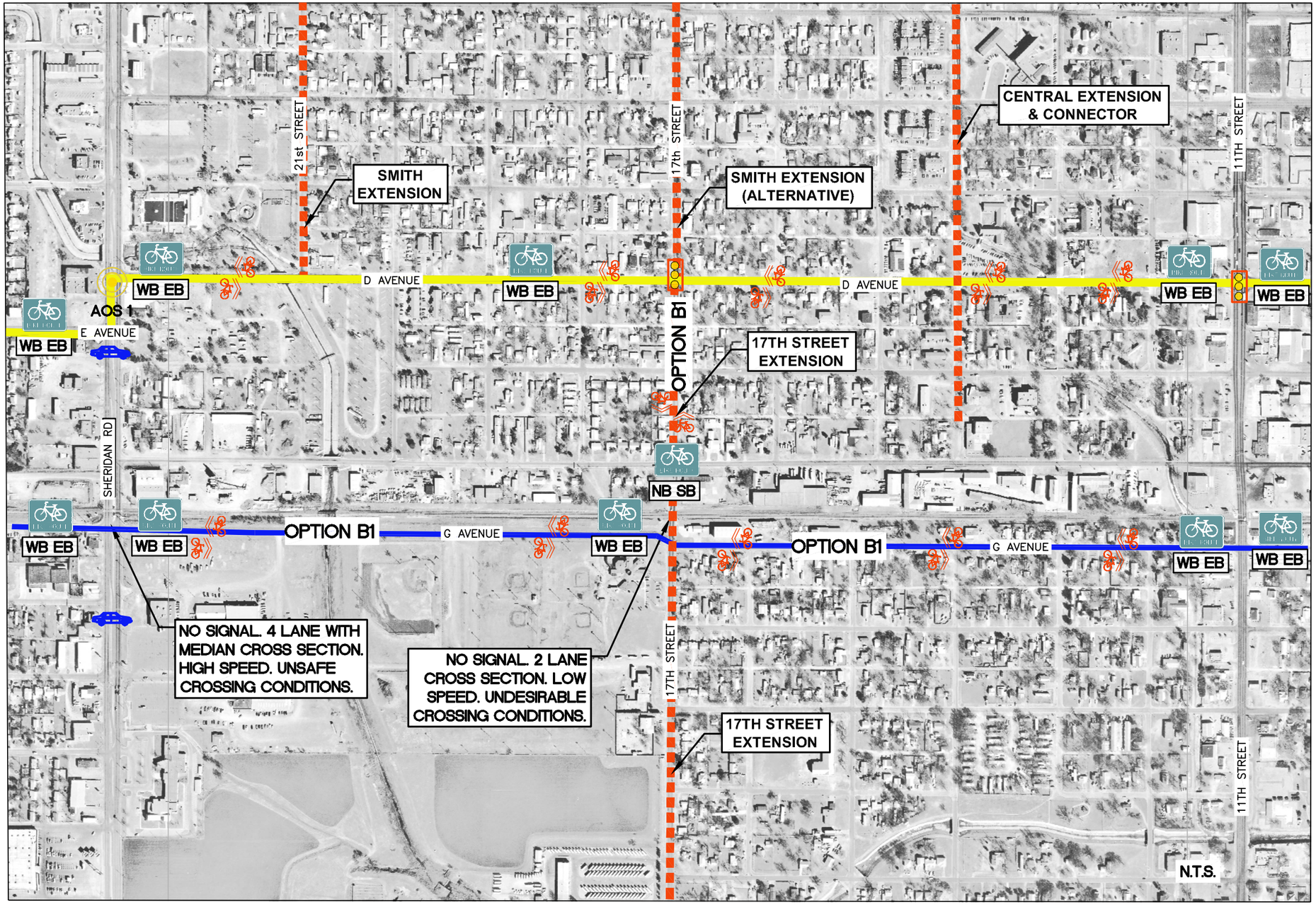
Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

RECOMMENDATION:

UTILIZE "D" AVENUE SHARED LANE FOR THIS ROUTE SEGMENT

Cameron Connector Segment B



LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH

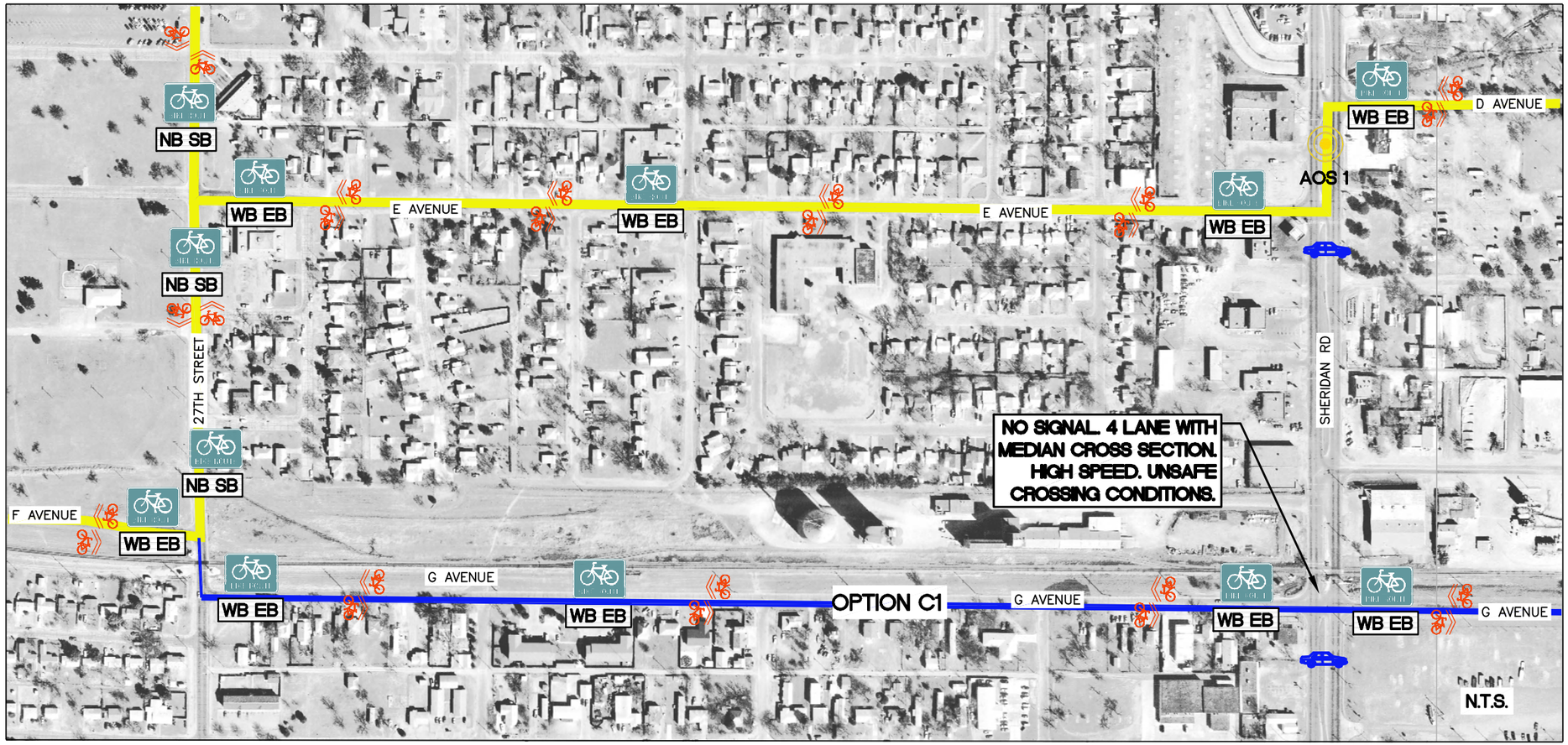
Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

RECOMMENDATION:

UTILIZE "D" AVENUE SHARED LANE FOR THIS ROUTE SEGMENT

Cameron Connector Segment C



LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH

Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

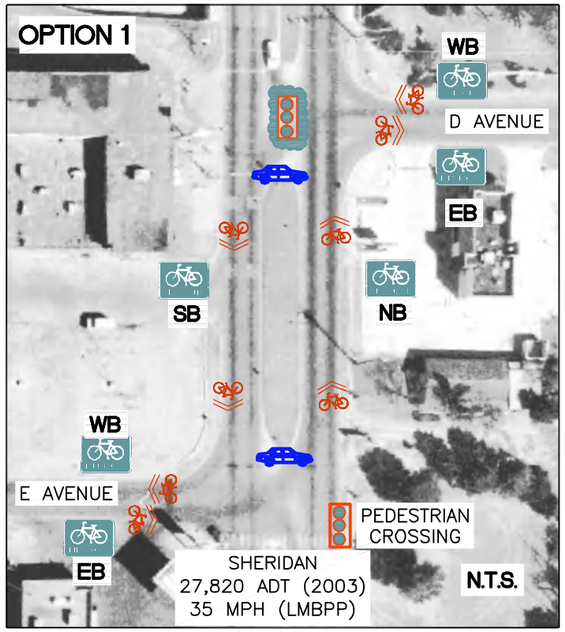
CONCLUSION:

"G" AVENUE OPTIONAL ROUTE IS NOT RECOMMENDED DUE TO SEVERAL UNSIGNALIZED CROSSING CONDITIONS (11th, 17th, & SHERIDAN.) AND THE COSTS THAT WOULD BE REQUIRED TO MAKE THESE INTERSECTIONS SAFE FOR BICYCLE CROSSINGS.

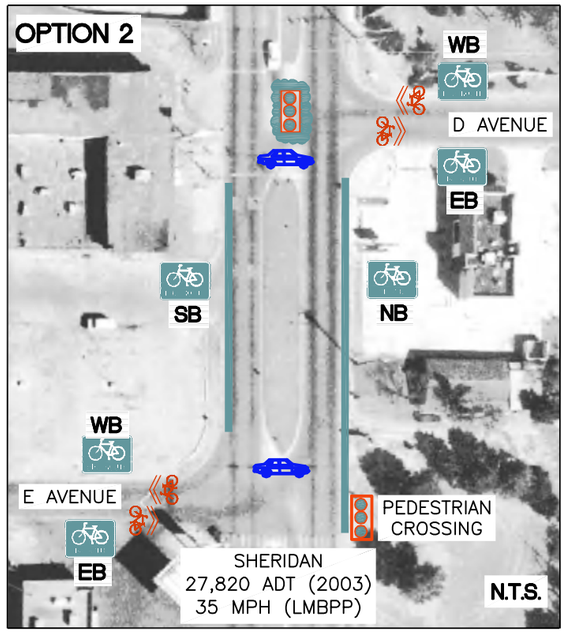
RECOMMENDATION:

UTILIZE "D" AVENUE SHARED LANE FOR THIS ROUTE SEGMENT

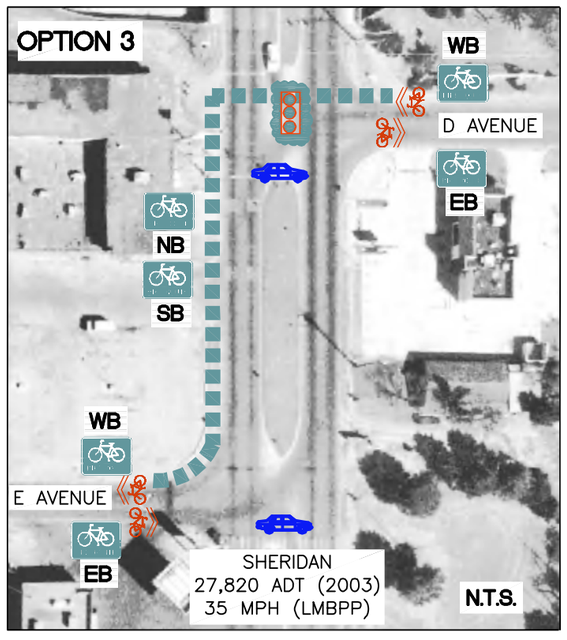
Area of Detailed Study 1



SHARED LANE WITH EXISTING SIGNAL
AND NEW PEDESTRIAN CROSSING SIGNAL



BIKE LANE WITH EXISTING SIGNAL
AND NEW PEDESTRIAN CROSSING SIGNAL



PROPOSED OFF STREET SHARED USE PATH

LEGEND

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH
- THREE LANE CONVERSION

Additional Information

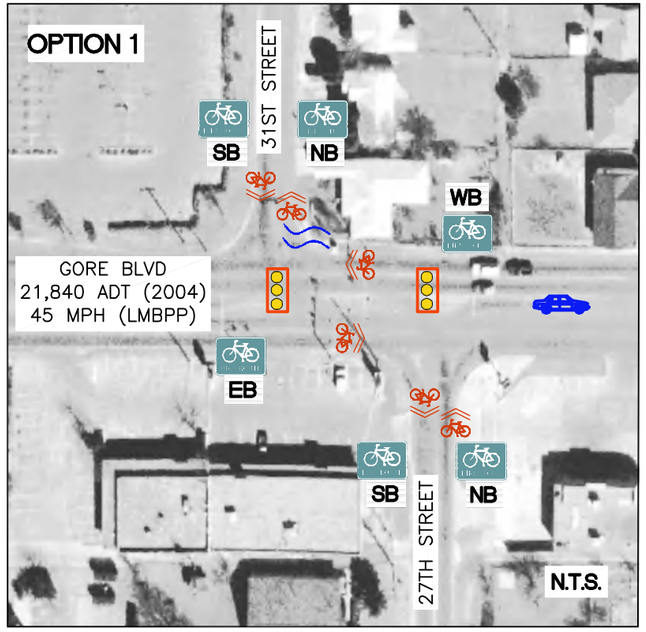
- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- HIGH TRAFFIC VOLUME

NOTES:
OPTIONS 1 AND 2 ARE NOT PREFERRED DUE TO SAFETY PRECAUTIONS. HIGH VEHICLE SPEEDS AND HIGH TRAFFIC VOLUMES ON SHERIDAN CREATE UNSAFE ON-STREET CROSSING AND TRAVEL CONDITIONS AT THESE INTERSECTIONS.

RECOMMENDATION:

OPTION 3 IS RECOMMENDED AS THE MOST FEASIBLE AND SAFE BICYCLE FACILITY AT THIS CROSSING. SEE PROPOSED CROSSINGS AT SHERIDAN RD AND GORE BLVD SHEET FOR DETAILED PLAN OF THIS PROPOSED INTERSECTION CROSSINGS

Cameron Connector Area of Detailed Study 2



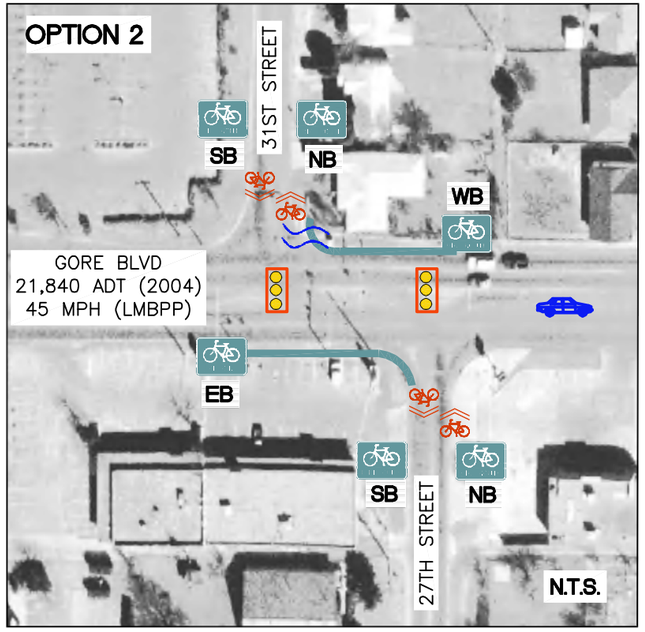
SHARED LANE AT INTERSECTION

NOTES:

1) CURRENT SIGNAL TIMING PROVIDES SAFETY FACTOR FOR BICYCLE TRAFFIC THROUGH INTERSECTION.

2) INVESTIGATE CLOSURE OF CURB CUT AT SHOPPING AREAS ON THE SOUTHWEST QUADRANT TO MITIGATE OPPOSING TRAFFIC FLOW FOR EASTBOUND BICYCLE TRAFFIC FROM 31ST ON TO GORE.

3) SHARED LANE FACILITY AT 27th AND 31st STREETS ARE SUFFICIENT IF A SEPARATE BIKE LANE AT THE 31st STREET INTERSECTION CAN BE PROVIDED SO AS TO MINIMIZE VEHICLE AND BICYCLE CONFLICTS DURING TURNING MOVEMENTS.



BIKE LANE AT INTERSECTION

NOTES:

1) ROADWAY WIDTH ON GORE CAN ACCOMMODATE NEW BIKE LANE DESIGNATIONS, BUT RE-STRIPING OF THIS OFF-SET INTERSECTION WOULD SLOW GEOMETRY AND POTENTIALLY CONFUSE VEHICLES AND BICYCLES.

2) POTENTIAL CONFLICTS BETWEEN CARS AND BICYCLE OCCURS AT 31st STREET AND GORE INTERSECTION

3) SHORT SECTIONS OF DESIGNATED BIKE LANES ON GORE DO NOT ENHANCE SAFETY AND MAY ONLY CAUSE CONFUSION FOR BICYCLES AND CARS. NOT RECOMMENDED.

