Signal Coordination and Timing Study

Machesney Park, Loves Park, and Rockford, IL

April 3, 2025
Submitted to:
Region 1 Planning Council

Innovating Through Informatics™

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Iteris, Inc. (Iteris) was contracted by the Region 1 Planning Council (R1PC) to provide professional traffic engineering services for a Signal Coordination and Timing Study along the Alpine Road corridor in the Cities of Loves Park and Rockford, and the Village of Machesney Park, IL. The scope of this work is to identify intersection improvements on the corridor that would enhance the experience for all users of the roadway. For example, optimizing the signal timing on the corridor will reduce stops and improve efficiency. Updating crosswalks will provide better protection for pedestrians. Modernizing equipment will reduce the likelihood of failures and make maintenance easier. Consistency will reduce the workload for all roadway users making it easier for them to make critical decisions safely.

The scope of work for this project includes data collection relevant to traffic and operations at 47 study intersections, a review of the existing conditions, development of optimized traffic signal timings, recommendations for hardware/software equipment, and implementation phases and costs.

This report focuses on the inventory and intersection level analysis of existing conditions.

1 EXISTING CONDITIONS

This project spans approximately ten miles on Alpine Road from Sandy Hollow Road to IL 173/West Lane Road in the Cities of Loves Park and Rockford, IL. The following intersections make up the project corridor.

1. Sandy Hollow Road
2. American Road
3. Manchester Drive
4. Harrison Avenue
5. Beach Street
6. Florida Drive/Cleveland Avenue
7. Louisiana Road
8. Broadway/Newburg Road
9. Center Terrace
10. Rockford Career College Entrance
11. Larson Avenue
12. East State Street (US Business 20)
13. Turner Street/Morsay Drive
14. Rural Street
15. Guilford Road/Skyline Drive
16. Brendenwood Road/Guilford Road
17. Highcrest Road
18. Highcrest Center/Edgebrook Entrance
19. Spring Creek Road
20. Pepper Drive
21. Garden Lane/High Point Drive
22. Innsbruck Drive
23. Siseman Road
24. East Riverside Boulevard
25. Valli Produce Entrance
26. Windsor Road
27. Maple Avenue
28. Harlem Road
29. Schnucks Entrance
30. Roosevelt Road
31. Gladys Drive/Huskie Circle
32. Rose Street
33. IL 173/West Lane Road

The remaining 14 intersections are intersections within a third of a mile of Alpine Road to the east or west. These intersections are close enough to the corridor to very likely interact with traffic operations on Alpine Road. The following side street intersections make up this list of the remining 14 study intersections.

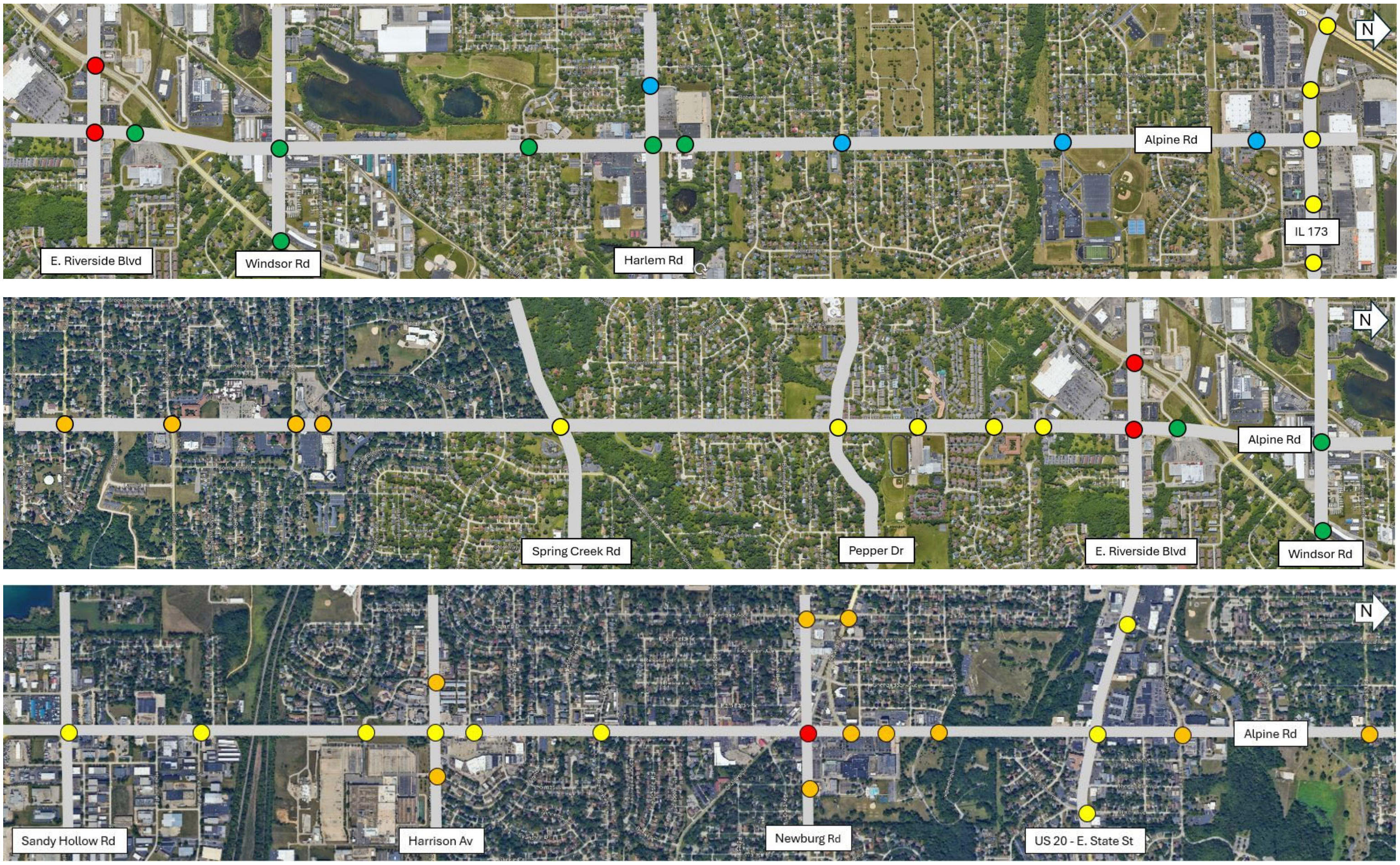
34. Harrison Avenue & Manchester Drive
35. Harrison Avenue & Holmes Street
36. Broadway & Parkside Drive/Eastmoreland Avenue
37. Newburg Road & Quentin Road
38. Charles Street & Parkside Drive
39. East State Street & Lynmar Court
40. East State Street & Dempster Road/Dawn Avenue
41. East Riverside Boulevard & Forest Hills Road
42. Forest Hills Road & Windsor Road
43. Harlem Road & Schnucks Entrance
44. IL 173 & IL 251/N 2nd Street
45. IL 173 & Orlando Street
46. IL 173 & Continental Drive
47. IL 173 & Kimber Drive

Through field visits and satellite imagery, Iteris notes that the traffic signals at the intersection of Alpine Road and Louisiana Road were removed sometime between May 2019 and August 2021. All other intersections remain under signal control.

Existing traffic signals along the corridor vary in ownership and maintenance among five agencies—Illinois Department of Transportation (IDOT), Winnebago County Highway Department (WCHD), City of Loves Park, City of Rockford, and the Village of Machesney Park.

Figure 1 on the following page shows a map of each project intersection with reference to its agency owner.

Figure 1 – Project Intersections



Legend:

- 🟡 Illinois Department of Transportation
- 🟢 City of Loves Park
- 🟠 City of Rockford
- 🔴 Winnebago County
- 🔵 Village of Machesney Park

1.1 Roadway Network

Alpine Road is a north-south principal arterial roadway consisting primarily of two through lanes in each direction, with dedicated left-turn lanes at most signalized intersections. The posted speed limit on Alpine Road ranges between 30 mph to 45 mph with adjacent land uses consisting mostly of commercial, recreational, and residential. Schools adjacent to the corridor are Harlem High School, Lutheran High School, and Holy Family Catholic School.

The 2022 Average Annual Daily Traffic (AADT) on Alpine Road ranges from 13,200 vehicles per day (vpd) on its north end to 24,700 vpd on the south end. The project corridor spans approximately ten miles from Sandy Hollow Road to IL 173/West Lane Road.

1.2 Data Collection

In August 2024, Iteris began data collection on Alpine Road to collect turning movement counts, signal timing plans, and inventory on existing infrastructure to identify opportunities to improve safety and consistency. Weekday traffic counts from 6:00 AM to 7:00 PM were collected at each study intersection.

According to the traffic counts collected, the study intersections along Alpine Road have AM peaks beginning at 7:15 AM. The midday peaks begin between 11:30 AM and 12:30 PM and the PM peaks begin between 3:30 PM and 4:30 PM.

1.3 Signal Operation

Under existing conditions, 12 study intersections run free operations all day, and 35 intersections run coordination by time-of-day (TOD). Table 1 on the following page shows the existing cycle lengths at coordinated intersections during the peak hours according to each intersection’s programmed schedule.

Table 1.1 - Existing Conditions

EXISTING CYCLE LENGTHS			
ALPINE ROAD	**AM PEAK C/L**	**MD/OFF-PEAK C/L**	**PM PEAK C/L**
Sandy Hollow Road to Beach Street	120 sec	110 sec	130 sec
Broadway/Newburg Road to Larson Avenue	140 sec	140 sec	100 sec
US 20 – E State Street to Innsbruck Drive	130 sec	140 sec	140 sec
Harlem Road to Schnucks Entrance	90 sec	90 sec	90 sec
IL 173 – WEST LANE ROAD			
IL 251/N 2nd Street to Kimber Drive	130 sec	110 sec	130 sec
FOREST HILLS ROAD			
Riverside Boulevard	126 sec	126 sec	126 sec
US 20 – E STATE STREET			
Lynmar Court to Dempster Road/Dawn Avenue	130 sec	140 sec	140 sec
BROADWAY/NEWBURG ROAD			
Parkside Drive/Eastmoreland Avenue	100 sec	100 sec	100 sec
Quentin Road	FREE	70 sec	70 sec
HARRISON AVENUE			
Manchester Drive to Holmes Street	120 sec	110 sec	130 sec

