K-113

Seth Child Road

CORRIDOR MANAGEMENT PLAN

MARCH 2019

PREPARED FOR:
CITY OF MANHATTAN
RILEY COUNTY
KANSAS DEPARTMENT OF TRANSPORTATION

MANHATTAN PROJECT NO. ST 1507, CIP#BN090P
KDOT PROJECT NO. 113-81 KA-4423-01

benesch

in partnership with:

gouldevans GCA RCA

MRIGlobal CAMBRIDGE SYSTEMATICS

ACKNOWLEDGMENTS

Partner Agencies

City of Manhattan
Riley County
Kansas Department of Transportation
Flint Hills MPO
Flint Hills ATA

Elected Officials

City of Manhattan

Linda Morse, Mayor
Mike Dodson, Commissioner
Usha Reddi, Commissioner
Jerred McKee, Commissioner
Wynn Butler, Commissioner

Riley County

Marvin Rodriguez, Commissioner
Ben Wilson, Commissioner
Ron Wells, Commissioner

Steering Committee

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David Adams, Riley County EMS
Deb Nuss, Manhattan Urban Area Planning Board
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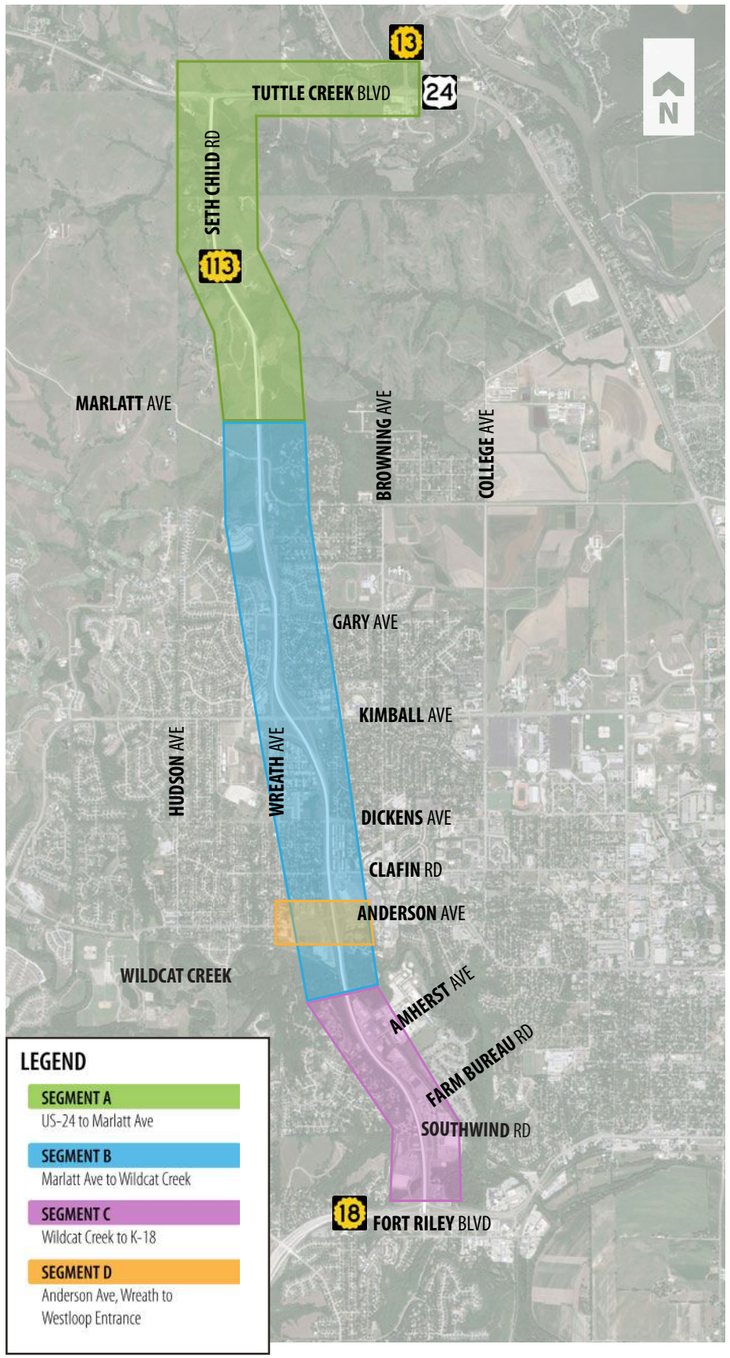
EXHIBIT ES.A | STUDY SEGMENT MAP



