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Traffic Circulation Study

For the

Borough of Wilkinsburg

In cooperation with Wilkinsburg Community Development Corporation

Prepared For:
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

I. Introduction

A. Purpose of Report and Study Objective

The purpose of this report is to determine the feasibility of the strategic elimination of one-way streets within the Borough of Wilkinsburg. The Pennsylvania Department of Transportation (PennDOT) Publication 212, *Official Traffic Control Devices* states that the removal of an existing restriction may be warranted if one of the following applies:

(1) A study indicates that none of the engineering and traffic study warrants

(2) The condition that originally justified the restriction no longer exists.

The following guidance on establishing a one-way street is provided in the same publication:

(1) The traffic flow can be accommodated in both directions. Whenever possible, an adjacent parallel street should be used to form a one-way couplet.

(2) The street has a reasonable number of intersections for entrance to or exit from the one-way street or one-way system.

(3) The roadways at the terminal points of the one-way street provide satisfactory transitions to and from the two-way operation.

(4) There will be a reduction of intersection delays.

(5) Existing bus routes can be satisfactorily accommodated.

(6) Emergency vehicles can reasonably and expeditiously reach their destinations.

This study evaluates the roadway network and establishes performance measures during the weekday peak hours to determine if the existing one-way roads in the study area are needed to adequately serve the traffic demand. Based on the findings of the traffic analysis, recommendations were developed to provide the following:

- Strategic conversion of one-way roads to two-way
- Network connectivity
- Traffic calming
- Bicycle facilities and connections to existing infrastructure
- Potential for the consolidation of bus routes

II. Existing Conditions

The study area, as defined by the Wilkinsburg Community Development Corporation (WCDC) includes the Wilkinsburg grid network, bounded by Hill Street to the north, Swissvale Avenue to the east, Rebecca Avenue to the south, and Pennwood Avenue to the west. Critical study intersections were selected for detailed analysis. Twenty signalized intersections and 11 unsignalized intersections were chosen for data collection to assist in the volume projections of two-way operation. Thirteen of the 31 intersections selected for data collection were identified as critical study intersections. **Figure 1** shows the study area, study intersections for data collection, and critical study intersections. **Appendix A**

A. Study Roadways

Rebecca Avenue

Rebecca Avenue is a one-way (eastbound), single lane local road with a posted speed limit of 25 mph and parking on both sides. The curb to curb width on Rebecca Avenue is 30-feet. Sidewalks are provided on both sides, while no bicycle infrastructure is provided. The primary land uses along the road are residential to the east of Center Street and commercial and institutional to the west of Center Street. No pavement markings are provided to delineate parking and travel lanes.

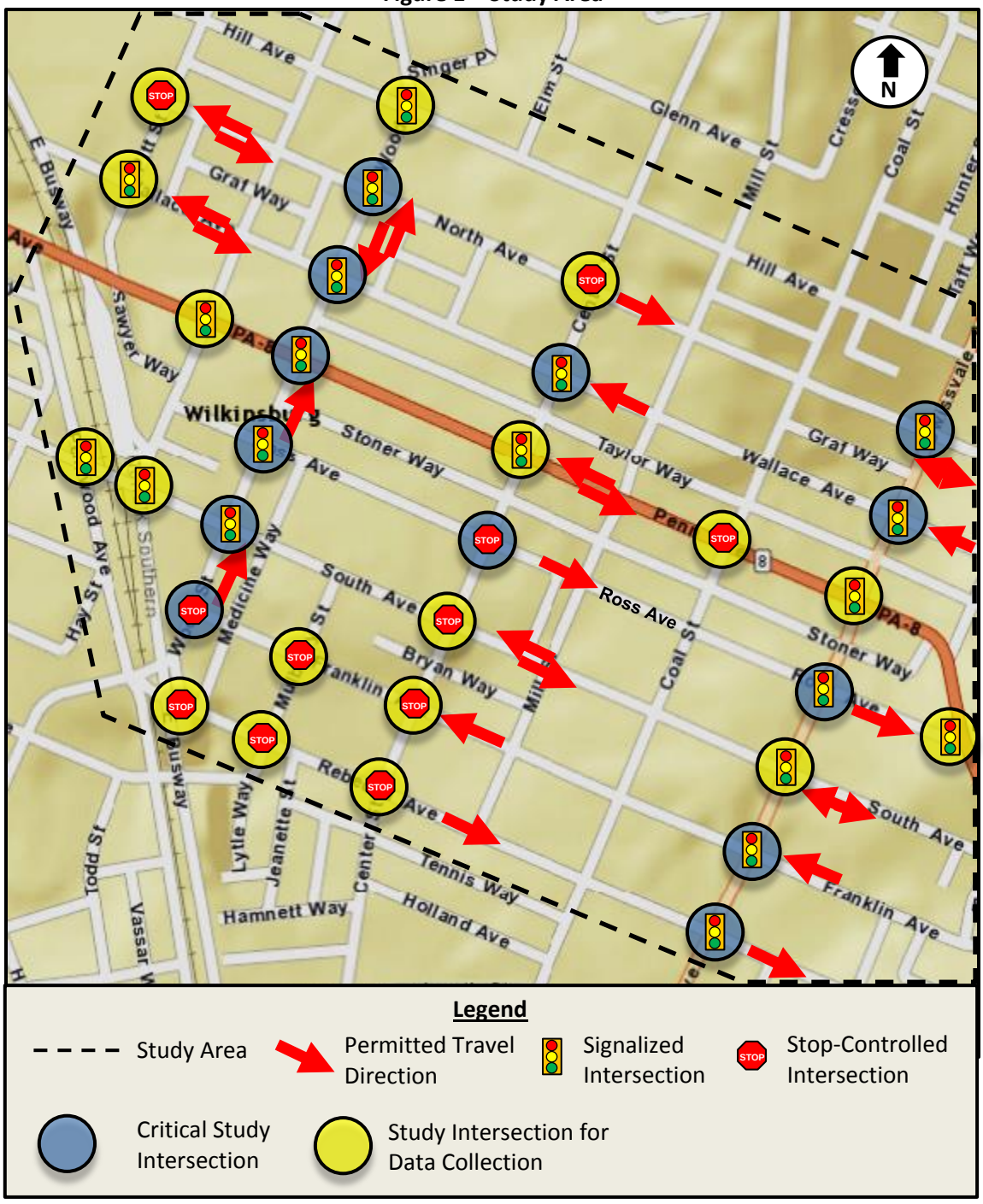
Franklin Avenue

Franklin Avenue is a one-way (westbound), single lane local road with a posted speed limit of 25 mph and parking on both sides. The curb to curb width on Franklin Avenue is 30-feet. Sidewalks are provided on both sides, while no bicycle infrastructure is provided. The primary land uses along the road are residential to the east of Mulberry Street and institutional to the west of Mulberry Street. No pavement markings are provided to delineate parking and travel lanes.

