CITY OF URBANA, ILLINOIS
DEPARTMENT OF PUBLIC WORKS

ADMINISTRATION

MEMORANDUM

TO: **Mayor Laurel L. Prussing and Members of City Council**

FROM: **William R. Gray, Public Works Director**

DATE: **November 8, 2012**

RE: **Windsor Road Corridor Analysis – Road Diet Study**

At the February 27, 2012 Committee of the Whole meeting direction was provided to staff as a result of a modern roundabout feasibility study to analyze the pros and cons of a road diet (current four/five lanes to two/three lanes) on Windsor Road between Philo Road and Lincoln Avenue and determine whether a single lane roundabout should be considered at the intersection of Windsor Road and Race Street.

City staff contracted with staff at the Regional Plan Commission (RPC) to perform this analysis since they have modeling, planning, and engineering expertise for this work. Mr. Sharif Ullah from RPC will present his findings at this Tuesday's Committee of the Whole meeting. Attached please find a copy of the study.

Pending City Council's comments and direction from this study, City staff will begin its investigation into the reconstruction of Windsor Road between Philo Road and Race Street determining the best pavement design, estimate of cost, and means to fund the project.

City staff seeks a motion from the City Council to accept this analysis.

CHAMPAIGN COUNTY REGIONAL PLANNING COMMISSION

Windsor Road Corridor Analysis

Draft Report

Champaign Urbana Urbanized Area Transportation Study

9/25/2012

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1.0 Introduction

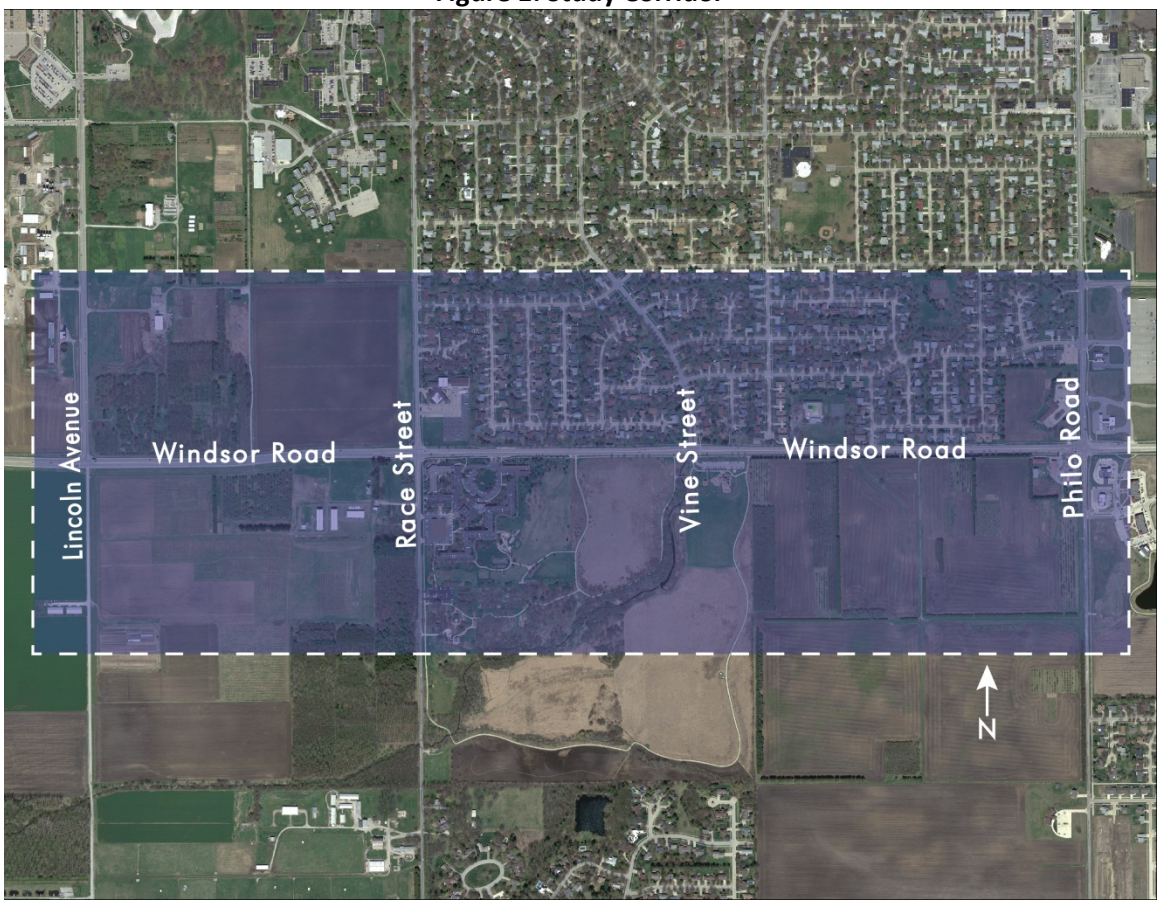
1.1 Background

The Champaign County Regional Planning Commission (CCRPC) received a request from Public Works officials at the City of Urbana to perform an alternative scenario analysis for the Windsor Road corridor between Lincoln Avenue and Philo Road in Urbana. The alternative analysis includes research on the potential for a single-lane modern roundabout at the Race Street/Windsor Road intersection and conversion of a four lane cross-section of Windsor Road into a three-lane cross-section with a center two-way left turn lane/median.

