
Phillips Road Realignment

Mecklenburg County, NC

Prepared for:

University of North Carolina Charlotte
Facilities Management

9201 University City Boulevard
Charlotte, NC 28223



Prepared by:



November 17, 2010

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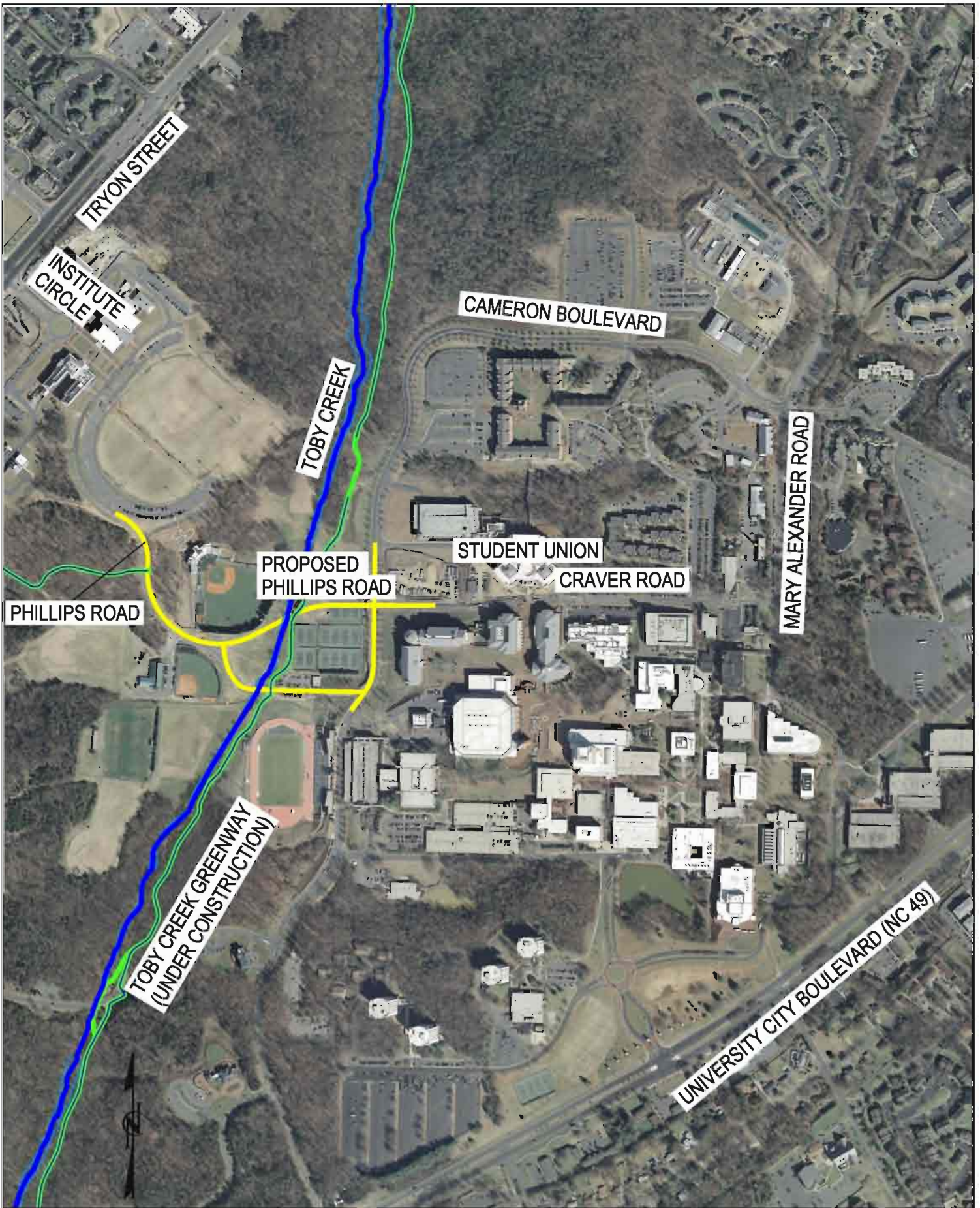
1.0 GENERAL DESCRIPTION

The purpose of this project is to prepare a conceptual design study for the proposed realignment of Phillips Road from the baseball and softball field access driveways to Cameron Boulevard at the Craver Road intersection. The project also includes widening the existing segment of Phillips Road from the Parking Lot 23 driveway to the beginning of the proposed realignment. This study includes a review of environmental features in the project area, an assessment of existing plans for the campus and the Mecklenburg County Greenway, a traffic forecast and analysis, development and evaluation of design concepts, and a conceptual design of the preferred alternative.

Phillips Road is located on the western side of campus, as shown in Figure 1, and is the only on-campus connection between the Charlotte Research Institute (CRI) and the main campus. The existing narrow road and its' substandard intersection with Cameron Boulevard present a strong need for improvements. Figure 1 shows the project study area.

This report focuses on the issues and needs for this realignment of Phillips Road and presents recommendations based on existing features, planned facilities, forecasted traffic, bikes and pedestrians, design issues, safety, and steering committee coordination. It provides a conceptual design for the preferred alternative and an opinion of probable construction cost to budget for implementation.





Phillips Road
Realignment

Figure 1
Project Location Map



2.0 BACKGROUND

2.1 Project Need

The Phillips Road Realignment project was identified as a need to provide improved connectivity between the CRI and main campus. Phillips Road terminates at its' intersection with Cameron Boulevard in a skew and on a curve with limited sight distance. In addition, the vertical alignment of Phillips Road on its' approach to Cameron is extremely steep, making it more difficult for the drivers to see and maneuver through the intersection. This intersection is only about 115 feet from the intersection of Barnhardt Lane on the opposite side of Cameron Boulevard. These intersections are offset enough to cause difficulty in

providing adequate traffic control through this area. Earlier in 2010 a traffic signal was installed to control through and turning movements from Phillips, Barnhardt, and Cameron. However, as a result of the intersection offset of Phillips Road and Barnhardt Lane, and each approach being on a separate phase, this four-phase traffic signal does not operate



efficiently, resulting in significant delays for drivers. Because of these issues, plans were made to relocate Phillips Road to intersect with Cameron Boulevard at Craver Road.

Craver Road runs through the center of campus from Cameron Boulevard to Mary Alexander Road. The Student Union is located between these two roads and contributes significantly to the traffic on Craver Road. Consideration has been given to closing Craver Road to through vehicular traffic with the exception of buses, delivery and emergency vehicles. Options proposed include bus only turn lanes from Cameron Boulevard, roundabouts on either side of the Student Union with limited access in front, or gates, to limit access to vehicles. Craver Road is, and will increasingly become, a major pedestrian thoroughfare as new projects are constructed on campus.

The CRI North Entry Road is another proposed road project presently under study and in the vicinity of Phillips Road. This project will connect Tryon Street to Snyder Road and

then to Cameron Boulevard. It will run adjacent to the proposed Charlotte Area Transit System's (CATS) Light Rail Transit (LRT) Blue Line Extension as it comes onto campus to a proposed station adjacent to Cameron Boulevard. The impacts of the CRI North Entry Road project are not discussed in this report; however, a separate report was completed that details the impacts related to that project.

2.2 Project Purpose

The purpose of this project is to provide an improved connection between the CRI and the main campus, to improve safety, capacity and function of Phillips Road as well as its' intersection with Cameron Boulevard, and to improve the road crossing over Toby Creek to minimize future flooding.

3.0 ENVIRONMENTAL FEATURES

The environmental features within the study area are shown on Figure 2. The only known issues of concern that need to be addressed are Toby Creek and its' related floodplains.



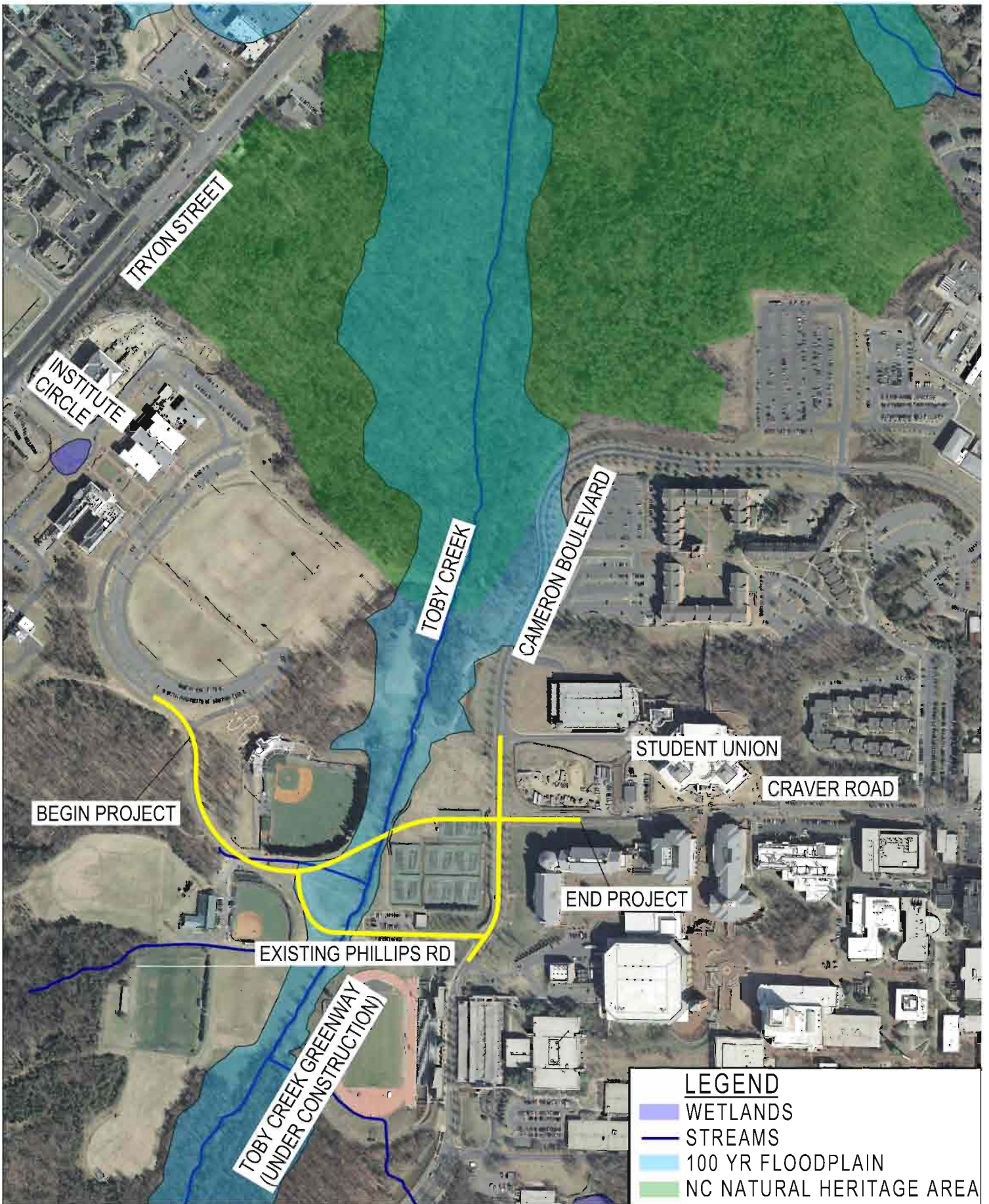
Toby Creek, part of the Yadkin River Basin, flows through campus from University City Boulevard (US 49), under Toby Creek