South Avenue

South Avenue is a two-way, two-lane local road with a posted speed limit of 25 mph, and 15 mph during school peak hours. On-street parking is provided on the south side of the road and restricted on the north side between Wood Street and Swissvale Avenue. Metered parking is provided on the north side to the west of Wood Street. The curb to curb width on South Avenue is 30-feet. Sidewalks are provided on both sides. While no bicycle infrastructure is provided, South Avenue is identified as an on-street bike route by *Bike Pittsburgh*. The primary land uses along the road are residential to the east of Center Street and institutional and commercial to the west of Center Street. No pavement markings are provided to delineate travel lanes, while marked parking spots are located between Hay Street and Wood Street.

Figure 1 – Study Area



Ross Avenue

Ross Avenue is a one-way (eastbound), single lane local road with a posted speed limit of 25 mph. Parking is provided on both sides of the street, east of Center Street. The curb to curb width on Ross Avenue is 30-feet. Metered parking is provided on the north side of Ross Avenue west of Center Street, while parking is restricted on the south side. Sidewalks are provided on both sides, while no bicycle infrastructure is provided. The primary land uses along the road are residential to the east of Center Street and commercial and institutional to the west of Center Street. No pavement markings are provided to delineate travel lanes, while marked parking spots are located to the west of Medicine Way.

Penn Avenue

Penn Avenue or State Route 8 is a two-way, two-lane arterial with a posted speed limit of 25 mph. Metered parking is provided on both sides of the street through the study area. Sidewalks are provided on both sides, while no bicycle infrastructure is provided. The primary land uses along Penn Avenue are commercial and mixed use. Pavement markings are provided to delineate travel lanes and metered parking spots.

Wallace Avenue

Wallace Avenue is a one-way (westbound) single lane local road between Wood Street and Swissvale Avenue, and a two-way, two-lane road west of Wood Street. Wallace Avenue has a posted speed limit of 15 mph. Parking is provided on the south side of the street and parking is restricted on the north side. Sidewalks are provided on both sides, while no bicycle infrastructure is provided. The primary land uses along Wallace Avenue are residential, commercial, and institutional. No pavement markings are provided to delineate parking and travel lanes.

North Avenue

North Avenue is a one-way (eastbound) single lane local road between Wood Street and Swissvale Avenue, and a two-way, two-lane road west of Wood Street with parking on both sides of the street. North Avenue has an assumed speed limit of 25 mph, as no speed limit signs are posted. The curb to curb width is 30-feet. Sidewalks are provided on both sides, while no bicycle infrastructure is provided. The primary land uses along North Avenue are residential and institutional.

Swissvale Avenue

Swissvale Avenue is a two-way north/south road with two to four lanes and a posted speed limit of 25 mph. Swissvale Avenue is a Borough road to the south of Penn Avenue and State Route 2058 to the north of Penn Avenue. The curb to curb width is 45-feet. Parking is provided on both sides of the road along the two-lane sections and restricted along the four-lane sections. Sidewalks are provided on both sides, while no bicycle infrastructure is provided. The primary land uses along Swissvale Avenue are commercial and residential. Pavement markings are provided to delineate travel lanes and mandatory turning movements.

Wood Street

Wood Street is a single lane one-way (north) local road to the south of Penn Avenue and a two-lane, two-way road to the north of Penn Avenue. Penn Avenue has an assumed speed limit of 25 mph, as no speed limit signs are posted. The curb to curb width is 30-feet south of Penn Avenue and 35-feet north of Penn Avenue. Metered parking is provided on both sides of the road. Sidewalks are also provided on both sides, while no bicycle infrastructure is provided. The primary land uses along the road are commercial. Pavement markings are provided to delineate travel lanes and parking spaces.

Data Collection

Turning movement counts were conducted at the study intersections as well as multiple intersections throughout the Borough between the dates of April 29, 2014 and May 6, 2014 on Tuesdays, Wednesdays, and Thursdays. The traffic counts were conducted during the AM peak period of 7:00 AM – 9:00 AM and the PM peak period of 4:00 PM and 6:00 PM. Cars, heavy vehicles, and pedestrians were classified separately. The AM peak hour generally occurred between 7:45 AM – 8:45 AM, while the PM peak hour occurred between 4:00 PM – 5:00 PM. Peak hour turning movement counts are shown in **Figure 2**. Raw traffic count data including all of the intersections counted are attached as **Appendix A**.

In addition to the turning movements conducted, a field inventory of existing conditions at each study intersection was conducted. The following data were collected/verified in the field:

- Roadway widths
- Approximate roadway grades
- Existing parking/circulation patterns
- Existing Signing
- Lane configurations
- Curb ramp conditions
- Signal controller type
- Existing signal phasing/timings.

The results of the field inventory and photos of the critical study intersections are attached as **Appendix B**.

B. Regional Travel Patterns

To assist in the reassignment of traffic volumes in a one to two-way scenario for study roadways, regional travel patterns were identified. Travel Demand Data including a select link analysis was provided by the Southwestern Pennsylvania Commission (SPC) Metropolitan Planning Organization. Included in the data were link Average Annual Daily Traffic (AADT), land uses, and origins/destinations.

The results of the select link analysis showed the majority of the trips originating from/to the east/west of Wilkinsburg, and utilizing Penn Avenue and South Avenue through the Borough. Combined with the traffic count data and field observations, the Port Authority parking lots for the Busway were identified as a major destination for traffic in the morning, and a major generator of traffic in the evening. The other major regional travel pattern identified was north/south trips utilizing Wood Street and Swissvale Avenue. Relatively few daily trips are destined to land uses located southwest of Wilkinsburg. Travel Demand Model data from the SPC is attached as **Appendix C**.

C. Pedestrian and Bicycle Facilities

An inventory of pedestrian and bicycle facilities were conducted at each study intersection/roadway selected for detailed analysis. Sidewalks are provided on both sides of each study roadway. With the exception of the intersection of North Avenue at Wood Street, marked crosswalks are provided at all study intersections. Pedestrian signals are not provided at Borough-maintained traffic signals; however, pedestrian signals are provided at all signalized intersections with Penn Avenue. No separated or on-street bicycle facilities are provided within the Borough limits.

Figure 2 – Existing Peak Hour Volumes

D. Intersection Capacity Analysis

Utilizing the existing traffic count data, peak hour intersection capacity analyses were performed for the study intersections using the HCM 2010 methodology, as applied by *PTV Vistro* traffic modeling software. The Highway Capacity Manual (HCM) assigns a Level of Service (LOS) designation between "A" and "F" to intersection operations. LOS "A" designates very good operating conditions, while LOS "F" denotes excessive delay. **Table 1** shows the guidelines used for designating Levels of Service at signalized and unsignalized intersections.

