

1. PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1. Purpose

The purpose of the proposed action is to address existing and 2040 transportation needs along Willow Road, from Illinois Route 43 (Waukegan Road) to Interstate 94 (Edens Expressway). The specific needs of the project include improving or enhancing safety for all users, improving mobility, and improving the facility condition and design. These needs will be addressed through either local, regional, or a combination of improvements.

1.2. Project Location

The study area is located in northeast Cook County, Illinois and within the Villages of Glenview, Northbrook, Northfield, and Winnetka (See Figure 1.1, Regional Location Map). The project study limits are along Willow Road with a west terminus at Illinois Route 43 (Waukegan Road) and an eastern terminus at Interstate 94 (Edens Expressway), a distance of approximately 1.8 miles (See Figure 1.2 Project Location Map).

Willow Road is classified as a Strategic Regional Arterial (SRA) and is under the jurisdiction of the Illinois Department of Transportation (IDOT). SRA's are a network of highways designed to accommodate long distance regional traffic, to complement the region's major highway and transit facilities, and to supplement the freeway system. Along the study corridor, there are six signalized intersections and the Interstate 94 (I-94) interchange, which provides access to and from the south on I-94. Existing land use along Willow Road within the project limits is a combination of residential, commercial, school, church, and park uses. Willow Road also crosses over the Middle Fork North Branch of the Chicago River. Generally, Willow Road between Sunset Ridge Road and Northfield Road is a two-lane facility with gravel shoulders. West of Sunset Ridge Road and east of Northfield Road, Willow Road is a four-lane road, with curb and gutter, and a center median.

1.3. Project Background

Willow Road was originally constructed as a concrete roadway in the mid-1940's with one lane in each direction. Over the past 70 years, there have been minor improvements which have included reconstruction or widening and resurfacing of the various intersections and sections within the study area. Willow Road was most recently resurfaced in 2008 from west of Sunset Ridge Road to east of Central Avenue/Happ Road due to deterioration of the pavement.

The Willow Road corridor has been the subject of numerous studies, but no major improvements have been made to the roadway facility in several decades. This study, initiated in 2009, will follow the National Environmental Policy Act (NEPA) and Context Sensitive Solutions (CSS) processes. CSS is a collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic, and environmental resources, while maintaining safety and mobility. The goal is to reach consensus on the project elements, but consensus may or may not be reached.

A Community Advisory Group (CAG) has been formed to facilitate the exchange of information between IDOT and project stakeholders. Through the CAG meetings and project coordination, the following Willow Road studies have been completed or are underway and have been considered in the development of the Purpose and Need:

- Community Context Audit, January 2010
- Draft *Physical Inventory of Infrastructure Elements*, September 2010
- Draft *Traffic Analysis Summary, Existing and 2030 No-Build Traffic Volumes*, July 2010
- Draft *Crash Analysis of Existing Conditions*, June 2010
- Problem Statement, August 2010
- Stakeholder comments

The Willow Road project is included in the Fiscal Year (FY) 2010-2015 Transportation Improvement Program (TIP) endorsed by the Chicago Metropolitan Agency for Planning (CMAP), the Metropolitan Planning Organization for the region in which the project is located. The FY 2010-2015 TIP number for this project is 02-09-0003. The project is also a part of the *GO TO 2040* Comprehensive Regional Plan (CRP) endorsed by CMAP.

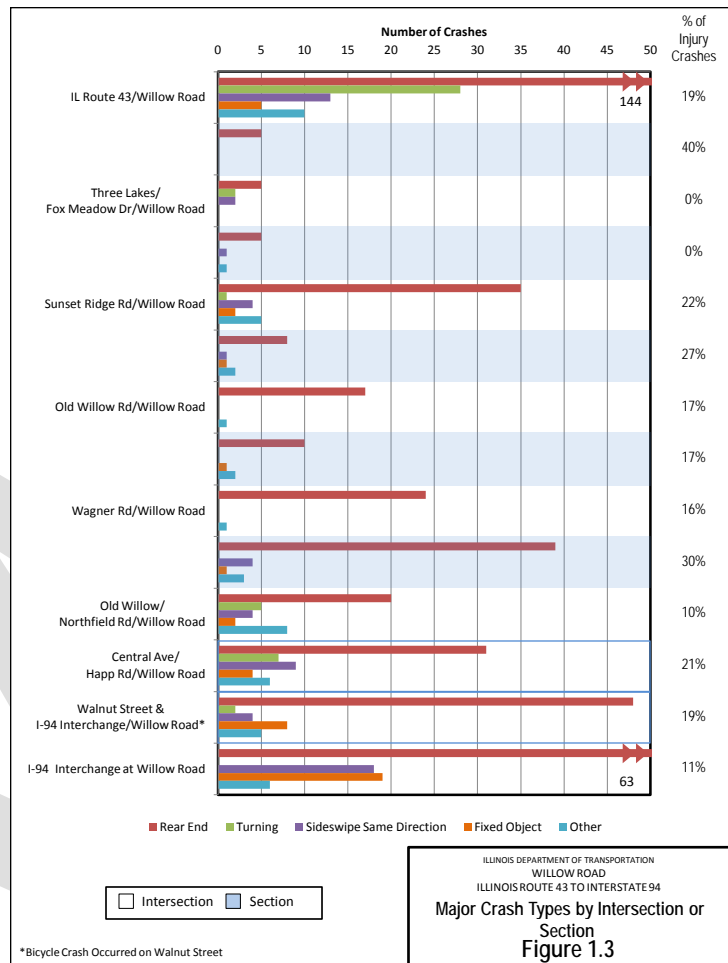
1.4. Need for the Proposed Action

1.4.1. Safety

A review of the crash history within the study limits was completed for the three-year study period from 2006 to 2008. Refer to the Draft *Crash Analysis of Existing Conditions*, report dated June 2010 for the full analysis. The Draft *Crash Analysis* will be updated with 2009 data when it is available. Crashes have been tabulated by year, crash type, injury type, and roadway conditions to ascertain overall trends and determine if any particular statistical overrepresentation exists that would warrant special countermeasure considerations.

