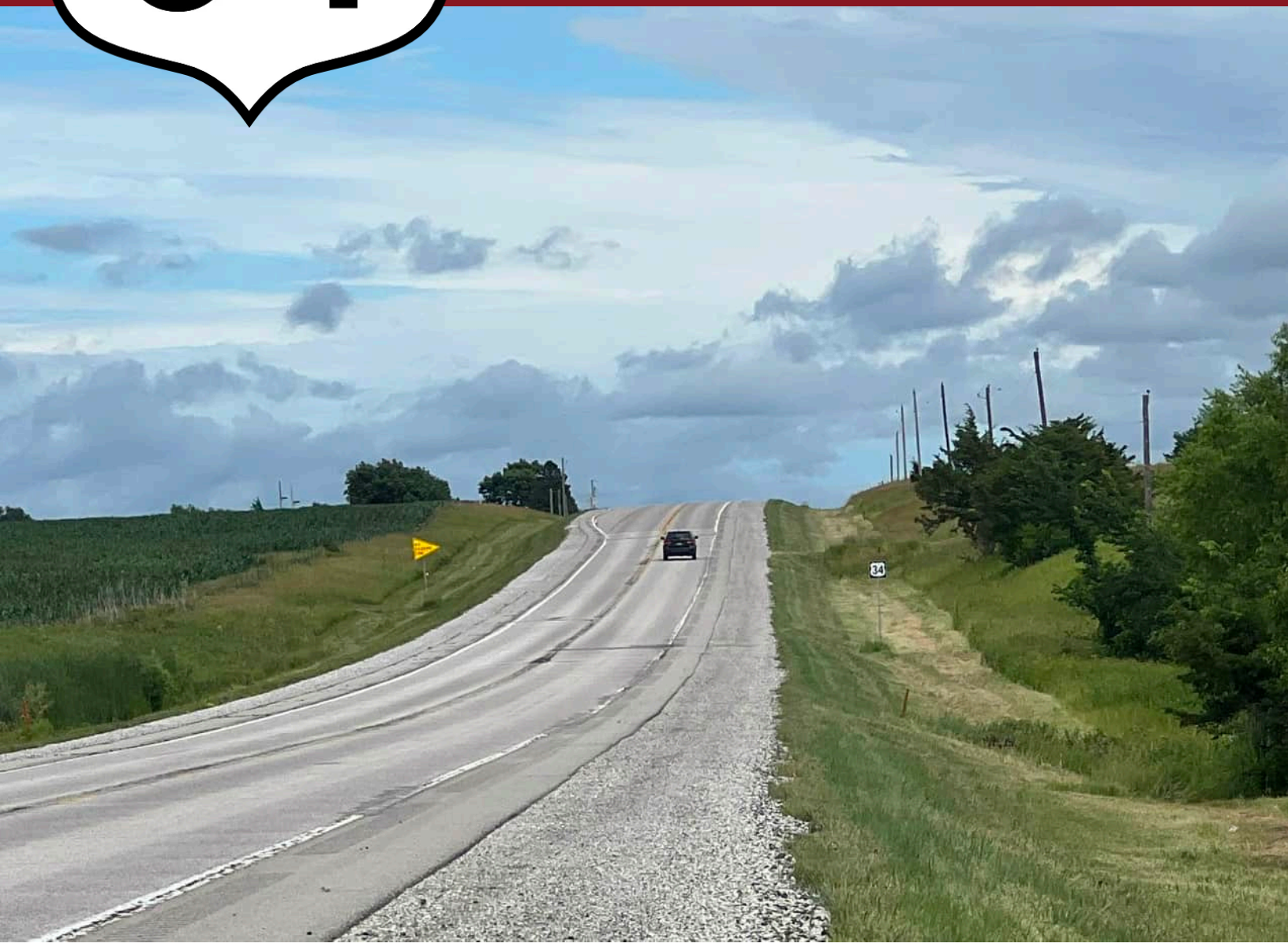
IOWA DOT

US 34 SUPER TWO PLANNING STUDY
Clarke, Lucas, and Monroe Counties

34

Existing Conditions Memorandum

Location and Environment Bureau | October 2023



EXECUTIVE SUMMARY

The Iowa Department of Transportation (DOT) is performing the U.S. Highway 34 (US 34) Super Two Planning Study, hereafter referred to as the Study, for a portion of the US 34 corridor in Clarke, Lucas, and Monroe Counties in south-central and southeastern Iowa. The purpose of the Study is to gain an understanding of the corridor's ability to meet current and future travel and mobility needs and to identify any potential improvement projects that may help meet those future needs.
The Study area is approximately 65 miles long beginning at the western limits of Clarke County and ending east of the US 34 junction with Iowa Highway 5 near Albia. This section of US 34 is primarily rural but passes through the communities of Osceola, Lucas, Chariton, and Albia.

This memorandum documents the methodology and findings of an existing conditions analysis performed on the Study area. The existing conditions analysis compared current Iowa DOT design criteria, policies, and guidance, as well as industry-best design practices, with the existing features of the Study corridor. Existing corridor features were reviewed using historical roadway construction plans and engineering drawings (as-built plans), aerial photography, and observations from an onsite field review of the corridor. The purpose of the comparisons was to identify any systemic (widespread) or isolated design concerns related to the existing roadway corridor and to assess whether the condition and functionality of the existing infrastructure can sufficiently handle current and future travel demands.

The existing conditions analysis considered the following:

- Horizontal roadway curvature
- Vertical roadway grades and curvature
- Decision sight distance
- Roadway cross-section and roadside features
- Intersection design and access
- Existing infrastructure condition
- At-grade railroad crossings
- Opportunities to pass slower-moving vehicles
- Traffic volumes

Table ES-1 summarizes the findings of the existing conditions analysis. Appendix A includes a series of corridor maps that also summarize the key findings of the existing conditions analysis.

Table ES-1. Summary of Existing Conditions Analysis Findings

Existing Features and Conditions	Summary of Findings
Horizontal Roadway Curvature	• All horizontal curves in the Study corridor meet minimum acceptable criteria for new roadway construction or 3R projects. • One location was noted with a combination of roadway curvature and adjacent roadside features that could result in a visual trap; crash data are inconclusive on whether a visual trap contributes to any crashes at this location. • Stopping sight distance around horizontal curves are consistent with current design practices.
Vertical Roadway Grade and Curvature	• Forty locations were identified with roadway grades greater than preferred maximum of 3% with seven locations greater than the acceptable maximum of 5%. • Ten sections with a roadway grade greater than 3% have an estimated reduction in travel speed between 5 and 10 mph. At four of those locations, there is an existing additional lane for passing. The remaining sections with a roadway grade greater than 3% are not expected to result in a significant reduction in travel speeds (less than 5 mph). • A number of crest-and-sag vertical curves in the Study corridor do not meet the criteria for new roadway construction but do meet the minimum acceptable criteria for 3R projects. • Six sag vertical curves through Osceola do not meet design criteria for new construction or 3R projects.
Decision Sight Distance	• Onsite field review observations identified two locations where the decision sight distance does not appear to meet acceptable criteria.
Roadway Cross Section and Roadside	• Typical roadway section has 12-foot travel lanes and 10-foot shoulders. • Centerline and shoulder rumble strips are present throughout a majority of the corridor. • Curb and gutter are present in Osceola; effective curb height is minimal and likely due to pavement surface elevation increases from past pavement overlay projects. • Dedicated turn lanes are provided at the following intersection locations: County Road R15/130th Avenue, County Road R16/135th Avenue, Southwest Boulevard, I-35 Southbound and Northbound on-ramps, Warren Avenue, IA 104/330th Avenue, US 65 North, US 65 South, 200th Avenue, Court Avenue, 220th Avenue/South 16th Street, South 1st Street, Albia Road, 290th Avenue/Cedar Street, 515th Avenue, and 520th Avenue.

Table ES-1. Summary of Existing Conditions Analysis Findings

Existing Features and Conditions	Summary of Findings
	• Sidewalk is provided along the northern and southern sides of US 34 in Osceola. • Utility poles in Osceola are inside acceptable clear-zone requirements according to Iowa DOT Standards and meet acceptable values based on Iowa Statewide Urban Design and Specifications criteria.
Intersection Design and Access	• Currently, there are an estimated 436 points of access along US 34 in the Study corridor, including 115 intersections; the greatest density of access points is in or near the communities along the corridor. • One intersection has a skew angle less than the minimum acceptable angle of 60 degrees and is considered highly skewed; the last 5 full years of available Iowa DOT crash data do not suggest notable crash trends exist at this intersection. • Limited intersection sight distance was noted at nine intersections in the Study corridor during the onsite field review. At these locations, features obstructing the desired sight triangles from the stop sign/stop bar location include retaining wall, guardrail, roadway curvature, trees, and other vegetative growth. The crash history suggests that limited sight distance at two intersections could be a factor in the crashes at these locations.
Infrastructure Condition	• Approximately 1.5 miles of US 34 have roadway pavements considered to be in poor condition; however, a recent resurfacing project could improve these conditions. • Approximately 60.0 miles of US 34 have roadway pavements considered to be in fair condition. • Approximately 4.4 miles of US 34 have roadway pavements considered to be in good condition. • Twelve existing bridges are within the Study corridor; none of the existing bridges are considered deficient or are load rated. Inspection reports noted that two bridges are scheduled for bridge deck overlays, one bridge is scheduled for replacement, and one bridge is currently being replaced.
BNSF Railroad Crossings	• The BNSF Railroad corridor (with two sets of tracks) runs parallel to US 34 at the communities within the Study corridor with four grade-separated crossings with US 34 (US 34 spans over the railroad). • There are 14 at-grade railroad crossings with local sideroads located within 0.5 mile of US 34; 2 are within 150 feet of the local roadway intersection with US 34.

Table ES-1. Summary of Existing Conditions Analysis Findings

Existing Features and Conditions	Summary of Findings
Passing Opportunities and Zones	• Approximately 48 miles (74%) of the corridor allows for passing in at least one direction of travel. • Some passing zones are minimal in length, particularly between Lucas and Chariton, and would provide limited passing opportunities if oncoming traffic was present. • Existing passing lanes are provided throughout the corridor but are shorter than the minimum lengths according to Iowa DOT Standards: four west of Osceola, six between Osceola and Chariton, one east of Chariton, and one east of Albia.
Traffic Volumes	• Existing traffic volumes were analyzed throughout the Study area. Forecasted traffic data were gathered for this Study: – Existing Year: 2018 – Program Year: 2028 – Design Year: 2048.

3R = resurfacing, rehabilitation, and restoration
BNSF = Burlington Northern Santa Fe
I-35 = Interstate 35
IA 104 = State Highway Iowa 104
mph = mile(s) per hour

The findings of the existing conditions analysis will aid in the next phase of the Study: development and evaluation of possible improvement alternatives. Areas noted in this memorandum as not meeting acceptable conditions will be a focus of the alternative development process and considered throughout the Study.

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ACRONYMS AND ABBREVIATIONS

<	less than
3R	resurfacing, rehabilitation, and restoration
AADT	average annual daily traffic
AASHTO	American Association of State Highway and Transportation Officials
BNSF	Burlington Northern Santa Fe
DSD	decision sight distance
I-35	Interstate 35
ICE	Infrastructure Condition Evaluation
Iowa DOT	Iowa Department of Transportation
LiDAR	light detection and ranging
MP	mile post
mph	mile(s) per hour
SSD	stopping sight distance
Study	US 34 Super Two Planning Study
SUDAS	Statewide Urban Design and Specifications
UP	Union Pacific
US 34	U.S. Highway 34

1 INTRODUCTION

The Iowa Department of Transportation (DOT) is performing the U.S. Highway 34 (US 34) Super Two Planning Study, hereafter referred to as the Study, for a portion of the US 34 corridor in Clarke, Lucas, and Monroe Counties in south-central and southeastern Iowa. The purpose of the Study is to gain an understanding of the corridor's ability to meet current and future travel and mobility needs and to identify any potential improvement projects that may help meet those future needs. The overarching goals of this Study are as follows:

- Develop US 34 Super Two improvements, specifically turn lane improvements and recommendations for passing or climbing lane locations and shoulder widening; recommend spot locations for two-lane highway improvements along the corridor.

- Provide a recommended prioritization of potential corridor improvement projects.

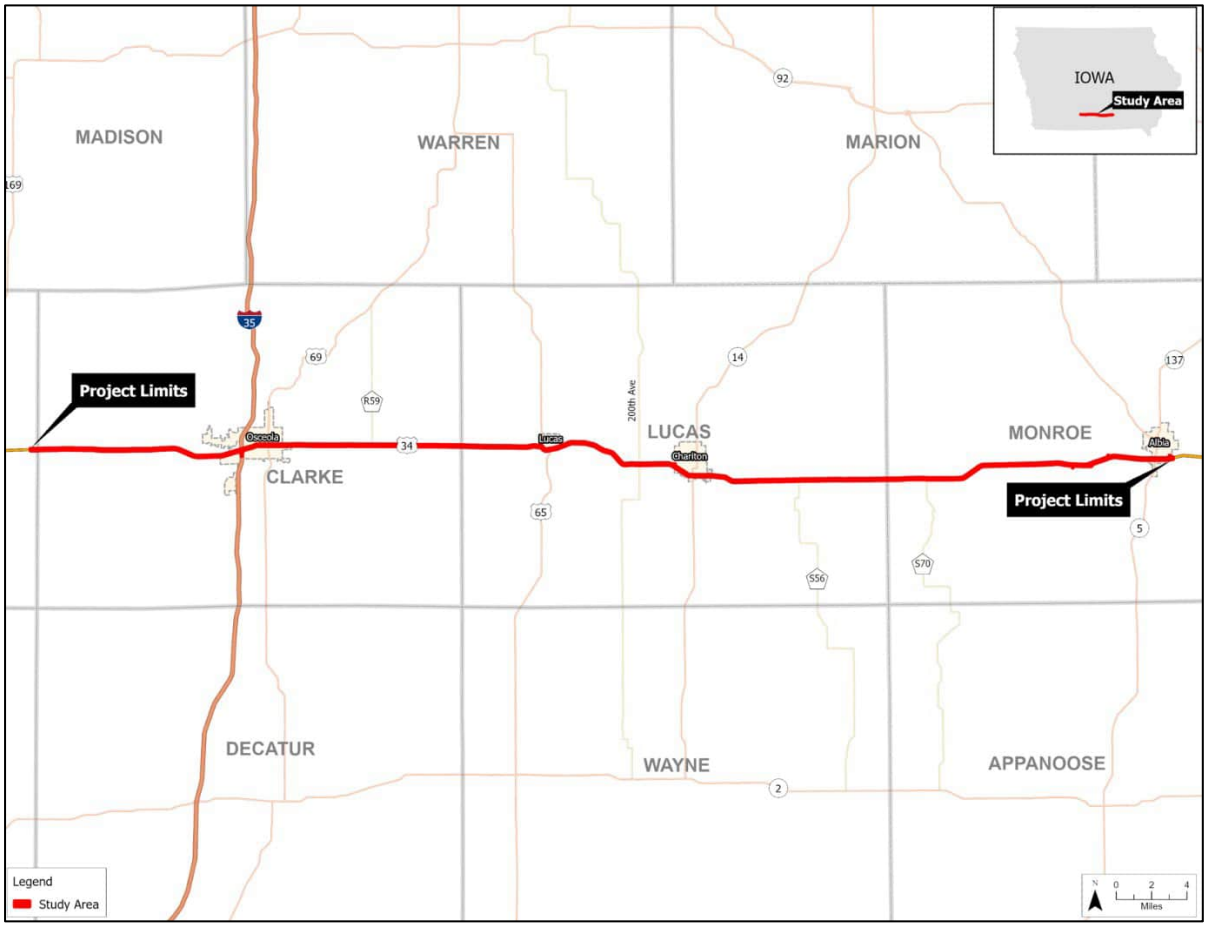
This memorandum summarizes the Study area features, notes the design criteria assumed for comparison with existing US 34 roadway features, and summarizes the various findings of the existing conditions analysis of the Study corridor. The existing conditions analysis considered existing roadway geometry and features, roadway and bridge condition, and mobility in the corridor. The purpose of the existing conditions analysis is to compare the existing US 34 roadway to current engineering and transportation practices and to gain an understanding on the current condition and functionality of the US 34 infrastructure within the Study corridor.

2 STUDY AREA

In Iowa, US 34 was one of the original U.S. highways when the system was created in 1926 and the first road to be fully paved across the state. Over the years, the roadway has been straightened and widened to accommodate increased traffic and larger vehicles. In 1992, Iowa DOT designated all of US 34 as the Red Bull Highway in honor of the 34th Infantry Division.

Today, US 34 is part of the Iowa primary road system and extends across the southern third of the state. Figure 1 shows the 65-mile-long Study area, which begins at the western limits of Clarke County and ends approximately 1 mile east of the US 34 junction with Iowa Highway 5 near Albia. This section of US 34 is currently a two-lane rural highway that passes through or near the Iowa communities of Murray, Osceola, Lucas, Chariton, and Albia. It is predominately rural in nature with roadway ditches and frequent points of access. In general, the existing US 34 rural roadway features remain through the various communities in the Study corridor, except in Osceola, where US 34 becomes an urban roadway through town with sections of curb and gutter; two-way, left-turn lanes; and sidewalks. Existing US 34 transitions to a four-lane divided roadway at the Interstate 35 (I-35) interchange on the western side of Osceola, the IA 14 interchange on the southern side of Chariton, and through the IA 5 intersection in Albia.

Figure 1. US 34 Study Area



US 34 has several water and railroad crossings within the Study area. These include White Breast Creek and its branches, Burlington Northern Santa Fe (BNSF) Railroad, Cedar Creek, Coal Creek, and Little White Breast Creek. US 34 also crosses I-35 on the western side of Osceola. The existing terrain along the Study corridor is mostly rolling hills with some localized areas of flatter grade between Chariton and Albia. The existing land use in the area is primarily rural and agricultural with some existing farmsteads along the corridor. In and near the Iowa communities along the Study corridor, land use is a mix of residential, commercial, and industrial.

3 EXISTING CRASH HISTORY

An existing crash history evaluation of the Study was performed using the latest 5 full years (2017 to 2021) of Iowa DOT crash data available at the time of this Study. The *US 34 Super Two Study: Existing Crash and Safety Performance Report* (Jacobs, 2022) documents the findings of the crash history.

Between 2017 and 2021, a total of 478 crashes occurred within the Study area. Of those, there were 95 crashes that resulted in at least 1 injury or possible injury and 5 fatal crashes. Many of the crashes (254 of 478) were single-vehicle type. Four of the five fatal crashes occurred in rural locations.

4 DESIGN CRITERIA

For the purposes of evaluating the existing roadway geometry within the Study corridor, a set of design criteria for two-lane rural and urban highways was developed in accordance with guidance in the *Iowa DOT Design Manual* (Iowa DOT, 2019), the *SUDAS Design Manual* (Iowa SUDAS, 2022), and *A Policy on Geometric Design of Highways and Streets* (AASHTO, 2011). The criteria developed focus on four categories: horizontal alignment geometry, vertical alignment geometry, typical roadway cross section, and roadside features (Figure 2).

Figure 2. Examples of the Roadway Categories Considered when Identifying Design Criteria for the Existing Conditions Analysis

(a)

(b)

(c)

(d)

(a): Horizontal Alignment = Geometry and curvature of the roadway centerline from the perspective of looking at the roadway from an airplane

(b): Vertical Alignment = Roadway elevation grade (slope) of the roadway in the uphill or downhill direction with curvature at points where roadway grade changes from the perspective of standing in the roadway ditch and looking toward the roadway centerline

(c): Typical Roadway Section = Roadway travel lanes, shoulders, medians, curb and gutter, and sidewalks from the perspective of standing in the middle of the road and looking along the roadway centerline

(d): Roadside = Area outside of roadway travel lanes and shoulders including graded slopes and ditch sections

Design criteria and practices evolve over time as new technologies emerge and transportation needs and the volume and mix of traffic change. As such, this existing conditions analysis considers two tiers of design criteria. The first tier considers criteria that would be applied to new roadway construction. New construction criteria are based on a range of design speeds with associated criterion values. A preferred design speed is generally 5 miles per hour (mph) greater than the posted speed limit, but lower design speeds are still considered acceptable in most cases. In urban areas, preferred design speed can be equal to the posted speed limit depending on factors such as the jurisdiction responsible for the roadway, context of the roadway, and vehicle mix. The second tier is applicable to resurfacing, rehabilitation, and restoration (3R) roadway projects, the criteria for which are based on posted speed limits. The first-tier criteria analysis is intended to identify locations where roadway design improvements would likely be considered in the case where the corridor or portions of the corridor are fully reconstructed. The second-tier criteria analysis identifies locations in the corridor where some roadway design improvements could be justified as part of regular maintenance and preservation projects.

Table 1 summarizes the current posted speed limits within the Study corridor along with the preferred design speed for new construction.

Table 1. Current Posted Speed Limits and Assumed Design Speeds for New Roadway Construction

Location	Posted Speed (mph)	New Construction Preferred Design Speed (mph)
Clark-Union Avenue to Osceola	55	60
Osceola	50-45-35	55-50-40
Osceola to Lucas	55	60
Lucas	45	50
Lucas to Albia	55	60
Albia	45	50

Table 2 summarizes the criteria established for the Study's existing conditions analysis. Locations identified as part of this Study that do not meet the design criteria shown in Table 2 are not necessarily areas of concern or indicative of an unsafe condition. The following sections discuss the criteria in more detail.

Table 2. Selected Design Criteria for Comparison with Existing US 34 Roadway Design Features

Criteria	DOT Rural Preferred	DOT Rural Acceptable	3R (Rural) Projects	Urban DOT (Minimum Acceptable)
Design Speed (mph)	60	50	55	40
Horizontal Curve Radius (feet)	1,330	758	960	762[a]
Maximum Horizontal Curve Superelevation	6%	8%	8%	--[b]
Crest Vertical Curve Rate of Curvature	151	84	29	44
Sag Vertical Curve Rate of Curvature	136	96	49	64
Minimum Roadway Grade	0.50%	0.00%[c]	--	0.00%[c]
Maximum Roadway Grade	3%	5%	6%	8%
SSD (feet)	570	425	250 to 495	305
Intersection Sight Distance (feet)	840	700	--	560
DSD (feet)	990	750	--	600
Lane Width (feet)	12	12	12	11
Shoulder Width (feet)	10	8	6	0
Auxiliary Lane Width (feet)	12	10	--	10
Lane Add Taper Rate	15:1	15:1	--	15:1
Lane Drop Taper Rate	60:1	60:1	--	30:1
Lane Shift Rate	Reverse curves	Reverse curves	--	30:1
Vertical Clearance (feet)	16.5	16	16.5	16
Vertical Clearance – Railroad (feet)	23.3	23.3	--	23.3
Horizontal Clear Zone (feet)	30	16	--	12

[a] Assumes no roadway superelevation; smaller curve radii with superelevation are acceptable.

[b] Optional in urban areas

[c] 0.30% of roadway curbs are present.

DSD = decision sight distance

SSD = stopping sight distance

5 ROADWAY GEOMETRIC DESIGN

Existing roadway construction plans and engineering drawings (as-built plans), available light detection and ranging (LiDAR) information provided by Iowa DOT, and observations from an onsite field corridor review were used to evaluate the existing horizontal, vertical, and typical roadway cross-section characteristics for this Study. The following sections summarize the various geometric characteristics of the existing roadway and how those features compare to the selected Study design criteria. Appendix A contains maps depicting the findings of the existing US 34 roadway geometric review.

5.1 HORIZONTAL ALIGNMENT

US 34 is made up of a series of horizontal tangents (sections of straight roadway) and curves through the Study corridor. Within the Study corridor, US 34 has a total of 71 horizontal roadway curves, 26 of which are superelevated (banked) around the curve. On average, this equates to one superelevated horizontal curve approximately every 2.5 miles.

HORIZONTAL CURVATURE

The radius and the superelevation or banking of a horizontal curve are important factors in safeguarding that drivers navigate a curve safely and comfortably and at a reasonable speed. Current Iowa DOT design policy adopts American Association of State Highway and Transportation Officials (AASHTO) guidance (AASHTO, 2011) for minimum curve radii and superelevation rates for a given speed. The design guidance states a maximum superelevation rate of 6 percent is preferred, whereas roadway banking of up to 8 percent is acceptable. AASHTO's guidance (AASHTO, 2011) is founded in studies that not only consider the roadway banking needed to physically prevent a vehicle from exiting the roadway while traveling around a curve, but also the comfort of the driver while traveling through a roadway curve.