Table 1 – HCM 2010 LOS Criteria

LOS	Control Delay (s/vehicle)		
	Volume/Capacity Ratio ≤1.0		v/c > 1.0
	Unsignalized[1]	Signalized	
A	≤ 10	≤ 10	N/A
B	> 10 and ≤15	> 10 and ≤20	N/A
C	> 15 and ≤25	> 15 and ≤35	N/A
D	> 25 and ≤35	> 25 and ≤55	N/A
E	> 35 and ≤50	> 35 and ≤80	N/A
F	> 50	> 50	ANY

[1] The LOS criteria apply to each lane on a given approach and to each approach on the minor street. LOS is not calculated for major-street approaches or for the intersection as a whole.

The detailed results of the existing conditions capacity analysis for the AM peak hour are shown in **Table 2**. **Figure 3** shows the level of service summary during the AM peak hour. **Table 3** shows the detailed results of the PM peak hour capacity analysis. **Figure 4** shows level of service summary during the PM peak hour. Detailed capacity analysis worksheets are attached as **Appendix D**.

Table 2 – Existing AM Peak Hour Intersection Capacity Analysis

Intersection Name	Control Type	Worst Movement	V/C	Delay (s/veh)	LOS
North Avenue at Wood Street	Signalized		0.09	7.8	A
North Avenue at Swissvale Avenue	Signalized		0.33	12.3	B
Wallace Avenue at Wood Street	Signalized		0.28	16.1	B
Wallace Avenue at Center Street	Signalized		0.36	20.5	C
Wallace Avenue at Swissvale Avenue	Signalized		0.23	15.1	B
Penn Avenue at Wood Street	Signalized		0.64	18.0	B
Ross Avenue at Wood Street	Signalized		0.20	15.4	B
Ross Avenue at Center Street	All-way stop	EBT	N/A	7.7	A
Ross Avenue at Swissvale Avenue	Signalized		0.22	10.6	B
South Avenue at Wood Street	Signalized		0.47	15.3	B
Franklin Avenue at Wood Street	All-way stop	WBL	N/A	9.6	A
Franklin Avenue at Swissvale Avenue	Signalized		0.45	24.6	C
Rebecca Avenue at Swissvale Avenue	Signalized		0.31	13.3	B

Figure 3 – Existing AM Level of Service

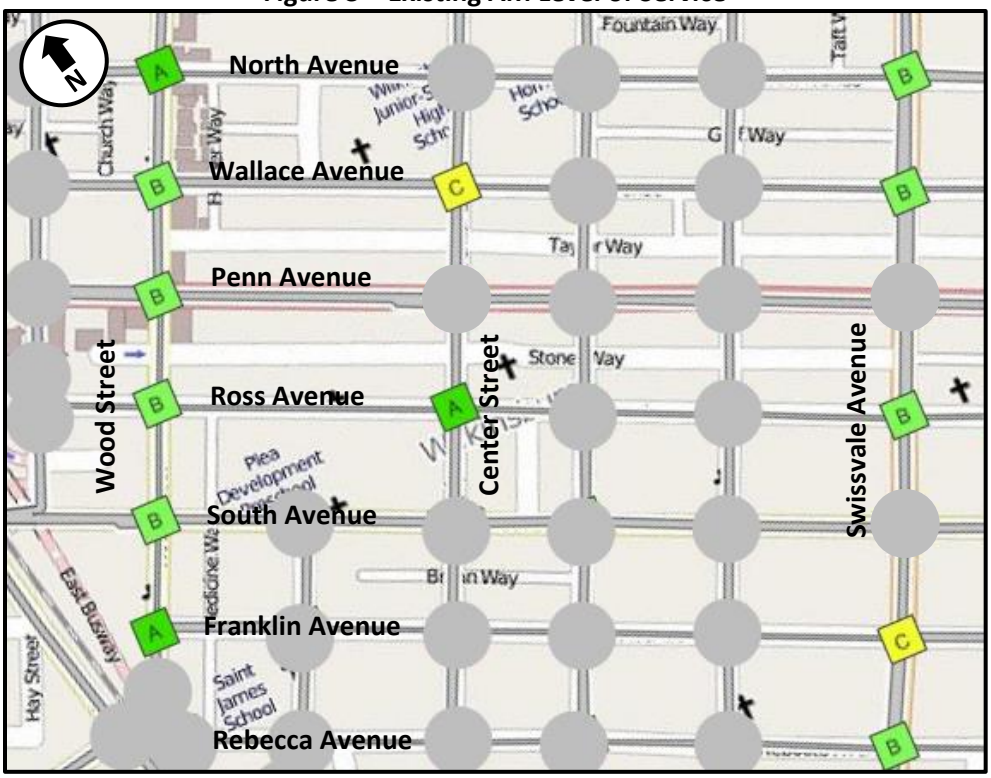
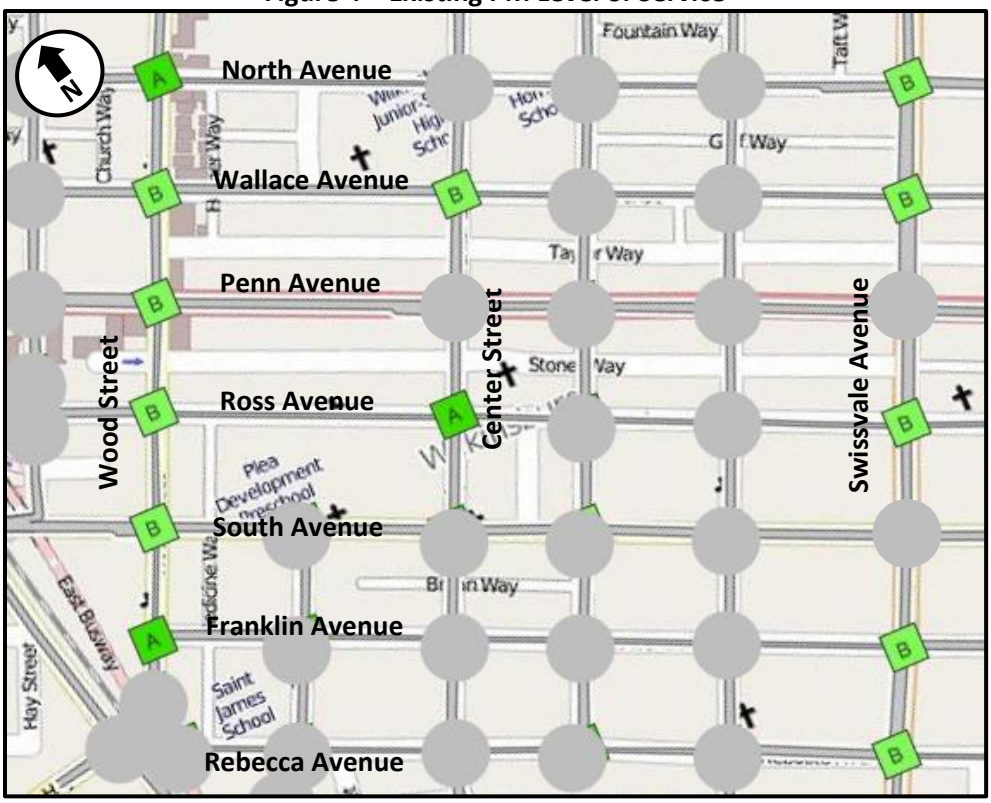