Introduction

Seth Child Road (K-113) is a state highway and major arterial located in Riley County and the western portion of Manhattan, Kansas. The corridor within the City is a four-lane rural section; a two-lane rural section is located within the County. With traffic volumes increasing and some locations, like Anderson Avenue, experiencing declining levels of service (LOS), both the City and the County along with the Kansas Department of Transportation (KDOT) recognized the need for long-range planning to ensure this important corridor will operate effectively into the future. In addition to the five-mile corridor between K-18 and US-24, the intersection of US-24 with K-13 was also studied.

A consulting team led by Alfred Benesch and Company (Benesch) was tasked with evaluating the corridor and making recommendations for long-term improvements. In addition to traffic analysis, public engagement was also performed by the team. Market and future land use analysis were provided by Rich Caplan and Associates and Gould Evans, respectively. Safety analysis was performed by MRIGlobal and updates to the travel demand model (TDM) were provided by Cambridge Systematics. Finally, pedestrian and bicycle facility evaluation was performed by GCA.

The goal of the study was to evaluate the Corridor for future traffic conditions and create a series of recommended improvements that could be phased in over time and position the Corridor to accommodate future growth.

The project limits for the 5.5 mile corridor extends from the north terminal of the K-113 interchange with K-18 to its intersection with US Highway 24 (US-24). In addition, the intersection of US-24 and K-13 was studied, as was Anderson Avenue, from Wreath Avenue to the signalized entrance of the Westloop Shopping Center. To better analyze the various improvement factors, the corridor was broken down into four segments representing different roadway sections, traffic, and development types. These segments are shown graphically in Exhibit ES.A to the left. Segment A is bound by US-24 on the north and Marlatt Avenue on the south and includes the intersection of K-13 and US-24. Segment B is defined by Marlatt Avenue on the north and the Wildcat Creek crossing at the south end. From south of Wildcat Creek through the K-18 interchange is Segment C. Finally, Segment D is Anderson Avenue from Wreath Avenue to West Loop traffic signal.

Traffic data was collected in 2017 at strategic locations along the corridor utilizing traffic analysis software to project data for design year 2040. In addition, crash data from the City, County and KDOT was used to evaluate safety. Consideration was given to existing conditions, 2040 No-Build scenario and comparison of potential alternatives.

Public Engagement

Gauging the public's perception and vision for the corridor was an important benchmark for success. This was achieved through the use of a steering committee which received study updates and offered input regarding its progress and direction. Members of the committee included representatives from the City of Manhattan's staff and Governing Body, Riley County staff, KDOT, Flint Hills Metropolitan Planning Organization (FHMPO), and Flint Hills Area Transportation Agency (ATA).

A Citizen's Advisory Committee was also established to provide further perspective. Members of this committee included representatives from the Manhattan School District, emergency services, Kansas State University, the business community, and area neighborhoods. This committee reviewed study updates and provided feedback as the study proceeded.

For the public at large, three methods of engagement were employed: public meetings, surveys, and a project website. These methods provided anecdotal information on perceived issues and desires of the community. Public feedback included enhanced aesthetics, improved signage and lighting, better pedestrian and bicycle connectivity, safer crossings of Seth Child Road, and more efficient left turning movements. More shopping, dining and family-oriented spaces were among the additional comments received.

EXECUTIVE SUMMARY

Market Analysis

The economic impact of the Seth Child Corridor was evaluated with different growth scenarios. Based on 2017 data, just under $5 million in property tax revenue was collected from property along the corridor where 2,085 persons were employed. Just over $14 million in sales tax revenue was generated by four taxing entities: the City, County, School District and State of Kansas. The Corridor's Annual Economic Impact was estimated to be approximately $19 million.

Three development growth scenarios were evaluated: high, medium and low growth. The low growth scenario represents the "Do Nothing" or "No Build" alternative. It results in a rise in annual economic impact of $15.3 million. Enhanced signage, landscaping upgrades, improved interchanges emphasizing free flow of vehicular traffic and few enhancements for bicycles and pedestrians represents the medium growth scenario. By the year 2040, the economic impacts for this scenario are estimated to increase by $25.4 million. The high growth scenario includes at-grade intersections with pedestrian enhancements to promote more walkability within the Corridor. It is anticipated that this scenario would promote redevelopment and new mixed-use development resulting in an increase in annual economic impact of $40.5 million in 2040.