Crash report data and associated Traffic Crash Reports from the state and local police were obtained from the Illinois Department of Transportation (IDOT) Division of Traffic Safety. In addition, site visits, field observations, and interviews with school crossing guards were conducted in May 2010. A total of 639 crashes occurred within the study limits from January 1, 2006 through December 31, 2008. These crashes occurred along Willow Road and along I-94 within the area of the Willow Road interchange ramps. Figure 1.3 to the right depicts the predominant types by location.

As shown to the right, the highest number of intersection crashes occurred at the Illinois Route 43 intersection, followed by the Sunset Ridge and the Central Avenue/Happ Road intersections. For the sections, the highest number of crashes occurred on I-94 in the vicinity of the Willow Road interchange, on Willow Road between Walnut Street and the I-94 interchange and on Willow Road between Wagner Road and Old Willow Road/Northfield Road.



The most common type of crash was rear end, accounting for 71 percent of the total crashes. The next most common types were sideswipe same direction, turning, and fixed object crashes which combined for an additional 24 percent of the total crashes. These are summarized in Table 1.1.

Of the 639 crashes, 115 crashes or 18 percent resulted in injuries. During the study period there were no Type K (fatality) crashes, two Type A (incapacitating injury) crashes, 46 Type B (non-incapacitating injury), and 67 Type C (reported, injury not evident). Of the 115 crashes with injuries, 72 percent were the result of rear end collisions. Another 10 percent involved turning crashes and 8 percent involved vehicles hitting a fixed object.

Table 1.1 – Total Crashes by Type, Frequency and Injury Severity

Crash Type	Number of Crashes	Frequency	Total Injury Crashes	Injury Types			Fatalities
				A	B	C	
Angle	17	2.7%	3	0	1	2	0
Animal	3	0.5%	0	0	0	0	0
Fixed Object	43	6.7%	9	0	8	1	0
Head On	2	0.3%	1	0	1	0	0
Other Non-Collision	1	0.2%	0	0	0	0	0
Other Object	7	1.1%	1	0	0	1	0
Overtuned	2	0.3%	2	0	1	1	0
Parked Motor Vehicle	0	0.0%	0	0	0	0	0
Pedal Cyclist	1	0.2%	1	0	0	1	0
Pedestrian	0	0.0%	0	0	0	0	0
Rear End	454	71.0%	83	2	27	54	0
Sideswipe Opposite Direction	4	0.6%	0	0	0	0	0
Sideswipe Same Direction	60	9.4%	3	0	0	3	0
Turning	45	7.0%	12	0	8	4	0
Total Crashes (2006-2008)	639	100.0%	115	2	46	67	0

There were a total of 69 crashes (46.3 percent) in the two-lane sections and 80 crashes (53.7 percent) in the four-lane sections. This demonstrates that there are safety problems in both the two-lane and the four-lane sections. Review of the roadway surface condition found that over 70 percent of all crashes occurred on a dry roadway surface, with 27 percent of crashes occurring on wet, snowy, or icy pavement conditions. The analysis suggests that wet pavement was not a major cause for crashes on Willow Road within the study area. Similarly, review of the roadway lighting conditions showed almost 80 percent of the crashes occurred in daylight conditions, 7 percent of the crashes occurred during night hours in sections without street lights and 10 percent occurred during night hours in sections with street lights. Lastly, the time of day and day of week analysis showed that during the weekdays, the number of crashes increased proportionately with the increase in traffic volumes. The weekday peak was highest during the period between 4:00 p.m. and 6:00 p.m. During the weekend, the number of crashes was highest during the period between 1 p.m. and 4 p.m. Similar to the weekday experience, the weekend crashes increased proportionately with the increase in traffic volumes.

There were no pedestrian crashes during the study period. Only one pedal cyclist crash and was the result of the cyclist riding between two vehicles waiting on Walnut Street to turn right onto Willow Road. It resulted in a Type C injury.

In summary, within the project study limits, approximately 16 crashes per month occur along Willow Road, with another one crash per month on I-94 at the interchange. Of these, three crashes per month are injury crashes. The predominant crash types of rear end and sideswipe crashes are up to 3 times higher than statewide averages for similar roadway types. There has also been a higher percentage than statistical average for Type A crashes on the section from Wagner Road to Northfield Road. Similarly, for Type B crashes, there has been a higher percentage than statistical average for the three sections of Sunset Ridge Road to Old Willow Road, Wagner Road to Northfield Road, and Central Avenue/Happ Road through I-94. The high incident of rear end, sideswipe, and turning crashes (87 percent of all crashes) is an indication of crash concerns and the need for safety improvements that warrant further consideration.