Existing roadway information suggests that curves have been constructed with radii ranging between 819 and 137,522 feet along the rural sections of US 34. Information obtained from as-built plans and estimated pavement slopes using LiDAR data suggest the majority of the existing rural curves have a combination of curve radius and roadway superelevation that fall within the range of current acceptable design practices and criteria for new construction. At locations where the existing curvature is less than new construction values, 3R criteria are maintained and the geometry is considered acceptable. In the lower-speed urban areas, all horizontal curves are within the current suggested parameters for an urban environment. No existing horizontal curves were rated as poor. Table 3 summarizes the existing horizontal curves in the Study corridor that do not meet the minimum acceptable superelevation rate for new construction.

Table 3. Summary of Existing Horizontal Curve Radius and Superelevation

Mile Post	Design Speed (mph)	Existing Radius (feet)	Existing Superelevation	Minimum Acceptable Superelevation (New Construction)	Minimum Acceptable Radius (3R)	Rating
134.8	60	1,146.0	7.08%	8.0%	960	Fair
142.5	60	5,730.0	2.20%	2.8%	960	Fair
143.2	60	1,910.0	4.58%	5.8%	960	Fair
143.7	60	1,910.0	4.58%	5.8%	960	Fair
162.3	60	5,730.0	2.20%	2.8%	960	Fair

Rating:

Good = Horizontal curve meets minimum acceptable criteria for new highway construction.

Fair = Horizontal curve does not meet acceptable criteria for new construction but meets or exceeds 3R criteria.

Poor = Horizontal curve does not meet minimum acceptable 3R criteria.

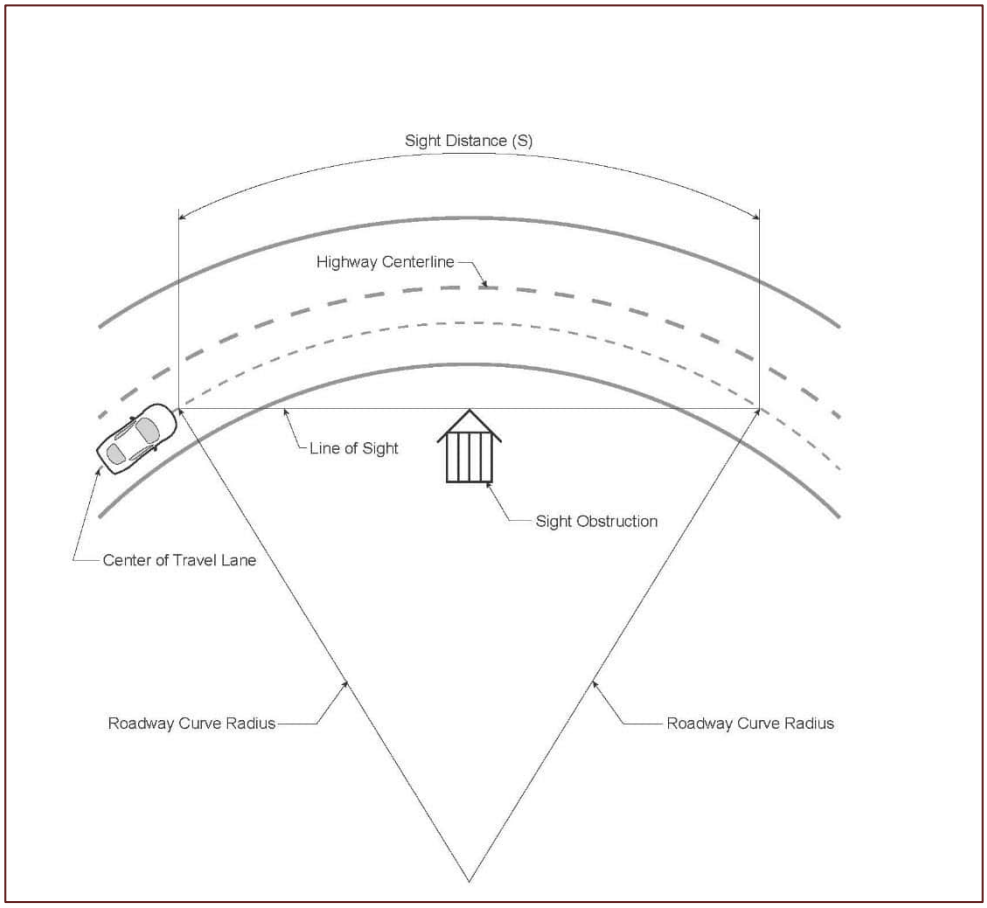
HORIZONTAL TANGENTS AND SUCCESSIVE CURVES

The lengths of horizontal tangent roadway sections between superelevated curves range from approximately 0.25 to 15 miles. There are some locations that have a series of two or more curves in succession. These tightly spaced series of curves are found outside the city limits of Lucas and 2 miles east of Chariton. Most of these series of successive curves are reverse curves, meaning each successive curve deflects, or turns, in the direction opposite of the previous curve. Where successive curves are present, the rate of change as the pavement banking transitions from one direction to another needs to be considered and to occur over a length that is comfortable to vehicle occupants. With the existing information available and observations driving the corridor as part of the onsite field review, no locations were identified as uncomfortable to drive while traveling at the posted speed limit.

STOPPING SIGHT DISTANCE AROUND HORIZONTAL CURVES

SSD is the distance required for a driver to detect an object or hazard within the traveled way and to react, brake, and stop the vehicle prior to coming into conflict with the object or hazard. When considering SSD in relation to a roadway's horizontal geometry, the ability of a driver to see around the roadway curve is the critical consideration. Figure 3 depicts a driver's line of sight around a roadway curve; the line of sight depicted would provide the distance needed to meet SSD criteria and should remain free of obstacles that could block a driver's view.

Figure 3. Stopping Sight Distance Line of Sight at a Horizontal Curve



Source: AASHTO, 2011.

Lines of sight at horizontal curves were estimated, compared with aerial photography, and observed during the onsite field review; no locations with obstructions related to horizontal geometry were identified. Rows of trees, crops, buildings, billboards, and all other possible sight obstructions appear to be at a sufficient distance away from the roadway as to not obstruct a driver's line of sight around the curve.

VISUAL TRAPS

A visual trap is a feature separate from the roadway that creates the appearance that the roadway continues straight when, in fact, there is an approaching curve in the road. To an inattentive driver or during periods where visibility may be limited, a visual trap could lead to potential run-off-the-road or cross-centerline crashes. Roadside features that can create such an appearance may include other roadways, tree lines, railroads, utility poles (power poles), or other objects that parallel a roadway and continue at the same bearing as the roadway curves away. Providing advanced curve warning signs, chevrons, or other visual features can often mitigate visual traps by breaking the linear appearance of the roadside feature.

A review of aerial photography and observations during the onsite field review identified one location (Table 4 and Figure 4) along the Study corridor where a visual trap may be present. Existing highway lighting exists through the curve, mitigating the risk of an approaching driver missing the curve in the roadway. No traffic signs or devices are currently in place to identify the roadway curve.

Figure 4. Visual Trap at a Horizontal Roadway Curve

Local sideroad at Court Avenue creates the appearance that the roadway continues straight.

Single-vehicle crashes have occurred at the horizontal curve location noted in Table 4. Crash data from the Study are not conclusive of the degree to which, if any, the potential visual trap contributed to the individual crash events. The *US 34 Super Two Study: Existing Crash and Safety Performance Report* provides additional details regarding the Study's crash data analysis (Jacobs, 2022).

Table 4. Summary of Locations with Potential for Creating a Visual Trap

Mile Post	Direction of Travel	Feature Creating Visual Trap	Existing Curve Warning or Delineation Signs
139.8	Eastbound	Sideroad (Court Avenue)	None

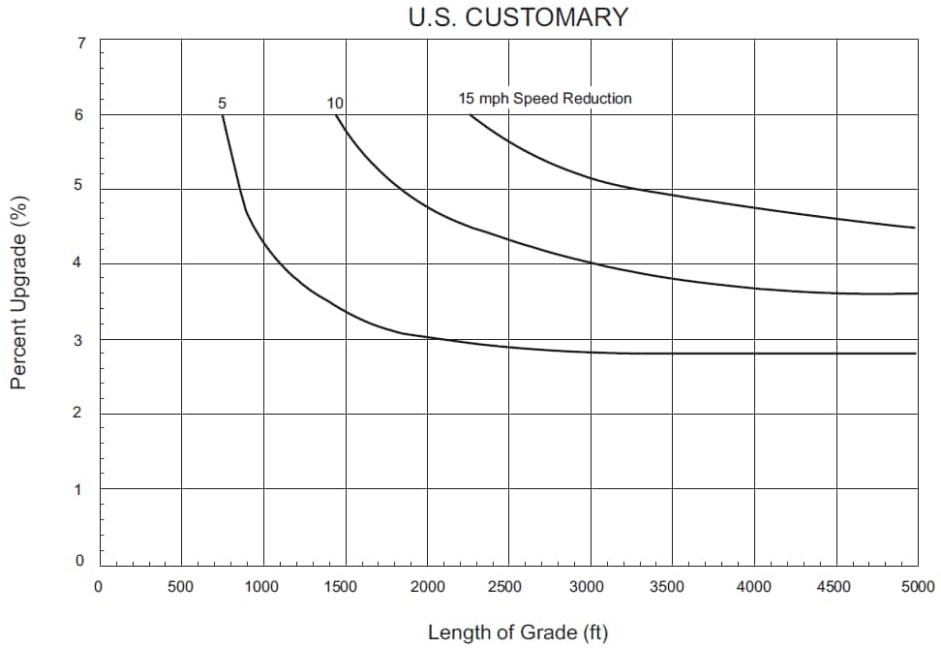
5.2 VERTICAL ALIGNMENT

When considering the vertical alignment of a roadway, the rate of elevation change, or roadway grade, and SSD at the locations where the roadway grade changes are the two main areas of focus from an engineering standpoint. Existing US 34 has approximately 218 changes in roadway grade within the Study corridor. At locations where the grade changes, the change is gradually made via parabolic curves, resulting in a smooth transition in the roadway driving surface between the adjacent roadway grades. The parabolic curves are referred to as crest vertical curves or sag vertical curves, depending on the orientation of the intersecting roadway grades. The type of vertical curve and the length of the rate of vertical curvature (a relationship between the change in roadway grade and vertical curve length) are the controlling factors when considering SSD along the vertical alignment. Roadway grade considerations and SSD factors are discussed further in the following subsections.

ROADWAY GRADES

Roadway grade can influence the free-flow travel speeds along a roadway and is important when considering pavement drainage needs during rain events. For two-lane highways, Iowa DOT design guidance suggests a preferred maximum grade of 3 percent, but grades of up to 5 percent are acceptable and not uncommon. Maintaining steep grades over an extended length of roadway can result in a degradation of travel speeds and overall operational performance of the highway, particularly if there is a high percentage of heavy trucks in the vehicle mix. This degradation can result in addition of travel delays, formation of vehicle queues, and potentially a reduction in passing opportunities. *A Policy on Geometric Design of Highways and Streets* provides guidance on what reduction in travel speeds can be expected for steeper grades over a given length of roadway (Figure 5; AASHTO, 2011). AASHTO guidance suggests that maintaining a 3 percent roadway grade should not result in travel-speed reduction of more than 5 mph for heavy vehicles (AASHTO, 2011). Grades greater than 3 percent maintained over longer distances can cause a more significant drop in speed.

Figure 5. AASHTO-suggested Travel-speed Impacts of Steep Roadway Grades



Source: AASHTO, 2011.

There are 40 locations within the corridor where the maximum preferred roadway grade is greater than 3 percent, with seven roadway grades in the Study area exceeding the maximum acceptable grade of 5 percent for new construction specified in current Iowa DOT design policy (Iowa DOT, 2019). Table 5 summarizes the locations of roadway grades that exceed the preferred maximum for new roadway construction (greater than 3 percent), including the length at which that grade is maintained and what reduction in travel speed for heavy trucks would be expected according to AASHTO (2011) guidance. As shown in Table 5, the majority of grades that exceed 3 percent are expected to result in minimal, if any, reduction in travel speed; however, 10 roadway grades have an expected reduction in heavy truck travel speed between 5 and 10 mph.

Table 5. Summary of Vertical Grades Greater than Preferred 3% Maximum

Beginning Mile Post	Length (feet)	Grade	Expected Reduction in Speed (see Figure 5)
103.1	1,465	3.89%	Between 5 and 10 mph[a]
103.8	950	3.64%	< 5 mph
107.4	800	3.03%	< 5 mph
116.1	50	5.16%	< 5 mph
116.4	50	4.08%	< 5 mph
116.4	200	5.20%	< 5 mph

Table 5. Summary of Vertical Grades Greater than Preferred 3% Maximum

Beginning Mile Post	Length (feet)	Grade	Expected Reduction in Speed (see Figure 5)
116.5	50	4.92%	< 5 mph
116.6	50	3.32%	< 5 mph
117.3	1,268	4.30%	Between 5 and 10 mph
122.2	725	3.36%	< 5 mph
124.5	850	3.72%	< 5 mph
124.9	50	5.60%	< 5 mph
127.6	963	3.60%	< 5 mph
128.4	475	3.90%	< 5 mph
128.7	740	4.00%	< 5 mph[a]
129.3	475	3.94%	< 5 mph[a]
129.5	35	4.00%	< 5 mph[a]
129.9	675	3.90%	< 5 mph[a]
130.6	1,325	4.00%	Between 5 and 10 mph[a]
132.3	423	5.74%	< 5 mph
135.0	1,175	6.00%	Between 5 and 10 mph[a]
136.6	2,048	3.04%	5 mph
137.8	1,600	3.12%	< 5 mph
138.7	196	4.60%	< 5 mph
139.2	319	4.60%	< 5 mph
139.3	421	4.20%	< 5 mph
140.3	625	4.17%	< 5 mph
141.1	3,067	3.13%	Between 5 and 10 mph[b]
141.9	735	3.13%	< 5 mph
143.3	866	5.03%	5 mph
143.8	75	3.72%	< 5 mph
143.9	350	3.60%	< 5 mph
144.6	525	5.83%	< 5 mph[a]
144.9	75	4.34%	< 5 mph
150.6	700	3.20%	< 5 mph

Table 5. Summary of Vertical Grades Greater than Preferred 3% Maximum

Beginning Mile Post	Length (feet)	Grade	Expected Reduction in Speed (see Figure 5)
151.7	150	3.04%	< 5 mph
153.0	50	3.66%	< 5 mph
161.8	1,250	3.96%	Between 5 and 10 mph
162.6	1,500	4.20%	Between 5 and 10 mph
165.2	1,700	4.28%	Between 5 and 10 mph

[a] Existing passing lane available (Section 8)

[b] Four-lane roadway section

< = less than

A minimum roadway grade of 0.5 percent is desired, but current design practices also consider flatter grades as acceptable as long as adequate pavement cross slopes (the slope of the pavement from the roadway centerline toward the roadway shoulders) are present to make certain that water drains freely from the travel surface. Flat roadway grades combined with flat pavement cross slopes may lead to ponding of water on the roadway surface during rain events.

Flat pavement cross slopes may be present at locations where the roadway pavement is transitioning between a superelevated horizontal curve and sections of roadway with a typical crowned pavement surface, and in areas near intersections where warping of the pavement surface may occur to smoothly connect intersecting roadway pavements. In urban areas where curb and gutter are present, minimum grades of 0.3 percent are recommended to maintain water flowing along the roadway gutter without ponding and encroaching too far into adjacent travel lanes.

There are areas along US 34 within the Study corridor where the longitudinal grade of the roadway is less than the 0.5 percent desirable grade. For most of these locations, the flat grades are not a concern because adequate pavement cross slopes are maintained with the crowned roadway surface. However, some of the flatter longitudinal grades are near areas of superelevated curves and at-grade intersections with local side roads. It is recommended that these areas be reviewed as part of future engineering studies to verify adequate pavement drainage is maintained.

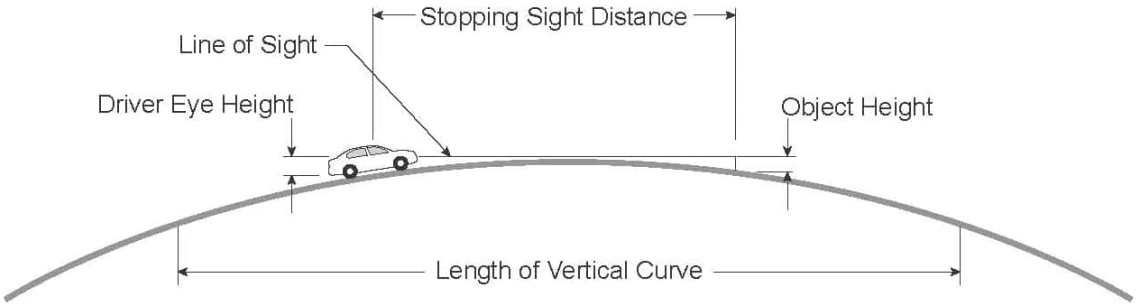
STOPPING SIGHT DISTANCE

SSD analyses for the vertical alignment is a function of the change in roadway grades and the length of the parabolic curve over which the change in grade is smoothly transitioned.
The design criterion derived from these parameters is the rate of curvature. Different rates of curvature standards are used to evaluate SSD, depending on the characteristics of a given location where a change in vertical grade occurs.

Crest Vertical Curves

Figure 6 shows a crest vertical curve, which is a parabolic curve used to smoothly transition a change in roadway grade. SSD at a crest vertical curve is based on the distance a driver is able to see over the highest point of the parabolic curve. The length of the vertical curve must create a flat enough transition between roadway grades to allow for a line of sight from the driver's eye, past the high point of the pavement surface, to an object in the traveled lane that is at least 2 feet high.

Figure 6. Schematic of a Typical Crest Vertical Curve and Line of Sight Needs for Stopping Sight Distance



The majority of the 106 crest vertical curves within the Study corridor meet minimum acceptable criteria for new construction and are rated as good. Table 6 provides a summary of the remaining crest curves, which do not meet the new construction criteria but still meet 3R criteria and are rated as fair. No existing crest vertical curves were identified as poor.

Table 6. Summary of Existing Crest Vertical Curves Rated as Fair for Stopping Sight Distance

Mile Post	Desired Rate of Curvature for New or 3R Construction	Existing Rate of Curvature	Rating
116.5	44/29	35	Fair
116.7	44/29	30	Fair
116.8	44/29	34	Fair
127.6	151/29	140	Fair
132.1	151/29	149	Fair
132.2	84/29	34	Fair
133.3	151/29	119	Fair
139.1	151/29	105	Fair
139.4	151/29	118	Fair

Table 6. Summary of Existing Crest Vertical Curves Rated as Fair for Stopping Sight Distance

Mile Post	Desired Rate of Curvature for New or 3R Construction	Existing Rate of Curvature	Rating
139.5	151/29	111	Fair
146.5	151/29	114	Fair
167.9	151/29	123	Fair

Rating:

Good = Curve SSD meets minimum acceptable criteria for new construction.

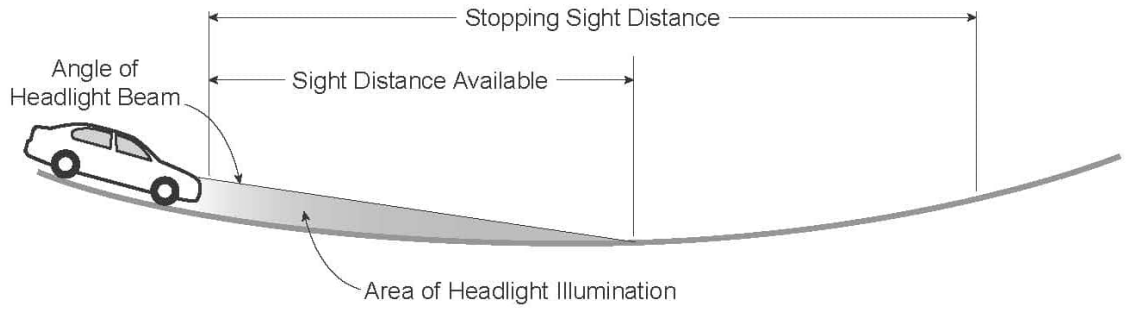
Fair = Curve SSD does not meet minimum acceptable criteria for new construction but meets or exceeds 3R criteria.

Poor = Curve SSD provides design speed less than acceptable 3R criteria.

Sag Vertical Curves

Figure 7 shows a sag vertical curve, which is also a parabolic curve used to smoothly transition the roadway grade. SSD needs at a sag vertical curve are based on the distance a vehicle's headlight beams can illuminate the roadway in dark conditions. If the length of vertical curve is too short, a vehicle's headlights may not illuminate the sag vertical curve for sufficient distance to allow for a driver to react, brake, and stop if an obstacle is in the vehicle's path. If roadway lighting is present to illuminate the pavement surface through the sag vertical curve in lieu of relying on a vehicle's headlights, a shorter sag curve with a more abrupt transition in roadway grade is acceptable. In general, existing roadway lighting is not present in the Study corridor.

Figure 7. Schematic of a Typical Sag Vertical Curve and Line of Sight Needs for Stopping Sight Distance



The majority of the 106 sag vertical curves in the Study area meet the minimum acceptable criteria for new roadway construction and are considered good. Like the crest vertical curves, most of the sag vertical curves that do not meet criteria for new construction still meet the acceptable 3R parameters and are rated as fair. However, six sag vertical curves through

Osceola were identified as poor but have existing roadway lighting. Table 7 summarizes the locations where sag vertical curves do not meet criteria for new construction.

Table 7. Summary of Existing Sag Vertical Curves Rated as Fair or Poor for Stopping Sight Distance

Mile Post	Rate of Curvature for New or 3R Construction	Existing Rate of Curvature	Rating
116.1	64/49	42	Poor
116.5	64/49	43	Poor
116.5	64/49	25	Poor
116.6	64/49	48	Poor
116.8	64/49	47	Poor
117	64/49	62	Fair
117.2	64/49	47	Poor
127.6	136/49	107	Fair
128.2	136/49	112	Fair
132.2	96/49	78	Fair
132.4	96/49	54	Fair
135	136/49	81	Fair
138.8	136/49	71	Fair
139.3	136/49	68	Fair
139.6	136/49	111	Fair
140.5	136/49	108	Fair
141	136/49	115	Fair
142	136/49	114	Fair
142.9	136/49	81	Fair
143.8	136/49	96	Fair
144.6	136/49	101	Fair
144.8	136/49	94	Fair
146.5	136/49	66	Fair
151.4	136/49	127	Fair
158.3	136/49	108	Fair

Rating:

Good = Curve SSD meets minimum acceptable criteria for new construction.

Fair = Curve SSD does not meet minimum acceptable criteria for new construction but meets or exceeds 3R criteria.

Poor = Curve SSD provides design speed less than acceptable 3R criteria.

5.3 DECISION SIGHT DISTANCE

DSD is the distance a driver needs to identify a possible change in travel path and decide which travel path to take. Decision points can include horizontal curves, intersections, exit ramps at interchanges, and lane shifts. For example, when approaching an intersection, a driver needs enough distance to identify the intersection location, determine which direction they will travel at the intersection (turn or continue through the intersection), and then react appropriately. DSD is a consideration with both horizontal and vertical roadway alignments. When considering horizontal alignments, DSD needs are similar to those shown in Figure 3. For vertical alignments, DSD needs are similar to those shown in Figure 6.

Suggested DSD values assume that an approaching driver can see the pavement surface and painted pavement makings at the decision point. This conservative estimate does not account for other visual cues that may be available to a driver approaching a decision point, such as advanced signing, delineators or chevrons, flashing beacons, and other roadside features.

Review of as-built plans identified a handful of locations where intersections are near crest vertical curves or roadside features along a preceding horizontal curve may hide changes in horizontal curvature, limiting an approaching driver's potential line of sight to the pavement surface. These locations were specifically reviewed during the onsite field visit, and Table 8 notes locations that do not meet desirable or acceptable DSD values.

