Appendix: Community Involvement

Community involvement is a key component in making transportation plans work both in process and in implementation. The Moving Greater University Circle Transportation & Mobility Study included a multi-pronged community involvement effort to enable stakeholders to fully understand the project issues, opportunities, and expectations. Through this process, the community actively influenced the study's direction and recommendations, yielding more applicable and readily implementable results. The project's Steering Committee and public agency partners received tailored briefings four times during this phase.

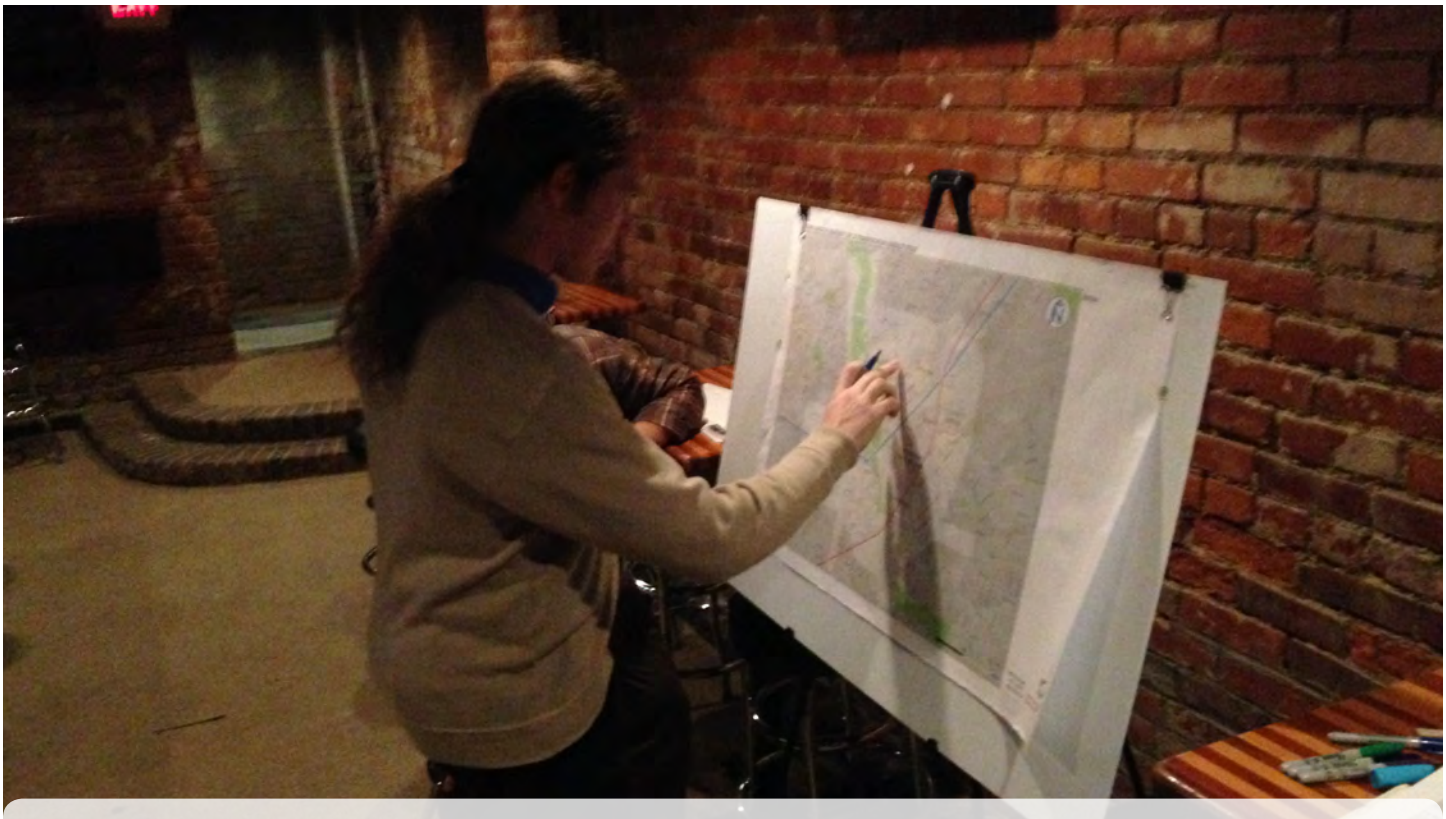
During October and November 2014, the Project Team hosted multiple events to help the community identify mobility issues throughout Greater University Circle. These events provided different, flexible settings so that the community could highlight why they use different modes to travel, where they do and do not travel (and why), and what improvements could be made to improve the complete transportation system. Events included open houses for the general public at highly trafficked locations (midday at Case Western Reserve University, University Hospitals, Cleveland Clinic, and early evening at Constantino's Market) and were coupled with focus group sessions and walking tours for stakeholders from Uptown, Upper Chester, the Cleveland Institute of Art, and the district's bicycling community. During this time, a Wikimap and survey were posted online so the community could participate on their own schedule. In total, over 650 participated in these opportunities, helping influence selection of the 11 focus areas that were identified for in-depth analysis.

Community members discuss proposed changes to University Circle areas

In April 2015, the Project Team presented concepts at open houses at Case Western Reserve University and Maximum Accessible Housing of Ohio, that addressed the issues highlighted by the community. Participants were guided through the recommended changes at the 11 focus areas and were asked about both the recommendations as well as whether these recommendations supported the project's overall goals.

A Wikimap and survey were again posted online with the same information presented at the Open Houses. In total, approximately 500 participants provided feedback, which was incorporated into the concepts presented earlier in this report.

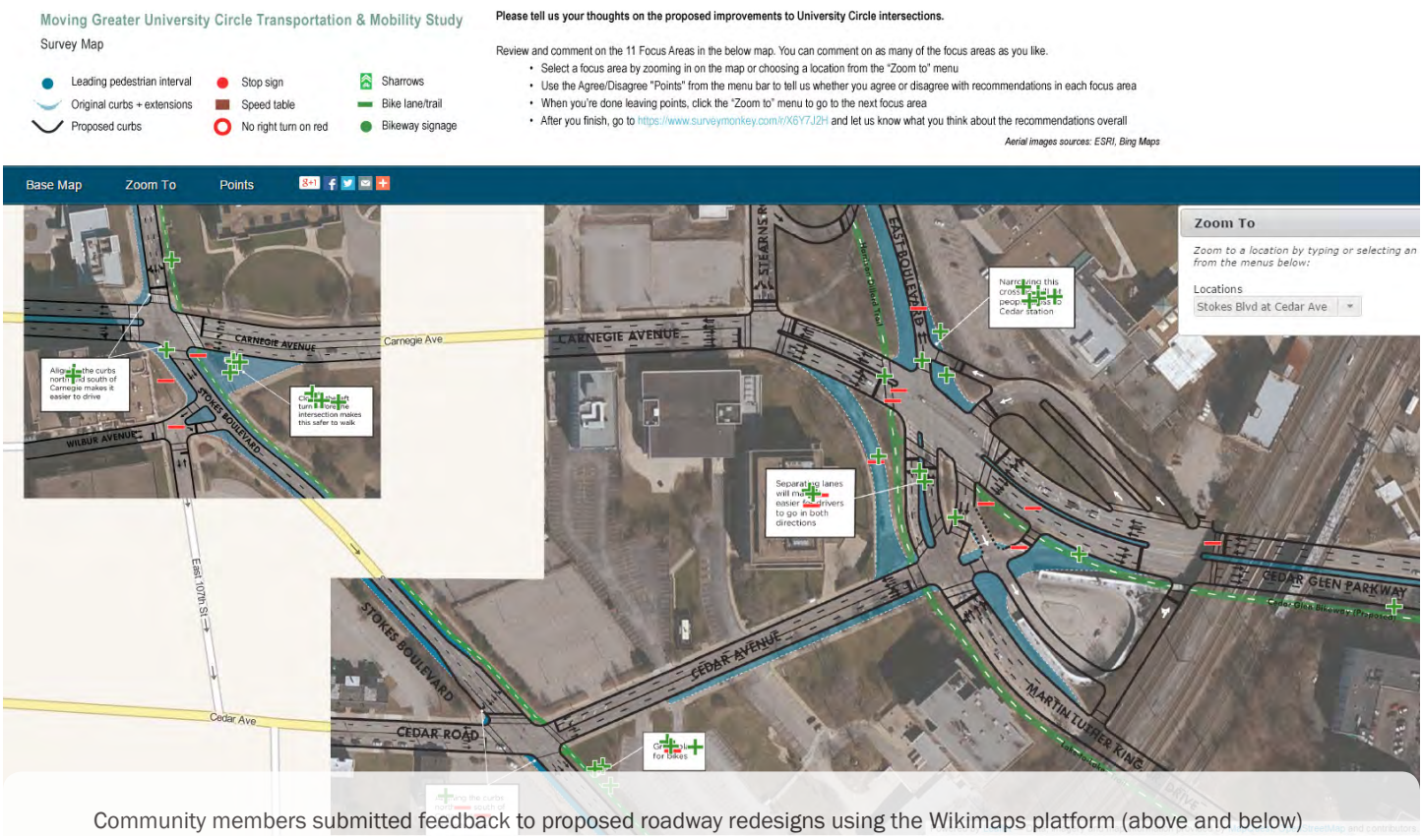
University Circle neighbors discuss proposed changes at a community meeting



A community member marks his thoughts about University Circle on the map

Project leaders discuss proposed changes with CWRU students

Members of the community perform a walking audit of roadway conditions in University Circle



Community members submitted feedback to proposed roadway redesigns using the Wikimaps platform (above and below)

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for a stakeholder survey, interactive map

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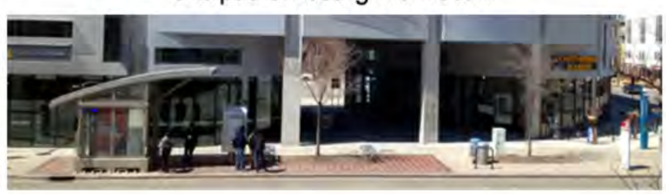

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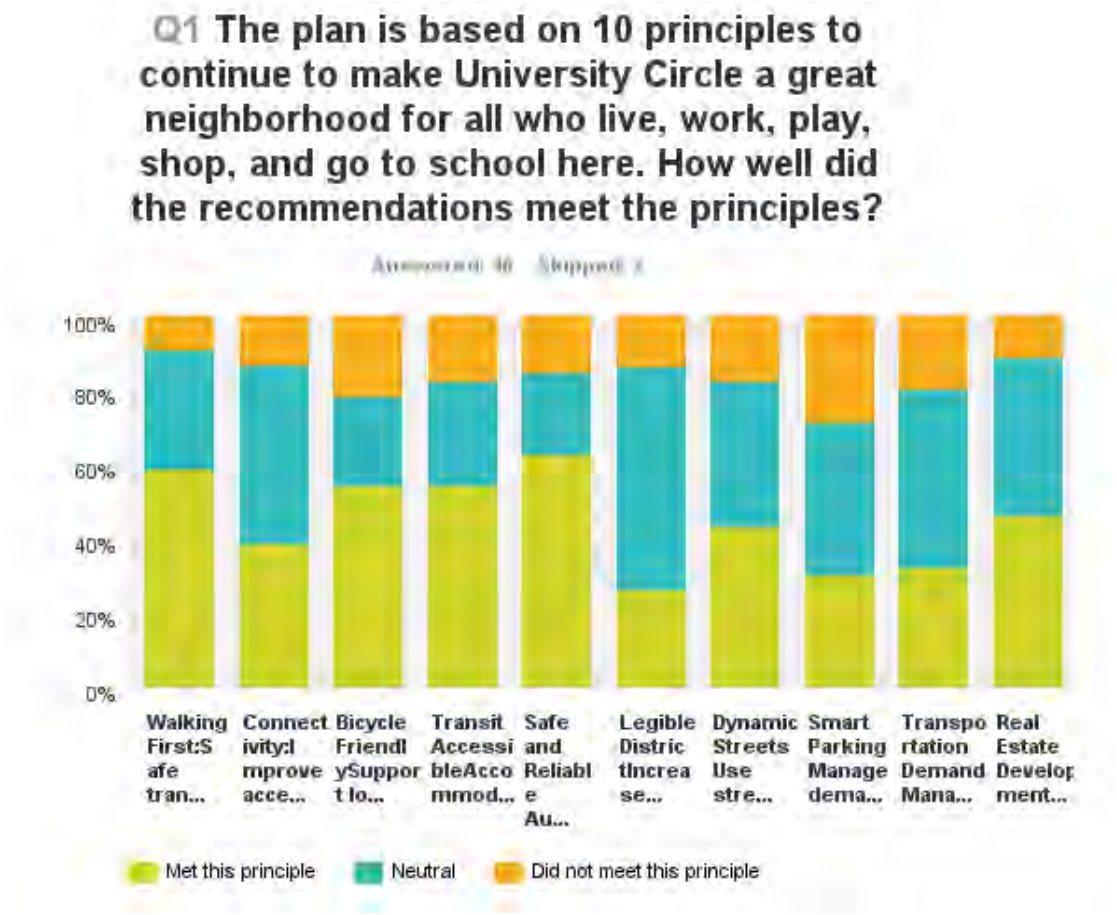
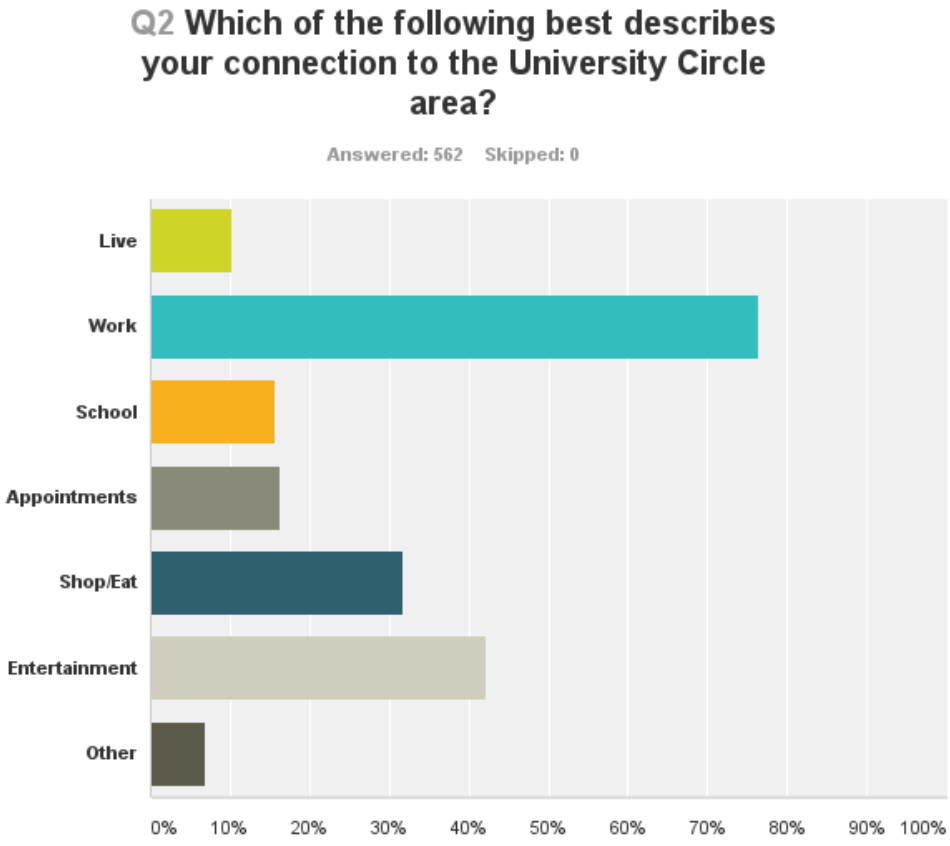
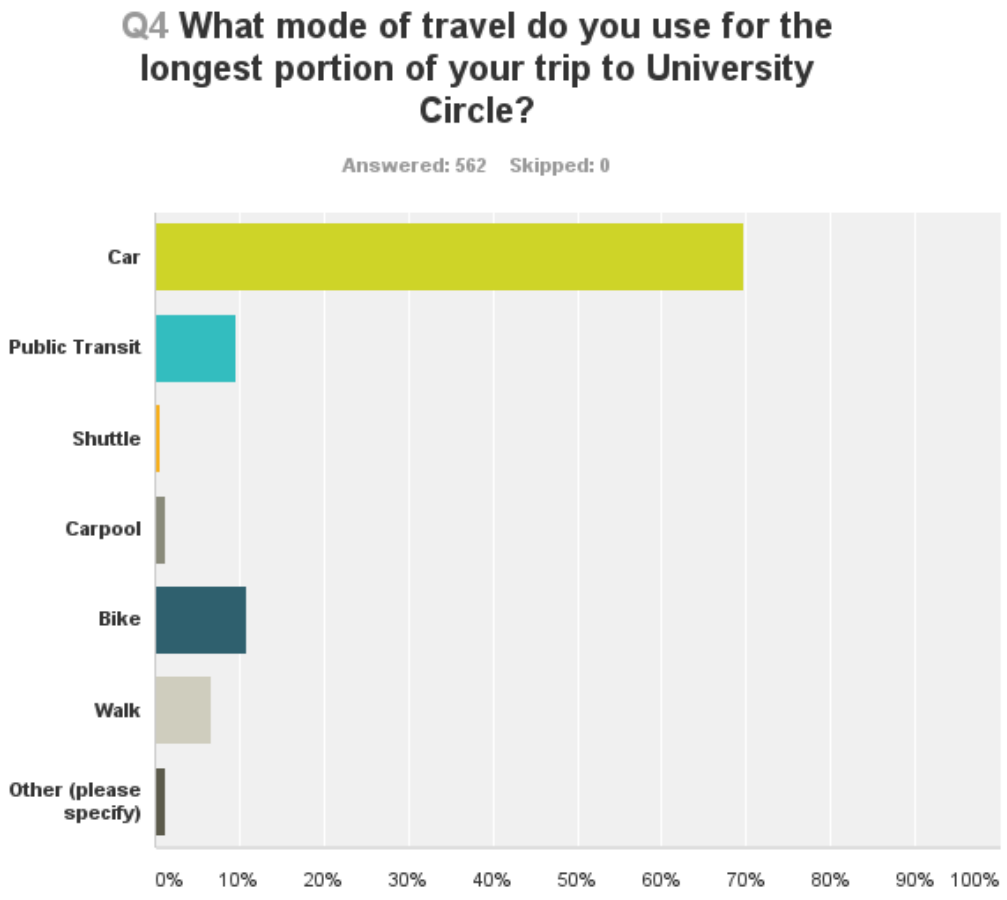
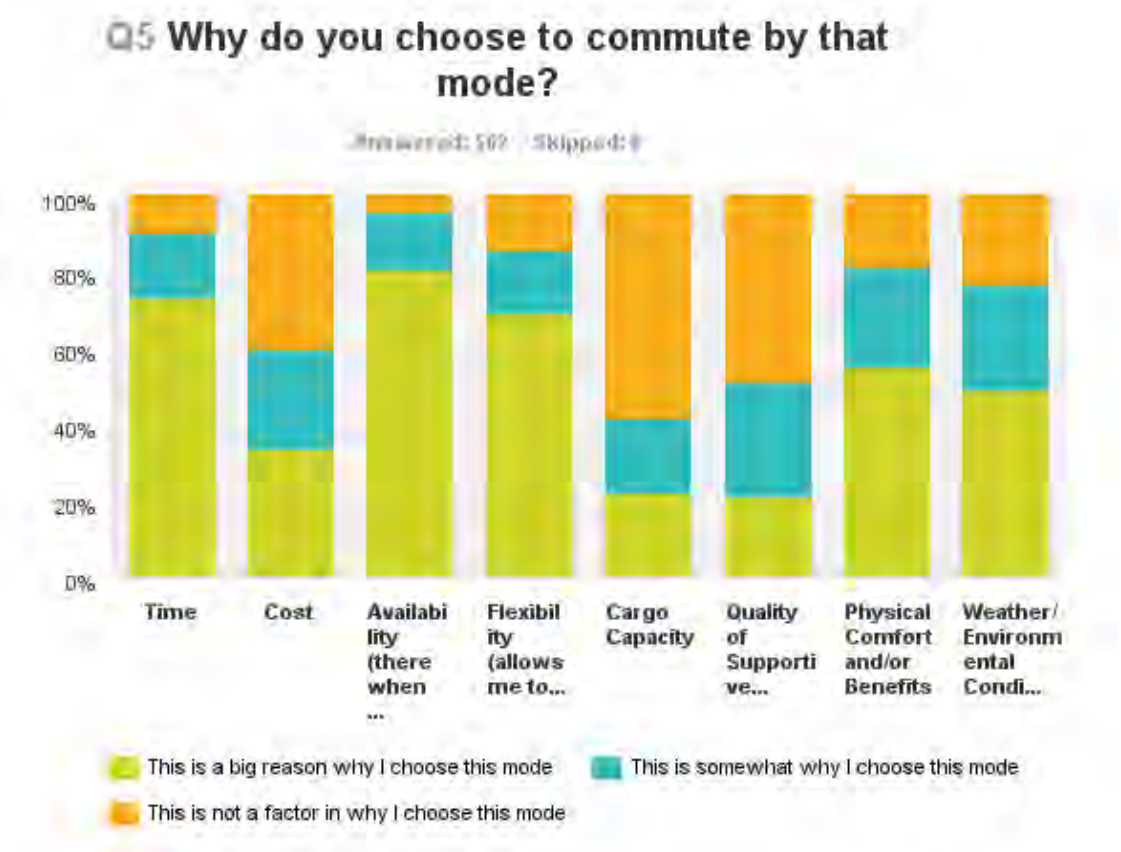
Flier distributed to community members announcing the MGUC online survey.