1.4.2. Mobility

Operations and Capacity

Willow Road was evaluated for existing 2009 and forecasted 2030 No-Build conditions to determine existing and future traffic operations. The results of the analysis are contained in the Draft *Traffic Analysis Summary, Existing and 2030 No-Build Traffic Volumes*, report dated, July 2010. The Draft *Traffic Analysis* will be updated with forecasted 2040 volumes when they are available. The six signalized intersections and the five sections in between them were evaluated to assess roadway operations, capacity, and how it accommodates the need of its users. The evaluation analyzed: 1) signalized intersections, 2) street sections, and 3) system performance.

The 2009 traffic counts were obtained by actual field traffic counts and the 2030 No-Build traffic projections were developed by CMAP based on socio-economic forecast data for the region. The 2030 No-Build forecasted volumes maintained the existing street configuration for Willow Road while including other programmed roadway improvements in the Chicago region. See Figure 1.4 and 1.5, respectively, for the Existing and the 2030 No-Build Annual Average Daily Traffic (AADT) maps. Within the project study limits, the existing AADT on Willow Road ranges between 24,800 and 32,000 vehicles per day. The 2030 No-Build AADT ranges between 28,000 and 36,000 vehicles per day.

Signalized Intersections

The Highway Capacity Software (HCS, version 5.4) was used to evaluate the intersection operations. The operation of an intersection is described by its Level of Service (LOS). Level of service is defined as a qualitative measure describing operation conditions within a traffic stream, as well as service measures, such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. These measures can be quantified and graded on a letter scale of A (best) to F (worst). See Table 1.2 below. The levels of service for a signalized intersection are a calculated Average Delay of seconds per vehicle. For SRA roadways, the IDOT Bureau of Design and Environment (BDE) Manual requires a LOS C or better for the arterial through lanes. However, in some circumstances, such as Willow Road, LOS D can be considered in urban/suburban areas when there would be substantial potential adverse socio-economic or environmental impacts.

Table 1.2 – LOS General Descriptions

Level of Service	General Description	Average Delay (seconds per vehicle)
A	Free flow traffic; many vehicles do not stop at all	≤10
B	Generally good traffic flow; more vehicles stop than with LOS A	>10-20
C	Fair traffic flow; the number of vehicles stopping is greater than LOS B although many still pass through without stopping	>20-35
D	Longer delays; many vehicles stop and the number passing through without stopping decreases	>35-55
E	Poor flow and progression; the number of vehicles stopping is very high	>55-80
F	Very high delays with long queues of vehicles	≥80

Analysis of the signalized intersections found that for existing traffic volumes during the A.M. peak hour, three of the six signalized intersection operated below LOS D. In the P.M. peak hour, four of the six intersections operated below LOS D. For the 2030 No-Build volumes, both the A.M. and P.M. peak hours, had four of six intersections operating below LOS D. The four intersections are at Illinois Route 43, Sunset Ridge Road, Wagner Road, and Central Avenue/Happ Road. The intersections at Illinois Route 43 and at Central Avenue/Happ Road operate at LOS F with 2030 No-Build volumes. These analyses show that four of the six signalized intersections within the study area are operating over capacity with either existing traffic or 2030 No-Build traffic volumes. Levels of service will continue to decline with future travel demands; substantial increases in delay will also occur, particularly at the Illinois Route 43, Sunset Ridge Road, and Wagner Road intersections. See Figures 1.6 through 1.9 at the end of the document for additional details for each intersection.

The operations of the Willow Road interchange with I-94 were also evaluated using existing traffic and 2030 No-Build traffic volumes. Based on its current configuration, it operates at LOS D for existing and future traffic conditions. However, the eastbound and westbound Willow Road ramps for northbound I-94 operate at LOS F and E in the A.M. and P.M. peaks, respectively, for both traffic scenarios.

Street Sections

The street sections were analyzed using the Highway Capacity Manual (HCM) 2000 Urban Street methodology. HCM methodology assesses mobility on a street which is measured in terms of travel speed for the through-traffic stream. Operation of a street section is quantified with a LOS based on the free flow speed of the section, with A (best) to F (worst). At LOS A, traffic moves freely at or above the posted speed limit; all drivers have complete mobility to change lanes. At LOS F, traffic flow is forced; every vehicle moves in lockstep with the vehicle in front of it. For the Urban Street Segment LOS analysis, Willow Road is classified as a Class II Suburban Principal Arterial. As with the signalized intersections, the minimum level of service for a suburban SRA like Willow Road is LOS D.

Analysis of the five street sections found that with existing volumes in both the A.M. and P.M. peak hours, all but three sections were at or below LOS D. The exceptions were westbound Willow Road between Wagner Road and Sunset Ridge Road and between Sunset Ridge Road and Three Lakes Drive/Fox Meadow Drive, as well as eastbound Willow Road between Wagner Road and Old Willow Road/Northfield Road. Most sections of Willow Road are over capacity.

As part of the street sections evaluation, the volume-to-capacity (V/C) ratios were also reviewed. V/C ratios relate the demand on a roadway, in terms of vehicles, to the ability of the roadway to carry traffic, its capacity. V/C is a measure of congestion of the through traffic lanes. V/C does not account for turning vehicles that, either because of the lack of turn lanes or because the turn lanes are themselves operating above capacity, add additional delay to the through traffic.