1.2 Study Corridor

The Windsor Road study corridor lies at the southwest corner of the City of Urbana's municipal boundary. The study corridor boundary includes Lincoln Avenue to the west and Philo Road to the east. Figure 1 shows an aerial view of the study corridor as of 2011.

Figure 1: Study Corridor



As can be seen in Figure 1, the Race Street/Windsor Road intersection is situated in the middle of the study corridor.

1.3 Study Objectives

The objectives of the study are to:

- Evaluate the installation of a single-lane roundabout at the Race Street/Windsor Road intersection.
- Evaluate the conversion of the Windsor Road study section into a three-lane cross-section (i.e. a road diet).

2.0 Existing Conditions Analysis

The existing conditions analysis of the study corridor includes an evaluation of existing lane and intersection profiles, traffic controls, traffic operational analysis, and crash analysis. Existing conditions data for the study corridor include the following:

- Lane profiles and intersection geometric and traffic control profiles
- Vehicular, pedestrian, and bicycle movement data at study intersections in the corridor on a typical weekday during morning (7:30AM to 9:00AM) and evening (4:30PM to 6:00PM) time frames
- Traffic crashes

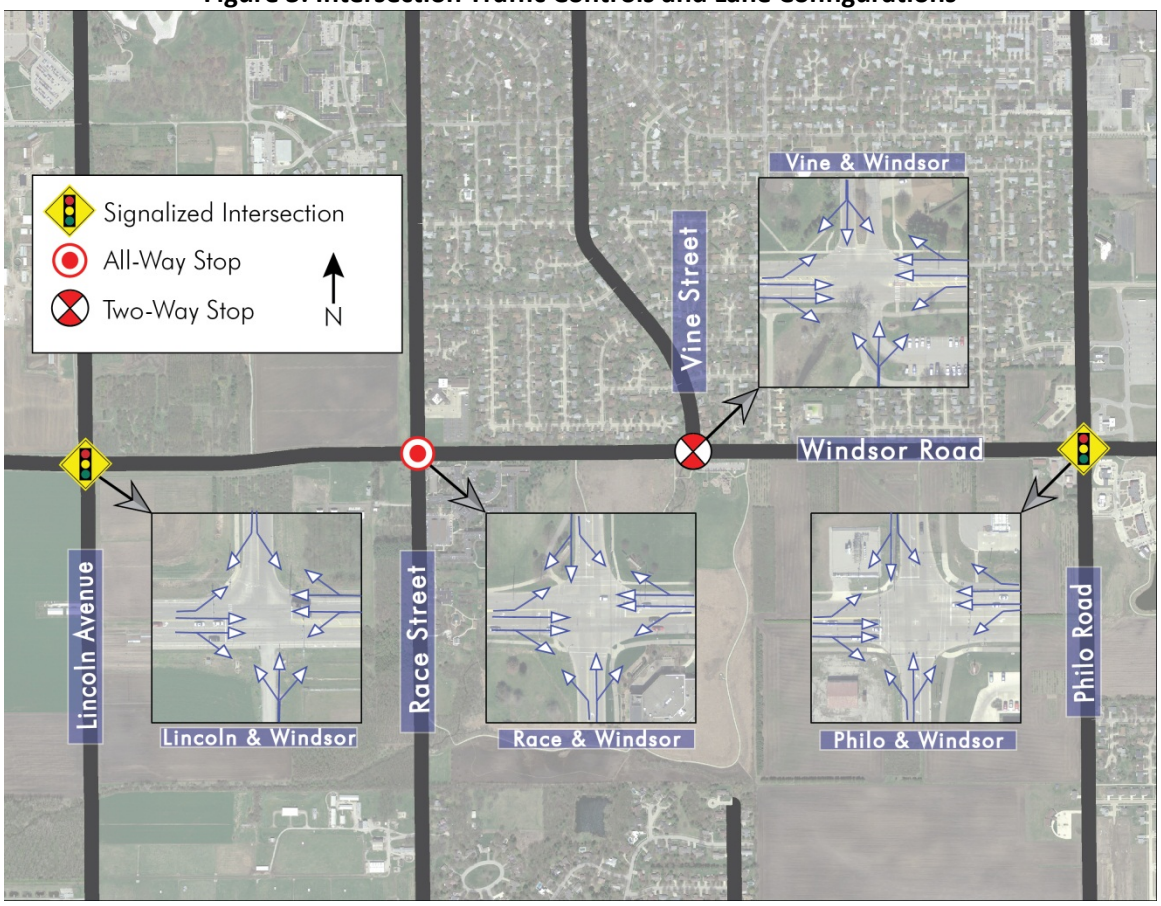
2.1 Existing Geometric Features of Roadways and Intersections

The Windsor Road study segment is classified as a “minor arterial” in the Champaign-Urbana Urbanized Area roadway functional classification system. A typical urban minor arterial interconnects and supplements the principal arterial system and provides service for trips of a moderate length. Figure 2 shows lane profiles along the study corridor. The study corridor is a four-lane roadway with two travel lanes in each direction.