Road and along Cameron Boulevard and then heads north-west towards Tryon Street on the northwestern side of the CRI campus dividing the main campus and CRI campus. The Division of Water Quality (DWQ) classifies Toby Creek as Impaired Waters.



The existing Phillips Road bridge over Toby Creek floods frequently. In this area the stream channel is fairly small and unable to handle a major storm. The channel is further narrowed by the addition of stabilizing rip rap. The floodplain at the proposed crossing is approximately 200 feet wide. The floodway is approximately 110 feet wide based on North Carolina and Federal Emergency

Management Agency (FEMA) flood plain mapping as of March 2009. The CLOMR which was completed for the Toby Creek Greenway project lists the 100-year floodplain elevation as 605 feet.



Phillips Road
Realignment

Figure 2
Environmental Features



4.0 TRAFFIC FORECASTS

As a result of the considerable changes to parking and the campus street network represented in the 2009 Campus Master Plan, future traffic volumes were derived from projected quantities and locations of parking. The anticipated parking supply was translated into vehicle trips and then distributed throughout the campus network.

4.1 Parking Generation

Each parking category has unique trip generation characteristics with respect to the number, timing, and direction of associated vehicle trips. Visitor and Commuter spaces tend to have the highest turnover rates. Employee traffic follows typical commuting patterns, with substantial directional differences between entering and exiting trips during the AM and PM peak periods. Estimated vehicle-trip generation rates per parking space, by type, were derived from data collected at other comparable universities. Table 1 details the parking generation rates assumed for this analysis.

Table 1 Traffic Generation Rates (Trips per Space)

Parking Type	AM		PM		Daily
	Enter	Exit	Enter	Exit	
Employee	0.38	0.06	0.09	0.28	4.75
Commuter	0.55	0.09	0.24	0.44	6.10
Resident	0.15	0.12	0.18	0.20	5.04
Visitor	0.62	0.19	0.17	0.44	8.20

Future on-campus parking supplies were estimated for 2020 and 2035 timeframes. Specific quantities and locations of parking spaces were obtained from the most recent Campus Master Plan. The 2035 parking totals reflect the ultimate build-out of campus, while the 2020 estimates represent an interim timeframe that does not include the last expected phases of development, such as the longer-term parking garages along US 29 (Tryon Road). In addition, the number and distribution of parking spaces by category (or type of permitted parking) was extrapolated from current allocations, adjusted to reflect changes in parking location across campus. For simplicity in distributing the resulting traffic, ten parking zones were identified across the campus, with specific parking estimates derived for each zone. Figure 3 illustrates the approximate location of each zone, while Table 2 through Table 4 detail the number of campus parking spaces by type and by zone.

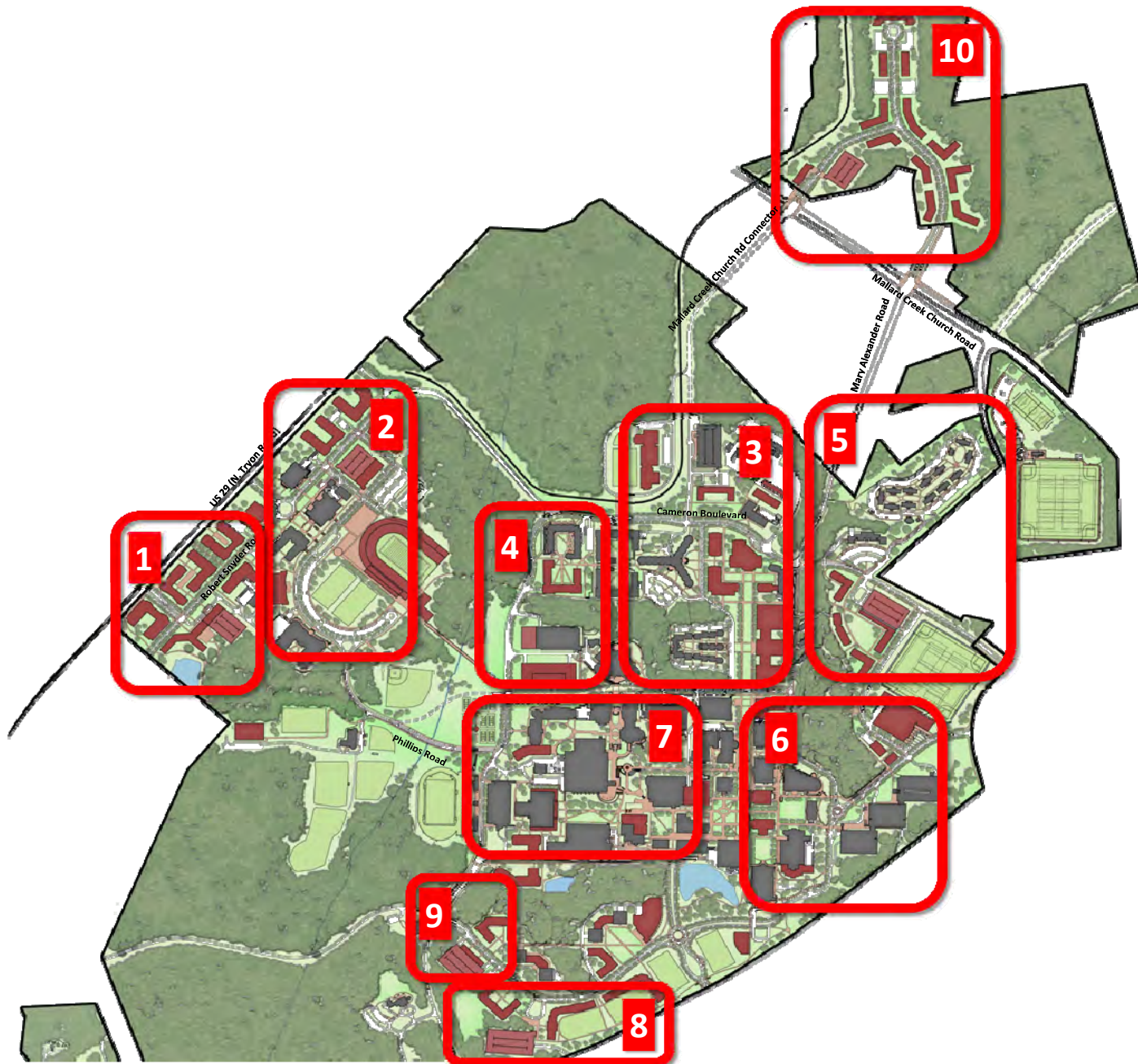


Table 2 Existing (2010) Parking Summary

Zone	Area	Employee	Commuter	Resident	Other	Total
1	West (North Tryon St)	0	0	0	0	0
2	West (Phillips Rd)	157	248	73	41	519
3	Central (Cameron Blvd)	326	449	808	161	1,744
4	Central (Cameron Blvd)	164	1,029	0	185	1,378
5	East (Cameron Blvd)	8	0	546	20	574
6	East (Van Landingham Rd)	631	2,687	401	325	4,044
7	Central (University Rd)	562	918	0	409	1,889
8	South (High Rise Rd)	31	731	546	41	1,349
9	South (Toby Creek Rd)	71	183	0	22	276
10	North (Stone Quarry Rd)	0	60	0	0	60
Total		1,950	6,306	2,373	1,204	11,833

Table 3 Interim (2020) Parking Summary

Zone	Area	Employee	Commuter	Resident	Other	Total
1	West (North Tryon St)	500	500	0	0	1,000
2	West (Phillips Rd)	359	1,321	220	41	1,941
3	Central (Cameron Blvd)	209	433	723	261	1,626
4	Central (Cameron Blvd)	164	1,029	0	185	1,378
5	East (Cameron Blvd)	8	0	546	20	574
6	East (Van Landingham Rd)	450	1,332	220	475	2,477
7	Central (University Rd)	592	918	0	409	1,919
8	South (High Rise Rd)	31	780	143	41	995
9	South (Toby Creek Rd)	71	783	600	22	1,476
10	North (Stone Quarry Rd)	0	60	0	0	60
Total		2,384	7,156	2,452	1,454	13,446

Table 4 Design Year (2035) Parking Summary

Zone	Area	Employee	Commuter	Resident	Other	Total
1	West (North Tryon St)	0	0	0	0	0
2	West (Phillips Rd)	157	248	73	41	519
3	Central (Cameron Blvd)	326	449	808	161	1,744
4	Central (Cameron Blvd)	164	1,029	0	185	1,378
5	East (Cameron Blvd)	8	0	546	20	574
6	East (Van Landingham Rd)	631	2,687	401	325	4,044
7	Central (University Rd)	562	918	0	409	1,889
8	South (High Rise Rd)	31	731	546	41	1,349
9	South (Toby Creek Rd)	71	183	0	22	276
10	North (Stone Quarry Rd)	0	60	0	0	60
Total		2,361	7,419	3,228	1,579	14,587

The corresponding traffic generation estimates using the parking totals in the previous tables and traffic rates from Table 1, yield the AM and PM peak hour and daily volumes generated by the parking on campus. These traffic volumes are included in Table 5 through Table 7.