Results from an online mobility survey distributed to University Circle community members





Results from an online mobility survey distributed to University Circle community members

NELSON NYGAARD

MEMORANDUM

To: Chris Bongorno, University Circle Incorporated

From: Nelson\Nygaard Project Team

Date: March 16, 2015

Subject: Moving Greater University Circle Traffic Analysis

OVERVIEW

The Moving Greater University Circle (MGUC) Transportation Study has focused on understanding and evaluating the comprehensive transportation systems and mobility issues that confront the Greater University Circle District study area. The current Mobility Phase has identified past studies and coordinated a large data collection element including but not limited to traffic counts, pedestrian counts, and bicycle usage. This enabled analysis to be based on multimodal evaluations of capacity during peak periods and comprehensive safety conditions

From the capacity evaluations, field observations, and public feedback, detailed evaluation of eleven (11) focus areas was performed leading to conceptual recommendations and evaluation of the potential change in traffic conditions with the proposed designs being implemented. These focus areas included:

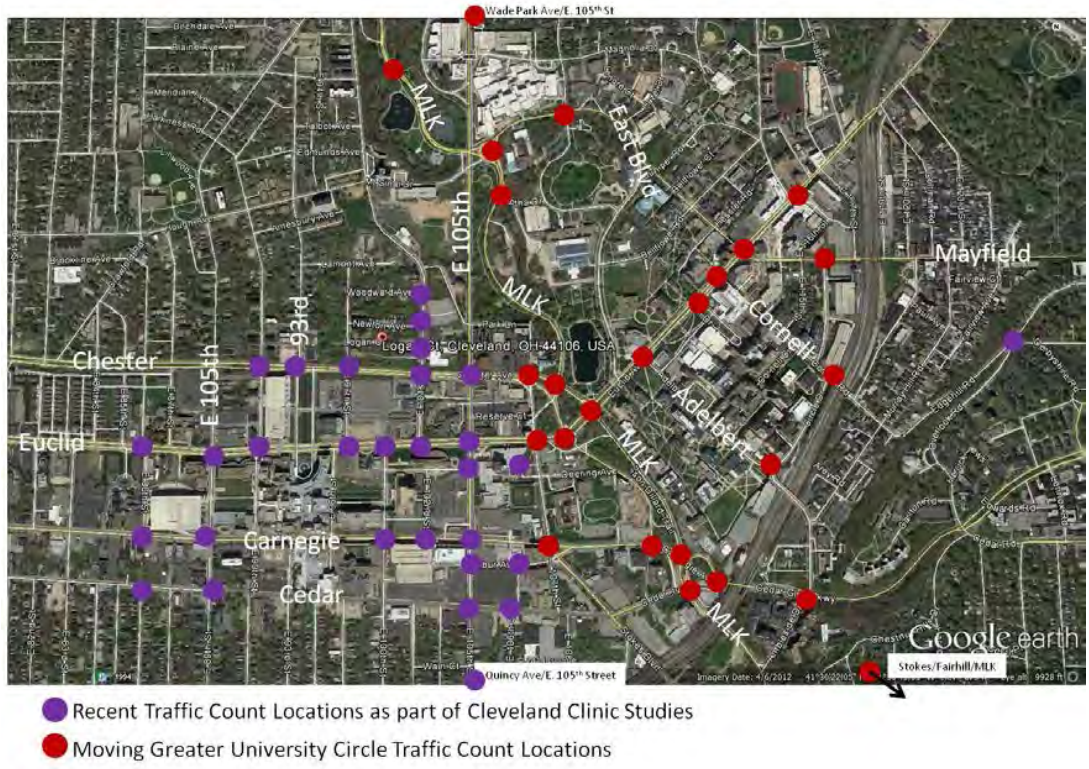
1. Chester Avenue at E 93rd
2. South Wade Park
3. Euclid Ave/Chester Ave/Stokes Blvd
4. E 107th at Carnegie Avenue
5. Stokes Blvd at Cedar Avenue
6. University-Cedar Train and Bus Station area
7. MLK Drive at Fairhill Road
8. CWRU North Campus
9. Euclid Avenue Uptown
10. Euclid Ave, Ford Road and Mayfield Road
11. Euclid Heights Blvd at Cedar Blvd

This memorandum outlines the data collection effort and the traffic analysis methodology and results for the proposed scenarios including a focus on vehicle operations along the Euclid Avenue corridor within the study area.

DATA COLLECTION

The MGUC study area consists of a complex transportation network covering approximately one-square mile. Traffic count data was collected by TMS Engineers during the Fall of 2014 and this was combined with data collected as part of on-going Cleveland Clinic studies in October 2013 and June 2014. In total 55 intersections were included in the data collection effort and these are shown in Figure 1. It is noted that roadway construction activity along the MLK Dr corridor was on-going during the Fall of 2014 which affected data collection at East Blvd., E 105th St., and Jeptha Dr. Follow-up counts at these locations are recommended to obtain traffic counts under fully operational conditions.

Figure 1 Map of Traffic Count Locations



A full listing of intersections and the date of data collection is included as Appendix A. NOACA provided crash statistics for 2008-2012 which is also included in Appendix A; this data is used to contextualize traffic conditions at focus areas for transportation design recommendations.

TRAFFIC ANALYSIS METHODOLOGY

Synchro (version 9) traffic analysis software was used to analyze the intersections within the MGUC study area as highlighted in Figure 1. The following settings and assumptions were used for traffic evaluation using Synchro:

- Traffic counts at 25 intersections, as agreed upon by the stakeholders, were undertaken in the Fall of 2014 (see Appendix A).
- Traffic counts over 9 hours (7-10am, 11am – 2pm, 3pm-6pm).
- Traffic counts included Cars, Trucks, Buses, Pedestrian, and Bicyclists. These counts were included within the Synchro model at all intersections including heavy vehicle percentages.
- The Peak Hour Factor for each approach was calculated and included in the Synchro model.
- Transit-only lanes were not entered into the model as they contain 100% bus volumes and are only applicable to Euclid Avenue in this study area.
- Signal timing sheets were obtained from the City of Cleveland (on Dec 3rd 2014) for each intersection and entered accordingly for both the AM and PM model.
- Bus volumes and the number of buses stopping on each roadway were included as bus blockages where appropriate.
- Lane configuration and turn restrictions were field checked during the traffic count process.
- The future development scenarios include proposed growth within the Greater University Circle District utilizing ITE Trip Generation rates, NOACA TAZ mode splits and trip distribution, and real estate development anticipated by University Circle, Inc. (see Appendix B).
- An initial 10% reduction in vehicular trip generation was assumed for the study area for the Transportation Demand Management scenario.

Two key indicators are used to analyze the road network, Level of Service (LOS) and average delay. Vehicular LOS is the National Cooperative Highway Research Program's (NCHRP) Highway Capacity Manual measure of vehicular quality of service of a roadway. Figure 2 describes the typical vehicular travel delay associated with the grade ratings of LOS.

Figure 2 Vehicular LOS Ratings[1]

LOS	Signalized Intersection	Unsignalized Intersection
A	≤10 sec	≤10 sec
B	10-20 sec	10-15 sec
C	20-35 sec	15-25 sec
D	35-55 sec	25-35 sec
E	55-80 sec	35-50 sec
F	≥80 sec	≥50 sec

Traffic conditions were evaluated under five scenarios to account for proposed development activity (incorporating population and employment growth) for the study area, conceptual design changes to the roadways, and introduction of transportation demand management (TDM) measures.

The five scenarios evaluated were:

1. Existing conditions, to serve as a system baseline.
2. Future conditions with planned developments (resulting in resident, visitor, and employment growth).
3. Future conditions with proposed transportation recommendations and no planned development.
4. Future conditions with development induced growth **and** proposed transportation design recommendations.
5. Future conditions with development induced growth, transportation design recommendations, and moderate TDM measures implemented.

Existing Conditions

The existing conditions scenario serves as a baseline of the Greater University Circle District transportation system. The scenario includes current roadway design, lane configuration, traffic signal timings and traffic counts.

Future with Development Growth

This scenario evaluated population, visitor, and employment growth resulting from planned developments within the study area. Utilizing ITE Trip Generation rates and NOACA TAZ mode splits and trip distribution, the proposed growth was added to the existing conditions Synchro model to analyze future traffic conditions.

[1] NCHRP. Highway Capacity Manual 2010

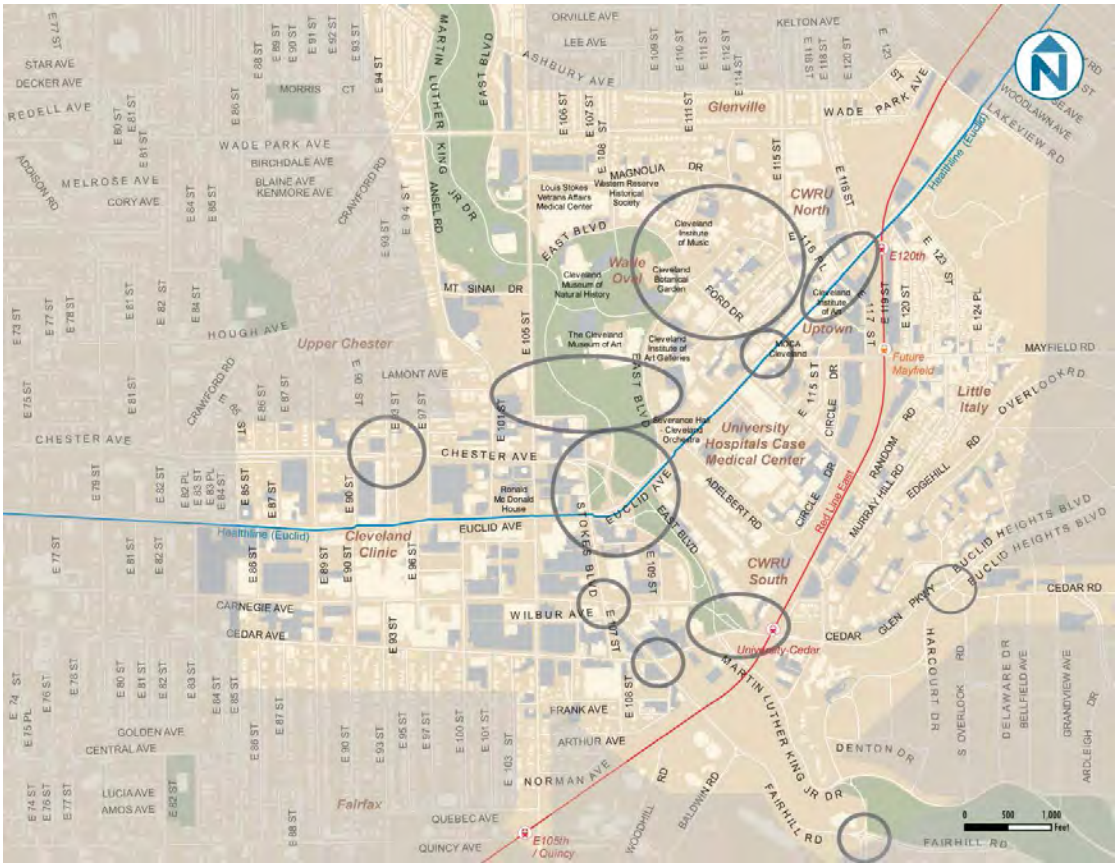
Future with Transportation Recommendations

Through the Mobility Phase of the Moving Greater University Circle study, eleven (11) focus areas were selected for site specific conceptual recommendations. These recommendations were based on field observations, traffic analysis, crash history, and public input. The focus areas are show in Figure 3. The conceptual design recommendations focus on helping University Circle to continue to grow while accommodating and encouraging travel by all modes through mobility strategies such as:

- Walking First
- Connectivity
- Bicycle Friendly
- Transit Accessible
- Safe and Reliable Auto Access
- Legible District
- Dynamic Streets
- Smart Parking
- Transportation Demand Management
- Real Estate Development

The focus areas and the associated recommendations are outlined in detail in Appendix C.