Table 8. Summary of Locations that Do Not Meet Acceptable Decision Sight Distance Values

Mile Post	Direction of Travel	Decision Point	Desirable DSD Length / Acceptable DSD Length (feet)	Approximate Available DSD (feet)
116.1	Eastbound	Intersection	600 / 600	350
132.3	Eastbound	Horizontal Curve	990 / 750	400
132.3	Westbound	Intersection	990 / 750	400

5.4 ROADWAY CROSS SECTION

The roadway cross-section analysis reviewed travel-lane widths, shoulder type and width, presence of turn lanes (also called auxiliary lanes), roadside hazards for an errant vehicle, and pedestrian accommodations in urban areas.

TRAVEL LANES AND SHOULDERS

Twelve-foot travel lanes with 10-foot shoulders are present for the clear majority of the Study corridor. Ten-foot shoulders exist in more than 76 percent of the Study corridor, and 8-foot shoulders exist in another 20 percent. Table 9 summarizes the typical roadway cross sections within the Study area.

Table 9. Summary of Typical Roadway Cross Sections

Location	Typical Lane Width (feet)	Shoulder Width (feet) and Type
Clarke-Union Avenue to MP 114.0	12	4 (paved) / 6 (granular)
MP 114.0 to Warren Avenue	12 (2 eastbound / divided median / 2 westbound)	Inside: 2 (paved)
		Outside: 4 (paved) / 6 (granular)
Warren Avenue to MP 116.0	12 (2 eastbound / divided median / 2 westbound)	Inside: 2 (paved) / 2 (granular)
		Outside: 4 (paved) / 6 (granular)
MP 116.0 to MP 117.4	44 (back of curb to back of curb)	
MP 117.4 to MP 141.1	12	4 (paved) / 6 (granular)
MP 141.1 to MP 141.6	12 (2 Eastbound and 2 Westbound)	4 (paved)
MP 141.6 to 520th Avenue	12	4 (paved) / 6 (granular)
520th Avenue to South C Street	12	2 (paved) / 6 (granular)
South C Street to South Florence Street	12 (2 Eastbound and 2 Westbound)	8 (paved)
South Florence Street to 201st Street	12	4 (paved) / 6 (granular)

MP = mile post

Centerline and shoulder rumble strips are present throughout most of the Study corridor. Rumble strips are not provided throughout the corporate limits of Osceola and Chariton; only shoulder rumble strips are present from 520th Avenue (MP 154.7) to Albia. Centerline rumble strips are in poor condition between Osceola and Lucas. US 34 through Osceola is the only section of the Study corridor with curb and gutter and measures 44 feet between curb lines. Through this section, a two-way, left-turn lane is provided.

INTERSECTION TURN LANES

Dedicated right- and left-turn lanes at intersection locations that remove turning traffic from US 34 through movement are scattered throughout the corridor and are primarily located in or near the small communities along the Study corridor. Table 10 lists the locations where turn lanes are present.

The existing turn lanes measure between 10 and 14 feet wide, with a 12-foot width being the most common. Shoulders adjacent to the dedicated right-turn lanes typically maintain the shoulder width of the approaching roadway, but at locations in Osceola, Chariton, and Albia, minimal (if any) shoulder is maintained next to the turn lanes. Right-turn lanes are developed by gradually widening the roadway pavement to full width along the approach to an intersection. At

locations where dedicated left-turn lanes are present, a painted or raised median ranging from 4 to 16 feet wide channelizes the left-turn and through-traffic flows at the intersection.

Table 10 lists the intersections requiring pavement tapers and shifts in travel lanes to develop turn lanes and median sections. The existing lane shifts and taper rates were estimated using aerial photography and compared with preferred and acceptable rates documented in current *Iowa DOT Design Manual* policies (Iowa DOT, 2019). Most of the locations have taper rates greater than those currently desired according to *Iowa DOT Design Manual* policies (Iowa DOT, 2019) and those that do not fall within the range of acceptable rates defined in AASHTO (2011) guidance.

Table 10. Summary of Existing US 34 Turn Lane Locations

Intersection (Location)	Direction of Travel	Existing Turn Lane Present	Existing Taper	Desired Taper
County Road R15 / 130th Avenue	Eastbound	Right	10:1	15:1
County Road R16 / 135th Avenue	Westbound	Right	24:1	15:1
Southwest Boulevard (Osceola)	Eastbound	Right	9:1	15:1
Southwest Boulevard (Osceola)	Westbound	Left	14:1	10:1
I-35 Southbound On-ramp (Osceola)	Westbound	Left	10:1	10:1
I-35 Northbound On-ramp (Osceola)	Westbound	Left	12:1	10:1
Warren Avenue (Osceola)	Westbound	Left	10:1	10:1
Warren Avenue (Osceola)	Eastbound	Left	10:1	10:1
IA 104 / 330th Avenue	Eastbound	Right	9:1	15:1
US 65 North	Eastbound	Left	11:1	10:1
US 65 North	Westbound	Right	13:1	15:1
US 65 South	Eastbound	Right	18:1	15:1
US 65 South	Eastbound	Left	10:1	10:1
US 65 South	Westbound	Left	10:1	10:1
200th Avenue	Westbound	Right	17:1	15:1
Court Avenue (Chariton)	Eastbound	Left	16:1	10:1
Court Avenue (Chariton)	Westbound	Right	17:1	15:1

Table 10. Summary of Existing US 34 Turn Lane Locations

Intersection (Location)	Direction of Travel	Existing Turn Lane Present	Existing Taper	Desired Taper
Court Avenue (Chariton)	Westbound	Left	6:1	10:1
220th Avenue / South 16th Street (Chariton)	Westbound	Right	24:1	15:1
South 1st Street (Chariton)	Eastbound	Left	10:1	10:1
South 1st Street (Chariton)	Eastbound	Right	14:1	15:1
South 1st Street (Chariton)	Westbound	Left	9:1	10:1
South 1st Street (Chariton)	Westbound	Right	14:1	15:1
Albia Road (Chariton)	Eastbound	Left	11:1	10:1
Albia Road (Chariton)	Westbound	Right	15:1	15:1
290th Avenue/Cedar Street	Eastbound	Left	6:1	10:1
290th Avenue/Cedar Street	Eastbound	Right	25:1	15:1
290th Avenue/Cedar Street	Westbound	Left	10:1	10:1
515th Avenue	Westbound	Right	11:1	15:1
520th Avenue	Eastbound	Right	11:1	15:1
520th Avenue	Westbound	Left	12:1	10:1

ROADSIDE

Clear-zone requirements of roadways are the basis of roadside evaluation. The clear zone is the theoretical area needed along the roadside necessary for the driver of an errant vehicle to regain control or come to a safe stop after exiting the roadway. The desire is to maintain a clear zone with graded slopes that are traversable and free of obstacles (such as steep drop offs, trees, utility poles) that would pose a risk to an errant vehicle and driver.

Existing roadside features and potential obstacles were evaluated as part of the onsite windshield survey, Google Earth, and as-built plans. Generally, the roadside appears to be free of fixed objects that could pose a hazard to an errant vehicle. However, within the Osceola city limits, there are many utility poles between South Gustin Drive and South View Drive that are within acceptable clear-zone requirements according to current *Iowa DOT Design Manual* policies (Iowa DOT, 2019) but are within acceptable values based on Iowa Statewide Urban Design and Specifications (SUDAS) criteria (Iowa SUDAS, 2022). Graded foreslopes are generally flat, and ditch sections, when closely located to US 34, appear traversable. Guardrail protection is provided at locations where objects are located near the US 34 travel way and could pose a risk to an errant vehicle, such as bridge barrier rails and drainage culvert structures. There are a few riprap-lined embankments, each less than 200 feet long, west of Albia that are all protected by cable guardrail.

PEDESTRIAN ACCOMMODATIONS

US 34 in Osceola is the only location within the Study corridor that provides specific pedestrian accommodations in the form of sidewalk. There is generally a 4- to 6-foot grassy buffer area between the curb and sidewalk. Existing sidewalks are typically a minimum of 4 feet wide and are considered to be in good to fair condition.

Sidewalk is continuous on the southern side of US 34 from South Ridge Road to just east of South View Drive and continuous on the northern side from South Delaware Street to east of South Dewey Street. Breaks in the curb line with sidewalk ramps are present at all locations; however, sidewalk ramps were not checked for compliance with current *Americans with Disabilities Act* requirements. All intersections with US 34 through Osceola have stop signs or traffic signals on the local roadways. Painted crosswalks or mid-block pedestrian crossings are generally not provided, other than at South Kossuth Street where there is a flashing pedestrian beacon and painted crosswalk.

5.5 INTERSECTIONS

There are 80 at-grade intersections between US 34 and local rural county roadways and another 35 with local roadways in the urban communities along the Study corridor. Of these 115 total US 34 intersections, 53 are with paved local roadways, 60 with gravel roads, and 2 with dirt roads. At all but three intersections, US 34 traffic maintains the right of way and traffic on the approaching intersecting roadway is required to stop. Two of the three remaining intersections are signal-controlled intersections in Osceola where US 34 traffic could be required to stop. The third intersection is stop controlled at the IA 5/Main Street intersection in Albia, which does not give US 34 the right of way. In addition to the public roadway intersections, there are currently an estimated 321 points of access within the Study corridor that include commercial and residential driveways, alleyways, and farm field entrances. There are, on average, seven access points to US 34 every mile. The density of access points fluctuates along the Study corridor, with the highest density found in the various communities compared to rural areas.

This existing conditions analysis focuses on the US 34 intersections with other public roadways. The following subsections discuss the review of existing intersection geometry and sight distance needs in the Study corridor.

INTERSECTION ALIGNMENT AND SKEW

Figure 8 shows the acute angle formed by two intersecting roadways, referred to as the intersection skew, which is a key geometric feature of an intersection. Preferred intersection geometry would limit the skew of an intersection to between 75 and 90 degrees; however, current design practices and guidance consider skews as low as 60 degrees acceptable. Skewed intersections can create difficulties for drivers stopped on the intersecting roadway to see oncoming traffic on the primary roadway and to judge the oncoming traffic's speed to identify a sufficient gap in traffic to safely maneuver through the intersection. When skew angles are less than 60 degrees, drivers stopped on the intersecting roadway must look back over their shoulders to see oncoming traffic. When skewed intersections are on or near horizontal curves, it can further complicate the perception of oncoming traffic and maintenance of sight lines to safely navigate through the intersection.

Figure 8. Example of Intersection Skew

Source: Microsoft Bing, 2023 aerial base map.

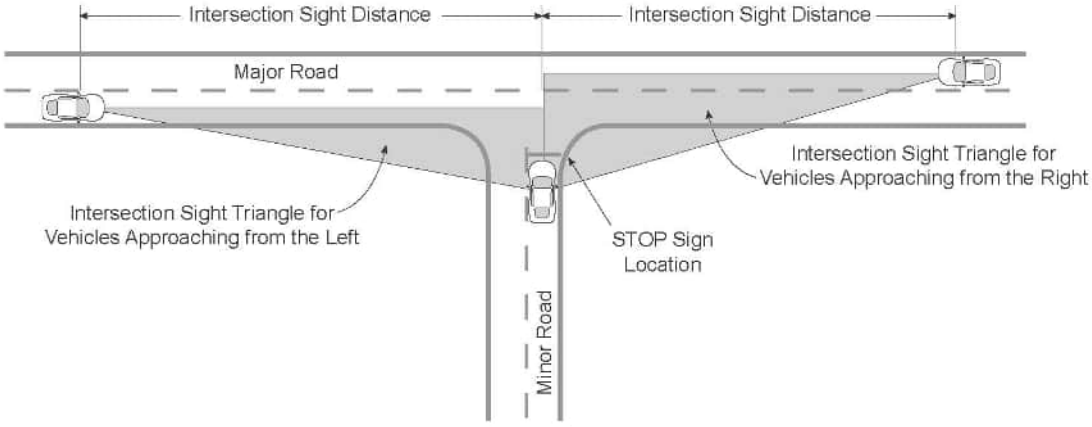
Most of the intersections within the Study corridor have intersecting roadways that are nearly perpendicular (90 degrees) to each other. However, there is one intersection in the Study area that has a skew angle less than 60 degrees. Albia Road/475th Lane approaches US 34 at a 56-degree skew as shown on Figure 8. There is no notable crash history at this intersection.

Most of the intersections in the Study corridor have four legs of approach: two on US 34 and two on the local intersecting roadway. At the four-legged intersections, opposite approach roadways are generally oriented directly across the intersection from one another, especially in the rural areas of the Study corridor. In addition to the four-legged intersections, there are several intersections with only three approaches, commonly referred to as T-intersections. Each T-intersection in the Study corridor consists of two US 34 approaches and one local side road approach.

INTERSECTION SIGHT DISTANCE

Roadside areas adjacent to an intersection should be kept free of sight obstructions so drivers can clearly see approaching traffic to pick an appropriate gap in traffic before proceeding into the intersection. Figure 9 depicts the concept of intersection sight triangles; the sight triangle is the roadside area that should be kept free of visual barriers to provide drivers the needed sight lines to assess oncoming traffic conditions.

Figure 9. Schematic of Intersection Sight Distance Needs



Review of aerial photography and as-built plan information did not identify any intersection locations of great concern; however, the onsite field review noted some intersections have potential sight triangle obstruction(s), assuming a vehicle is stopped at the current location of the painted stop bar or stop sign on the minor roadway approach(es). Possible sight distance obstructions include adjacent embankments, trees, crops, or other vegetative growth, railroad equipment, and billboards or signs. Table 11 lists the locations identified during the onsite field review with possible sight distance limitations from the existing stop sign location. Table 11 lists other characteristics of these intersections that may also influence the ability of a driver to see oncoming traffic and pick a safe gap to maneuver through the intersection from a minor approach roadway, including intersection skew and roadway curvature. Appendix B contains photographs taken during the onsite windshield survey at these locations. There is notable crash history at South Ridge Road in Osceola and South 4th Street in Chariton. There have been eight crashes at South Ridge Road, including an excessive speed sideswipe, two cargo or equipment failures, one vehicle that ran off the road into a utility pole, three failures to yield from the stop sign, and one driver distraction. Seven of these crashes resulted in property damage only; one resulted in a serious injury. There have been two crashes at South 4th Street: failure to yield at the stop sign and an unknown crash that was broadside in traffic where the hillcrest obscured the vision. One resulted in a minor injury crash, and the other resulted only in property damage (vehicle totaled). The *US 34 Super Two Study: Existing Crash and Safety Performance Report* (Jacobs, 2022) provides additional information on the Study crash history.

Table 11. Locations Identified during the Onsite Field Review with Possible Intersection Sight Distance Obstructions

Intersection (Location)	Quadrant(s)	Possible Obstruction	Intersection-Related Crash History (2016 to 2021)	Other Limiting Factors	Photo Log Reference[a]
South Ridge Road (Osceola)	Southeast	Trees, retaining wall	8 recorded crashes with 1 serious injury	US 34 horizontal and vertical curves	94
South McPherson Street (Osceola)	Southeast, Southwest	Trees, retaining wall	No crash history	US 34 horizontal and vertical curves	99, 100
South Jackson Street (Osceola)	Southwest	--	1 minor injury crash	US 34 vertical curve	102, 103
137th Trail	Southwest	Trees	No crash history	US 34 horizontal curve	199
210th Avenue	Southwest	--	No crash history	US 34 vertical curve	264
South 4th Street (Chariton)	Southwest	Guardrail	2 recorded crashes with 1 minor injury	US 34 vertical curve	--
210th Trail	Southeast	Guardrail	No crash history	US 34 vertical curve	446
625th Avenue	Northwest	--	No crash history	US 34 vertical curve	472
South 13th Street / 201st Street (Albia)	Northeast, Southeast	--	3 recorded crashes with 1 possible injury	US 34 vertical curve	523, 526

[a] See Appendix B.

6 INFRASTRUCTURE CONDITION

Iowa DOT routinely reviews the condition of existing roadway pavements, bridges, and other related infrastructure on its system. Condition reports available at the time of this existing conditions analysis were reviewed to rate the current condition of the existing roadway and bridge infrastructure along the corridor.

6.1 EXISTING PAVEMENT CONDITIONS

Existing pavement conditions noted in this Study are based on an Infrastructure Condition Evaluation (ICE) interactive map (Iowa DOT, n.d.b). ICE is a function of Pavement Condition Index, International Roughness Index, structure sufficiency ratings, traffic mix (percentage of vehicles by type), and congestion index. ICE normalizes the previously listed criteria, and each criterion contributes a different percentage to the total composite score. The percentage each criterion contributes is based on the impact each will typically have on the pavement. The resultant composite rating is a number between 0 (worst) and 100 (best). The *ICE Technical Memo, Iowa Infrastructure Condition Evaluation* (Iowa DOT, 2020) provides additional details regarding ICE, including a more detailed description and summary of the composite rating criteria.

Table 12 summarizes the ICE ratings for the existing pavement in the corridor. Observations in the field were generally consistent with the ICE ratings observed on the ICE interactive map (Iowa DOT, n.d.b). The worst pavement conditions (ICE less than 60) are in portions of Osceola and just east of Lucas. The remaining majority of the Study corridor has fair pavement conditions (ICE between 60 and 80), with the most favorable conditions (ICE greater than 80) located at the western limits of Osceola, just west of Lucas, and through Chariton. A hot-mix asphalt resurfacing project within the Osceola city limits was completed in 2022. This project is not included in the current ICE ratings and may improve this area from the “poor” rating currently shown in Table 12.

Table 12. Summary of Existing Pavement Infrastructure Condition Evaluation Ratings

ICE Composite Rating	Approximate Length (miles)	Rating
ICE < 60	1.5	Poor
60 < ICE < 70	23.3	Fair
70 < ICE < 80	36.7	
ICE ≥ 80	4.4	Good

≥ = greater than or equal to

6.2 EXISTING BRIDGE CONDITIONS

There are currently 12 US 34 bridges (Table 13) in the Study corridor: 5 bridges cross a creek or river feature, 2 bridges cross over I-35, 3 bridges cross over a railroad, and 1 bridge crosses an abandoned railroad that is now a bike path. Review of prior Iowa DOT bridge inspection and maintenance reports provided by Iowa DOT suggest that all 12 structures are in good or fair condition and all but 2 bridges meet current structural and functional parameters necessary to serve traffic. The two bridges over I-35 are listed as functionally obsolete because the vertical or horizontal clearance may be less than preferred criteria. All the bridges in the corridor are capable of carrying legal highway loads; none of the bridges have posted weight restrictions at the time of this existing conditions analysis (Iowa DOT, n.d.a.).

Most of the bridges were constructed in the 1960s and received regular maintenance and some rehabilitation work over the years. Iowa DOT inspection reports have noted that the US 34 bridge over White Breast Creek (near MP 134.4) and the US 34 bridge over the BNSF Railroad (near MP 163.2) are scheduled for bridge deck overlay in 2023. Also, the US 34 bridge over the BNSF Railroad (near MP 132.3) and the US 34 bridge over the Russell Boulevard and BNSF/Union Pacific (UP) railroad (near MP 141.8) are scheduled for bridge deck overlay in 2027. The US 34 bridge over Coal Creek (near MP 165.8) is scheduled for replacement in 2027. The bridge over a stream near MP 134.8 is currently being replaced. No other bridges have been identified as needing replacement at the time of this existing conditions analysis.

Overall, the width of the existing bridges measured between bridge rails is less than the width of the approach roadways (travel lanes plus shoulders), with the exception of the two bridges over I-35 (MP 115.2), the BNSF Railroad (MP 132.3), and White Breast Creek (MP 134.4), which have widths equal to the approach roadway width. The existing bridge over a stream near MP 134.8 has a width less than the width of the approach roadway; however, the bridge replacement project will construct a bridge equal to the width of the approach roadway. The narrower bridge widths are acceptable, but it is typically desired to maintain the approach roadway width across the bridge.

Table 13. Summary of Existing US 34 Bridges within the Study Corridor

FHWA No.	Mile Post	Feature Crossed	Bridge Width (feet)	Overall Condition	Year Built
20021	115.2	I-35	40	Good	2009
20031	115.2	I-35	40	Good	2010
20040	119.1	BNSF Railroad	30	Fair	1967
34221	132.3	BNSF Railroad	48	Fair	1974
34251	134.4	White Breast Creek	44	Good	2017
34260	134.8	Stream	30	Fair	1921
34280	140.2	Abandon railroad bike path	32	Good	1960
34310	141.8	Russell Boulevard and BNSF and UP Railroads	30	Fair	1960
34340	145	Little White Breast Creek	28	Fair	1958
37380	163.2	BNSF Railroad	30	Fair	1964
37390	163.4	Cedar Creek	30	Fair	1964
37400	165.8	Coal Creek	30	Fair	1964

FHWA = Federal Highway Administration

No. = number

7 AT-GRADE RAILROAD CROSSINGS

The BNSF Railroad corridor runs an east-west route and nearly parallels US 34 within and around the communities of Osceola and Lucas within the Study corridor. US 34 provides several grade-separated crossings over the BNSF Railroad and one at-grade railroad crossing through the Study corridor.

The Study identified a total of 14 at-grade railroad crossings on local roadways that are within 0.5 mile of the local roadway's intersection with US 34. Of these, two are within 150 feet of the local side road intersection with US 34. Table 14 summarizes the existing railroad crossing locations that are within 150 feet of the local roadway's intersection with US 34.

Table 14. Summary of At-grade Railroad Crossings near US 34

Side Road (US 34 Mile Post)	Crossing Control	Advanced Signing	Approximate Crossing Distance from US 34 (feet)
Warren Avenue (115.5)	Crossing gates and lights	Yes	65
Ridge Road (116.1)	Crossing gates and lights	Yes	55

There is one at-grade railroad crossing along US 34 at MP 167.9 in Albia. The crossing is located approximately 250 feet from the IA 5 intersection and 260 feet from the South Main Street intersection. This crossing is equipped with lights and stop bars only. Although the railroad crossing is located near two intersections, stakeholder input did not indicate any issues with queueing traffic.

8 PASSING OPPORTUNITIES

Dedicated passing lanes, four-lane roadway sections, and passing zones provide passing opportunities throughout the Study corridor.

8.1 PASSING LANES

Passing lane locations are scattered throughout the Study corridor, with four located west of Osceola, six located between Osceola and Chariton, one just east of Chariton, and one east of Albia. Passing lane lengths generally are between 0.25 and 0.5 mile and provide opportunities to pass slower-moving vehicles when passing opportunities are limited or steep grades are present. Table 15 summarizes the passing lane locations.

Table 15. Summary of Existing US 34 Passing Lane Locations

Mile Post to Mile Post	Direction of Travel	Length
103.1 to 103.2	Westbound	0.15 mile
103.9 to 104.2	Eastbound	0.25 mile

Table 15. Summary of Existing US 34 Passing Lane Locations

Mile Post to Mile Post	Direction of Travel	Length
106.0 to 106.3	Westbound	0.38 mile
108.7 to 109.0	Eastbound	0.26 mile
127.4 to 127.7	Westbound	0.30 mile
128.9 to 129.2	Eastbound	0.36 mile
128.9 to 129.2	Westbound	0.29 mile
129.6 to 129.9	Westbound	0.26 mile
130.2 to 130.7	Westbound	0.45 mile
135.0 to 135.4	Eastbound	0.32 mile
144.2 to 144.7	Westbound	0.46 mile
169.0 to 169.2	Westbound	0.20 mile

The passing lane lengths within the Study corridor are shorter in length than the minimum passing lane lengths provided in the *Iowa DOT Design Manual* (Iowa DOT, 2019) but do meet or exceed values provided in AASHTO (2011). In addition, the westbound passing lane at mile post 106 passes through the County Road R15/130th Street paved intersection. This can cause sight distance issues for vehicles on the paved side road.

8.2 NO-PASSING ZONES

Aerial photography and observations during the onsite windshield survey were used to estimate the total number and length of posted passing zones in the Study corridor. Table 16 summarizes the locations where passing is prohibited.

Approximately 48 miles, or 74 percent of the corridor, allows for passing in at least one direction of travel. Observations during the windshield survey and driving the corridor suggest that in the areas where passing is allowed, opportunities exist where gaps in oncoming traffic are sufficient to allow for a safe passing maneuver. However, some highway segments have passing zones less than 1 mile. From east of Lucas through to the east side of Chariton and from mile post 150 to mile post 155, individual passing zones are shorter in length due to more frequent changes in the roadway grade and curvature. In the areas with the short passing zones, any opposing traffic can greatly limit the number of available passing opportunities.