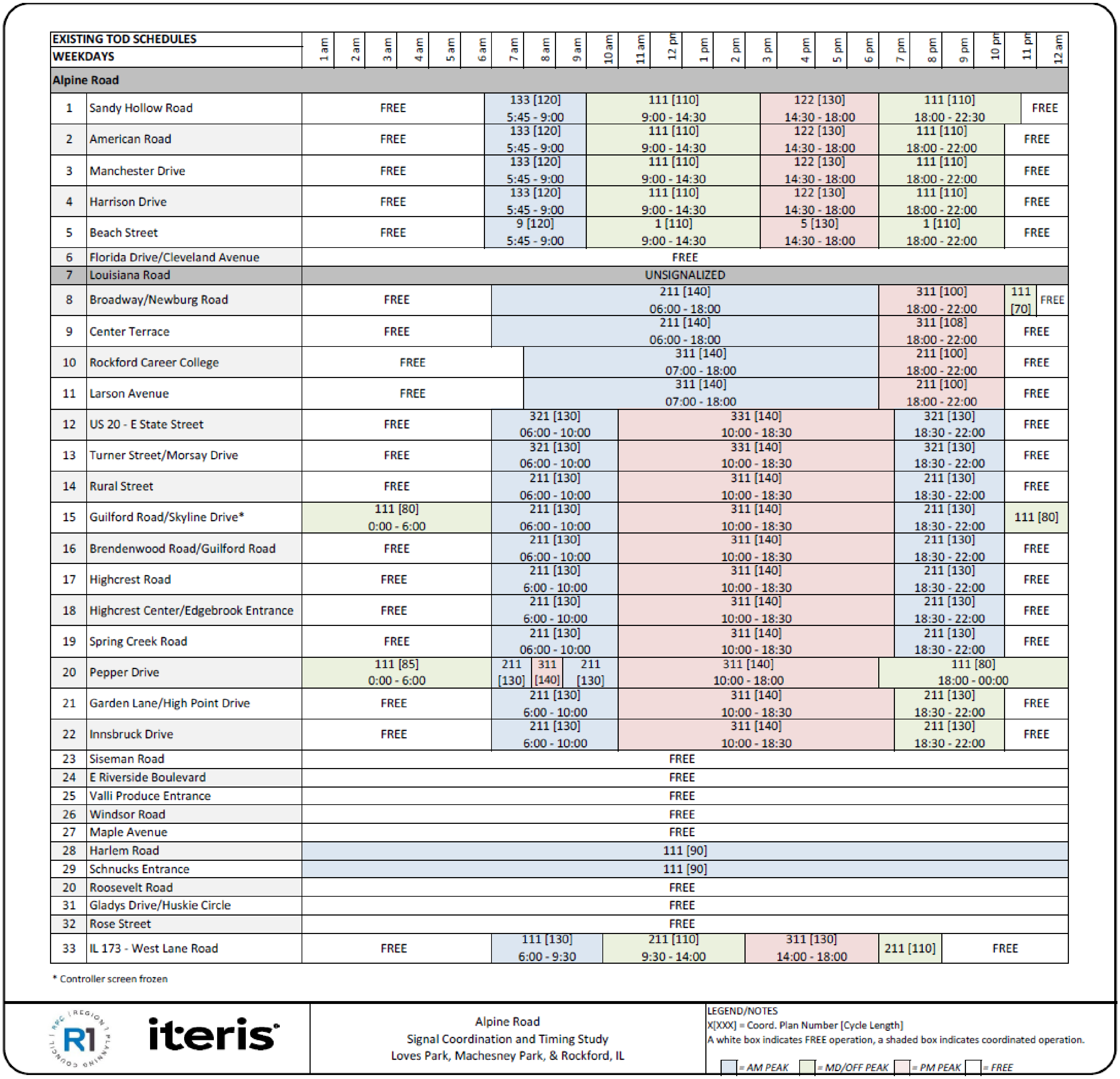
As shown above, the corridor includes a variety of cycle lengths within the same peak period. Cycle lengths influence the progression of traffic along a corridor. Inconsistencies in cycle lengths can cause an increase in stops and delays.

Generally, traffic signals within the project area run free operations overnight and begin the morning signal timing plans at 5:45 AM or 6:00 AM. Three intersections operate with one signal timing plan all day: Alpine Road's intersections with Harlem Road and Schnucks Entrance, and Broadway at Parkside Drive. **Figure 2** on the following page details the various times of the day the signal timing plans change at each intersection on weekdays. It shows stretches of the study corridor running the same time-of-day schedule, with the longest distance of three and one-half miles between US 20 – E State Street and Innsbruck Drive.

Many intersections in the project area are interconnected. Interconnect provides communication between individual signals and allows these signals to keep synchronized clocks. Without the ability to maintain synchronization between signals, individual clocks can drift over time, creating a maintenance problem in the long-term. The intersections on Alpine Road from Sandy Hollow Road to Florida Drive/Cleveland Avenue are interconnected using radio signals. The existing signal timing schedule shown in Figure 2 suggests some communication from US 20 – E State Street to Spring Creek Road, but field inventory shows fiber interconnect at only two intersections: at US 20 – E State Street and at Turner Street/Morsay Drive. Fiber terminal boxes without fiber connections were found at Brendenwood Rd/Guilford, Highcrest Center/Edgebrook Entrance, and at Pepper Drive. Fiber interconnect also exists between the signals on IL

173.

Figure 2 - Existing Day Plan Schedule



EXISTING TOD SCHEDULES WEEKDAYS		1 am	2 am	3 am	4 am	5 am	6 am	7 am	8 am	9 am	10 am	11 am	12 pm	1 pm	2 pm	3 pm	4 pm	5 pm	6 pm	7 pm	8 pm	9 pm	10 pm	11 pm	12 am
Alpine Road																									
1	Sandy Hollow Road	FREE					133 [120] 5:45 - 9:00				111 [110] 9:00 - 14:30					122 [130] 14:30 - 18:00				111 [110] 18:00 - 22:30				FREE	
2	American Road	FREE					133 [120] 5:45 - 9:00				111 [110] 9:00 - 14:30					122 [130] 14:30 - 18:00				111 [110] 18:00 - 22:00				FREE	
3	Manchester Drive	FREE					133 [120] 5:45 - 9:00				111 [110] 9:00 - 14:30					122 [130] 14:30 - 18:00				111 [110] 18:00 - 22:00				FREE	
4	Harrison Drive	FREE					133 [120] 5:45 - 9:00				111 [110] 9:00 - 14:30					122 [130] 14:30 - 18:00				111 [110] 18:00 - 22:00				FREE	
5	Beach Street	FREE					9 [120] 5:45 - 9:00				1 [110] 9:00 - 14:30					5 [130] 14:30 - 18:00				1 [110] 18:00 - 22:00				FREE	
6	Florida Drive/Cleveland Avenue	FREE																							
7	Louisiana Road	UNSIGNALIZED																							
8	Broadway/Newburg Road	FREE						211 [140] 06:00 - 18:00												311 [100] 18:00 - 22:00				111 [70]	FREE
9	Center Terrace	FREE						211 [140] 06:00 - 18:00												311 [108] 18:00 - 22:00				FREE	
10	Rockford Career College	FREE							311 [140] 07:00 - 18:00											211 [100] 18:00 - 22:00				FREE	
11	Larson Avenue	FREE							311 [140] 07:00 - 18:00											211 [100] 18:00 - 22:00				FREE	
12	US 20 - E State Street	FREE						321 [130] 06:00 - 10:00				331 [140] 10:00 - 18:30								321 [130] 18:30 - 22:00				FREE	
13	Turner Street/Morsay Drive	FREE						321 [130] 06:00 - 10:00				331 [140] 10:00 - 18:30								321 [130] 18:30 - 22:00				FREE	
14	Rural Street	FREE						211 [130] 06:00 - 10:00				311 [140] 10:00 - 18:30								211 [130] 18:30 - 22:00				FREE	
15	Guilford Road/Skyline Drive*	111 [80] 0:00 - 6:00						211 [130] 06:00 - 10:00				311 [140] 10:00 - 18:30								211 [130] 18:30 - 22:00				111 [80]	
16	Brendenwood Road/Guilford Road	FREE						211 [130] 06:00 - 10:00				311 [140] 10:00 - 18:30								211 [130] 18:30 - 22:00				FREE	
17	Highcrest Road	FREE						211 [130] 6:00 - 10:00				311 [140] 10:00 - 18:30								211 [130] 18:30 - 22:00				FREE	
18	Highcrest Center/Edgebrook Entrance	FREE						211 [130] 6:00 - 10:00				311 [140] 10:00 - 18:30								211 [130] 18:30 - 22:00				FREE	
19	Spring Creek Road	FREE						211 [130] 06:00 - 10:00				311 [140] 10:00 - 18:30								211 [130] 18:30 - 22:00				FREE	
20	Pepper Drive	111 [85] 0:00 - 6:00						211 [130]	311 [140]	211 [130]		311 [140] 10:00 - 18:00								111 [80] 18:00 - 00:00					
21	Garden Lane/High Point Drive	FREE						211 [130] 6:00 - 10:00				311 [140] 10:00 - 18:30								211 [130] 18:30 - 22:00				FREE	
22	Innsbruck Drive	FREE						211 [130] 6:00 - 10:00				311 [140] 10:00 - 18:30								211 [130] 18:30 - 22:00				FREE	
23	Siseman Road	FREE																							
24	E Riverside Boulevard	FREE																							
25	Valli Produce Entrance	FREE																							
26	Windsor Road	FREE																							
27	Maple Avenue	FREE																							
28	Harlem Road	111 [90]																							
29	Schnucks Entrance	111 [90]																							
20	Roosevelt Road	FREE																							
31	Gladys Drive/Huskie Circle	FREE																							
32	Rose Street	FREE																							
33	IL 173 - West Lane Road	FREE						111 [130] 6:00 - 9:30			211 [110] 9:30 - 14:00					311 [130] 14:00 - 18:00				211 [110]		FREE			

* Controller screen frozen

Alpine Road
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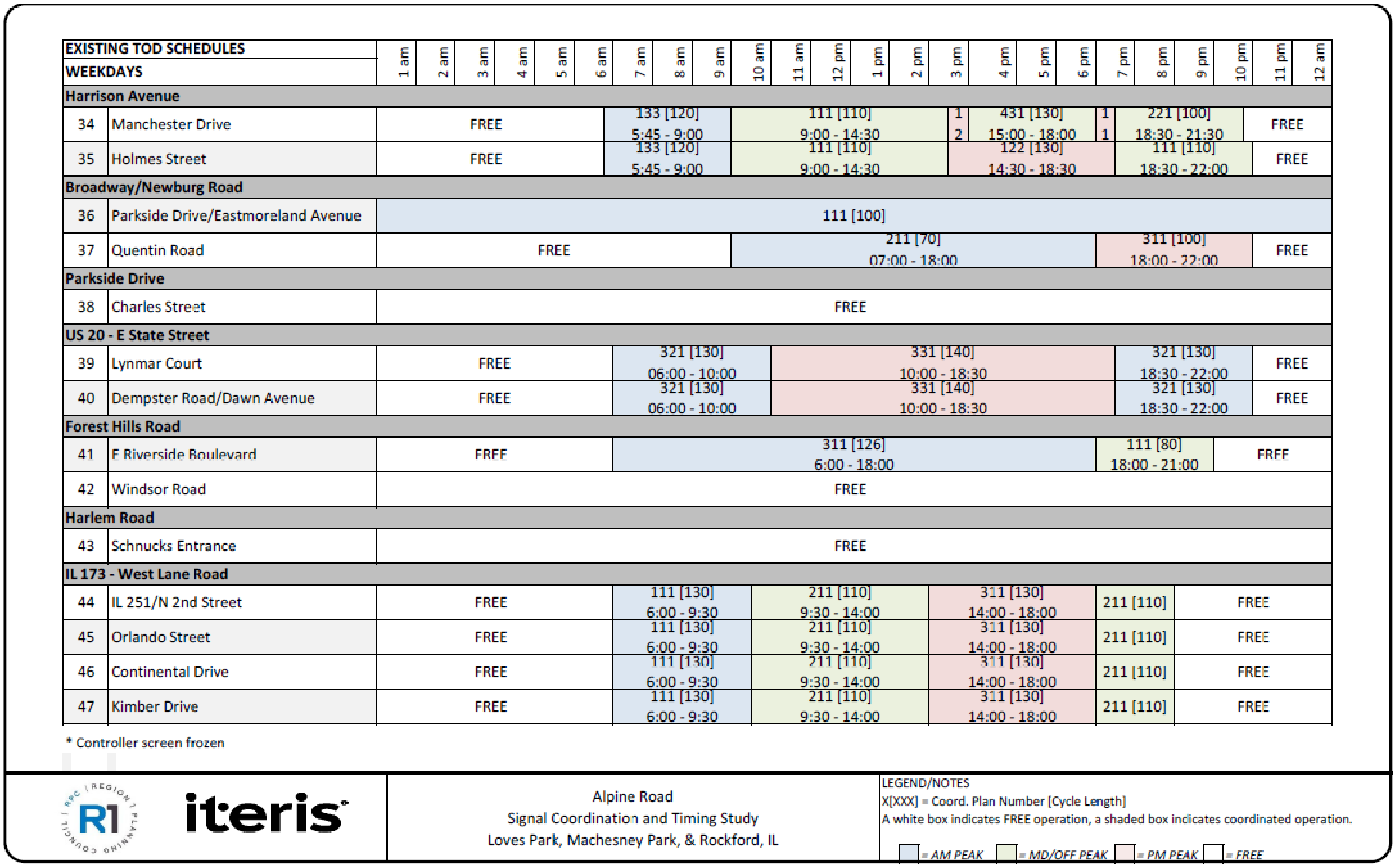
LEGEND/NOTES
X[XXX] = Coord. Plan Number [Cycle Length]
A white box indicates FREE operation, a shaded box indicates coordinated operation.