Figure 3 Map of Focus Areas



Future with Development Growth and Transportation Recommendations

This scenario evaluated the combination of changes resulting from development induced growth and the implementation of design recommendations at the eleven (11) focus areas.

Future with Development Growth, Transportation Recommendations, and TDM

The first phase of the Moving Greater University Circle Study proposed several strategies to reduce vehicle traffic through transportation demand management strategies. The final future scenario evaluated included changes in traffic based on development induced growth, transportation design recommendations, and the successful introduction of moderate programming of TDM strategies for area employers and institutions for a 10% reduction in localized vehicle traffic.

TRAFFIC ANALYSIS RESULTS

The LOS results for existing conditions include all intersections in the study area. Future condition LOS comparisons are specific to the eleven (11) focus areas of the Moving Greater University Circle study area.

Level of Service Analysis

Existing Conditions

More than half of the intersections evaluated in the study area (both signalized and unsignalized) are performing at a LOS C or better with less than 30 seconds of vehicular delay (Figure 4).

Three signalized intersections however, including Martin Luther King Jr. Drive at Carnegie Avenue, University-Cedar Station (Carnegie Ave, MLK Dr, Cedar Glen Parkway), and Carnegie Avenue at Stearns Road, have delays of more than 60 seconds during the morning peak (LOS E or above).

During the evening peak period, Cedar Glen Parkway at Ambleside Drive, and Martin Luther King Jr. Drive at Stokes Blvd/Fairhill Road also have delays of more than 60 seconds (LOS E).

In addition, certain approaches currently operate with more than 60 seconds of delay, as identified in Figure 4.

Figure 4 Existing Level Of Service Results

Street	Cross Street	AM Peak Period	PM Peak Period	Approaches at LOS E	Approaches at LOS F
Focus Areas					
Chester Avenue	93rd Street	B	B		
Euclid Avenue	Mayfield Road	C	C	Southbound Through (PM)	Southbound Through (AM)
MLK Drive	Stokes Blvd /Fairhill Drive	B	E		Eastbound Through (PM)
University Cedar Station	(MLK Dr/Cedar Glen/Chester/Carnegie)	F	D	Eastbound Through (PM)	Westbound Through, Eastbound Left (AM)
Carnegie Avenue	107th Street /Stokes Blvd	C	B		
Chester Avenue	107th Street /Stokes Blvd	A	B		
Stokes Blvd	Euclid Avenue	D	D	Westbound Left (AM)	Westbound Left (PM)
Euclid Avenue	115th Street	B	C		
Additional Locations Evaluated in the Study Area					
Euclid Avenue	Chester Ave/MLK Dr	C	C	Eastbound Left	

Street	Cross Street	AM Peak Period	PM Peak Period	Approaches at LOS E	Approaches at LOS F
				(AM)	
MLK Dr	Jeptha Dr	A	A		
MLK Dr	Chester Avenue	B	C		
Euclid Avenue	Adelbert Road	B	D	Eastbound Through (PM)	
Euclid Avenue	Cornell Rd	C	D	Westbound Left (AM)	Westbound Left (PM)
Euclid Avenue	MLK Dr	C	C	Eastbound Left (AM)	Eastbound Left (PM)
Euclid Avenue	University Hospital Dr	A	B	Northbound Left/ Westbound Left (AM and PM)	
Mayfield Road	Circle Drive	D	C		
Circle Drive	Cornell Road	C	D	Northbound Left (AM)	Southbound Through (PM)
Circle Drive	Adelbert Road	B	B		
Cedar Glen Parkway	Ambleside Drive	D	E	Westbound Through (AM)	Southbound Through (PM)
Cedar Avenue	MLK Dr	C	D		
Carnegie Avenue	Cedar Ave/ MLK Dr	F	D	Eastbound Through (PM)	Westbound Through (AM)
Carnegie Avenue	Stearns Road	E	B	Westbound Through (AM)	
Wade Park Avenue	E.105th Street	B	B		
East Boulevard	Wade Oval Drive/E.108th Street	B	B		
Chester Ave	93rd St	C	B		
Chester Ave	97th St	A	B		
Chester Ave	101st St	C	C		
Chester Ave	105th St	B	B		
Euclid Ave	89th St	C	C		
Euclid Ave	100th St	B	B		
Euclid Ave	105th St	C	D		
Carnegie Ave	86th St	C	B		
Carnegie Ave	89th St	B	C		
Carnegie Ave	100th St	B	B		
Carnegie Ave	102nd St	A	A		

Future Conditions

In order to analyze the study area network incorporating potential development growth, the existing Synchro network was built with the additional peak period trip generation and associated trip distribution. Figure 5 provides a comparison of existing conditions to the future condition scenarios evaluated which consisted of the following:

- Future with Development Growth
- Future with Transportation Recommendations (in the 11 focus areas)
- Future with Development Growth and Transportation Recommendations
- Future with Development Growth, Transportation Recommendations and TDM Strategies.

Although some locations show a decrease in Level of Service under the future scenarios compared to the existing conditions, it is important to view the context of improvements for people walking, bicycling, and riding transit as well as the improvement of safety at high crash intersections. Future TDM strategies can also help to mitigate any vehicle delay as a result of future growth and transportation design recommendations.

In the long term with the implementation of the recommended transportation design changes and the proposed development growth, improved LOS and reduced overall delay would occur at the intersections of:

- MLK Jr Blvd at Stokes Blvd and Fairhill Road (PM Peak)

An overall decrease in LOS but still at LOS D or better may result at:

- Chester Avenue at E 93rd St (PM Peak)
- Carnegie Avenue at 107th St/Stokes Blvd (PM Peak)

The two focus areas that would experience future conditions at vehicular LOS E are Stokes Blvd at Euclid Avenue and Euclid Avenue at Mayfield Road/Ford Road. Figure 5 highlights the LOS changes as well as the average seconds of delay per vehicle at the focus area intersections under the modeled scenarios.

Figure 5 Comparison of LOS Changes for Focus Areas

Intersection	High Crash Site	Existing		Future with Transportation Recommendations		Future with Development Growth (with ave. delay in secs)		Future with Development Growth and Transportation Recommendations (with ave. delay in secs)		Future with Development Growth, Transportation Recommendations, and TDM	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Chester Avenue at 93rd Street	Yes (76 in 4 yr period)	B	B	B	C	C 30.4s	B 18.5s	C 33.4s	C 31.8s	B	C
Euclid Avenue at Mayfield Road/Ford Road	Yes (27 in 4 yr period)	C	C	D	C	E 74.3s	C 25.3s	E 74.3s	C 25.3s	D	C
MLK Jr Blvd at Stokes Blvd/Fairhill Road	Not evaluated at time of study	B	E	C	D	B 19.5s	E 70.5s	C 21.3s	E 59.0s	C	D
University Cedar Station	Yes (145 in 4 yr period)	F	D	F	D	F 207.4s	E 78.1s	F 208.3s	E 78.7s	F	D
Carnegie Avenue at 107th Street/Stokes Blvd	Yes (84 in 4 yr period)	C	B	B	C	B 19.6s	C 23.1s	C 26.7s	C 26.1s	C	C
Chester Avenue at 107th/Stokes Blvd	Yes (26 in 4 yr period)	A	B	A	B	A 6.4s	B 12.9s	A 6.3s	B 12.7s	A	B
Stokes Blvd at Euclid Avenue	Yes (75 in 4 yr period)	D	D	D	D	E 58.9s	E 64.9s	E 61.6s	E 62.7s	D	E
Euclid Avenue at 115th Street	Yes (36 in 4 yr period)	B	C	B	C	B 16.7s	C 30.8s	C 20.2s	C 30.8s	B	C

Euclid Avenue Queuing Analysis

As a key transportation corridor in the University Circle study area, Euclid Avenue provides an important east-west link from University Circle to Downtown Cleveland. The building and implementation of the BRT Healthline in 2007 also included major roadway improvements and as such any proposed changes to Euclid Avenue are of particular concern to the City. In order to assess potential impacts to the Euclid Avenue corridor within the University Circle study area, Synchro was utilized to analyze the intersection queuing impacts under existing conditions, future development growth conditions and future conditions with development growth and the proposed transportation recommendations.

With the anticipated development growth along the Euclid Avenue corridor, queue lengths do extend under the future condition (with development growth) compared to the existing conditions as shown in Figure 6. Under the future condition with development growth and the proposed transportation recommendations (in the 11 focus areas), the queue lengths are very similar when compared to the future conditions with development growth only. The primary changes occur at the following intersections:

- Euclid Avenue/E 105th St – PM Eastbound Thru improved with proposed recommendations
- Euclid Avenue/Stearns Rd – PM Eastbound Thru and Westbound Thru improved with proposed recommendations
- Euclid Avenue/Stokes Blvd– PM Eastbound Thru marginally longer queues under the proposed recommendations

It is noted however, that the queuing impacts between the two future scenarios are negligible due to the main transportation recommendations not directly affecting the predominant east-west movements along the Euclid Avenue corridor. Any significant queuing impacts under the future conditions stems from the continued development growth within the University Circle area and in particular the Euclid Avenue corridor. Figure 6 does note when queuing is metered by an upstream signal and also when the queue length exceeds the available capacity of the link. Under the future conditions the area surrounding Euclid Avenue at Stearns Road, Stokes Blvd and E 105th St becomes an area for additional future analysis as it relates to signal timing due to the proximity of the intersections and the reduced capacity with the separated BRT line.

Figure 6 Comparison of Vehicular Queuing for Euclid Avenue

Intersection	Existing				Future with Development Growth				Future with Transportation Recommendations			
	AM		PM		AM		PM		AM		PM	
	EBT	WBT	EBT	WBT	EBT	WBT	EBT	WBT	EBT	WBT	EBT	WBT
Euclid Ave at 100th St	238	20	215	125	303	289	289	211	303	289	279	211
Euclid Ave at 105th St	195	172	285	237	#530	#380	#555	#493	#530	#380	#529	#468
Euclid Ave at Stokes Blvd	435	186	#498	#311	#767	314	#610	375	#767	#316	#633	375
Euclid Ave at Stearns Rd	m4	144	m45	111	m72	257	m158	73	m70	257	m123	60
Euclid Ave at MLK Dr	323	244	250	334	299	273	297	398	297	273	290	398
Euclid Ave at Adelbert Rd	358	171	457	169	473	361	#603	87	473	361	#603	87
Euclid Ave at University Hospital Dr	215	264	234	250	250	397	288	m295	250	397	288	m295
Euclid Ave at Cornell Rd	77	210	223	134	153	m247	281	193	153	m247	281	193
Euclid Ave at Mayfield Rd	104	199	247	176	157	230	305	252	157	230	305	252
Euclid Ave at E 115th St	83	178	145	136	104	225	166	178	105	230	166	178

Notes: m = Queue metered by upstream signal
= Queue length may exceed capacity

APPENDIXES

- Appendix A:
  - Data Collection Sheets
  - Crash Data
- Appendix B:
  - Projected Development Program
- Appendix C:
  - Proposed Transportation Recommendations

Appendix A Traffic Count List and Crash Data

Intersection		Date Traffic Data Collected	Crash Statistics Available
Carnegie Ave	Stokes Blvd	Sept 16 2014	Yes
Carnegie Ave	Cedar Ave/Cedar Glen Parkway	Oct 07 2014	Yes
Euclid Ave	Stokes Blvd	Sept 16 2014	Yes
Euclid Ave	Chester Ave/MLK Dr	Sept 16 2014	Yes
Martin Luther King Jr Dr	Jeptha Dr	Oct 07 2014	Yes
Martin Luther King Jr Dr	Chester Ave	Sept 23 2014	Yes
Euclid Ave	Adelbert Rd	Sept 18 2014	Yes
Euclid Ave	Cornell Rd	Sept 23 2014	Yes
Euclid Ave	Mayfield Rd	Sept 23 2014	Yes
Euclid Ave	E. 115th St	Sept 18 2014	Yes
Euclid Ave	Martin Luther King Jr Dr	Sept 16 2014	Yes
Euclid Ave	University Hospital Dr	Sept 18 2014	Yes
Mayfield Rd	Circle Dr	Sept 17 2014	Yes
Circle Dr	Cornell Rd	Sept 30 2014	Yes
Circle Dr	Adelbert Rd	Sept 30 2014	Yes
Cedar Glen Parkway	Ambleside Dr	Sept 30 2014	Yes
Stokes Blvd/Fairhill Rd	Martin Luther King Jr Dr	Oct 07 2014	Yes
Cedar Avenue	Martin Luther King Jr Dr	Oct 02 2014	Yes
Carnegie Avenue	Cedar Ave/ MLK Dr	Oct 02 2014	Yes
Carnegie Avenue	Stearns Rd	Oct 02 2014	Yes
Chester Avenue	E 107th St	Sept 24 2014	Yes
Martin Luther King Jr Dr	East Blvd (Entire Circle)	Jan 27th 2015	Yes
Wade Park Ave	E.105th Street	Oct 01 2014	Yes
East Blvd	Wade Oval Drive/E.108th St	Oct 07 2014	Yes
MLK south of the ramps to/from Wade Park Ave		Oct 07 2014	Yes
Carnegie Avenue	E 86th St	Yes	Yes
Carnegie Avenue	E 89th St	Yes	Yes
Cedar Avenue	E 86th St	Yes	Yes
Cedar Avenue	E 89th St	Yes	Yes
Cedar Avenue	E 105th St	Jun 17 2014	Yes
Cedar Avenue	E 106th St	Jun 19 2014	Yes
Chester Avenue	E 90th St	Jun 10 2014	Yes
Chester Avenue	E 93rd St	Jun 10 2014	Yes

Chester Avenue	E 97th St	Jun 05 2014	Yes
Chester Avenue	E 101st St	Jun 05 2014	Yes
Chester Avenue	E 105th St	Jun 10 2014	Yes
E 100th Street	Carnegie Ave	Oct 31 2013	Yes
E 100th Street	Cleveland Clinic	Oct 08 2013	Yes
E 100th Street	Euclid Ave	Oct 31 2013	Yes
E 100th Street	Parking Lot & Garage	Oct 10 2013	Yes
E 102nd Street	Carnegie Ave	Oct 31 2013	Yes
E 105th Street	Carnegie Ave	Oct 24 2013	Yes
E 105th Street	Cleveland Clinic Dr	Oct 24 2013	Yes
E 105th Street	Euclid Ave	Oct 24 2013	Yes
E 105th Street	Wilbur Ave	Oct 31 2013	Yes
Euclid Avenue	E 86th St	Jun 25 2014	Yes
Euclid Avenue	E 89th St	Jun 26 2014	Yes
Euclid Avenue	E 90th St	Jun 12 2014	Yes
Euclid Avenue	E 97th St	Jun 12 2014	Yes
Euclid Avenue	E 101st St	Jun 12 2014	Yes
Frank Avenue	E 105th St	Jun 18 2014	Yes
Frank Avenue	E 106th St	Jun 19 2014	Yes
Wilbur Avenue	E 105th St	Jun 18 2014	Yes
Wilbur Avenue	E 106th St	Jun 19 2014	Yes
Newton Avenue	E 101st St	Jun 05 2014	Yes