Under existing traffic conditions during peak hours, all sections have a V/C greater than 1.00 except between Central Avenue/Happ Road and Interstate 94. The other sections have ratios over 1.00 indicating congested conditions, with the highest values on the sections between Three Lakes Drive/Fox Meadow Drive and Old Willow Road/Northfield Road. In comparison, under the 2030 No-Build condition, all sections in either the A.M. or P.M. peak hour have V/C ratios equal to or greater than 1.00. In addition, the V/C ratios in the 2030 No-Build are all higher than the corresponding ratios under the existing condition indicating greater congestion levels. The highest values are again on the sections between Three Lakes Drive/Fox Meadow Drive and Old Willow Road/Northfield Road.

In summary, most sections of Willow Road are over capacity with existing traffic volumes. With the future travel demand projected for the 2030 No-Build condition, Willow Road conditions will continue to decline and LOS will worsen as all sections will be over capacity. The existing and 2030 street section levels of service and V/C ratios are shown in the following tables:

1.4.3. Facility Condition and Design

Willow Road was originally constructed in the mid-1940's. An inventory of the roadway corridor condition was completed and summarized in the technical memorandum, *Draft Physical Inventory of Infrastructure Elements*, September 2010. It can be found in Appendix C. Although there have been various improvements to maintain the roadway, the pavement is over 60 years old and exceeds its design life. The bridge over the Middle Fork North Branch of the Chicago River is over 60 years old and exceeds its design life. There have been recent repairs and deck resurfacing, but the bridge deck and beams are in poor condition. The bridge over the Edens is in slightly better condition and was rehabilitated with an improvement in the fall of 2010.

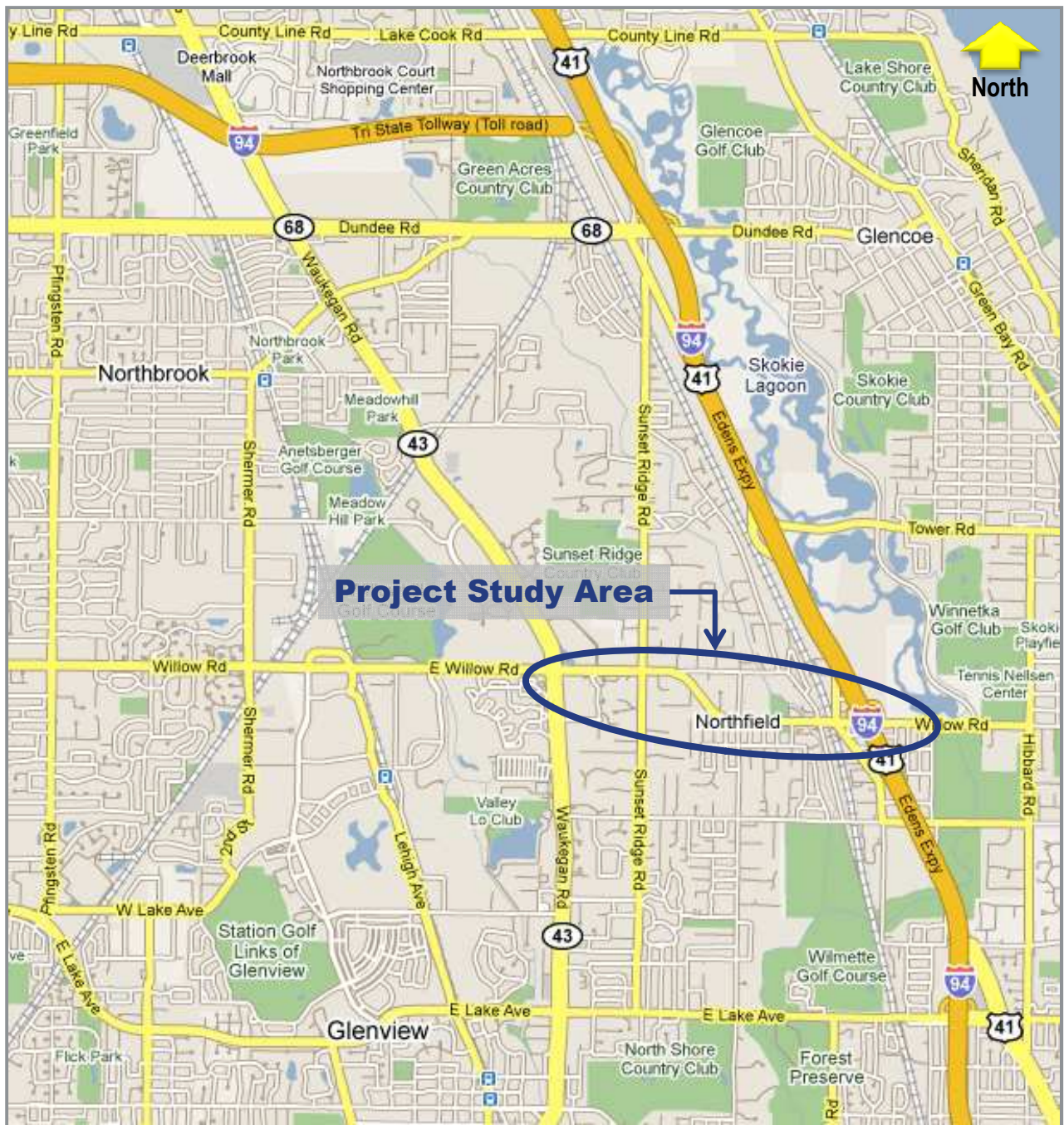
The existing roadway profile is flat with grades of less than one percent. The vertical profile needs improvement to provide more efficient drainage of the pavement, shoulders, and shallow swales. The road crosses a flood plain at the Middle Fork North Branch of the Chicago River. Flooding outside of the right-of-way occurs in the vicinity. Flooding on Willow Road has been reported between Central Avenue/Happ Road and I-94.