LEGEND

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH
- THREE LANE CONVERSION

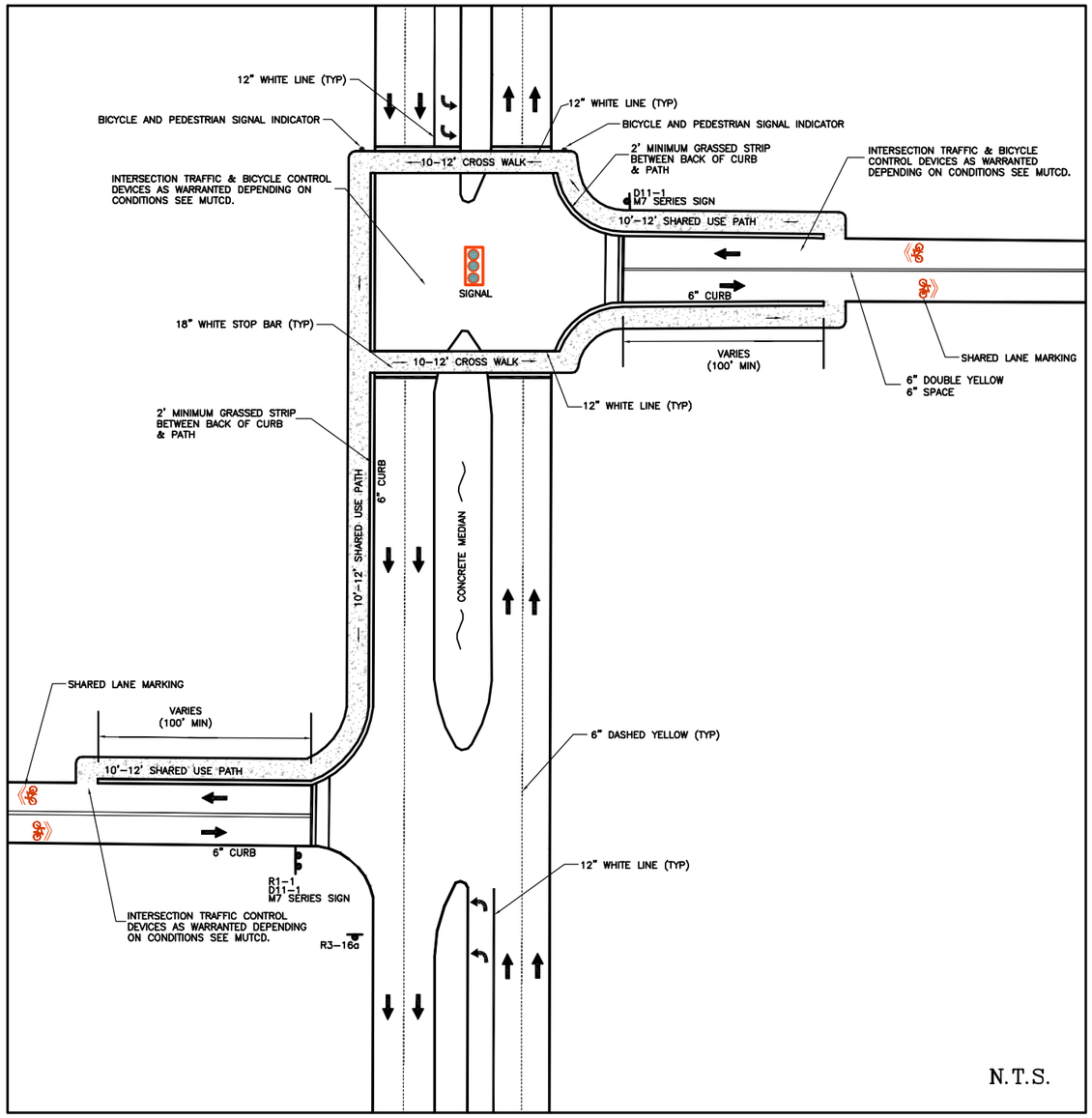
Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- HIGH TRAFFIC VOLUME

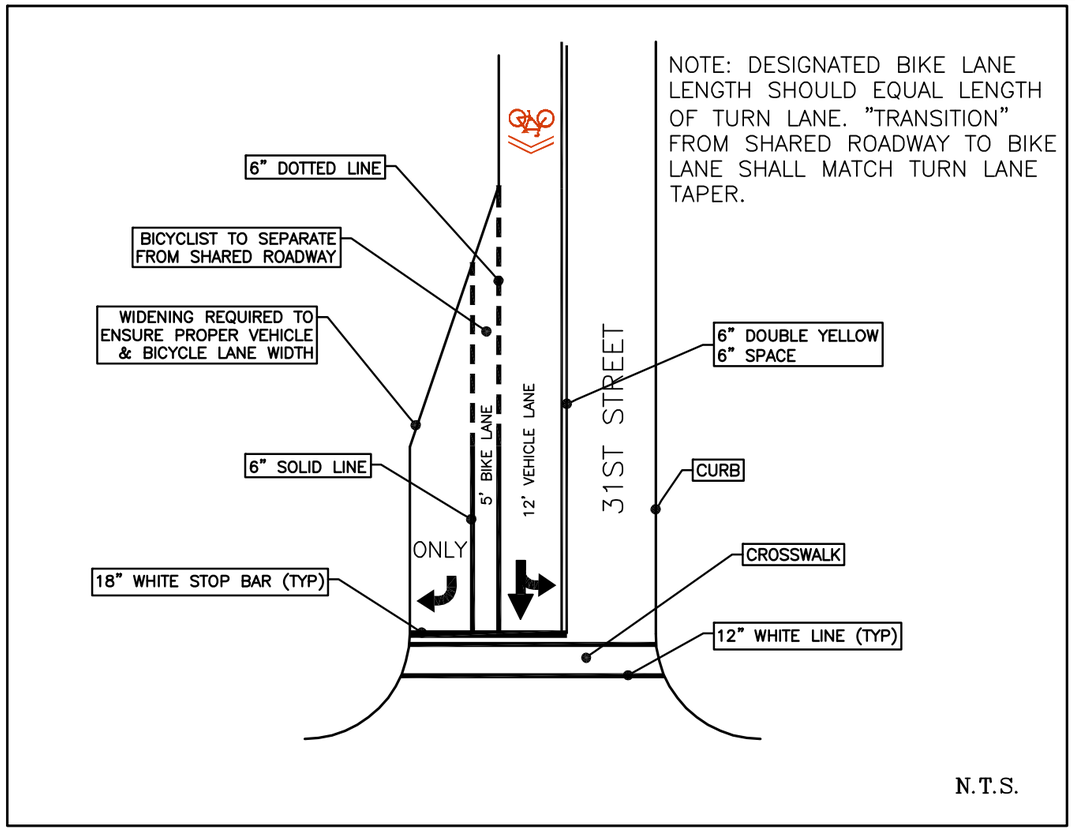
RECOMMENDATION:

SHARED LANE FACILITIES WITH DESIGNATED BIKE LANE ON 31st STREET AT GORE. SEE PROPOSED CROSSINGS AT SHERIDAN RD. AND GORE BLVD SHEET FOR PLAN VIEW OF PROPOSED INTERSECTION MODIFICATIONS AT 31st STREET AND GORE BLVD.

Cameron Connector Proposed Crossings @ Sheridan RD. and Gore Blvd



"D" AVENUE @ SHERIDAN ROAD



27th AND 31st STREET @ GORE BLVD

Summary of Options, Recommendations, Costs and Phasing for Route 1 - Cameron Connector

Segment	Street	Location	Bike Facility Type	Cost
A	D Avenue	6th ST to 11th ST	Shared Roadway	**$8,520**
B	D Avenue	11th ST to Sheridan Rd	Shared Roadway	**$16,860**
Study Area 1	Intersection	D Ave @ Sheridan Road	**see below for options**	**see below**
Option 1	Proposed shared roadway striping and signage along Sheridan Avenue requiring additional lane widths on Sheridan and new pedestrian signal at "E" Avenue intersection			$51,500
Option 2	Proposed bike lanes on Sheridan Avenue requiring additional lane widths on Sheridan and new pedestrian signal at "E" Avenue intersection			$54,200
Option 3	Proposed off street shared use path on west side of Sheridan and along "D" and "E" Avenues to facilitate safe movements across Sheridan. Paths extend approx. 200' beyond the intersections on "D" and "E" to provide safe turning movements onto path, away from intersections			**$34,848**
C	E Avenue	Sheridan Rd to 27th	Shared Roadway	**$9,840**
D	Dr. Hamm Drive	27th to 38th	**see below for options**	**see below**
Option D1	Utilize existing pavement width and limit work to additional striping and signage for shared roadway designation			$5,520
Option D2	Add 4' shoulders on each side along entire length of segment to provide safety margin for cyclists and add striping and signage for shared roadway designation			**$81,360**
E	27th Street	E Ave to Ferris	Shared Roadway	**$13,596**
Study Area 2	Intersection	27th Street @ Gore	**see below for options**	**see below**
Option 1	Proposed shared roadway striping and signage on Gore Blvd. at 27th Street and 31st Street and potential modification to signal timing.			$1,500
Option 2	Proposed separate bike lane striping and signage on Gore Blvd. at 27th Street and 31st Street and potential modification to signal timing.			$4,200
Option 3	Proposed shared roadway striping and signage on Gore Blvd. at 27th Street and 31st Street. Addition of new right turn/through lane on 31st Street (onto Gore) to reduce potential turning conflicts.			**$16,950**
		Total Phase I Costs		**$100,614**
		Total Costs in "Postponed" Phase		**$81,360**

SEE APPENDIX FOR DETAILED COST ESTIMATES FOR EACH PHASE I ROUTE

LEGEND	
Recommended Option	
Recommended Option - Postponed to future phase	

Elmer Thomas Connector - Introduction

Recommended Facility Type for Each Segment		
Segment	**Facility Type**	**Comments**
A	Bike Lanes	3 Lane Conversion on Ferris
B	Shared Roadway	Option B3 is recommended
C	Shared Roadway	Ferris to Greer Park
C	Off-Street Shared Use Path	use ex. Sidewalk ROW to Greer
D	Shared Roadway	Meadowbrook Drive portion
E	Shared Roadway	Glenn/Ash/63rd/Euclid/Compass
F	Shared Roadway	Woodland/76th/Folkstone

Rogers Lane

Quanah Parker Trail

82nd Street

52nd Street

38th Street

Sheridan Road

Cache Road

Ferris Ave

Segment F

Segment E

Segment D

Segment C

Segment B

Segment A

Options A1, A2

Options B1, B2, B3

Options C1, C2, C3, C3A, C3B

Existing 5' sidewalk ROW as eastern edge of Greer Park to be used as off-street path to connect Ferris Ave segment to Greer than to Meadowbrook.

Shared roadway facility residential areas near 31st Street is recommended over the potential routes at or near existing middle school site

Consider on-street shared lane extension on Ferris Ave to 6th St in order to provide connection to the north/south McClung Post route.

Shared roadway facilities through these residential areas provide excellent east/west connectivity.

Three lane conversion of this section of Ferris Avenue is recommended to permit new bike lanes. City Engineer should conduct additional detailed traffic analysis of this proposal to ensure adequate capacity for vehicles.

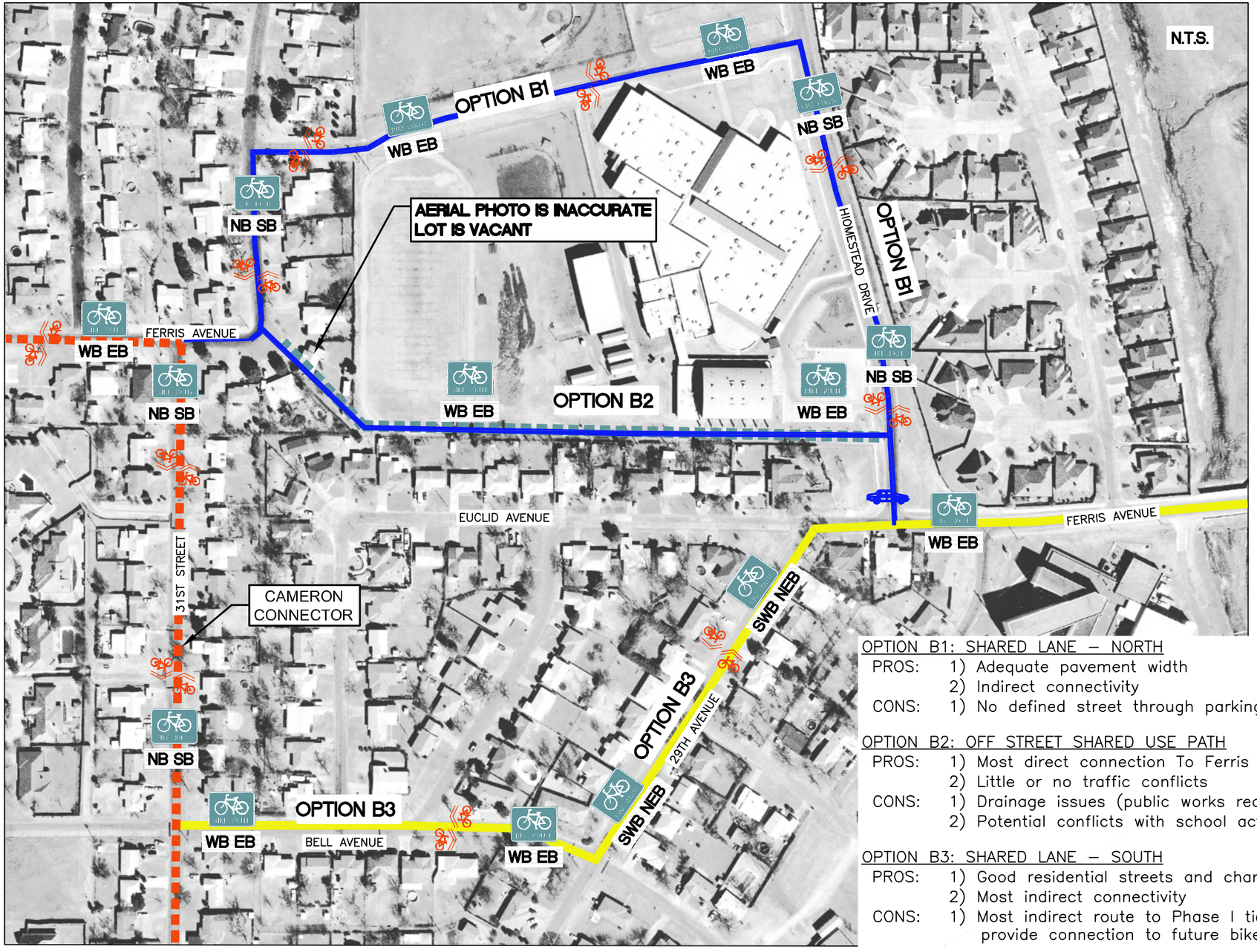
Legend

- Shared Lane
- Bike Lane with Three Lane Conversion
- Segment Sections and Identification
- Potential Alternative Route
- Areas of Detailed Study

N.T.S.

Lawton Bike Master Plan - Inset Map
Route 2 - Elmer Thomas Connector

EThomas Connector Segment B



LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH

Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

OPTION B1: SHARED LANE – NORTH

PROS:
1) Adequate pavement width
2) Indirect connectivity

CONS:
1) No defined street through parking areas

OPTION B2: OFF STREET SHARED USE PATH

PROS:
1) Most direct connection To Ferris Avenue
2) Little or no traffic conflicts

CONS:
1) Drainage issues (public works recommends against)
2) Potential conflicts with school activities

OPTION B3: SHARED LANE – SOUTH

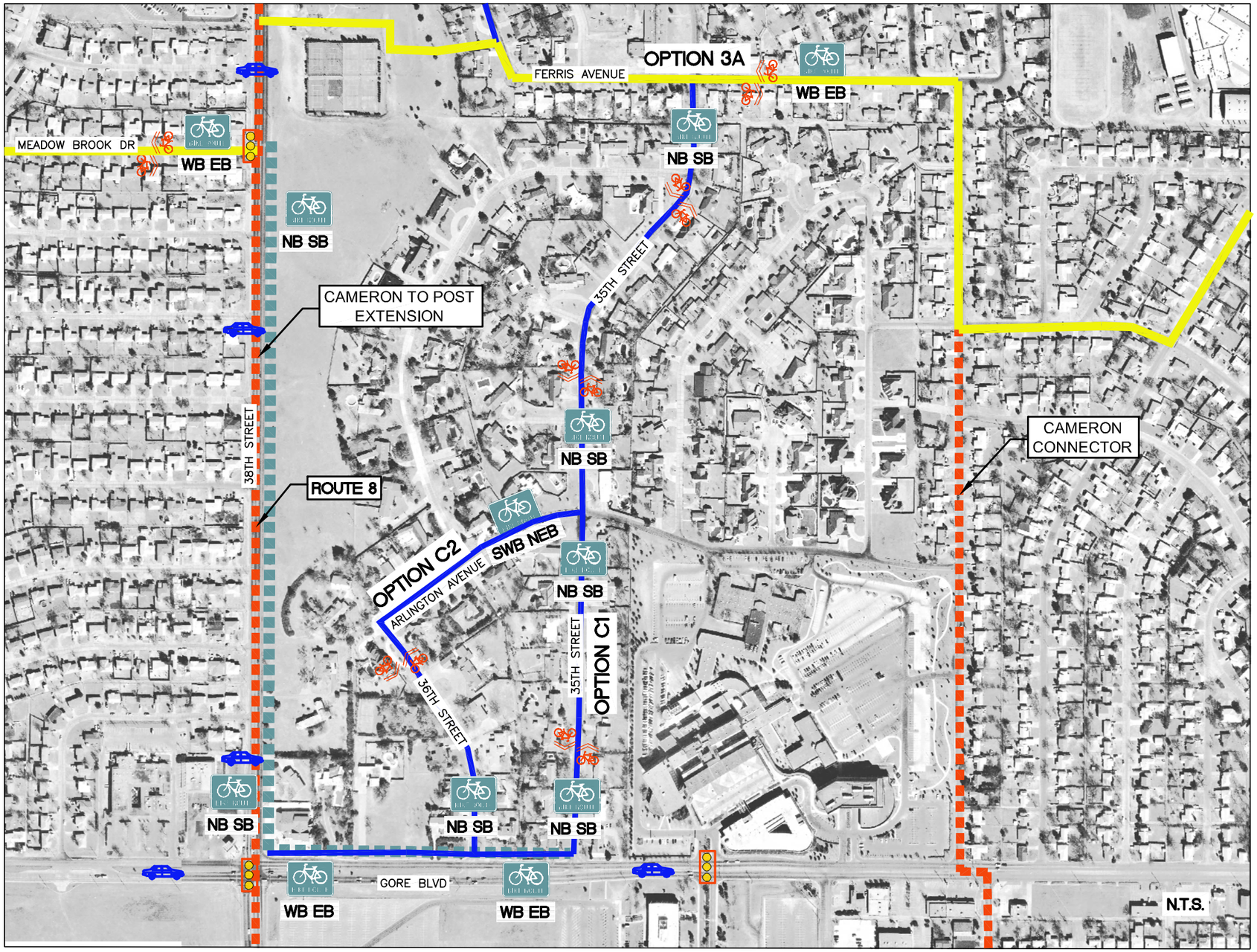
PROS:
1) Good residential streets and character
2) Most indirect connectivity

CONS:
1) Most indirect route to Phase I tie–in; but does provide connection to future bike route on 31st

RECOMMENDATION:

OPTION B3 IS THE RECOMMENDED ROUTE

EThomas Connector Segment C



LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH

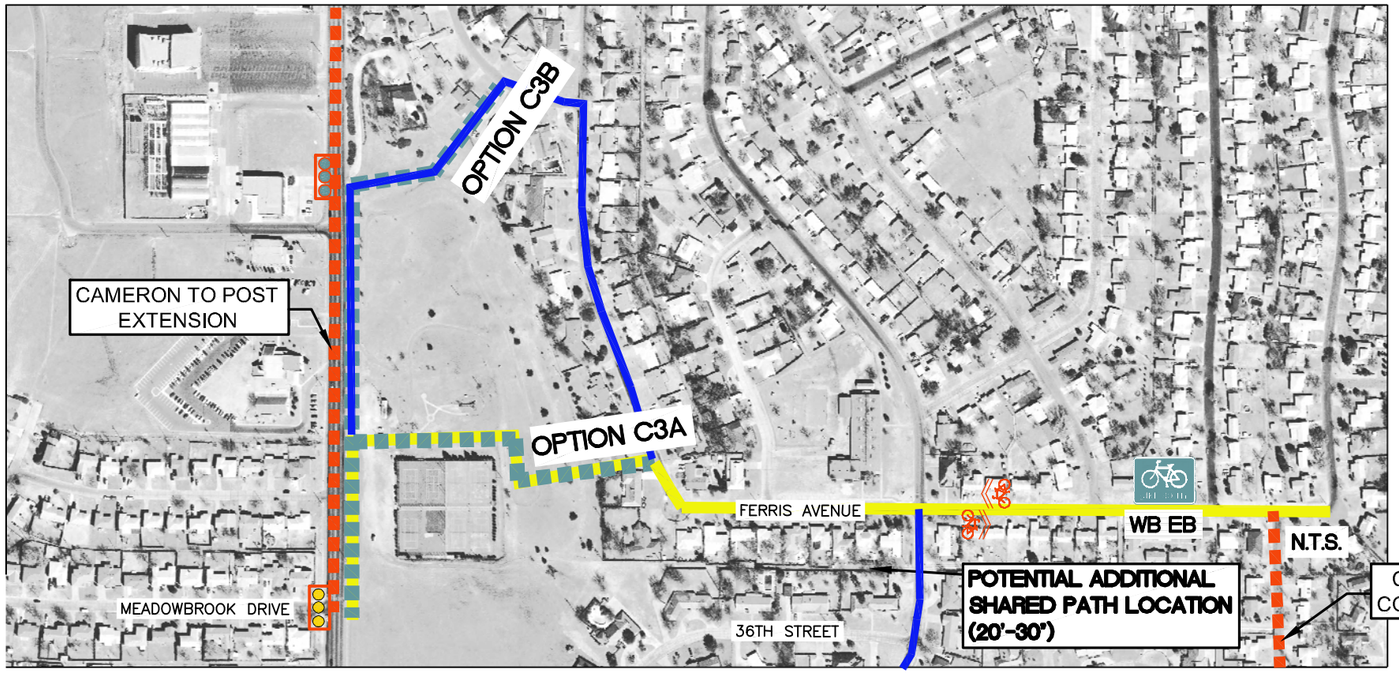
Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

NOTES:
Options C1 and C2 offer on street routes to provide connection from Ferris to Meadowbrook however, both options are not direct and require the cyclist to travel the Gore Blvd and 38th street intersections. Traffic congestion at 38th Street and the hospital area creates unsafe conditions.