Location	*CHESTER AVE & STOKES BLVD*	*EUCLID AVE & CHESTER AVE*	*EUCLID AVE & STEARNS RD*	*STOKES BLVD & EUCLID AVE*	*EUCLID AVE & EAST BLVD*
Total Number of Collisions	45	4	70	26	45
Number of Fatal Crashes					
Number of Injury Crashes	10		14	10	8
Number of Property Damage Only Crashes	35	4	56	53	37
Collision Characteristics					
Motorists Only	44	4	69	60	44
Motorist and Bicyclist			1	1	1
Motorist and Pedestrian	1			2	
Most Common Direction of Travel	East-West	North-South	East-West	East-West	North-South
Most Common Light Conditions (proxy for Time of Day)	Daylight	Dark-Lighted (after dark street with lights	Daylight	Daylight	Daylight
Most Common Crash Type and Factors Cited	Rear-ending for following too closely	Sideswipe-Passing with Left Turning Vehicles	Sideswipe-Passing Traveling Straight	Sideswipe-Passing with improper lane change or improper turning	Rear-ending for following too closely
Pedestrian and/or Bicycle Crash Details	Driver Didn't See Pedestrian "view obstructed" - Daytime Crash		Driver Failure to Yield - Daytime Crash	Car-Bike: No Driver Errors - Daylight Car-Ped: Driver failure to yield in both instances. One at night, one daylight	Driver improper turning - after dark

Location	*Carnegie Ave & E 105th St*	*Carnegie Ave & 107th & Stokes Blvd*	*Cedar Ave & Stokes Blvd*
Total Number of Collisions	84	84	96
Number of Fatal Crashes			
Number of Injury Crashes	23	12	30
Number of Property Damage Only Crashes	61	72	66
Collision Characteristics			
Motorists Only	84	83	94
Motorist and Bicyclist			1
Motorist and Pedestrian		1	1
Most Common Direction of Travel	North-South	North-South	North-South
Most Common Light Conditions (proxy for Time of Day)	Daylight	Daylight	Daylight
Most Common Crash Type and Factors Cited	Rear-ending due to following too closely	Sideswipe with Improper Turning	Sideswipe with Improper Turning; 2nd most common (22 crashes) angled crash, 7 are red light running (7% overall)
Pedestrian and/or Bicycle Crash Details			Car-Bike: Daylight - no driver errors noted while traveling through intersection Car-Ped: Night (along lighted street) driver inattention while traveling through intersection

Location	*East Blvd/MLK & Carnegie*	*Cedar Ave/Cedar Glen Pkwy & MLK & Carnegie*	*Cedar Glen Pkwy btwn MLK/EastBlvd & Ambleside Dr*	*Murry Hill Rd btwn Cedar Glen & Adelbert Rd*
Overlapping Intersection Area				
Total Number of Collisions	27	47	59	12
Number of Fatal Crashes				
Number of Injury Crashes	1	14	17	4
Number of Property Damage Only Crashes	26	33	42	8
Collision Characteristics				
Motorists Only	27	47	57	12
Motorist and Bicyclist			1	
Motorist and Pedestrian			1	
Most Common Direction of Travel	East-West	East-West	East-West	North-South
Most Common Light Conditions (proxy for Time of Day)	Daylight	Daylight	Daylight	Daylight
Most Common Crash Type and Factors Cited	Rear-ending for following too closely	Rear-ending for following too closely	Rear-ending for following too closely	Rear-ending or Sideswipe passing with improper lane change
Pedestrian and/or Bicycle Crash Details			Car-Bike: Driver Inattention while turning at intersection, daylight Car-Ped: Driver failure to yield at intersection signal, at night (lighted streets).	

Location	*E 118st St & Wade Park Ave*	*Bellflower Rd & Ford Dr*
Total Number of Collisions	4	18
Number of Fatal Crashes	1	
Number of Injury Crashes	1	1
Number of Property Damage Only Crashes	2	17
Collision Characteristics		
Motorists Only	3	17
Motorist and Bicyclist	1	1
Motorist and Pedestrian		
Most Common Direction of Travel	East-West	East-West
Most Common Light Conditions (proxy for Time of Day)	Daylight	Daylight
Most Common Crash Type and Factors Cited	Hitting Fixed Objects at dusk or night	Rear ending due to following too closely - Tied with - Hitting parked cars due to other driver error
Pedestrian and/or Bicycle Crash Details	Car-Bike: noted as Property Damage Crash - Driver failure to control vehicle, daylight	Car-Bike: noted as Property Damage Crash - Driver failure to yield traveling straight through intersection, daylight
Fatality Crash Detail	Due to driver hitting fixed object in snow/nighttime conditions	

Location	*Euclid btwn Mayfield/Ford & E 115th/E 116th Sts*	*Euclid btwn E 115th & E 118th Sts*	*Euclid btwn E 118th and 120th Station/Coltman Rd*
Total Number of Collisions	27	36	47
Number of Fatal Crashes			
Number of Injury Crashes	3	15	14
Number of Property Damage Only Crashes	24	21	33
Collision Characteristics			
Motorists Only	26	34	46
Motorist and Bicyclist	1	1	1
Motorist and Pedestrian		1	
Most Common Direction of Travel	East-West	East-West	East-West
Most Common Light Conditions (proxy for Time of Day)	Daylight	Daylight	Daylight
Most Common Crash Type and Factors Cited	Rear ending due to following too closely - Tied with - Sideswipe Passing due to other driver error	Rear-ending following too closely	Rear-ending following too closely
Pedestrian and/or Bicycle Crash Details	Car-Ped: noted as Property Damage Crash - "No Driver Error" at intersection at night (streets lighted)	Car-Bike: Driver Failure to yield at intersection, daylight Car-Ped: Driver inattention (non-interesection crash), night (streets lighted)	Car-Bike: noted as Property Damage Crash - Driver failure to control vehicle along roadway, daylight

Appendix B Development Program

Institution	Location	Type	Change to Parking	Status	Sources
VA Medical Center	West side of E.105th St between Wade Park Ave & East Blvd	Phase 1: 800 car parking garage, two-story atrium, warehouse and laboratory, 20,000 sq ft mental health addition Phase 2: 370,000 sq ft patient care tower, a rehabilitation center for the blind Phase 3: office complex, 2,080 car parking garage, 122 bed center for homeless veterans	Phase 1: 800 car parking garage; Phase 2: 2,080 car parking garage	Completion expected in 2014	http://planning.city.cleveland.oh.us/projects/detail.php?ID=9
Cleveland Museum of Natural History	Along Wade Oval Drive	Reconfigure and add exhibit space, new 300 car parking garage to replace existing surface lot along Wade Oval Drive	New 300 car parking garage to replace existing surface lot along Wade Oval Drive	2016 – break ground 2019 – finish construction	http://www.cleveland.com/architecture/index.ssf/2014/03/the_cleveland_museum_of_natura_1.html
Case Western Reserve University	Juniper Rd between Ford Dr and Bellflower Rd	Alumni center expansion	Small net loss of existing surface parking		http://www.cleveland.com/metro/index.ssf/2013/09/case_western_reserve_universit_14.html
Case Western Reserve University	E.115th St near Wade Park Ave	16 double-occupancy townhouses on East 115th Street and 274 beds in a five-story apartment-style building		Construction to start in 2014, open in 2015	http://www.cleveland.com/metro/index.ssf/2014/03/case_western_reserve_universit_23.html
Case Western Reserve University and Cleveland Museum of Art	East Blvd at Bellflower Rd	Current CIA Buildings Will be Demolished and Site Re-Purposed In Future	TBD	Purchase agreement in place. Transfer in 2015.	http://blog.cleveland.com/architecture/2013/01/the_cleveland_institute_of_art_1.html
Case Western Reserve University	West of E.105th St to Ansel Rd south of Mt. Sinai Dr	Future Development Potential in West Quad	TBD		http://www.ideastream.org/news/feature/case_western_reserve_scales_back_west_quad_project http://case.edu/administration/cpfm/pdc/mp/proj_over_west.html
Intesa/University Circle Inc.	Corner of Mayfield and E.117th St	New mixed-use development including 200 apartments, a 700 space parking garage, office space.	700 car parking garage		http://www.cleveland.com/business/index.ssf/2014/05/intesa_project_in_university_c.html
Case Western Reserve University	Bellflower Rd btwn East Blvd & Ford Dr	Tinkham Veale University Center (89,000 gsf with large event facilities now occupied)		Opens August 24, 2014	
Case Western Reserve University	Between E.105th St & Ansel Rd south of Mt. Sinai Dr	Tilfereth Israel Renovation/Addition			http://www.cleveland.com/architecture/index.ssf/2014/03/cwru_will_soon_launch_a_59_mil.html
Cleveland Clinic	Carnegie Ave btwn E.102nd & E.105th Sts	Cancer Center Expansion (f377,000 sf)		2014 – break ground 2017 – construction completed	http://www.cleveland.com/healthfit/index.ssf/2014/08/cleveland_clinic_to_unveil_plans_today_for_new_cancer_center_all_cancer_treatment_to_be_under_one_roof.html
Cleveland Clinic	Cedar Avenue to Wilbur Avenue, between E 105th St and E 106th St	New parking structure	Building 3,000-space parking structure on land that currently holds a 500-space surface lot.	2014 – break ground 2017 – construction completed	http://www.cleveland.com/business/index.ssf/2014/08/cleveland_clinic_cancer_center.html

Institution	Location	Type	Change to Parking	Status	Sources
Cleveland Clinic	Euclid Avenue between East 93rd and East 100th Streets	New CC/CWRU Medical (500,000 sf)	714 required spaces to be provided in the proposed Wilbur/Cedar Parking Deck with other structured parking reassigned accordingly	2014/2015 – Break ground 2019 - Completed	
The Finch Group	Chester Ave btwn E.93rd & E.101st Sts	Upper Chester Mixed-Use Developments: residential apartments above first floor retail space in 6story structures; two level s of parking provided north of the buildings; a linear park along Chester Ave.	800 parking spaces	Initial wave of construction could be finished by June 2015	http://www.upperchesterliving.com/development.html http://www.cleveland.com/business/index.ssf/2014/03/the_finch_group_buys_upper_che.html
	Crawford at Wade Park Ave	Demolition and reconstruction of MLK Plaza retail center		Identified as development opportunity by the city	http://planning.city.cleveland.oh.us/dev/cpc/basemap.jsp
	Carnegie Ave at Stokes Blvd	John Hay High School renovation linking school campus to CWRU & Cleveland Clinic		Identified as development opportunity by the city	http://planning.city.cleveland.oh.us/dev/cpc/basemap.jsp
	Cedar at E.105th St	Redevelop the area to a mixed-use district incorporating institutional and research facilities with residential development including live-work spaces		Identified as development opportunity by the city	http://planning.city.cleveland.oh.us/dev/cpc/basemap.jsp
	Area south of Carnegie, east of E.105th and west of Stokes	Redevelop area for office, institutional and research facilities incorporating residential development, including live-work spaces, in locations closer to University Circle		Identified as development opportunity by the city	http://planning.city.cleveland.oh.us/dev/cpc/basemap.jsp
University Circle Inc	Euclid Ave at Stearns Rd	High-rise apartment building (25 -28 stories tall)	Expect to build on top of a parking garage, details TBD	Agreement signed; aiming for 2017 opening	http://www.cleveland.com/business/index.ssf/2014/04/developers_plan_high-rise_apar.html
	Euclid at Mayfield	Mixed-use development with 200 apartments, shops, restaurants, bookstore, grocery store	In the future, the lot on the corner of Euclid Avenue and Ford Road will be opened for retail parking, plus 100 metered spaces in the Triangle Apartments parking lot.	Under construction	
Perrotti Development	Mayfield Road and East 119th St	Proposed 17 condo building (24,000 sf)	Unknown	Unknown; plans for seeking financing in 2008 and commencing construction in 2009	http://blog.cleveland.com/architecture/2008/04/little_italy_condo_project_sho.html
Casa d'Angolo Condominiums	Mayfield Road and E. 126th St	3-unit Condo development over street level retail to replace Primo Vino restaurant	Unknown	Construction planned to begin spring 2015	http://www.cleveland.com/business/index.ssf/2014/06/condominium_project_will_repla.html
Golden Bowl Site	Mayfield Road and E.123rd Street	Vacant Site Could be mixed use site	Unknown	Looking for Developer	LIRC
	Woodhill Supply Site, E 123rd St between Mayfield Rd and Euclid Ave	192 Market Rate Apartments	Unknown	Going through the approval process. Hoping to break ground first part of 2015	LIRC

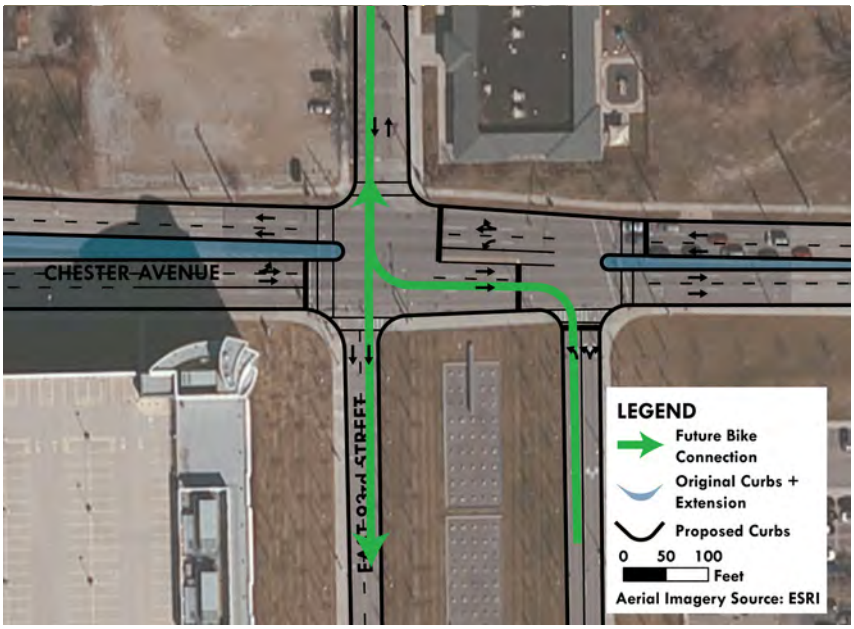
Institution	Location	Type	Change to Parking	Status	Sources
Case Western Reserve University	Lincoln Storage Building, 11201 Cedar Avenue	Think[box] - 55,000 gsf center for innovation, invention and collaboration in renovated Lincoln Storage Building	Unknown	Cosntruction to begin in 2014.	Email
Linsalata Alumni Center		Linsalata Alumni Center - 8,000 gsf event space addition to existing center.	Unknown		Email
Case Western Reserve University	North Residence Village	Residence hall - 123,230 sf new conscturction	Unknown	Scheduled for completion at start of 2015-2016 AY.	Email
Case Western Reserve University	E 118th St, north end of CWRU football field	Wyant Athletic and Wellness Center - 23,960 GSF new construction	Unknown	Scheduled for completion in fall or winter 2014	Email
Case Western Reserve University	1855 Ansel Rd	Maltz Performing Arts Center - Expand and renovate Temple-Tifereth Israel into performing arts center	Unknown		Email