🟦 = AM PEAK 🟩 = MD/OFF PEAK 🟥 = PM PEAK ☐ = FREE

Figure 2 - Existing Day Plan Schedule (cont.)



EXISTING TOD SCHEDULES WEEKDAYS		1 am	2 am	3 am	4 am	5 am	6 am	7 am	8 am	9 am	10 am	11 am	12 pm	1 pm	2 pm	3 pm	4 pm	5 pm	6 pm	7 pm	8 pm	9 pm	10 pm	11 pm	12 am
Harrison Avenue																									
34	Manchester Drive	FREE					133 [120] 5:45 - 9:00				111 [110] 9:00 - 14:30					1 2	431 [130] 15:00 - 18:00			1 1	221 [100] 18:30 - 21:30		FREE		
35	Holmes Street	FREE					133 [120] 5:45 - 9:00				111 [110] 9:00 - 14:30					122 [130] 14:30 - 18:30				111 [110] 18:30 - 22:00				FREE	
Broadway/Newburg Road																									
36	Parkside Drive/Eastmoreland Avenue	111 [100]																							
37	Quentin Road	FREE									211 [70] 07:00 - 18:00									311 [100] 18:00 - 22:00				FREE	
Parkside Drive																									
38	Charles Street	FREE																							
US 20 - E State Street																									
39	Lynmar Court	FREE						321 [130] 06:00 - 10:00				331 [140] 10:00 - 18:30								321 [130] 18:30 - 22:00				FREE	
40	Dempster Road/Dawn Avenue	FREE						321 [130] 06:00 - 10:00				331 [140] 10:00 - 18:30								321 [130] 18:30 - 22:00				FREE	
Forest Hills Road																									
41	E Riverside Boulevard	FREE						311 [126] 6:00 - 18:00												111 [80] 18:00 - 21:00			FREE		
42	Windsor Road	FREE																							
Harlem Road																									
43	Schnucks Entrance	FREE																							
IL 173 - West Lane Road																									
44	IL 251/N 2nd Street	FREE						111 [130] 6:00 - 9:30			211 [110] 9:30 - 14:00					311 [130] 14:00 - 18:00				211 [110]		FREE			
45	Orlando Street	FREE						111 [130] 6:00 - 9:30			211 [110] 9:30 - 14:00					311 [130] 14:00 - 18:00				211 [110]		FREE			
46	Continental Drive	FREE						111 [130] 6:00 - 9:30			211 [110] 9:30 - 14:00					311 [130] 14:00 - 18:00				211 [110]		FREE			
47	Kimber Drive	FREE						111 [130] 6:00 - 9:30			211 [110] 9:30 - 14:00					311 [130] 14:00 - 18:00				211 [110]		FREE			

* Controller screen frozen

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LEGEND/NOTES
X[XXX] = Coord. Plan Number [Cycle Length]
A white box indicates FREE operation, a shaded box indicates coordinated operation.

🟦 = AM PEAK 🟩 = MD/OFF PEAK 🟥 = PM PEAK ☐ = FREE

1.4 Review of Basic Timing Parameters

As part of this project, the signal timing parameters and the phasing configuration for all study intersections were reviewed to ensure safe operation of the intersections and to check whether they meet the minimum recommendations. The timing parameters that were reviewed include:

- Minimum Green Time
- Yellow Time
- All-Red Clearance
- Walk Time
- Flashing Don't Walk

Some of the settings (i.e. vehicle and pedestrian clearance intervals) are important for the safe operation of intersections and can provide significant liability if they do not meet the minimum standards. Other settings, such as the actuated settings (recall operation), assist in providing more efficient operation of the intersection during coordinated and non-coordinated times. In developing the updated timing parameters, Iteris used the guidelines set forth in the latest Manual on Uniform Traffic Control Devices, ITE Signal Timing Manual and the current IDOT practices and preferences.

Existing basic timing parameters were all obtained manually during field visits. After performing the field review, the basic timing parameters were checked to determine if the existing values met the minimum standards, or if they needed to be updated.

Minimum Green Time

According to the ITE Signal Timing Manual, the minimum green should be 2-5 seconds for a left-turn phase, 4-10 seconds for a side street through, and 10-15 seconds for mainline through. A review of the existing timings showed that most signals provided at least these recommended values or higher. The intersections of Alpine Road at Dempster Road, Lynmar Court, and American Road provide a minimum green time of 1 second for some left-turn phases. It is recommended that these be increased to meet the recommended green time of 2-5 seconds.

Other intersections provide a disproportionate amount of green time for the coordinated phases. At Alpine Road and Valli Produce Entrance, the north-south through movements have a minimum green time of 40 seconds. At Alpine Road and Garden Lane/High Point Drive, the north-south through movements have a minimum green time of 28 seconds. Lastly, the mainline through movements at Quentin Road and Newburg Road and at Alpine Road and Florida Drive/Cleveland Avenue have a 25 second minimum green time.

Yellow Time

The yellow time is typically based on the approach speed for each movement. Using the standard ITE clearance interval formula, the minimum required yellows are shown in **Table 1.2**.

Table 1.2 - ITE Minimum Yellow Intervals

SPEED LIMIT (MPH)	MINIMUM YELLOW TIME (SEC)
<25	3.0
30	3.2
35	3.6
40	3.9
45	4.3
50	4.7
55	5.0
60	5.4
65	5.8

Based on the posted speed limit along Alpine Road, its mainline movements should have a minimum yellow interval of 3.9 to 4.3 seconds. Existing mainline movements on Alpine Road have existing intervals that meet the minimum requirements except at five intersections. The intersections of Rose Street, Gladys Drive/Huskie Circle, Maple Avenue, Siseman Road, and Garden Lane/High Point Drive should have a minimum yellow interval of 4.3 seconds. At intersections adjacent to Alpine Road, the mainline movements generally meet the minimum requirements, except at Charles Street and Parkside Drive where the yellow time should be 3.6 seconds and at Forest Hills Road and Windsor Road where it should be 4.3 seconds.

For turning movements, the approach speed used to determine yellow interval is lower than the posted speed. This is because drivers inherently slow down to make a turn. Typical drivers will slow to 15-20 mph to make a turn. Using the ITE yellow table, this would require less than 3 seconds of yellow. ITE recommends never using less than a 3 second yellow interval. A review of the existing timing showed that all turning phases on the corridor provide 3.0 seconds of yellow time.

<u>All-Red Clearance Time</u>

If used, red clearance interval, as per ITE Signal Timing Manual, typically ranges from 0.5 to 2.0 seconds. The red clearance interval is provided to allow vehicles additional time to clear the intersection if entered on the yellow clearance. A review of existing timings shows the following intersections provide all-red times exceeding 2.0 seconds.

1. Alpine Road & Manchester Drive
2. Alpine Road & Beach Street
3. Alpine Road & Florida Drive/Cleveland Avenue
4. Alpine Road & Broadway/Newburg Road
5. Alpine Road & US 20 – E State Street
6. Alpine Road & Pepper Drive
7. Alpine Road & Garden Lane/High Point Drive
8. Alpine Road & Innsbruck Drive
9. Alpine Road & Valli Produce Entrance
10. Alpine Road & Windsor Road
11. Alpine Road & Harlem Road
12. Alpine Road & Rose Street
13. Alpine Road & IL 173
14. Parkside Drive & Charles Street
15. US 20 – E State Street & Lynmar Court
16. US 20 – E State Street & Dempster Road
17. IL 173 & N 2nd Street
18. IL 173 & Orlando Street

19. IL 173 & Continental Drive

20. IL 173 & Kimber Drive

Pedestrian Clearance Time

According to MUTCD guidelines and current IDOT practices, the pedestrian clearance (flashing don't walk) interval was calculated using the following formula:

$$\mathrm{FDW} = \frac{D}{S}$$

Where D is the crosswalk distance (curb to curb), and S is the assumed pedestrian walking speed of 3.5 feet/second.

While on site, Iteris measured the crossing distance for each crosswalk. Iteris found the programmed pedestrian clearance times inadequate for at least one pedestrian crossing at many intersections. Iteris also found programmed pedestrian clearances at Alpine Road and Valli Produce Entrance provided significantly more than the calculated clearance.

Walk Time

The MUTCD requires a minimum walk time of 4 seconds for a signalized pedestrian movement but recommends at least 7 seconds be used when possible. The walk interval is calculated using the following formula:

$$W = \frac{D}{S} - \mathrm{FDW}$$

Where D is the distance from the furthest pedestrian push-button to the opposite curb, S is a speed of 3.0 feet/second, and FDW is the Flashing Don't Walk interval calculated in the previous step. A review of existing pedestrian timings shows three intersections provide a walk time of less than 7 seconds. Iteris also found programmed pedestrian walk times at Alpine Road and Valli Produce Entrance provide significantly more than the calculated value. Calculated pedestrian timings can be found in the Appendix.

1.5 Existing Intersection Operations

The effectiveness of transportation facilities is measured in terms of Level of Service (LOS), ranging from LOS A to LOS F. LOS A represents free-flow conditions and LOS F represents oversaturated conditions. The LOS criteria for signalized intersections, as defined in the Highway Capacity Manual, Sixth Edition (HCM), are provided in **Table 1.3**.

Table 1.3 - Level of Service Criteria for Signalized Intersections

LEVEL OF SERVICE (LOS)	AVERAGE DELAY	VOLUME-TO-CAPACITY (V/C) RATIO
A	≤ 10.0 seconds	< 1.0
B	> 10.0 and ≤ 20.0 seconds	< 1.0
C	> 20.0 and ≤ 35.0 seconds	< 1.0
D	> 35.0 and ≤ 55.0 seconds	< 1.0

LEVEL OF SERVICE (LOS)	AVERAGE DELAY	VOLUME-TO-CAPACITY (V/C) RATIO
E	> 55.0 and ≤ 80.0 seconds	< 1.0
F	> 80.0 seconds	< 1.0

Iteris analyzed the study intersections for the weekday peak hours and Saturday peak hour using Synchro 11 capacity analysis software. The Synchro model for existing weekday peak hours shows most intersections operating with LOS D or better.