Table 5 Existing (2010) Traffic Generation Rates Based on Parking Type

Zone	Area	AM		PM		Daily
		Enter	Exit	Enter	Exit	
1	West (North Tryon St)	0	0	0	0	0
2	West (Phillips Rd)	233	48	94	186	2,963
3	Central (Cameron Blvd)	592	188	310	521	9,680
4	Central (Cameron Blvd)	743	138	293	580	8,573
5	East (Cameron Blvd)	97	70	102	120	2,954
6	East (Van Landingham Rd)	1,979	390	829	1,582	24,074
7	Central (University Rd)	972	194	340	741	11,623
8	South (High Rise Rd)	521	141	283	458	7,695
9	South (Toby Creek Rd)	141	25	54	110	1,634
Total		5,278	1,194	2,305	4,298	69,196

Table 6 Interim (2020) Traffic Generation Rates Based on Parking Type

Zone	Area	AM		PM		Daily
		Enter	Exit	Enter	Exit	
1	West (North Tryon St)	465	75	165	360	5,425
2	West (Phillips Rd)	921	175	396	744	11,208
3	Central (Cameron Blvd)	588	188	297	508	9,418
4	Central (Cameron Blvd)	743	138	293	580	8,573
5	East (Cameron Blvd)	97	70	102	120	2,954
6	East (Van Landingham Rd)	1,231	264	481	965	15,267
7	Central (University Rd)	983	196	343	750	11,766
8	South (High Rise Rd)	488	97	223	399	5,962
9	South (Toby Creek Rd)	561	151	306	494	8,318
Total		6,077	1,354	2,606	4,920	78,891

Table 7 Design Year (2035) Traffic Generation Rates Based on Parking Type

Zone	Area	AM		PM		Daily
		Enter	Exit	Enter	Exit	
1	West (North Tryon St)	465	75	165	360	5,425
2	West (Phillips Rd)	888	148	356	700	10,100
3	Central (Cameron Blvd)	482	103	171	368	5,870
4	Central (Cameron Blvd)	654	123	254	509	7,581
5	East (Cameron Blvd)	271	209	311	352	8,800
6	East (Van Landingham Rd)	1,198	237	441	921	14,158
7	Central (University Rd)	878	179	299	666	10,583
8	South (High Rise Rd)	713	133	294	561	8,199
9	South (Toby Creek Rd)	681	142	324	566	8,636
Total		6,230	1,349	2,615	5,003	79,352

4.2 Traffic Distribution

How traffic distributes through the campus street network in traveling between parking spaces and the surrounding road network depends mainly on the location of the parking itself. For example, vehicles accessing the parking along the southern and eastern edges of campus would mostly enter campus from the main entrances along NC 49. Traffic parking in the western zones would likely access campus via US 29. External destinations and directional distributions were also used to help estimate traffic patterns. Distribution percentages were based on the current distribution of traffic, and consider changes resulting from new on-/off-campus roadway projects, as well as anticipated increases in congestion and delay. The external distribution of traffic entering and exiting campus is estimated as:

- 30% to/from the north along US 29 (North Tryon Street)
- 20% to/from the south along US 29 (North Tryon Street)
- 30% to/from the south along NC 49
- 20% to/from the east along NC 49

To account for campus traffic not associated with parking spaces (pick-up/drop-off, buses, delivery and service vehicles), an additional traffic volume of approximately five percent was distributed throughout the campus street network.

4.3 Forecasted Alternatives

The *Traffix* software package was used to distribute the traffic between the parking areas and the ultimate off-campus destinations. For all scenarios, Phillips Road is realigned to intersect Cameron Boulevard across from Craver Road, as is proposed in this study and reflects the 2009 Campus Master Plan. Other roadway links such as the CRI North Entry Road and Mallard Creek Church Road Connector roadway influence the traffic volumes using the

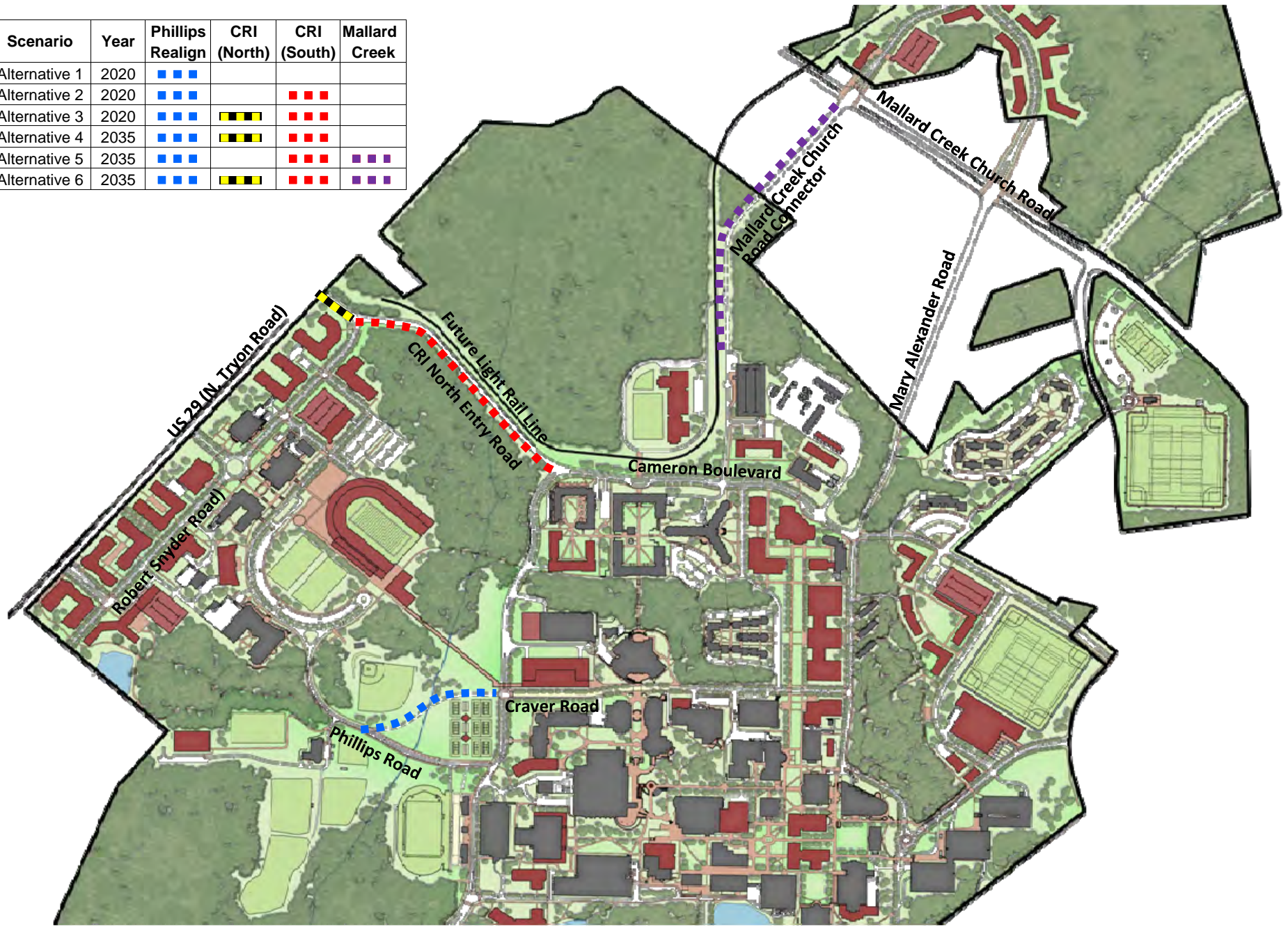
realigned Phillips Road segment, and were therefore added or removed from the model for a variety of different scenarios. The following six alternatives were specifically tested:

- *Alternative 1:* Interim Year (2020) Without CRI North Entry Road
- *Alternative 2:* Interim Year (2020) With Partial Build-Out of CRI North Entry Road
- *Alternative 3:* Interim Year (2020) With Full Build-Out of CRI North Entry Road
- *Alternative 4:* Design Year (2035) With Full Build-Out of CRI North Entry Road without the Mallard Creek Church Road Connector
- *Alternative 5:* Design Year (2035) With Partial Build-Out of CRI North Entry Road with the Mallard Creek Church Road Connector
- *Alternative 6:* Design Year (2035) With Full Build-Out of CRI North Entry Road with the Mallard Creek Church Road Connector

The partial build-out of the CRI North Entry Road would be a roadway segment extending from Cameron Boulevard northwest to an extension of Robert Snyder Road. The full build-out would extend the CRI North Entry Road fully to US 29 (North Tryon Street) across from Barton Creek Drive. The CRI North Entry Road is expected to be a two-lane facility with exclusive turn-lanes at intersections. As the North Entry Road approaches US 29 (NORTH Tryon St.) the approach will be widened to accommodate the projected travel demands. The Mallard Creek Church Road Connector would extend from Cameron Boulevard to Mallard Creek Church Road across from Stone Quarry Road. An illustration of these alternatives is included as Figure 4.