Land Use Analysis

Utilizing the three growth scenarios described above, future land use was evaluated for various Corridor segments. Segment A, which is primarily located in the County, has limited development presently with that trend expected to continue into the future. The expected primary opportunity remains the rural, large-lot residential development pattern. For segments B and C, the expected development is projected to be more residential and commercial in nature. Infill and renovations along with re-tenanting of retail and office space are anticipated to contribute to this growth. Table ES.1 provides a summary of the estimated development growth scenarios. Residential growth is estimated to vary from 10 dwelling units for the "Low Growth" scenario to approximately 187 dwelling units for the "High Growth" scenario. Similarly, the amount of retail and office space is expected to experience a growth of 74,900 sq. ft. for the "Low Growth" scenario to 176,100 sq. ft. for the "High Growth" scenario.

TABLE ES.1 FUTURE LAND USE SUMMARY

Low Growth	Segment A		Segment B		Segment C	
	# of Units	Acres	# of Units	Acres	# of Units	Acres
Single Family Residential	4	1	2	.5	4	1
Multi-Family Residential	0	-	0	-	0	-
	Sq. Ft.	Acres	Sq. Ft.	Acres	Sq. Ft.	Acres
Retail	0	-	28,000	-	24,500	2.25
Office	5,000	0.46	10,500	0.96	6,000	0.55
Medium Growth	**Segment A**		**Segment B**		**Segment C**	
	# of Units	Acres	# of Units	Acres	# of Units	Acres
Single Family Residential	5	-	4	1	7	-
Multi-Family Residential	0	-	60	5	0	-
	Sq. Ft.	Acres	Sq. Ft.	Acres	Sq. Ft.	Acres
Retail	0	-	49,400	4.54	30,100	2.76
Office	5,000	0.46	10,500	0.96	7,000	0.64
High Growth	**Segment A**		**Segment B**		**Segment C**	
	# of Units	Acres	# of Units	Acres	# of Units	Acres
Single Family Residential	7	-	6	1.5	9	2.25
Multi-Family Residential	0	-	120	10	45	3.75
	Sq. Ft.	Acres	Sq. Ft.	Acres	Sq. Ft.	Acres
Retail	0	-	65,300	6	59,500	5.46
Office	5,000	0.46	25,500	2.34	20,800	1.91

Traffic Analysis Summary

Intersections and other corridor elements within each segment were analyzed with existing geometry and traffic control using Synchro and Sim Traffic simulation software. Intersections were evaluated assuming an acceptable level of service for the overall intersection is LOS D. The acceptable level of service for an individual turn movement is LOS E.

Table ES-2 summarizes the intersections on K-113 that do not meet acceptable LOS for existing 2017 volumes nor those projected for 2040 for the overall intersections.

TABLE ES.2 INTERSECTION WITH LOS CONCERNS (2017 AND 2040 NO BUILD)

	2017			2040		
	D	E	F	D	E	F
US-24 / Seth Child Road (K-113) #	PM	-	-		AM	PM
US-24 / Seth Child Road (K-13) #	-	-	-	AM, PM	-	-
Marlatt / Seth Child Road (K-113) #	-	-	-	-	-	AM, PM
KFB Plaza-Leadership Lane / Seth Child Road (K-113) #	-	-	-	-	-	PM
Gary / Seth Child Road (K-113) #	-	-	AM, PM	-	-	AM, PM
Dickens / Seth Child Road (K-113) #	-	-	AM, PM	-	-	AM, PM
Claflin / Seth Child Road (K-113)	PM	-	-	AM, PM	-	-
Anderson / SB Seth Child Road (K-113) Ramp	PM	-	-	PM	AM	-
Anderson / NB Seth Child Road (K-113)	-	-	PM	-	-	PM
Southwind / Seth Child Road (K-113)	PM	-	-	PM	-	-

Unsignalized intersections reported the side road level of service

In general, Segment B, which includes the Anderson Avenue interchange, has the majority of LOS issues. This is attributed to the proximity of the intersections relative to each other as well as geometrics and traffic control. It should also be noted that the ramps at Anderson Avenue have significant vehicle queuing issues that exacerbate the challenges at this location. As traffic volumes grow, additional LOS issues occur in Segment A which includes Marlatt Avenue and the intersections with US-24.