At Alpine Road and Sandy Hollow Road, the east- and westbound movements operate at LOS E in the AM and PM peak hours. Analyses show the westbound left turn near capacity in the AM, and exceeding capacity in the PM peak. In the afternoon, it is likely that westbound left-turning vehicles are double-cycled. Collected traffic counts shown approximately 350 vehicles in the afternoon peak hour, exceeding the recommended volume for dual left turn lanes.

At Alpine Road and Spring Creek Road, the intersection operates at LOS E during the AM and PM peak hours. In the AM peak hour, the eastbound and northbound approaches operate at LOS F and have v/c ratios greater than 1.0 meaning the volume exceeds the capacity. During this peak, the eastbound through movement's 95th percentile queue is projected to be at least 613 feet, with indication that the queue length could be longer. Left-turning vehicles are anticipated to use the two-way left-turn lane (TWTL) to reach the eastbound left-turn lane. The 95th percentile queue of the northbound through movement in the AM peak period is projected to be at least 632 feet and blockage of the left-turn lane is anticipated due to the raised median installed on Alpine Road. During the PM Peak hour, the northbound approach operates at LOS F, while the eastbound and southbound approaches operate at LOS E. The v/c ratio of the northbound through movement exceeds 1.0, with a projected 95th percentile queue length of 667 feet. Field observations confirmed that the northbound queues occasionally extended to Brookview Road, located approximately 725 feet south of Spring Creek Road.

At Alpine Road and East Riverside Boulevard, the westbound left movement in the PM peak operates at LOS F and exceeds capacity. The projected queue length for the westbound left turn during this period is at least 334 feet, exceeding the available storage space of 175 feet and likely spilling over to the adjacent through lane. Another movement exceeding the available storage space is the northbound left-turn lane at E State Street in the PM peak period. Currently, the projected 95th percentile queue length is 391 feet, and the available storage space is 125 feet. Alpine Road south of its intersection with E State Street provides a striped median, which the northbound queue can utilize to prevent queueing on the adjacent through lane.

Detailed results for each study intersection under existing conditions are summarized in the Appendix.

2 TRAFFIC SIGNAL INVENTORY

As part of this project, Iteris was tasked with collecting a detailed inventory of the signals shown in **Table 2.1**. With this data, Iteris was also asked to provide recommended equipment upgrades for the Village to include in their future planning.

Table 2.1 - Traffic Signal Inventory Locations

Int. #	Intersection	Int. #	Intersection
1	Alpine Rd & Sandy Hollow Rd	24	Alpine Rd & East Riverside Blvd
2	Alpine Rd & American Rd	25	Alpine Rd & Valli Produce Ent
3	Alpine Rd & Manchester Dr	26	Alpine Rd & Windsor Rd
4	Alpine Rd & Harrison Av	27	Alpine Rd & Maple Av
5	Alpine Rd & Beach St	28	Alpine Rd & Harlem Rd
6	Alpine Rd & Florida Dr/Cleveland Av	29	Alpine Rd & Schnucks Ent
7*	Alpine Rd & Louisiana Rd	30	Alpine Rd & Roosevelt Rd
8	Alpine Rd & Broadway/Newburg Rd	31	Alpine Rd & Gladys Dr/Huskie Cir
9	Alpine Rd & Center Ter	32	Alpine Rd & Rose St
10	Alpine Rd & Rockford Career College Ent	33	Alpine Rd & IL 173/West Lane Rd
11	Alpine Rd & Larson Av	34	Manchester Dr & Harrison Av
12	Alpine Rd & East State St (US 20)	35	Holmes St & Harrison Av
13	Alpine Rd & Turner St/Morsay Dr	36	Parkside Dr & Broadway
14	Alpine Rd & Rural St	37	Quentin Rd & Newburg Rd
15	Alpine Rd & Guilford Rd/Skyline Dr	38	Parkside Dr & Charles St
16	Alpine Rd & Brendenwood Rd/Guilford Rd	39	Lynmar Court & E State St
17	Alpine Rd & Highcrest Rd	40	Dempster Rd & E State St
18	Alpine Rd & Highcrest Ctr/Edgebrook Ent	41	Forest Hills Rd & E Riverside Blvd
19	Alpine Rd & Spring Creek Rd	42	Forest Hills Rd & Windsor Rd
20	Alpine Rd & Pepper Dr	34	Schnucks Ent & Harlem Rd
21	Alpine Rd & Garden Ln/High Point Dr	44	N 2nd St & IL Route 173
22	Alpine Rd & Innsbruck Dr	45	Orlando St & IL Route 173
23	Alpine Rd & Siseman Rd	46	Continental Dr & IL Route 173

*Unsignalized intersection

A detailed inventory table is included in the Appendix to this report. A summary of the existing equipment is discussed in the following sections.

2.1 Traffic Signal Cabinet

All the traffic signal cabinets in the inventory are NEMA style cabinets. A breakdown of the cabinet types is shown in **Table 2.2** below.

Table 2.2 - Traffic Signal Cabinet Type

CABINET TYPE	COUNT
NEMA TS1	39
NEMA TS2 Type 1	7

Most of the traffic signal cabinets are NEMA TS1. Iteris recommends upgrading the NEMA TS1 cabinets to a TS2 Type 1 or to ATC. TS1 is an outdated standard that requires maintenance contractors to stock parts that are becoming more difficult to find and increasing in price. In addition, troubleshooting TS1 cabinets is more difficult and time consuming than TS2 and ATC cabinets. Further, given that the age of these cabinets is approaching 30+ years, it is likely that equipment malfunctions will become more prevalent, as the components within are reaching the end of their design lives. ATC is the most recent cabinet standard. Where TS1 cabinets are replaced, it may be worth considering skipping TS2 and adopting ATC, though the change is more dramatic.

2.2 Traffic Signal Controller

All the traffic signal controllers in the project corridor are Siemens brand. A variety of models were identified as shown in **Table 2.3** below.

Table 2.3 - Traffic Signal Controller Type

CONTROLLER TYPE	COUNT
Siemens M03	2
Siemens M10	6
Siemens M40	17
Siemens M50	13
Siemens M60	8

Iteris recommends upgrading all M03, M10, and M40 controllers. These controllers are aged technology and are no longer supported by Siemens. These controllers are about 40 years old and well past their design life. The M50 controllers are approaching 20 years of age. There have been significant advancements in technology and features included in the newer ATC controllers. Upgrading to ATC controllers will be required if a plan to have a centralized traffic signal management system in the future. Current ATC controllers on IDOT's approved list are Econolite Cobalt and Yunex (Siemens) M60. Planned replacement of these controllers will provide for smooth transition to the new equipment, rather than dealing with temporary equipment while waiting for new parts to come in under an emergency order.

2.3 Battery Backup Systems

The project corridor has eleven traffic signals with battery backup systems (BBS) installed, as listed below.

- Alpine Rd & Windsor Rd
- Alpine Rd & Maple Av
- Alpine Rd & Harlem Rd
- Alpine Rd & Schnucks Ent
- Alpine Rd & Gladys Dr/Huskie Cir
- Alpine Rd & Rose St
- Alpine Rd & IL 173
- IL 173 & N 2nd St
- IL 173 & Orlando St
- IL 173 & Continental Dri
- IL 173 & Kimber Dr

Iteris recommends installing BBS at all signalized intersections without one. BBS provides power to a traffic signal cabinet that has lost utility power. The signals can run in normal operation for a time and then flash all-red until power is restored or the batteries are exhausted. This is an important piece of safety equipment to significantly reduce or eliminate the instances of a dark intersection, which causes confusion for drivers and increases the crash risk at the intersection.

2.4 Emergency Vehicle Preemption

Most study intersections in the corridor have Emergency Vehicle Preemption (EVP). All EVP units installed are Tomar products. There are no recommended upgrades to the EVP equipment. Signals currently without EVP are:

- Alpine Rd & American Rd
- Alpine Rd & Manchester Dr
- Alpine Rd & Turner St/Morsay Dr
- Alpine Rd & Garden Ln/High Point Dr
- Alpine Rd & Innsbruck Dr
- Alpine Rd & Siseman Rd
- Alpine Rd & Roosevelt Rd
- Manchester Dr & Harrison Av
- Quentin Rd & Newburg Rd
- Forest Hills Rd & Windsor Rd
- Schnucks Ent & Harlem Rd

2.5 Vehicle Detection Systems

All study intersections are equipped with detectors, which provide actuation for vehicles on all approaches. There is a mix of inductive loops and video detection. A breakdown of the existing detection types is shown in **Table 2.4**. At the time of field inventory and observations, most detectors were confirmed to be operating well. Iteris staff were unable to confirm detection at Guilford Road/Skyline Drive due to a frozen controller screen.

Table 2.4 - Vehicle Detection Type

DETECTION TYPE	COUNT
Inductive Loops	**24**
Iteris Vantage Edge 2	**13**
Iteris Vantage Next	**4**
Iteris Vantage Plus	**1**
Odetics Vantage Plus	**3**
ITS Plus	**1**

Video detection adds flexibility to detection layouts and the ability to collect additional metrics when compared to loops. It is recommended that loop detectors be replaced with video detection. If the Cities desire to use Signal Performance Measures (SPM) in the future, video detection will make the setup process easier and more affordable than using loops.

2.6 Pedestrian Signal Heads

Approximately half of the study intersections have signalized pedestrian crossings, and most signalized crossings have countdown pedestrian signal heads. There are three non- countdown pedestrian heads at Alpine Road and Highcrest Road. The Manual on Uniform Traffic Control Devices (MUTCD) requires that all pedestrian signal heads display a countdown of the pedestrian clearance interval. This is also the current IDOT standard. Iteris recommends upgrading non-countdown pedestrian signal heads to new countdown heads at this intersection.

2.7 Pedestrian Pushbuttons

Currently the MUTCD requires that all pushbuttons be “latching”, which displays a confirmation LED to let the pedestrian know the button accepted the call. However, the new Public Right-of-Way Accessibility Guidelines (PROWAG) require that all pedestrian pushbuttons be APS buttons. IDOT has updated its standard to use APS buttons at all signalized crossings and plans to upgrade old pushbuttons to APS buttons through upcoming traffic signal projects, roadway projects, resurfacing projects, and permit projects. The inventory found a mix of latching and non-latching pedestrian pushbuttons.