Table 3 – Existing PM Peak Hour Intersection Capacity Analysis

Intersection Name	Control Type	Worst Movement	V/C	Delay (s/veh)	LOS
North Avenue at Wood Street	Signalized		0.19	8.7	A
North Avenue at Swissvale Avenue	Signalized		0.22	11.1	B
Wallace Avenue at Wood Street	Signalized		0.20	13.3	B
Wallace Avenue at Center Street	Signalized		0.22	14.4	B
Wallace Avenue at Swissvale Avenue	Signalized		0.21	13.3	B
Penn Avenue at Wood Street	Signalized		0.64	17.4	B
Ross Avenue at Wood Street	Signalized		0.25	15.2	B
Ross Avenue at Center Street	All-way stop	EBT	N/A	8.9	A
Ross Avenue at Swissvale Avenue	Signalized		0.36	14.8	B
South Avenue at Wood Street	Signalized		0.28	11.6	B
Franklin Avenue at Wood Street	All-way stop	WBL	N/A	7.6	A
Franklin Avenue at Swissvale Avenue	Signalized		0.19	11.6	B
Rebecca Avenue at Swissvale Avenue	Signalized		0.35	16.5	B

Figure 4 – Existing PM Level of Service



The results of the existing conditions capacity analyses show all study intersections performing at LOS C or better during the AM and PM peak hours. At unsignalized intersections, the delay of the worst movement is considered the primary measure of performance, as the uncontrolled movement (movement without the stop sign) typically experiences no delay. The worst movements at the unsignalized study intersections operate at LOS A. In urbanized areas, LOS D is generally acceptable; therefore the results of the existing conditions capacity analysis show acceptable performance and suggest that the study intersections have additional capacity.

III. One-Way to Two-Way Conversion

A primary purpose of this report is to project and evaluate operating conditions within the critical study area following the conversion of the existing one-way roads within the Borough to two-way. As discussed in Section II, regional travel demand data and a select link analysis from the SPC was provided to aid in the development of two-way volumes based on existing travel patterns. Additionally, assumptions were made on the limits of two-way travel to minimize cut-through traffic and expensive intersection/signal modification on roadways outside of the Borough's central grid network. **Table 4** outlines the recommended limits of the two-way conversions of existing one-way roads within the Borough.

Table 4 – Two-Way Conversion Limits

Road Name	Existing One-Way Direction	Proposed Western Limit of 2-Way Conversion	Proposed Eastern Limit of 2-Way Conversion
North Avenue	Eastbound	Wood Street (existing two-way to the west)	Swissvale Avenue
Wallace Avenue	Westbound	Wood Street (existing two-way to the west)	Swissvale Avenue
Ross Avenue	Eastbound	Hay Street	Swissvale Avenue
Franklin Avenue	Westbound	Wood Street	Swissvale Avenue
Rebecca Avenue	Eastbound	Spur to Wood Street	Swissvale Avenue
Wood Street	North	Rebecca Avenue (Southern Limit)	Penn Avenue (existing two-way to the north)

A. Traffic Volume Assignment Methodology

Westbound Traffic

To reduce the potential for cut-through traffic and avoid expensive intersection modifications along SR 8 to the east, Swissvale Avenue was assumed as the eastern terminus for the one- to two-way conversions. Based on these limits, the traffic volume assignment to the new direction of travel was based on a reassignment/diversion of existing turning movements on Swissvale Avenue. For the purpose of this study, vehicles turning from Swissvale Avenue to travel west were assumed to continue to destinations west of the study area. Westbound through traffic was diverted and redistributed to the new two-way paths as follows:

- 50% through trips diverted from Franklin Avenue
- 33.3% through trips diverted from South Avenue
- 33.3% through trips diverted from Penn Avenue
- 33.3% through trips diverted from Wallace Avenue

Eastbound Traffic

Unlike Swissvale Avenue to the east, the western limit of the study area does not have a defining road which serves the majority of inbound traffic that can take advantage of new two-way streets; therefore the reassignment projections of vehicles did not rely on diverting and reassigning turning movements, but rather diverting regional through trips entering the network to take advantage of alternate routes to Penn Avenue, South Avenue, and Rebecca Avenue. Because North Avenue and Ross Avenue have low volumes and do not provide a direct connection to the west, no trips were diverted from these roads. Westbound through traffic was diverted and redistributed to the new two-way paths as follows:

- 25% through trips diverted from Penn Avenue
- 25% through trips diverted from South Avenue
- 25% through trips diverted from Rebecca Avenue

Southbound Traffic

For projecting the traffic volumes that will utilize Wood Street if it were two-way, the traffic volumes on parallel routes in the new direction (southbound) were analyzed. It was assumed that providing for southbound travel on Wood Street would divert traffic from the parallel routes as follows:

- 50% through trips diverted from Center Street
- 50% through trips diverted from Hay Street

Figure 5 shows the projected traffic volumes at the study intersections following the conversion of one-way roads to two-way. **Appendix E** includes figures showing the diversion and reassignment of volumes from existing roadways to the new direction of travel on the roads being studied for two-way conversion.

B. Two-Way Conversion: Intersection Capacity Analysis

Based on the projected traffic volumes assuming one- to two-way conversion on the study roadways, capacity analyses were run for all study intersections to determine the impact. To accommodate the opposite direction at signalized intersections on existing one-way roads, the new movements were modeled as utilizing the same existing phases as the opposing approach (i.e., eastbound green = westbound green with left-turning vehicles yielding to through vehicles).

The detailed results of the capacity analysis for projected conditions compared to existing conditions are shown in **Table 5** for the AM peak hour and **Table 6** for the PM peak hour. **Figure 6** shows the LOS summary for the projected two-way scenario during the AM peak hour, while **Figure 7** shows the LOS summary for the PM peak hour. Detailed capacity analysis worksheets are attached as **Appendix D**.