Appendix C Focus Areas

CHESTER AVENUE AT E. 93RD STREET

Existing

Proposed



SOUTH WADE PARK

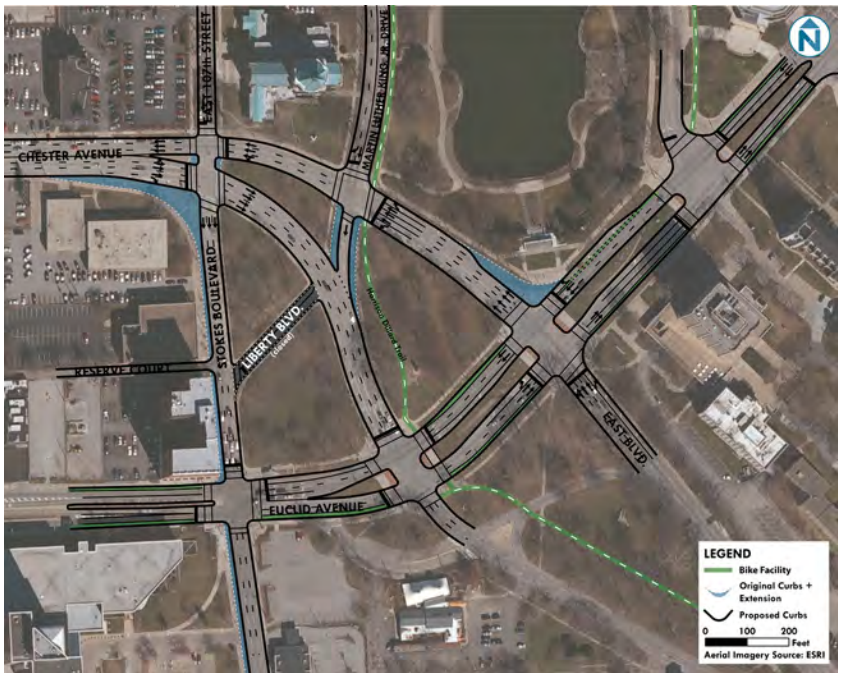
Existing

Proposed

EUCLID, CHESTER, STOKES

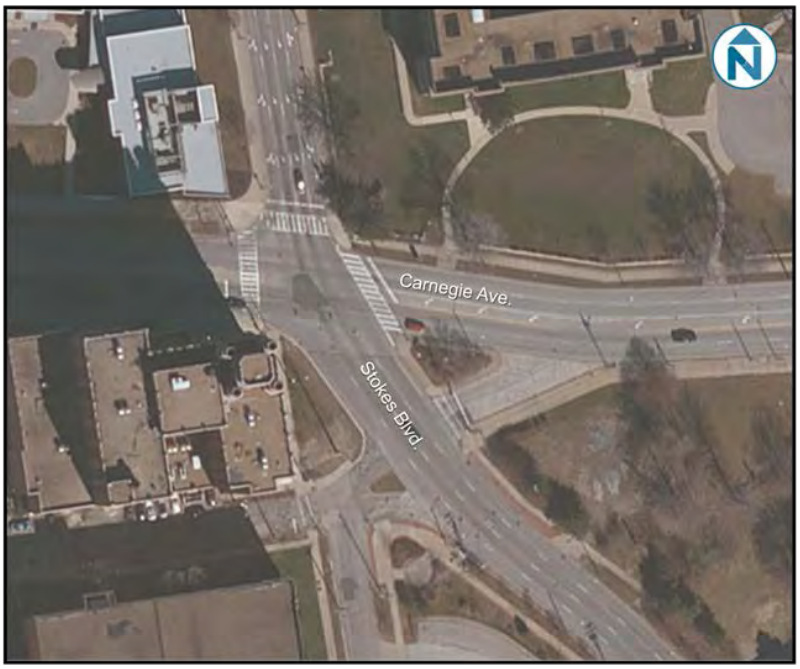
Existing

Proposed

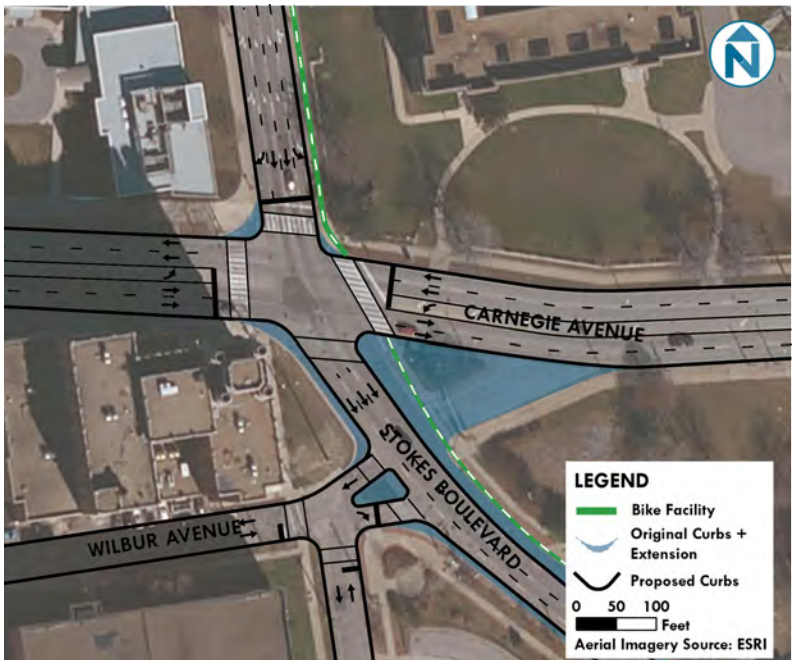


E. 107TH STREET & CARNEGIE AVENUE

Existing



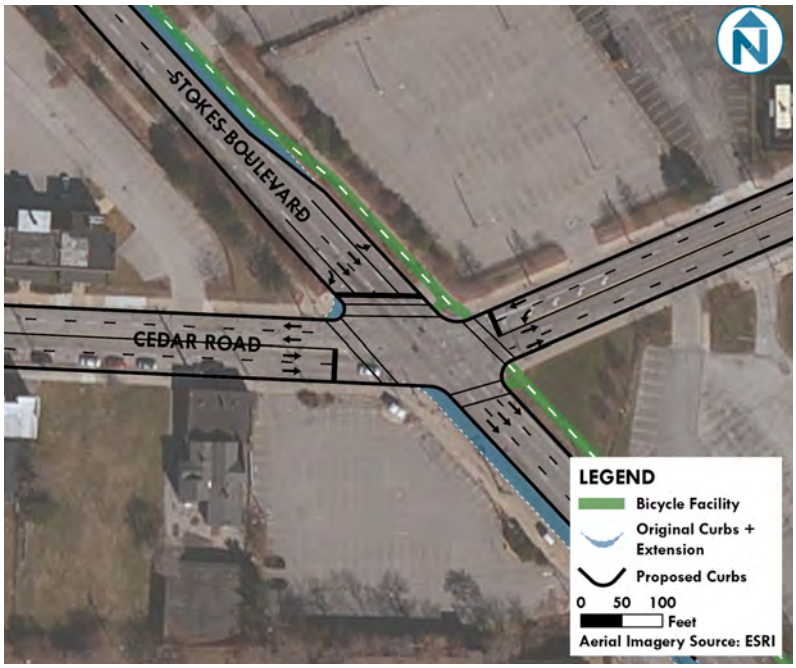
Proposed



STOKES BOULEVARD & CEDAR AVENUE

Existing

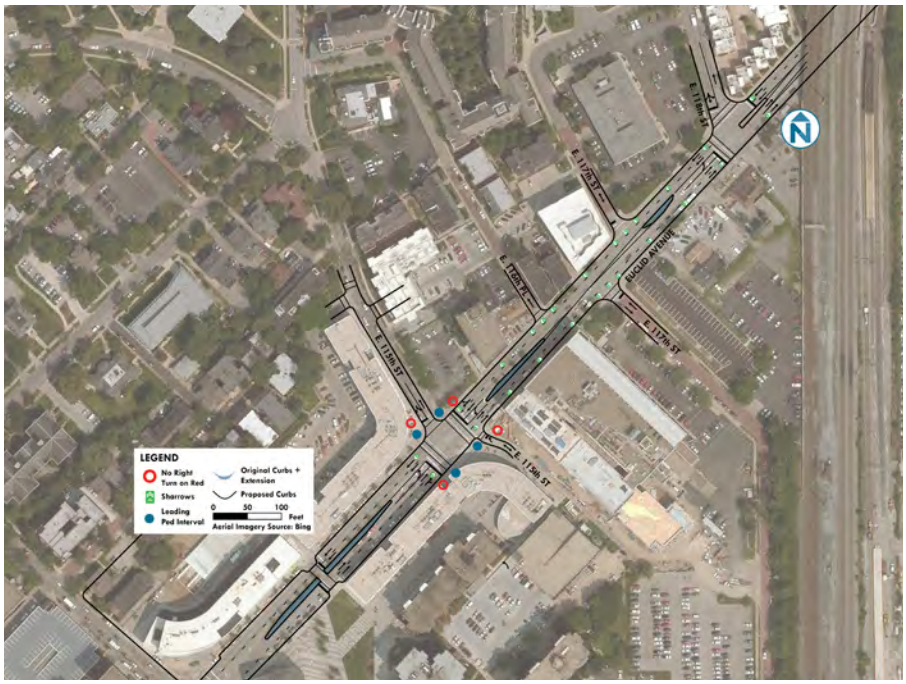
Proposed



EUCLID AVENUE UPTOWN

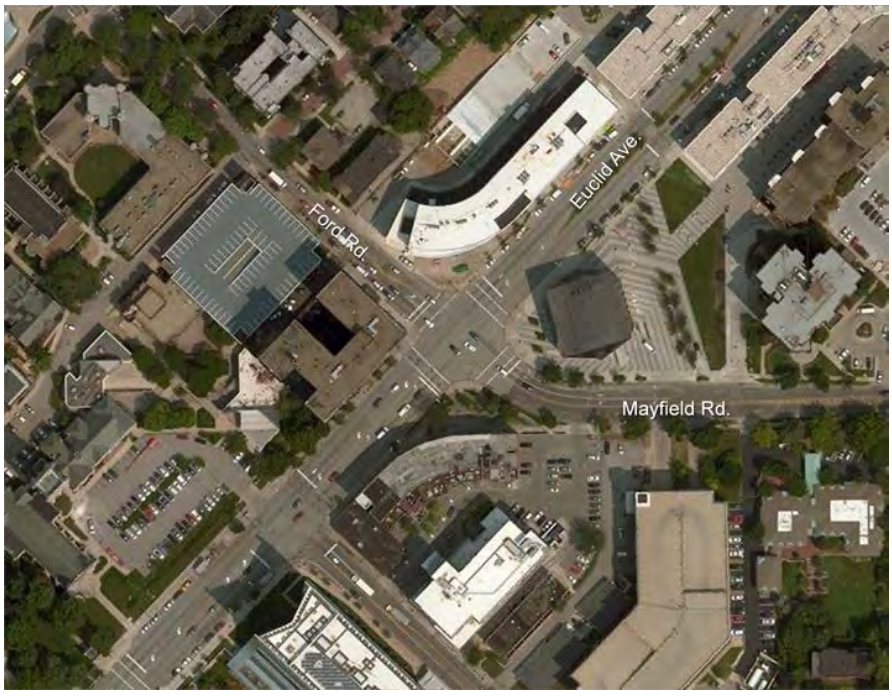
Existing

Proposed

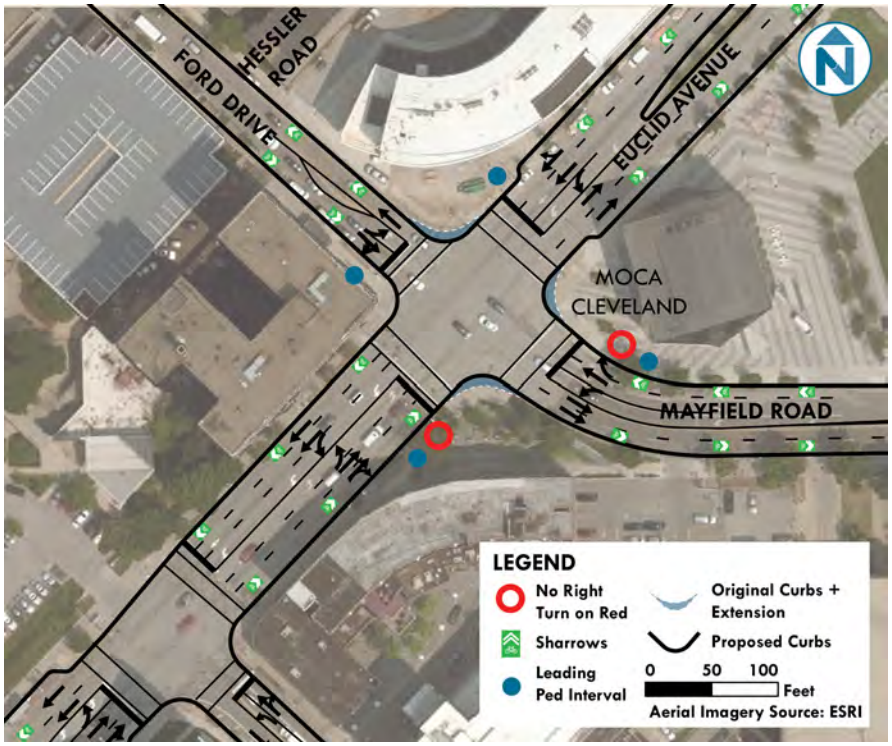


EUCLID AVENUE & FORD/MAYFIELD ROADS

Existing



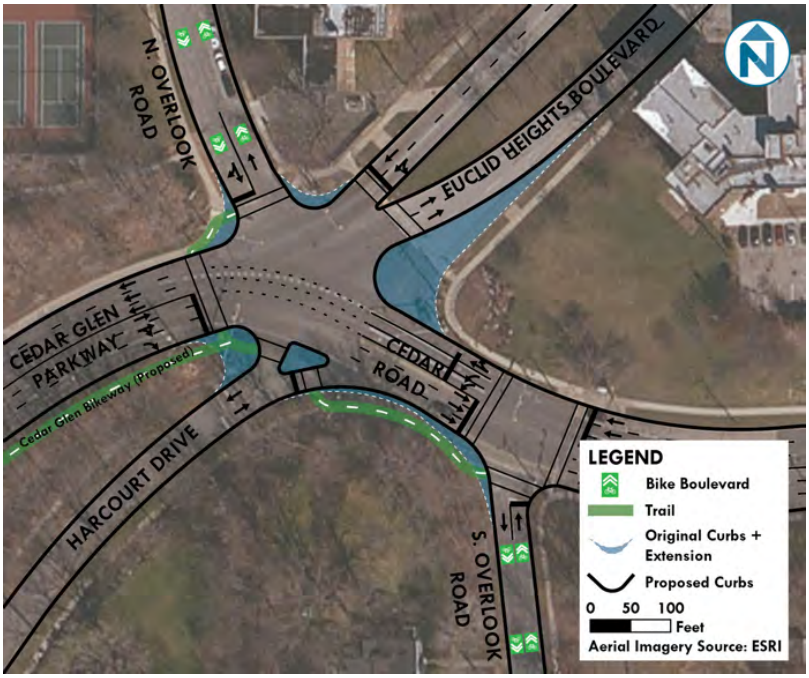
Proposed



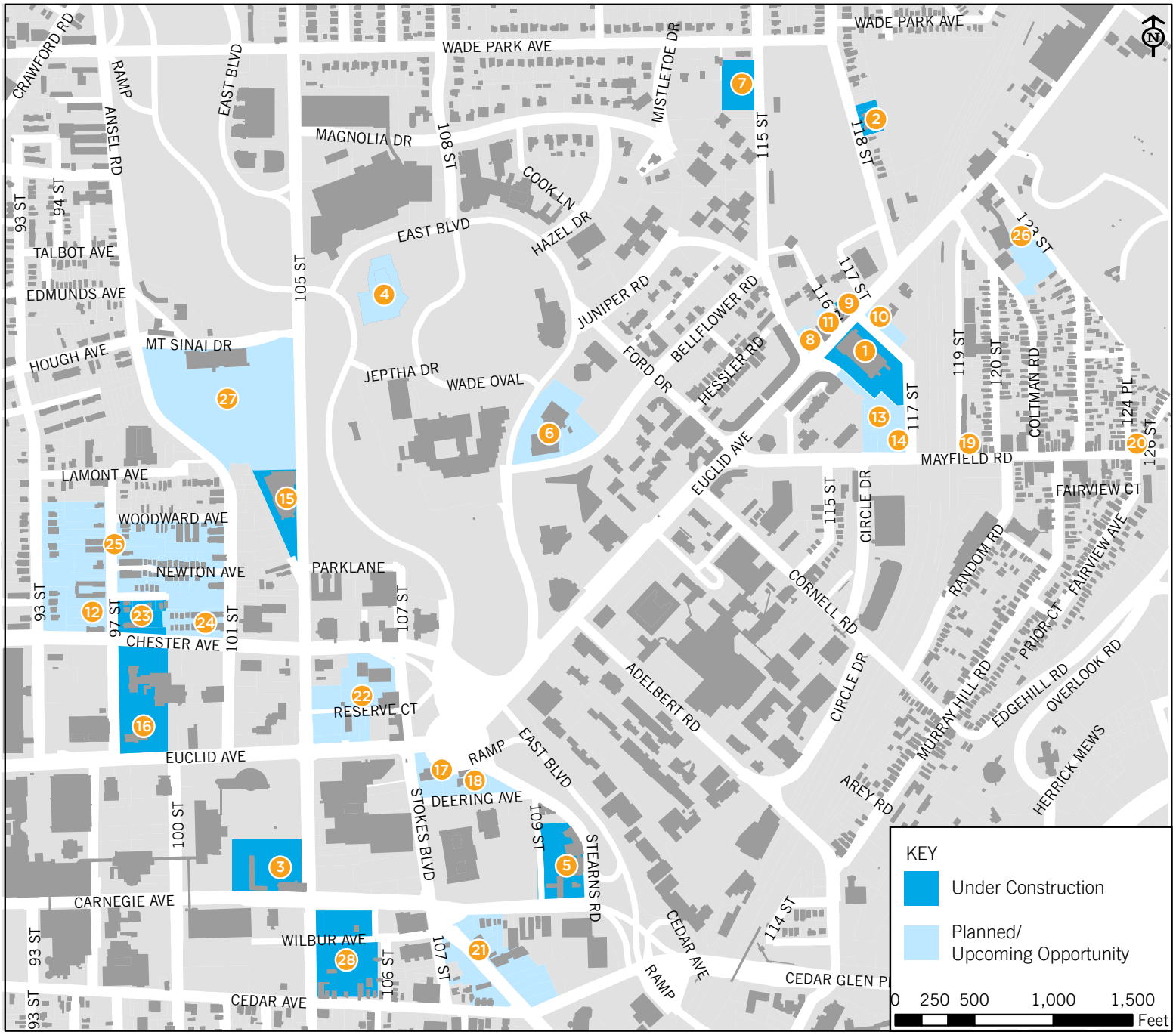
EUCLID HEIGHTS BOULEVARD & CEDAR ROAD

Existing

Proposed



UNIVERSITY CIRCLE FUTURE DEVELOPMENTS



1. CIA Campus Consolidation
2. Circle118 Flats - Oval
3. CCF Cancer Center
4. CMNH Expansion
5. CMSD School of the Arts
6. 1956 CIA Gund Site
7. CWRU N Residence Hall
8. Euclid and 115 - NE
9. Euclid and 116 - NW
10. Euclid and 117 - SE
11. Euclid Tavern
12. Hough Heritage Housing (Upper Chester)
13. Intesa - Phase 1
14. Intesa - Phase 2
15. CWRU Maltz Performing Arts Center
16. New CWRU Medical Center
17. One University Circle - Phase 1
18. One University Circle - Phase 2
19. Perotti Development (Little Italy)
20. Primo Vino Development (Little Italy)
21. Stokes Corridor
22. Third District Police Station and Environs
23. Upper Chester- Innova Phase 1
24. Upper Chester- Innova Phase 2
25. Upper Chester - Future Phases
26. Visconsi Development (Little Italy)
27. CWRU West Campus
28. CCF 3,000-Space Garage