Figure 3 shows lane configuration and traffic control type information for the major intersections in the study corridor. There are two signalized and two un-signalized major intersections along the study corridor. The main focus of the study is an All-Way Stop Controlled (AWSC) intersection at the Race Street and Windsor Road intersection.

Figure 2: Lane Profiles

Figure 3: Intersection Traffic Controls and Lane Configurations



2.2 Traffic Operational Conditions

Morning (7:30AM to 9:00AM) and afternoon (4:30PM to 6:00PM) vehicular, pedestrian and bicycle movement data were collected at the following study intersections from April 23rd to 27th, 2012:

- Lincoln Avenue/Windsor Road
- Race Street/Windsor Road
- Vine Street/Windsor Road
- Philo Road/Windsor Road

2.2.1 Peak Hour Traffic

Table 1 shows peak-hour turning movement counts at the study intersections.

Table 1: Peak Hour Traffic Volumes

Approach Volume (AM Peak Hour)												
Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lincoln/Windsor	1	0	0	54	1	129	438	367	2	0	685	246
Race/Windsor	140	114	24	15	45	73	95	299	38	19	665	33
Vine/Windsor	6	8	5	12	4	67	48	255	9	2	659	19
Philo/Windsor	70	103	18	51	66	116	116	170	14	11	503	86
Approach Volume (PM Peak Hour)												
Intersection	Northbound			Southbound			Eastbound			Westbound		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Thru	Right
Lincoln/Windsor	1	1	3	218	5	395	152	663	1	0	532	50
Race/Windsor	37	58	35	41	128	110	105	733	85	35	427	46
Vine/Windsor	20	7	10	35	11	74	80	693	28	16	398	23
Philo/Windsor	55	107	51	114	126	111	198	439	65	81	351	51

2.2.2 24-Hour Traffic Counts

Table 2 shows 24-hour traffic volumes along the study corridor collected in 2011. The traffic volumes shown in Table 2 are not seasonally adjusted.

Table 2: 24-Hour Traffic Volumes (Collected in 2011)

Location	24-Hr Traffic Volume
Windsor Road W of Lincoln Avenue	16,269
Windsor Road E of Lincoln Avenue	13,650
Windsor Road E of Race Street	11,687
Windsor Road W of Philo Road	8,792
Windsor Road E of Philo Road	6,783
Lincoln Avenue N of Windsor Road	9,644
Race Street N of Windsor Road	3,755
Race Street S of Windsor Road	2,677

2.2.3 Level-of-Service

Level-of-Service (LOS) is a qualitative measure describing operational conditions from "A" (best) to "F" (worst) within a traffic stream or at intersections, which is quantified for signalized and unsignalized intersections in terms of vehicle control delay. Control delay is the component of delay that results from the type of traffic control at an intersection. It is measured by comparing the controlled condition against the uncontrolled condition. The difference between the travel time that would have occurred in the absence of the intersection control and the travel time that results from the presence of the intersection control is the control delay. Average control delay per vehicle is estimated for each lane group, and aggregated for each approach and the intersection as a whole.

Table 3 shows the LOS criteria for signalized intersections.

Table 3: LOS Criteria for Signalized Intersection

Control Delay per Vehicle (sec/veh)	LOS for Volume to Capacity Ratio ≤1
≤10	A
>10 and ≤20	B
>20 and ≤35	C
>35 and ≤55	D
>55 and ≤80	E
>80	F

Table 4 shows the LOS criteria for unsignalized intersections.

Table 4: LOS Criteria for Unsignalized Intersections

Control Delay per Vehicle (sec/veh)	LOS for Volume to Capacity Ratio ≤1
≤10	A
>10 and ≤15	B
>15 and ≤25	C
>25 and ≤35	D
>35 and ≤50	E
>50	F

Table 5 shows the LOS and average control delay at each study intersection for the AM and PM peak hours. A LOS analysis was completed using HCS and Synchro 8 software. Both software programs are based upon the methodologies outlined in the "Highway Capacity Manual (HCM 2010)" published by the Transportation Research Board in 2010.

As can be seen in Table 5, at the Race Street/Windsor Road intersection, the westbound approach was congested during the AM peak hour and the eastbound approach was congested during the PM peak hour. At the Lincoln Avenue/Windsor Road intersection, both the eastbound and westbound approaches were congested during the AM peak hour.

Table 5: Existing Intersection Control Delays and LOS

Intersection	Approach	LOS	Average Control Delay (sec/veh)	LOS	Average Control Delay (sec/veh)
		AM Peak		PM Peak	
Race Street/Windsor Road	Eastbound	C	20.6	F	56.6
	Westbound	F	61.6	D	30.4
	Northbound	C	22.3	C	16.8
	Southbound	C	19.3	D	29.2
	Overall	E	40.2	E	42.4
Philo Road/Windsor Road	Eastbound	B	11.3	B	17.3
	Westbound	B	16.8	B	17.6
	Northbound	C	21.5	C	29.1
	Southbound	C	26.0	C	25.3
	Overall	**B**	**18.0**	**C**	**20.5**
Vine Street/Windsor Road	Northbound	D	33.0	F	81.9
	Southbound	D	26.7	F	56.0
Lincoln Avenue/Windsor Road	Eastbound	F	87.9	B	10.6
	Westbound	E	72.1	B	16.0
	Southbound	C	33.7	F	204.5
	Overall	E	74.0	E	70.8

2.3 Crash Data Analysis

Data for intersection and mid-block crashes along the Windsor Road study corridor from 2007 to 2011 were analyzed to identify existing safety and operational issues.