RECOMMENDATION: **OPTION C3A IS RECOMMENDED.**

EThomas Connector Segment C



EXISTING PHOTO–C3A
5' SIDEWALK RIGHTS–OF–WAY

EXISTING PHOTO–C3B
5' SIDEWALK RIGHTS–OF–WAY

LEGEND

Route Options & Recommendations
- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

Proposed Bike Routes & Types
- SHARED LANE
- BIKE LANE
- SHARED USE PATH

Additional Information
- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

NOTES:
1) Two public rights–of–way exist at the eastern edge of Greer Park that could provide access from Ferris and Meadowbrook.
2) The two existing 5' sidewalk rights–of–ways (see photos) could provide bike access if:
   a) The privately owned and constructed improvements within these areas are removed and new 5' path provided.
   b) An additional shared use path is constructed through Greer Park to Meadowbrook Drive intersection area.

RECOMMENDATION: **CONSTRUCT OPTION C3A AS ROUTE THROUGH GREER PARK TO CONNECT FERRIS AVE AND MEADOWBROOK AT 38th STREET.**

Summary of Options, Recommendations, Costs and Phasing for Route 2 - Elmer Thomas Connector

Segment	Street	Location	Bike Facility Type	Cost
A	Ferris Ave	13th st to Sheridan Rd	**see below for options**	**see below**
Option A1	Convert 4 lane section into 2 through lanes and center turn lane with bike lanes each direction for this section of Ferris. High traffic volumes warrant bike lanes.			**$108,132**
Option A2	Utilize existing pavement width and lane widths and include only striping and signage to create a shared roadway facility. Safety concerns due to traffic volumes.			$14,400
B	Ferris Ave	Homestead Drive to 31st St.	**see below for options**	**see below**
Option B1	Create shared roadway along Homestead to the north side of Tomlinson School and then west along school drive to connect back to 31st Street and Ferris Avenue, just north of 31st Street. Feasible, but extensive striping and signage needed along school drive to provide distinct separation of travel and parking lanes			**$10,620**
Option B2	Create off street shared use path at south end of school property. Feasible, but drainage and privacy issues may complicate this option.			$82,140
Option B3	Route bikeway through the residential areas to the south of the school and then re-connect with Ferris Ave. via 31st Street. Feasible, but not a very direct connection.			**$10,260**
C	Ferris Ave	35th St. to Meadowbrook	**see below for options**	**see below**
Option C1	Due to no existing, direct access through to Greer Park at western end of Ferris, route bikeway through the residential areas to the south along 35th St. down to Gore Blvd and then back up 38th St. to Meadowbrook. Feasible, but Gore Blvd. crossing is hazardous and unsignalized, 38th St. segment is difficult and heavy volume, and route is not very direct.			$215,520
Option C2	Same rationale and routing as Option C1 except the route is along 36th St. in lieu of 35th St. Same concerns and difficulties at Gore and 38th as Option C1.			$207,420
Option C3A	Utilize the existing 5' wide sidewalk right-of-way at location to create two one way access trail between Ferris and Greer Park, then extend an off street shared use path through the park to connect at Meadowbrook crossing signal on 38th St.			**$48,240**
Option C3B	Utilize the existing 5' wide sidewalk right-of-way at location to create two one way access trail between Ferris and Greer Park, then extend an off street shared use path through the park to connect at Meadowbrook crossing signal on 38th St.			**$60,240**
D	Meadow Brook Dr	38th St. to 53rd Street	Shared Roadway	**$17,700**
E	Glenn/Ash/63rd/Euclid & Compass	53rd St. to Woodland Dr	Shared Roadway	**$13,440**
F	Woodland to 76th to Folkstone	Compass to Micklegate Blvd	Shared Roadway	**$17,400**
		Total Phase I Costs		**$215,172**
		Total Costs in "Postponed" Phase		**$0**

SEE APPENDIX FOR DETAILED COST ESTIMATES FOR EACH PHASE I ROUTE

LEGEND	
Recommended Option	
Recommended Option - Postponed to future phase	

McClung/Post Extension - Introduction

Recommended Facility Type for Each Segment		
Segment	**Facility Type**	**Comments**
A	Shared Roadway	these segments are postponed until bike facilities along E. Rogers Lane are built in future phases
B	Shared Roadway	
Area of Study 1	Bike Lanes thru intersection	
C	Shared Roadway	6th Street - Cache to Gore
Area of Study 2	Bike Lanes thru intersection	designated lanes - no new paving
D	Shared Roadway	6th Street - Gore to Lee
E	Shared Roadway	6th Street - Lee to Douglas
F	Shared Roadway	6th Street - Douglas to Belmont

Rogers Ln

Segment A

Options A1, A2

Utilize Morningside Drive as trail entry from Rogers Lane

This portion of route to be constructed in subsequent phase when proposed bike facilities on East Rogers Lane are developed.

Segment B

Options B1, B2, B3

High speed traffic and 45 mph speed limit warrants a separate bike lane or shared use path in this area

Cache Rd

Segment C

Create new on-street facilities through Elmer Thomas Park that are separate and complimentary to the existing off-road bike trail system.

Designated bike lanes at Gore Blvd. crossing are recommended.

Gore Blvd

11th Street

Segment D

The 6th Ave shared roadway facility provides excellent north/south connectivity

Lee Blvd

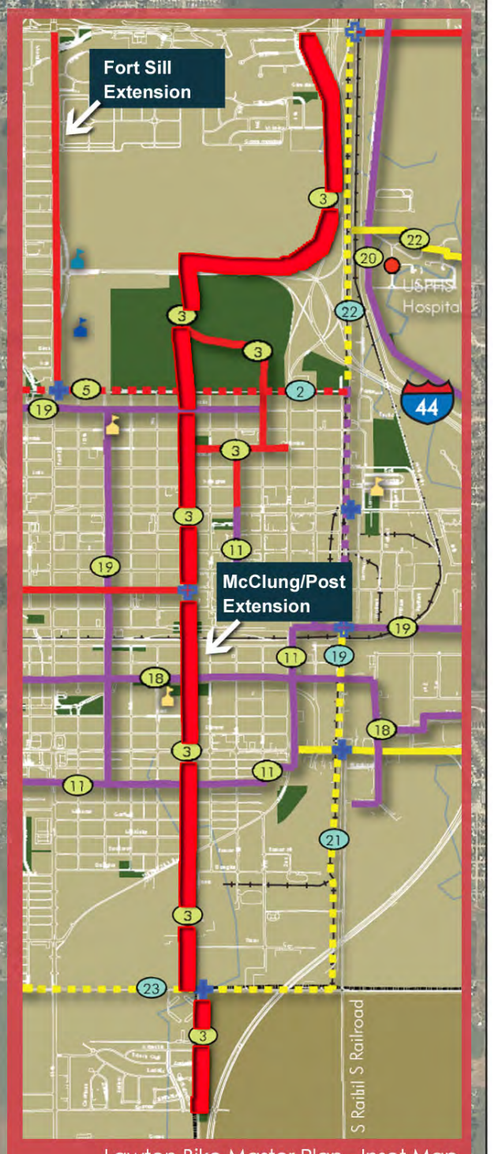
Segment E

More detailed traffic analysis of turning movements at this intersection is needed prior to final design.

Sheridan Rd

Segment F

Belmont Ave

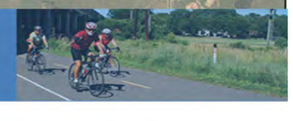


Lawton Bike Master Plan - Inset Map
Route 3 - Mc/Clung Post Extension

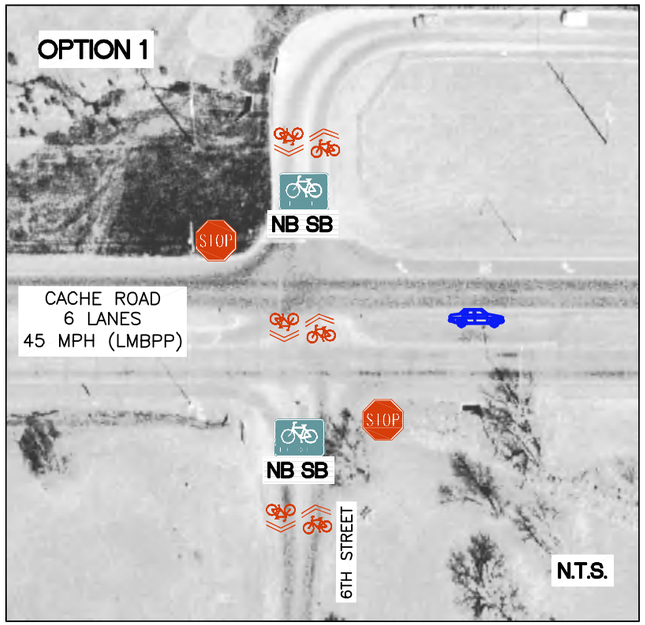
Legend

- Shared Lane
- Bike Lane with Three Lane Conversion
- Segment Sections and Identification
- Potential Alternative Route
- Areas of Detailed Study

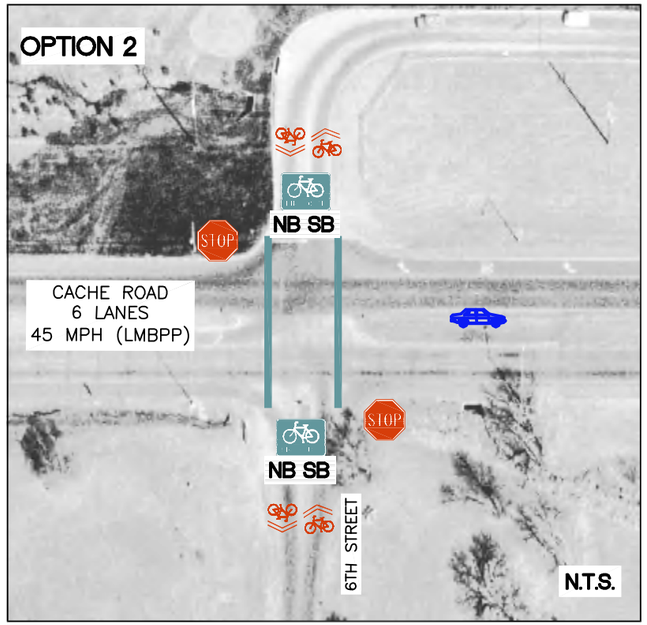
N.T.S.



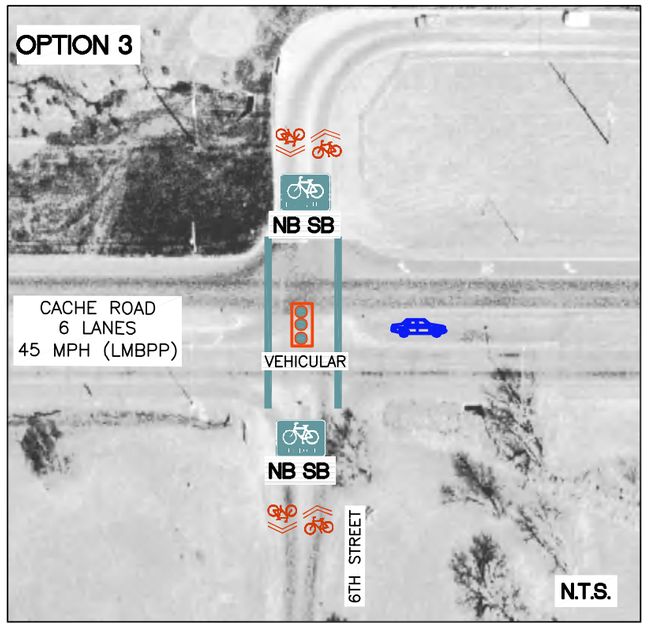
McClung/Post Ext
Area of Detailed Study 1



SHARED LANE – NO SIGNAL



BIKE LANE – NO SIGNAL



BIKE LANE – NEW TRAFFIC SIGNAL

NOTES:

1) HIGH TRAFFIC VOLUMES & SPEEDS ALONG CACHE ROAD RENDER NON–SIGNALIZED, AT GRADE CROSSING DANGEROUS.
2) PEDESTRIAN CROSSING SIGNAL WILL LIKELY NOT IMPEDE TRAFFIC SUFFICIENTLY TO PROVIDE DESIRED SAFETY LEVEL.
3) NEW TRAFFIC SIGNAL (ACTIVATED) PROVIDES MOST COST EFFICIENT & SAFE SOLUTION FOR THIS ROUTE SEGMENT.

LEGEND

Proposed Bike Routes & Types

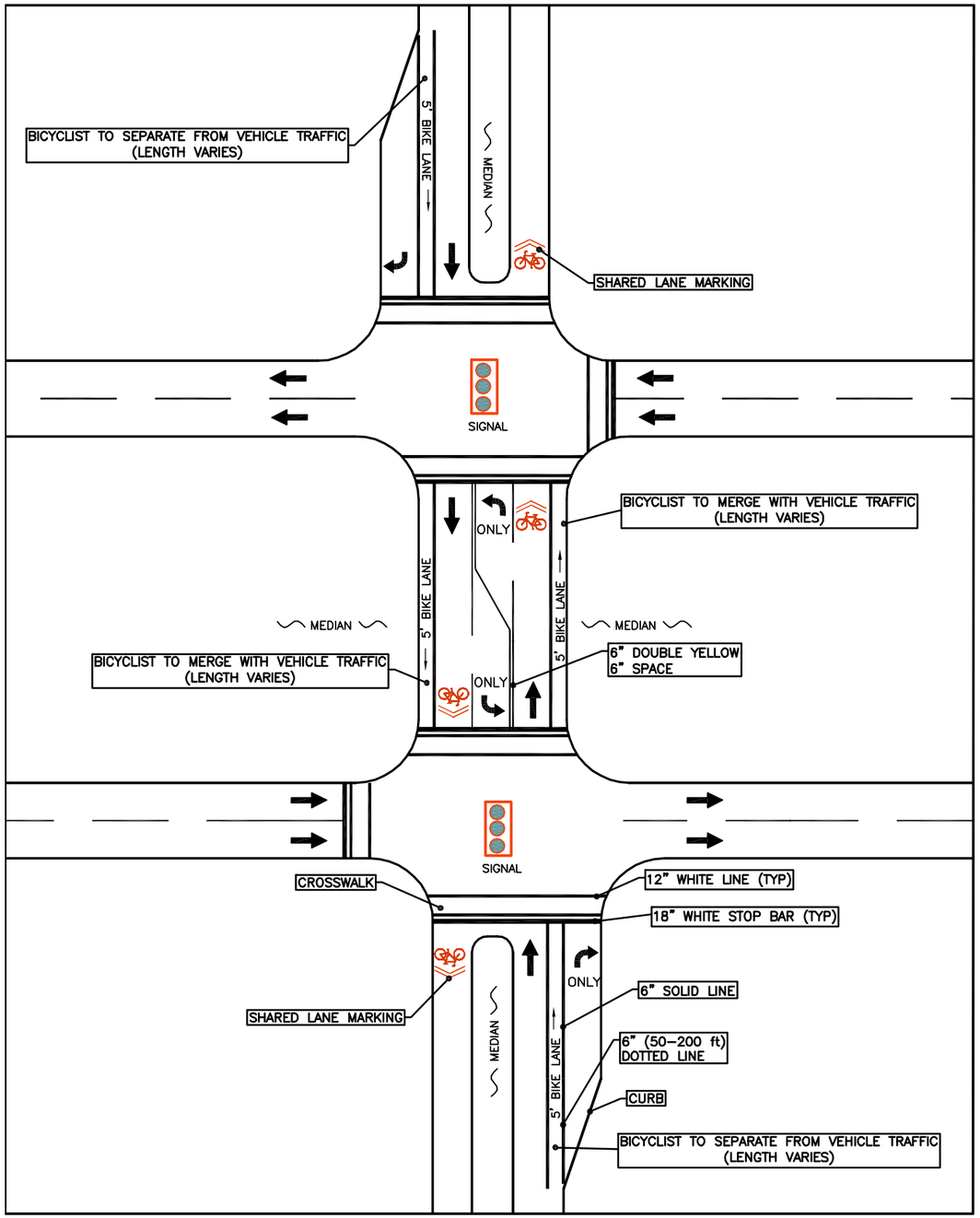
- SHARED LANE
- BIKE LANE
- SHARED USE PATH
- THREE LANE CONVERSION

Additional Information

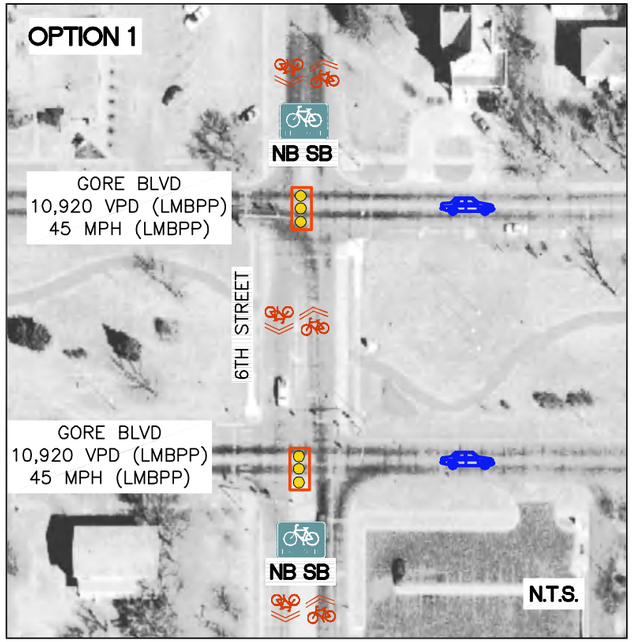
- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- HIGH TRAFFIC VOLUME
- PROPOSED/EXISTING STOP SIGN

RECOMMENDATION:

OPTION 3 (NEW TRAFFIC SIGNAL AT CACHE RD) IS RECOMMENDED TO PROVIDE SAFE CROSSING AT THIS HIGH SPEED, HIGH VOLUME INTERSECTION. THIS SIGNAL HOWEVER IS NOT PRIORITIZED IN PHASE I UNTIL SUCH TIME THAT THE BIKE FACILITIES ON EAST ROGERS LANE ARE CONSTRUCTED.