Table 16. Summary of Existing US 34 No-passing Zones

Eastbound			Westbound		
Mile Post Start	Mile Post End	Description	Mile Post Start	Mile Post End	Description
102.8	103.1	No Passing	102.9	103.3	No Passing

Table 16. Summary of Existing US 34 No-passing Zones

Eastbound			Westbound		
Mile Post Start	Mile Post End	Description	Mile Post Start	Mile Post End	Description
3.1-Mile Passing Zone			0.7-Mile Passing Zone		
106.2	106.4	No Passing	140.0	140.2	No Passing
1.1-Mile Passing Zone			2.1-Mile Passing Zone		
107.5	107.8	No Passing	106.3	106.5	No Passing
1.9-Mile Passing Zone			1.2-Mile Passing Zone		
109.7	110.0	No Passing	107.7	107.9	No Passing
3.8-Mile Passing Zone			1.0-Mile Passing Zone		
113.8	114.0	No Passing	108.9	109.2	No Passing
1.9-Mile Passing Zone			0.7-Mile Passing Zone		
115.9	117.6	No Passing	109.9	110.1	No Passing
1.2-Mile Passing Zone			3.7-Mile Passing Zone		
118.8	119.1	No Passing	113.8	114.2	No Passing
0.8-Mile Passing Zone			1.7-Mile Passing Zone		
119.9	120.1	No Passing	115.9	117.6	No Passing
1.3-Mile Passing Zone			1.4-Mile Passing Zone		
121.4	121.6	No Passing	119.0	119.2	No Passing
0.3-Mile Passing Zone			0.9-Mile Passing Zone		
121.9	122.2	No Passing	120.1	120.2	No Passing
0.8-Mile Passing Zone			1.3-Mile Passing Zone		
123.0	123.2	No Passing	121.5	121.7	No Passing
1.0-Mile Passing Zone			0.4-Mile Passing Zone		
124.2	124.4	No Passing	122.1	122.3	No Passing
0.4-Mile Passing Zone			0.9-Mile Passing Zone		
124.8	125.1	No Passing	123.2	123.4	No Passing
2.1-Mile Passing Zone			0.9-Mile Passing Zone		
127.2	127.6	No Passing	124.3	124.6	No Passing
0.5-Mile Passing Zone			0.4-Mile Passing Zone		
128.1	128.3	No Passing	125.0	125.3	No Passing
1.2-Mile Passing Zone			0.6-Mile Passing Zone		
129.5	129.8	No Passing	125.9	126.0	No Passing
0.3-Mile Passing Zone			1.3-Mile Passing Zone		
130.1	130.5	No Passing	127.3	127.8	No Passing

Table 16. Summary of Existing US 34 No-passing Zones

Eastbound			Westbound		
Mile Post Start	Mile Post End	Description	Mile Post Start	Mile Post End	Description
1.5-Mile Passing Zone			0.5-Mile Passing Zone		
132.0	133.0	No Passing	128.3	128.5	No Passing
3.1-Mile Passing Zone			0.3-Mile Passing Zone		
136.1	136.5	No Passing	128.8	129.4	No Passing
0.5-Mile Passing Zone			0.6-Mile Passing Zone		
137.0	137.4	No Passing	130.0	130.8	No Passing
0.5-Mile Passing Zone			1.2-Mile Passing Zone		
137.9	138.1	No Passing	132.0	133.0	No Passing
0.3-Mile Passing Zone			2.2-Mile Passing Zone		
138.4	138.7	No Passing	135.2	135.5	No Passing
0.2-Mile Passing Zone			0.8-Mile Passing Zone		
138.9	139.2	No Passing	136.3	136.6	No Passing
0.1-Mile Passing Zone			0.5-Mile Passing Zone		
139.3	140.3	No Passing	137.1	137.5	No Passing
0.7-Mile Passing Zone			0.6-Mile Passing Zone		
141.0	141.1	No Passing	138.1	138.3	No Passing
0.4-Mile Passing Zone			0.3-Mile Passing Zone		
141.5	142.8	No Passing	138.6	138.8	No Passing
0.3-Mile Passing Zone			0.3-Mile Passing Zone		
143.1	143.3	No Passing	139.1	139.3	No Passing
0.1-Mile Passing Zone			0.2-Mile Passing Zone		
143.4	143.9	No Passing	139.5	140.4	No Passing
0.2-Mile Passing Zone			0.6-Mile Passing Zone		
144.1	144.6	No Passing	141.0	141.1	No Passing
0.5-Mile Passing Zone			0.4-Mile Passing Zone		
145.1	145.4	No Passing	141.5	143.1	No Passing
0.2-Mile Passing Zone			0.2-Mile Passing Zone		
145.6	145.7	No Passing	143.3	143.4	No Passing
0.9-Mile Passing Zone			0.2-Mile Passing Zone		
146.6	146.7	No Passing	143.6	144.0	No Passing
0.5-Mile Passing Zone			1.3-Mile Passing Zone		
147.2	147.7	No Passing	145.3	145.5	No Passing

Table 16. Summary of Existing US 34 No-passing Zones

Eastbound			Westbound		
Mile Post Start	Mile Post End	Description	Mile Post Start	Mile Post End	Description
	2.5-Mile Passing Zone			0.3-Mile Passing Zone	
150.2	150.4	No Passing	145.8	145.9	No Passing
	0.4-Mile Passing Zone			0.8-Mile Passing Zone	
150.8	151.1	No Passing	146.7	146.9	No Passing
	0.2-Mile Passing Zone			0.3-Mile Passing Zone	
151.3	151.6	No Passing	147.2	147.7	No Passing
	0.9-Mile Passing Zone			2.6-Mile Passing Zone	
152.5	152.7	No Passing	150.3	150.5	No Passing
	0.3-Mile Passing Zone			0.4-Mile Passing Zone	
153.0	153.4	No Passing	150.9	151.2	No Passing
	0.4-Mile Passing Zone			0.3-Mile Passing Zone	
153.8	153.9	No Passing	151.5	151.7	No Passing
	0.5-Mile Passing Zone			0.9-Mile Passing Zone	
154.4	154.9	No Passing	152.6	152.9	No Passing
	2.0-Mile Passing Zone			0.3-Mile Passing Zone	
156.9	157.1	No Passing	153.2	153.6	No Passing
	0.3-Mile Passing Zone			0.8-Mile Passing Zone	
157.4	157.6	No Passing	154.4	154.9	No Passing
	2.6-Mile Passing Zone			2.2-Mile Passing Zone	
160.2	160.3	No Passing	157.1	157.3	No Passing
	1.3-Mile Passing Zone			0.3-Mile Passing Zone	
161.6	161.7	No Passing	157.6	157.8	No Passing
	0.5-Mile Passing Zone			2.5-Mile Passing Zone	
162.2	162.5	No Passing	160.3	160.4	No Passing
	1.7-Mile Passing Zone			1.3-Mile Passing Zone	
164.2	164.4	No Passing	161.7	161.9	No Passing
	0.5-Mile Passing Zone			0.5-Mile Passing Zone	
164.9	165.1	No Passing	162.4	162.7	No Passing
	2.2-Mile Passing Zone			1.7-Mile Passing Zone	
167.3	168.1	No Passing	164.4	164.6	No Passing
	0.6-Mile Passing Zone			0.5-Mile Passing Zone	
168.7	169.0	No Passing	165.1	165.3	No Passing

Table 16. Summary of Existing US 34 No-passing Zones

Eastbound			Westbound		
Mile Post Start	Mile Post End	Description	Mile Post Start	Mile Post End	Description
			2.3-Mile Passing Zone		
			167.6	168.3	No Passing
			0.6-Mile Passing Zone		

9 TRAFFIC VOLUMES

Iowa DOT supplied existing 2018 average annual daily traffic (AADT) volume data. These data were used to gather a general understanding of traffic trends within the Study area. Traffic volumes showed the City of Osceola, more specifically the area around the I-35 interchanges, having significantly greater traffic volumes than smaller rural counterparts. AADT around this location ranged from 6,800 to 9,700 vehicles. Rural sections withing the Study area generally showed lower AADT volumes that ranged from 2,200 to 4,400 vehicles. The highest rural section of AADT volume is just east of Albia (approximately 4,400 vehicles).

Readily available existing and forecasted traffic data years were gathered for this Study from two sources within the Iowa DOT. The first source was the Iowa DOT Turning Movements website (Iowa DOT, n.d.c) and the second was a traffic forecast for the past and future years of 2018, 2028, and 2048 supplied by Iowa DOT. The 2018 AADT data were used to gain an understanding of daily traffic trends. The 2028 (program year) and 2048 (horizon/design year) forecasted traffic data will be used to aid in turn lane analysis. AADT volume data were used to understand the composition of the vehicle mix currently using US 34, particularly the volume of heavy or large trucks, including single-unit trucks and large agricultural equipment.

10 CONCLUSIONS

This existing conditions analysis studied and compared features of the existing Study corridor to current Iowa DOT design guidance and policy and industry-defined best practices. The existing corridor was compared against criteria for new roadway construction and acceptable criteria for general roadway maintenance and preservation. Overall, the Study corridor features are within today's acceptable design parameters. Only isolated locations had current roadway features that do not align with current design practices; no widespread or systemic concerns were identified during the analysis.

Key takeaways from this existing conditions analysis are as follows:

- The existing US 34 roadway meets current design practices and policies with isolated locations that may be considered less than ideal. These areas involve geometrics, turn lane tapers, intersection alignment, and sight distance needs.

- Seven locations within the Study corridor have vertical grades that are greater than the 5 percent acceptable maximum vertical grade for new construction. Ten locations within the Study corridor could see a reduction in truck travel speed between 5 and 10 mph. Four of these 10 locations have an existing additional lane for passing.

- Two locations have less than acceptable DSD: one within Osceola and one just outside of Lucas.

- The existing infrastructure primarily has fair to good pavement conditions, with only 1.5 miles of poor pavement noted at locations within Osceola and just east of Lucas. A recent resurfacing project within Osceola may improve the current pavement conditions rating. All existing bridges appear to be in reasonable condition, and none are currently posted for weight restrictions or considered deficient. Bridge inspection reports suggest that two bridges are scheduled for bridge deck overlays in 2023, one bridge is scheduled for replacement in 2026, and one bridge is currently being replaced.

- All passing lanes within the Study corridor are shorter in length than the minimum guidelines for Super Two highways provided in the *Iowa DOT Design Manual* (Iowa DOT, 2019).

- There are sections of relatively short passing zones (less than the desired 1-mile length) from east of Lucas to east of Chariton and from MP 150 to MP 155.

The findings of this existing conditions analysis will aid in the development and analysis of possible improvement alternatives for the Study.

11 REFERENCES

American Association of State Highway and Transportation Officials (AASHTO). 2011. *A Policy on Geometric Design of Highways and Streets*. 6th Edition.

Iowa Department of Transportation (Iowa DOT). 2019. *Iowa DOT Design Manual*. June 25. https://www.iowadot.gov/design/design-manual.

Iowa Department of Transportation (Iowa DOT). 2020. *ICE Technical Memo, Iowa Infrastructure Condition Evaluation.* https://iowadot.gov/systems_planning/pr_guide/Plans%20and%20Studies/ICE-Technical-Memo-2020.pdf.

Iowa Department of Transportation (Iowa DOT). n.d.a. Bridge Tool. Accessed September 2022. http://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=db6cb43313354a4f85505089ab317e7a.

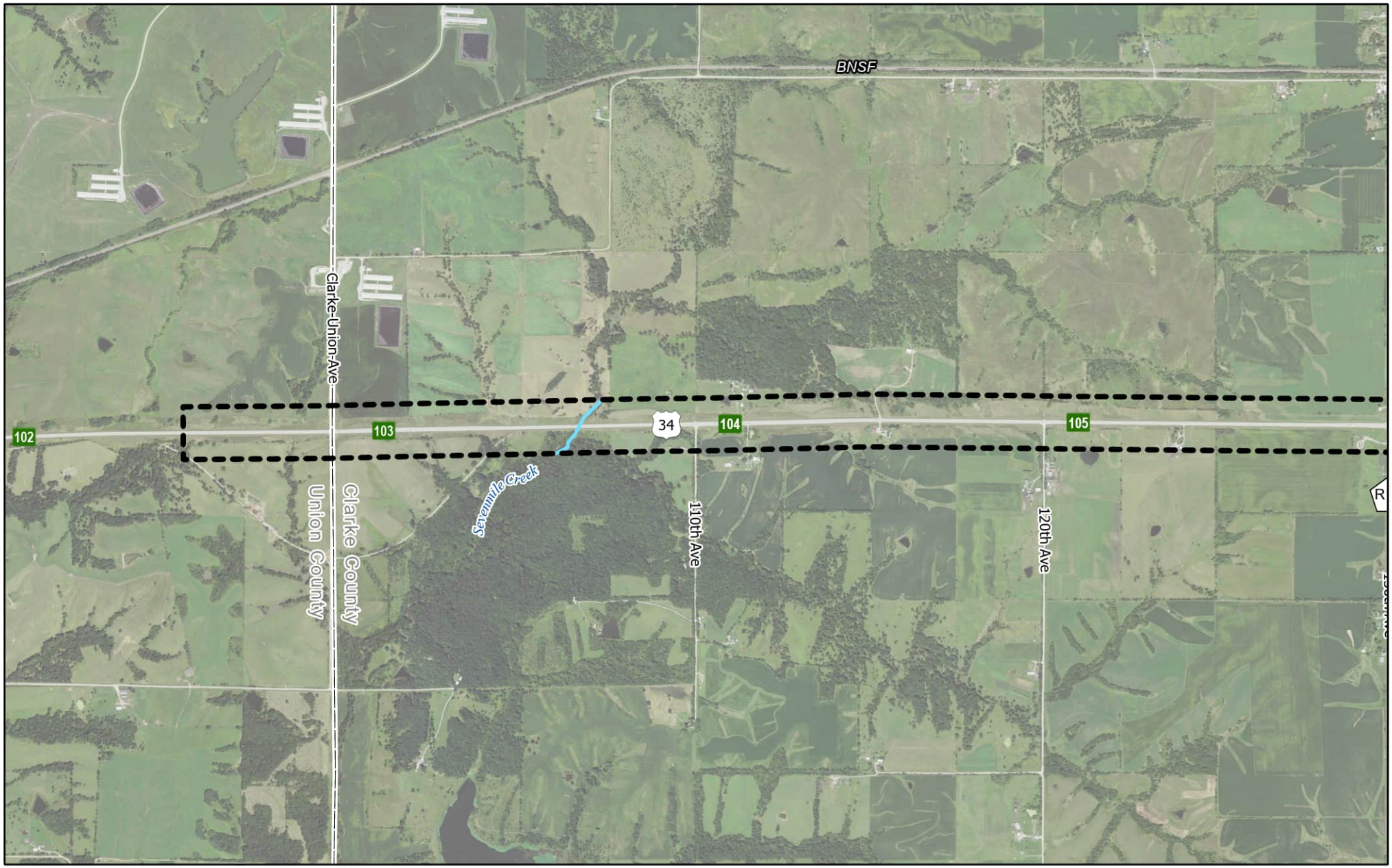
Iowa Department of Transportation (Iowa DOT). n.d.b. *Infrastructure Condition Evaluation (ICE)*. Accessed July 2022. http://iowadot.maps.arcgis.com/apps/webappviewer/index.html?id=23c9e6c132c8498bab6cb2e85b21ec7e.

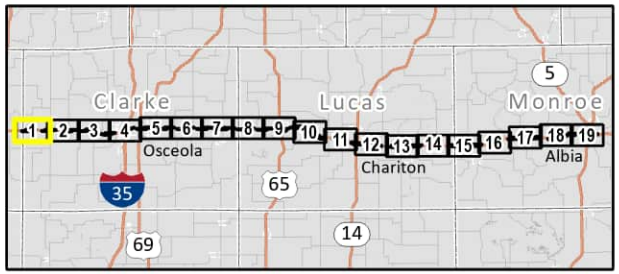
Iowa Department of Transportation (Iowa DOT). n.d.c. *Iowa Traffic Data, Turning Movement*. https://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=0cce99afb78e4d3b9b24f8263717f910.

Iowa Statewide Urban Design and Specifications (SUDAS). 2022. *SUDAS Design Manual*. http://www.iowasudas.org/.

Jacobs. 2022. *US 34 Super Two Study: Existing Crash and Safety Performance Report.* Prepared for Iowa Department of Transportation. December.

APPENDIX A – US 34 STUDY CORRIDOR MAPS WITH SUMMARY OF EXISTING CONDITIONS ANALYSIS FINDINGS





- Study Area
- City Limits Boundary
- Vertical Grades Steeper Than 5%
- Fair Horizontal Curve
- Fair Sag Vertical Curve
- Fair Crest Vertical Curve
- Poor Sag Vertical Curve
- Possible Intersection Sight Distance Obstruction (No Crash History)
- Possible Intersection Sight Distance Obstruction (with Crash History)
- Visual Trap
- Intersection Skew
- Railroad Crossing Sideroad
- US 34 Mile Post
- Bridge Location with FHWA ID

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Feet

Base Map Source: NAIP Imagery
Data Sources: IADOT

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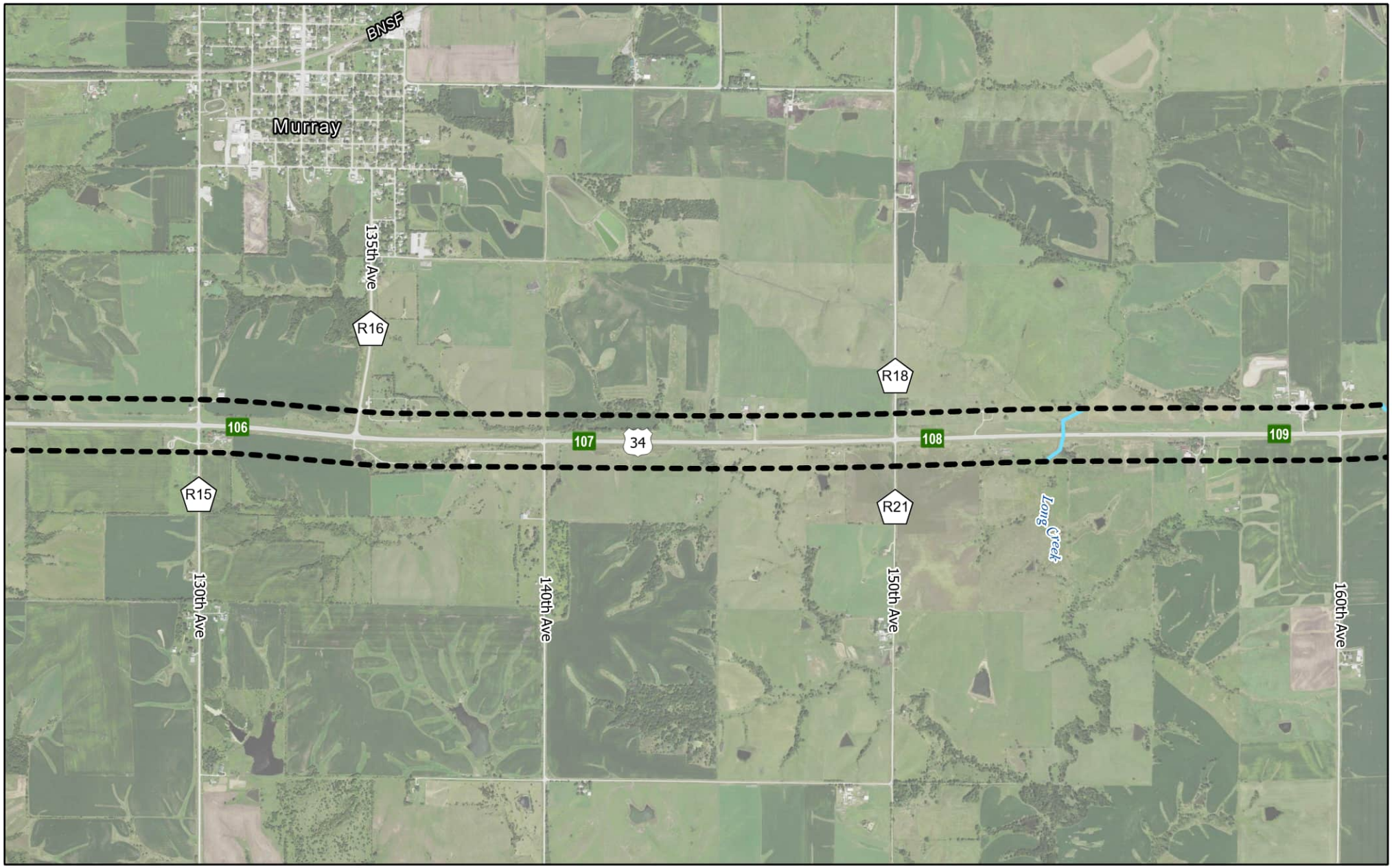

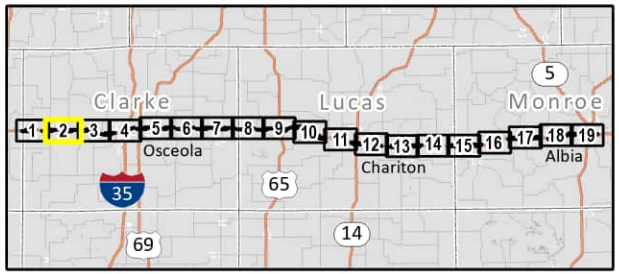

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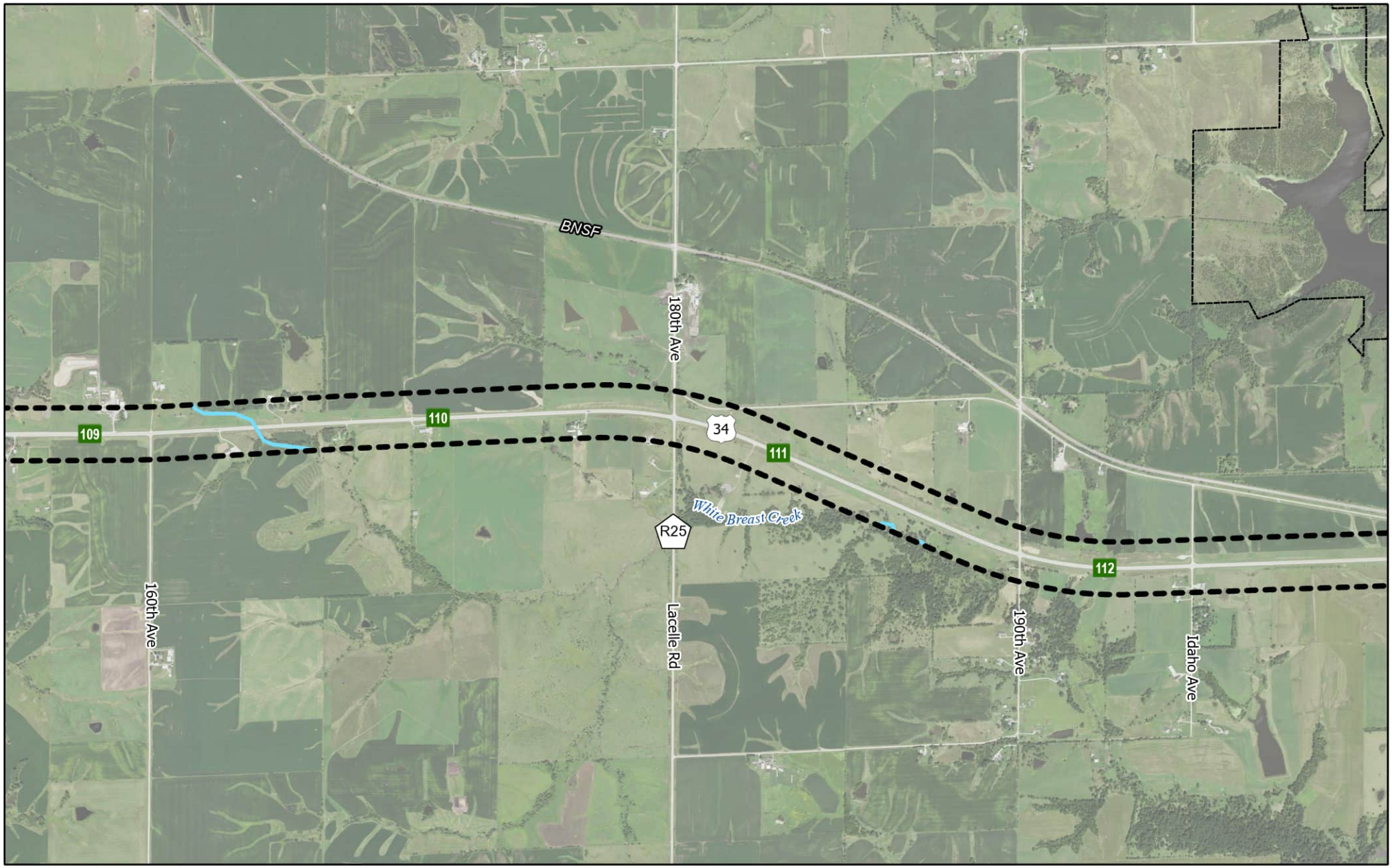