The roadway cross section also includes intermittent sidewalks throughout the project limits. Although the sidewalks along the south side of Willow Road are nearly continuous, the north side has long sections of sidewalk with gaps. There are two school crossings within the project limits, at the Sunset Ridge Road and Wagner Road intersections. While there have been no pedestrian crashes during the study period, these crossings have poorly defined pavement edges and do not meet ADA sidewalk ramp requirements. The traffic signals lack modern features such as countdown timers and ADA pushbuttons. Finally, the sidewalks and crosswalks only accommodate crossing the south and east legs of each intersection. The current roadway facility and design does not continuously and consistently accommodate pedestrian and bicycle facilities.

Review of the signal equipment at the six signalized intersections revealed that equipment is outdated and needs modernization at four intersections including Sunset Ridge Road, Wagner Road, Old Willow Road/Northfield Road, and Central Avenue/Happ Road. The existing equipment cannot be connected to other signals to provide signal coordination. Also, at these four intersections, the roadway geometry does not meet current standards for a design speed of 40 mph. Left turn lanes and merge lanes are too short and do not meet the minimum requirements. In addition, the lane drop taper eastbound between Three Lakes Drive/Fox Meadow Drive and Sunset Ridge Road and westbound immediately west of Old Willow Road/Northfield Road do not meet standards. Lastly, the I-94 interchange ramps do not meet current interstate design standards. The directional and loop ramp tapers, ramp terminal tapers, and auxiliary lane lengths are deficient; some are deficient in length in excess of 50 percent.

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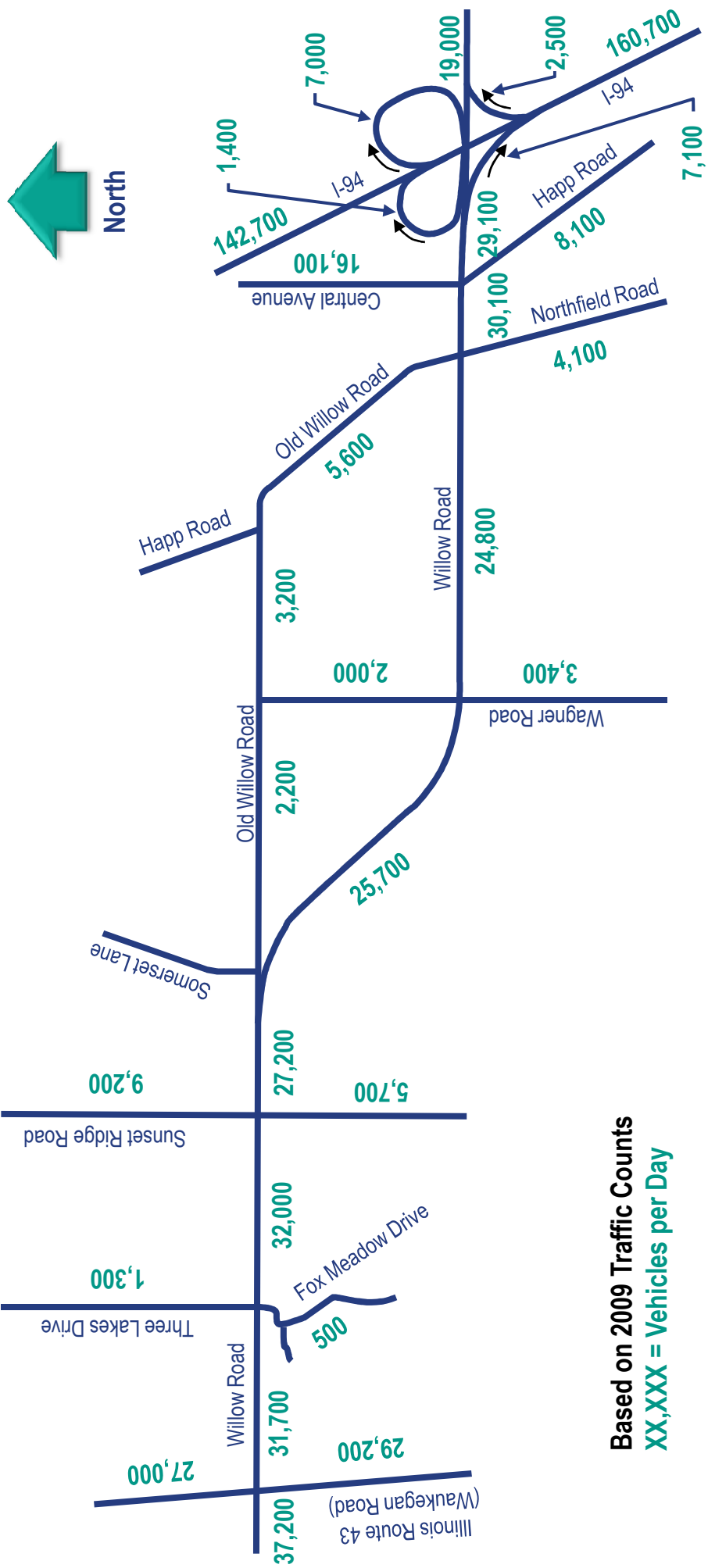
Regional Location Map