MEMORANDUM

To: Chris Bongorno, UCI

From: Nelson\Nygaard Project Team

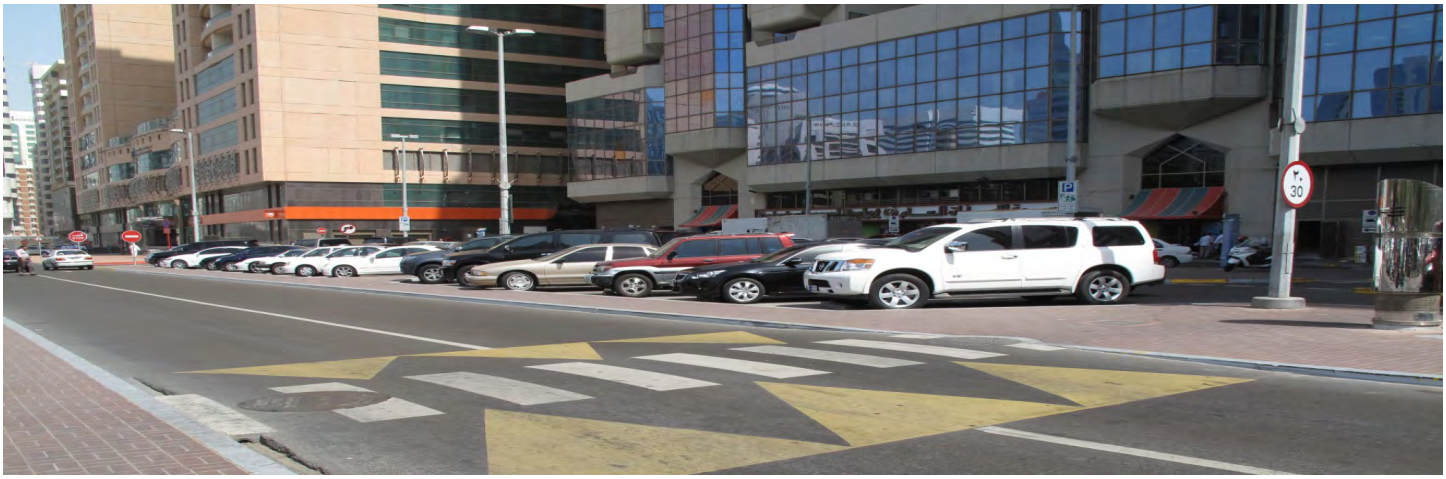
Date: April 29, 2015

Subject: Speed Tables

WHAT ARE SPEED TABLES?

Speed tables are raised (or vertical) sections of roadway that are similar to speed humps and speed bumps in height, but have a flat top that is typically long enough for the entire wheelbase of a car to rest on its top. The speed table has become increasingly popular throughout the world as a self-enforcing method of controlling traffic speeds and traffic volume while simultaneously improving pedestrian safety.

Speed tables are generally used on local, residential, or neighborhood streets with posted speed limits between 25-35 mph. At its highest point the maximum height of a standard speed table is approximately 3-3.5 inches. Its length, in total, is approximately 22 feet in the direction of traffic, with 10 feet devoted to the flat top area, and 6 feet to each the sloped approaches. The table will generally take up the entire width of the street, but can be adjusted for drainage if needed[1].



1 Parkhill, Margaret, Rudolph Sooklall, and Geni Bahar. "Updated guidelines for the design and application of speed humps." In ITE 2007 Annual Meeting and Exhibit. Pittsburgh PA. 2007.

WHAT DO THEY DO?

Speed tables are designed to encourage drivers to travel at a consistent, appropriate speed without requiring stopping or significantly reducing speed to traverse them. This also helps to eliminate, or reduce, the dangerous practice of rapid acceleration between braking periods that sometimes accompanies speed humps, speed bumps, or series' of stop signs. Depending on the spacing between tables, vehicle operating speeds generally range from 25-30 mph.

Table 1 Typical Operating-Speed Range of Streets with Speed Tables

	Typical Operating-Speed Range (mph)
Institute of Transportation Engineers	25-27
Boston Complete Streets Guidelines	25-30
Huntsville, Alabama	22-27
Los Angeles County, California	25-30
Pennsylvania Traffic Calming Handbook	25-30

WHERE DO THEY GO?

Speed tables are typically used on local and collector streets, or main streets. They are generally not recommended for use on major arterials, highways, or other main roadways. Speed tables are typically installed at various points between intersections, but can also be used at pedestrian crossings to create a raised crosswalk or, less commonly, at intersections to create raised intersections. When paired with crosswalks or intersections the flat top of speed tables is often made of high quality materials (such as bricks or pavers), patterned materials, or distinctive painting. They can be especially effective when paired with other traffic calming measures such as curb extensions, on-street parking, and street trees.

WHEN SHOULD SPEED TABLES BE USED?

Speed tables are used to address unacceptable speeds and/or excessive cut-through traffic on neighborhood streets[2]. They will provide nearly the same speed and traffic volume reduction benefits of the speed hump while providing a more comfortable driving experience (especially appropriate in residential or cultural districts), and less wear and tear on vehicles. The table is also a more appropriate option than speed humps for bus routes and emergency vehicle routes, as they cause less disruption to large vehicles such as fire trucks, ambulances, and school buses.

Streets meeting the following conditions are appropriate for speed tables[3]:

- 85th percentile speed is equal to or greater than 30 mph
- Street is not a local or through truck route
- Street is not an emergency vehicle route or snow emergency route

2 Ewing, Reid. "Traffic calming in the United States: are we following Europe's lead." Urban Design International 13, no. 2 (2008): 90-104.

3 "Traffic Calming Design Guidelines," NYC DOT, accessed April 28, 2015, http://www.nyc.gov/html/dot/html/pedestrians/streetdesignmanual.shtml

- Street does not have a fire department station or hospital emergency entrance on the block
- Street has only one lane in each direction (or one lane total for a one way street)
- Street is not wider than 50 feet, and if wider than 45 feet has clear markings establishing one moving lane in each direction
- Street does not have a grade of more than 8%

On streets containing a school, speeding need not be a priority when considering whether to install speed tables.

OTHER CONSIDERATIONS

Maintenance Costs

Speed tables, on average, cost approximately $2,500, but can vary significantly in price depending on the types of materials used. The approximate low end of the cost scale is about $1,000, while the high end of the scale is approximately $6,900. Accordingly, the costs of maintaining speed tables can also vary greatly depending on the materials.

Emergency Responders

Vertical traffic-calming measures (speed tables, humps, and bumps, etc.) can lead to an increase in the response time of emergency vehicles[4]. This, in turn, can lead to opposition of vertical traffic-calming measures from emergency responders, and traffic officials, and even residents, particularly when the measures are being proposed on primary emergency routes. However, because speed tables are less disruptive than other vertical measures they are generally perceived more favorably by emergency responders and are less likely to be met with opposition.

Snow Removal

As with any vertical traffic calming measure, speed tables may require some extra planning and labor in the event of snow. Because of their extended length and gentler slopes, however, the impact of speed tables on snow removal and associated costs is minimal. Plowing operators should always be made aware of the existence of speed tables, but the gentle slope of a typical speed table will allow most plows to traverse over them without incident. Communities in areas with frequent winter weather events could also consider installing rubber speed tables which can be removed and reinstalled without being destroyed.

4 Batson, S. M. "Offset Speed Tables for Reduced Emergency Response Delay." In Intersection Safety: Achieving Solutions Through Partnerships. 2004.

CASE STUDY

Boca Raton, Florida

In the late 1990's the city of Boca Raton, Florida, developed a neighborhood traffic calming program in response to the needs and demands of local residents who had become increasingly concerned about the volume and speed of traffic on neighborhood streets. To save on costs associated with more expensive traffic calming measures, and eliminate the need for expensive and time consuming design work, the city decided to exclusively use "enhanced" speed tables[5].

The Boca Raton "enhanced" speed table design includes a standard four inch high, ten foot long table with six foot approaches for a total length of twenty-two feet. It is also paired with a choker, which narrows the street to 18 feet, and high quality pavers for the table top. The cost of the speed tables alone (without the chokers) was approximately $1,500 per table. Combined with the chokers the cost was approximately $10,000 per table.[6]

By 2002, a study[7] of the effects of the Boca Raton speed tables showed them to be very successful at reducing average vehicle speed to appropriate levels. This included locations where the average speed at the speed tables was reduced from 31-33 mph to about 21 mph, and remained below 30 mph between 200-350 feet away from the tables. Citywide, the traffic volumes of Boca Raton have decreased 27% on average, while 85th percentile speeds have decreased 18% on average.[8]

5 Daniel, Janice, Steven Chien, and Rachel Liu. Effectiveness of Certain Design Solutions on Reducing Vehicle Speeds. No. FHWA-NJ-2005-007. New Jersey Department of Transportation, 2005.

6 "City Neighborhood Traffic Calming," City of Boca Raton, accessed April 28, 2015, http://www.myboca.us/muni/pdf/traffic/TrafficCalmingInventory2.pdf

7 Daniel, Chien, & Liu, 2005

8 "Traffic Calming – Before/After Studies," City of Boca Raton, accessed April 28, 2015, http://www.myboca.us/muni/traffic/trafficcalm.shtm

MEMORANDUM

To: University Circle, Inc

From: Nelson\Nygaard Consulting Associates, Inc.

Date: July 27, 2015

Subject: University Circle - MLK Jr. Dr/Carnegie Ave

This technical memo provides data and analysis of the traffic impacts of the proposed MLK Jr. Dr/ Carnegie Ave. roadway modifications recommended within the Moving Greater University Circle Transportation & Mobility Study. This memo describes the proposed recommendation, articulates existing transportation conditions, and presents the projected future transportation impacts given the implementation of the roadway modifications.

EXISTING CONDITIONS

The MLK Jr. Drive/Carnegie Avenue intersection recently underwent configuration changes as a result of the reconstruction of the RTA Cedar-University Station. Figure 1 shows the most recent aerial of the intersection, which has undergone some changes through the construction, but the roadway lane configurations are the same. To document existing transportation patterns, vehicle, pedestrian, and bicycle turning movement counts (TMC's) were utilized from the *Moving Greater University Circle Transportation & Mobility Study*. These counts were undertaken in the fall of 2014 and included heavy vehicles, buses, cars, pedestrians and bicyclists. Updated traffic turning movement counts were undertaken on April 28th at MLK Jr. Drive/Cedar Avenue/Carnegie Avenue to account for construction projects that were recently completed.

To assess existing traffic operations at intersections, turning movement counts and volumes were compiled and evaluated utilizing the procedures outlined by the 2010 Highway Capacity Manual (HCM) through the Synchro modeling software. The MLK Jr. Dr/Carnegie Ave. intersection was analyzed for level-of-service (LOS), reporting the vehicular delay with a letter grade A to F, volume to capacity ratio (V/C), the average vehicle stop time delay in seconds and the 95th percentile queue lengths.

A summary chart of the results of the existing traffic capacity analysis for weekday peak hours is

presented in Table 1 and shows that the overall intersection level of service is LOS E in the morning peak hour and LOS D in the afternoon peak hour. The intersection capacity analysis worksheets are provided in the Appendix of this memo.

Figure 1 Existing Roadway Configuration

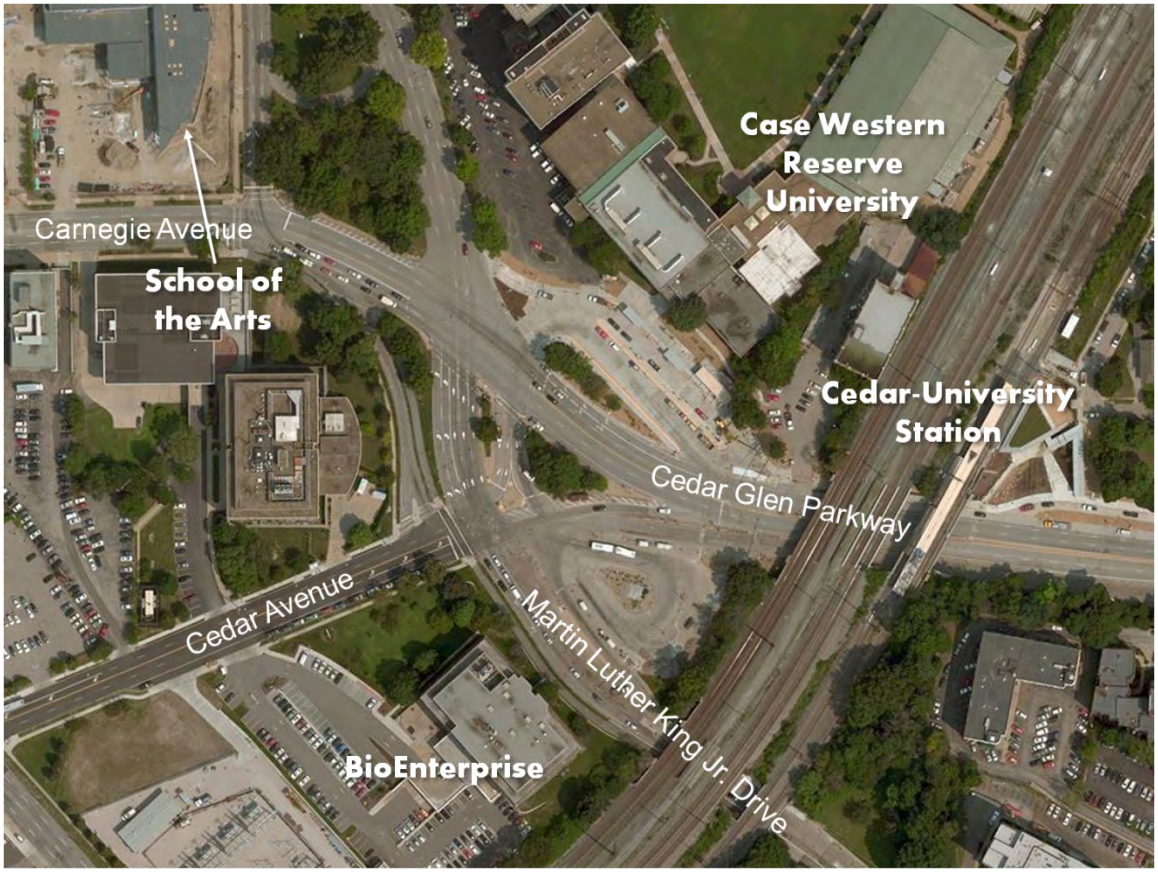


Table 1 Existing Intersection Level of Service

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Queue(ft) 95th %	LOS	Delay	V/C	Queue(ft) 95th %
MLK Jr. Dr./ Carnegie Ave.									
	EB	C	30.6	1.02	135	E	78.9	1.05	813
	WB	D	50.4	1.09	936	A	5.9	0.59	25
	NB	F	104.2	1.10	530	C	29.9	0.45	224
	Intersection	E	72.2	1.10	-	D	45.1	1.05	-

FUTURE CONDITIONS AND RECOMMENDATIONS

The Moving Greater University Circle Transportation & Mobility Study, which included public feedback and field observations, found that pedestrians (particularly students from the John Hay High School) were crossing the northern leg of the MLK Jr. Dr/Carnegie Ave intersection, despite the lack of a crosswalk. This crossing movement is the desire line from the northern sidewalk of Carnegie Ave. to the RTA station and is heavy during the morning peak and at the beginning of the afternoon peak. The alternative crossing movement involves crossing five roadways which is significantly longer in both distance (625-ft vs. 475-ft) and time (5 pedestrian crossings vs. 2 pedestrian crossings). With the fall 2015 opening of the School of Arts at the corner of Stearns Rd and Carnegie Ave, the demand for a northern crossing across MLK Jr. Dr will continue to increase. See figures 2-5 for images of this movement.