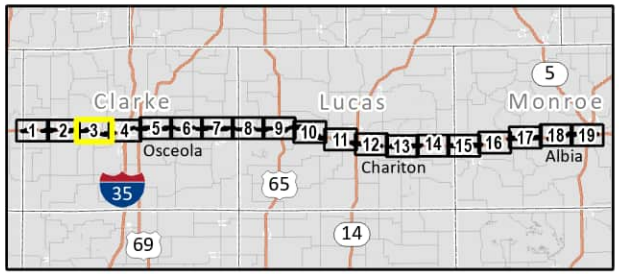

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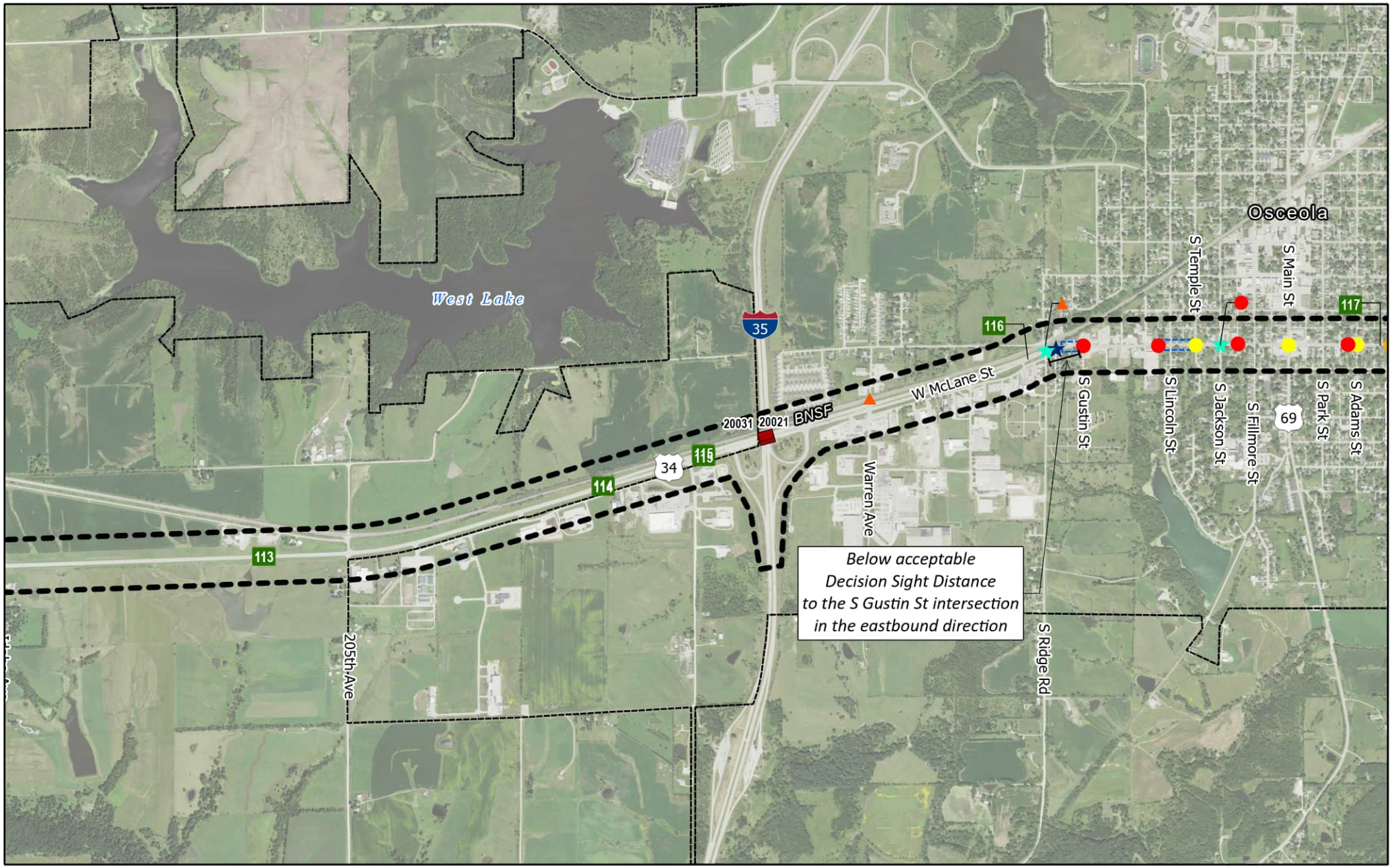

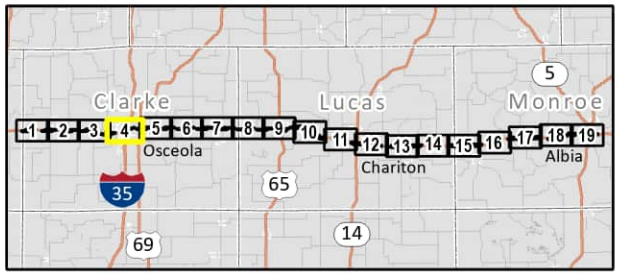

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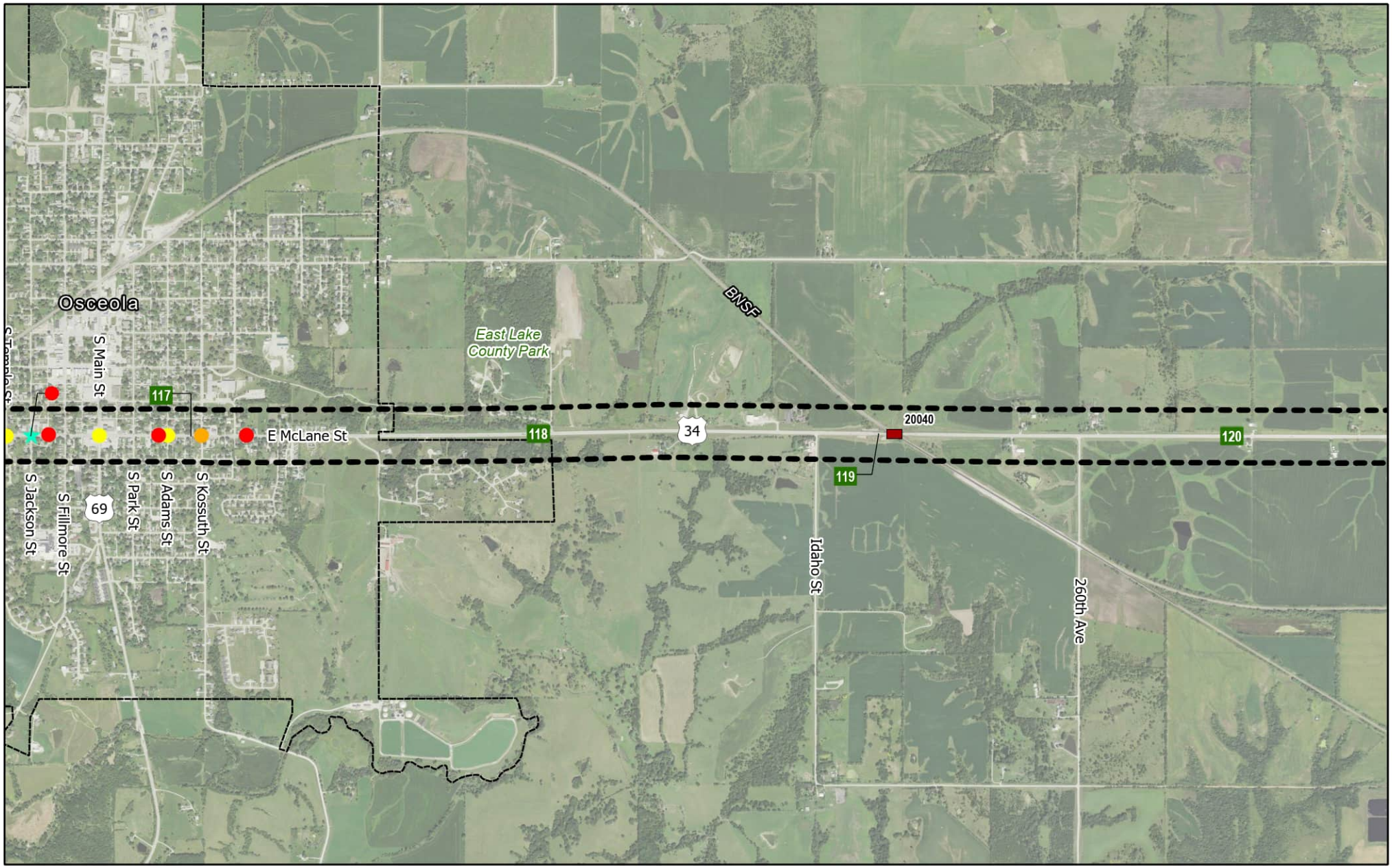

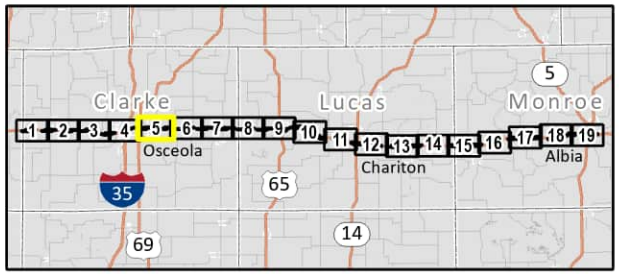

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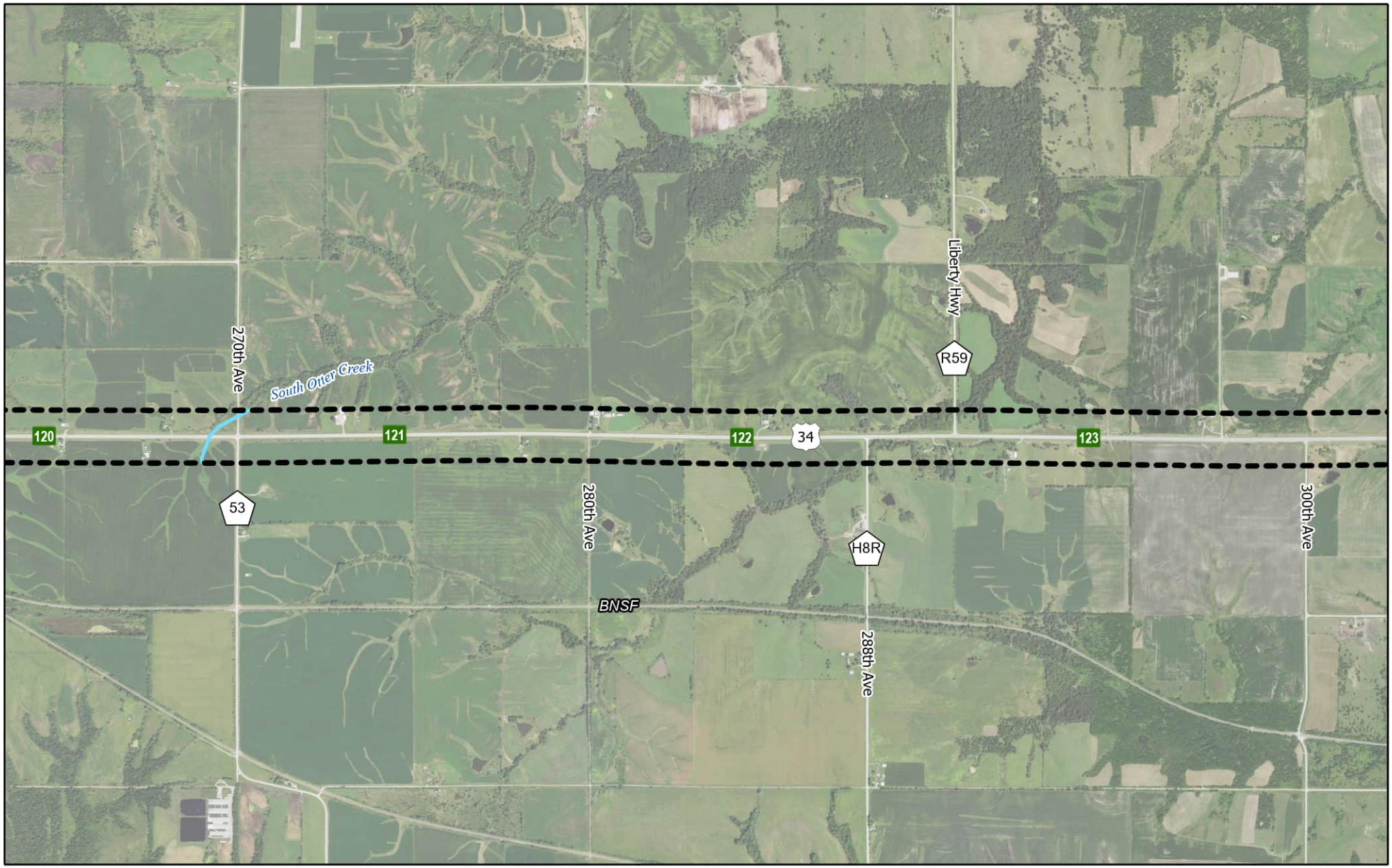

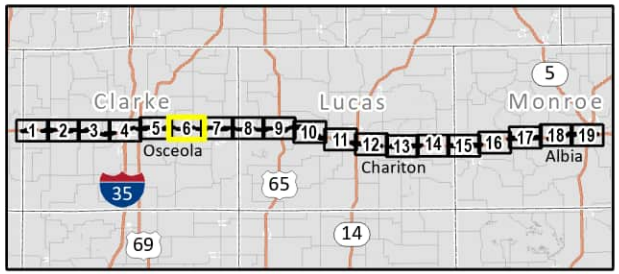

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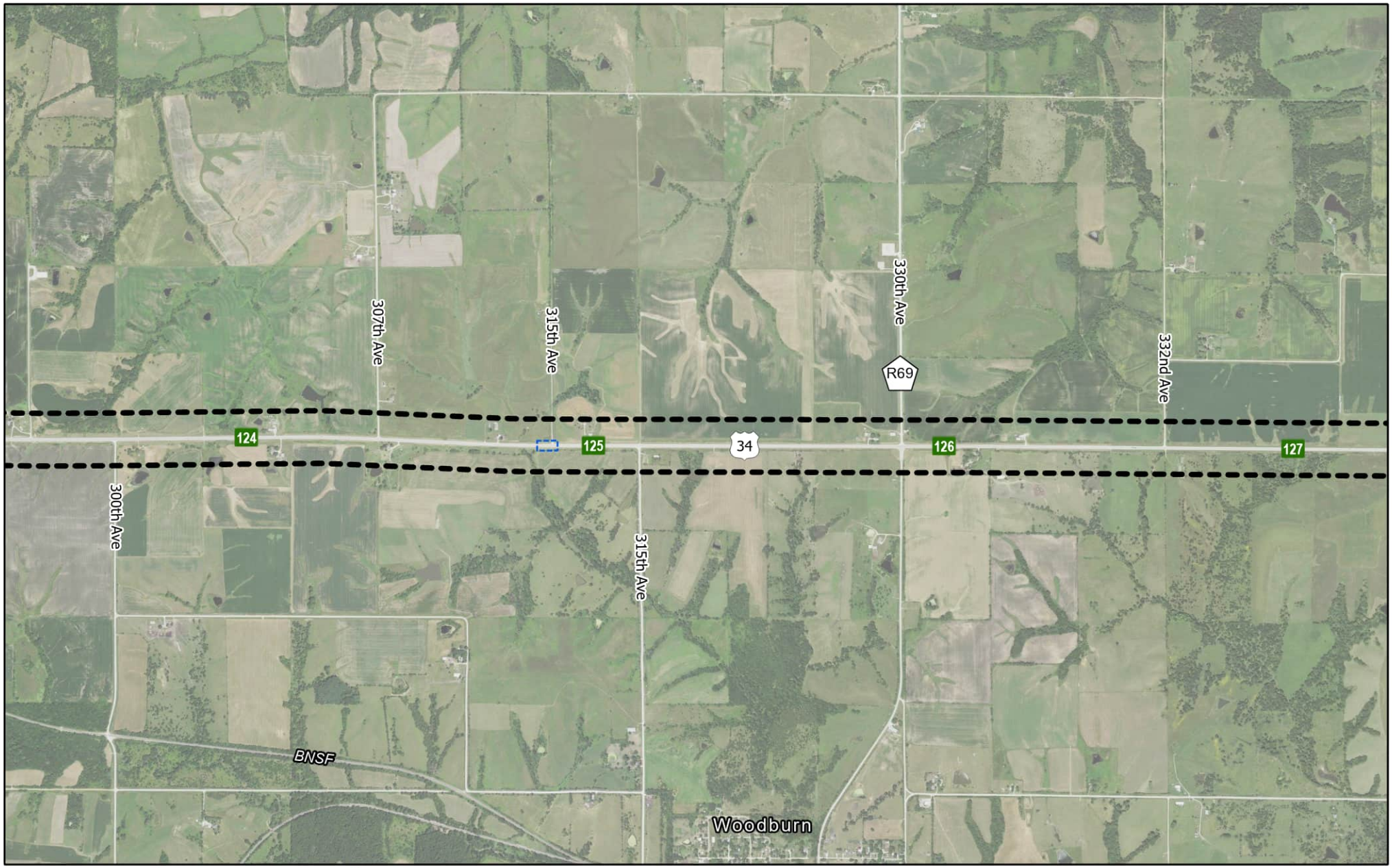

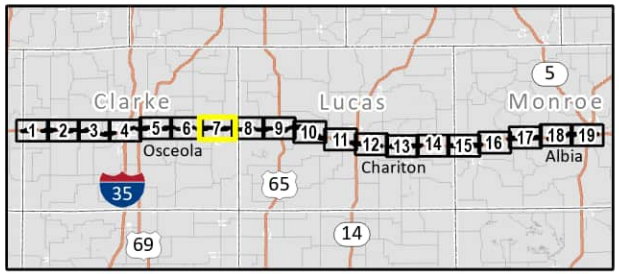

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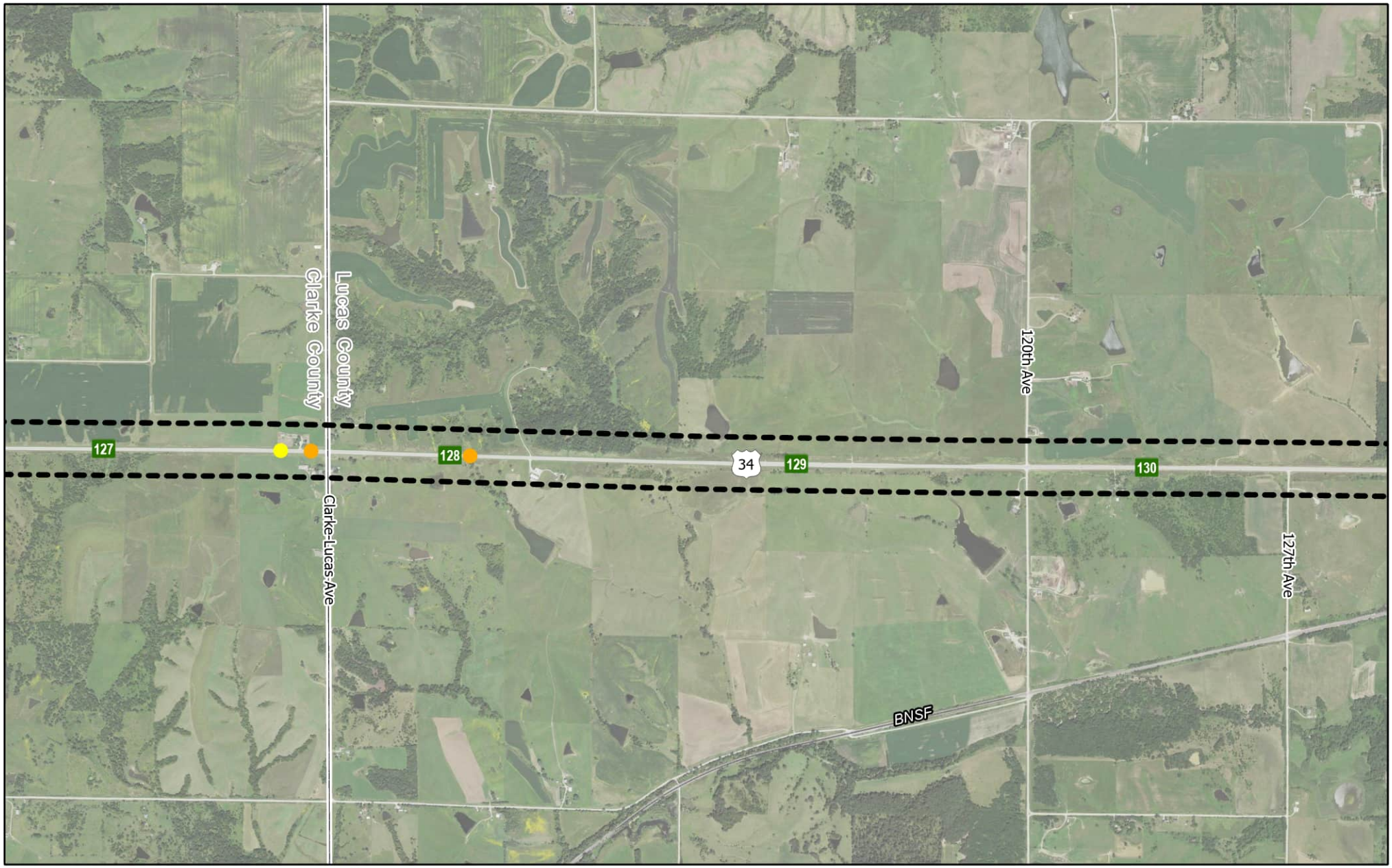