Figure 5 – Projected Peak Hour Volumes

Table 5 – AM Peak Hour Intersection Capacity Analysis: Existing vs. Two-Way Conversion

Intersection Name	Control Type	Existing			Two-Way Conversion		
		V/C	Delay (s/veh)	LOS	V/C	Delay (s/veh)	LOS
North Avenue at Wood Street	Signalized	0.09	7.8	A	0.12	8.0	A
North Avenue at Swissvale Avenue	Signalized	0.33	12.3	B	0.35	16.2	B
Wallace Avenue at Wood Street	Signalized	0.28	16.1	B	0.24	13.3	B
Wallace Avenue at Center Street	Signalized	0.36	20.5	C	0.25	15.9	B
Wallace Avenue at Swissvale Avenue	Signalized	0.23	15.1	B	0.23	15.2	B
Penn Avenue at Wood Street	Signalized	0.64	18.0	B	0.62	18.9	B
Ross Avenue at Wood Street	Signalized	0.20	15.4	B	0.20	14.7	B
Ross Avenue at Center Street	All-way stop	N/A	7.7	A	N/A	7.9	A
Ross Avenue at Swissvale Avenue	Signalized	0.22	10.6	B	0.23	10.7	B
South Avenue at Wood Street	Signalized	0.47	15.3	B	0.46	14.7	B
Franklin Avenue at Wood Street	All-way stop	N/A	9.6	A	N/A	10.7	B
Franklin Avenue at Swissvale Avenue	Signalized	0.45	24.6	C	0.45	24.6	C
Rebecca Avenue at Swissvale Avenue	Signalized	0.31	13.3	B	0.32	13.8	B

Figure 6 – Two-Way Conversion AM Level of Service

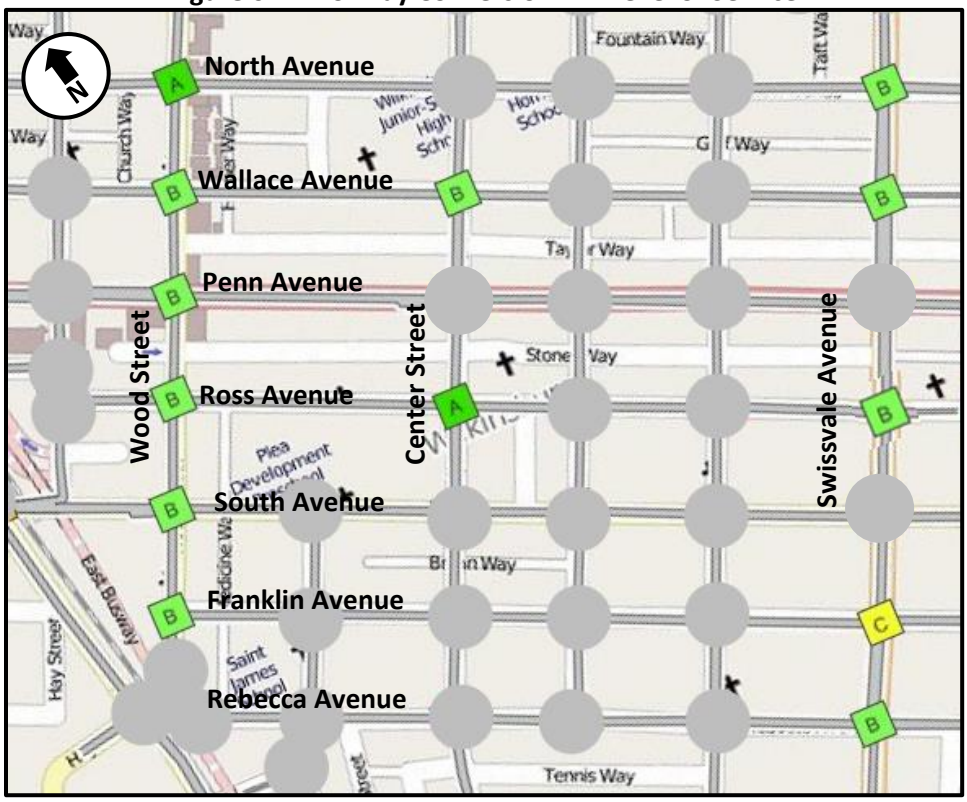
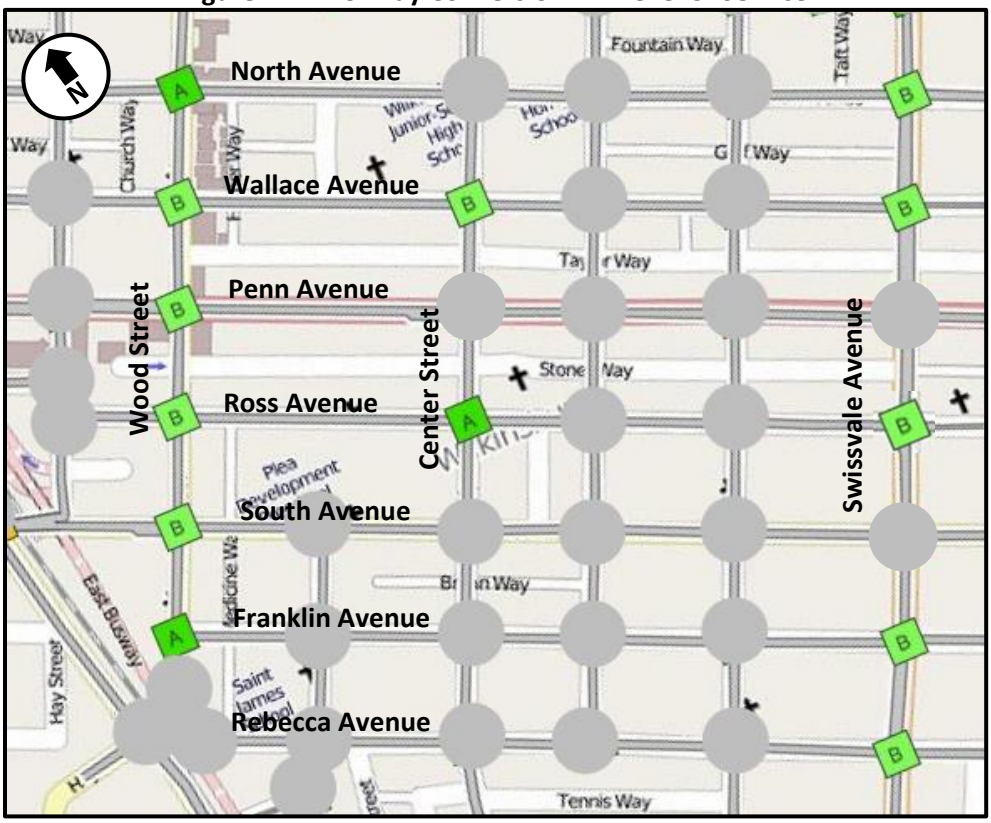


Table 6 – PM Peak Hour Intersection Capacity Analysis: Existing vs. Two-Way Conversion

Intersection Name	Control Type	Existing			Two-Way Conversion		
		V/C	Delay (s/veh)	LOS	V/C	Delay (s/veh)	LOS
North Avenue at Wood Street	Signalized	0.19	8.7	A	0.25	9.1	A
North Avenue at Swissvale Avenue	Signalized	0.22	11.1	B	0.30	12.8	B
Wallace Avenue at Wood Street	Signalized	0.20	13.3	B	0.25	13.8	B
Wallace Avenue at Center Street	Signalized	0.22	14.4	B	0.19	13.9	B
Wallace Avenue at Swissvale Avenue	Signalized	0.21	13.3	B	0.22	13.6	B
Penn Avenue at Wood Street	Signalized	0.64	17.4	B	0.48	17.0	B
Ross Avenue at Wood Street	Signalized	0.25	15.2	B	0.25	14.5	B
Ross Avenue at Center Street	All-way stop	N/A	8.9	A	N/A	8.9	A
Ross Avenue at Swissvale Avenue	Signalized	0.36	14.8	B	0.40	14.6	B
South Avenue at Wood Street	Signalized	0.28	11.6	B	0.24	11.4	B
Franklin Avenue at Wood Street	All-way stop	N/A	7.6	A	N/A	8.3	A
Franklin Avenue at Swissvale Avenue	Signalized	0.19	11.6	B	0.19	11.7	B
Rebecca Avenue at Swissvale Avenue	Signalized	0.35	16.5	B	0.36	15.4	B

Figure 7 – Two-Way Conversion PM Level of Service



The results of the capacity analysis show the projected two-way volumes on the study roadways do not significantly impact operations. Additionally, the low volume to capacity ratios (generally < 0.5) at the study intersections reinforces the flexibility in reconfiguring lane geometry and implementing changes to circulation patterns. All study intersections are projected to operate at an acceptable LOS C or better during both peak hours.