A list of all locations that do not have APS pushbuttons is as follows:

No Pushbuttons:

- Manchester Dr & Harrison Av
- Alpine Rd & Highcrest Ctr/Edgebrook Ent (East and west leg crossing)

Non-Latching Pushbuttons:

- Alpine Rd & Brendenwood Rd/Guilford Rd
- Alpine Rd & Highcrest Rd
- Alpine Rd & Highcrest Ctr/Edgebrook Ent
- Alpine Rd & Pepper Dr
- Quentin Rd & Newburg Rd
- Dempster Rd & US 20 - E State St

Latching Pushbuttons:

- Alpine Rd & Beach St
- Alpine Rd & Florida Dr/Cleveland Av
- Alpine Rd & Larson Av
- Alpine Rd & Turner St/Morsay Dr
- Alpine Rd & Rural St
- Alpine Rd & Brendenwood Rd/Guilford Rd
- Alpine Rd & Highcrest Rd
- Alpine Rd & Highcrest Ctr/Edgebrook Ent
- Alpine Rd & Pepper Dr
- Alpine Rd & Valli Produce Ent
- Alpine Rd & Windsor Rd
- Alpine Rd & Maple Av
- Alpine Rd & Harlem Rd
- Alpine Rd & Schnucks Ent
- Alpine Rd &Roosevelt Rd
- Alpine Rd & Gladys Dr/Huskie Cir
- Holmes St & Harrison Av
- Parkside Dr & Charles St
- Lynmar Ct & US 20 – E State St

Iteris recommends upgrading all non-APS buttons to APS. Intersections with no pushbuttons and with non-latching buttons should be prioritized.

2.8 Field Equipment Damage and Additional Comments

While in the field taking inventory, Iteris staff noted any damaged or malfunctioning traffic signal related items, as well as any information pertaining to the safety of road users and the operation of the intersection. This is for informational purposes only.

Beach St – Southeast Corner

Alpine Rd & Beach Street

At Beach Street, a signaled pedestrian crossing is provided on the south of the intersection. The crossing does not provide sidewalk connections, ADA ramps, or a visible crosswalk for pedestrian safety.

Highcrest Ctr/Edgebrook Ent Signal Pole

Alpine Rd & Highcrest Ctr/Edgebrook Ent

At Alpine Rd & Highcrest Ctr/Edgebrook Ent, the signal pole located at the southwest corner is damaged.

Innsbruck Dr Cabinet

Alpine Rd & Innsbruck Dr

At Innsbruck Dr, the cabinet exterior’s rear side is damaged.

Eastbound Rose St Traffic Signal

Alpine Rd & Rose St

At Rose St, as eastbound three-section signal head is dark.

3 SIGNAL COORDINATION AND TIMING STUDY

With a detailed inventory and existing conditions, Iteris developed optimized signal timings along Alpine Road from Sandy Hollow Road to IL 173/West Lane Road, and on adjacent signals within a third of a mile of Alpine Road.

3.1 System Operation

Using the traffic counts collected earlier in this project, Iteris developed a Synchro network to model the existing conditions. The existing conditions models were the basis of the optimized signal timing plans included in this report. The scope of work for this project included developing weekday AM, Midday/Off-peak, and PM plans.

Iteris created optimized timing plans for each period with the basic timing parameters included in the existing conditions. Iteris used the guidelines set forth in the latest Manual on Uniform Traffic Control Devices, ITE Signal Timing Manual, and current agency practices and preferences.

Determining cycle lengths for a coordinated system is a balance. Longer cycle lengths can marginally increase capacity but possibly accommodate all pedestrian timing. Shorter cycle lengths can reduce delays but will likely require a suspension of coordination during a pedestrian call to accommodate pedestrians crossing safely.

Multiple cycle lengths were studied for this project ranging from 90 to 150 seconds for each peak period based on the traffic volumes. Upon completion of the Synchro analyses, the cycle lengths for the weekday peaks were: **130 seconds for the AM, 110 seconds for the Midday/Off-Peak, and 130 seconds for the PM**. The system runs free overnight. The proposed cycle lengths are shown in Table 3.1.

Table 3.1 – Proposed Cycle Lengths: Alpine Road

PROPOSED CYCLE LENGTHS			
AM PEAK C/L	MD/OFF-PEAK C/L	PM PEAK C/L	OVERNIGHT C/L
130 sec	110 sec	130 sec	Free

In addition to cycle lengths, Iteris optimized splits and offsets along the project corridor. Synchro was used to optimize the splits to ensure each movement would receive sufficient green time, with low likelihood of waiting through multiple red intervals. The synchro reports are included in Appendix.

3.2 Intersection Operation

Iteris analyzed the study intersections for the weekday peak hours and Saturday peak hour under the optimized signal timing plans using Synchro 11 capacity analysis software. The proposed timing plans treat the entire project corridor as one continuous system, despite the intersection spacing and overall corridor length. There are segments where it could be broken into smaller systems, such as at Spring Creek Road where the signals to the north and south are approximately three-quarters of a mile, making a natural break in the system. However, Iteris found good progression could be made along the entire corridor without significant undue delays at individual intersections.

The Synchro model for the proposed weekday peak hours shows most intersections operating with LOS D or better. During the AM peak hours, Spring Creek Road experiences longer delays at LOS E.

3.2.1 Alpine Road and Sandy Hollow Road

During the AM peak period, the eastbound approach operates at LOS E while the westbound approach operates at LOS D. Under existing conditions, the westbound left turn in the AM Peak is near capacity with a v/c ratio of 0.97 and a projected queue length of 242 feet. With optimized signal timing plans, the westbound left turn has a v/c ratio of 0.75 and its queue length projected at 199 feet.

During the PM peak, east and westbound approaches are shown to operate at LOS E. The v/c ratio of the westbound left-turning movement is reduced from 1.02 to 0.87. The projected queue length is also reduced from a building queue of at least 532 feet to 478 feet. At 478 feet, the westbound left turn queue is anticipated to spill back to Lonergan Drive. As mentioned under existing conditions, traffic counts show approximately 350 vehicles turning left in the PM peak. It is recommended that the westbound approach provide dual left turn lanes to accommodate the PM peak volumes.

3.2.2 Alpine Road and Spring Creek Road

Under existing conditions, Alpine Road and Spring Creek Road operate at LOS E during the AM and PM peak hours. In the AM peak hour, the eastbound and northbound approaches operate at LOS F, with v/c ratios of 1.14 and 1.11, respectively. In the PM peak hour, the northbound approach operates at LOS F and is also over capacity with a v/c ratio of 1.20.

Under optimized timings, the AM peak eastbound and northbound approaches continue to operate at LOS F with v/c ratios of 1.08 and 1.05, respectively. The 95th percentile queue for the eastbound approach is 582 feet and 615 feet for the northbound approach. Vehicles are expected to be double-cycled, and the queues may be longer. PM peak conditions improve under optimized timings, with the v/c ratio of the northbound approach reduced from 1.20 to 0.93. The queue length is projected to decrease from 667 feet to 468 feet.

Northbound right turning volumes in the AM exceed the threshold of 150 vehicles for a right-turn lane warrant. A dedicated right-turn lane for the northbound direction is recommended, along with signal improvements to allow northbound right turn overlap, like the south and westbound approaches.

As previously mentioned, Spring Creek Road is located approximately three-quarter mile away from the adjacent signals on Alpine Road and can be a natural break in the corridor. Agencies may consider running free operations at this intersection to allow flexibility between each phase split.

3.2.3 Alpine Road at East Riverside Boulevard and East State Street

Further analysis of the optimized timing shows improvements at East Riverside Boulevard and at East State Street. During the PM peak, the v/c ratio of the westbound left turn at East Riverside is reduced from 1.11 to 0.86. The 95th percentile queue is projected to be 291 feet, exceeding the available storage space of 175 feet and likely to temporarily spill over to the adjacent lane due to a raised median.

Similarly, delays to the northbound and southbound movements at Alpine Road and East State Street are reduced under the proposed PM timings. While left turn queues exceed the available storage space, vehicles can queue on a striped median.

3.3 Measures of Effectiveness

Travel time and delay studies are typically used to determine conditions along the corridor before and after implementation of optimized timings. For this study, Synchro 11 reports are used to quantify improvements to the network's performance. **Table 3.2** below provides a comparison of delays, stops, fuel consumption, and emissions for all vehicles on Alpine Road within the study area.

Table 0.2 – Alpine Road Measures of Effectiveness Comparison

	Study	Travel Time (hr)	Stops (#)	Fuel (gal)	CO (kg)	NOx (kg)	VOC (kg)
AM PEAK	Existing	649	22,967	1,023	71.54	13.92	16.58
	Proposed	606	22,105	983	68.74	13.37	15.93
	Change	**↓43**	**↓862**	**↓40**	**↓2.8**	**↓0.55**	**↓0.65**
		↓7%	**↓4%**	**↓4%**	**↓4%**	**↓4%**	**↓4%**
MD PEAK	Existing	540	20,147	881	61.60	11.98	14.28
	Proposed	481	15,989	797	55.74	10.85	12.92
	Change	**↓59**	**↓4,158**	**↓84**	**↓5.86**	**↓1.13**	**↓1.36**
		↓11%	**↓21%**	**↓10%**	**↓10%**	**↓9%**	**↓10%**
PM PEAK	Existing	816	30,250	1,283	89.67	17.45	20.78
	Proposed	725	25,036	1,162	81.19	15.80	18.82
	Change	**↓91**	**↓5,214**	**↓121**	**↓8.48**	**↓1.65**	**↓1.96**
		↓11%	**↓17%**	**↓9%**	**↓9%**	**↓9%**	**↓9%**

The results from synchro's Measures of Effectiveness (MOE) reports showed positive results during all study periods. Detailed MOE reports, included in the Appendix, show a count of vehicles arriving when the signal turns yellow. Vehicles in the dilemma zone are more likely to have accidents such as rear-end collisions or right-angle accidents involving vehicles or pedestrians. A decrease in this number is a safety improvement for the corridor achieved through signal coordination and timing. Further improvements may occur if lead-lag configurations at intersections with protected only left turns are considered at different times of the day to improve the flow of traffic.

3.4 Time-Of-Day Schedule

Under the proposed conditions, all study intersections are recommended to run coordination by time-of-day (TOD). After a review of the count data and field observations, Iteris determined the Time-of-Day plan shown on **Table 3.3** to be appropriate.

Table 0.3 - Proposed Weekday Time-of-Day Schedule

COORDINATION PLAN PERIODS			
AM PLAN (130s)	**MD PLAN (110s)**	**PM PLAN (130s)**	**OFF-PEAK PLAN (110s)**
6:00 AM – 9:00 AM	9:00 AM –2:30 PM	2:30 PM – 6:00 PM	6:00 PM – 8:00 PM

When the signal timing plans change from one cycle length to another, the controller's transition algorithm may shorten or lengthen the cycle lengths and may also change the length of green time a phase is provided. This transition period typically takes one to five cycles. The larger the difference between cycle lengths, the longer the transition will take. Transition periods should be observed after implementation to ensure that the signals are "in step" and ready for the oncoming change in traffic.

Figure 3 on the following pages show the proposed weekday day plan schedules.