Figure 2 Pedestrian Desire Line vs. Existing Route

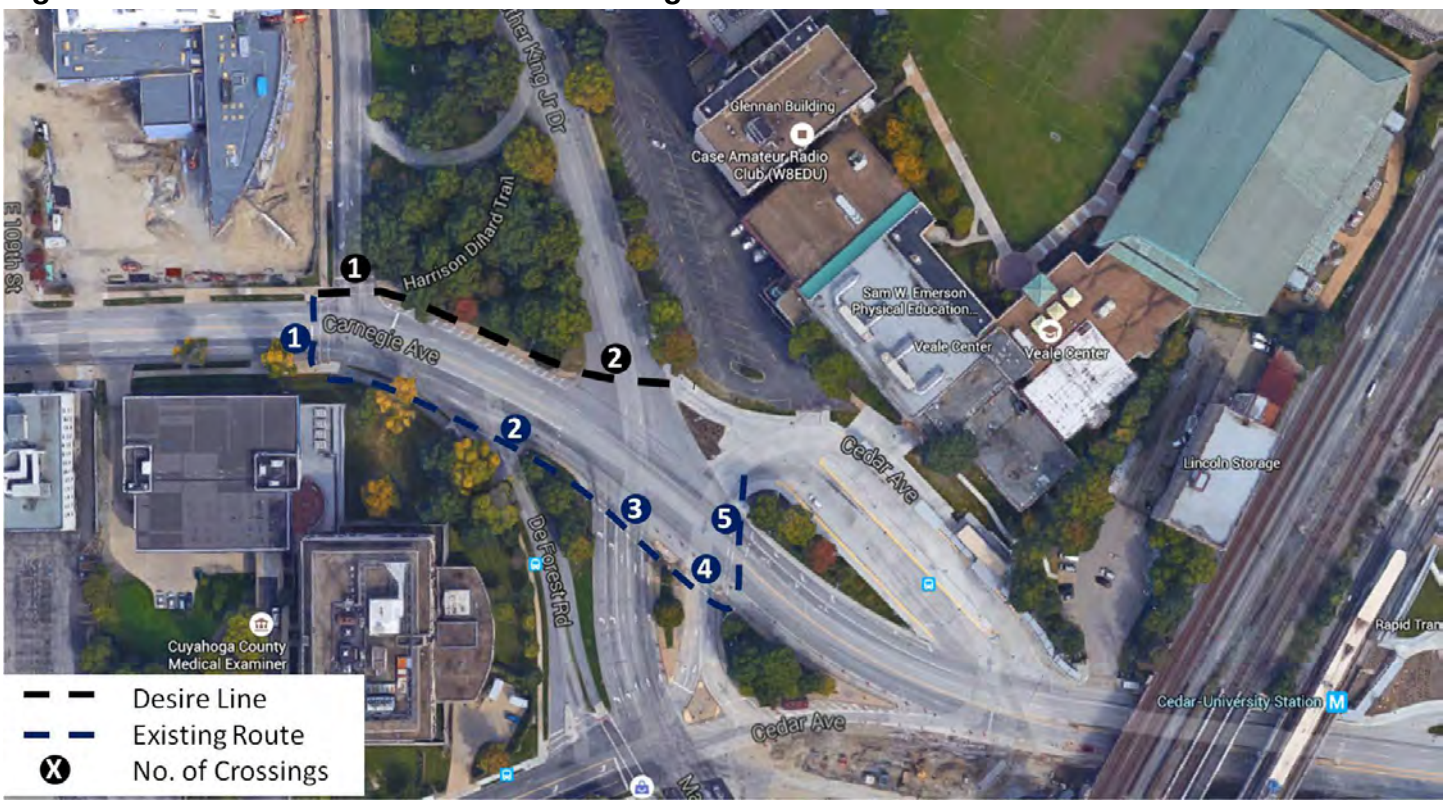


Figure 3 Pedestrians Crossing MLK Jr. Dr

Figure 4 Pedestrians Crossing MLK Jr. Dr

Figure 5 Pedestrians Crossing MLK Jr. Dr

In order to facilitate a safe and convenient crossing across MLK Jr. Dr, a number of recommendations are proposed within the intersection as outlined below.

- Install northern crosswalk across MLK Jr. Dr. with signal phase
- Narrow MLK Jr. Dr. northern leg from four (4) to three (3) receiving lanes. The existing fourth lane is superfluous as none of the approaches supply four lanes.
- MLK Jr. Dr southern approach remains three thru lanes
- Change Carnegie Ave. westbound lane configuration to two thru lanes and one right-turn lane (from a thru lane, a thru/right lane and a right lane)
- Optimization of signal phasing.

To assess the potential impacts of the proposed recommendations the intersection was analyzed for level-of-service (LOS), reporting the vehicular delay with a letter grade A to F, volume to capacity ratio (V/C), the average vehicle stop time delay in seconds and the 95th percentile queue lengths.

The results of the existing traffic capacity analysis for weekday peak hours with the proposed recommendations are presented in Table 2. The intersection capacity analysis worksheets and projected traffic volumes are provided in the Appendix of this memo. As shown in Table 3, the levels of service remain the same for all approaches and for the intersection overall. The queue lengths either improve or remain constant in all but one case, which worsens only slightly. V/C either decreases or remains the same in all cases.

Table 2 Proposed Recommendations under Existing Traffic Volumes

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Queue(ft) 95th %	LOS	Delay	V/C	Queue(ft) 95th %
MLK Jr. Dr./ Carnegie Ave.	EB	C	33.3	0.95	120	E	78.9	1.05	813
	WB	D	49.2	1.02	788	A	4.3	0.54	14
	NB	F	111.0	0.87	560	C	29.9	0.45	224
	Intersection	E	74.9	1.02	-	D	44.6	1.05	-

Table 3 Level of Service Summary

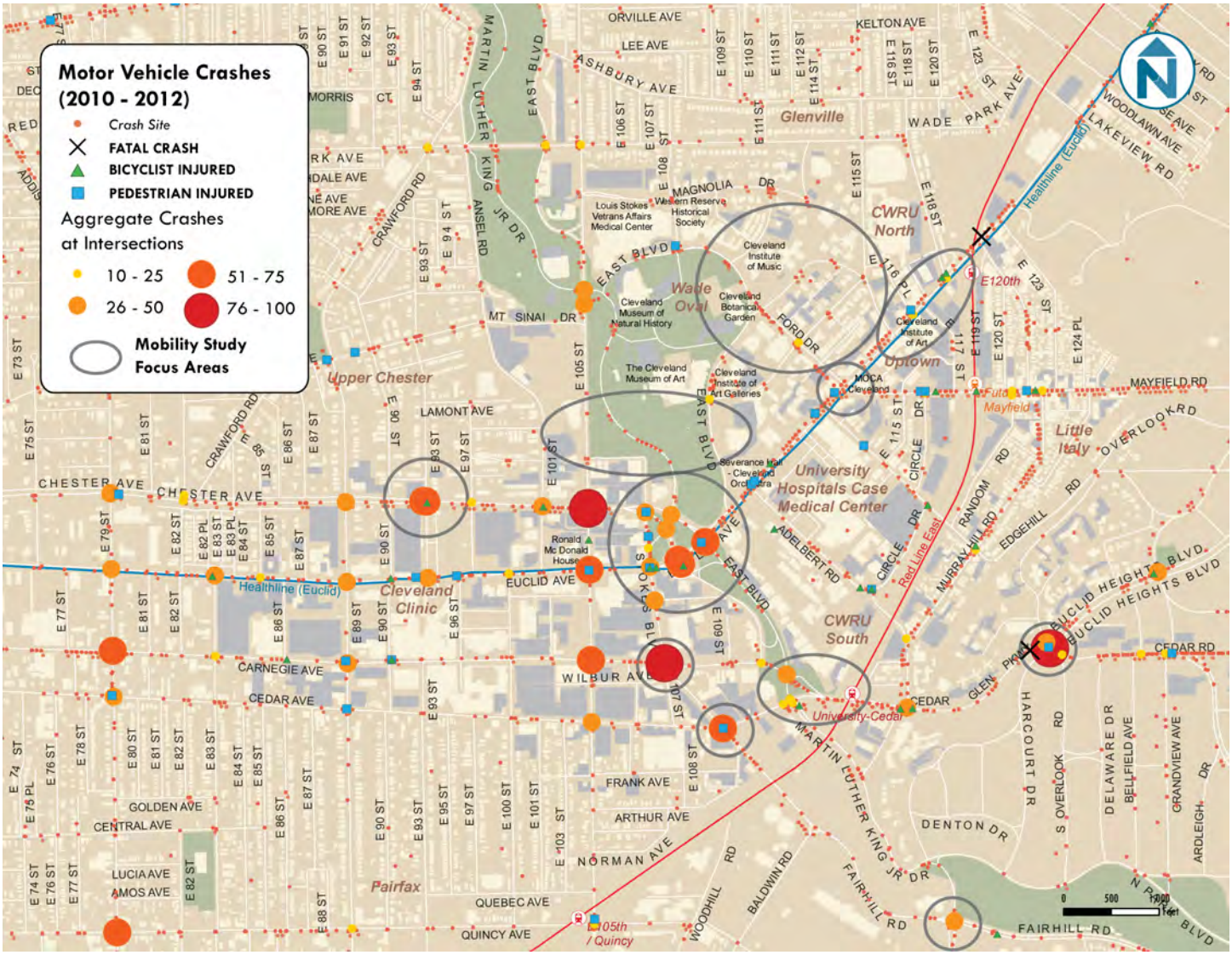
Intersection	AM Peak Hour LOS		PM Peak Hour LOS	
	Existing	Existing with Recommendations	Existing	Existing with Recommendations
MLK Jr. Dr./ Carnegie Ave.				
- EB	C	C	E	E
- WB	D	D	A	A
- NB	F	F	C	C
- Overall	E	E	D	D

NEXT STEPS

With the proposed recommendation of providing a northern crosswalk and reducing the MLK Jr. Drive receiving lanes to 3 lanes (from 4 lanes), the next steps would be to undertake a demonstration pilot. While the analysis shows that the recommendations would have minimal impacts on the existing conditions a pilot demonstration could be achieved with low cost and without permanent installation in order for the City to monitor the impacts on the intersection and network as a whole. Monitoring of the changes would include before and after observations incorporating pedestrian usage and compliance, vehicle queue lengths and vehicle compliance.

The pilot installation would require temporary pedestrian signals, crosswalk markings, lane reduction markings with temporary barrier, advance warning signage and intersection signal timing modifications. An initial cost estimate would be approximately $15,000-$20,000 but would be detailed further based upon the City's requirements.

Appendix: Crash Map



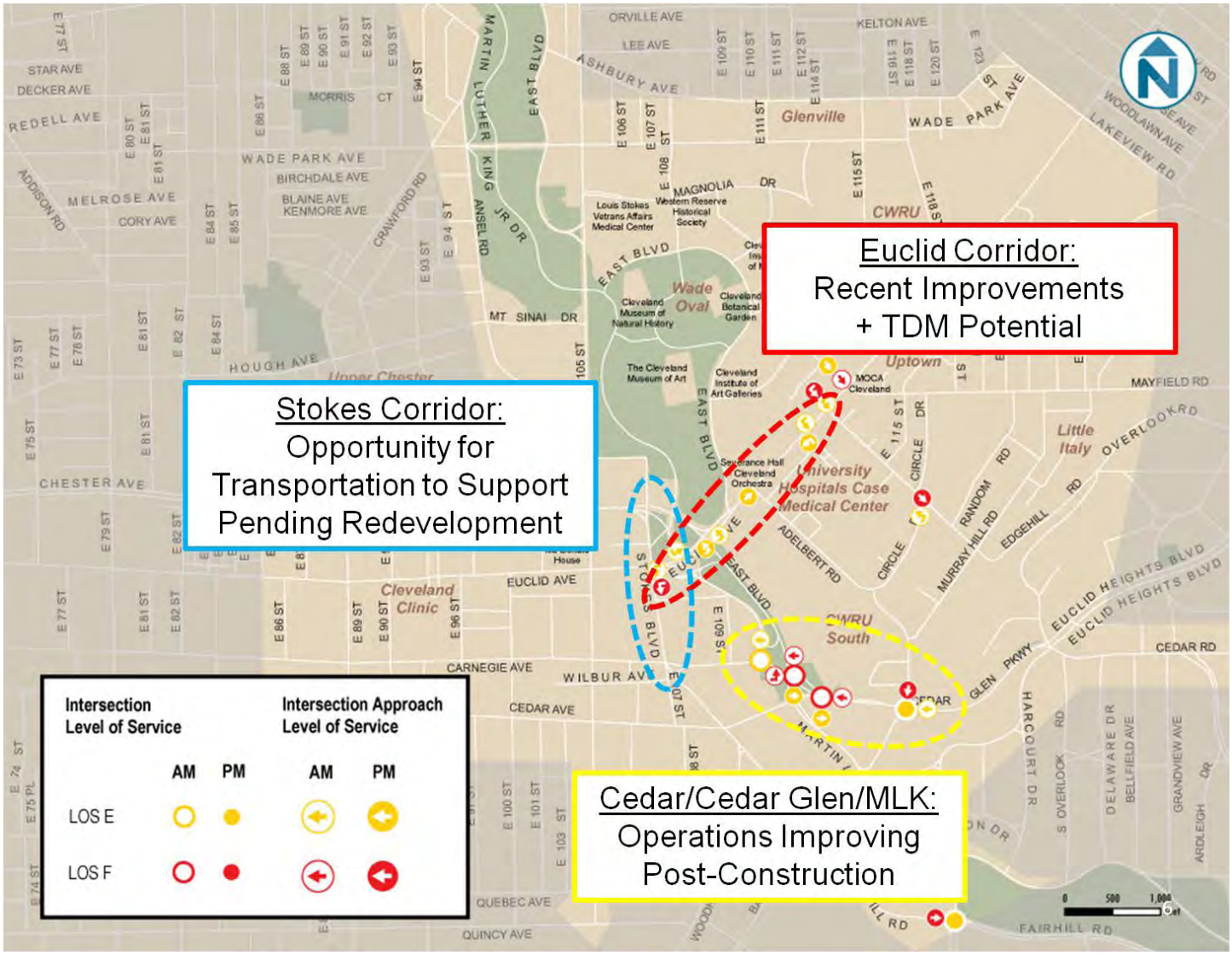
NELSON NYGAARD

Appendix: LOS Map

NELSON NYGAARD

Submitted electronically.