C. Transit Routes

A review of the transit routes through the study area was conducted to analyze the potential impact or benefit to transit operations resultant from the two-way conversion of study roadways. **Table 7** shows the bus routes serving the Borough of Wilkinsburg. The detailed bus route maps are attached as **Appendix F**.

Table 7 – Port Authority Bus Routes in Wilkinsburg

Number Designation	Name of Route	Study Roadways Utilized
61 A, 61 B	North Braddock, Braddock – Swissvale	Wood Street, Ross Avenue, South Avenue, Swissvale Avenue
P68, 68	Braddock Hills Flyer, Braddock Hills	Wood Street, South Avenue, Wallace Avenue, Swissvale Avenue
P 71, 71	Swissvale Flyer, Edgewood Town Center	Wood Street, Wallace Avenue
71D	Hamilton	Wood Street, Wallace Avenue
79	East Hills	Wallace Avenue, Ross Avenue, Swissvale Avenue
P78, 78	Oakmont Flyer / Oakmont	Wallace Avenue, Ross Avenue, Swissvale Avenue
86	Liberty	Wood Street, Wallace Avenue
P2	East Busway Short	South Avenue

Based on the capacity analyses and acceptable levels of service projected, none of the bus routes through Wilkinsburg are projected to be significantly impacted by two-way conversions. Following the two-way conversions of existing one-way roads, the potential exists for consolidated bus routes/stops. Currently many bus routes utilize Wallace Avenue and Ross Avenue as one-way pairs. If both of these roadways are to be converted to two-way, the Port Authority would have flexibility in modifying existing routes to better serve their riders.

D. Traffic Signal Warrant Analysis

Traffic Signal Warrant Analyses were conducted for the projected two-way traffic volumes. In addition to the revised analysis, a review was conducted of a PennDOT *Preliminary Traffic Signal Removal Analysis Summary*, from July, 2013. The traffic turning movement data collection for this project included two-hours during the AM peak, and two hours during the PM peak; therefore the signal warrants analyzed for this report do not include the typical 13-hours of data needed to analyze for 4-

hour and 8-hour volume warrants. However, based on the peak period data, engineering judgment was used to determine if the other hours may or do not likely meet the traffic signal warrants analyzed. The results of the traffic signal warrant analyses for the two-way projected volumes are summarized in **Table 8**. PennDOT signal removal recommendations are attached as **Appendix G**. The detailed traffic signal warrant analysis sheets for two-way volumes are attached as **Appendix H**.

Table 8 – Signal Warrant Analysis Summary

#	Intersection	Meet any Warrants with 2-way Traffic?	Notes
1	North Avenue at Wood Street	No	There is a nearby school
2	Wallace Avenue at Wood Street	No	No warrants met
3	Penn Avenue at Wood Street	Yes	Volume warrants met
4	Ross Avenue at Wood Street	No	No warrants met
5	South Avenue at Wood Street	Potentially	1 hour of 8 hour warrant met, 1 hour of 4 hour warrant met
6	Franklin Avenue at Wood Street	No	No warrants met
7	Center Street at Wallace Avenue	No	No warrants met
8	Center Street at Ross Avenue	No	No warrants met
9	North Avenue at Swissvale Avenue	No	No warrants met
10	Wallace Avenue at Swissvale Avenue	Potentially	1 hour of 8 hour warrant met
11	Ross Avenue at Swissvale Avenue	Potentially	1 hour of 8 hour warrant met, 1 hour of 4 hour warrant met
12	Franklin Avenue at Swissvale Avenue	Potentially	1 hour of 8 hour warrant met, 1 hour of 4 hour warrant met
13	Rebecca Avenue at Swissvale Avenue	Potentially	1 hour of 8 hour warrant met, 1 hour of 4 hour warrant met

The results of the signal warrant analyses show the majority of study intersections will not likely meet any signal warrants with 2-way traffic. The intersection of Penn Avenue and Wood Street does meet volume warrants for a signal.

E. Cross-Section Alternatives

The relatively narrow 30-foot roadway widths in the study area limit the opportunities for providing all of the following three elements:

- Parking on Both Sides
- Two-Way Operation

- Bicycle Lanes or Cycle Tracks

With two-way operation and the assumption of 10-11' travel lanes the following configurations are applicable to the reconfiguration of the existing one-way roads:

- Remove parking on one-side – 8' parking, two 11' travel lanes
- Keep parking on both sides and design as a "Yield Street" – 7' parking, 16' two-way unmarked travel way, 7' parking

A Yield Street involves a narrow two-way road with parking on both sides, in which one of two oncoming vehicles have to yield right-of-way and slow down and/or pull over to allow for the vehicle in the opposing direction to pass. An example of a yield street currently exists in Wilkinsburg on North Avenue between Pitt Street and Wood Street. Yield Streets are ideal for residential areas with low traffic volumes and a low utilization of parking to provide gaps for vehicles to pull over when passing. Although these roadways are often interpreted as bothersome to drivers, the narrow travel way and need to yield right-of-way generally slows drivers and increases their attentiveness, thus increasing safety.

F. Bicycle Facilities

In addition to projecting traffic volumes and performing capacity analyses at the study intersections, an objective of this study was to investigate and recommend opportunities to incorporate bicycle infrastructure into the Borough's roadway network. The existing on-street bicycle routes defined by *Bike Pittsburgh* are South Avenue, Hay Street, Wood Street, and Swissvale Avenue. The lack of bicycle infrastructure on these routes decreases the likelihood of attracting new riders that are not comfortable biking with cars and trucks.

As part of the correspondence with the Wilkinsburg Community Development Corporation, the desire was expressed to have bicycle lanes to the north and south of Penn Avenue to better serve east/west movements. Connections to existing on-street bicycle facilities and popular destinations were considered in the development of recommendations. The following potential cycling destinations were identified to the east and west:

- Frick Park to the West
- Pittsburgh Downtown and East Liberty to the West
- Busway Parking Lot to the West
- Existing Bike Route on Montier Street to the Northeast
- Existing Bike Route on Brinton Street to the Southeast

Wallace Avenue was identified as an ideal roadway for bicycle facilities due to its close proximity to Penn Avenue and destinations in the central business district, and direct connection to the existing Busway parking lot, which could accommodate bicycle racks and/or bicycle lockers for commuters.