It should be noted that the traffic forecasting, including trip generation and distribution, for this project was done in conjunction with the traffic forecasting for the CRI North Entry Road project, as the two projects are closely related. The volumes derived for the six tested alternatives are identical to the volumes used in the CRI North Entry Road project. The AM and PM peak period traffic volumes for each of the six scenarios are provided as Figure 5 through Figure 10.

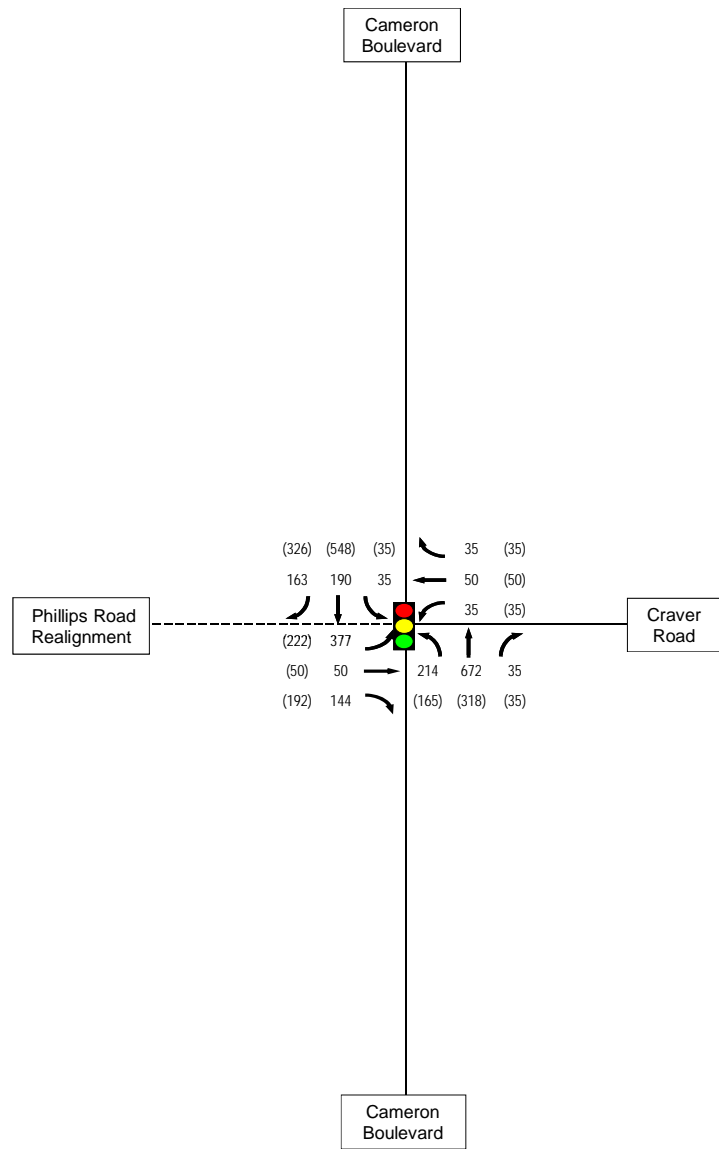
Scenario	Year	Phillips Realign	CRI (North)	CRI (South)	Mallard Creek
Alternative 1	2020	■ ■ ■			
Alternative 2	2020	■ ■ ■		■ ■ ■	
Alternative 3	2020	■ ■ ■	■ ■ ■ ■ ■	■ ■ ■	
Alternative 4	2035	■ ■ ■	■ ■ ■ ■ ■	■ ■ ■	
Alternative 5	2035	■ ■ ■		■ ■ ■	■ ■ ■
Alternative 6	2035	■ ■ ■	■ ■ ■ ■ ■	■ ■ ■	■ ■ ■



Phillips Road
Realignment

Figure 4
Alternatives Illustration



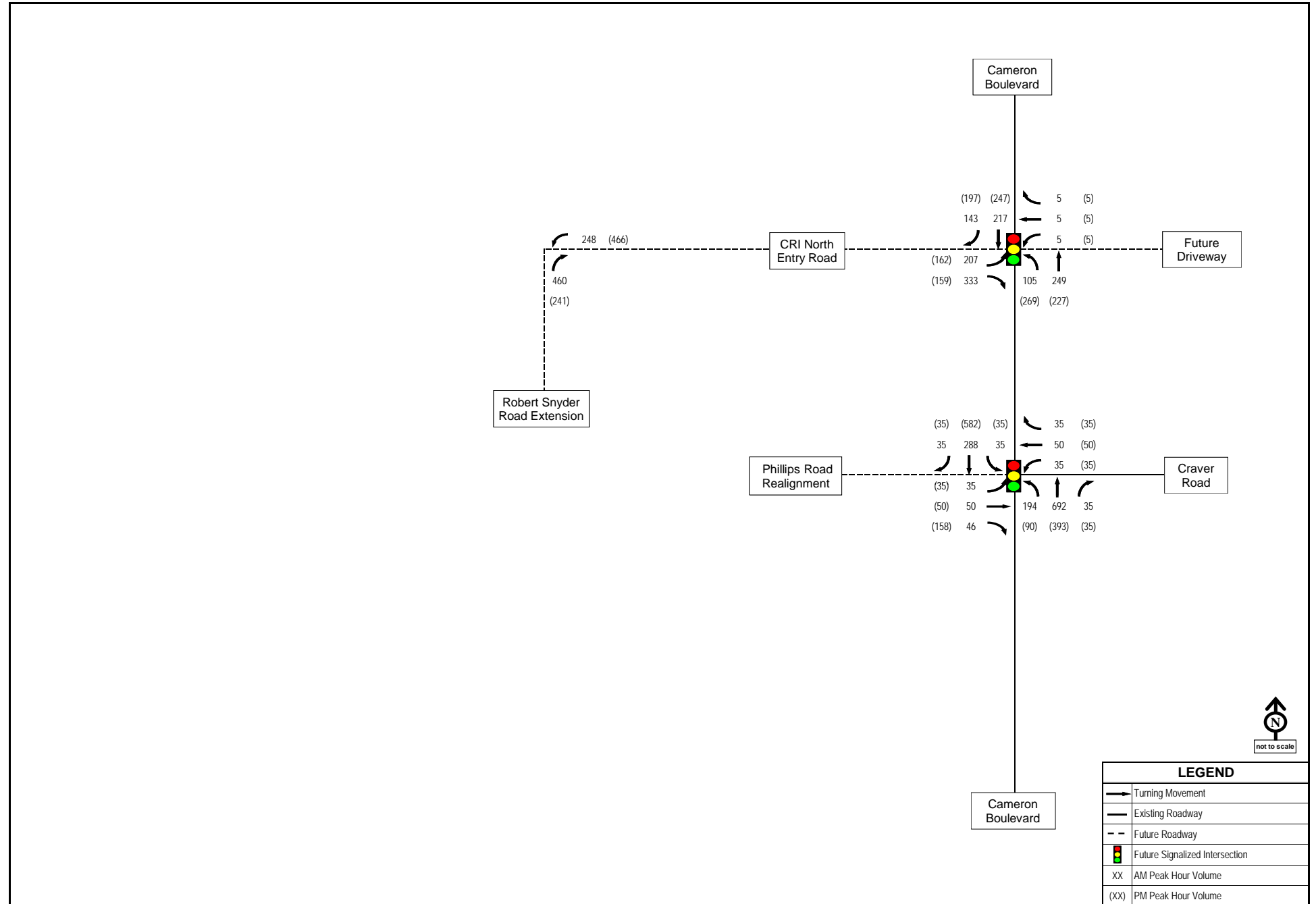


LEGEND	
	Turning Movement
	Existing Roadway
	Future Roadway
	Future Signalized Intersection
XX	AM Peak Hour Volume
(XX)	PM Peak Hour Volume

Phillips Road Realignment

Figure 5
Alternative 1: Interim Year (2020) Peak Hour Traffic Volumes
(Without CRI Connector Roadway)