Willow Road

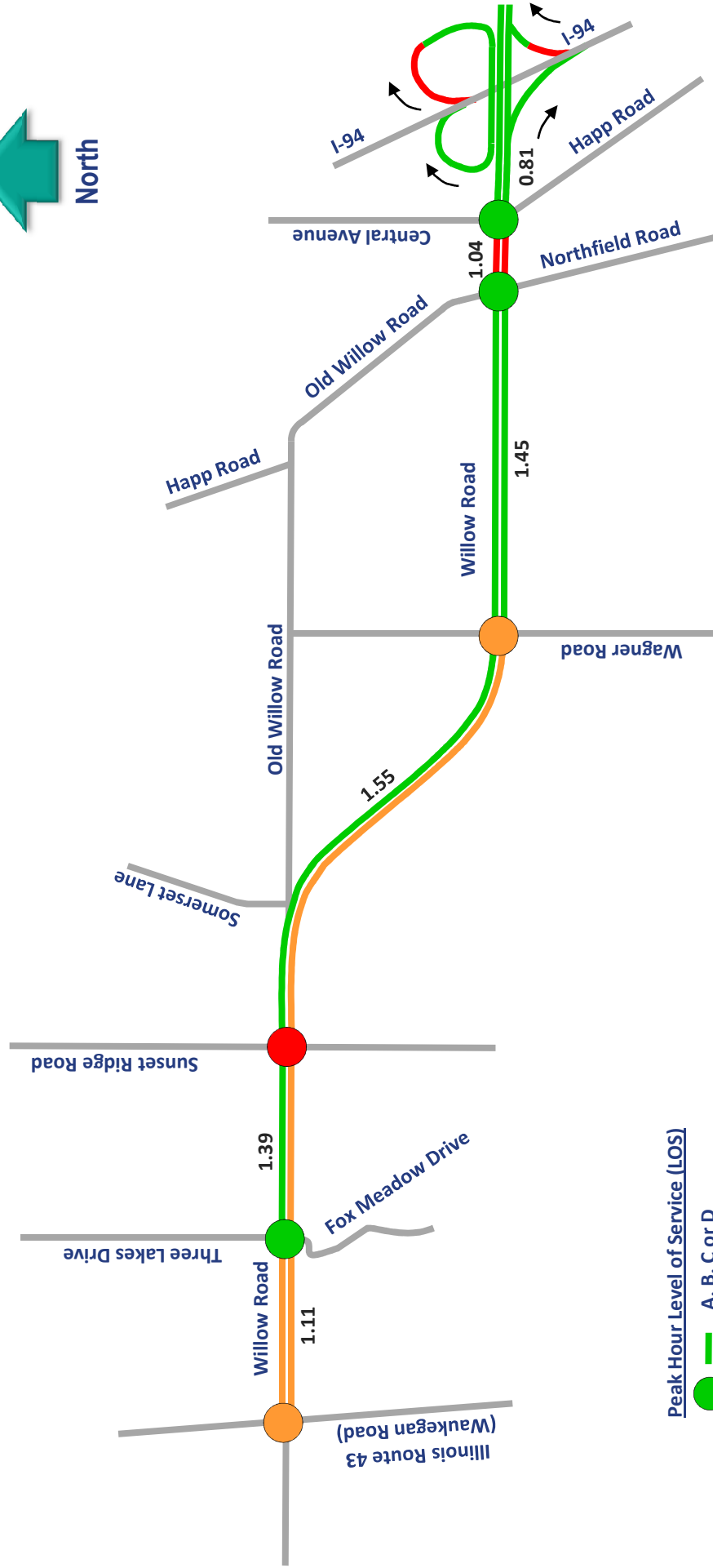
Illinois Route 43 to Interstate 94
Illinois Department of Transportation
Cook County

Figure 1.1



Willow Road
 Illinois Route 43 To Interstate 94

Existing (2009)
Annual Average Daily Traffic (AADT)