Ross Avenue was identified as the roadway to the south that would provide an east/west connection similar to South Avenue, but with less vehicular traffic and an opportunity to provide separated facilities without impacting existing traffic circulation.

Additional roadways with the available width to accommodate bicycle facilities include Hay Street, Wood Street to the north, and Swissvale Avenue.

IV. Findings and Recommendations

Based on the findings of the traffic analysis, recommendations were developed to provide the following:

- Strategic conversion of one-way roads to two-way
- Traffic Signal Removal, Retainage and/or Upgrade
- Network connectivity
- Traffic calming
- Bicycle facilities and connections to existing infrastructure
- Potential for the consolidation of bus routes

The traffic analysis projects that the conversion of all study roadways from one-way to two-way will result in acceptable conditions at all study intersections. Because no new trips are projected to be generated as a result of two-way conversions, changes to circulation patterns are projected to divert existing vehicles to other routes rather than increasing the volume into the study network; therefore similar results to that of existing conditions and the projected two-way conditions are expected if selected roadways are kept one-way to provide room for alternate modes.

A. Cross-Section Recommendations

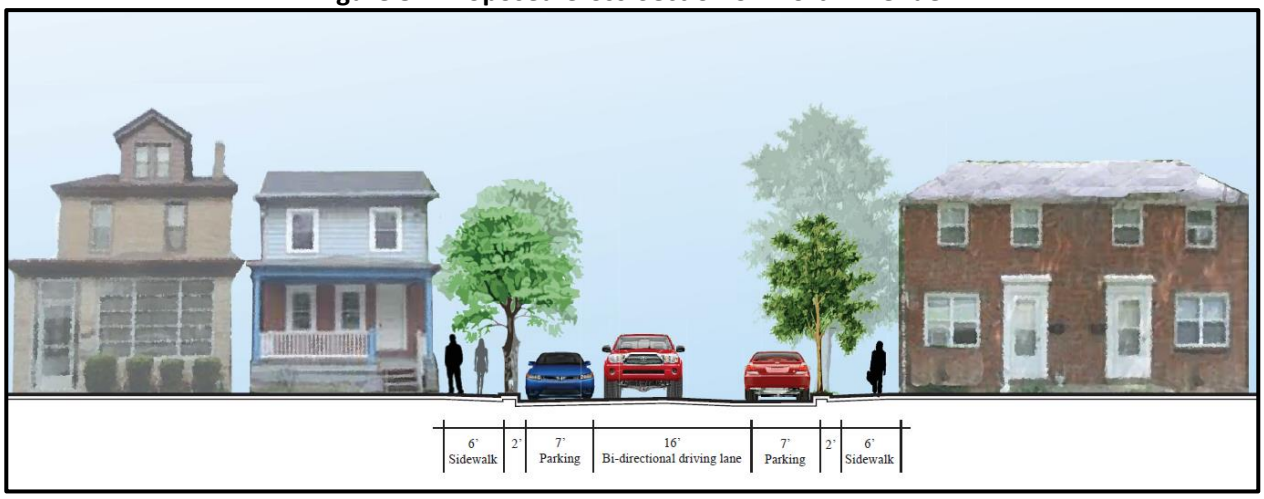
Based on analyzing what can be provided within the existing 30-foot roadways, and the results of the traffic analysis combined with the other goals of the study, recommendations were developed for each study roadway.

North Avenue

North Avenue is proposed to be converted from one-way to two-way operation between Swissvale Avenue to Wood Street. There is an existing two-way section of North Avenue between Pitt Street and Wood Street including parking on both sides. This “Yield Street” cross-section is recommended to be extended to Swissvale Avenue. All existing parking restrictions are recommended to remain. Because

North Avenue is primarily residential, has low utilization of existing parking, and has low vehicular traffic volumes, the two-way Yield Street is projected to perform acceptably, improving circulation through two-way operation and providing a traffic calming effect. **Figure 8** shows the proposed cross-section on North Avenue.

Figure 8 – Proposed Cross-Section on North Avenue



Wallace Avenue

Wallace Avenue is proposed to be converted from one-way to two-way, with parking restricted on the north-side from Pitt Street to Swissvale Avenue. Existing parking is currently restricted along the majority of the north-side of Wallace Avenue. By keeping the parking restriction on the north-side of the road, two travel lanes will result in few parking losses, while accessing destinations along Wallace Avenue will be easier for motorists.

Although the traffic analysis does not project a great increase in cut-through traffic, the proximity to the Busway parking lot increases the likelihood of through traffic bypassing Penn Avenue and using Wallace Avenue to travel eastbound in the evening. If the increase in cut-through traffic is perceived as too great, a one-way conversion of the block between Pitt Street and Hay Street would prevent eastbound cut-through traffic from the Busway parking lot. The rest of Wallace Avenue would benefit from two-way operation and improved circulation. **Figure 9** shows the proposed cross-section on Wallace Avenue.

Figure 9 – Proposed Cross-Section on Wallace Avenue

Ross Avenue

Ross Avenue is proposed to remain one-way with existing parking remaining on both sides. To improve connectivity for cyclists, the following cross-section is recommended:

- 7' parking
- 5' contraflow bicycle lane
- 10' one-way travel lane
- 8' parking

Keeping Ross Avenue one-way allows the additional space to be utilized by bicycles in the opposing direction of automobile travel. Stop signs specifically for cyclists would be provided in the opposing direction of automobile travel. Cyclists traveling in the same direction as other vehicles would travel in the same lane as cars, as demarcated by "Sharrows," which increase drivers' awareness of cyclists on the roadway and reinforce the correct direction of travel. **Figure 10** shows an example of a successfully implemented contraflow bicycle lane on a one-way, 30-foot roadway in Washington, D.C. The same cross-section as shown in Figure 10 is proposed on Ross Avenue between Hay Avenue and Swissvale Avenue.

Figure 10 – Example of Contraflow Bicycle Lane on One-Way Road

Franklin Avenue

Franklin Avenue is proposed to be converted from one-way to two-way operation between Wood Street and Swissvale Avenue. Similar to North Avenue, Franklin Avenue is primarily residential, exhibits low vehicular traffic volumes, and has low utilization of existing parking; therefore it is recommended to be converted to a two-way Yield Street. **Figure 8** shows the proposed cross-section on Franklin Avenue.