PROTOTYPICAL INTERSECTION WITH DEDICATED RIGHT TURN LANES



SHARED LANE THROUGH INTERSECTION
(SHARED USE MARKINGS)

LEGEND

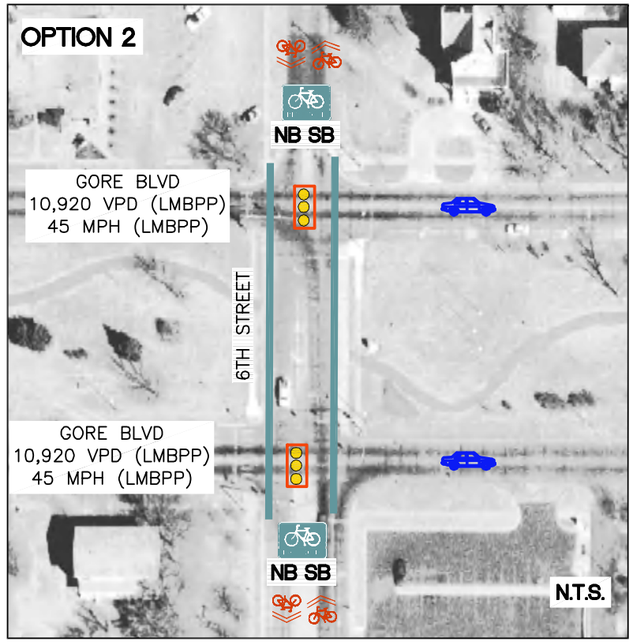
Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH
- THREE LANE CONVERSION

Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- HIGH TRAFFIC VOLUME
- PROPOSED/EXISTING STOP SIGN

McClung/Post Ext Area of Detailed Study 2



BIKE LANE THROUGH INTERSECTION3
(TO INCLUDE STRIPING IMPROVEMENTS)

NOTES:
1) SUFFICIENT LANE WIDTHS & FLEXIBLE GEOMETRY OF THIS INTERSECTION PERMIT A DEDICATED BIKE LANE EACH WAY.

RECOMMENDATION:

OPTION 2 (DEDICATED BIKE LANES THROUGH THE INTERSECTION) ARE RECOMMENDED. SEE FIGURE (THIS PAGE) FOR PLAN VIEW OF INTERSECTION MARKINGS AND IMPROVEMENTS ON 6th STREET AT GORE BLVD.

Summary of Options, Recommendations, Costs and Phasing for Route 3 - McClung Post Extension

Segment	Street	Location	Bike Facility Type	Cost
A	Frontage Road / Morningside Drive	Rogers Lane to Frontage Rd	**see below for options**	**see below**
Option A1	Utilize existing frontage road from Rogers Lane south to the on-ramp to I-44 as a shared roadway facility. Heavy volume and turning movements and accelerating speeds complicate this option.			$2,640
Option A2	Utilize Morningside Drive from Rogers Lane south to the intersection with the Frontage Road as a shared roadway facility. Reduced volumes and low speeds make this route more safe for bicyclists entering this route from the north. More detailed study of Rogers Lane intersection with Morningside will be needed.			**$4,380**
B	Frontage Road	Morningside to Cache Rd	**see below for options**	**see below**
Option B1	Create separate bike lanes each direction on this segment due to high speed traffic and high volumes along this stretch of roadway. Feasible means to provide connectivity, but costly.			$732,240
Option B2	Create separate off street shared use path on west side of Frontage Road due to high speed traffic and high volumes along this stretch of roadway. Feasible means to provide connectivity, but costly.			$267,096
Option B3	Reduce posted speed limit to 35 mph and create shared roadway facility. Biggest issue is speed of vehicles in this segment. Other speed monitoring and limiting measures may be needed. Most cost effective means to connect to Rogers Lane.			**$13,080**
Study Area 1	Intersection	Cache at 6th Street	**see below for options**	**see below**
Option 1	Create shared roadway striping and signage at this intersection. **NOT FEASIBLE** without new traffic signal, due to high speeds, high volume on Cache.			$420
Option 2	Create separate bike lanes through this intersection. **NOT FEASIBLE** without new traffic signal, due to high speeds, high volume on Cache.			$7,020
Option 3	Create separate bike lanes through this intersection to reduce conflicts with vehicle turning movements **and add new traffic signal** to control vehicle movements along the busy and high speed Cache Road section.			**$231,120**
C	6th/3rd/Columbia/4th	Cache to Gore	Shared Roadway	**$31,320**
Study Area 2	Intersection	6th St @ Gore	**see below for options**	**see below**
Option 1	Create shared roadway striping and signage at this intersection. Feasible, but does not fully address possible vehicle turning conflicts onto Gore.			$420
Option 2	Create separate bike lanes at both entrances to this intersection to accommodate the possible vehicle turning conflicts onto Gore. Existing pavement width adequate to add bike lane without sacrificing vehicle lane widths.			**$1,590**
D	6th St	Gore to Lee	Shared Roadway	**$17,760**
E	6th St	Lee to Douglas	Shared Roadway	**$9,960**
F	6th St	Douglas to Belmont	Shared Roadway	**$12,660**
		Total Phase I Costs		**$73,290**
		Total Costs in "Postponed" Phase		**$248,580**

SEE APPENDIX FOR DETAILED COST ESTIMATES FOR EACH PHASE I ROUTE

LEGEND	
Recommended Option	
Recommended Option - Postponed to future phase	

Smith Extension - Introduction

Recommended Facility Type for Each Segment		
Segment	**Facility Type**	**Comments**
A	Shared Roadway	17th Street - Smith to Lawton
B	Shared Roadway	Lawton Dr. connection to 16th
Area of Study 1	Bike Lanes thru intersection	16th at Cache - create bike "portals"
Area of Study 2	DELETE	unsafe crossing conditions at Cache
C	DELETE THIS SEGMENT	portion along Pershing - Cache to Elm
C	Shared Roadway	Elm/16th/17th/Laird to Ferris
D	DELETE THIS SEGMENT	portion from Pershing to Gore to "D" Ave
Area of Study 3	DELETE	unsafe crossing conditions at Gore
D	Shared Roadway on new route	17th St. - Elm to Ferris to Gore to D Ave

17th St

Smith Ave

Fort Sill Blvd

On-street shared roadway facilities are suitable in these residential areas.

Segment A

Separate bike lanes or "portals" are recommended at the Cache Road crossing.

This area of the route should be deleted from the Master Plan due to major traffic conflicts at the Cache Rd. crossing.

Cache Rd

Segment B Options B1, B2

Segment C

Sheridan Rd

Ferris Ave

Multiple shared roadway facilities in these residential areas provide ample opportunity for potential users to access the overall route system.

This area of the trail to be removed due to major traffic conflicts at Gore Blvd.

Segment D

Gore Blvd

New, alternative north-south route for Segment D is recommended. Route provides for signalized crossings at Ferris and Gore thus providing greater safety margins.

D Ave

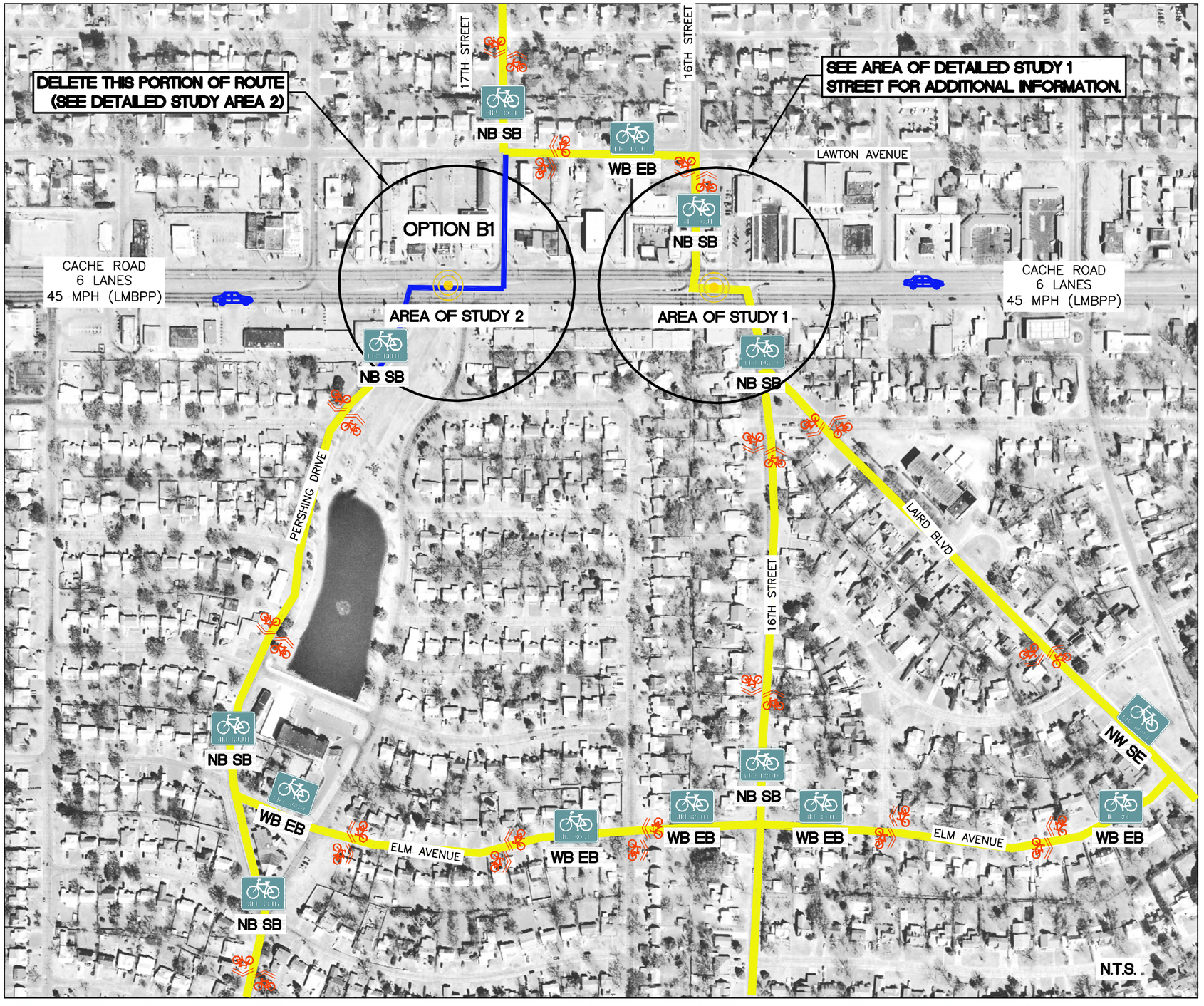
Legend

- Shared Lane
- Bike Lane with Three Lane Conversion
- Segment Sections and Identification
- Potential Alternative Route
- Areas of Detailed Study

N.T.S.

Lawton Bike Master Plan - Inset Map
Route 4 - Smith Extension

Smith Extension Segment B



LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

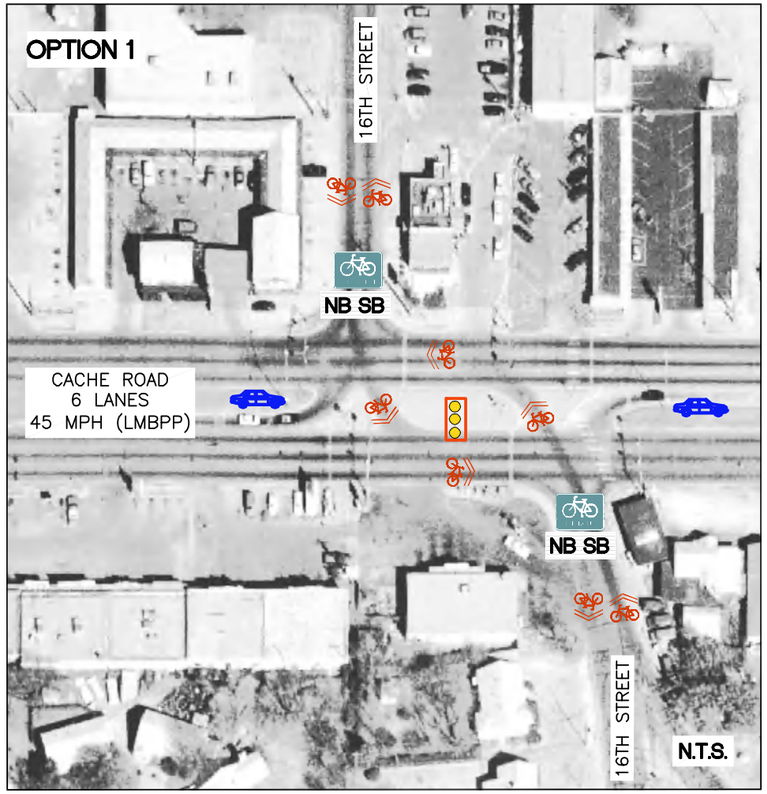
Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH

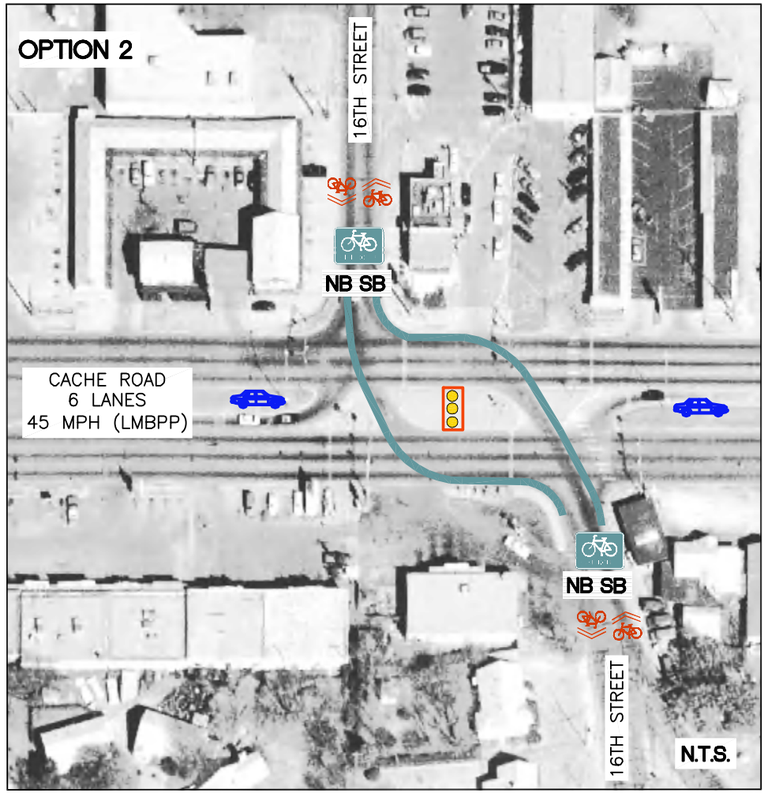
Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

Smith Extension Area of Detailed Study 1



SHARED LANE



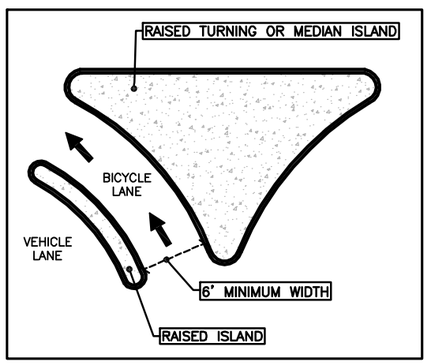
BIKE LANE

LEGEND

Proposed Bike Routes & Types
- SHARED LANE
- BIKE LANE
- SHARED USE PATH
- THREE LANE CONVERSION

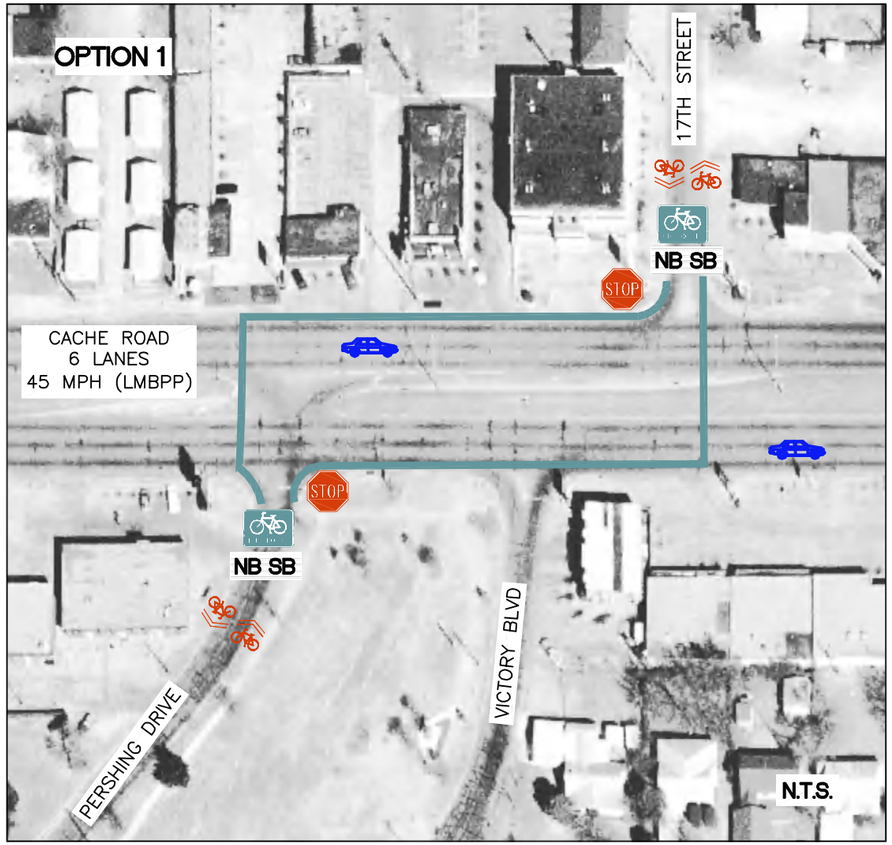
Additional Information
- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- HIGH TRAFFIC VOLUME
- PROPOSED/EXISTING STOP SIGN

NOTES:
1) SIGNAL ON CACHE AT 16th STREET OFFERS BICYCLE TRAFFIC SUFFICIENT SAFETY MARGIN WHEN ATTEMPTING TO CROSS CACHE RD.
2) SEPARATED BICYCLE "PORTALS" PROVIDE ADDITIONAL PROTECTION FOR CYCLISTS THROUGH THE CACHE ROAD CROSS-SECTION. (SEE FIGURE)
3) TIMING OF THE CACHE ROAD TRAFFIC SIGNAL MAY NEED MODIFICATION TO PROVIDE ADDITIONAL TIME FOR BICYCLISTS TO CROSS CACHE ROAD.