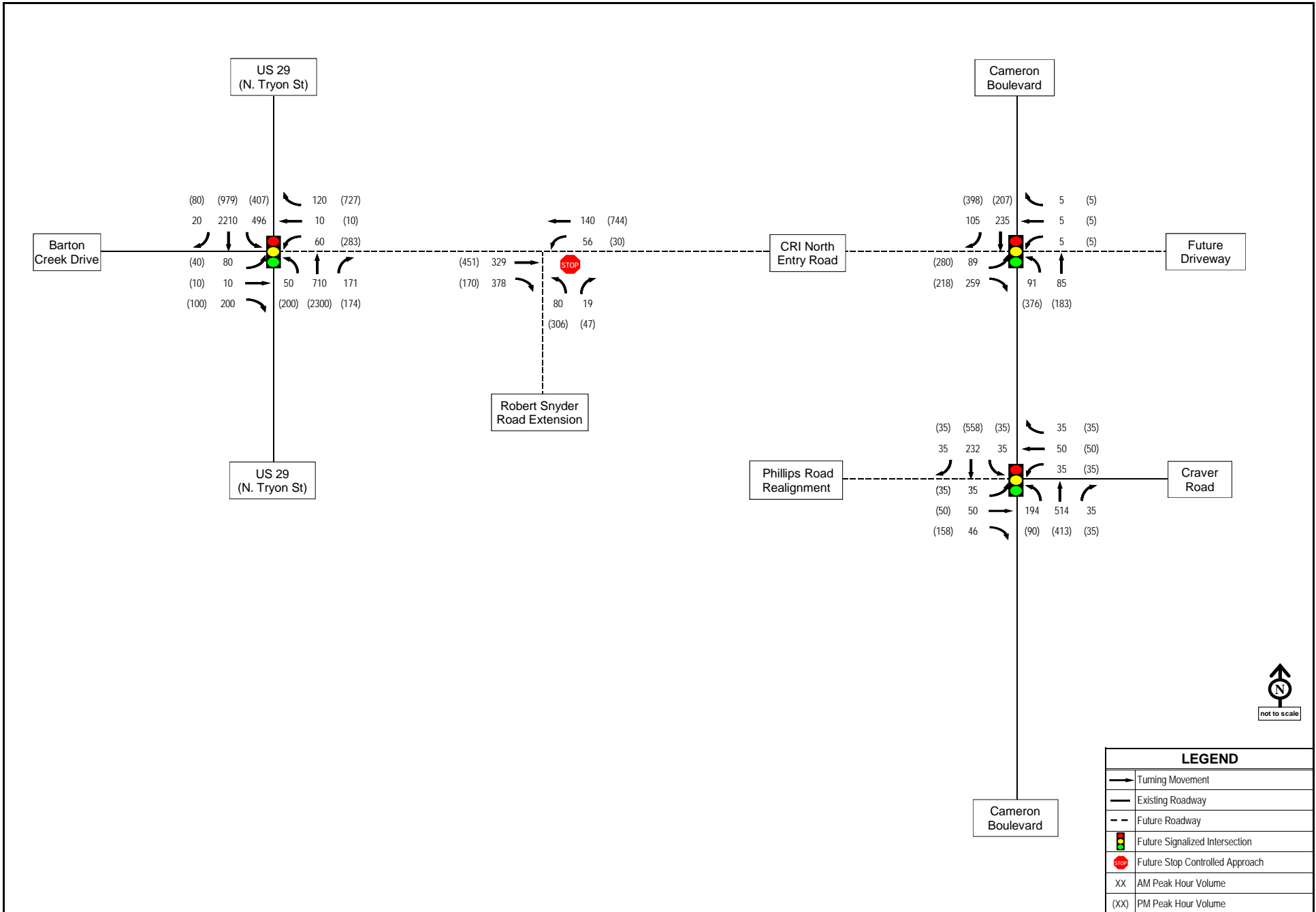


LEGEND	
	Turning Movement
	Existing Roadway
	Future Roadway
	Future Signalized Intersection
XX	AM Peak Hour Volume
(XX)	PM Peak Hour Volume

Phillips Road Realignment

Figure 6
Alternative 2: Interim Year (2020) Peak Hour Traffic Volumes
(With Partial CRI Connector Roadway)

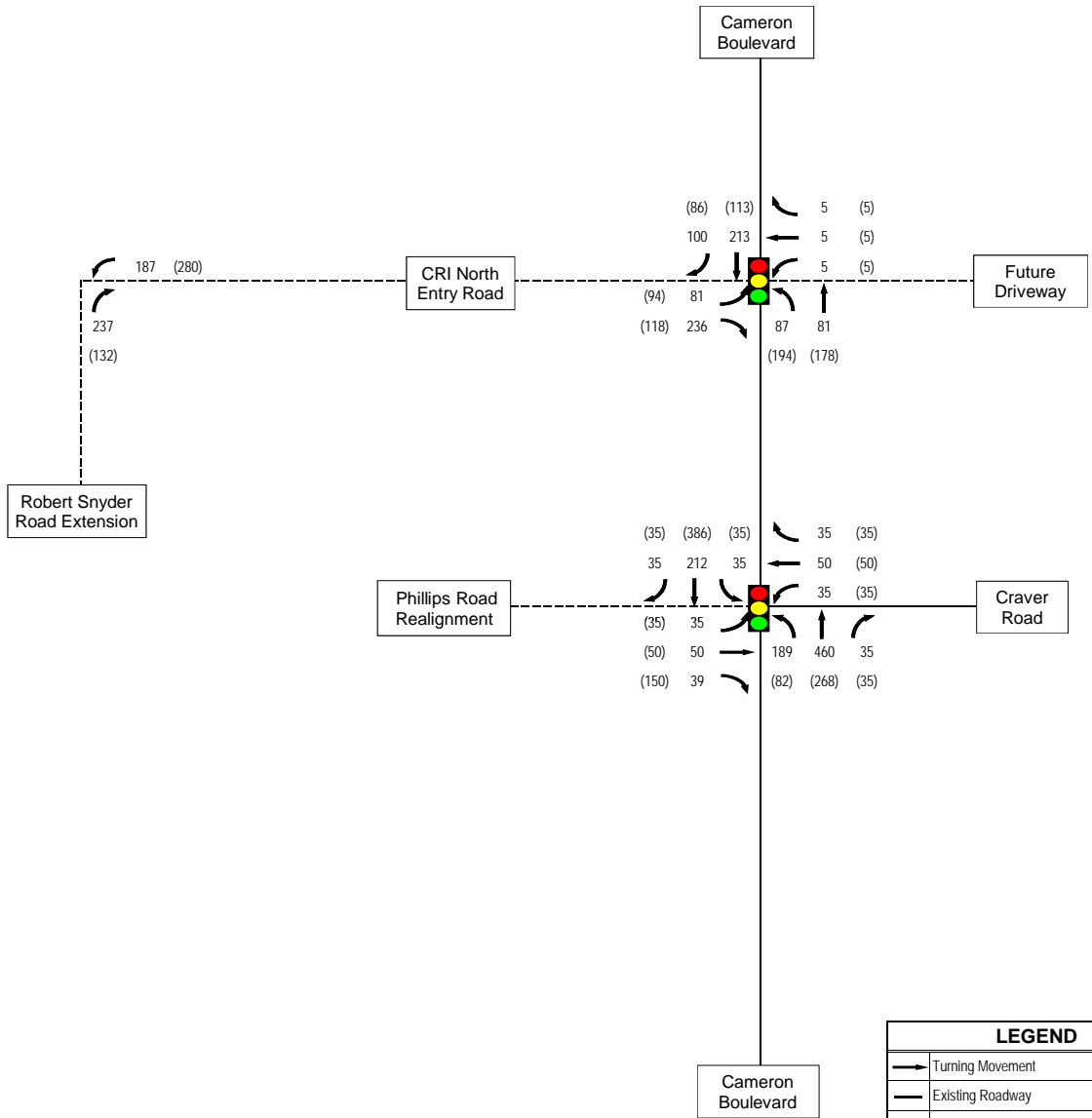




Phillips Road Realignment

Figure 7
Alternative 3: Interim Year (2020) Peak Hour Traffic Volumes
(With Full CRI Connector Roadway)



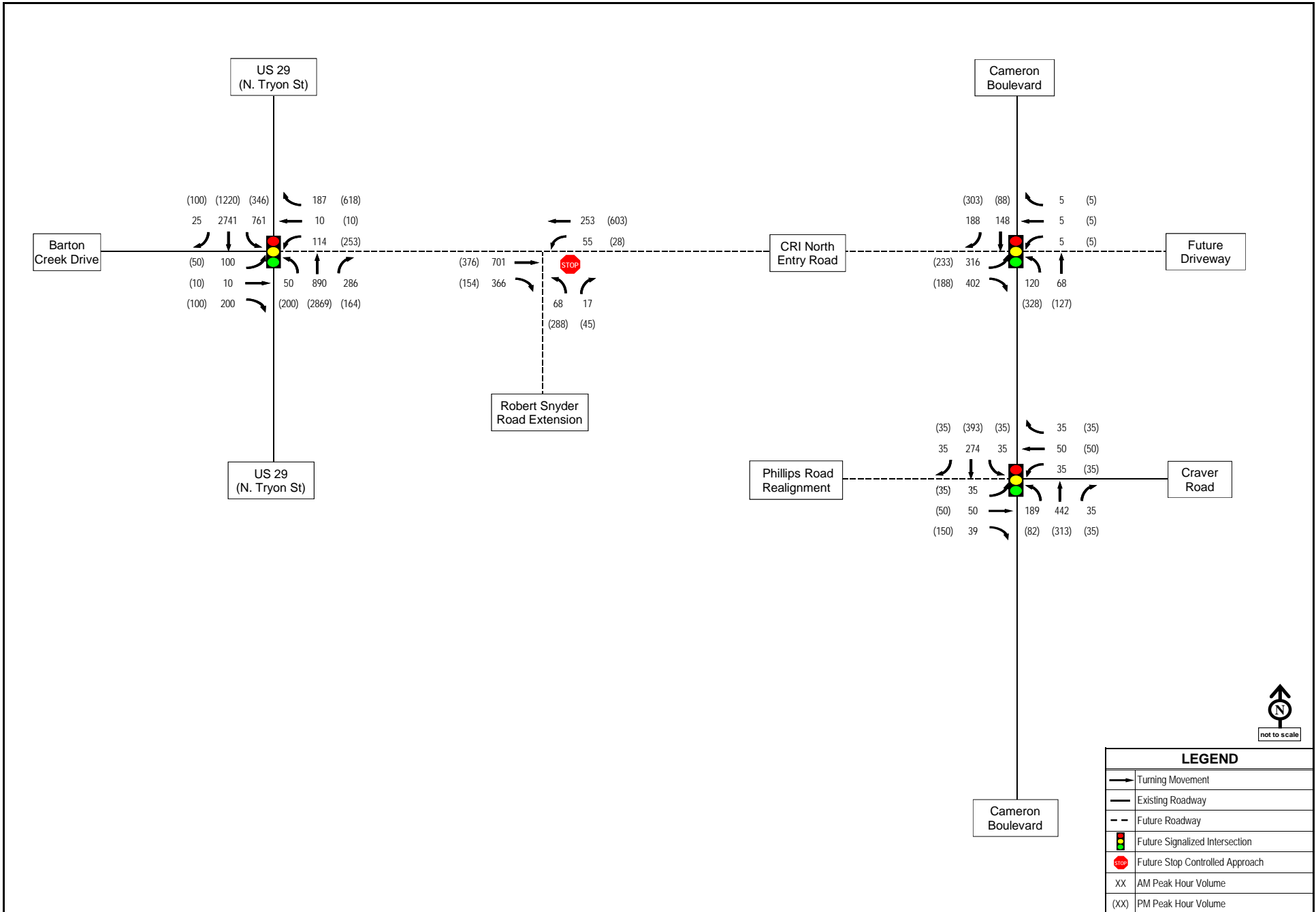


LEGEND	
	Turning Movement
	Existing Roadway
	Future Roadway
	Future Signalized Intersection
XX	AM Peak Hour Volume
(XX)	PM Peak Hour Volume