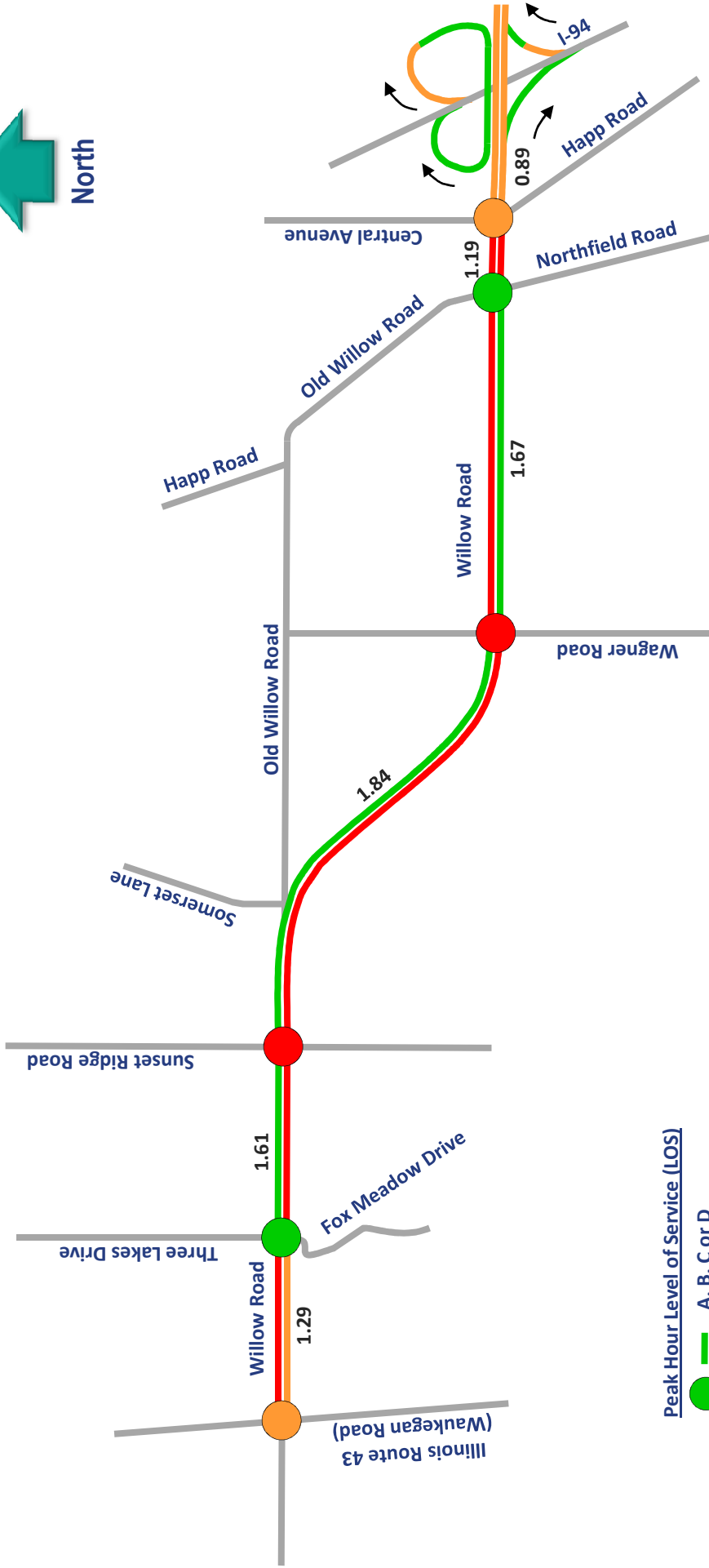
Peak Hour Level of Service (LOS)

- A, B, C or D
- E
- F

X.XX — V/C Ratio (2-Way)

Willow Road
Illinois Route 43 To Interstate 94

**AM Peak Period
Existing Intersection and Section
Level of Service**



Peak Hour Level of Service (LOS)