The safety analysis revealed a crash history within the study area of 403 crashes from 2012 to 2015. Forecasts for the 20-year crash frequency (2020 to 2039) estimate 2,414 crashes if no Corridor improvements are made. In addition to Anderson Avenue, the following intersections are identified as needing evaluation for potential improvements to mitigate crashes:

- US-24/K-13
- Anderson Avenue/NB K-113 Ramp Terminal
- Southwind Road/Seth Child Road (K-113)
- Amherst Avenue/Seth Child Road (K-113)
- Claflin Road/Wreath Avenue
- Claflin Road/Browning Avenue
- Claflin Road/Seth Child Road (K-113)
- Marlatt Avenue/Seth Child Road (K-113)

Alternative Development and Evaluation

With input from stakeholders, including the Citizen's Advisory and Steering Committees, alternative evaluation criteria were established with respect to engineering performance, stakeholder acceptance, and cost. Initially, each intersection was evaluated as an independent node. The Corridor was then examined as a whole system.

TABLE ES.4 EVALUATION CRITERIA

Performance	Acceptance
Accommodate Future Capacity	Promote Corridor
Relieve Congestion	Promote Multi-Modal
Safeguard Users	Facilitate Development
Efficient Bike & Pedestrian Movement	Minimize R/W Impacts
Efficient Vehicular Movement	Improve Aesthetics

Alternatives considered included several interchange configurations including Diverging Diamond, Single Point Urban Interchanges, and traditional Diamond Interchanges. Also considered were at-grade intersections including traffic signals and roundabouts. Matrix analysis was performed for each corridor intersection using evaluation described in Section 6 for performance, acceptance, and cost. After the alternatives were ranked for individual intersections the overall corridor was evaluated. As a result, an ultimate improvement scenario utilizing at-grade intersections and a landscaped median is recommended for the Seth Child Road (K-113) Corridor. This scenario results in improved level of service throughout the corridor, overall crash reduction, better accommodation of bicycles and pedestrians, improved aesthetics, a sense of identity and place for the corridor, and maximize the opportunity for growth and development growth. Table ES.3 summarized the overall corridor improvement recommendations along with a proposed plan to implement the modifications to the Corridor.

ECONOMIC IMPACT OF SETH CHILD ROAD INVESTMENT

The estimated reconstruction cost of $64.9 million in Seth Child Road (K-113) investment is projected to yield the following annual economic benefits:

- **Generate nearly $320 million in additional economic output;**
- **Grow state sales tax revenues by $2.3 million;**
- **Grow city and county sales tax revenues by $365,000;**
- **Support or create an additional 90 direct jobs throughout the economy.**

Additional indirect jobs will also be generated.

TABLE ES.3 SETH CHILD ROAD RECOMMENDATIONS AND PHASING

Implementation Priority	Location	Segment	Corridor Recommendation	Cost
1	US-24 and Seth Child Road (K-113)	Segment A	Single Lane Roundabout	$1.9 Million
2	US-24 and K-13	Segment A	Single Lane Roundabout	$1.5 Million
3A	Anderson Ave & Seth Child Rd (K-113)	Segment B	At-Grade Signalized Intersection	$8.6 Million
3B	Claflin Rd and Seth Child Rd (K-113)	Segment B	Incorporate with Seth Child and Anderson Improvements. Maintain Traffic Signal	$4.5 Million
3C	Anderson Ave (Wreath to Seth Child Rd)	Segment B	Access Management, Maintain Signal and EB/WB Left-turn Lanes at Wreath	$1.9 Million
4A	Southwind Rd and Seth Child Rd (K-113)	Segment C	Maintain At-Grade Traffic Signal, Add NB/SB Dual Left-turn Lanes, 6-Lane Urban Roadway Section	$4.8 Million
4B	Farm Bureau Rd and Seth Child Rd (K-113)	Segment C	Maintain At-Grade Traffic Signal, 6-Lane Urban Roadway Section	$3.5 Million
4C	Amherst Ave and Seth Child Rd (K-113)	Segment C	Maintain At-Grade Traffic Signal, 6-Lane Urban Roadway Section	$5.9 Million
4D	Wild Cat Creek Bridge on Seth Child Rd (K-113)	Segment C	Wildcat Creek Bridge for 6-Lane Urban Roadway Section	$6.0 Million
5	Marlatt Ave and Seth Child Rd (K-113)	Segment B	At Grade Roundabout	$4.5 Million
6	Kimball Ave and Seth Child Rd (K-113)	Segment B	At Grade Signal	$8.0 Million
7	Seth Child Rd (K-113) Claflin to Kimball	Segment B	At Grade Intersections with 6 Lane Urban Roadway Section, Gary Ave & Leadership Lane	$3.3 Million
8	Seth Child Rd (K-113) Kimball to Marlatt	Segment B	At Grade Intersections with Right In/Right Out or 3/4 Access at Gary Ave. and Leadership Lane	$7.8 Million
9	Seth Child Rd (K-113) Marlatt to US-24	Segment A	2-Lane Rural Section, Turn Lanes As Warranted	$2.7 Million
Total Corridor Improvement Cost			**(2017 Dollars)**	**$64.9 Million**