2.3.1 Crash Trends

Figure 4 shows the total number of reported crashes per year from 2007 to 2011 along the study corridor. The total of reported crashes includes both intersection and mid-block crashes. The crash frequency exhibited a significant increase in 2011 when compared to the previous years.

Figure 4: Crash Trends (2007-2011)

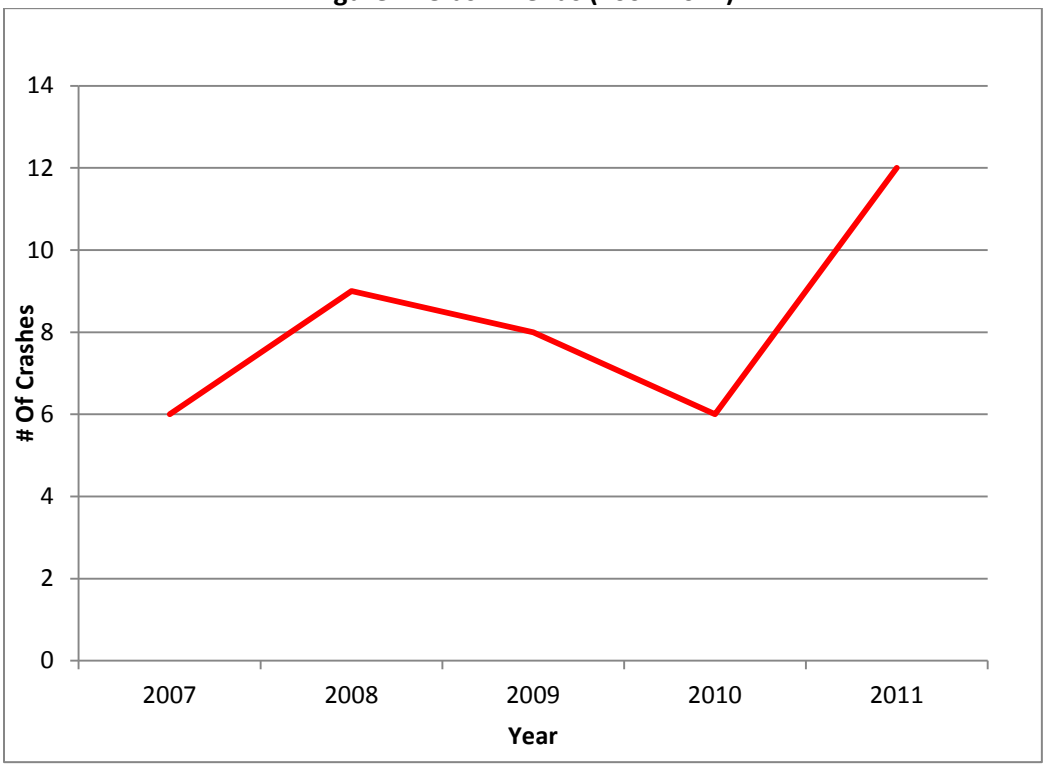


Figure 5 shows the distribution of intersection and mid-block crashes along the study corridor. As can be seen in Figure 5, the majority of the crashes (73%) occurred at intersections.

Figure 5: Intersection and Mid-Block Crashes

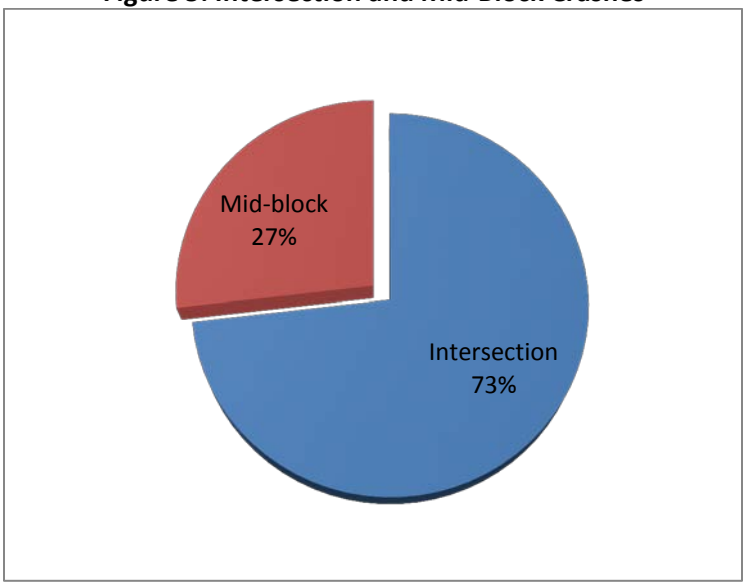


Table 6 shows the number of crashes per year at selected intersections along the study corridor.