Figure 3 - Proposed Day Plan Schedule

<table>
<tr><th colspan="2">PROPOSED TOD SCHEDULES</th><th rowspan="2">1 am</th><th rowspan="2">2 am</th><th rowspan="2">3 am</th><th rowspan="2">4 am</th><th rowspan="2">5 am</th><th rowspan="2">6 am</th><th rowspan="2">7 am</th><th rowspan="2">8 am</th><th rowspan="2">9 am</th><th rowspan="2">10 am</th><th rowspan="2">11 am</th><th rowspan="2">12 pm</th><th rowspan="2">1 pm</th><th rowspan="2">2 pm</th><th rowspan="2">3 pm</th><th rowspan="2">4 pm</th><th rowspan="2">5 pm</th><th rowspan="2">6 pm</th><th rowspan="2">7 pm</th><th rowspan="2">8 pm</th><th rowspan="2">9 pm</th><th rowspan="2">10 pm</th><th rowspan="2">11 pm</th><th rowspan="2">12 am</th></tr>
<tr><th colspan="2">WEEKDAYS</th></tr>
<tr><td colspan="26">Alpine Road</td></tr>
<tr><td>1</td><td>Sandy Hollow Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>2</td><td>American Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>3</td><td>Manchester Drive</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>4</td><td>Harrison Drive</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>5</td><td>Beach Street</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>6</td><td>Florida Drive/Cleveland Avenue</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>7</td><td>Louisiana Road</td><td colspan="24">UNSIGNALIZED</td></tr>
<tr><td>8</td><td>Broadway/Newburg Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>9</td><td>Center Terrace</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>10</td><td>Rockford Career College</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>11</td><td>Larson Avenue</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>12</td><td>US 20 - E State Street</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>13</td><td>Turner Street/Morsay Drive</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>14</td><td>Rural Street</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>15</td><td>Guilford Road/Skyline Drive*</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>16</td><td>Brendenwood Road/Guilford Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>17</td><td>Highcrest Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>18</td><td>Highcrest Center/Edgebrook Entrance</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>19</td><td>Spring Creek Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>20</td><td>Pepper Drive</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>21</td><td>Garden Lane/High Point Drive</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>22</td><td>Innsbruck Drive</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>23</td><td>Siseman Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>24</td><td>E Riverside Boulevard</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>25</td><td>Valli Produce Entrance</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>26</td><td>Windsor Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>27</td><td>Maple Avenue</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>28</td><td>Harlem Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>29</td><td>Schnucks Entrance</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>20</td><td>Roosevelt Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>31</td><td>Gladys Drive/Huskie Circle</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>32</td><td>Rose Street</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
<tr><td>33</td><td>IL 173 - West Lane Road</td><td colspan="6">FREE</td><td colspan="3">133 [130]
6:00 - 9:00</td><td colspan="5">111 [110]
9:00 - 14:30</td><td colspan="4">122 [130]
14:30 - 18:00</td><td colspan="2">111 [110]
18:00 - 20:00</td><td colspan="4">FREE</td></tr>
</table>

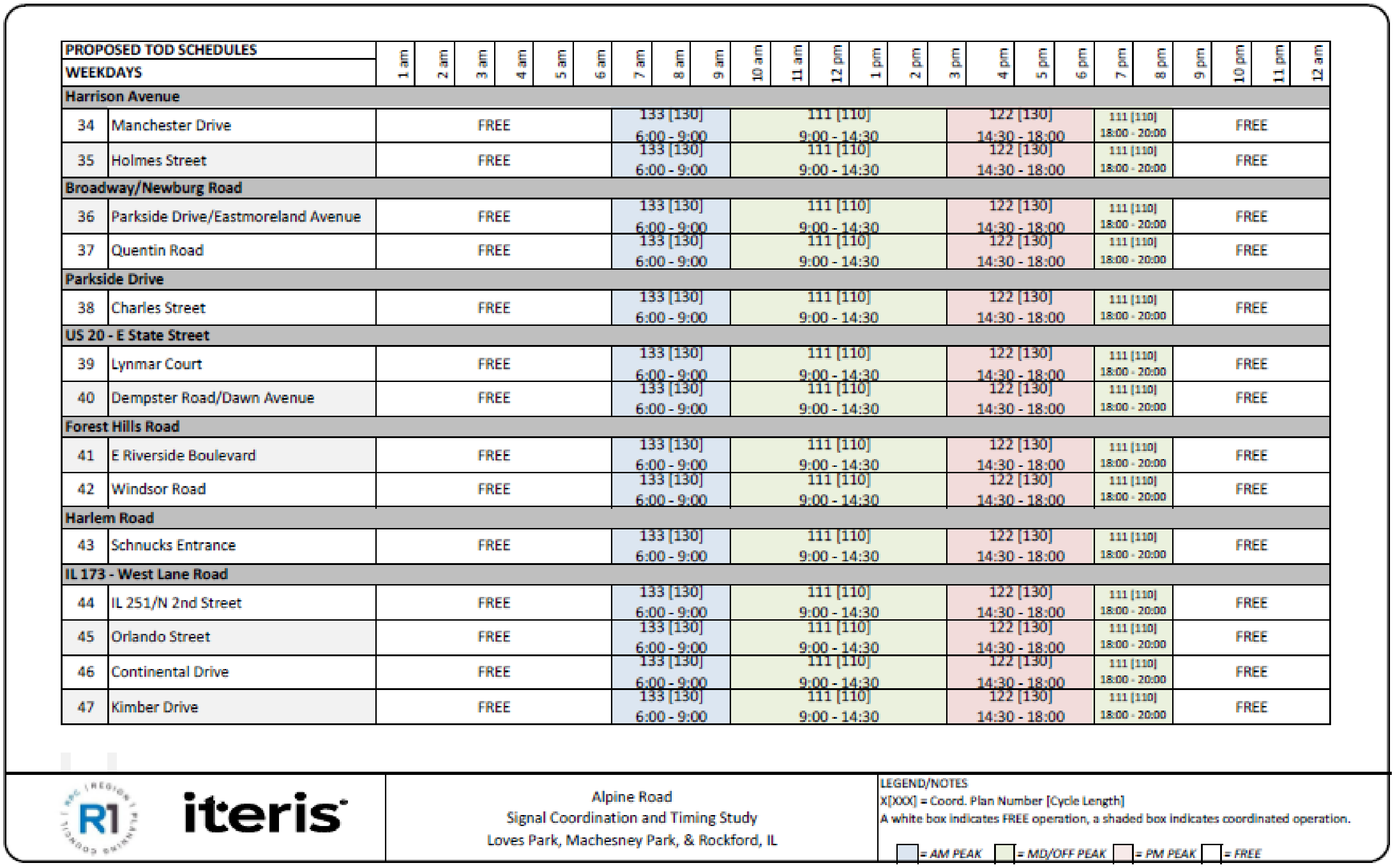
* Existing signal controller screen frozen

Alpine Road
Signal Coordination and Timing Study
Loves Park, Machesney Park, & Rockford, IL

LEGEND/NOTES
X[XXX] = Coord. Plan Number [Cycle Length]
A white box indicates FREE operation, a shaded box indicates coordinated operation.

🟦 = *AM PEAK* 🟩 = *MD/OFF PEAK* 🟥 = *PM PEAK* ⬜ = *FREE*

Figure 3 - Proposed Day Plan Schedule (cont.)



PROPOSED TOD SCHEDULES WEEKDAYS		1 am	2 am	3 am	4 am	5 am	6 am	7 am	8 am	9 am	10 am	11 am	12 pm	1 pm	2 pm	3 pm	4 pm	5 pm	6 pm	7 pm	8 pm	9 pm	10 pm	11 pm	12 am
Harrison Avenue																									
34	Manchester Drive	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
35	Holmes Street	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
Broadway/Newburg Road																									
36	Parkside Drive/Eastmoreland Avenue	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
37	Quentin Road	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
Parkside Drive																									
38	Charles Street	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
US 20 - E State Street																									
39	Lynmar Court	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
40	Dempster Road/Dawn Avenue	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
Forest Hills Road																									
41	E Riverside Boulevard	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
42	Windsor Road	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
Harlem Road																									
43	Schnucks Entrance	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
IL 173 - West Lane Road																									
44	IL 251/N 2nd Street	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
45	Orlando Street	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
46	Continental Drive	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			
47	Kimber Drive	FREE						133 [130] 6:00 - 9:00			111 [110] 9:00 - 14:30						122 [130] 14:30 - 18:00			111 [110] 18:00 - 20:00		FREE			

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LEGEND/NOTES
X[XXX] = Coord. Plan Number [Cycle Length]
A white box indicates FREE operation, a shaded box indicates coordinated operation.

🟦 = AM PEAK 🟩 = MD/OFF PEAK 🟥 = PM PEAK ☐ = FREE

4 HARDWARE AND SOFTWARE RECOMMENDATIONS

The following section provides guidance on equipment improvements to the study intersections that will improve traffic flow, safety, and maintenance.

4.1 Traffic Signal Cabinet

As mentioned in the Traffic Signal Inventory section, most traffic signal cabinets on the study corridor are NEMA style cabinets. Iteris recommends upgrading NEMA TS1 cabinets to a TS2 Type 1 or to ATC. TS1 is an outdated standard that requires maintenance contractors to stock parts that are becoming more difficult to find and increasing in price. ATC cabinets are the latest cabinet standard. Given the age of existing cabinets in the study corridor, it may be worth skipping TS2 and adopting ATC.

Iteris recommends that the replacement of NEMA TS1 cabinets be prioritized over the existing NEMA TS2 Type 1 cabinets. TS1 cabinets are located at the following locations:

1. Alpine Road & American Road
2. Alpine Road & Manchester Drive
3. Alpine Road & Harrison Avenue
4. Alpine Road & Broadway/Newburg Road
5. Alpine Road & Center Terrace
6. Alpine Road & Rockford Career College
7. Alpine Road & Larson Avenue
8. Alpine Road & East State Street (US 20)
9. Alpine Road & Rural Street
10. Alpine Road & Guilford Road/Skyline Drive
11. Alpine Road & Brendenwood/Guilford Road
12. Alpine Road & Highcrest Road
13. Alpine Road & Highcrest Center
14. Alpine Road & Spring Creek Road
15. Alpine Road & Garden Lane/High Point Drive
16. Alpine Road & Innsbruck Drive
17. Alpine Road & Siseman Road
18. Alpine Road & E Riverside Boulevard
19. Alpine Road & Valli Produce Entrance
20. Alpine Road & Windsor Road
21. Alpine Road & Maple Avenue
22. Alpine Road & Harlem Road
23. Alpine Road & Schnucks Entrance
24. Alpine Road & Roosevelt Road
25. Alpine Road & Rose Street
26. Alpine Road & IL 173/West Lane Road
27. Manchester Drive & Harrison Avenue
28. Holmes Street & Harrison Avenue
29. Parkside Drive & Broadway
30. Quentin Road & Newburg Road
31. Lynmar Court & E State Street
32. Dempster Road & E State Street
33. Forest Hills Road & E Riverside Boulevard
34. Forest Hills Road & Windsor Road
35. Schnucks Entrance & Harlem Road
36. N 2nd Street & IL Route 173
37. Orlando Street & IL Route 173
38. Continental Drive & IL Route 173
39. Kimber Drive & IL Route 173

4.2 Traffic Signal Controller

Iteris recommends upgrading all Siemens M50 controllers and older to ATC controllers. ATC controllers are designed to provide advanced functionalities and features to improve efficiency, safety, and traffic management. Such controllers will be required if the jurisdictions plan to have a centralized traffic signal management system in the future. Current ATC controllers on IDOT's approved list are Econolite Cobalt and Yunex (Siemens) M60.

Replacement of traffic signal controllers should begin with Siemens M03 followed by M10 and M40. These signals should be prioritized above Siemens M50 controllers due to their age.