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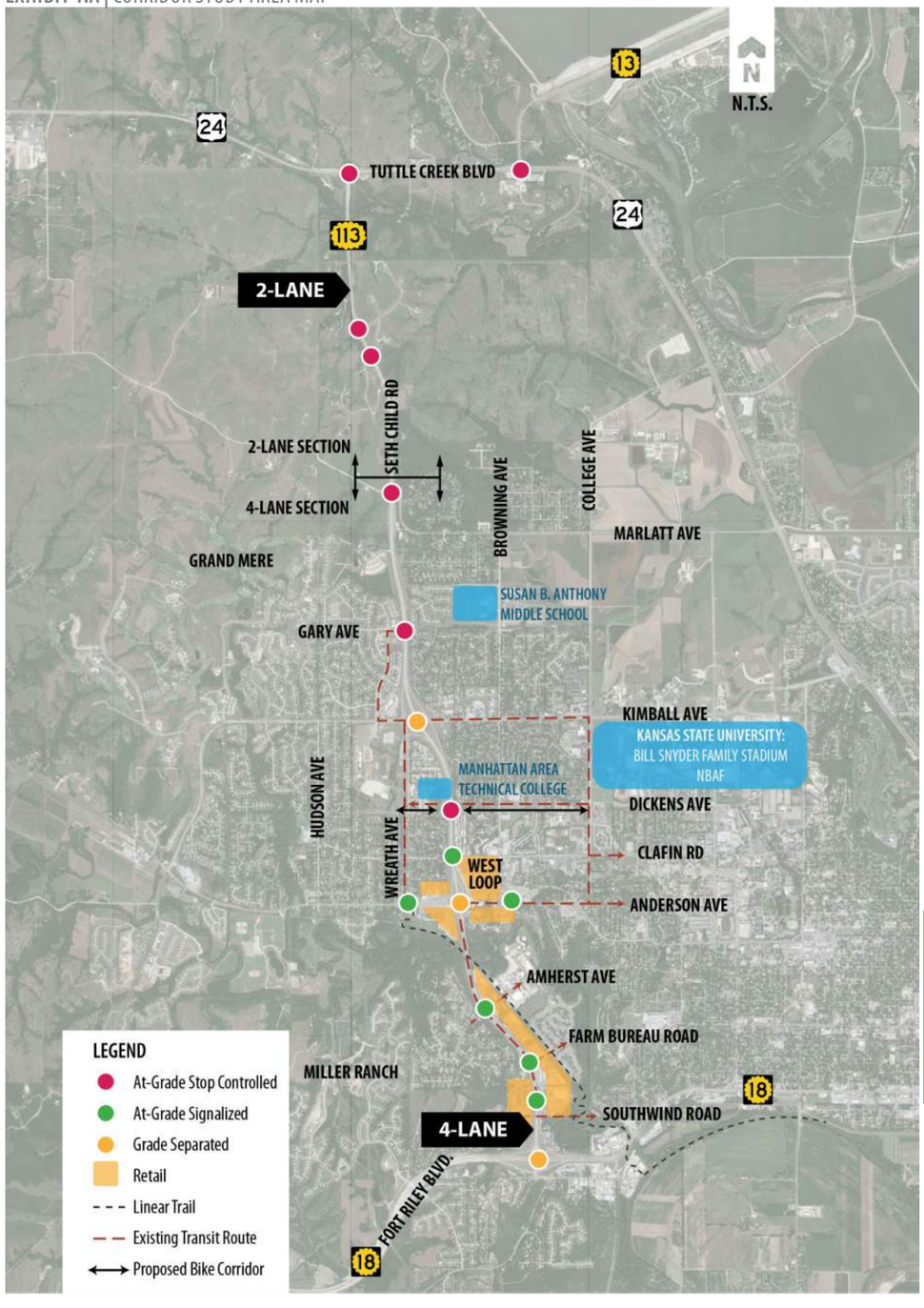
EXHIBIT 1.A | CORRIDOR STUDY AREA MAP