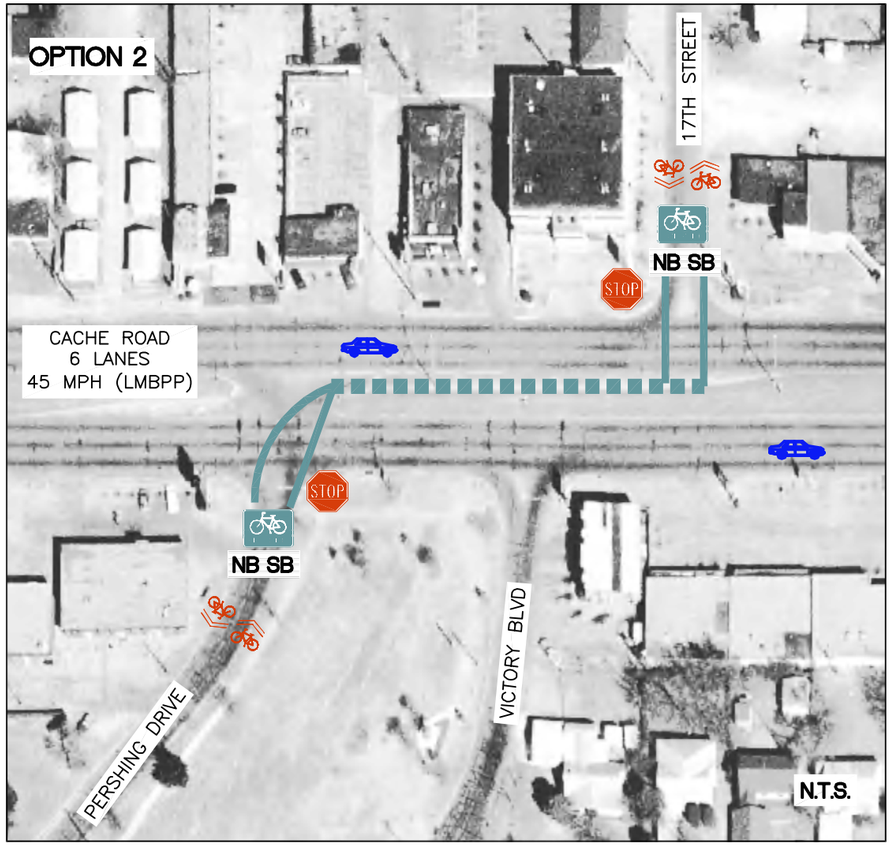


PROTOTYPICAL "PORTAL"

Area of Detailed Study 2



BIKE LANE– NO SIGNAL



BIKE LANE/SHARED USE PATH – NO SIGNAL

LEGEND

Proposed Bike Routes & Types
- SHARED LANE
- BIKE LANE
- SHARED USE PATH
- THREE LANE CONVERSION

Additional Information
- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- HIGH TRAFFIC VOLUME
- PROPOSED/EXISTING STOP SIGN

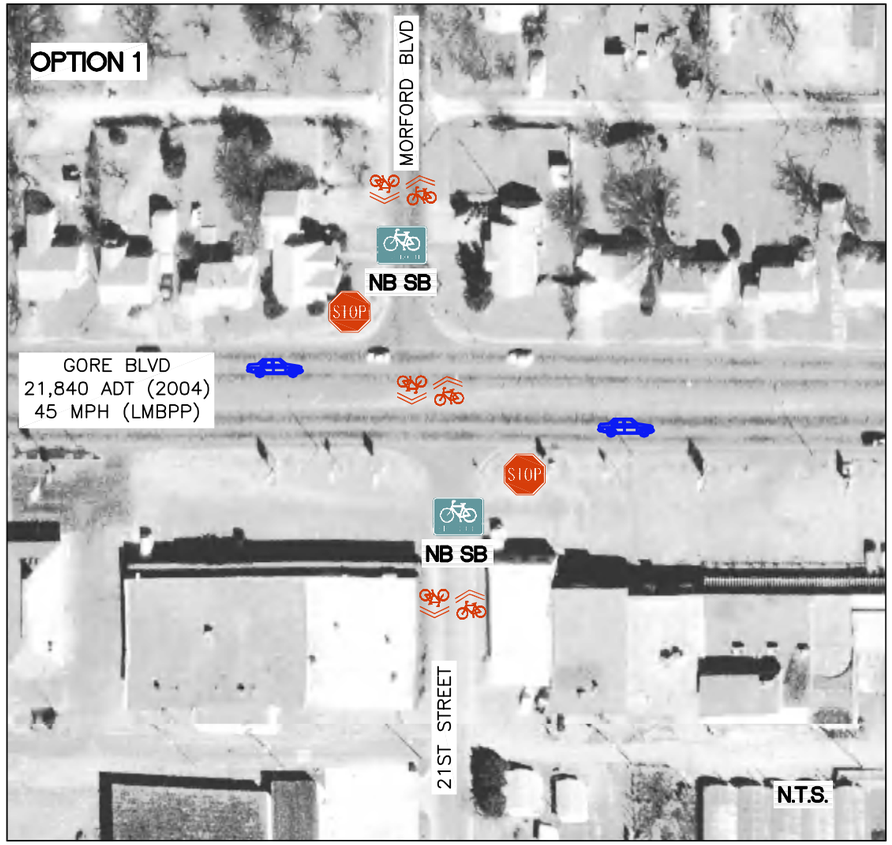
NOTES:

1) LITTLE OR NO "SIGNAL PROTECTION" FOR BICYCLES ATTEMPTING TO TRAVERSE CACHE RD.
2) MULTIPLE THROUGH & TURN LANES ON CACHE ROAD INCREASE THE POTENTIAL CONFLICTS AT 17TH STREET & PERSHING DRIVE.
3) RELATIVE SPEED & VOLUME OF TRAFFIC ON CACHE CREATES AN UNSAFE CROSSING CONDITION FOR BICYCLISTS AT THIS LOCATION.

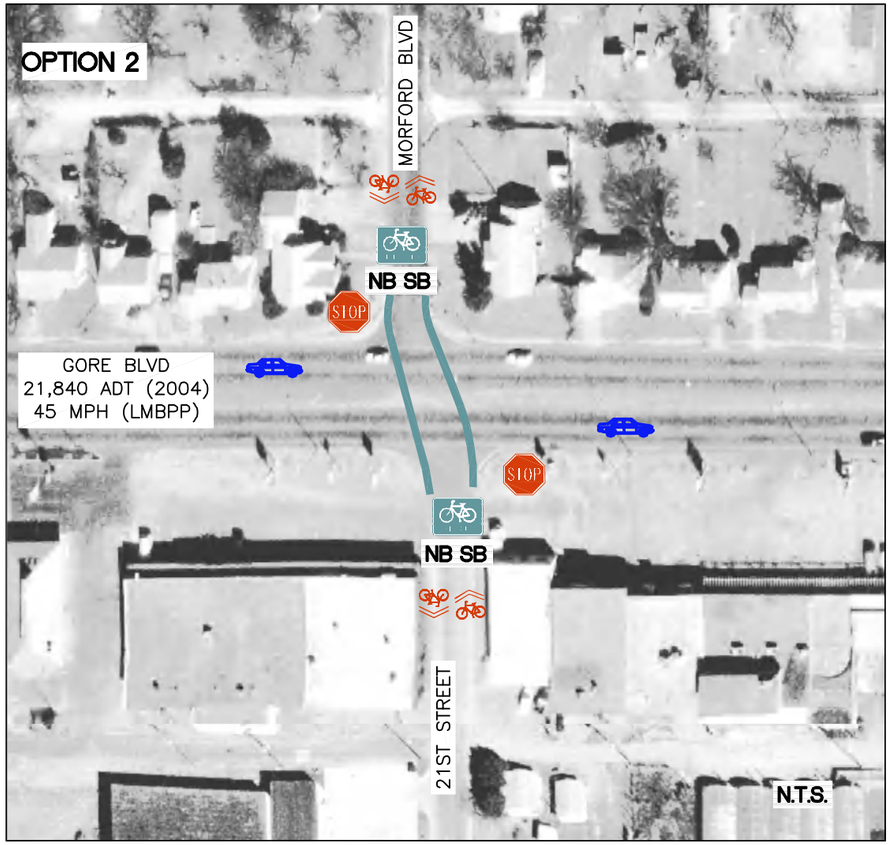
RECOMMENDATION:

REMOVE THE 17th STREET AT CACHE ROAD CROSSING ON THE MASTER PLAN

Area of Detailed Study 3



SHARED LANE – NO SIGNAL



BIKE LANE – NO SIGNAL

LEGEND

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH
- THREE LANE CONVERSION

Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- HIGH TRAFFIC VOLUME
- PROPOSED/EXISTING STOP SIGN

NOTES:

1) NO SIGNAL "PROTECTION" FOR CYCLISTS ATTEMPTING TO CROSS GORE BLVD.
2) 4 LANES OF HIGH SPEED, HIGH VOLUME TRAFFIC & IMPAIRED SIGHT DISTANCE ON GORE BLVD DISCOURAGES CROSS–MOVEMENTS
3) ALTERNATIVE ROUTE & CROSSING (GORE @ 17TH) OFFERS SIMILAR N/S CONNECTIVITY IN SAFER LOCATION.

RECOMMENDATION:

DELETE THIS CROSSING FROM THE MASTER PLAN

Summary of Options, Recommendations, Costs and Phasing for Route 4 - Smith Extension

Segment	Street	Location	Bike Facility Type	Cost
A	17th	Smith To Cache Road	Shared Roadway	**$10,440**
B	Lawton	16th Street to 17th Street	Shared Roadway	**$4,380**
Option B2	This segment to be **eliminated due to the infeasible**, unsafe crossing conditions at 17th and Cache intersection.			$5,280
Study Area 1	Intersection	16th @ Cache	**see below for options**	**see below**
Option 1	Create shared roadway striping and signage at this intersection. Feasible, but does not fully address possible vehicle turning conflicts onto Cache.			$420
Option 2	Create separate bike lane striping and signage at this intersection to reduce conflicts with vehicle turning movements. Separate bike lanes at heavy volume, arterial road intersections are recommended to address possible vehicle turning conflicts.			**$2,760**
Study Area 2	INTERSECTION CROSSING AT CACHE BLVD AND 17TH AVENUE/PERSHING IS NOT SIGNALIZED AND **INFEASIBLE** DUE TO SAFETY CONCERNS. **ALTERNATIVE CROSSING/ROUTE IS WARRANTED**			NA
C	Pershing to Elm to 16th to Laird to 13th	Cache to Ferris	Shared Roadway	**$31,320**
D	INTERSECTION OF MORFORD AND GORE BLVD IS NOT SIGNALIZED AND INFEASIBLE DUE TO SAFETY CONCERNS. **ALTERNATIVE ROUTE FOR SEGMENT D IS WARRANTED.**			NA
ALTERNATIVE ROUTE FOR SEGMENT D	Provide new routing of Segment D along existing 17th Street, from Elm Street (north) to "D" Avenue (south). This route permits a shared roadway facility through the main residential areas served by the original route and crosses Gore Blvd. at a signalized intersection.			**$15,120**
Study Area 3	INTERSECTION OF MORFORD AND GORE BLVD IS NOT SIGNALIZED AND **INFEASIBLE** DUE TO SAFETY CONCERNS. **ALTERNATIVE CROSSING/ROUTE IS WARRANTED. SEE ALTERNATIVE ROUTE FOR SEGMENT D ABOVE.**			NA
		Total Phase I Costs		**$64,020**
		Total Costs in "Postponed" Phase		**$0**

SEE APPENDIX FOR DETAILED COST ESTIMATES FOR EACH PHASE I ROUTE

LEGEND	
Recommended Option	
Recommended Option - Postponed to future phase	

Fort Sill Extension- Introduction

Recommended Facility Type for Each Segment		
Segment	**Facility Type**	**Comments**
A	Bike Lanes	coordinate w/ ODOT work @ Rogers Ln.
B	Bike Lanes	lanes on shoulders, pvmt repair needed
C	Bike Lanes	utilize Option 1 - "at grade" bike lanes

Rogers Ln

Proposed interchange modifications by ODOT will impact proposed bike facilities in this area. Coordinate final bike improvements with final ODOT design as available.

Segment A

Existing paved shoulders provide good base for bike lanes along Fort Sill Blvd.

Segment B

Sheridan Rd

Fort Sill Blvd

Bike lanes at Cache Rd. should be "at grade" to provide full access to route network for sur-rounding areas.Optional route directs bike lanes under Cache Rd.

Cache Rd

Segment C
Options C1, C2

Utilize existing pedes-trian crossing at Cherry Street to provide access across Fort Sill Blvd for the one way traffic patterns in this area.

Cherry Ave

Ferris Ave

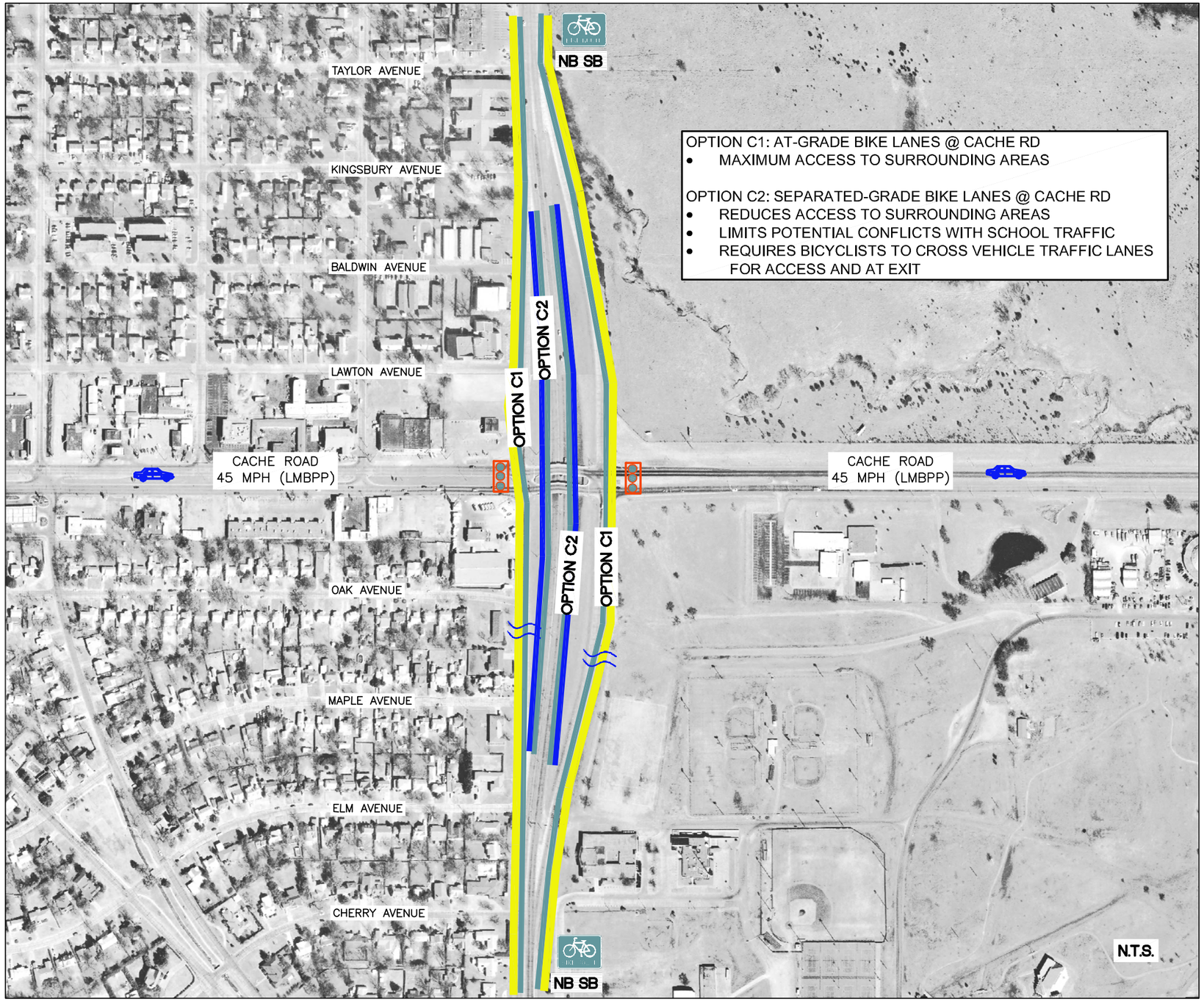
Legend

- Bike Lane
- Shared Lane
- Bike Lane with Three Lane Conversion
- Segment Sections and Identification
- Potential Alternative Route
- Areas of Detailed Study

N.T.S.

Lawton Bike Master Plan - Inset Map
Route 5 - Fort Sill Extension

Fort Sill Extension Segment C



LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH

Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

RECOMMENDATION:

UTILIZE OPTION C1 AS MOST EFFICIENT MEANS TO PROVIDE NORTH SOUTH ACCESS AND CIRCULATION TO SURROUNDING AREAS

Summary of Options, Recommendations, Costs and Phasing for Route 5 - Fort Sill Extension

Segment	Street	Location	Bike Facility Type	Cost
A	Fort Sill Blvd	Rogers Lane to Hill Top Dr	Bike Lane	**$17,520**
B	Hill Top Dr	Hill Top Dr to Andrews Ave	Bike Lane	**$38,280**
C	Fort Sill Blvd	Andrews to Ferris	**see below for options**	**see below**
Option C1	Create separate bike lanes each direction on this segment due to high volumes along this stretch of roadway. This option provides for "at grade" lanes at Cache to permit maximum access to surrounding areas.			**$108,000**
Option C2	Create separate bike lanes each direction on this segment due to high volumes along this stretch of roadway. This option provides for "separated grade" lanes at Cache Road that reduces access to surrounding areas, but limits potential conflicts with school traffic.			$433,320
		Total Phase I Costs		**$163,800**
		Total Costs in "Postponed" Phase		**$0**

SEE APPENDIX FOR DETAILED COST ESTIMATES FOR EACH PHASE I ROUTE

LEGEND	
Recommended Option	
Recommended Option - Postponed to future phase	

52nd Street Gate Extension - Introduction

Recommended Facility Type for Each Segment		
Segment	**Facility Type**	**Comments**
A	Shared Roadway	utilize Option 3 and reduce speed limit
B	Off-Street Shared Use Path	utilize easement on east side of 52nd
C	Bike Lanes	Cheyenne to Quanah Parker (postpone)

Rogers Lane

67th Street

Quanah Parker Trail

Short segment of shared roadway is recommended. Need to reduce current speed limits.

Shared use path on BOE land presents most feasible & cost effective solution for high volume traffic area.

Segment A
Options A1, A2, A3

Segment B
Options B1, B2, B3, B4

Segment C

The portion of Segment C south of Cheyenne Drive is postponed to subsequent phase.

52nd Street

38th Street

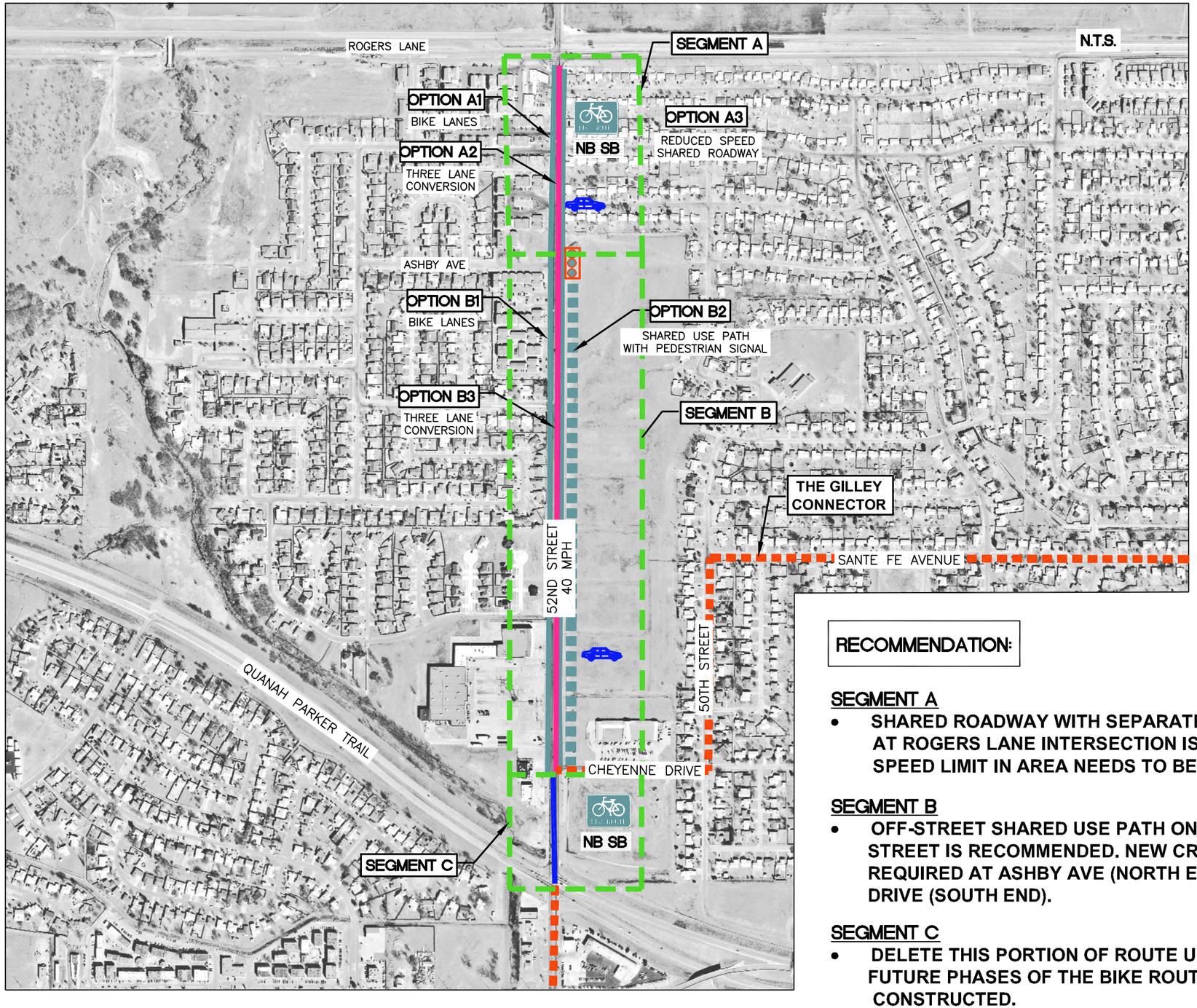
Legend

- Bike Lane
- Shared Lane
- Bike Lane with Three Lane Conversion
- Segment Sections and Identification
- Potential Alternative Route
- Areas of Detailed Study

N.T.S.