Phillips Road Realignment

Figure 9
Alternative 5: Design Year (2035) Peak Hour Traffic Volumes
(With Partial CRI Connector, With Mallard Creek Church Road Connector)





Phillips Road Realignment

Figure 10
Alternative 6: Design Year (2035) Peak Hour Traffic Volumes
(With Full CRI Connector, With Mallard Creek Church Road Connector)



5.0 TRAFFIC ANALYSIS

Intersection levels of service analyses were performed for the typical weekday AM and PM peak hours using *Synchro/SimTraffic* Professional Version 7. From this analysis, vehicle delays, queues, and levels of service were determined, which guided recommendations for the appropriate lane configurations and storage lengths at the intersections along the CRI North Entry Road. Analysis was performed for the six alternatives previously identified, which are as follows:

- *Alternative 1:* Interim Year (2020) Without CRI North Entry Road
- *Alternative 2:* Interim Year (2020) With Partial Build-Out of CRI North Entry Road
- *Alternative 3:* Interim Year (2020) With Full Build-Out of CRI North Entry Road
- *Alternative 4:* Design Year (2035) With Full Build-Out of CRI North Entry Road without the Mallard Creek Church Road Connector
- *Alternative 5:* Design Year (2035) With Partial Build-Out of CRI North Entry Road with the Mallard Creek Church Road Connector
- *Alternative 6:* Design Year (2035) With Full Build-Out of CRI North Entry Road with the Mallard Creek Church Road Connector

Although traffic operations during all six alternatives were examined, it was determined that projections under Alternative 1 were the worst case scenario along Phillips Road. Alternative 1 accounts for the Phillips Road Realignment but does not include any other future road projects in the area, such as the CRI North Entry Road or the Mallard Creek Church Road Connector. Without these alternate travel routes in place, it is shown that the traffic volumes along Cameron Boulevard at the Phillips Road Realignment intersection are at their peak. Thus, the recommendations for design at this intersection were based on the operations found under Alternative 1.

Alternative 1 Analysis

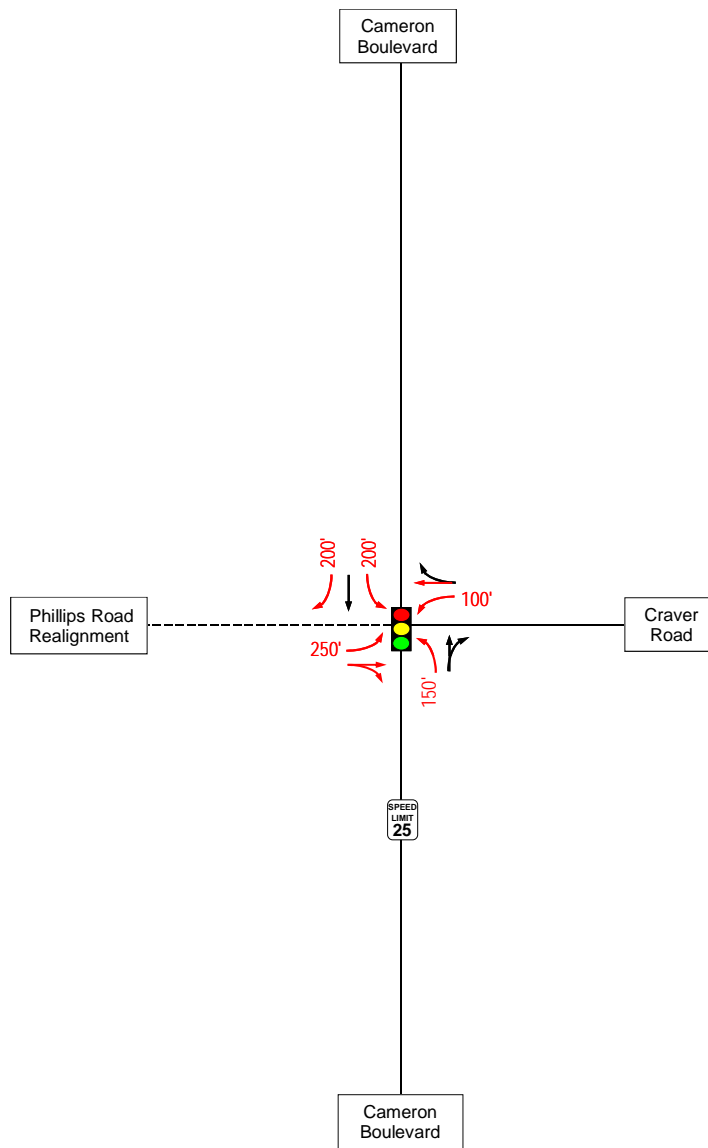
Under Alternative 1, Interim Year (2020) without CRI North Entry Road, the intersection of Cameron Boulevard and Craver Road/Phillips Road Realignment is projected to have approximately 2,000 vehicles traveling through this intersection during both the AM and PM peak hours. The new eastbound approach of Phillips Road Realignment is projected to have 571 arriving vehicles and 427 departing vehicles in the AM peak hour, and 464 arriving vehicles and 541 departing vehicles in the PM peak hour.

Traffic analysis indicates that in order to accommodate the projected traffic demand, the intersection should be signalized and additional capacity will be required on multiple approaches. Specifically, the new eastbound approach should be constructed to include two approaching lanes accommodating an exclusive left-turn lane and a shared through/right-turn lane; in addition, Cameron Boulevard should be widened across this intersection to provide an exclusive right-turn lane on the southbound approach, as well as an exclusive left-

turn lane on both the northbound and southbound approaches. With these configurations in place, the intersection is projected to operate at LOS C in the AM peak hour and LOS B in the PM peak hour, as shown in Table 8. This table also reports the levels of service for each approach of the intersection, summarizing both delay and queuing maximums for each approach. As shown in the table, the eastbound and westbound approaches are projected to have the longest average delay per vehicle, which is common for side streets. Additionally, the new eastbound approach is projected to have a maximum queue of 302 feet (approximately 12 car lengths) during the AM peak hour. During the PM peak hour, the maximum queue is not projected to exceed 200 feet (approximately 8 car lengths). Figure 11 illustrates the proposed lane configurations and traffic control at this intersection.

Table 8 Level of Service Results for Alternative 1

Intersection and Approach		Alternative 1 Interim Year (2020) Without CRI Connector Roadway					
		AM			PM		
		LOS	Delay	95 th Queue	LOS	Delay	95 th Queue
Cameron Boulevard at Phillips Road Realignment/Craver Road	Overall	C	25 sec	-	B	18 sec	-
	Eastbound	D	36 sec	302 ft	C	27 sec	196 ft
	Westbound	D	37 sec	53 ft	D	37 sec	54 ft
	Northbound	C	21 sec	126 ft	B	11 sec	81 ft
	Southbound	B	14 sec	45 ft	B	16 sec	33 ft



not to scale

LEGEND	
	Existing Roadway
	Future Roadway
	Existing Lane Configuration
	Future Lane Configuration
	Future Signalized Intersection

Phillips Road Realignment

Figure 11
Future Lane Configurations and Traffic Control
(2020 Without CRI Connector Roadway)



6.0 DESIGN CONSTRAINTS AND ISSUES

6.1 Existing and Planned Facilities

The location of the realigned roadway is severely constrained in all directions. Existing facilities include Hayes Stadium and the new tennis court complex, currently under construction, on either side of the proposed alignment, and softball fields, track and intramural fields to the south of the existing Phillips Road. Planned facilities to consider are the EPIC building and the football stadium, which are also planned to be located in the vicinity of Phillips Road.

Existing facilities along the existing Phillips Road must remain accessible after the road is realigned. This will require realigning the existing Phillips Road into the proposed roadway since access from Cameron Boulevard will be closed. Approximately 215 feet of the existing roadway from Cameron Boulevard will be removed.

6.2 Toby Creek and Floodplain

Toby Creek flows through campus from near North Tryon Street on the northwestern side of the CRI campus, along Cameron Boulevard and then continues under Toby Creek Road and on to University City Boulevard (US 49), dividing the main campus and CRI campus. The existing Phillips Road crosses Toby Creek with a bottomless culvert as shown in the picture to the right. Observers report that the creek floods with heavy rains, extending well outside its channel



and overtopping Phillips Road. Resolving this issue is critical for the realigned roadway. According to a hydraulic analysis and a Federal Emergency Management Agency (FEMA) Conditional Letter of Map Revision (CLOMR) for the floodplain encroachment that was prepared in 2007, the floodplain elevation is 605 feet. This study was prepared in relation to the Toby Creek Greenway project being developed by Mecklenburg County. The study recommended a CON/SPAN prefabricated concrete bottomless culvert/bridge with a 20-foot span and 10-foot rise to carry the design flow of the creek.

6.3 Toby Creek Greenway

Mecklenburg County is constructing the Toby Creek Greenway alongside Toby Creek through the campus. The greenway crossing is presently being constructed to cross Phillips Road at grade. However, when Phillips Road is realigned the greenway is recommended to travel under the bridge or culvert for Toby Creek. In the project area, the greenway is located in the tightly constrained area between Toby Creek and the tennis complex retaining wall under construction.

7.0 ALTERNATIVES

Designs for both the 2035 design year and 2020 interim year were considered and evaluated. The interim design considered traffic without the addition of the CRI North Entry Road or the Mallard Creek Church Road Connector. Without these nearby planned projects in place, traffic on the Phillips Road Realignment will continue to increase as it will remain the only connection between the CRI and main campus. In the design year both of these projects are assumed to be constructed which would relieve some of the burden off of Phillips Road and distribute traffic to these additional roadways; however, recommendations were made for the worst case scenario for Phillips Road to make sure traffic is operating acceptably during both the interim and design years. Symmetric widening and widening only to the north side of the existing road were the two design alternatives.