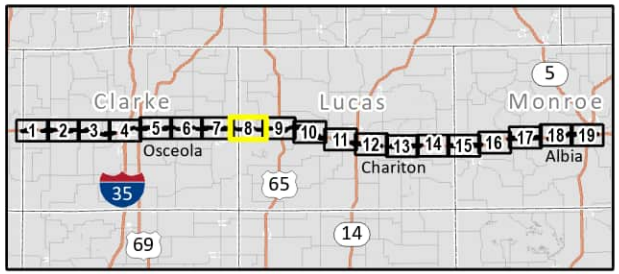

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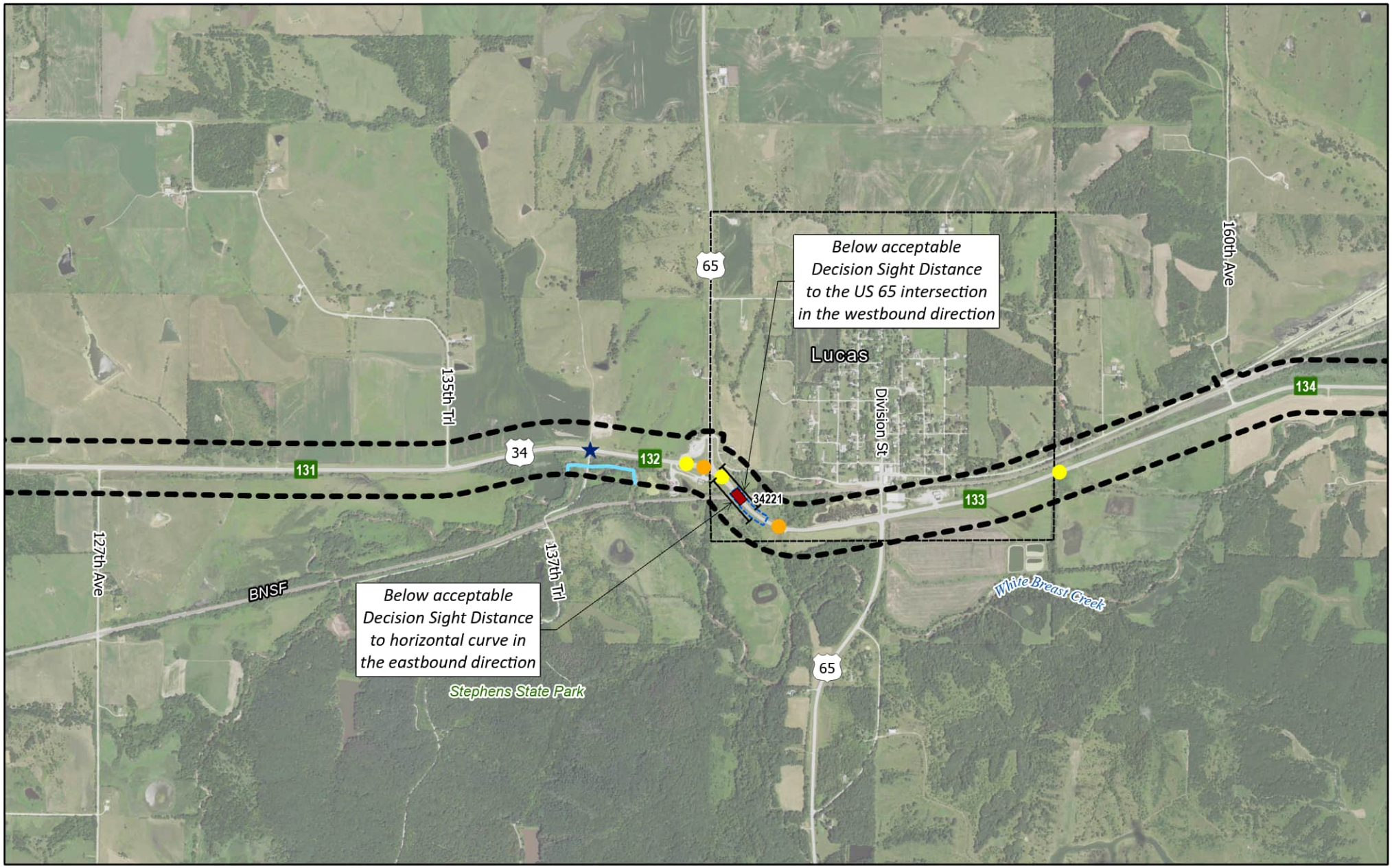

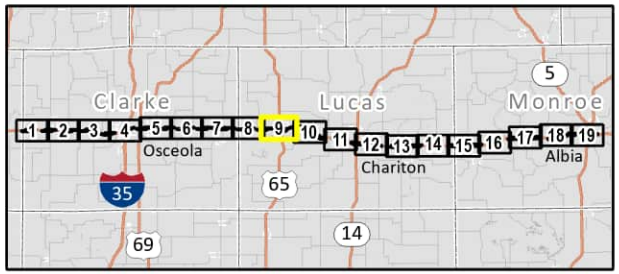

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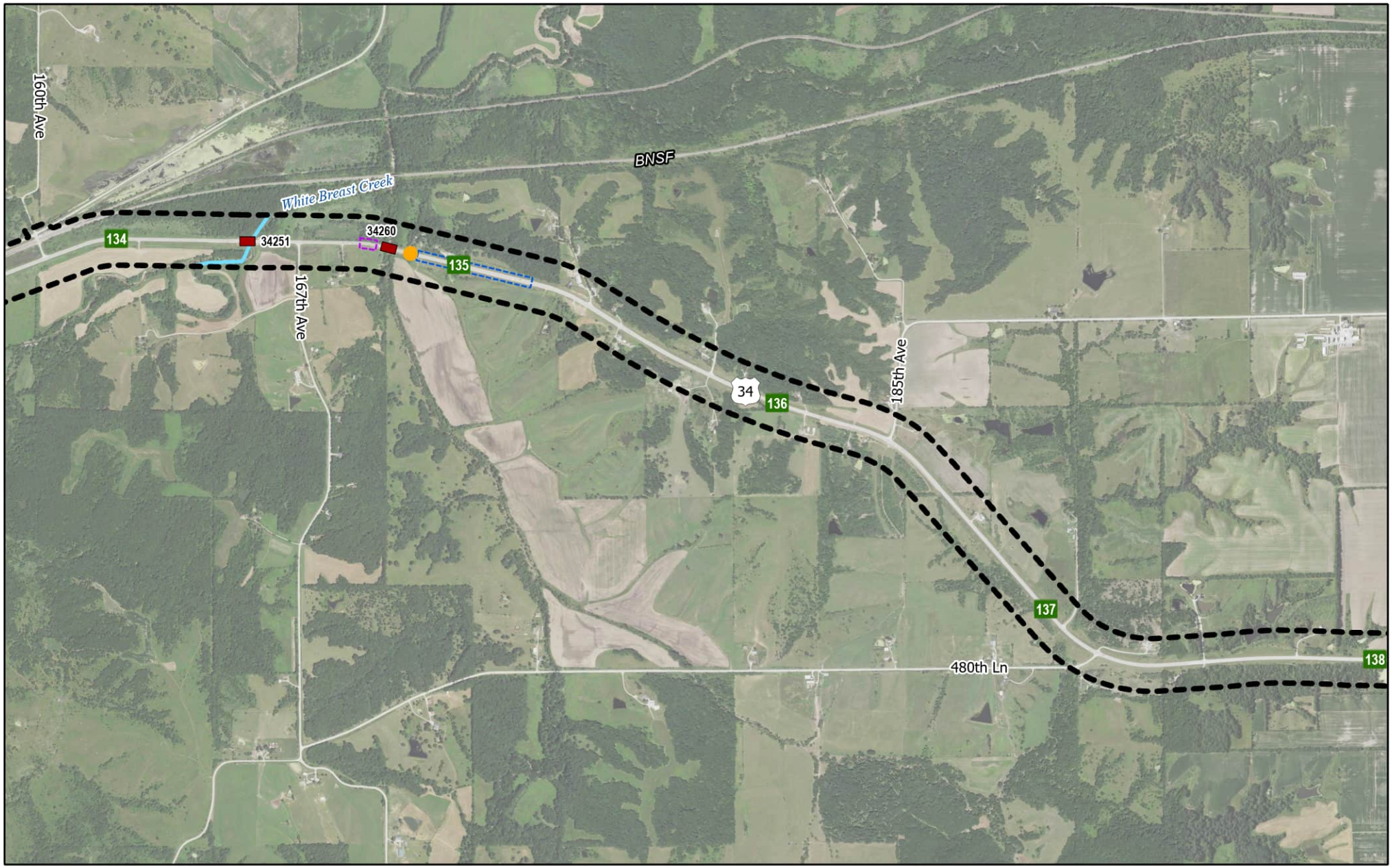

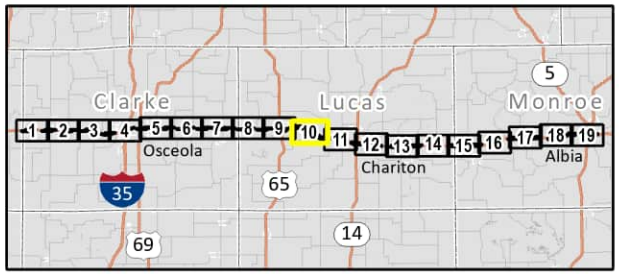

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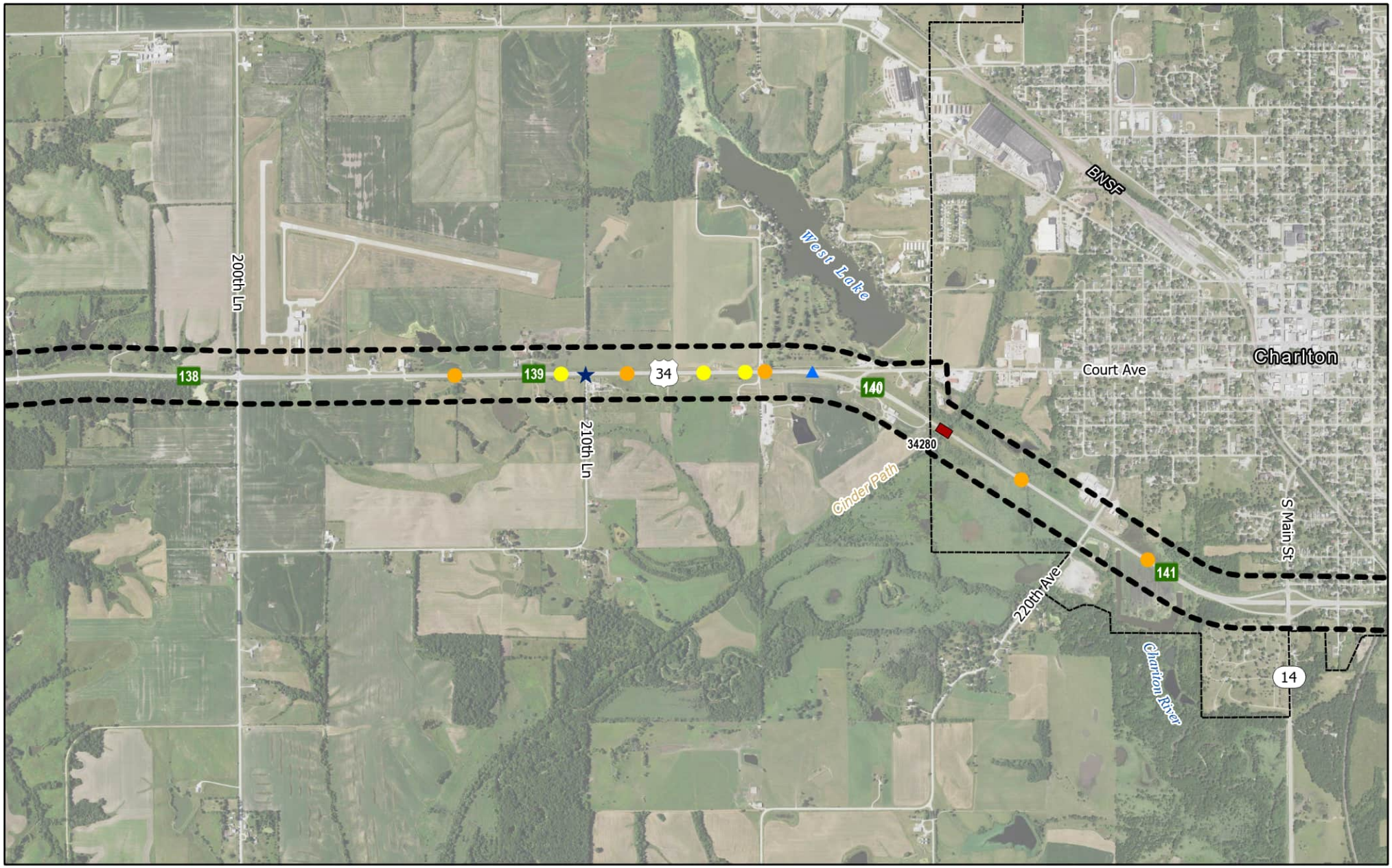
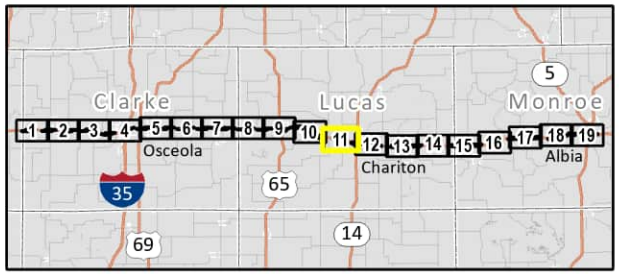
Jacobs

IOWADOT





- Study Area
- City Limits Boundary
- Vertical Grades Steeper Than 5%
- Fair Horizontal Curve
- Fair Sag Vertical Curve
- Fair Crest Vertical Curve
- Poor Sag Vertical Curve
- Possible Intersection Sight Distance Obstruction (No Crash History)
- Possible Intersection Sight Distance Obstruction (with Crash History)
- Visual Trap
- Intersection Skew
- Railroad Crossing Sideroad
- US 34 Mile Post
- Bridge Location with FHWA ID

N

0 1,000 2,000

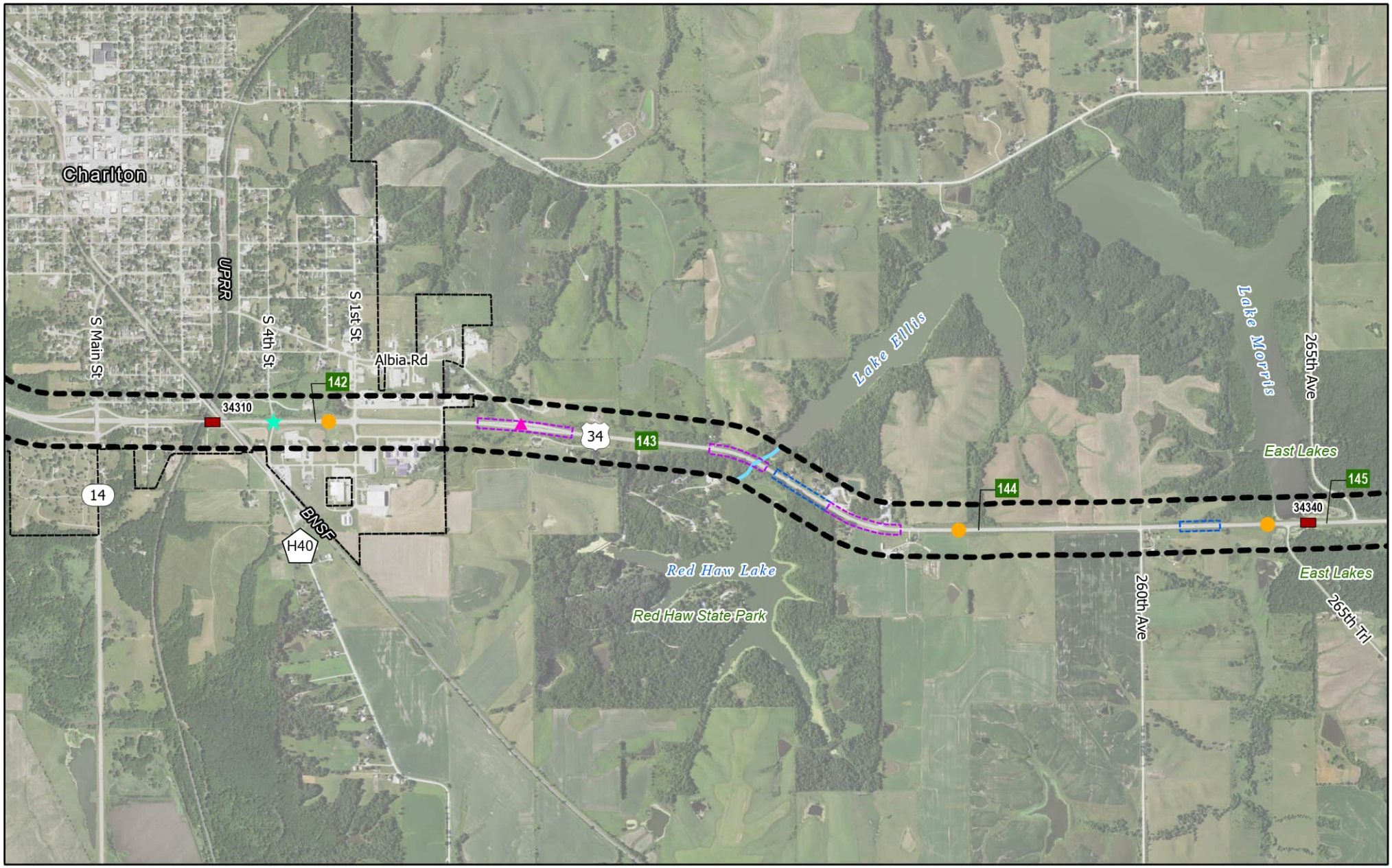
Feet

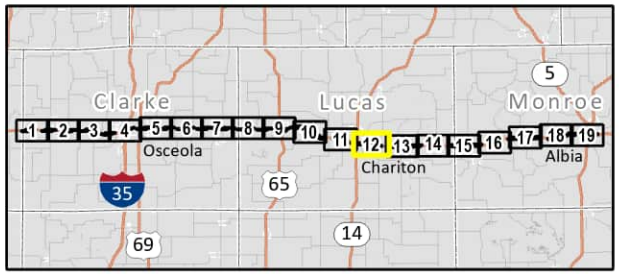
Base Map Source: NAIP Imagery
Data Sources: IADOT

Existing Conditions
US 34 Super Two Study

Jacobs

IOWADOT





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Feet

Base Map Source: NAIP Imagery
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Existing Conditions
US 34 Super Two Study

Jacobs

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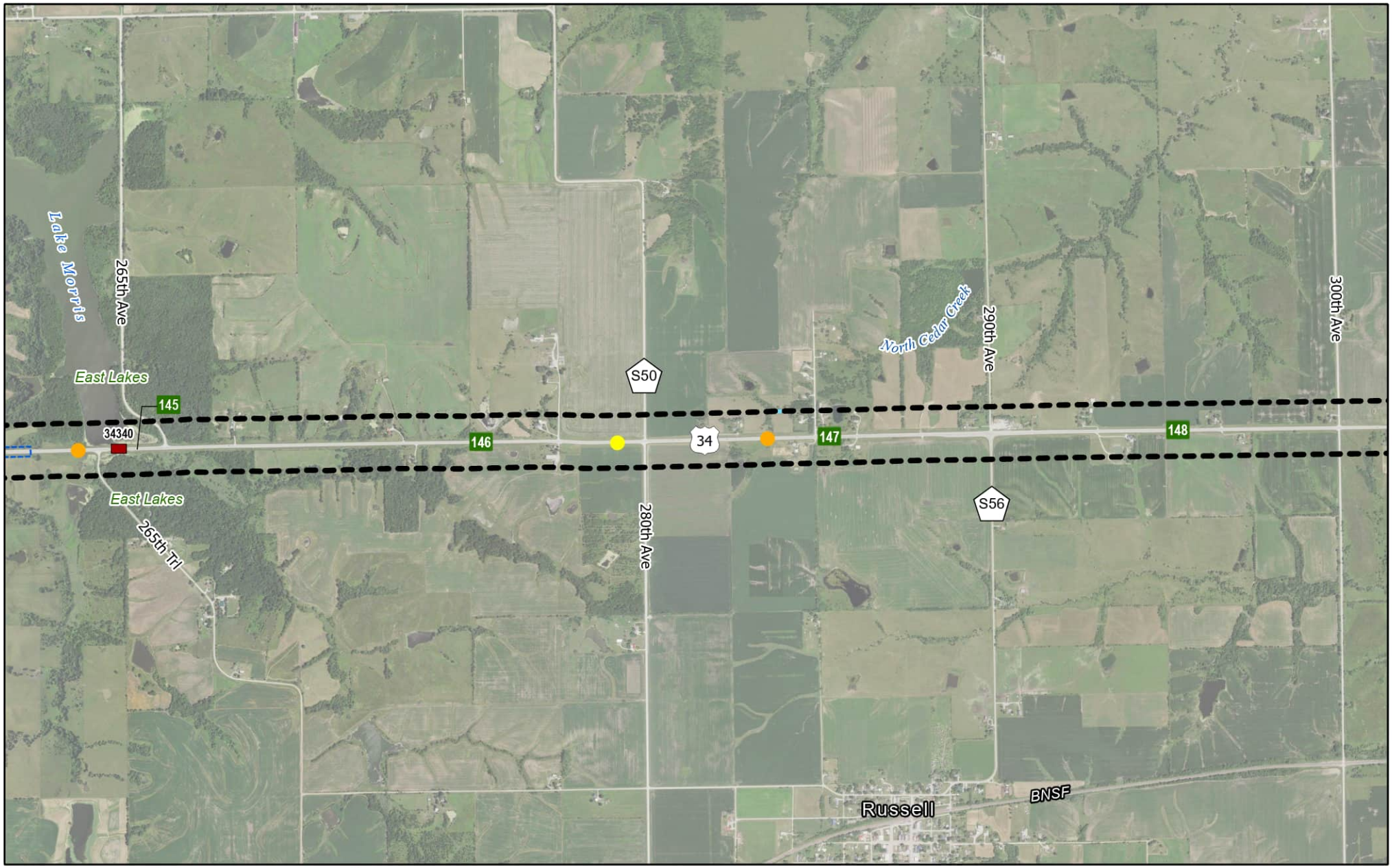

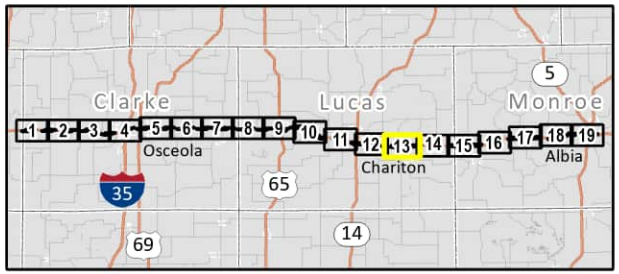

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Feet

Base Map Source: NAIP Imagery
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Existing Conditions
US 34 Super Two Study

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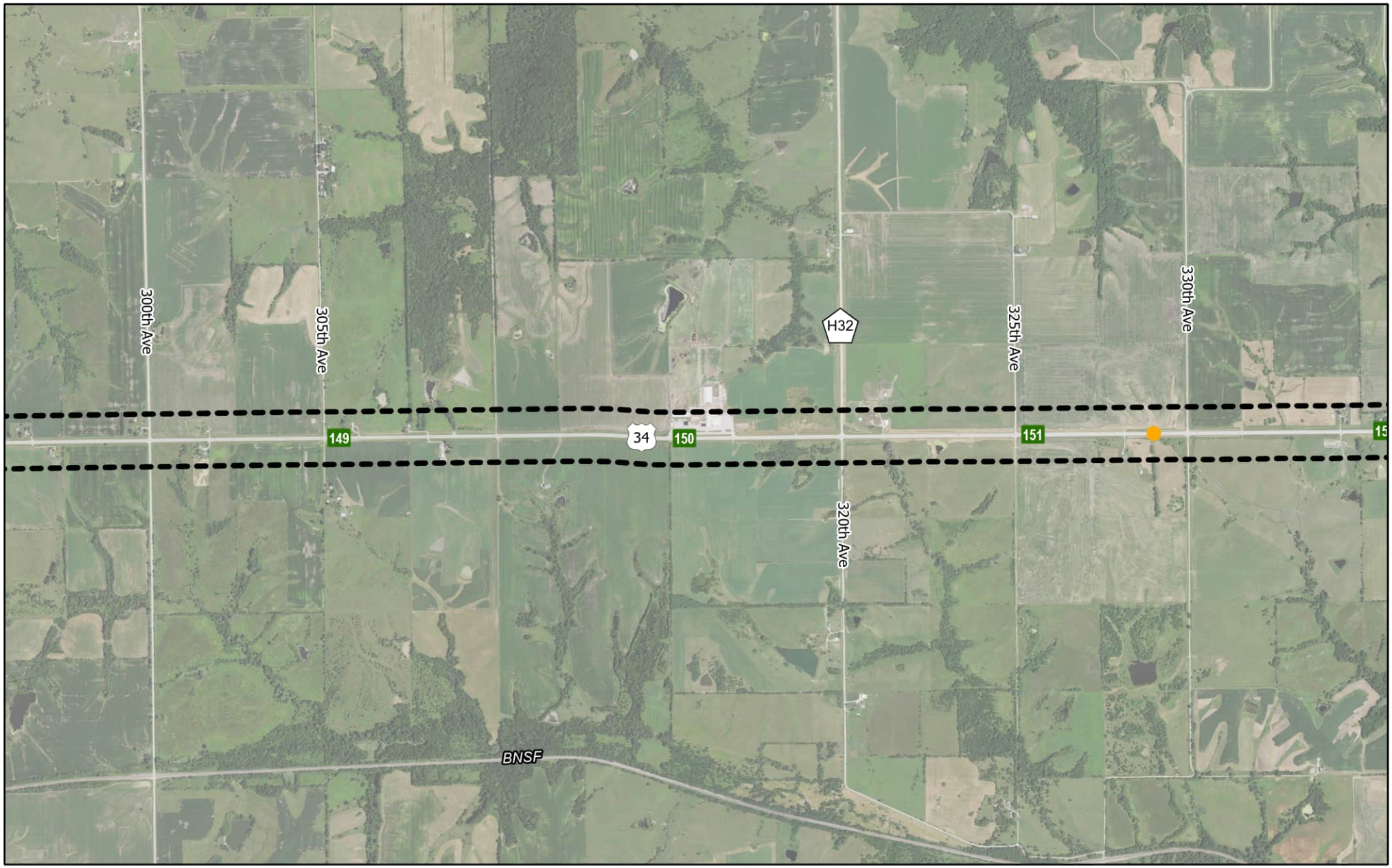