Lawton Bike Master Plan - Inset Map
Route 6 - 52nd Street Gate

52nd ST Gate Extension Segments A,B, & C



RECOMMENDATION:

SEGMENT A

- **SHARED ROADWAY WITH SEPARATE BIKE LANE AT ROGERS LANE INTERSECTION IS RECOMMENDED. SPEED LIMIT IN AREA NEEDS TO BE REDUCED TO 35 MPH**

SEGMENT B

- **OFF-STREET SHARED USE PATH ON EAST SIDE OF 52nd STREET IS RECOMMENDED. NEW CROSSING SIGNALS ARE REQUIRED AT ASHBY AVE (NORTH END) AND CHEYENNE DRIVE (SOUTH END).**

SEGMENT C

- **DELETE THIS PORTION OF ROUTE UNTIL SUCH TIME THAT FUTURE PHASES OF THE BIKE ROUTE ARE PLANNED AND CONSTRUCTED.**

LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH

Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

Summary of Options, Recommendations, Costs and Phasing for Route 6 - 52nd Street Gate Extension

Segment	Street	Location	Bike Facility Type	Cost
A	52nd Street	Rogers Lane to Pollard Ave	**see below for options**	**see below**
Option A1	Create separate bike lanes by adding new pavement to 52nd Street, striping and signage each direction along this segment due to heavy volume and higher speeds along this arterial road.			$115,770
Option A2	Convert 4 lane section into 3 lane section (except keep 4 lanes at intersection with reduced lane widths) to permit striping and signage needed for separate bike lanes in each direction for this section of 52nd St. High traffic volumes warrant bike lanes.			$26,856
Option A3	Create shared roadway facility (striping and signage) on this short segment **and** reduce speed limit to 35 MPH along this stretch.			**$4,450**
B	52nd Street	Pollard to Cheyenne	**see below for options**	**see below**
Option B1	Create separate bike lanes by adding new pavement to 52nd Street, striping and signage each direction along this segment due to heavy volume and higher speeds along this arterial road. Feasible means to provide connectivity, but costly.			$378,450
Option B2	Create separate off street shared use path on east side of 52nd Street (within existing powerline easement) starting at Ashby Avenue at the north and extending to Cheyenne Drive at the south) due to high speed traffic and high volumes along this stretch of roadway. Add pedestrian/bicycle signal and crossing at Ashby Avenue to permit safe crossing of 52nd Street onto path. Feasible means to provide connectivity, but costly.			**$245,171**
Option B3	Convert 4 lane section into 3 lane section (except at intersections) to permit striping and signage needed for separate bike lanes in each direction. High traffic volumes warrant bike lanes. May not provide adequate levels of service for vehicles per City Engineer.			$83,640
C	52nd Street	Cheyenne To Quanah Parker	**see below for options**	**see below**
Option C1	Convert 4 lane section into 3 lane section (except at intersections) to permit striping and signage needed for separate bike lanes in each direction for this section of 52nd St. High traffic volumes warrant more detailed review of impact of lane reduction would have on traffic levels of service per City Engineer.			$16,830
Option C2	Create separate bike lanes by adding new pavement to 52nd Street, striping and signage each direction along this segment due to heavy volume and higher speeds along this arterial road. Feasible means to provide connectivity, but costly.			**$76,260**
		Total Phase I Costs		**$249,621**
		Total Costs in "Postponed" Phase		**$76,260**

SEE APPENDIX FOR DETAILED COST ESTIMATES FOR EACH PHASE I ROUTE

LEGEND	
Recommended Option	
Recommended Option - Postponed to future phase	

Cameron to Post - Introduction

Recommended Facility Type for Each Segment		
Segment	**Facility Type**	**Comments**
A	Off-Street Shared Use Path	widen existing path-Lincoln to 40th
B	DELETE THIS SEGMENT	high traffic volumes, high speeds and turning movements - RECOMMEND ALTERNATIVE ROUTE
C	DELETE THIS SEGMENT	
B	Shared Roadway	utilize 40th St. as parallel route to 38th
C	Shared Roadway	utilize 40th St. as parallel route to 38th
D	Off-Street Shared Use Path	new path on west side of 38th

Rogers Lane

52nd Street

38th Street

Sherid

Recommend utilization of existing off-street trail from Lincoln to 40th St.

Segment A
Option A1, A2, A3

Lincoln

Segment B

Recommend optional 40th St. route to bypass difficult 38th & Cache roadway areas.

Difficult topography, multiple driveways and congested intersection at Cache Rd make bike facilities (on or off-street) along 38th Street infeasible for Segments B and C. Seek alternative route.

Quanah Parker Trail

Cache Road

Segment C

Segment D
Option D1, D2, D3, D4

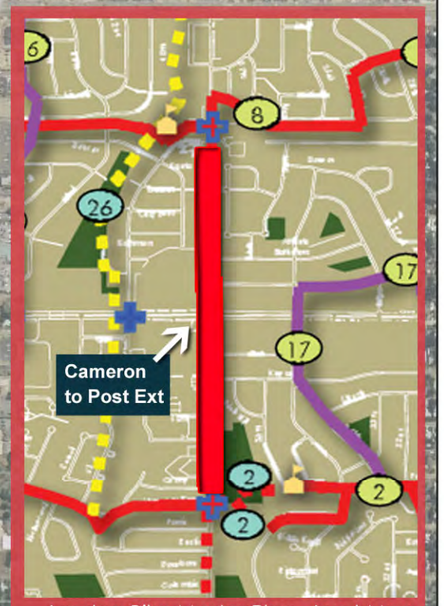
Meadow Brook

Recommend utilization of proposed off-street trail on west side of 38th Street to be constructed as a part of the City's street widening project. Will connect 40th Street to Meadowbrook and to Greer Park (via crossing at Meadowbrook traffic signal).

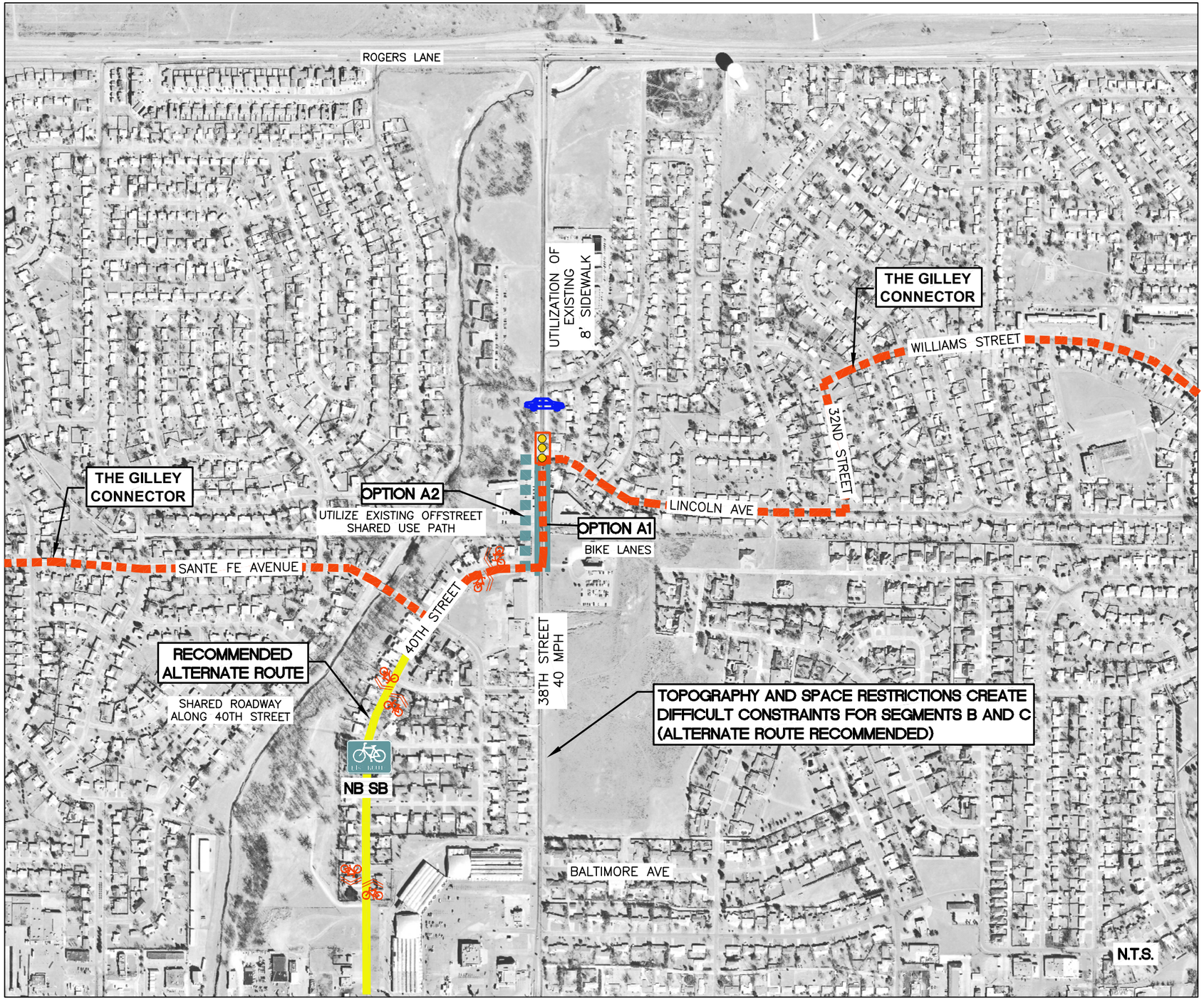
Legend

- Bike Lane
- Shared Lane
- Bike Lane with Three Lane Conversion
- Segment Sections and Identification
- Potential Alternative Route
- Areas of Detailed Study

N.T.S.



Lawton Bike Master Plan - Inset Map
Route 8 - Cameron to Post Ext



Cameron To Post Segments A & B

LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH

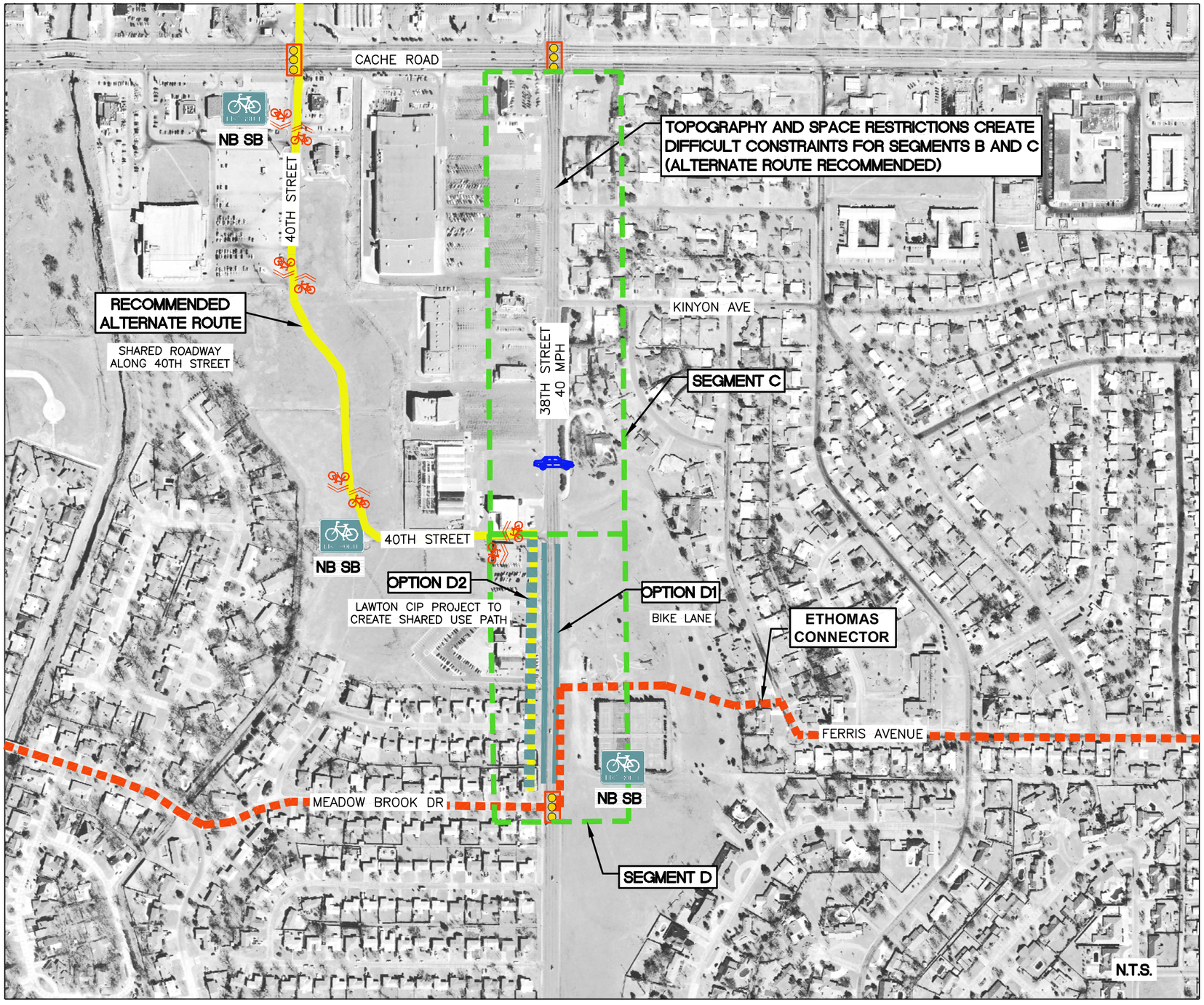
Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

RECOMMENDATION:

UTILIZE OPTION A2 FOR SEGMENT A OF THIS ROUTE DUE TO SPACE AND TOPOGRAPHY LIMITATIONS ON 38TH STREET.

A SHARED ROADWAY ON 40TH STREET IS THE RECOMMENDED ROUTE FOR SEGMENT B.



Cameron To Post Segments C, D

LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)
- THREE LANE CONVERSION

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH

Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

RECOMMENDATION:

SEGMENT C: UTILIZE A SHARED ROADWAY ON 40TH STREET AS THE ALTERNATIVE RECOMMENDED ROUTE

SEGMENT D: UTILIZE OPTION D2 WHICH CREATES A SHARED USE PATH ON WEST SIDE OF 38TH STREET (PART OF FUTURE CITY CIP PROJECT)

Summary of Options, Recommendations, Costs and Phasing for Route 8 - Cameron To Post Extension

Segment	Street	Location	Bike Facility Type	Cost
A	38th Street	Lincoln to 40th Street	**see below for options**	**see below**
Option A1	Create separate bike lanes by adding new pavement to 38th Street, striping and signage each direction along this segment due to heavy volume and higher speeds along this arterial road. Feasible means to provide connectivity, but costly.			$63,300
Option A2	Utilize existing off street shared use path on west side of 38th St. and widen it by 2-4' to accommodate two way pedestrian/bike traffic. Off road facility recommended on this short section due to high volumes and multiple turning movements along this stretch of roadway. Connect to 40th Street route.			**$240**
B and C	DIFFICULT TOPOGRAPHY, LIMITED LANEAGE CAPACITY AND MULTIPLE TURNING MOVEMENTS AT INTERSECTION OF 38th AND CACHE BLVD MAKES THESE SECTIONS OF THE BIKE LANE INFEASIBLE ALONG 38TH STREET DUE TO SAFETY CONCERNS. **ALTERNATIVE ROUTE FOR THESE SEGMENTS IS RECOMMENDED.**			
OPTIONAL ROUTE FOR SEGMENTS B & C	Provide new north/south routing for these segments along existing 40th Street, from Lincoln Avenue (north) to Greer Park (south). This route permits a shared roadway facility through the main residential areas served by the original route and crosses Cache Blvd. at a signalized intersection.			**$12,150**
D	38th Street	40th Street to Meadow Brook	**see below for options**	**see below**
Option D1	Create separate bike lanes by adding new pavement to 38th Street, striping and signage each direction along this segment due to heavy volume and higher speeds along this arterial road. Feasible means to provide connectivity, but costly.			**$182,150**
Option D2	Utilize new off-street shared use path on west side of 38th Street that will be constructed as part of City road widening project (CIP funds to build path)			**$240**
		Total Phase I Costs		**$12,630**
		Total Costs in "Postponed" Phase		**$0**

SEE APPENDIX FOR DETAILED COST ESTIMATES FOR EACH PHASE I ROUTE

LEGEND	
Recommended Option	
Recommended Option - Postponed to future phase	

The Gilley Connector - Introduction

Recommended Facility Type for Each Segment		
Segment	**Facility Type**	**Comments**
A	Shared Roadway	through good residential areas
B	Shared Roadway	through good residential areas
C	Shared Roadway	connect to 52nd via Cheyenne

Rogers Lane

52nd Street

38th Street

17th Street

Cache Road

Segment A

Segment B

Segment C

1

Existing traffic signal may require timing adjustment to provide proper level of protection to bicyclists at this offset intersection.

Good residential streets provide excellent opportunity for shared roadway facilitiies east/west connectivity.

Utilize existing off-street trail on west side of 38th Street to connect the crossing at Lincoln and the extension of the Gilley route at 40th Street.

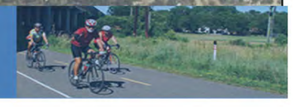
Utilize Cheyenne Drive as a connector to the 52nd Street bike route.