8.0 RECOMMENDATIONS

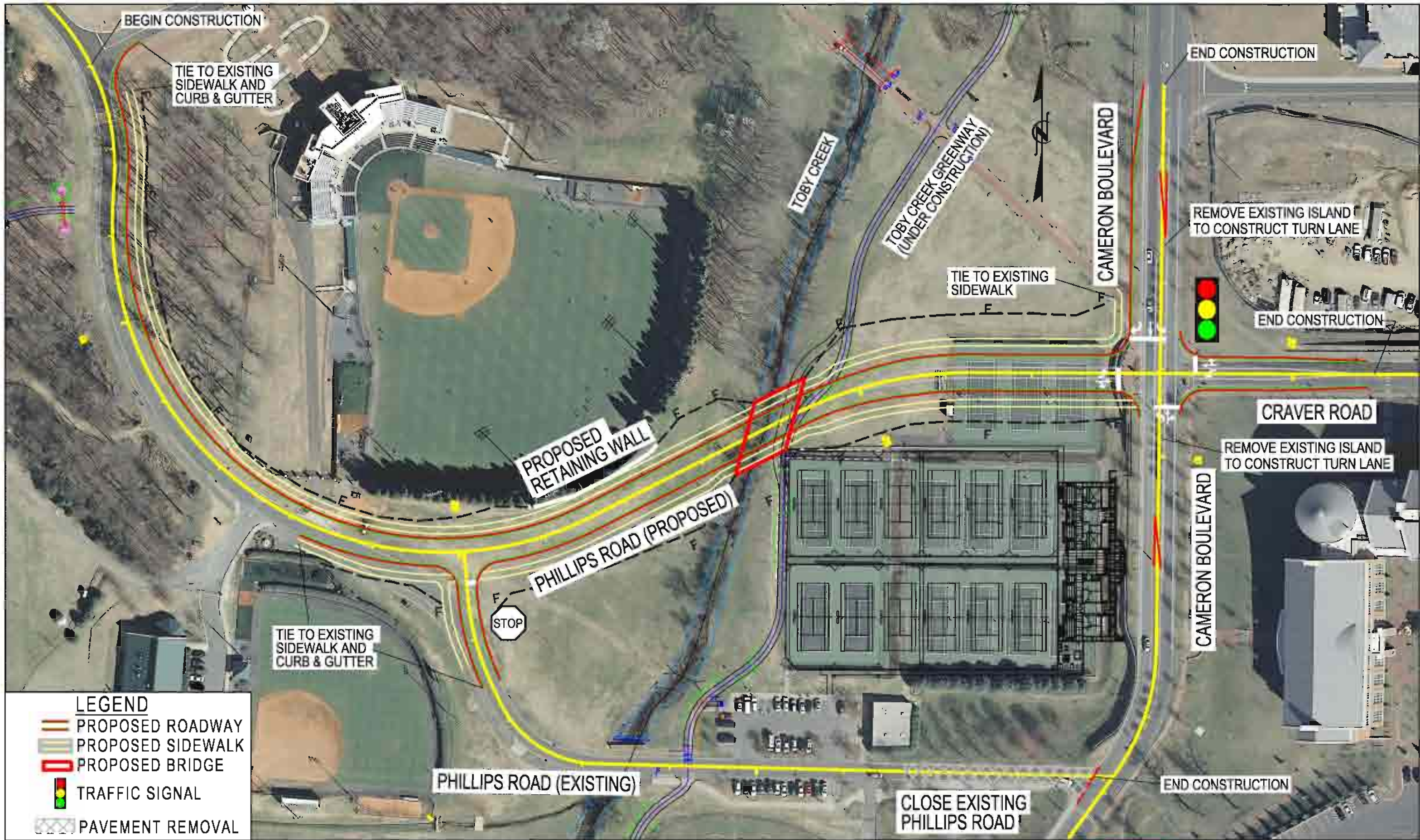
8.1 *Recommended Improvements and Typical Section*

Phillips Road would be widened beginning at the drive to Parking Lot 23, just north of the baseball stadium, to the access drive into the stadium. From that point to Cameron Boulevard, Phillips Road would be realigned and constructed on new location as shown in Figure 12. The recommended typical section is 30 feet of pavement to allow for 11-foot travel lanes and 4-foot bike lanes in each direction, and 1'-6" concrete curb and gutter would be used to match the existing. New eight-foot brick sidewalks were recently installed on both sides in the area to be widened. As a result, it was decided to widen only on the north side to preserve the sidewalk on the southern side and reduce overall construction cost. The proposed eight-foot sidewalks would be placed 10 feet behind the curb where feasible. Due to constraints, the sidewalk would be offset only five feet for a distance of approximately 750 feet on the north side of the project. This would reduce impacts to the fence at the service driveway to the baseball stadium and to the scoreboard. The sidewalk would also be pulled in to a five foot offset at the creek and greenway crossing to reduce the width of the bridge structure and resulting impacts to the new tennis complex presently under construction. A retaining wall would be necessary on the north side of the proposed roadway to reduce impacts to the baseball field and scoreboard. Based on the conceptual design, the wall would vary in height from five to eight feet and would be approximately 170 feet in length. This would require a railing or fence to be placed between the sidewalk and the retaining wall to protect pedestrians from falls while walking along the sidewalk. The typical section for the Phillips Road widening and realignment is shown in Figure 13.

8.2 *Existing Phillips Road Closure*

The existing section of Phillips Road between the realigned portion and Cameron Boulevard would be needed to provide access to the Irwin Belk Track and Field Center, the new tennis complex, and the intramural fields. However, this access would only be provided from the Phillips Road end, and the section from the track and field center driveway and Cameron Boulevard would be removed. The remaining roadway would be slightly realigned to provide an acceptable "T-intersection" into the Phillips Road Realignment.

The existing signal pedestals and controllers at the intersection of Cameron Boulevard, Phillips Road, and Barnhardt Lane would be realigned to the proposed intersection of Cameron Boulevard, Craver Street, and the Phillips Road Realignment.



Phillips Road
Realignment

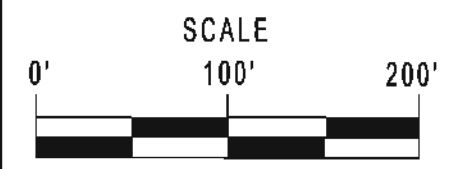
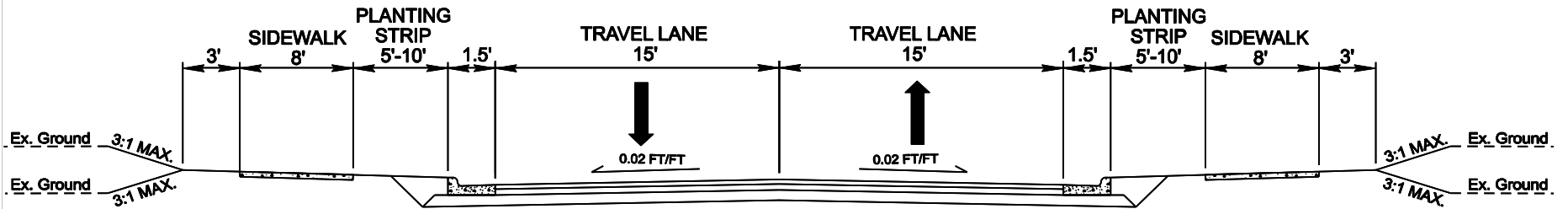
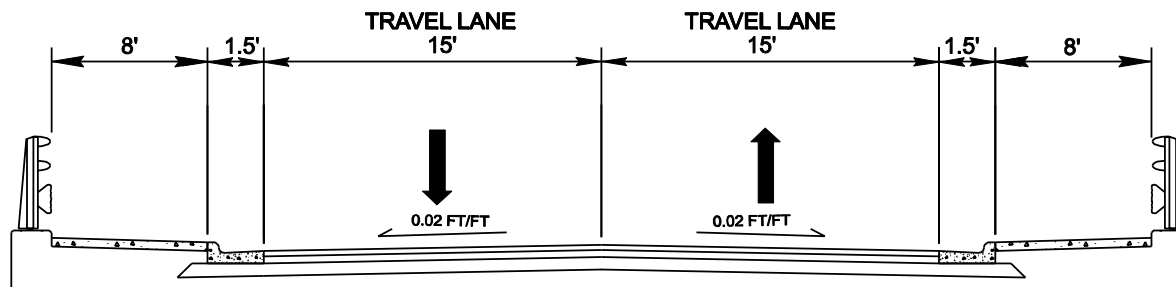


Figure 12
Conceptual Design





TYPICAL SECTION
PHILLIPS ROAD



TYPICAL SECTION
PHILLIPS ROAD BRIDGE OVER TOBY CREEK

8.3 Toby Creek and Greenway Crossing

The proposed realignment of Phillips Road would cross Toby Creek and the Toby Creek Greenway. The grade separation for the greenway was recommended by the University's Steering Committee during project meetings to provide a safer condition for pedestrians and a steady flow for traffic. In addition, concerns were raised about the existing roadway flooding during heavy rains. It was noted that the water flow occasionally overtops the creek banks and sometimes the road. It appears that the existing creek channel and culvert may be inadequate for the design year storm as a result of upstream development over the past years.