Appendix: Corridor Map



Appendix: Capital Cost Estimates

Intersection		Planning Level Cost Estimate
MLK Cedar University Station	$	477,926.41
Chester Ave at E.93rd St	$	97,704.53
South Wade Park	$	13,579.83
Chester Ave, Euclid Ave, Stokes Blvd/E 107th	$	112,411.86
Carnegie Ave at Stokes Blvd	$	60,271.53
Stokes Blvd at Cedar Ave	$	93,271.53
Euclid Heights Blvd at Cedar Glen Parkway	$	113,957.58
MLK Blvd at Fairhill Rd	$	90,958.23
Euclid Ave at Mayfield Rd	$	60,284.81
CWRU North Campus	$	110,003.03
Euclid Ave Uptown	$	17,375.24
Total	**$**	**1,247,744.57**

Planning Ranges	
< $50,000	Euclid Ave Uptown South Wade Park
$50,000 - $100,000	Chester Ave at E.93rd St Carnegie Ave at Stokes Blvd Stokes Blvd at Cedar Ave MLK Blvd at Fairhill Rd Euclid Ave at Mayfield Rd
$100,000 - $150,000	CWRU North Campus Euclid Heights Blvd at Cedar Glen Parkway Chester Ave, Euclid Ave, Stokes Blvd/E 107th
>$150,000	MLK Cedar University Station

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
MLK Jr. Dr at Carnegie Ave							
MLK Jr. Dr at Carnegie Ave	new ramps	$ 1,100.00	Ramp	2	$ 2,200.00		
	4" thermoplastic marking	$ 0.98	Linear foot	150	$ 147.00		
	6" thermoplastic marking	$ 2.00	Linear foot	150	$ 300.00		
	12" thermoplastic marking	$ 3.93	Linear foot	150	$ 589.50		
	Signage	$ 200.00	Sign	6	$ 1,200.00		
	Pedestrian Signal Unit	$ 2,250.00	Signal	2	$ 4,500.00		
	Portable Signal Bases	$ 400.00	each	2	$ 800.00		
	Monitoring	$ 100.00		6	$ 600.00		
	Traffic Turning Movement Counts	$ 800.00		2	$ 1,600.00		
	SUBTOTAL				**$ 11,936.50**		
	erosion & sediment control			5%	$ 596.83		
	drainage & utility relocation			15%	$ 1,790.48		
	maintenance of traffic during construction			10%	$ 1,193.65		
	design contingency			25%	$ 2,984.13		
	construction mobilization			10%	$ 1,193.65		
	TOTAL				**$ 19,695.23**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
Chester Ave at E. 93rd Sheet							
Chester Ave at E. 93rd Sheet	New ADA ramps	$ 1,100.00	Ramp	2	$ 2,200.00		
	4" thermoplastic marking	$ 0.98	Linear foot	200	$ 196.00		
	6" thermoplastic marking	$ 2.00	Linear foot	100	$ 200.00		
	12" thermoplastic marking	$ 3.93	Linear foot	50	$ 196.50		
	Signage	$ 200.00	Sign	4	$ 800.00		
	Curb extension	$ 10,000.00	Extension	3	$ 30,000.00		
	granite linear curb	$ 52.30	Linear foot	170	$ 8,891.00		
	backfill	$ 50.00	Cubic yard	250	$ 12,500.00		
	PCC sidewalk 4 inch	$ 17.00	Square yard	170	$ 2,890.00		
	sod	$ 8.82	Square yard	250	$ 2,205.00		
	SUBTOTAL				**$ 57,878.50**		
	erosion & sediment control			5%	$ 2,893.93		
	drainage & utility relocation			15%	$ 8,681.78		
	maintenance of traffic during construction			10%	$ 5,787.85		
	design contingency			25%	$ 14,469.63		
	construction mobilization			10%	$ 5,787.85		
	TOTAL				**$ 97,704.53**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
MLK Jr. Dr at Carnegie Ave							
MLK Jr. Dr at Carnegie Ave	new ramps	$ 1,100.00	Ramp	2	$ 2,200.00		
	4" thermoplastic marking	$ 0.98	Linear foot	150	$ 147.00		
	6" thermoplastic marking	$ 2.00	Linear foot	150	$ 300.00		
	12" thermoplastic marking	$ 3.93	Linear foot	150	$ 589.50		
	Signage	$ 200.00	Sign	6	$ 1,200.00		
	Pedestrian Signal Unit	$ 2,250.00	Signal	2	$ 4,500.00		
	Portable Signal Bases	$ 400.00	each	2	$ 800.00		
Stearns Road & Carnegie Avenue	new ramps	$ 1,100.00	Ramp	6	$ 6,600.00		
	4" thermoplastic marking	$ 0.98	Linear foot	170	$ 166.60		
	6" thermoplastic marking	$ 2.00	Linear foot	170	$ 340.00		
	12" thermoplastic marking	$ 3.93	Linear foot	170	$ 668.10		
	Signage	$ 200.00	Sign	6	$ 1,200.00		
	Pedestrian Signal Unit	$ 2,250.00	Signal	2	$ 4,500.00		
	Portable Signal Bases	$ 400.00	each	2	$ 800.00		
MLK Jr. Drive at Cedar Avenue	new ramps	$ 1,100.00	Ramp	10	$ 11,000.00		
	4" thermoplastic marking	$ 0.98	Linear foot	200	$ 196.00		
	6" thermoplastic marking	$ 2.00	Linear foot	200	$ 400.00		
	12" thermoplastic marking	$ 3.93	Linear foot	200	$ 786.00		
	Signage	$ 200.00	Sign	14	$ 2,800.00		
	Pedestrian Signal Unit	$ 2,250.00	Signal	2	$ 4,500.00		
	Portable Signal Bases	$ 400.00	each	2	$ 800.00		
Cedar Glen Parkway & New Bus Entrance	new ramps	$ 1,100.00	Ramp	6	$ 6,600.00		
	4" thermoplastic marking	$ 0.98	Linear foot	250	$ 245.00		
	6" thermoplastic marking	$ 2.00	Linear foot	250	$ 500.00		
	12" thermoplastic marking	$ 3.93	Linear foot	250	$ 982.50		
	Signage	$ 200.00	Sign	6	$ 1,200.00		
	Pedestrian Signal Unit	$ 2,250.00	Signal	2	$ 4,500.00		
	Portable Signal Bases	$ 400.00	each	2	$ 800.00		
Curb Extensions/Road Closure	Small curb extension	$ 10,000.00	Extension	3	$ 30,000.00		
	granite linear curb	$ 52.30	Linear foot	2050	$ 107,215.00		
	backfill	$ 50.00	Cubic yard	1708.333	$ 85,416.67		
	Remove island	$ 77.00	Linear foot	100	$ 7,700.00		
	SUBTOTAL				**$ 289,652.37**		
	erosion & sediment control			5%	$ 14,482.62		
	drainage & utility relocation			15%	$ 43,447.86		
	maintenance of traffic during construction			10%	$ 28,965.24		
	design contingency			25%	$ 72,413.09		
	construction mobilization			10%	$ 28,965.24		
	TOTAL				**$ 477,926.41**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
South Wade Park (not including east-west connection across park)							
South Wade Park	new ramps	$ 1,100.00	Ramp	4	$ 4,400.00		
	4" thermoplastic marking	$ 0.98	Linear foot	100	$ 98.00		
	6" thermoplastic marking	$ 2.00	Linear foot	80	$ 160.00		
	12" thermoplastic marking	$ 3.93	Linear foot	40	$ 157.20		
	Signage	$ 200.00	Sign	4	$ 800.00		
	Speed Table	$ 3,500.00	each	1	$ 3,500.00		
	bike lane	$ 14,060.00	Per mile	0.25	$ 3,515.00		
	SUBTOTAL				**$ 8,230.20**		
	erosion & sediment control			5%	$ 411.51		
	drainage & utility relocation			15%	$ 1,234.53		
	maintenance of traffic during construction			10%	$ 823.02		
	design contingency			25%	$ 2,057.55		
	construction mobilization			10%	$ 823.02		
	TOTAL				**$ 13,579.83**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
Chester, Euclid Ave, Stokes Blvd and E. 107th Street							
Chester, Euclid Ave, Stokes Blvd and E. 107th Street	new ramps	$ 1,100.00	Ramp	2	$ 2,200.00		
	4" thermoplastic marking	$ 0.98	Linear foot	300	$ 294.00		
	6" thermoplastic marking	$ 2.00	Linear foot	200	$ 400.00		
	12" thermoplastic marking	$ 3.93	Linear foot	80	$ 314.40		
	Signage	$ 200.00	Sign	6	$ 1,200.00		
	Small curb extension	$ 10,000.00	Extension	2	$ 20,000.00		
	granite linear curb	$ 52.30	Linear foot	400	$ 20,920.00		
	backfill	$ 50.00	Cubic yard	500	$ 25,000.00		
	SUBTOTAL				**$ 68,128.40**		
	erosion & sediment control			5%	$ 3,406.42		
	drainage & utility relocation			15%	$ 10,219.26		
	maintenance of traffic during construction			10%	$ 6,812.84		
	design contingency			25%	$ 17,032.10		
	construction mobilization			10%	$ 6,812.84		
	TOTAL				**$ 112,411.86**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
Carnegie Ave at Stokes Blvd							
Carnegie Ave at Stokes Blvd	new ramps	$ 1,100.00	Ramp	2	$ 2,200.00		
	4" thermoplastic marking	$ 0.98	Linear foot	200	$ 196.00		
	6" thermoplastic marking	$ 2.00	Linear foot	100	$ 200.00		
	12" thermoplastic marking	$ 3.93	Linear foot	40	$ 157.20		
	Signage	$ 200.00	Sign	2	$ 400.00		
	Small curb extension	$ 10,000.00	Extension	1	$ 10,000.00		
	granite linear curb	$ 52.30	Linear foot	250	$ 13,075.00		
	backfill	$ 50.00	Cubic yard	250	$ 12,500.00		
	SUBTOTAL				**$ 36,528.20**		
	erosion & sediment control			5%	$ 1,826.41		
	drainage & utility relocation			15%	$ 5,479.23		
	maintenance of traffic during construction			10%	$ 3,652.82		
	design contingency			25%	$ 9,132.05		
	construction mobilization			10%	$ 3,652.82		
	TOTAL				**$ 60,271.53**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
Cedar Ave at Stokes Blvd							
Cedar Ave at Stokes Blvd	new ramps	$ 1,100.00	Ramp	3	$ 3,300.00		
	4" thermoplastic marking	$ 0.98	Linear foot	200	$ 196.00		
	6" thermoplastic marking	$ 2.00	Linear foot	100	$ 200.00		
	12" thermoplastic marking	$ 3.93	Linear foot	40	$ 157.20		
	Signage	$ 200.00	Sign	2	$ 400.00		
	Small curb extension	$ 10,000.00	Extension	3	$ 30,000.00		
	granite linear curb	$ 52.30	Linear foot	250	$ 13,075.00		
	backfill	$ 50.00	Cubic yard	250	$ 12,500.00		
	SUBTOTAL				**$ 56,528.20**		
	erosion & sediment control			5%	$ 2,826.41		
	drainage & utility relocation			15%	$ 8,479.23		
	maintenance of traffic during construction			10%	$ 5,652.82		
	design contingency			25%	$ 14,132.05		
	construction mobilization			10%	$ 5,652.82		
	TOTAL				**$ 93,271.53**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
Euclid Heights Blvd at Cedar Glen Pkwy and Cedar Rd							
Euclid Heights Blvd at Cedar Glen Pkwy and Cedar Rd	new ramps	$ 1,100.00	Ramp	3	$ 3,300.00		
	4" thermoplastic marking	$ 0.98	Linear foot	200	$ 196.00		
	6" thermoplastic marking	$ 2.00	Linear foot	100	$ 200.00		
	12" thermoplastic marking	$ 3.93	Linear foot	40	$ 157.20		
	Signage	$ 200.00	Sign	2	$ 400.00		
	Small curb extension	$ 10,000.00	Extension	3	$ 30,000.00		
	granite linear curb	$ 52.30	Linear foot	380	$ 19,874.00		
	backfill	$ 50.00	Cubic yard	300	$ 15,000.00		
	bike path	$ 14,060.00	Per mile	0.1	$ 1,406.00		
	sharrow markings	$ 229.00	Marking	8	$ 1,832.00		
	SUBTOTAL				**$ 69,065.20**		
	erosion & sediment control			5%	$ 3,453.26		
	drainage & utility relocation			15%	$ 10,359.78		
	maintenance of traffic during construction			10%	$ 6,906.52		
	design contingency			25%	$ 17,266.30		
	construction mobilization			10%	$ 6,906.52		
	TOTAL				**$ 113,957.58**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
MLK Jr. and Stokes Blvd at Fairhill Road							
MLK Jr. and Stokes Blvd at Fairhill Road	new ramps	$ 1,100.00	Ramp	6	$ 6,600.00		
	4" thermoplastic marking	$ 0.98	Linear foot	300	$ 294.00		
	6" thermoplastic marking	$ 2.00	Linear foot	100	$ 200.00		
	12" thermoplastic marking	$ 3.93	Linear foot	40	$ 157.20		
	Signage	$ 200.00	Sign	6	$ 1,200.00		
	Small curb extension	$ 10,000.00	Extension	2	$ 20,000.00		
	granite linear curb	$ 52.30	Linear foot	250	$ 13,075.00		
	backfill	$ 50.00	Cubic yard	250	$ 12,500.00		
	Remove island	$ 77.00	Linear foot	100	$ 7,700.00		
	SUBTOTAL				**$ 55,126.20**		
	erosion & sediment control			5%	$ 2,756.31		
	drainage & utility relocation			15%	$ 8,268.93		
	maintenance of traffic during construction			10%	$ 5,512.62		
	design contingency			25%	$ 13,781.55		
	construction mobilization			10%	$ 5,512.62		
	TOTAL				**$ 90,958.23**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
Euclid Ave at Mayfield Road							
Euclid Ave at Mayfield Road	No Turn on Red signage	$ 200.00	Sign	2	$ 400.00		
	Small curb extension	$ 10,000.00	Extension	3	$ 30,000.00		
	sharrow markings	$ 229.00	Marking	24	$ 5,496.00		
	Lead Pedestrian Intervals Timing	$ 200.00	Hour	2	$ 400.00		
	4" thermoplastic marking	$ 0.98	Linear foot	260	$ 254.80		
	6" thermoplastic marking	$ 2.00	Linear foot	65	$ 130.00		
	12" thermoplastic marking	$ 3.93	Linear foot	65	$ 255.45		
	SUBTOTAL				**$ 36,536.25**		
	erosion & sediment control			5%	$ 1,826.81		
	drainage & utility relocation			15%	$ 5,480.44		
	maintenance of traffic during construction			10%	$ 3,653.63		
	design contingency			25%	$ 9,134.06		
	construction mobilization			10%	$ 3,653.63		
	TOTAL				**$ 60,284.81**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
CWRU North Campus							
CWRU North Campus	No Turn on Red, Bikeway, speed limit signage	$ 200.00	Sign	25	$ 5,000.00		
	Small curb extension	$ 10,000.00	Extension	1	$ 10,000.00		
	granite linear curb	$ 52.30	Linear foot	50	$ 2,615.00		
	remove pedestrian-actuated signals						
	Speed Table	$ 3,500.00	each	2	$ 7,000.00		
	new ramps	$ 1,100.00	Ramp	40	$ 44,000.00		
	4" thermoplastic marking	$ 0.98	Linear foot	1240	$ 1,215.20		
	6" thermoplastic marking	$ 2.00	Linear foot	310	$ 620.00		
	12" thermoplastic marking	$ 3.93	Linear foot	310	$ 1,218.30		
	SUBTOTAL				**$ 66,668.50**		
	erosion & sediment control			5%	$ 3,333.43		
	drainage & utility relocation			15%	$ 10,000.28		
	maintenance of traffic during construction			10%	$ 6,666.85		
	design contingency			25%	$ 16,667.13		
	construction mobilization			10%	$ 6,666.85		
	TOTAL				**$ 110,003.03**		

Intersection	Item	Unit Price	Unit	Amount	Cost		Source
Euclid Avenue Uptown							
Euclid Avenue Uptown	No Turn on Red, Bikeway, speed limit signage	$ 200.00	Sign	4	$ 800.00		
	add leading pedestrian interval	$ 200.00	Hour	2	$ 400.00		
	4" thermoplastic marking	$ 0.98	Linear foot	380	$ 372.40		
	6" thermoplastic marking	$ 2.00	Linear foot	95	$ 190.00		
	12" thermoplastic marking	$ 3.93	Linear foot	95	$ 373.35		
	sharrow markings	$ 229.00	Marking	25	$ 5,725.00		
	SUBTOTAL				**$ 7,060.75**		
	erosion & sediment control			5%	$ 353.04		
	drainage & utility relocation			15%	$ 1,059.11		
	maintenance of traffic during construction			10%	$ 706.08		
	design contingency			25%	$ 1,765.19		
	construction mobilization			10%	$ 706.08		
	TOTAL				**$ 17,375.24**		