Siemens M03 Controller Locations:

1. Alpine Road & Guilford Road/Skyline Drive
2. Forest Hills Road & E Riverside Boulevard

Siemens M10 Controller Locations:

1. Alpine Road & Spring Creek Road
2. Alpine Road & Innsbruck Drive
3. Alpine Road & Sideman Road
4. Alpine Road & Roosevelt Road
5. Manchester Drive & Harrison Avenue
6. Quentin Road & Newburg Road

Siemens M40 Controller Locations:

1. Alpine Road & American Road
2. Alpine Road & Manchester Drive
3. Alpine Road & Harrison Avenue
4. Alpine Road & Broadway/Newburg Road
5. Alpine Road & Center Terrace
6. Alpine Road & Rockford Career College
7. Alpine Road & Larson Avenue
8. Alpine Road & Rural Street
9. Alpine Road & Brendenwood/Guilford Road
10. Alpine Road & Highcrest Road
11. Alpine Road & Highcrest Center
12. Alpine Road & Garden Lane/High Point Drive
13. Alpine Road & E Riverside Boulevard
14. Alpine Road & Valli Produce Entrance
15. Alpine Road & Rose Street
16. Parkside Drive & Broadway
17. Schnucks Entrance & Harlem Road

Regardless of any plans to move to a centralized system, planning these replacements will enable the jurisdictions to proactively upgrade the controllers rather than waiting for the equipment to fail at some inopportune time, such as the middle of the night on a holiday weekend. Planned replacement will allow a smooth transition to the new equipment, rather than dealing with temporary equipment while waiting for new parts to come in under an emergency order.

2.9 Battery Backup Systems

The installation of battery backup systems (BBS) along the corridor is a priority for the maintenance of safe operations. Dark signals present unsafe situations to motorists, pedestrians, and cyclists, especially during the nighttime. The current practice in responding to a dark intersection is to have a crew respond and place portable stop signs on all approaches. This practice poses a safety risk for all users of the road when an intersection is dark, and it also poses a safety risk for the crew in the roadway with a dark signal. The use of battery backup systems nearly eliminates this unsafe situation.

The installation efforts can be as small or large as funding allows as this is individual to the intersection. However, Iteris recommends beginning at busier intersections as listed below.

1. Alpine Road & Sandy Hollow Road
2. Alpine Road & Harrison Avenue
3. Alpine Road & Broadway/Newburg Road
4. Alpine Road & East State Street
5. Alpine Road & Spring Creek Road
6. Alpine Road & Riverside Boulevard
7. Alpine Road & Windsor Road
8. Alpine Road & Harlem Road
9. Alpine Road & IL 173/West Lane Road
10. Forest Hills Road & E Riverside Boulevard
11. N 2nd Street & IL Route 173

4.3 Vehicle Detection Systems

The study corridor utilizes a mix of loops and video detection. There are currently 24 intersections utilizing loops to detect the presence of vehicles. Loops are relatively cost-effective to install and maintain. Loop detectors are installed in the roadway and often require minimal attention after installation. Frequent freeze-thaw cycles can damage loop detection as pavement moves. Repairing or adjusting loops may involve cutting into road surfaces, causing traffic disruptions and possible maintenance challenges.

Video detection, installed in 22 intersections, can provide more flexibility than loops since detection areas are "drawn" and can be programmed and reprogrammed. However, they can be negatively affected by weather and the presence of shadows throughout the day. Three intersections utilize Odetics Vantage Plus, which should be upgraded as funding becomes available due to the age of these systems.

If the jurisdictions desire to use Signal Performance Measures (SPM) in the future, video detection will make the setup process easier and more affordable than using loops.

4.4 Pedestrian Signal Heads and Pushbuttons

As mentioned in Section 2.6, most signalized pedestrian crossings have countdown pedestrian signal heads. Iteris recommends upgrading three (3) non-countdown pedestrian heads at Highcrest Road to comply with MUTCD and IDOT standards. Pedestrian signal heads and pushbuttons should be considered at Alpine Road and East State Street to accompany the existing crosswalk along the south leg of the intersection.

Effective September 7, 2023, the Public-Right-of-Way Accessibility Guidelines (PROWAG) require accessible pedestrian signals (APS) at all new and altered pedestrian signal heads installed at crosswalks. APS have audible and vibrotactile features so that pedestrians who are blind or have low vision will know when to cross a street. With this ruling, Iteris recommends the installation of APS pushbuttons with the installation of countdown pedestrian heads at Highcrest Road. Iteris also recommends other pedestrian push buttons in the study area be upgraded to APS. Intersections with no pushbuttons and with non-latching buttons should be prioritized.

4.5 Interconnect

Interconnect provides communication between individual signals and allows these signals to keep synchronized clocks. It is recommended to maintain synchronization between signals to avoid individual clocks from drifting over time, providing a consistent and reliable travel time through the project corridor.

Fiber optic cable communication provides a reliable and high-speed method of interconnecting signals and managing signal systems. It can transmit data over long distances without loss of signal quality, which may be important on a long corridor such as Alpine Road. The initial installation of fiber optic cables may be more expensive than other communication methods but is a preferred choice for communication infrastructure due to its reliability and ability to support increased data demands and future applications as traffic systems advance. The cost of the fiber optic cable and conduit are approximately $40 per foot. As previously mentioned, many intersections in the study area were found to be interconnected, but approximately eight miles of Alpine Road were found to have no interconnect. Some intersections were found to have fiber terminal boxes without fiber connection. For an eight-mile span of Alpine Road, the cost adds up to approximately $1.7 million not including efforts or costs related to prior coordination, design, or studies.

Radio frequency allows wireless connectivity between signals across a network by using radio waves to transmit data and may be a more cost-effective option than fiber optic cable. Intersections with radio frequency communication can often by remotely monitored or managed, allowing troubleshooting of issues without the need for on-site visits. Wireless radio would need to be installed at each intersection. The cost for a wireless radio is approximately $3,500 each.

To reap the benefits of either of the above interconnect technologies, the agencies should implement a centralized traffic management system. Such a system provides a way to actively monitor the operation of the intersections on the system. Users can make changes to timing, check intersection and detection status, and perform troubleshooting tasks from the office. Issues can be found more quickly and addressed proactively, often before the driving public becomes aware and before something small turns into a big issue. Siemens does produce such software, but there are several other options that would work well with the area's Siemens controllers. The cost is estimated to be between $50,000 to $100,000.

A GPS clock can be used to synchronize the time in traffic signal equipment to ensure that devices are operating on the same precise time reference. Precise time synchronization is vital for coordinating signals efficiently and can help in maintenance and diagnostics by providing accurate timestamps in events and logs. In comparison to wireless radio and fiber optic, GPS clocks are easily attainable at about $1,000 per unit. Iteris recommends having GPS clocks at the very least to keep the clocks synchronized for the optimized timings to function properly.

5 IMPLEMENTATION PHASES AND COSTS

Recommended improvements listed in the prior sections should be implemented over time as funding becomes available. Iteris recommends upgrading equipment for safety purposes first before upgrading equipment to benefit from new features.

5.1 Safety Improvements

IMPROVEMENT	COST
Battery Backup System	$6,000
Countdown Pedestrian Head	$650 per head
APS Pushbutton	$1,000 per button

As previously mentioned, dark signals present unsafe conditions to all users of the road, and the installation of battery backup systems provides insurance for traffic equipment to function during power interruptions. There are currently 11 intersections with battery backup. At $6,000 each, providing the remaining 35 intersections with BBS will cost approximately $210,000.

Upgrading pedestrian crossing equipment improves the safety of the crossing as well as lowers the liability of the jurisdictions should an incident occur. When countdown heads are used the pedestrians have a visual indication of when they must be out of the intersection before crossing vehicles begin to move. This allows them to quicken their pace or remain on a refuge island if needed. Replacing three non-countdown pedestrian signal heads at Alpine Road and Highcrest Road totals approximately $1,950.

Additionally, the use of APS buttons has shown to provide significant safety improvements for visually impaired pedestrians with its audible and vibrotactile features. The final PROWAG ruling requires that the entity making alterations to the intersection must assess whether the installation of APS is required. Prior to the final ruling, PROWAG guidelines indicated that these alterations include the replacement of a signal head, or the alteration of a signal controller and software. Consequently, the pedestrian pushbuttons at Alpine Road and Highcrest Road are recommended to be upgraded to APS buttons when countdown pedestrian signal heads are installed. This is projected to cost $4,000 in addition to the $1,950 estimated for the countdown signal heads at this intersection. As funding becomes available, the transformation of the remaining pushbuttons to APS to meet PROWAG and IDOT standards is estimated at an additional $86,000.

At Alpine Road and High Crest Center/Edgebrook Entrance, the east and west leg provide countdown pedestrian signal heads, but without actuated push buttons. The “walk” signal automatically comes up when the northbound and southbound traffic receive a green indication. The addition of APS buttons at this intersection would be an additional cost of approximately $4,000.

Furthermore, PROWAG states that altered facilities must be connected to a pedestrian circulation path so that pedestrians with disabilities can realize the benefits accessible with these guidelines. Consequently, it is recommended that sidewalks be installed at the following intersections with existing pedestrian crossings:

1. Alpine Road & Beach Street
2. Alpine Road & Pepper Drive
3. Dempster Road & East State Street

Additionally, it is recommended that ramps at the following intersections be upgraded to meet ADA standards:

1. Alpine Road & Larson Avenue
2. Alpine Road & Highcrest Road
3. Alpine Road & Highcrest Center/Edgebrook Entrance
4. Alpine Road & Pepper Drive
5. Manchester Drive & Harrison Avenue
6. Quentin Road & Newburg Road
7. Dempster Road & East State Street

Intersections that currently provide crosswalks without pedestrian signal heads or pushbuttons are located at the following locations:

1. East State Street
2. Rural Street
3. Highcrest Road
4. Garden Lane

The total cost of providing BBS and APS pushbuttons in the study area is approximately $305,950, not including work related to replacing pedestrian ramps or providing connections to a sidewalk.

5.2 Equipment Replacement

ITEM	COST
ATC Signal Controller	$5,000
Video Vehicle Detection System	$40,000
TS Cabinet	$28,000

This set of upgrades is about replacing aged technology proactively instead of waiting for equipment failure. These upgrades should lower maintenance costs for the jurisdictions and provide the latest features to help efficiently move traffic through the corridor.

Most controllers in use within the study area are well beyond their designed life spans. Replacement of these older controllers should be prioritized over the other remaining components. Replacing controllers older than M50 in 25 intersections will cost approximately $125,000. The replacement of M50 controllers found in 13 intersections will cost an additional $65,000.

Similarly, TS1 is an outdated standard that requires maintenance contractors to stock parts that are becoming more difficult to find and increasing in price. The replacement of NEMA TS1 cabinets is estimated to cost $1.1M. Replacing the NEMA TS2 Type 1 cabinets will cost an additional $196,000.

The total cost of upgrading the traffic signal cabinets and controllers is between $1.25M and $1.5M, depending on whether the M50s and NEMA TS2 Type 1 cabinets are upgraded or not.

5.3 Interconnect

ITEM	COST
Wireless Radio	$3,500 each
Fiber Optic Cable	$40/ft

For successful implementation, interconnect should be installed to allow communication between traffic signals. Without communication, individual clocks are expected to drift over time and the benefits of the corridor optimization will not be attained. Iteris recommends the above interconnect technologies, which can provide ways to actively monitor the intersections. Users can make changes to timing, check intersection and detection status, and perform troubleshooting tasks from the office.