Table 6: Intersection Crashes

Intersection	2007	2008	2009	2010	2011	Total
	No. of Crashes					
Lincoln Avenue/Windsor Road	0	0	0	0	7	7
Race Street/ Windsor Road	2	2	2	2	0	8
Vine Street/Windsor Road	1	1	1	1	1	5
Philo Road/Windsor Road	1	5	3	0	1	10
Total	**4**	**8**	**6**	**3**	**9**	**30**

Crashes at intersections along the corridor showed a declining trend except at the Lincoln Avenue/Windsor Road intersection. This intersection experienced a sharp rise in the number of crashes in 2011.

2.3.2 Crash Types

Table 7 shows crash type information at the study intersections. Turning and rear-end crashes were the predominant crash types at the study intersections.

Table 7: Crash Types at Study Intersections

Intersection	Crash Type				
	Turning	Rear End	Angle	Fixed Object	Other
Lincoln Avenue/Windsor Road	2	4	1	0	0
Race Street/Windsor Road	0	2	4	0	2
Vine Street/Windsor Road	4	0	0	1	0
Philo Road/Windsor Road	3	2	4	1	0
Total	**9**	**8**	**9**	**2**	**2**

Table 8 shows crash type information for mid-block crashes along the study corridor. As can be seen in Table 8, there was only one rear-end mid-block crash.

Table 8: Crash Types for Mid-block Crashes

Roadway	Segment		Crash Type				
	From	To	Turning	Rear end	Angle	Fixed Obj	Sideswipe
Windsor Road	Lincoln Avenue	Race Street	2	0	0	0	0
	Race Street	Vine Street	1	1	1	1	1
	Vine Street	Philo Road	0	0	0	3	0
Total			**3**	**1**	**1**	**4**	**1**

2.3.3 Crash Severity

Crash severity levels are generally classified into three different categories:

- Fatal Crash
- Injury Crash
- Property Damage Only (PDO)

The Illinois Department of Transportation's (IDOT) Division of Traffic Safety categorizes injury crashes into three severity categories: A-Injury, B-Injury, and C-Injury. A-Injury is the most severe while C-Injury is the least severe.

Table 9 shows severity levels of intersection crashes along the study corridor. The majority of the intersection crashes (70%) were PDO crashes.

Table 9: Crash Severity Levels for Intersection Crashes

Intersection	Crash Severity				
	Fatal	Injury			PDO
		A	B	C	
Lincoln Avenue/Windsor Road	0	0	0	1	6
Race Street/Windsor Road	0	0	3	1	4
Vine Street/ Windsor Road	0	0	0	1	4
Philo Road/ Windsor Road	0	2	1	0	7
Total	**0**	**2**	**4**	**3**	**21**

Table 10 shows the severity levels of mid-block crashes along the study corridor. The majority of mid-block crashes (81%) were PDO crashes.

Table 10: Crash Severity Levels for Mid-block Crashes

Roadway	Segment		Fatal	Injury Type			PDO
				A	B	C	
Windsor Road	Lincoln Avenue	Race Street	0	0	1	0	2
	Race Street	Vine Street	0	0	0	0	5
	Vine Street	Philo Road	0	0	1	0	2
Total			**0**	**0**	**2**	**0**	**9**

2.3.4 Crash Rates

Table 11 shows crash rates (per million entering vehicles) at the intersections along the study corridor. As can be seen in Table 11, crash rate at the Race Street/Windsor Road intersection was 0.28. Average crash rate for similar intersections in Champaign Urbana Urbanized Area was 0.31 with a standard deviation value of 0.2[1]. Thus, this intersection's crash rate was less than the average crash rate for similar intersections in the region.

Table 11: Crash Rates at the Study Intersections (2007 – 2011)

Intersection	No. of Crashes (2007 - 2011)	Daily Entering Vehicles	Crash Rate (per MEV*)
Lincoln Avenue/Windsor Road	7	19,782	0.19
Race Street/ Windsor Road	8	15,885	0.28
Vine Street/Windsor Road	5	10,815	0.25
Philo Road/Windsor Road	10	12,188	0.45

* MEV = Million Entering Vehicles

Table 12 shows crash rates for the roadway segments along the study corridor. As can be seen in Table 12, crash rates for the study roadway segments are low and well below 1.0 crash rate per million vehicles per mile.

Table 12: Crash Rates at Roadway Segments (2007 – 2011)

Roadway	Segment	No. of Crashes (2007 - 2011)	Length of Segment (miles)	Average Daily Traffic	Crash Rate (Per MEV/Mile)
Windsor Road	Lincoln Avenue - Race Street	3	0.50	13,650	0.24
	Race Street - Vine Street	5	0.41	11,687	0.57
	Vine Street - Philo Road	3	0.59	8,792	0.32