Rebecca Avenue

Rebecca Avenue is proposed to be converted from one-way to two-way operation between the spur to Wood Street and Swissvale Avenue. To accommodate two travel lanes, elimination of parking on the south-side of Rebecca Avenue is recommended. Elimination of the south-side parking is projected to result in fewer impacts to parking and drop-off zones than if the north-side parking were eliminated. A "Yield Street" is not ideal along Rebecca Avenue because of higher existing/projected traffic volumes and the institutional land uses toward the west. At the spur to Wood Street, it is recommended to prohibit a left-turn onto the Rowland Connector, and to force a right-turn onto Wood Street. This turn prohibition is recommended to prevent cut-through traffic in the new direction while serving vehicles destined to the central business district. Similar to the configuration proposed on Wallace Avenue, **Figure 9** shows the proposed cross-section on Rebecca Avenue.

Wood Street

Wood Street is proposed to be converted from one-way to two-way operation between the existing two-way sections at Franklin Avenue and Penn Avenue. To accommodate two travel lanes, elimination of parking on one of the sides is recommended. Because the land-uses, existing parking utilization, and provision of off-street parking lots vary between blocks, using pavement markings to shift the travel lanes is recommended to provide the following configuration:

- Parking removal on west side between Ross Avenue and Penn Avenue
- Parking removal on east side between Ross Avenue and South Avenue
- Parking removal on west side between South Avenue and Franklin Avenue

Approximately 18 metered spaces would be eliminated to provide room for the southbound travel lane with the recommended configuration above. **Figure 11** shows the proposed cross-section on Wood Street, although the parking is recommended to switch sides depending on the block.

Figure 11 – Proposed Cross-Section on Wallace Avenue

Based on the recommendation of parking removal on Wood Street in front of Wood Towers, coordination with the property manager is recommended to encourage off-site passenger loading behind the building. Additional coordination with business owners will be needed to finalize parking removal recommendations.

B. Lane Configuration Recommendations

Locations where new directions of travel are recommended were modeled with single shared through/turn lanes. Where the roadway width does not allow for an existing lane configuration (separate turn lane) due to the new direction of travel, the existing lane configuration was changed in the model to reflect a single shared through/turn lane. The results of the analysis show acceptable performance at all study intersections utilizing the modified lane geometry.

C. Bicycle Facility Recommendations

In addition to the bicycle facility recommendations made along the study roadways, other roadways in the study area were identified as prime opportunities to provide on-street bicycle lanes and/or shared-lane markings. On multiple sections of Swissvale Avenue, the lack of on-street parking and wide travel lanes creates opportunities for on-street bicycle lanes and narrower travel lanes. This roadway would create an ideal north-south connection for cyclists. Wide sections of Hay Street and Wood Street also present opportunities for the marking of on-street bicycle lanes with no negative impact on traffic operations. Further study is recommended to finalize the limits and proposed operations of bicycle facilities along these routes.

D. Signal Removal Recommendations

Recommendations for signal removal were not solely based on signal warrants, but also included engineering judgment taking into consideration driver expectation and the potential for future growth attributed to redevelopment/revitalization efforts. The majority of signal recommendations that counter the signal warrant analysis results are on Swissvale Avenue. Because Swissvale Avenue serves as the major north/south roadway into/out of the Borough of Wilkinsburg, new trip generators in the central business district will increase traffic on Swissvale Avenue more so than on the east/west roadways, as east/west travel has multiple parallel routes. Due to the expensive cost of new signal construction, and the potential for growth along the corridor, it is recommended to keep the signals along Swissvale Avenue. **Table 9** includes the signal removal recommendations at the critical study intersections. At intersections where signal removal is recommended, results from the PennDOT study evaluating sight distance are included in the table.

Table 9 – Signal Removal Recommendations

#	Intersection	Signal Recommendation	PennDOT Sight Distance Evaluation	Traffic Control Recommendation
1	North Avenue at Wood Street	Remove	Not Met for NW Bound North Avenue Approach	All-Way Stop
2	Wallace Avenue at Wood Street	Remove	Limited Sight Distance	All-Way Stop
3	Penn Avenue at Wood Street	Keep Signal		
4	Ross Avenue at Wood Street	Remove	Limited Sight Distance	All-Way Stop
5	South Avenue at Wood Street	Keep Signal		
6	Franklin Avenue at Wood Street	Keep Stop-Controlled		
7	Center Street at Wallace Avenue	Keep Signal[1]		
8	Center Street at Ross Avenue	Keep Stop-Controlled		
9	North Avenue at Swissvale Avenue	Keep Signal		
10	Wallace Avenue at Swissvale Avenue	Keep Signal		
11	Ross Avenue at Swissvale Avenue	Keep Signal		
12	Franklin Avenue at Swissvale Avenue	Keep Signal		
13	Rebecca Avenue at Swissvale Avenue	Keep Signal		

[1] Recommendation to keep signal based on community input and proximity to high school.

E. Cost Estimate

Based on the recommendations in this report, a cost estimate was developed for the engineering costs for completion of the traffic studies, the design of the improvements for implementation, and the construction/implementation of the improvements. **Table 10** includes the conceptual level cost estimate.

Table 10 – Cost Estimate for Recommendations and Design

#	Description of Work	Unit Cost	Units	Quantity	Total
1	Remove and Dispose/Salvage Existing Signal Equipment	$10,000	Per Signal	3	$30,000
2	Removal of Existing Pavement Markings and Restriping for New Direction	$500	Per Intersection	22	$11,000
3	Three Section Signal Heads[1]	$775	Per Head	4	$3,100
4	Signal Modification (Installation, Wiring/Programming Controller)	$5,000	Per Intersection	4	$20,000
5	Removal of Existing One-Way/Do Not Enter Signs	$200	Per Intersection	22	$4,400
6	Parking Sign Replacement and Removal of Meters	$15,000	Lump Sum	1	$15,000
7	Installation of New Parking Signs	$15,000	Lump Sum	1	$15,000
8	Installation of Temporary "New Traffic Pattern" Signs	$400	Per Intersection	22	$8,800
9	Construction of Bicycle Lanes on Ross Avenue	$10,000	Per Mile	0.47	$4,700
10	Phase 2 Traffic Study for Inclusion of All Impacted Intersections	$40,000	Lump Sum	1	$40,000
11	Design and Modification of Signal Permits (Phase 3)	$15,000	Per Signal	4	$60,000
12	Design Bicycle Lane and Wayfinding Signing	$15,000	Lump Sum	1	$15,000
				Net Total	$227,000
				25% Contingency	$56,750
				Total Estimate for Study, Design, and Construction	**$283,750**

[1]Each intersection on Swissvale Avenue and Wood Street provide one signal head for the proposed new direction

F. Short-Term Recommendations

The recommendations described in this study include the ultimate recommended circulation patterns, signal removals, and changes to parking. In the short-term, cost effective improvements can be made to increase circulation and the overall performance of the roadway network.

Two-Way Yield Streets

Because the two-way yield streets are low volume and do not generally have pavement markings or signals along the majority of their length, the conversion of Franklin Avenue and North Avenue from one-way to two-way is recommended as a cost effective improvement to circulation. These conversions can be completed mostly with signing and minor changes to existing pavement markings.

Signal Upgrades

As part of improving vehicular flow and minimizing both pedestrian and vehicular delay, a retiming of the city signals is recommended.