Legend

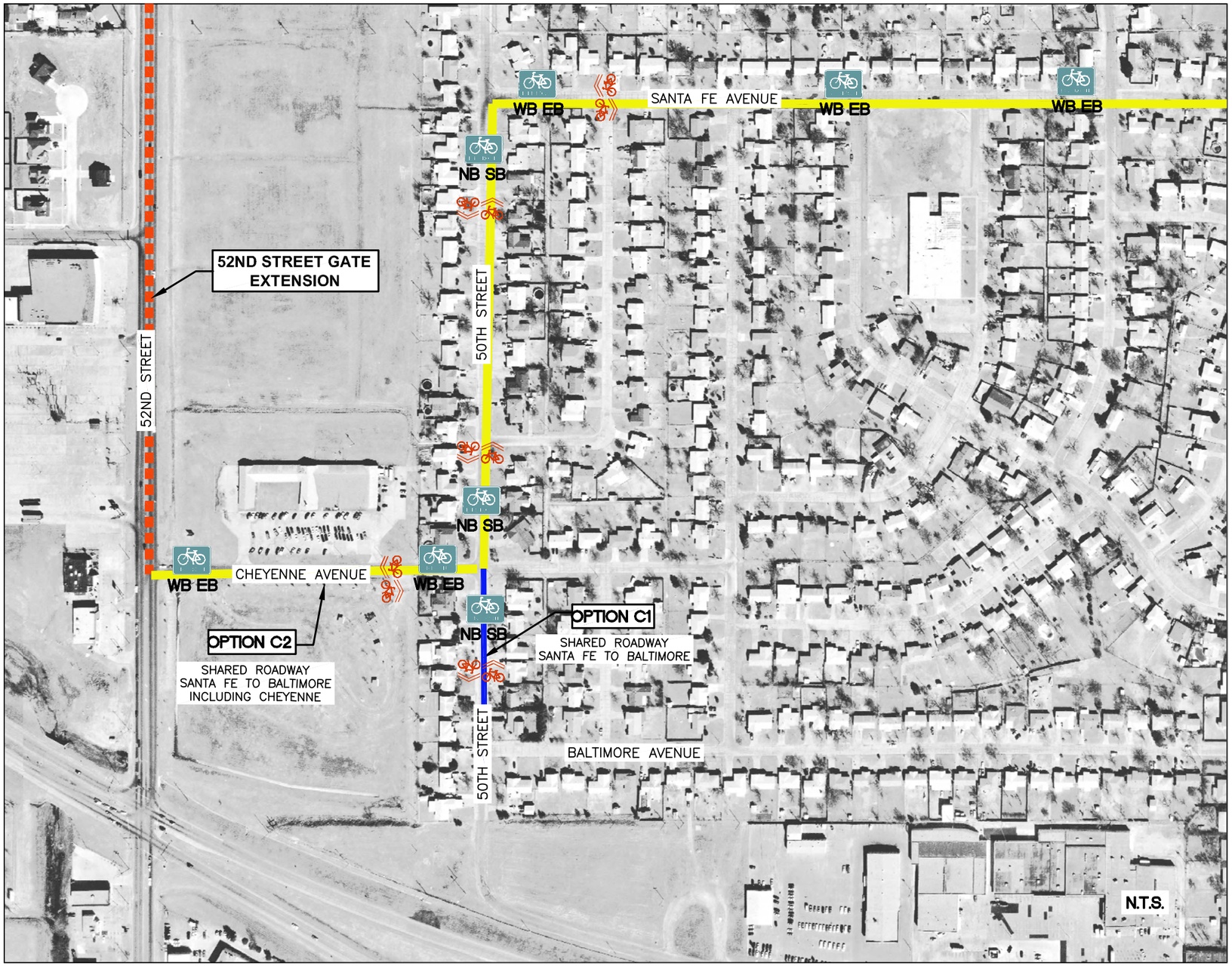
- Shared Lane
- Bike Lane with Three Lane Conversion
- Segment Sections and Identification
- Potential Alternative Route
- Areas of Detailed Study

N.T.S.

Lawton Bike Master Plan - Inset Map
Route 9 - The Gilley Connector



Gilley Connector Segment C



LEGEND

Route Options & Recommendations

- RECOMMENDED ROUTE
- OPTIONAL ROUTE
- FUTURE BIKE FACILITY (PER MASTER PLAN)

Proposed Bike Routes & Types

- SHARED LANE
- BIKE LANE
- SHARED USE PATH
- THREE LANE CONVERSION

Additional Information

- EXISTING SIGNAL
- PROPOSED SIGNAL (PEDESTRIAN OR VEHICULAR)
- PROPOSED MODIFICATION TO EXISTING SIGNAL
- PAVEMENT IMPROVEMENT RECOMMENDED
- AREA OF DETAILED STUDY
- HIGH TRAFFIC VOLUME

RECOMMENDATION:

UTILIZE OPTION C2 (SHARED ROADWAY ON CHEYENNE) AS MOST EFFECTIVE MEANS TO TERMINATE THE WESTERN END OF GILLEY CONNECTOR AT 52ND STREET.

Summary of Options, Recommendations, Costs and Phasing for Route 9 - The Gilley Connector

Segment	Street	Location	Bike Facility Type	Cost
A	Smith/Williams/32nd St	17th to Lincoln	Shared Roadway	**$21,360**
B	Lincoln/38th/40th and Santa Fe	32nd St to 50th St	Shared Roadway	**$20,220**
C	50th/Cheyenne St	Santa Fe to 52nd Street	**see below for options**	**see below**
Option C1	Create shared roadway striping and signage for this segment, from Santa Fe to Baltimore Avenue. This segment to Baltimore will likely be less utilized than the segment on Cheyenne to 52nd Street.			$5,820
Option C2	Create shared roadway striping and signage for this segment, from Santa Fe to Cheyenne and then to 52nd Street. Provides link to the 52nd Street connector to Fort Sill.			**$8,580**
		Total Phase I Costs		**$47,400**
		Total Costs in "Postponed" Phase		**$0**

SEE APPENDIX FOR DETAILED COST ESTIMATES FOR EACH PHASE I ROUTE

LEGEND	
Recommended Option	
Recommended Option - Postponed to future phase	

Design Guidelines for On-street Bicycle Facilities

The 2008 Lawton Metropolitan Bicycle and Pedestrian Plan (LMBPP) provided design guidelines for the implementation of the comprehensive network of bicycle routes proposed in the Plan. These guidelines were intended to help establish a clear, continuous, uniform, and safe circulation network that will encourage people to walk and ride bicycles throughout the City. The construction of new bikeways, however, pose unique planning and design challenges because the bicycle is not compatible with either automobiles or pedestrians, the automobile being a hazard to the bicyclist and the bicycle presenting dangers to the pedestrian. As the City reviewed possible implementation of the Phase I on-street priority routes, they determined that a need for additional or expanded design standards were needed to deal with the issues arising on these Phase I routes.

To this end, the following guidelines are offered as expanded or additional guidelines to the principles contained in the LMBPP and are not intended to void those standards that have been approved by the City as a part of the LMBPP. In general, the standards contained in this section include guidelines related to:

1. Recommended Rules for Bikeway Facility types by Road Classification;
2. Recommended Guidelines for Intersections with Bikeway Facilities; and
3. Design Standards for Shared Roadways and Bike Lanes for various road types

Ultimately, the final design of individual bikeway facilities at specific locations depends almost entirely on the unique and current conditions along the specific route. These design guidelines address the various factors for bikeway design, including levels of separation from roadways and walkways, widths and clearances, merging distances, signage and street crossings, but in all instances, these standards are not intended to replace or supplant sound engineering design and judgment. Each case should be reviewed, planned, designed and constructed with these standards in mind, but specific site conditions should dictate ultimate final design decisions.

Bikeway Facilities by Road Classifications

Bikeways should be planned and designed according to classifications that define the level of separation they maintain from roadways and walkways. The ideal solution for the development of bikeways is to physically separate them from both roadways and walkways, but in many instances this ideal solution is not feasible. The LMBPP's Phase I implementation plan was to prioritize on-street facilities in order to hasten bikeway development in the City at the most economical costs, but a field review and engineering analysis of the Phase I routes indicated that some of these proposed facilities were not appropriate for the roadway type on which they were occurring.

The following chart provides additional guidance for future bike route planning and design in terms of the roadway type being targeted for the future facility. All other design issues and conditions being equal, this chart should be used as the "rules" for determining which type bike facility is most appropriate for each roadway classification.

Table 4.1 Recommendations for On-Street bicycle facilities by Roadway Classification

Classification	Volume	Speed	Lanes	Recommendations
Local	Below 5,000 ADT	25 mph	2	Shared Roadway
Collector	Below 20,000 ADT	Below 35 mph	2-3	Shared Roadway
Collector	10,000 to 20,000 ADT	Below 35 mph	4	Convert to Three Lanes (w/ designated bike lanes) or Shared Roadway
Arterial	Below 20,000 ADT	35 mph	4	Designated Bike Lanes (both directions)
Arterial	Below 20,000 ADT	Above 35 mph	4-5	Bike Lanes or Off-street Shared Use Path
Arterial	Above 20,000 ADT	Above 35 mph	4+	Bike Lanes or Off-street Shared Use Path

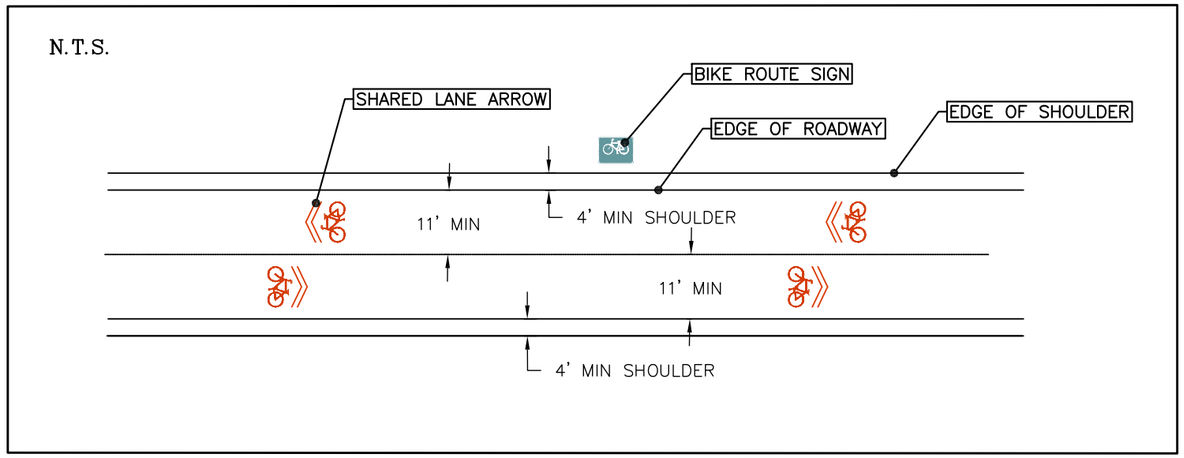
Roadway Classification Definitions:

- **Local**: A street which is primarily residential and is used primarily by residents of a neighborhood.
- **Collector**: Relatively low-speed (25-35 mph), relatively low-volume (5,000-20,000 average daily trips) street that provides circulation within and between neighborhoods. Collectors usually serve short trips and are intended for collecting trips from local streets and distributing them to the arterial network.
- **Arterial**: Medium-speed (35-45 mph), medium-capacity (10,000-35,000 average daily trips) roadway that provides intra-community travel and access to the county-wide highway system. Access to community arterials should be provided at collector roads and local streets, but direct access from parcels to existing arterials is common.

In general, the Lawton Bicycle and Pedestrian Master Plan and this Feasibility Study recommend that on-street shared lanes (sharrow) be utilized as the preferred bicycle facility type for local and low volume collector roadways within the City. The City should evaluate the standard cross sections for each of these roadway types and determine if reduced lane widths for segments which are proposed to contain on-street bike routes can be accomodated.

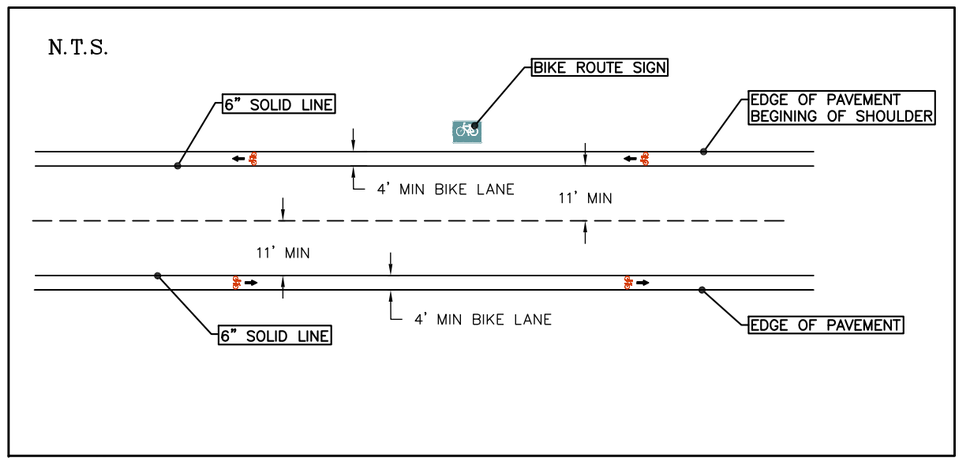
In addition, Exhibit 4-1 (on next page) provides some design guidelines for on-street bicycle facilities, including shared lane and designated bike lanes.

SHARED ROADWAY

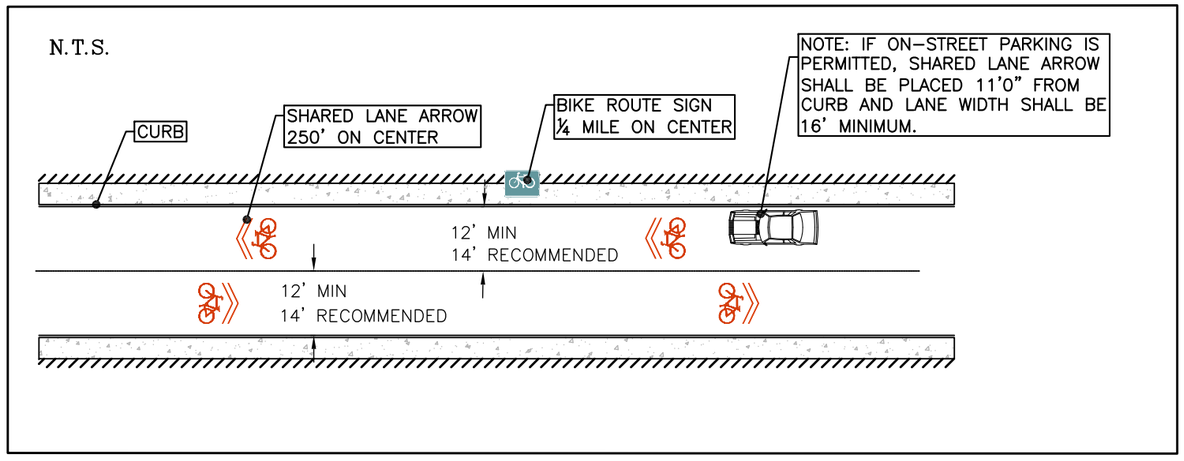


SHARED ROADWAY WITH PAVED SHOULDERS

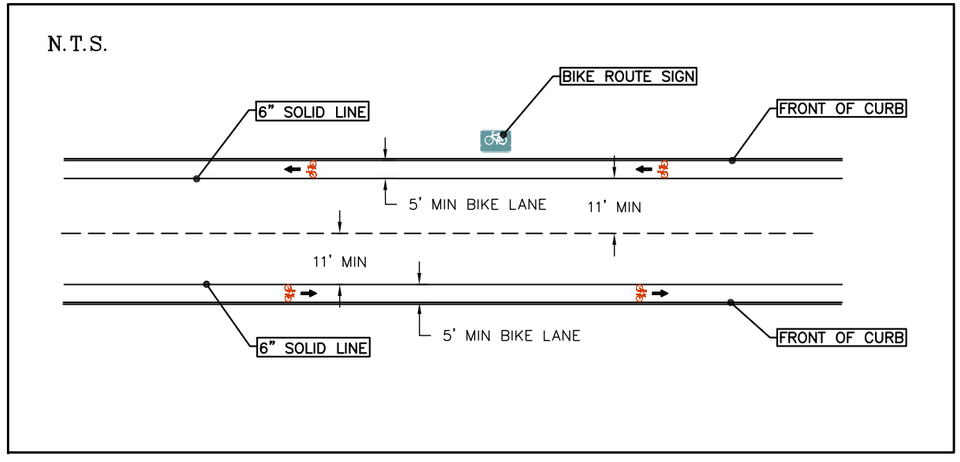
BIKE LANE



BIKE LANE WITH SHOULDER



SHARED ROADWAY WITH CURBS



BIKE LANE WITH CURB AND GUTTER

GENERAL NOTES:
1) SIGNAGE AND MARKING OF ROUTES TO BE IN ACCORDANCE WITH MUTCD
2) IF THE LONGITUDINAL JOINT BETWEEN THE GUTTER PAN AND PAVEMENT SURFACE IS NOT SMOOTH, 4 FT. OF RIDE ABLE SURFACE SHOULD BE PROVIDED.
3) BIKE LANE MARKING SHALL BE PAINTED ON THE FAR SIDE OF EACH INTERSECTION. ADDITIONAL STENCILS MAY BE PLACED ON LONG, UNINTERRUPTED SECTIONS OF ROADWAY.

Bicycle Facilities at Intersections

As stated in the Lawton Metropolitan Bicycle and Pedestrian Plan (LMBPP),

> *"Intersections represent one of the primary collision points for bicyclists and pedestrians. Generally, the larger the intersection, the more difficult it is for bicyclists and pedestrians to cross. On-coming vehicles from multiple directions and increased turning movements sometimes may make difficult for motorists to see non-motorized travelers. Most intersections do not provide a designated place for bicyclists. Bike lanes and pavement markings often end before intersections, causing confusion for bicyclists. Loop and other traffic signal detectors, such as video, often do not detect bicycles. Bicyclists wanting to make a left turn can face quite a challenge. Bicyclists must either choose to behave like motorists by crossing travel lanes and seeking refuge in a left-turn lane, or they may act as pedestrians and dismount their bikes, push the pedestrian walk button located on the sidewalk, and then cross the street the crosswalk. In some situations bicyclists traveling straight may have difficulty maneuvering from the far right lane, across a right turn lane, to a through lane of travel. Furthermore, motorists often do not know which bicyclist movement to expect."*

Based on an analysis of the proposed LMBPP Master Plan routes and a review of existing conditions at the major intersections along the Phase I routes, the number and type of intersection configurations present across the City are too many and too varied to permit the development of intersection design standards for 'typical" intersection types. Detailed design and traffic analysis (particularly a review of existing turning movements and volumes) of each intersection along each route will be required to adequately determine the safest route for bicyclists. Improvements to these complex crossings must be considered on a detailed, case-by-case basis, understanding the unique conditions at the site and utilizing sound engineering judgment.

Figure 4.1 (see this page) provides a graphic depiction of the typical bike and automobile movements at major intersections. This graphic clearly indicates the multiple variations that could be encountered if a bike lane striping and signage plan for a "typical" intersection was attempted. This exhibit was generated by AASHTO and suggests that: (1) designated bike lanes should be provided on major roadways as the cyclist approaches major intersections; and (2) because there is no clear method to determine which direction a cyclist may take at the crossing, the preferred method to deal with intersections is to permit the cyclist to "act" as a vehicle and merge with the appropriate vehicle lane to achieve their intended turning movements or directions.