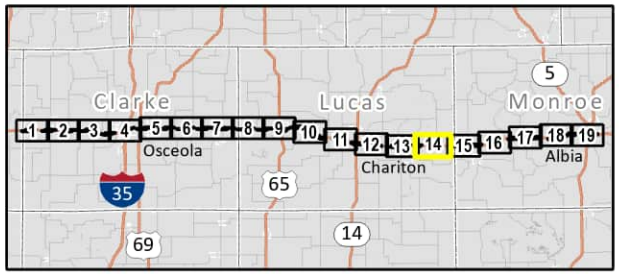

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Feet

Base Map Source: NAIP Imagery
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Existing Conditions
US 34 Super Two Study

Jacobs

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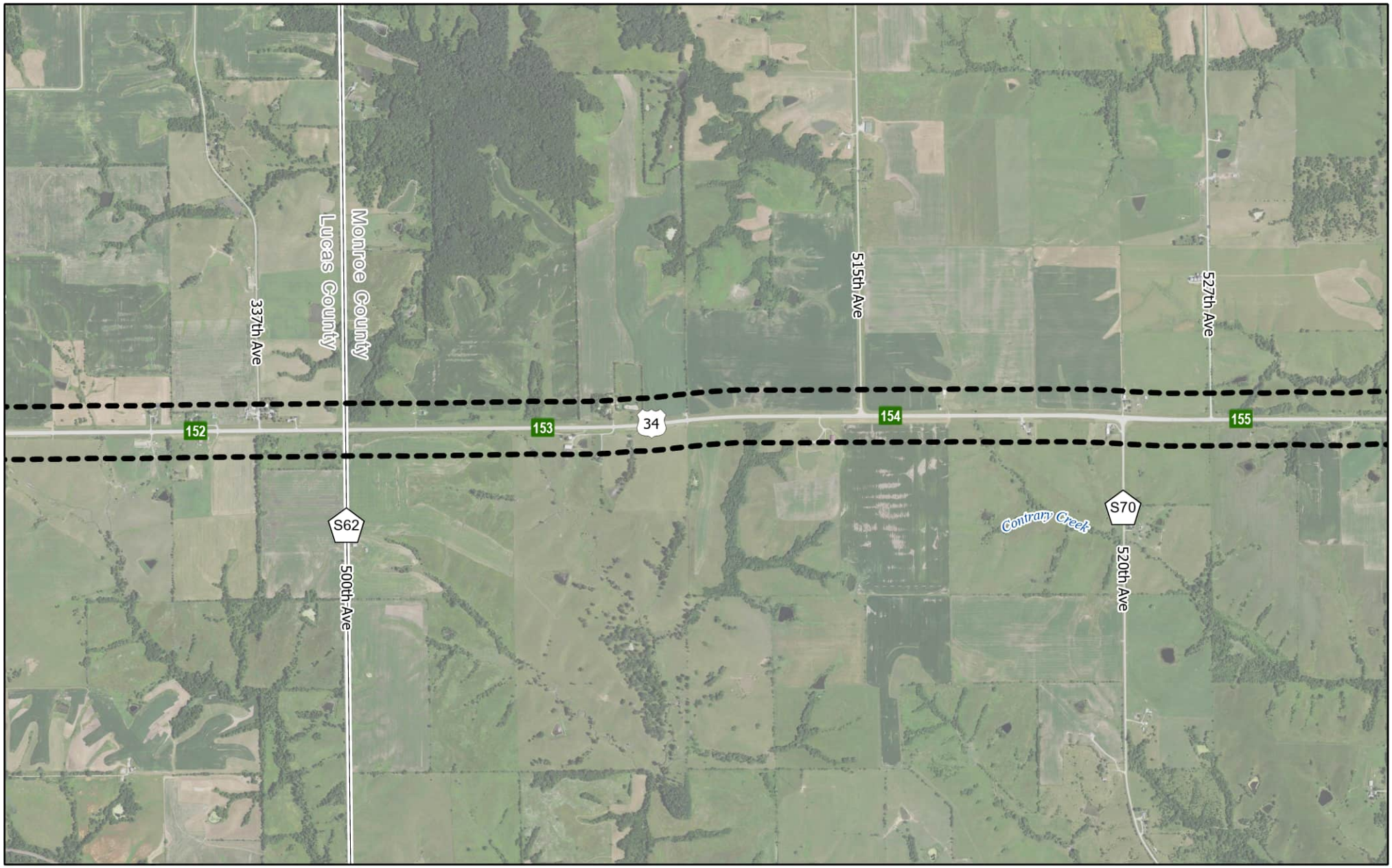

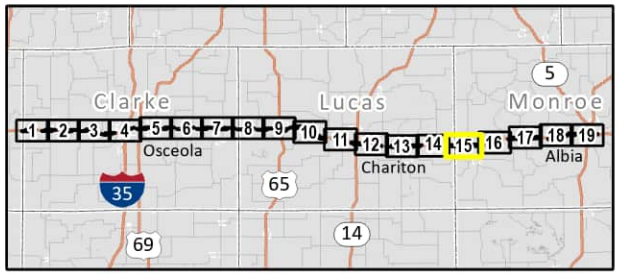

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Existing Conditions
US 34 Super Two Study

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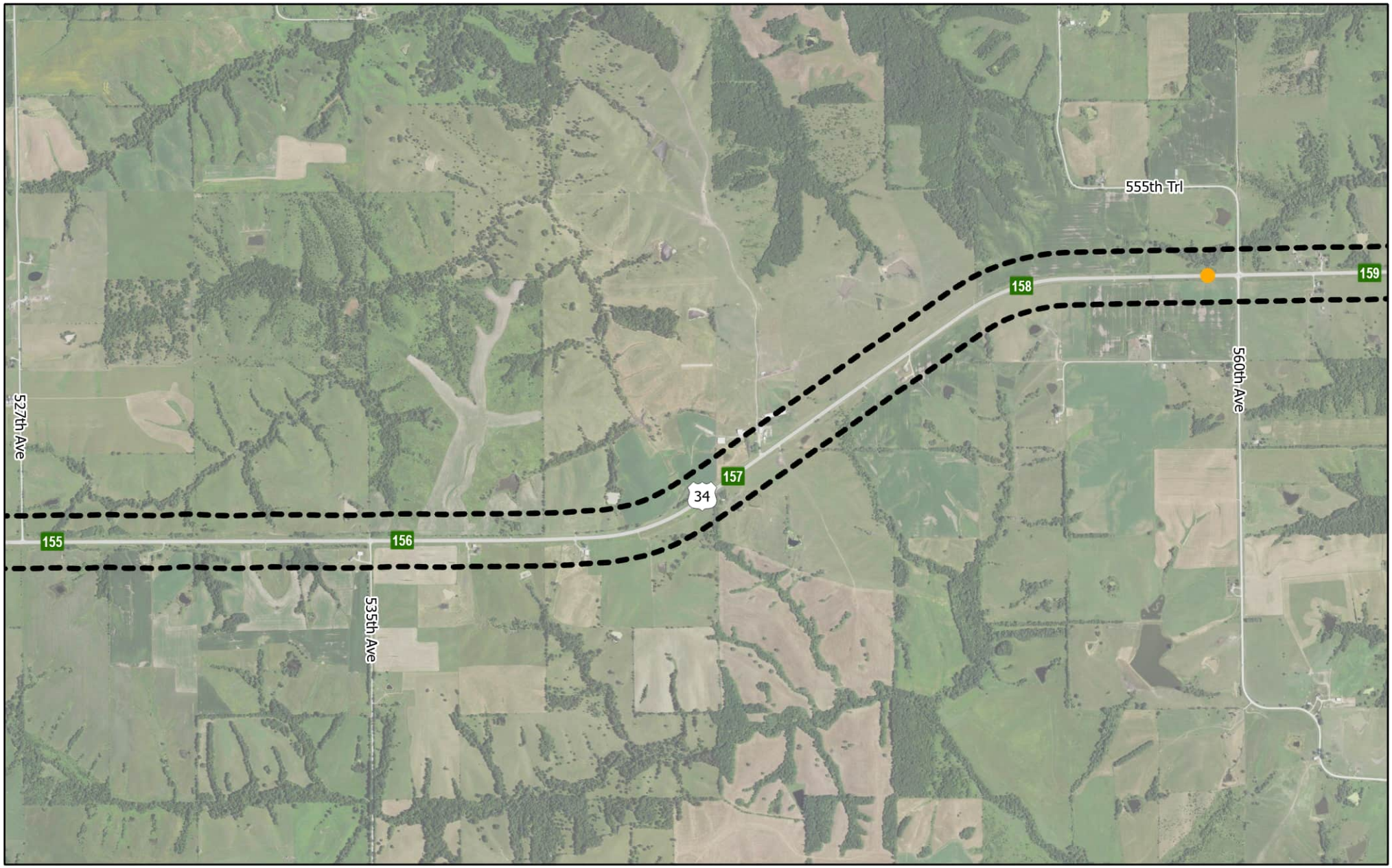

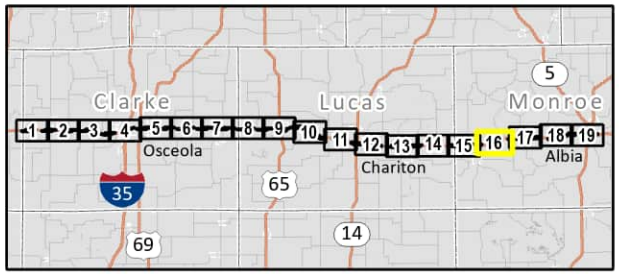

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Base Map Source: NAIP Imagery
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Existing Conditions
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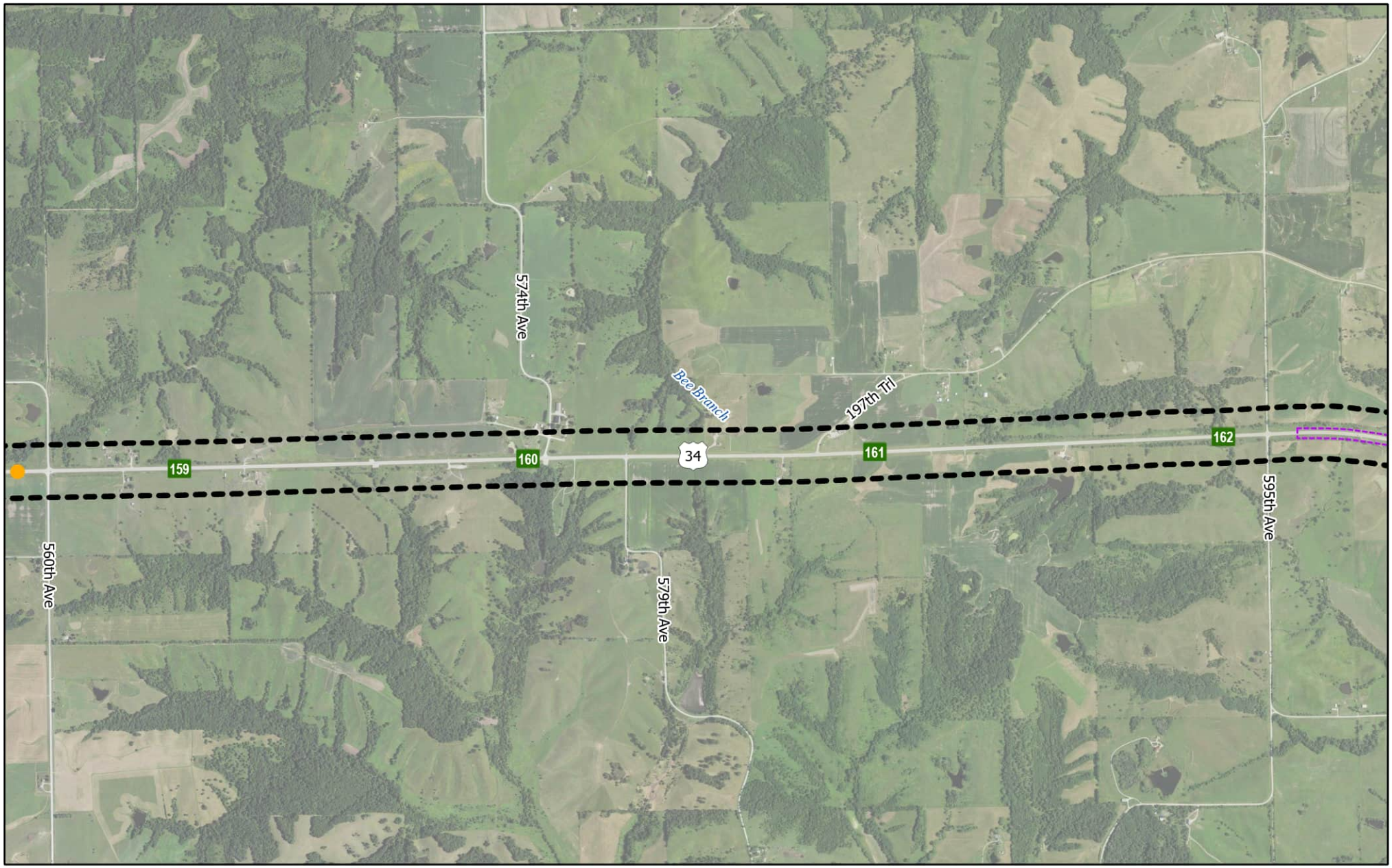

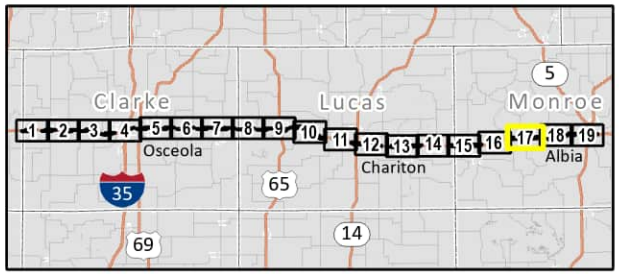

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US 34 Super Two Study

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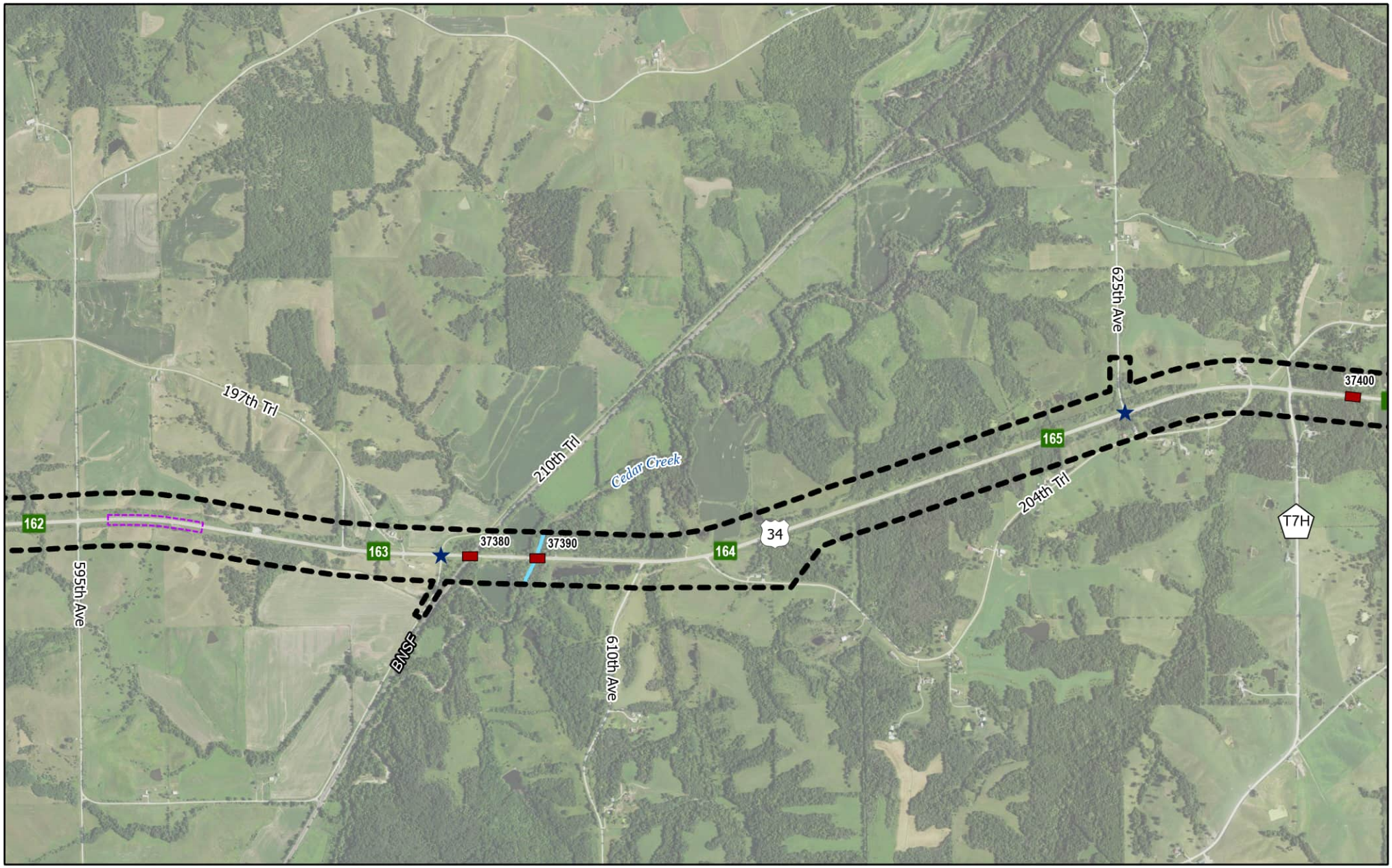

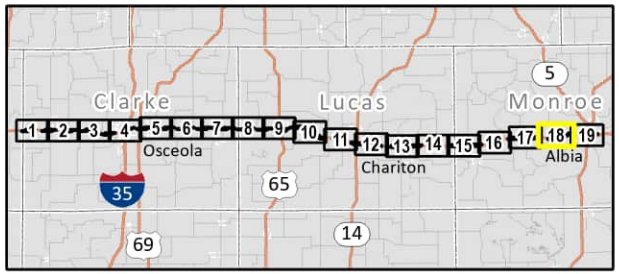

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Existing Conditions
US 34 Super Two Study

Jacobs

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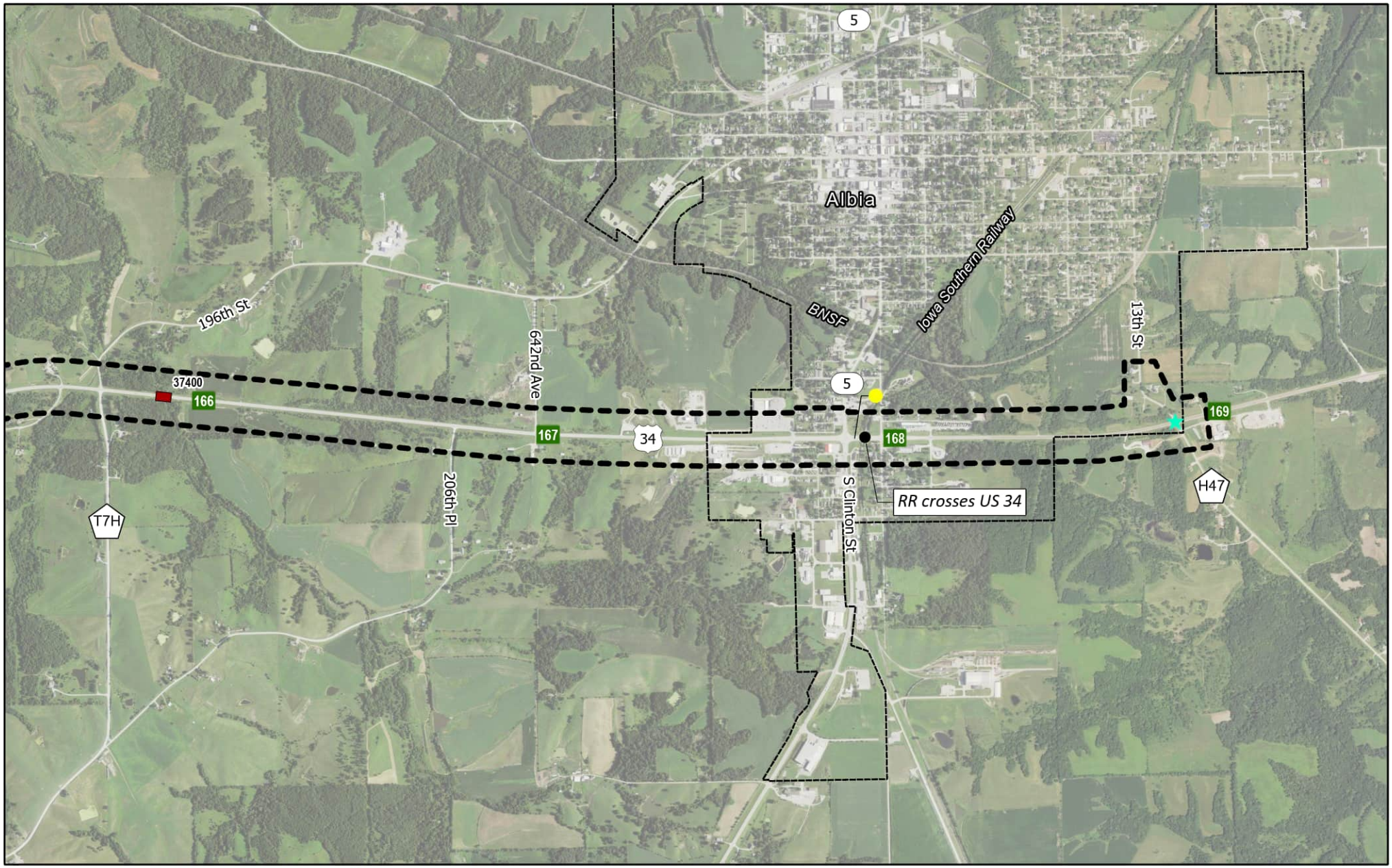

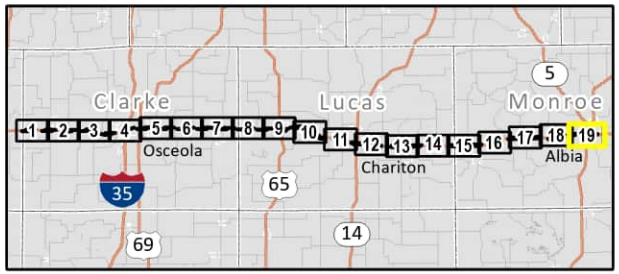

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Feet

Base Map Source: NAIP Imagery
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Existing Conditions
US 34 Super Two Study

Jacobs

IOWADOT

APPENDIX B – ONSITE WINDSHIELD SURVEY PHOTO LOG

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
Beginning of the Study Area to Osceola		
1	East	US 34 at Beginning of the Study
2	West	US 34 at Beginning of the Study
3	West	US 34 at Clarke-Union Ave
4	East	US 34 at Clarke-Union Ave
5	North	Clarke-Union Ave
6	East	US 34 at Clarke-Union Ave
7	West	US 34 at Clarke-Union Ave
8	East	US 34 at end of westbound passing lane
9	West	US 34 at beginning of westbound passing lane
10	East	US 34 at beginning of eastbound passing lane
11	West	Triple RCB near MP 103.6
12	West	US 34 at 110th Ave
13	East	US 34 at 110th Ave
14	West	US 34 at end of eastbound passing lane
15	West	US 34 at 120th Ave
16	East	US 34 at 120th Ave
17	West	Buggy sign
18	North	130th Ave
19	East	US 34 at 130th Ave
20	West	US 34 at 130th Ave
21	South	130th Ave
22	West	US 34 at 130th Ave
23	East	US 34 at 130th Ave
24	West	US 34 at 135th Ave (from southbound left turn/thru lane)