Multiple options were evaluated for the Toby Creek and Toby Creek Greenway crossings. A bridge, multiple culverts, and a Con/Span structure were considered. A separate culvert for the greenway and the creek and one structure spanning both of them were also evaluated. It should be pointed out that a hydraulic analysis was not a part of the scope for this project; rather, use of the most recent information, studies, and observations was to be evaluated. Based on this information and existing culvert sizes upstream and downstream, a bridge or Con/Span structure with an approximately 50-foot span is recommended to span the creek and the greenway. Either of these options would provide additional capacity for the creek in case of a large rain event. The proposed conceptual profile for Phillips Road Realignment elevates the road above the 100-year flood plain elevation for Toby Creek. However, during final design a hydraulic analysis, including a CLOMR, and geotechnical investigations should be completed to determine the exact span length and appropriate bridge structure type to provide the most reasonable and feasible structure for the crossing. Since the existing Phillips Road would need to be maintained the flooding issue for the existing creek crossing would need to be addressed also. The previously recommended hydraulic analysis should also address issues with the existing creek channel and crossing. Recommendations may include items such as excavating a larger creek channel and evaluating if it would be a good candidate for stream restoration, removing some of the rip-rap in the existing culvert that is restricting its' flow and capacity, and installing floodplain pipe culverts by bore and jack on each side of the culvert to provide more capacity during floods. These improvements would increase the capacity of the water flow and reduce flooding but would likely not stop it during the heaviest rains. However, this may be adequate with the use of the existing roadway proposed to change from a major campus connector roadway to an access road. If the hydraulic analysis recommends additional needs for the crossing, another option would be to raise the grade of the existing road and crossing to provide a higher and wider opening for the channel. This option would provide the capacity needed for the creek flow but would have a much higher construction cost. It would also cause further design issues and impacts with elevation changes conflicting with the parking areas and driveways of the new tennis complex and the track and field stadium.

An at-grade greenway crossing option was also considered. In addition to previous comments made about the Steering Committee preferences toward a grade separated crossing, from a design perspective, this option was discarded primarily due to the elevation differences between the roadway and greenway. With the greenway immediately adjacent to the retaining wall for the new tennis complex there is not enough space to ascend to the roadway without using a steep grade or steps which were viewed as unacceptable.

Initially, bus pullouts were requested to be located along Phillips Road in the area near the baseball and softball fields. In discussions with the Steering Committee it was decided to locate a bus stop in the turnaround area of the access drive to the Parking Lot 23, adjacent to the proposed football stadium.

8.4 Opinion of Probable Cost

Conceptual designs were prepared for the recommended improvements as previously indicated and are shown in Figure 12 and Figure 13. An opinion of probable construction cost was estimated based on the conceptual designs for this project and as requested, was separated into the widening section and the realignment section using the conceptual designs. Through the widening section, the existing roadway will be widened only on the north side to allow the recently installed brick paver sidewalk to be retained on the south side and to control the construction cost. The realignment of Phillips Road would result in improvements on Cameron Boulevard and Craver Road to include turn lanes. A summary of probable construction costs is provided below, as well as a more detailed breakdown of costs by section are in Table 10 through Table 12.

Table 9 Summary of Probable Construction Costs

Roadway Section	Opinion of Probable cost
Widen Existing	\$210,000.00
New Location	\$1,830,000.00
Full Project Estimated Cost	\$2,030,00.00

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

No utility design, utility realignment, right-of-way, or administrative costs are included with the estimates.

Table 10 Opinion of Probable Cost – Phillips Road Widening Only

Description	Quantity	Unit	Price	Amount
Clearing and Grubbing	0.4	Acre	\$ 6,000.00	\$ 2,400.00
Earthwork	850	CY	\$ 8.00	\$ 6,800.00
Pavement Removal		SY	\$ 3.00	\$ -
Drainage Existing Location (2-L.C&G widening)	0.13	Miles	\$ 100,000.00	\$ 13,000.00
Fine Grading	1,883	SY	\$ 1.50	\$ 2,823.83
Pavement Widening	670	SY	\$ 40.00	\$ 26,800.00
New Pavement		SY	\$ 35.00	\$ -
Pavement Resurfacing	1,373	SY	\$ 9.00	\$ 12,357.00
Subgrade Stabilization	670	SY	\$ 6.00	\$ 4,020.00
1'-6" Concrete Curb and Gutter	635	LF	\$ 12.00	\$ 7,620.00
2'-6" Concrete Curb and Gutter		LF	\$ 15.00	\$ -
8' Brick Paver Sidewalk	539	SY	\$ 61.00	\$ 32,858.67
7" Monolithic Islands	0	SY	\$ -	\$ -
Erosion Control	0.3	Acres	\$ 12,000.00	\$ 3,600.00
New Traffic Signal - black powder coated metal pedestals (Phillips Rd Relocation and Cameron)		Each	\$ 90,000.00	\$ -
Traffic Signal Removal (Existing Phillips Rd and Cameron)		Each	\$ 10,000.00	\$ -
Traffic Control	0.13	Miles	\$ 40,000.00	\$ 5,200.00
Thermo and Markers	0.13	Miles	\$ 10,000.00	\$ 1,300.00
Misc. & Mob (15% Strs&Util)				\$ -
Misc. & Mob (45% Functional)				\$ 53,450.78
Construction Cost				\$ 180,000.00
E. & C. 15%				\$ 30,000.00
Total				\$ 210,000.00

Table 11 Opinion of Probable Cost – Phillips Road Realignment Only

Description	Quantity	Unit	Price	Amount
Clearing and Grubbing	0.9	Acre	\$ 6,000.00	\$ 5,400.00
Earthwork	18,650	CY	\$ 8.00	\$ 149,200.00
Pavement Removal	507	SY	\$ 3.00	\$ 1,521.00
Drainage Existing Location (2-L.C&G widening)	0.15	Miles	\$ 100,000.00	\$ 14,600.00
Drainage New Location (2-L.C&G w/bike lanes)	0.19	Miles	\$ 200,000.00	\$ 38,000.00
Fine Grading	9,007	SY	\$ 1.50	\$ 13,511.17
Pavement Widening	938	SY	\$ 40.00	\$ 37,506.67
New Pavement	3,400	SY	\$ 35.00	\$ 119,000.00
Pavement Resurfacing	942	SY	\$ 9.00	\$ 8,478.00
Subgrade Stabilization	4,338	SY	\$ 6.00	\$ 26,026.00
1'-6" Concrete Curb and Gutter	2,835	LF	\$ 12.00	\$ 34,020.00
2'-6" Concrete Curb and Gutter		LF	\$ 15.00	\$ -
8' Brick Paver Sidewalk	1,891	SY	\$ 61.00	\$ 115,371.33
7" Monolithic Islands	0	SY	\$ -	\$ -
Erosion Control	0.8	Acres	\$ 12,000.00	\$ 9,600.00
New Traffic Signal - black powder coated metal pedestals (Phillips Rd Relocation and Cameron)	1	Each	\$ 90,000.00	\$ 90,000.00
Traffic Signal Removal (Existing Phillips Rd and Cameron)	1	Each	\$ 10,000.00	\$ 10,000.00
Traffic Control	0.34	Miles	\$ 40,000.00	\$ 13,400.00
Thermo and Markers	0.34	Miles	\$ 10,000.00	\$ 3,350.00
Structures				
CON/SPAN bridge- Toby Creek & greenway 56' L x 48' W	1	LS	\$ 458,000.00	\$ 458,000.00
4'-8' Retaining Wall	200.00	LF	\$ 275.00	\$ 55,000.00
Misc. & Mob (15% Strs&Util)				\$ 76,950.00
Misc. & Mob (45% Functional)				\$ 310,042.88
Construction Cost				\$ 1,590,000.00
E. & C. 15%				\$ 240,000.00
Total				\$ 1,830,000.00

Table 12 Opinion of Probable Cost – Phillips Road Full Project

Description	Quantity	Unit	Price	Amount
Clearing and Grubbing	1.3	Acre	\$ 6,000.00	\$ 7,800.00
Earthwork	19,500	CY	\$ 8.00	\$ 156,000.00
Pavement Removal	507	SY	\$ 3.00	\$ 1,521.00
Drainage Existing Location (2-L.C&G widening)	0.28	Miles	\$ 100,000.00	\$ 27,600.00
Drainage New Location (2-L.C&G w/bike lanes)	0.19	Miles	\$ 200,000.00	\$ 38,000.00
Fine Grading	10,890	SY	\$ 1.50	\$ 16,335.00
Pavement Widening	1,600	SY	\$ 40.00	\$ 64,000.00
New Pavement	3,400	SY	\$ 35.00	\$ 119,000.00
Pavement Resurfacing	2,315	SY	\$ 9.00	\$ 20,835.00
Subgrade Stabilization	5,000	SY	\$ 6.00	\$ 30,000.00
1'-6" Concrete Curb and Gutter	3,470	LF	\$ 12.00	\$ 41,640.00
2'-6" Concrete Curb and Gutter		LF	\$ 15.00	\$ -
8' Brick Paver Sidewalk	2,430	SY	\$ 61.00	\$ 148,230.00
7" Monolithic Islands	0	SY	\$ -	\$ -
Erosion Control	1.0	Acres	\$ 12,000.00	\$ 12,000.00
New Traffic Signal - black powder coated metal pedestals (Phillips Rd Relocation and Cameron)	1	Each	\$ 90,000.00	\$ 90,000.00
Traffic Signal Removal (Existing Phillips Rd and Cameron)	1	Each	\$ 10,000.00	\$ 10,000.00
Traffic Control	0.47	Miles	\$ 40,000.00	\$ 18,800.00
Thermo and Markers	0.47	Miles	\$ 10,000.00	\$ 4,700.00
Structures				
CON/SPAN bridge- Toby Creek & greenway 56' L x 48' W	1	LS	\$ 458,000.00	\$ 458,000.00
4'-8' Retaining Wall	200.00	LF	\$ 275.00	\$ 55,000.00
Misc. & Mob (15% Strs&Util)				\$ 76,950.00
Misc. & Mob (45% Functional)				\$ 362,907.45
Construction Cost				\$ 1,760,000.00
E. & C. 15%				\$ 270,000.00
Total Cost				\$ 2,030,000.00