Several signals in the study area are interconnected in closed loop systems. Signals on IL 173, connected by fiber, belong in one system that prioritizes east-west traffic movement on IL 173. Another system, also connected by fiber, is located along East State Street. Lastly, signals along Alpine Road from Sandy Hollow Road to Florida Drive/Cleveland Avenue form another system using radio signals. While the existing interconnected systems in the study area are either connected by fiber or by radio, it is possible for a system to operate with fiber interconnect and wireless radio at select locations.

There are currently 27 intersections without communication, some containing fiber terminal boxes without fiber connections. These intersections can be added to a new system, or an existing system can be expanded without a complete overhaul of existing infrastructure. While closed loop systems can provide signal coordination and timing within their network of signals, coordinating with other systems across a larger area may not be as efficient which can lead to congestion between different parts of the region.

5.4 Advanced Traffic Management System

An Advanced Traffic Management System (ATMS) is recommended as it would provide the agencies with a variety of benefits. An ATMS includes, at minimum, a central software package and communications infrastructure that would enable remote communication between the devices at the intersection and a central management center, such as a Traffic Management Center in an agency facility.

An ATMS software package would serve the need to keep the corridor interconnected and coordinated and add many other features, such as signal controller database management and real-time system status with alerting capabilities. Engineers and electricians would be able to proactively respond to issues before they become problems, whether a failed detector or an intersection in flash. A central record of controller databases can be maintained within the software and frequently checked against field databases to assure the integrity of the controller data. Most packages include the ability to connect video feeds and dynamic message signs, among other components. Many are also moving to cloud-based systems, removing the need to own, maintain, and periodically replace centralized servers. Most also can manage a variety of access levels shared across multiple jurisdictions—ideal for a corridor such as Alpine Road which falls within such a variety of jurisdictions. Monitoring other IP-addressable equipment is possible, including Malfunction Monitoring Units and Uninterruptable Power Supplies. Many systems also have or will soon be able to collect and act on Automated Traffic Signal Performance Measures.

A cost is provided here as a range due to the variety of inputs that could affect the final cost, such as the degree to which fiber optic cable installation is needed, as well as the selection of the specific ATMS software. Network improvements that would include installing fiber optic cables along the entire corridor and a switch in each traffic signal cabinet on the corridor would cost about $2.5M - $3.0M. The ATMS software could cost between $50,000 and $200,000, depending on the brand selected, how the licensing is handled, and which optional features are chosen. At this early stage, the agencies could expect an ATMS installation to cost between $2.7M and $3.5M.

5.5 Improvements by Intersection

Should jurisdictions wish to make improvements along the corridor by intersection instead of by equipment, **Figure 4** in the following pages shows how estimated costs can vary. This table does not include estimates related to construction of sidewalks as previously mentioned, nor does it include estimates to provide communication between signals. A more detailed cost estimate table can be found in the Appendix.

Figure 4 – Cost Estimate by Intersection

LOCATION	RECOMMENDED IMPROVEMENTS						
Alpine Road	Traffic Signal Cabinet	Traffic Signal Controller	Battery Backup System	Detection System	Pedestrian Signal Heads	APS Pushbuttons	TOTAL
Sandy Hollow Road	◆		●	◆			$$$
American Road	◆	◆	●	◆			$$$$
Manchester Drive	◆	◆	●	◆			$$$$
Harrison Avenue	◆	◆	●				$$
Beach Street	◆		●			●	$$
Florida Drive/Cleveland Avenue	◆		●			●	$$
Broadway/Newburg Road	◆	◆	●	◆			$$$$
Center Terrace	◆	◆	●	◆			$$$
Rockford Career College Entrance	◆	◆	●	◆			$$$$
Larson Avenue	◆	◆	●	◆		●	$$$$
East State Street (US Business 20)	◆		●				$
Turner Street/Morsay Drive	◆	◆	●	◆		●	$$$$
Rural Street	◆	◆	●	◆		●	$$$$
Guilford Road/Skyline Drive	◆	◆	●	◆			$$$$
Brendenwood Road/Guilford Road	◆	◆	●	◆		●	$$$$
Highcrest Road	◆	◆	●	◆	●	●	$$$$
Highcrest Center/Edgebrook Entrance	◆	◆	●	◆		●	$$$$
Spring Creek Road	◆	◆	●	◆			$$$$
Pepper Drive	◆	◆	●	◆		●	$$$$
Garden Lane/High Point Drive	◆	◆	●	◆			$$$$
Innsbruck Drive	◆	◆	●	◆			$$$$
Siseman Road	◆	◆	●	◆			$$$$
E Riverside Boulevard	◆	◆	●	◆			$$$$
Valli Produce Entrance	◆	◆	●	◆		●	$$$$
Windsor Road	◆	◆				●	$$
Maple Avenue	◆	◆				●	$$
Harlem Road	◆	◆				●	$$
Schnucks Entrance	◆	◆				●	$$
Roosevelt Road	◆	◆	●			●	$$
Gladys Drive/Huskie Circle	◆					●	$
Rose Street	◆	◆					$
IL 173/West Lane Road	◆	◆					$

Key:

●	Safety Improvement (Priority)
◆	Equipment Upgrade

$	Less than $35,000
$$	$35,000 < $50,000
$$$	$50,000 < $75,000
$$$$	Greater than $75,000

Figure 4 – Cost Estimate by Intersection (cont.)

Location	Recommended Improvements						
	Traffic Signal Cabinet	Traffic Signal Controller	Battery Backup System	Detection System	Pedestrian Signal Heads	APS Pushbuttons	Total
Harrison Avenue							
Manchester Drive	◆	◆	●	◆		●	$$$$
Holmes Street	◆	◆	●			●	$$
Broadway/Newburgh Road							
Parkside Drive/Eastmoreland Avenue	◆	◆	●	◆			$$$$
Quentin Road	◆	◆	●	◆		●	$$$$
Parkside Drive							
Charles Street	◆		●			●	$$
US 20 – E State Street							
Lynmar Court	◆	◆	●	◆		●	$$$$
Dempster Road/Dawn Avenue	◆		●			●	$$
Forest Hills Road							
E Riverside Boulevard	◆	◆	●	◆			$$$$
Windsor Road	◆	◆	●	◆			$$$$
Harlem Road							
Schnucks Entrance	◆	◆	●	◆			$$$$
IL 173 – West Lane Road							
IL 251 – N 2nd Street	◆	◆					$
Orlando Street	◆	◆					$
Continental Drive	◆	◆					$
Kimber Drive	◆	◆					$

Key:

● Safety Improvement (Priority)
◆ Equipment Upgrade

$ Less than $35,000
$$ $35,000 < $50,000
$$$ $50,000 < $75,000
$$$$ Greater than $75,000

LOCATION	RECOMMENDED IMPROVEMENTS						
Alpine Road	◆ Traffic Signal Cabinet	◆ Traffic Signal Controller	● Battery Backup System	◆ Detection System	● Pedestrian Signal Heads	● APS Pushbuttons	Total
Sandy Hollow Road	$ 28,000	-	$ 6,000	$ 40,000	-	-	**$ 74,000**
American Road	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
Manchester Drive	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
Harrison Avenue	$ 28,000	$ 5,000	$ 6,000	-	-	-	**$ 39,000**
Beach Street	$ 28,000	-	$ 6,000	-	-	$2,000	**$ 36,000**
Florida Drive/Cleveland Avenue	$ 28,000	-	$ 6,000	-	-	$2,000	**$ 36,000**
Broadway/Newburg Road	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
Center Terrace	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
Rockford Career College Entrance	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
Larson Avenue	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	$2,000	**$ 81,000**
East State Street (US Business 20)	$ 28,000	-	$ 6,000	-	-	-	**$ 34,000**
Turner Street/Morsay Drive	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	$2,000	**$ 81,000**
Rural Street	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	$2,000	**$ 81,000**
Guilford Road/Skyline Drive	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
Brendenwood Road/Guilford Road	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	$8,000	**$ 87,000**
Highcrest Road	$ 28,000	$ 5,000	$ 6,000	$ 40,000	$1,950	$4,000	**$ 84,950**
Highcrest Center/Edgebrook Entrance	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	$8,000	**$ 87,000**
Spring Creek Road	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
Pepper Drive	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	$4,000	**$ 83,000**
Garden Lane/High Point Drive	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
Innsbruck Drive	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
Siseman Road	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
E Riverside Boulevard	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	**$ 79,000**
Valli Produce Entrance	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	$6,000	**$ 85,000**
Windsor Road	$ 28,000	$ 5,000	-	-	-	$12,000	**$ 45,000**
Maple Avenue	$ 28,000	$ 5,000	-	-	-	$4,000	**$ 37,000**
Harlem Road	$ 28,000	$ 5,000	-	-	-	$4,000	**$ 37,000**
Schnucks Entrance	$ 28,000	$ 5,000	-	-	-	$4,000	**$ 37,000**
Roosevelt Road	$ 28,000	$ 5,000	$ 6,000	-	-	$2,000	**$ 41,000**
Gladys Drive/Huskie Circle	$ 28,000	-	-	-	-	$4,000	**$ 32,000**
Rose Street	$ 28,000	$ 5,000	-	-	-	-	**$ 33,000**
IL 173/West Lane Road	$ 28,000	$ 5,000	-	-	-	-	**$ 33,000**
Alpine Road Subtotal	**$896,000**	**$135,000**	**$150,000**	**$800,000**	**$1,950**	**$70,000**	**$2.05M**
Advanced Traffic Management System Cost							**$50,000 - $200,000**
ALPINE ROAD TOTAL COST							**$2.1M - $2.3M**

LOCATION	**RECOMMENDED IMPROVEMENTS**						
	◆ **Traffic Signal Cabinet**	◆ **Traffic Signal Controller**	● **Battery Backup System**	◆ **Detection System**	● **Pedestrian Signal Heads**	● **APS Pushbuttons**	**TOTAL**
Harrison Avenue							
Manchester Drive	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	$4,000	$ 83,000
Holmes Street	$ 28,000	$ 5,000	$ 6,000	-	-	$4,000	$ 43,000
Broadway/Newburgh Road							
Parkside Drive/Eastmoreland Avenue	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	$ 79,000
Quentin Road	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	$2,000	$ 81,000
Parkside Drive							
Charles Street	$ 28,000	-	$ 6,000	-	-	$10,000	$ 44,000
US 20 – E State Street							
Lynmar Court	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	$2,000	$ 81,000
Dempster Road/Dawn Avenue	$ 28,000	-	$ 6,000	-	-	$2,000	$ 36,000
Forest Hills Road							
E Riverside Boulevard	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	$ 79,000
Windsor Road	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	$ 79,000
Harlem Road							
Schnucks entrance	$ 28,000	$ 5,000	$ 6,000	$ 40,000	-	-	$ 79,000
IL 173 – West Lane Road							
IL 251 – N 2ND Street	$ 28,000	$ 5,000	-	-	-	-	$ 33,000
Orlando Street	$ 28,000	$ 5,000	-	-	-	-	$ 33,000
Continental Drive	$ 28,000	$ 5,000	-	-	-	-	$ 33,000
Kimber Drive	$ 28,000	$ 5,000	-	-	-	-	$ 33,000
Subtotal	**$392,000**	**$60,000**	**$60,000**	**$280,000**	**-**	**$24,000**	**$816,000**
						SIDE STREET TOTAL COST	**$816,000**