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
25	East	US 34 at 135th Ave (from southbound left turn/thru lane)
26	West	US 34 at 135th Ave (from southbound right turn lane)
27	East	US 34 at 135th Ave (from southbound right turn lane)
28	North	135th Ave
29	West	US 34 at 135th Ave
30	East	US 34 at 135th Ave
31	East	US 34 at 140th Ave
32	West	US 34 at 140th Ave
33	East	US 34 at 150th Ave
34	West	US 34 at 150th Ave
35	North	150th Ave
36	West	US 34 at 150th Ave
37	East	US 34 at 150th Ave
38	South	150th Ave
39	East	US 34 at the beginning of eastbound passing lane
40	East	US 34 at 160th Ave
41	West	US 34 at 160th Ave
42	East	National Historic Trail sign
43	East	US 34 at MP 110
44	West	US 34 at MP 110
45	East	US 34 at 180th Ave/Lacelle Road
46	West	US 34 at 180th Ave/Lacelle Road
47	North	180th Ave
48	East	US 34 at 180th Ave/Lacelle Road
49	West	US 34 at 180th Ave/Lacelle Road

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
50	South	Lacelle Road
51	East	US 34 at 190th Ave
52	West	US 34 at 190th Ave
53	West	US 34 at 190th Ave
54	East	US 34 at 190th Ave
55	South	190th Ave
56	North	190th Ave
57	East	US 34 at Idaho St
58	West	US 34 at Idaho St
59	North	Idaho St
60	West	US 34 at Idaho St
61	East	US 34 at Idaho St
62	South	Idaho St
Osceola		
63	East	US 34 at 250th Ave
64	West	US 34 at 250th Ave
65	North	250th Ave/RR Crossing
66	West	US 34 at 250th Ave
67	East	US 34 at 250th Ave
68	South	250th Ave
69	East	Osceola city sign
70	East	US 34 road widening for median section
71	East	US 34 road widening for median section
72	East	US 34 at Southwest Blvd
73	West	US 34 at Southwest Blvd

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
74	East	US 34 at Southwest Blvd
75	West	US 34 at Southwest Blvd
76	West	US 34 median at Southwest Blvd
77	East	US 34 median/westbound left turn lane at Southwest Blvd
78	East	Guardrail at bridge over I-35
79	East	Guardrail at bridge over I-35
80	East	Eastbound US 34 Bridge over I-35
81	East	Westbound US 34 Bridge over I-35
82	West	Guardrail at bridge over I-35
83	West	Guardrail at bridge over I-35
84	North	Warren Ave
85	West	US 34 at Warren Ave
86	East	US 34 at Warren Ave
87	South	Warren Ave RR crossing
88	South	Warren Ave
89	East	US 34 at Warren Ave
90	West	US 34 at Warren Ave
91	East	US 34 at Furnas Dr
92	East	US 34 at Furnas Dr
93	West	US 34 road widening for median section
94	East	US 34 at S Ridge Rd
95	West	US 34 at S Ridge Rd
96	North	S Ridge Rd
97	West	US 34 at S Ridge Rd
98	East	US 34 at S Ridge Rd

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
99	West	US 34 at S McPherson St
100	East	US 34 at S McPherson St
101	East	US 34 at S Jackson St
102	West	US 34 at S Jackson St
103	West	US 34 at S Jackson St
104	East	US 34 at S Jackson St
105	East	US 34 at Main St
106	East	US 34 at Main St
107	South	Main St
108	West	US 34 at Main St
109	North	Main St
110	West	US 34 at Main St
111	East	US 34 at S Kossuth St
112	West	US 34 at S Kossuth St
113	West	US 34 at S Kossuth St
114	East	US 34 at S Kossuth St
115	West	S Kossuth St intersection
116	West	Henry's Crossing sign
117	East	US 34 at Harken Hills Dr
118	West	US 34 at Harken Hills Dr
119	West	US 34 median striping
120	East	East Lake County Park sign
121	West	US 34 at East Lake Park entrance
122	East	US 34 at East Lake Park entrance

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
Osceola to Lucas		
123	West	US 34 at Idaho St
124	East	US 34 at Idaho St
125	East	Embankment at BNSF Railroad Bridge
126	East	Guardrail at BNSF Railroad Bridge
127	East	Embankment/Guardrail at BNSF Railroad Bridge
128	West	BNSF Railroad Bridge
129	West	Guardrail at BNSF Railroad Bridge
130	West	Guardrail at BNSF Railroad Bridge
131	East	US 34 at 260th Ave
132	West	US 34 at 260th Ave
133	East	US 34 poor centerline rumble strips
134	East	US 34 at 270th Ave
135	West	US 34 at 270th Ave
136	North	270th Ave
137	West	US 34 at 270th Ave
138	East	US 34 at 270th Ave
139	South	US 34 at 270th Ave
140	East	US 34 at 280th Ave
141	West	US 34 at 280th Ave
142	East	US 34 at 288th Ave
143	West	US 34 at 288th Ave
144	East	South Otter Creek Twin RCB
145	North	Liberty Hwy
146	West	US 34 at Liberty Hwy

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
147	East	US 34 at Liberty Hwy
148	East	US 34 at 297th Ave
149	West	US 34 at 297th Ave
150	East	US 34 at 300th Ave
151	West	US 34 at 300th Ave
152	West	US 34 at 307th Ave
153	East	US 34 at 307th Ave
154	West	US 34 at 315th Ave (N)
155	East	US 34 at 315th Ave (N)
156	West	US 34 at 315th Ave (S)
157	East	US 34 at 315th Ave (S)
158	East	US 34 at 330th Ave
159	West	US 34 at 330th Ave
160	East	US 34 at 330th Ave
161	West	US 34 eastbound right turn lane at 330th Ave
162	West	US 34 at 330th Ave
163	East	US 34 at 330th Ave
164	South	330th Ave
165	North	330th Ave
166	West	US 34 at 332nd Ave
167	East	US 34 at 332nd Ave
168	South	332nd Ave
169	East	US 34 at end of westbound passing lane
170	East	US 34 at 100th Ave
171	West	US 34 at 100th Ave

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
172	North	100th Ave
173	West	US 34 at 100th Ave
174	East	US 34 at 100th Ave
175	South	100th Ave
176	West	US 34 at beginning of westbound passing lane
177	East	US 34 at end of westbound/beginning eastbound passing lanes
178	West	US 34 at end of eastbound/beginning westbound passing lanes
179	East	US 34 at end of westbound passing lane
180	East	US 34 at 120th Ave
181	West	US 34 at 120th Ave
182	North	120th Ave
183	West	US 34 at 120th Ave
184	East	US 34 at 120th Ave
185	South	120th Ave
186	West	US 34 at beginning of westbound passing lane
187	East	US 34 at end of westbound passing lane
188	East	US 34 at 127th Ave
189	West	US 34 at 127th Ave
190	West	US 34 at beginning of westbound passing lane
191	North	135th Trail
192	West	US 34 at 135th Trail
193	East	US 34 at 135th Trail
194	East	Guardrail at White Breast Creek Twin RCB
195	East	Guardrail at White Breast Creek Twin RCB
196	West	White Breast Creek Twin RCB

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
197	East	Stephens State Forest sign
198	East	US 34 at 137th Trail
199	West	US 34 at 137th Trail
200	South	137th Trail
201	West	US 34 at 137th Trail
202	East	US 34 at 137th Trail
203	East	signs
Lucas		
204	East	US 34 west of the US 65 N intersection
205	West	US 34 west of the US 65 N intersection
206	East	US 34 east of the US 65 N intersection
207	East	US 34 east of the US 65 N intersection
208	West	US 34 west of the US 65 N intersection
209	East	US 34 east of the US 65 N intersection
210	North	US 65
211	North	US 65
212	South	US 34 at BNSF Railroad Bridge
213	East	BNSF Railroad Bridge
214	West	US 34 east of the BNSF Railroad Bridge
215	East	signs
216	North	Division St
217	East	US 34 at US 65 S (from northbound left turn/thru lane)
218	West	US 34 at US 65 S (from northbound left turn/thru lane)
219	East	US 34 at US 65 S (from northbound right turn lane)
220	West	US 34 at US 65 S (from northbound right turn lane)

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
221	South	US 65 S
222	West	US 34 at Division St
223	East	US 34 at Division St
Lucas to Chariton		
224	North	160th Ave
225	North	160th Ave RR crossing
226	West	US 34 at 160th Ave
227	East	US 34 at 160th Ave
228	West	Guardrail at White Breast Creek Bridge
229	West	Guardrail at White Breast Creek Bridge
230	West	White Breast Creek Bridge
231	East	US 34 at 167th Ave
232	West	US 34 at 167th Ave
233	East	Guardrail at Stream Bridge
234	East	Guardrail at Stream Bridge
235	West	Stream Bridge
236	West	Guardrail at Stream Bridge
237	West	Guardrail at Stream Bridge
238	East	US 34 at beginning of eastbound passing lane
239	West	US 34 poor pavement
240	West	US 34 at 177th Trail
241	East	US 34 at 177th Trail
242	North	177th Trail
243	North	179th Ave
244	West	US 34 at 179th Ave

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
245	East	US 34 at 179th Ave
246	West	US 34 at 185th Trail
247	East	US 34 at 185th Trail
248	North	185th Trail
249	North	190th Ave
250	West	US 34 at 190th Ave
251	East	US 34 at 190th Ave
252	East	US 34 at 480th Ln
253	West	US 34 at 480th Ln
254	South	480th Ln
255	East	US 34 at 200th Ave
256	West	US 34 at 200th Ave
257	North	200th Ave
258	West	US 34 at 200th Ave (from southbound right turn lane)
259	East	US 34 at 200th Ave (from southbound right turn lane)
260	South	200th Ave
261	West	US 34 at 200th Ave (from southbound left turn/thru lane)
262	East	US 34 at 200th Ave (from southbound left turn/thru lane)
263	East	US 34 at 210th Ave
264	West	US 34 at 210th Ave
Chariton		
265	East	Chariton city sign
266	West	US 34 at Country Club Blvd
267	East	US 34 at Country Club Blvd
268	East	Chariton visual trap

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
269	East	US 34 median at Court Ave
270	East	US 34 median at Court Ave
271	West	US 34 at Court Ave (from southbound right turn lane)
272	East	US 34 at Court Ave (from southbound right turn lane)
273	West	US 34 at Court Ave (from southbound left turn lane)
274	East	US 34 at Court Ave (from southbound left turn lane)
275	East	Court Ave at HyVee Rd
276	West	Court Ave at HyVee Rd
277	South	HyVee Rd
278	West	Court Ave at HyVee Rd
279	East	Court Ave at HyVee Rd
280	North	HyVee Rd
281	South	Triple RCB at HyVee Rd
282	East	Court Ave on-ramp to US 34
283	West	Court Ave on-ramp to US 34
284	West	Court Ave on-ramp to US 34
285	West	Court Ave on-ramp to US 34
286	East	Court Ave on-ramp gore to US 34
287	West	US 34 at Court Ave
288	East	Guardrail at Abandoned railroad bike path Bridge
289	West	Guardrail at Abandoned railroad bike path Bridge
290	West	US 34 eastbound exit ramp to IA 14
291	West	IA 14 westbound on ramp to US 34
292	East	US 34 westbound exit ramp to IA 14
293	East	IA 14 eastbound on ramp to US 34

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
294	East	Guardrail at Russell Blvd/BNSF and UP railroads Bridge
295	East	Guardrail at Russell Blvd/BNSF and UP railroads Bridge
296	West	Russell Blvd/BNSF and UP railroads Bridge
297	West	Guardrail at Russell Blvd/BNSF and UP railroads Bridge
298	West	Guardrail at Russell Blvd/BNSF and UP railroads Bridge
299	South	Lincoln Ave
Chariton to Albia		
300	West	US 34 median widening
301	West	US 34 eastbound left turn lane at Albia Rd
302	East	US 34 eastbound lane merge at Albia Rd
303	West	US 34 at Albia Rd
304	East	US 34 at Albia Rd
305	West	US 34 eastbound lane merge at Albia Rd
306	East	US 34 at 472nd Ln
307	West	US 34 at 472nd Ln
308	South	472nd Ln
309	East	Red Haw State Park sign
310	East	US 34 at Red Haw State Park (from northbound left turn lane)
311	West	US 34 at Red Haw State Park (from northbound left turn lane)
312	East	US 34 at Red Haw State Park (from northbound right turn lane)
313	West	US 34 at Red Haw State Park (from northbound right turn lane)
314	South	Red Haw State Park
315	South	Red Haw State Park sign
316	East	Guardrail at City Reservoir Inlet Twin RCB
317	East	Guardrail at City Reservoir Inlet Twin RCB

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
318	East	City Reservoir Inlet Twin RCB
319	West	Guardrail at City Reservoir Inlet Twin RCB
320	West	Guardrail at City Reservoir Inlet Twin RCB
321	East	US 34 at end of westbound passing lane
322	East	US 34 at 260th Ave
323	West	US 34 at 260th Ave
324	South	260th Ave
325	West	US 34 at 265th Trail
326	East	US 34 at 265th Trail
327	South	265th Trail
328	East	Guardrail at Little White Breast Creek Bridge
329	East	Guardrail at Little White Breast Creek Bridge
330	West	Little White Breast Creek Bridge
331	West	Guardrail at Little White Breast Creek Bridge
332	West	Guardrail at Little White Breast Creek Bridge
333	West	US 34 at 265th Ave
334	East	US 34 at 265th Ave
335	North	265th Ave
336	West	US 34 at 277th Ave
337	East	US 34 at 277th Ave
338	North	277th Ave
339	West	US 34 at 280th Ave
340	East	US 34 at 280th Ave
341	North	280th Ave
342	West	US 34 at 280th Ave

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
343	East	US 34 at 280th Ave
344	South	280th Ave
345	West	US 34 at 285th Ave
346	East	US 34 at 285th Ave
347	North	285th Ave
348	East	Russell city sign
349	West	US 34 at 290th Ave/Cedar St (from northbound left turn/thru lane)
350	East	US 34 at 290th Ave/Cedar St (from northbound left turn/thru lane)
351	West	US 34 at 290th Ave/Cedar St (from northbound right turn lane)
352	East	US 34 at 290th Ave/Cedar St (from northbound right turn lane)
353	West	US 34 eastbound left turn lane at 290th Ave/Cedar St
354	West	US 34 at 290th Ave/Cedar St
355	East	US 34 at 290th Ave/Cedar St
356	South	290th Ave/Cedar St
357	East	US 34 westbound left turn lane at 290th Ave/Cedar St
358	East	US 34 at 300th Ave
359	West	US 34 at 300th Ave
360	West	US 34 at 300th Ave
361	East	US 34 at 300th Ave
362	South	300th Ave
363	North	300th Ave
364	North	305th Ave
365	West	US 34 at 305th Ave
366	East	US 34 at 305th Ave
367	North	310th Ave signs

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
368	West	US 34 at 310th Ave
369	East	US 34 at 310th Ave
370	North	310th Ave
371	East	Russell Livestock Market
372	West	US 34 at 320th Ave
373	East	US 34 at 320th Ave
374	North	320th Ave
375	West	US 34 at 320th Ave
376	East	US 34 at 320th Ave
377	South	320th Ave
378	East	US 34 at 325th Ave
379	West	US 34 at 325th Ave
380	North	325th Ave
381	West	US 34 at 325th Ave
382	East	US 34 at 325th Ave
383	South	325th Ave
384	East	US 34 at 330th Ave
385	West	US 34 at 330th Ave
386	North	330th Ave
387	West	US 34 at 330th Ave
388	East	US 34 at 330th Ave
389	South	330th Ave
390	West	US 34 at 337th Trail
391	East	US 34 at 337th Trail
392	North	337th Trail

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
393	West	US 34 at 500th Ave/County Line Rd
394	East	US 34 at 500th Ave/County Line Rd
395	North	500th Ave/County Line Rd
396	West	US 34 at 500th Ave/County Line Rd
397	East	US 34 at 500th Ave/County Line Rd
398	South	500th Ave/County Line Rd
399	West	US 34 at 515th Ave (from southbound right turn lane)
400	East	US 34 at 515th Ave (from southbound right turn lane)
401	East	US 34 at 515th Ave (from southbound left turn lane)
402	West	US 34 at 515th Ave (from southbound left turn lane)
403	North	515th Ave
404	East	US 34 at 520th Ave (from northbound right turn lane)
405	West	US 34 at 520th Ave (from northbound right turn lane)
406	East	US 34 at 520th Ave (from northbound left turn lane)
407	West	US 34 at 520th Ave (from northbound left turn lane)
408	South	520th Ave
409	West	US 34 at 527th Ave
410	East	US 34 at 527th Ave
411	North	527th Ave
412	East	US 34 at 535th Ave
413	West	US 34 at 535th Ave
414	South	535th Ave
415	East	US 34 at 555th Trail/560th Ave
416	West	US 34 at 555th Trail/560th Ave
417	North	555th Trail/560th Ave

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
418	West	US 34 at 555th Trail/560th Ave
419	East	US 34 at 555th Trail/560th Ave
420	South	555th Trail/560th Ave
421	East	Cable guardrail near riprap embankment at MP 159.5
422	East	Cable guardrail near riprap embankment at MP 159.5
423	South	Riprap embankment at MP 159.5
424	West	Cable guardrail near riprap embankment at MP 159.5
425	West	Cable guardrail near riprap embankment at MP 159.5
426	West	US 34 at 574th Ave
427	East	US 34 at 574th Ave
428	North	574th Ave
429	East	US 34 at 579th Ave
430	West	US 34 at 579th Ave
431	South	579th Ave
432	West	US 34 at 197th Trail (W)
433	East	US 34 at 197th Trail (W)
434	North	197th Trail (W)
435	West	US 34 at 595th Ave
436	East	US 34 at 595th Ave
437	North	595th Ave
438	West	US 34 at 595th Ave
439	East	US 34 at 595th Ave
440	South	595th Ave
441	East	Cable guardrail near riprap embankment at MP 162.6
442	North	Riprap embankment at MP 162.6

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
443	West	US 34 at 197th Trail (E)
444	East	US 34 at 197th Trail (E)
445	North	197th Trail (E)
446	East	US 34 at 210th Trail
447	West	US 34 at 210th Trail
448	North	210th Trail
449	West	US 34 at 210th Trail
450	East	US 34 at 210th Trail
451	North	210th Trail
452	South	210th Trail
453	East	Guardrail at BNSF Railroad Bridge
454	East	Guardrail at BNSF Railroad Bridge
455	West	BNSF Railroad Bridge
456	West	Guardrail at BNSF Railroad Bridge
457	West	Guardrail at BNSF Railroad Bridge
458	East	Guardrail at Cedar Creek Bridge
459	East	Guardrail at Cedar Creek Bridge
460	West	Cedar Creek Bridge
461	West	Guardrail at Cedar Creek Bridge
462	West	Guardrail at Cedar Creek Bridge
463	West	US 34 at 610th Ave
464	East	US 34 at 610th Ave
465	South	610th Ave
466	East	US 34 at 204th Trail (W)
467	West	US 34 at 204th Trail (W)

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
468	South	204th Trail (W)
469	East	Cable guardrail near riprap embankment at MP 165
470	North	Riprap embankment at MP 165
471	East	Cable guardrail near riprap embankment at MP 165
472	West	US 34 at 625th Ave
473	East	US 34 at 625th Ave
474	North	625th Ave
475	East	US 34 at 204th Trail (E)
476	West	US 34 at 204th Trail (E)
477	South	204th Trail (E)
478	East	US 34 at 196th St
479	West	US 34 at 196th St
480	North	196th St
481	West	US 34 at 196th St
482	East	US 34 at 196th St
483	South	196th St
484	East	Guardrail at Coal Creek Bridge
485	East	Guardrail at Coal Creek Bridge
486	West	Coal Creek Bridge
487	West	Guardrail at Coal Creek Bridge
488	West	Guardrail at Coal Creek Bridge
489	East	US 34 at 206th Pl
490	West	US 34 at 206th Pl
491	South	206th Pl
492	West	US 34 at 642nd Ave

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
493	East	US 34 at 642nd Ave
494	North	642nd Ave
495	East	Buggy sign
Albia		
496	East	Albia city sign
497	East	US 34 at S C St
498	West	US 34 at S C St
499	North	S C St
500	East	US 34 at S C St
501	West	US 34 at S C St
502	South	S C St
503	East	US 34 at IA 5/S Clinton St
504	North	IA 5/S Clinton St
505	West	US 34 at IA 5/S Clinton St
506	South	IA 5/S Clinton St
507	North	IA 5/S Clinton St
508	West	US 34 at IA 5/S Clinton St
509	East	Guardrail at RR crossing
510	West	Guardrail at RR crossing
511	East	US 34 at S Main St
512	West	US 34 at S Main St
513	North	S Main St
514	West	US 34 at S Main St
515	East	US 34 at S Main St
516	South	S Main St

Table B1. Index of Windshield Survey Photographs

Picture No.	Direction Taken	Description
517	East	US 34 at S Florence St
518	West	US 34 at S Florence St
519	North	S Florence St
520	West	US 34 at S Florence St
521	East	US 34 at S Florence St
522	South	S Florence St
523	East	US 34 at S 13 St/S 201st St
524	West	US 34 at S 13 St/S 201st St
525	North	S 13 St/S 201st St
526	East	US 34 at S 13 St/S 201st St
527	West	US 34 at S 13 St/S 201st St
528	South	S 13 St/S 201st St
529	West	US 34 at end of westbound passing lane
530	East	US 34 at end of the Study

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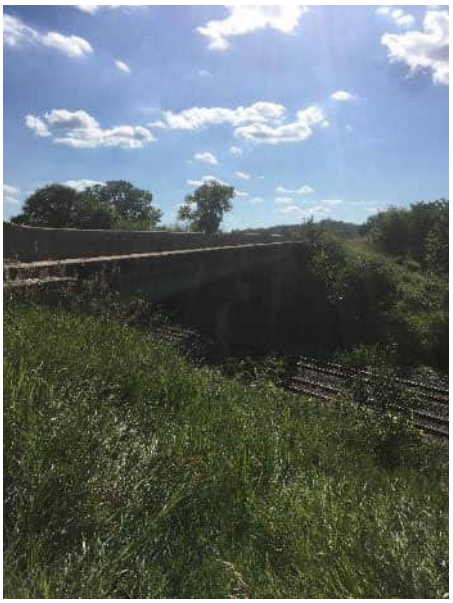

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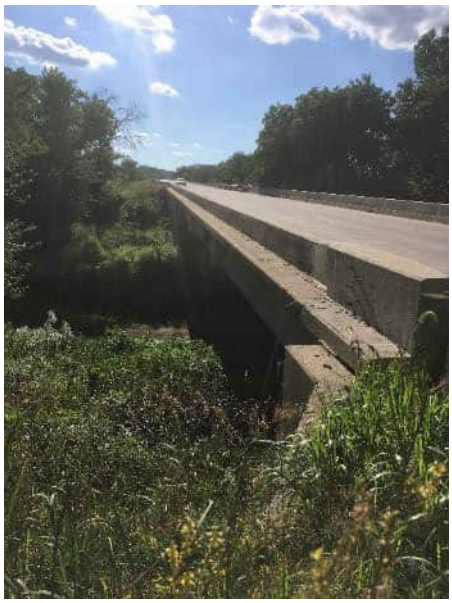

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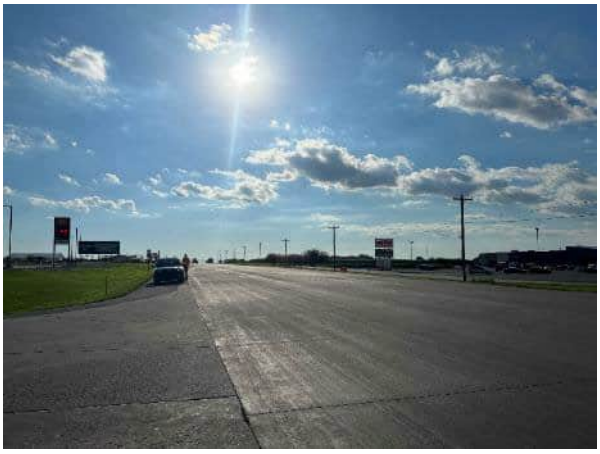

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