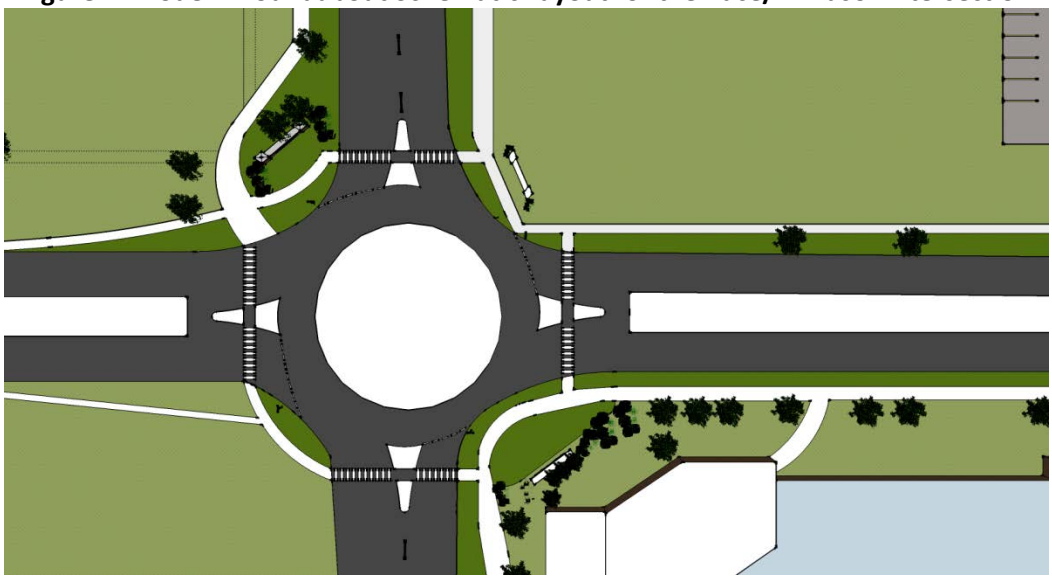
3.0 Alternative Analysis

An alternative scenario of a single-lane roundabout at the Race Street/Windsor Road intersection was considered for the analysis. The conversion of the Windsor Road study corridor into a two-lane cross-section with a two-way left turn lane/median from the east of Lincoln Avenue to the west of Philo Road was also considered.

Figures 6 and 7 show the existing and respective proposed changes at the Race Street/Windsor Road intersection for the alternative analysis.

Figure 6: Existing Schematic Layout at the Race/Windsor Intersection

Figure 7: Modern Roundabout Schematic Layout for the Race/Windsor Intersection



3.1 Traffic Operations

Table 13 and Table 14 show a comparison of the LOS and control delay by approach at the Race Street/Windsor Road intersection. This data accounts for existing AWSC and alternative single-lane roundabout intersection control scenario during the AM and PM peak hours respectively.

Table 13: LOS and Control Delay Comparison for AM Peak

Intersection	Approach	All-Way Stop		Single-Lane Roundabout	
		Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS
Race St/Windsor Rd	Eastbound	20.6	C	10.1	B
	Westbound	**61.6**	**F**	**190.1**	**F**
	Northbound	22.3	C	14.3	B
	Southbound	19.3	C	20.8	C
	Overall	**40.2**	**E**	**97.0**	**F**

Table 14: LOS and Control Delay Comparison for PM Peak

Intersection	Approach	All-Way Stop		Single-Lane Roundabout	
		Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS
Race St/Windsor Rd	Eastbound	**56.6**	**F**	**86.3**	**F**
	Westbound	30.4	D	13.3	B
	Northbound	16.8	C	14.1	B
	Southbound	29.2	D	12.8	B
	Overall	**42.4**	**E**	**49.9**	**E**

As can be seen in Table 13 and Table 14, a single-lane roundabout would worsen traffic operational conditions at the study intersection. The study intersection currently warrants a traffic signal based on the Manual on Uniform Traffic Control Devices (MUTCD) traffic signal control warrant analysis and would be installed as funding becomes available[2].

3.2 Horizon Year 2040 Analysis

CCRPC's in-house countywide travel demand model was utilized to assess projected traffic volumes along the Windsor Road study corridor segments. The in-house travel demand model predicts future travel by all travel modes including automobile, transit, bicycling, and walking based on demands for travel considering land-use, economic growth, cost of fuel, and value of time. Table 15 shows a comparison of 2011 24-hour traffic volumes from the study corridor and the projected 24-hour traffic volumes for 2040.

Table 15: Existing and Projected (2040) 24-Hour Traffic Volume Comparisons

Location	24-Hr Traffic Volume		% Change
	2011	2040	
Windsor Road W of Lincoln Avenue	16,269	19,256	18.4
Windsor Road E of Lincoln Avenue	13,650	17,923	31.3
Windsor Road E of Race Street	11,687	14,958	28.0
Windsor Road W of Philo Road	8,792	11,384	29.5

As can be seen in Table 15, traffic volumes along the study corridor are predicted to experience significant growth over the next 30 years. Additional traffic growth would contribute to increased congestion at the already congested intersection approaches during the AM and PM peak hours.

Table 16 shows the LOS and control delays at the Race Street/Windsor Road intersection approaches in the horizon year 2040. For this study period, PM peak hours were considered for two types of intersection control: Existing AWSC and single-lane roundabout.

Table 16: LOS and Control Delay Comparisons for Horizon Year 2040

Intersection	Approach	All-Way Stop		Single-Lane Roundabout	
		Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS
Race Street/Windsor Road	Eastbound	**74.9**	**F**	**458.0**	**F**
	Westbound	**76.3**	**F**	**82.7**	**F**
	Northbound	25.2	D	**44.3**	**E**
	Southbound	**76.2**	**F**	**142.5**	**F**
	Overall	**72.3**	**F**	**263.9**	**F**

For the horizon year 2040 scenario, the Race Street/Windsor Road traffic operational condition will be fully congested in all approaches for the single-lane roundabout scenario.