Green circle: A, B, C or D

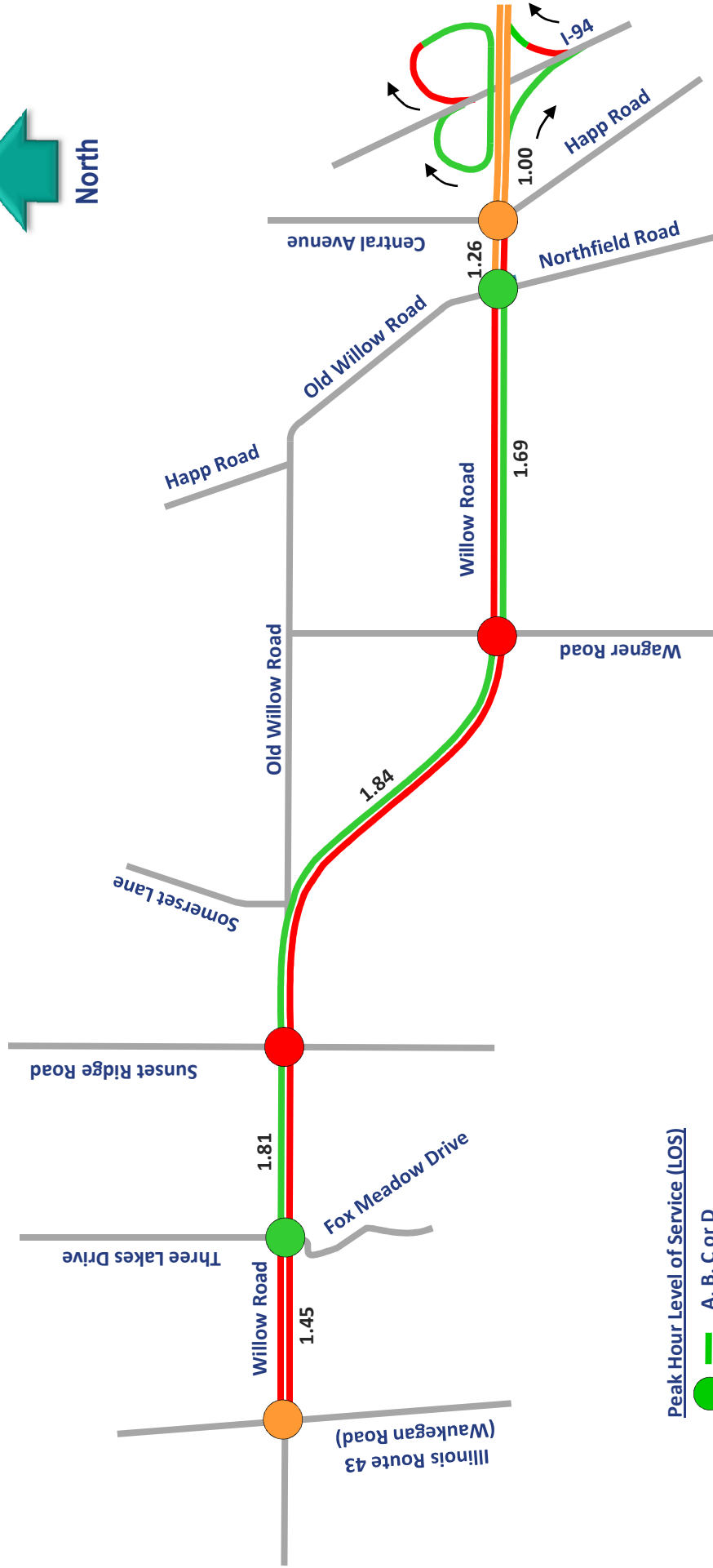
Orange circle: E

Red circle: F

Black line: V/C Ratio (2-Way)

Willow Road
Illinois Route 43 To Interstate 94

**PM Peak Period
Existing Intersection and Section
Level of Service**



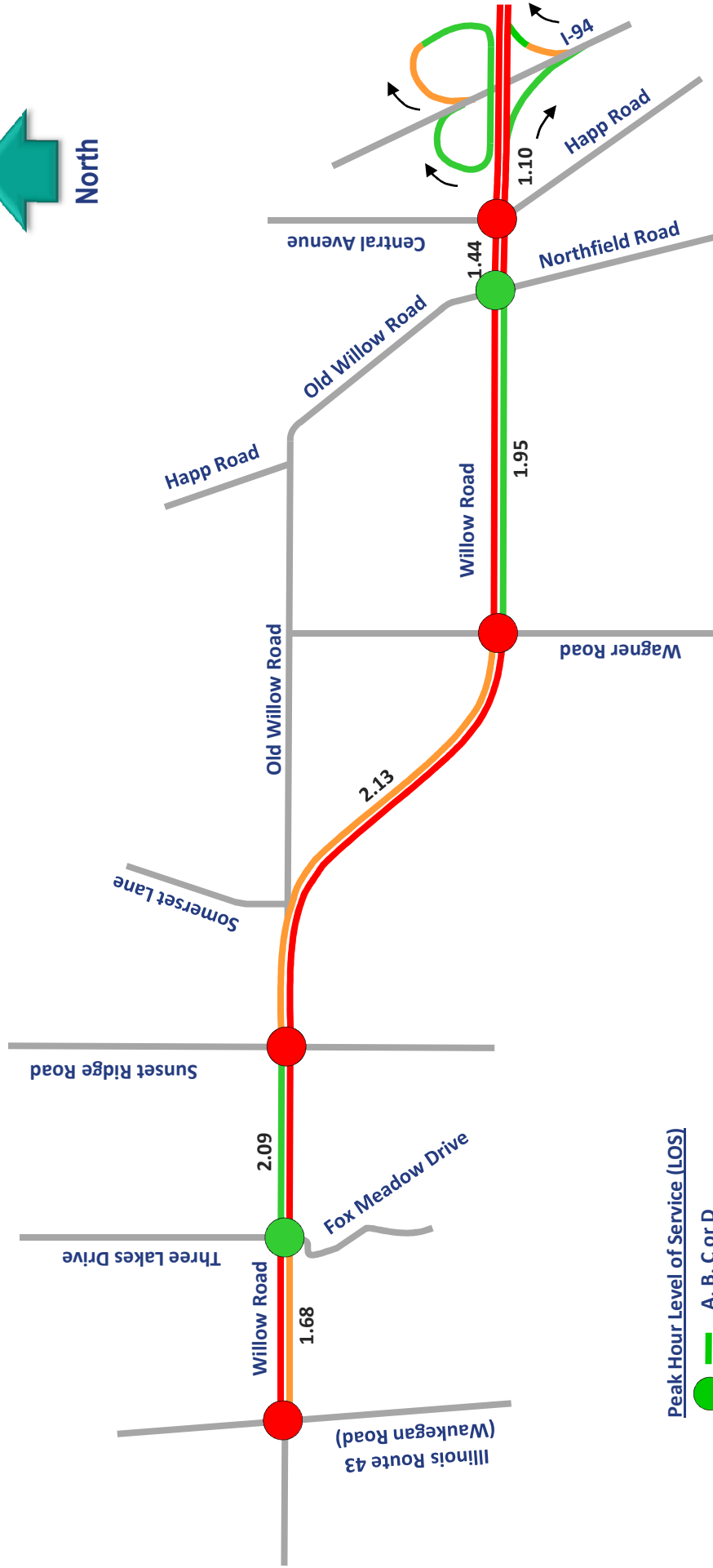
Peak Hour Level of Service (LOS)

- A, B, C or D
- E
- F

X.XX V/C Ratio (2-Way)

Willow Road
Illinois Route 43 To Interstate 94

**AM Peak Period
2030 No Build Intersection and Section
Level of Service**



Peak Hour Level of Service (LOS)

- A, B, C or D
- E
- F

X.XX — V/C Ratio (2-Way)

Willow Road
Illinois Route 43 To Interstate 94

**PM Peak Period
2030 No Build Intersection and Section
Level of Service**