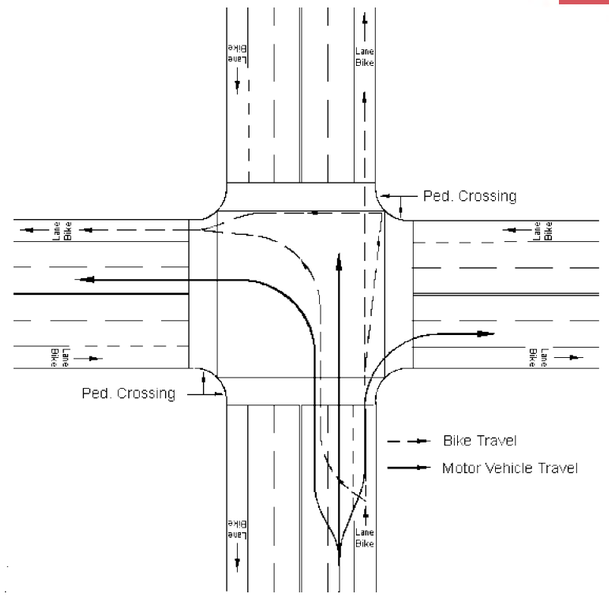


Figure 4.1 Typical Bike and Auto Movements at Major Intersections (AASHTO)

Intersection Guidelines/Rules

As a general rule, however, the City should consider adopting some type of design standards for bike routes through intersections in order to provide a consistent approach for both cars and bicyclists. To this end, the following intersection treatments should be evaluated as minimum standards that govern bicycle facility design at intersections across the City:

- **Four-Way-Stops on Local Roadways**: Where local streets, with shared roadway bicycle facilities, intersect other local streets, the minimum intersection treatment and bicycle route facilitator should be stop sign placement on intersecting streets in order to prioritize the bike route as having the right-of-way and to coordinate the flow of traffic and to protect bicyclists from moving vehicles. Surprisingly, there are several locations along the proposed bike routes in the residential areas of the City do not have stop signs at any single leg of these four way intersections.
- **Signal Modifications at Intersections**: In many instances, bicycle detection loops and signal cycle timing should be adjusted to accommodate bicycle travel through signalized intersections. The extent of adjustment required should be reviewed on a case-by-case basis and in consultation and oordination with the City's public works and engineering departments. In most instances, larger intersections may require additional green time for the bike route phase to facilitate safe travel through the

- **Separate Bike Lanes at Major Intersections**: To promote safety at major intersections where potential car and bicycle conflicts can occur, separate bike lanes are recommended. Primarily at collector and arterial streets, when left-turn or right-turn demand exceeds the available vehicle storage area within the available turn lanes at signalized intersections OR when two or more lanes (in one direction) exist on the bike route leg of the intersection, separate bike lanes are recommended to protect bicyclists from potential conflicts with vehicle movements. Figure 4.2 (see this page)provides a graphic depiction of possible bike lane configurations and striping at an individual "leg" of an intersection as developed by AASHTO. Because the difficulty, geometry and traffic conditions at each intersection throughout the City is different, these guidelines provide typical treatments that should be evaluated as the bike route approaches an intersection. More detailed analysis of the intersection is warranted as the specific bike route is being designed and constructed, and this analysis should be coordinated with the City Engineer.

Intersection Types in Lawton

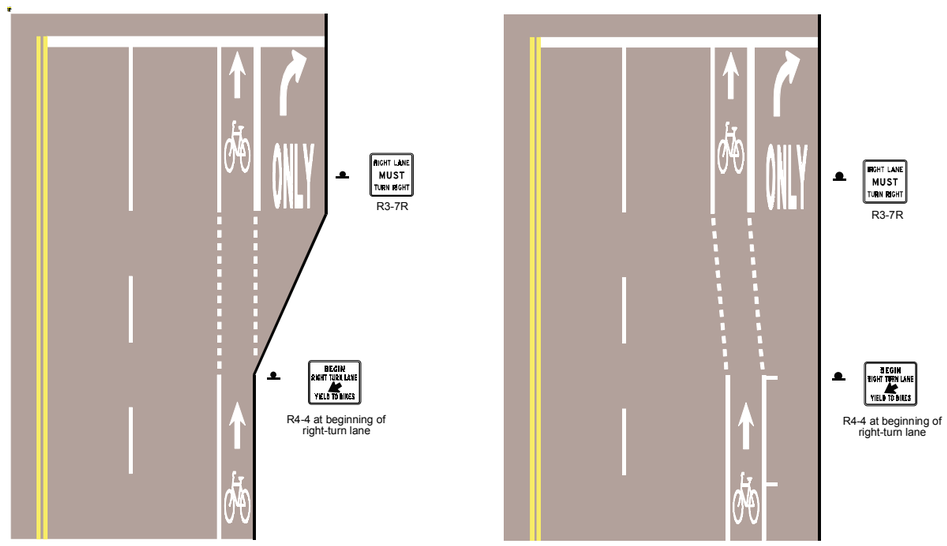
In many instances, the City can and should adopt design standards for bike routes through various intersection types in order to provide a consistent approach for both cars and bicyclists throughout the City. To this end, the following intersection "types" have been identified as typical across the Lawton community and they warrant some level of design guidelines as provided on the following pages. In particular, many of these intersections are encountered in Phase I.

Intersection Type 1: Local Streets

Roadway Class of Bike Route:	Local street
Intersected Roadway:	Local street
Traffic control at Intersection:	Four Way Stop Sign
Posted Speed on Bike route:	Below 35 MPH
Intersection Geometry/Alignment:	Aligned

Recommended Treatment/Rule:

Route Type:	Shared Roadways through Intersection
Treatments/Rules:	All streets to be marked & signed as four way stops



a. Right-turn-only lane

b. Parking lane into right-turn-only lane

NOTE: The dotted lines in cases "a" and "b" are optional (see case "c".)

c. Right-turn-only lane

d. Optional right/straight and right-turn-only l

Figure 4.2: Potential Bike Lane Striping/Signage at Intersections

Intersection Type 2: Locals and Collectors

Roadway Class of Bike Route:	Local street
Intersected Roadway:	Collector street
Traffic control at Intersection:	Signalized
Posted Speed on Bike route:	Below 35 MPH
Intersection Geometry/Alignment:	Aligned

Recommended Treatment/Rule:

1.If no bike route (planned or built) on intersecting street:

Route Type: Shared Roadway through Intersection

Treatments/Rules: May require modified signal timing and detection loops to permit safe bicycle movements to and through intersection

2. If bike route is planned or built on intersecting street:

Route Type: Transition from shared roadway to separate bike lanes at intersection on both streets

Treatments/Rules: - May require modified signal timing and detection loops to permit safe bicycle movements to and through intersection
- Bike lane positioning should be determined on the volume of turning movements at each leg of intersection **(See Figure 4.2 for potential striping solutions)**

Intersection Type 3: Collectors/Arterials

Roadway Class of Bike Route:	Collector street
Intersected Roadway:	Collector or Arterial street
Traffic control at Intersection:	Signalized
Posted Speed on Bike route:	Greater than 35 MPH
Intersection Geometry/Alignment:	Aligned

Recommended Treatment/Rule:

1. If no bike route (planned or built) on intersecting street:

Route Type: Bike Lanes through Intersection

Treatments/Rules: - May require modified signal timing and detection loops to permit safe bicycle movements to and through intersection
- If 2 or more lanes (in one direction) are present along bike route, provide separate bike lane at intersection that provides separation for bicyclists and minimizes potential turning conflicts with vehicles based on analysis of turning movements/volumes **(See Figure 4.2 for potential striping solutions)**

Intersection Type 3: Collectors/Arterials (continued)

2. If bike route is planned or built on intersecting street:

Route Type: Bike Lanes through Intersection

Treatments/Rules: - May require modified signal timing (i.e. add pedestrian phase) and detection loops to permit safe bicycle movements to and through intersection
- If 2 or more lanes (in one direction) are present along all bike routes, provide separate bike lane at intersection legs that provides separation for bicyclists and minimizes potential turning conflicts with vehicles based on analysis of turning movements/volumes **(See Figure 4.2 for potential striping solutions)**
- Install Refuge islands or similar measures to permit a two step crossing function for bicyclists across the intersecting street if the needed signal timing modifications adversely impact traffic flow or levels of service at the intersection or if the signal timing modifications are not possible

Intersection Type 4: Off-set or Misaligned Intersections

Roadway Class of Bike Route:	Local or Collector street
Intersected Roadway:	Arterial street
Traffic control at Intersection:	Signalized or unsignalized
Posted Speed on Bike route:	Greater than 35 MPH
Intersection Geometry/Alignment:	Off-set or misaligned

Recommended Treatment/Rule:

1. If intervening arterial street does not have a traffic signal:

Treatments/Rules: **AVOID THIS INTERSECTION AND FIND ALTERNATIVE ROUTE**

Intersection Type 4: Off-set or Misaligned Intersections (continued)

2. If intervening arterial street has one or more signal(s) at bike route and can not be avoided:

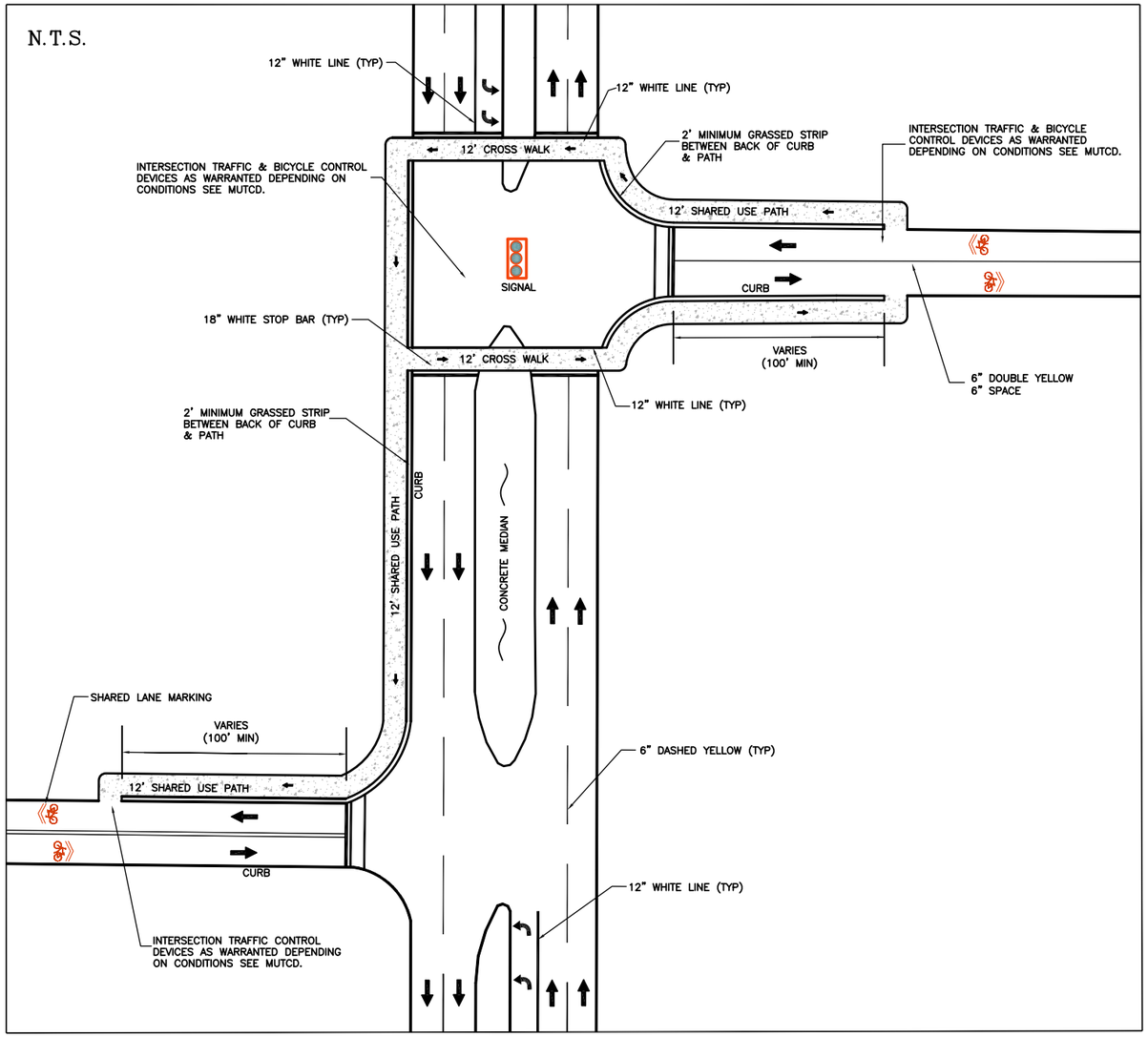
Route Type: Off-street shared use paths along intersecting Arterial and transition to shared use path on lower classified street at the intersections

Treatments/Rules:
- Bicyclists should be required to dismount & walk bike across intersection on pedestrian crossing. Modified signal timing may be required to provide sufficient time for crossing.
- Off-street paths should begin a minimum of 100 feet from in tersection and, to the maximum extent feasible, should be available on both sides of street and provide full access to and through the intersections (i.e. crosswalks at both intersec tions and paths on both sides of lower classified street)

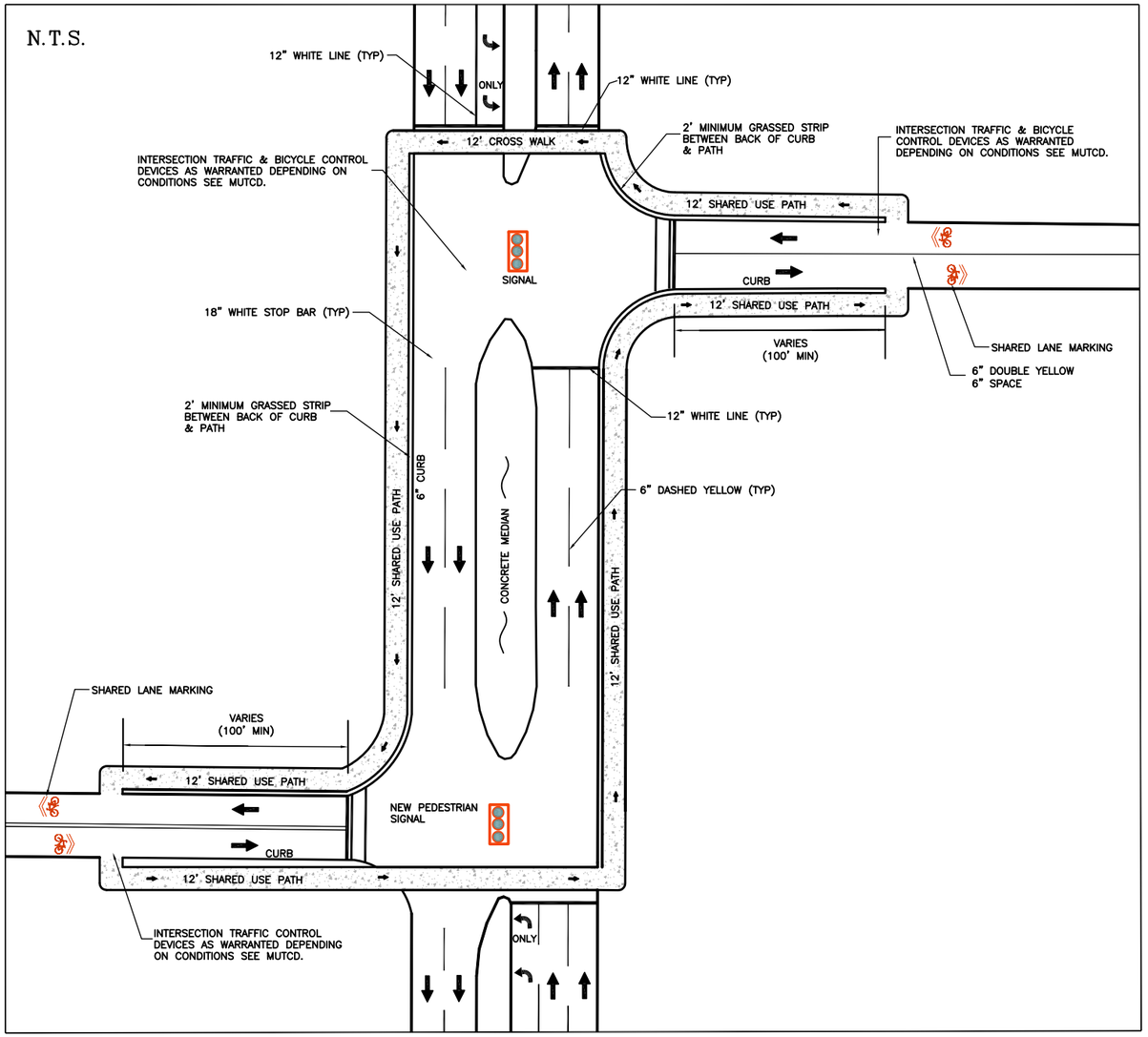
See Exhibit 4-4 on the following pages for graphic depiction.

- Off-street shared use path should be provided along entire length of arterial and should be minimum twelve feet (12') in width and be separated from nearest travel lane by a mini mum of two feet (2').
- Install Refuge islands or similar measures to permit a two step crossing function for bicyclists across the intersecting street if the needed signal timing modifications adversely impact traffic flow or levels of service at the intersection or if the signal timing modifications are not possible.

Design Guidelines for Bike Routes at Off-set or Misaligned Intersections



"MINIMUM" STANDARD



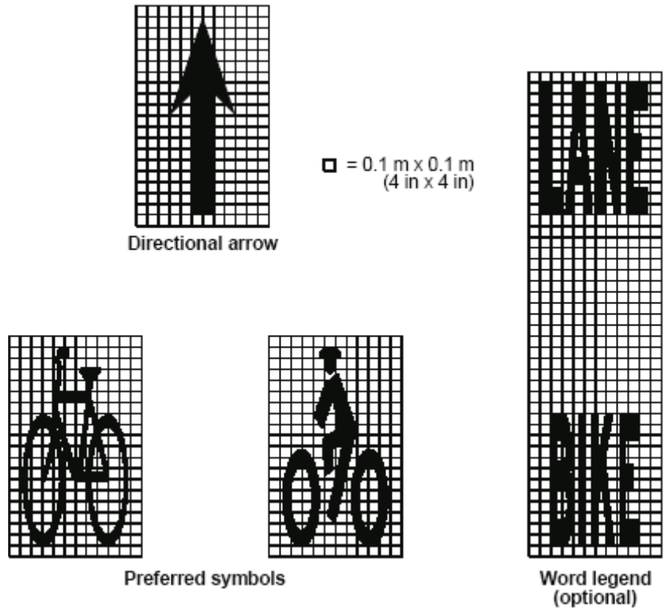
"PREFERRED" STANDARD

Bicycle Lane Markings and Signage

Bike Lane Markings

A bike lane should be painted with standard pavement symbols to inform bicyclists and motorists of the presence of the bike lane. The standard pavement symbols are one of two bicycle symbols (or the words "BIKE LANE") and a directional arrow. These symbols should be painted on the far side of each intersection. Additional stencils may be placed on long, uninterrupted sections of roadway. All pavement markings are to be white and reflectorized. Additional bicycle facility marking size, shape, and material shall be based upon the typical markings shown below.

Typical Bike Lane Markings



Bike Signs

Bicycle signs shall be standard in shape, legend, and color. All signs shall be retroreflectorized for use on bikeways, including shared-use paths and bicycle lane facilities. Where signs serve both bicyclists and other road users, vertical mounting height and lateral placement shall be as specified in part 2 of MUTCD. On shared-use paths, lateral sign clearance shall be a minimum of 0.9 m (3 ft) and a maximum of 1.8m(6 ft) from the near edge of the sign to the near edge of the path. Mounting height for ground-mounted signs on shared-use paths shall be a minimum of 1.2 m (4 ft) and a maximum of 1.5 m (5 ft), measured from the bottom edge of the sign to the near edge of the path surface. When overhead signs are used on shared-use paths, the clearance from the bottom edge of the sign to the path surface directly under the sign shall be a minimum of 2.4 m (8ft).

A representative sampling of bicycle facility signs are shown on subsequent pages. All signs should be consistent with the requirements of MUTCD, 2009 edition.

Bicycle Lane Signs

R1-1

R1-2

R3-16

R3-16a

R3-17

R3-17a

R4-1

R4-2

R4-3

R4-4


R4-7

R5-3


R5-6

R7-9

R7-9a


R9-3a

R9-5

R9-6

R9-7

R10-3

R15-1

Other Regulatory Signs


W1-1


W1-2


W1-3


W1-4


W1-5


W1-6


W1-7


W2-1


W2-2


W2-3


W2-4


W2-5


W3-1a


W3-2a


W3-3


W5-2a

W5-4


W7-5

Other Regulatory Signs

W8-1

W8-2

W10-1

OR

W12-2


W8-10

W8-10p


W11-1


W11-1


W16-7


W11-1

W16-1

Bicycle Route Guide Signs

D11-1

M1-8

M1-9

D1-1b(L)

M4-11

D1-1b(R)

M4-12

D1-1c

M4-13

M7-1

M7-2

M7-3

M7-4

M7-5

M7-6

M7-7

D4-3