Table 17 shows the LOS and control delays comparison at the Race Street/Windsor Road intersection approaches in the horizon year 2040 PM peak period considering two types of intersection control: traffic signal and single-lane roundabout.

Table 17: LOS and Control Delay Comparisons for Horizon Year 2040

Intersection	Approach	Traffic Signal		Single-Lane Roundabout	
		Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS
Race St/Windsor Rd	Eastbound	15.6	B	458.0	F
	Westbound	9.6	A	82.7	F
	Northbound	10.2	B	44.3	E
	Southbound	12.9	B	142.5	F
	Overall	**13.0**	**B**	**263.9**	**F**

The study intersection would require traffic signal for efficient traffic operation based on the results shown in Table 16 and Table 17.

3.3 Roadway Reconfiguration (Road Diet)

The Windsor Road study corridor was evaluated for a roadway reconfiguration scenario. This scenario includes converting a four-lane cross-section of Windsor Road into a three-lane cross-section with one through lane in each direction and a center turn lane/median.

Roadway corridors for road-diet conversion should include some of the following criteria[3].

- Moderate volumes (8-15,000 ADT)
- Roads with safety issues
- Transit corridor
- Popular or essential bicycle routes/links
- Commercial reinvestment areas
- Economic enterprise zones
- Historic streets
- Scenic roads
- Entertainment district
- Main Streets

Table 18 shows applicability of these criteria for the study corridor. As can be seen in Table 18, none of the above mentioned criteria is fully applicable for the study corridor.

Table 18: Road-Diet Conversion Criteria

Criteria	Applicability for the Study Corridor	Comments
Moderate Volume (8-15,000 ADT)	Not Applicable for the horizon year 2040	As shown in Table 15, major portion of the study corridor would have ADT greater than 15,000 by 2040
Roads with Safety Issues	Not Applicable	As shown in Table 11 and Table 12, crash rates at the intersections and roadway segments along the study corridor are low
Transit Corridor	Not Applicable	The study corridor is not an established transit route
Popular or essential bicycle route/link	Applicable	Portion of the study corridor (Lincoln Ave -Race St) already has on-street bike lanes, and sidepaths are available for the remaining section of the corridor
Commercial reinvestment area	Not Applicable	
Economic enterprise zone	Not Applicable	
Historic street	Not Applicable	
Scenic Road	Not Applicable	
Entertainment district	Not Applicable	
Main street	Not Applicable	

Based on the existing conditions analysis and projected traffic growth along the study corridor in the horizon year 2040, the following factors were also considered:

- Major portions of the study corridor have 24-hour traffic volumes close to 15,000. Moreover, the horizon year 2040 24-hour traffic volumes would be close to 20,000. Studies show that roads with Average Daily Traffic (ADT) of 15,000 or less exhibited safety and operational benefits of "Road-Diet" conversion[4].

- Road diet conversion improves traffic safety by reducing rear-end and side-swipe crashes. However, as described in section 2.3. the study corridor had only one rear-end and one side-swipe mid-block crash between 2007 and 2011.

- Road-diets aid smoother traffic operation along the corridors with higher driveway densities. As shown in Table 19, the study corridor's driveway density is very low.

Table 19: Driveway Densities along the Study Corridor

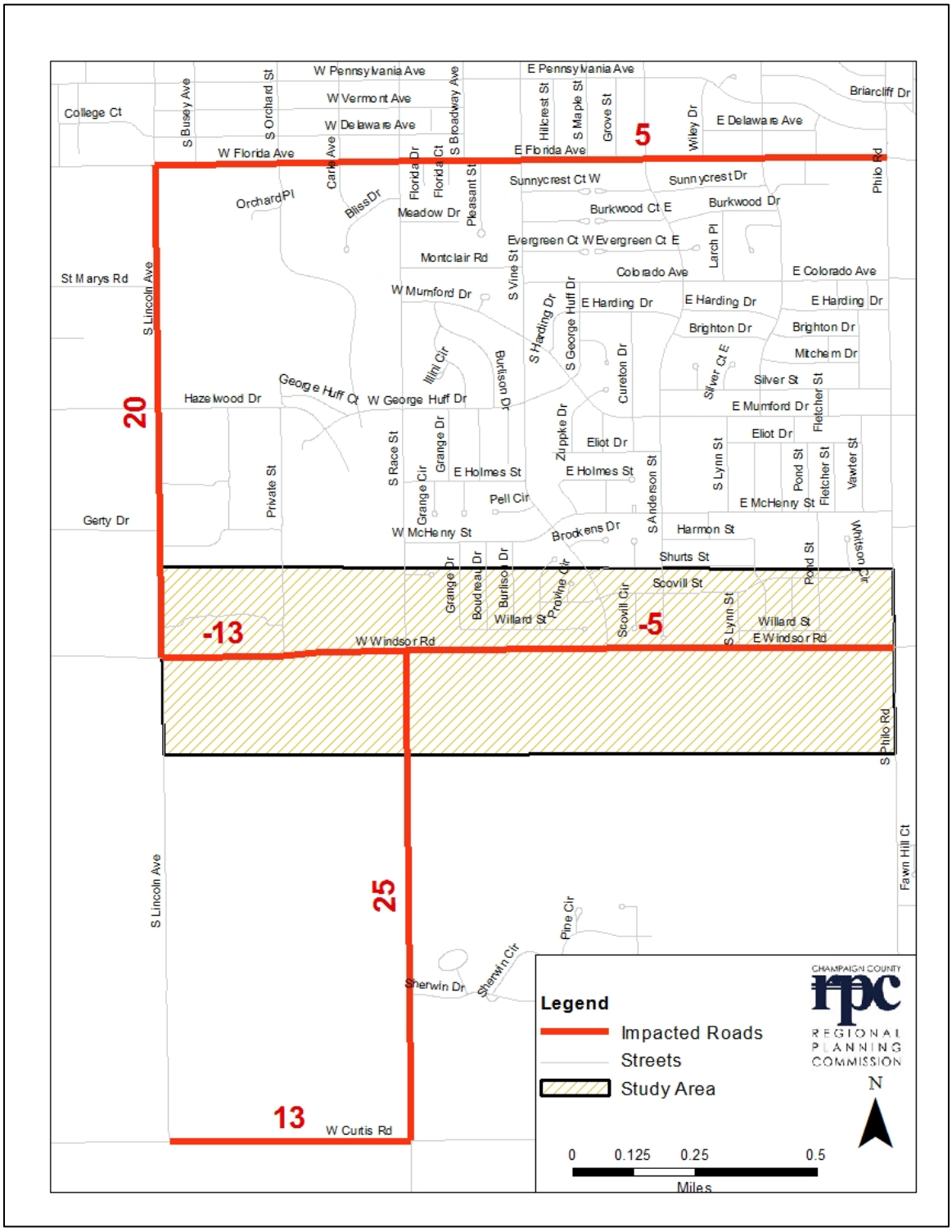
Corridor	Segment		No. of Driveways	Distance (mile)	Driveway Density (per mile)
	From	To			
Windsor Road	Lincoln Ave	Race St	1	0.50	2.0
	Race St	Vine St	2	0.41	4.8
	Vine St	Philo Rd	5	0.59	8.5

3.3.1 The Impact of Road-Diet on the Roadway Network

CCRPC's in-house travel demand model was utilized to estimate changes in traffic volumes due to proposed implementation of a road-diet along the Windsor Road study corridor. Figure 8 shows roadways impacted by the roadway reconfiguration on Windsor Road. The percent increase or decrease in projected daily traffic volumes due to the road-diet is also shown in Figure 8.

The proposed lane reconfiguration on Windsor Road would force additional traffic on to Curtis Road, Lincoln Avenue, and Florida Avenue. Curtis Road lacks suitable driving conditions to absorb the traffic due to poor road surface, narrow travel lanes, lack of shoulder, and pavement markings. Lincoln Avenue is part of the University District road network and additional traffic would negatively impact the high frequency of pedestrian and bicycle activities within the University District. Moreover, additional northbound left turn traffic at the Lincoln Avenue/Windsor Road intersection would further deteriorate traffic congestion at this intersection as shown in Table 5.

Figure 8: Percent Change in Traffic Volumes due to the Proposed Lane Reconfiguration



4.0 Study Findings

The following findings are summarized based on the detailed evaluation of the study corridor for existing conditions and horizon year 2040 conditions:

- The Race Street/Windsor Road intersection experiences congested conditions on the westbound approach and eastbound approach during the AM and PM peak hours respectively. This intersection currently warrants a traffic signal.

- The Race Street/Windsor Road intersection experiences an average of 1.6 crashes per year; however, none of these crashes resulted in fatalities or severe injuries.

- Crash rate at the study intersection is lower than the average crash rate for similar intersections in Champaign Urbana Urbanized Area.

- There was only one rear-end mid-block crash along the study corridor within the last five year period (2007-2011).

- At present, 24-hour traffic volumes along the study corridor are close to 15,000.

- It is predicted that the study corridor will experience significant traffic growth by horizon year 2040.

- A single-lane roundabout will worsen traffic operational conditions at the Race Street/Windsor Road intersection for both existing and future conditions.

- The study corridor is not a suitable candidate for a “Road-Diet” conversion considering existing and future ADT, crash history, adverse impacts on other roadways, and driveway densities.

5.0 Recommendations

The study recommendations include the following:

- The Race Street/Windsor Road intersection should be evaluated for a traffic signal or a multi-lane roundabout to eliminate congested traffic operational conditions during the AM and PM peak hours.

- The Windsor Road study corridor should not be considered for a roadway reconfiguration or road-diet conversion.

REFERENCES

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2. Ourston Roundabout Engineering – *Intersection Control Study: Windsor Road/Race Street,* prepared for the City of Urbana, Ourston Roundabout Engineering, June 2011.

3. Burden D., et al. – *Road Diets: Fixing the Big Roads,* accessed from the www.walkable.org website.

4. Federal Highway Administration- *Proven Safety Countermeasures: Road Diet (Roadway Reconfiguration), FHWA-SA-12-013,* Federal Highway Administration, FHWA, Washington, DC.