For years, Seth Child Road (K-113) has served as a vital north-south corridor for the western edge of Manhattan. Local traffic has benefited from its connectivity with Kimball Avenue, Anderson Avenue and Fort Riley Boulevard (K-18) while serving highway traffic as a main connection between K-18 and US-24 (Tuttle Creek Blvd).

This corridor has facilitated City and County growth over the last few decades. Development has occurred with commercial retail centers near the intersections of Southwind Road, Farm Bureau and Amherst Avenue. The Westloop Shopping area along Anderson Avenue has redefined itself several times, maintaining a thriving retail center.

Kansas State University, a significant employer and member of the Manhattan community, continues to expand along Kimball Avenue, most recently with the National Bio and Agro-Defense Facility (NBAF). Residential development continues to march westward. Miller Ranch and Grand Mere developments are two residential catalysts contributing to housing market growth. With new homes planned northwest of the corridor and continued growth of Kansas State University's campus, the community's future is bright assuming projected impacts to the existing street network, specifically Seth Child Road, are effectively addressed.

In recognizing the need to apply transportation planning efforts to the corridor, the City of Manhattan, Riley County and the Kansas Department of Transportation (KDOT) partnered to fund this Seth Child Road study. As corridor developed over the years, a variety of intersection types were implemented including at-grade traffic signals and stop controlled intersections as well as grade separated interchanges. This intersection dissimilarity complicates the existing and future functionality of the corridor. For that reason, the City, County and KDOT came together to develop a comprehensive plan to encourage and manage growth along Seth Child Road. Alfred Benesch & Company (Benesch) was hired to lead a team to identify existing issues, project future conditions and create a Corridor vision for the next twenty years and beyond. Benesch, with its partners Gould Evans, Rich Caplan & Associates, MRI Global, Cambridge Systematics and GCA, Inc, conducted a comprehensive evaluation of the corridor system. Traffic operations, public engagement, future land use planning, economic analysis, bicycle and pedestrian facilities and transit were all considered. The result is a series of Corridor improvements that can be implemented as standalone projects while maintaining a well-planned, functioning transportation system that meets community stakeholders' expectations.

The Corridor is defined, for the purpose of this study, as beginning at the north side of the K-18 interchange with Seth Child Road (K-113) extending northward to the existing at-grade intersection with US-24. The intersection of US-24 with K-13, at the north end, was included in the study as was Anderson Avenue between Wreath Avenue to the West Loop Shopping Center. Exhibit 1.A illustrates the corridor study intersections and area information.

The project team utilized public engagement, traffic analysis, and value planning techniques to evaluate the Corridor and develop planning recommendations. Through a collaborative process which included stakeholder input, the study identified and assessed existing and future conditions based on transportation performance, stakeholder acceptance, and cost. The result is a list of improvements to facilitate a vision for the Seth Child Road Corridor over the next 20 years and beyond.

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PUBLIC INVOLVEMENT PURPOSE & PROCESS

The objectives of the communications and public participation effort for the project were to efficiently and effectively inform, encourage input and collaboratively work with relevant stakeholders and the general public. A Steering Committee and Citizen's Advisory Committee were both implemented to provide transparency in the project and to encourage input and collaboration of community members. Three Committee Meetings and two Public Information Meetings were held during the study.

STEERING COMMITTEE

Project owners, high-level stakeholders and relevant experts came together to form a Steering Committee which fully participated in the workshop and meetings, including Citizen's Advisory Committee meetings. Members provided substantive information and advice for making project-level decisions. In addition, they shared guidance on issues related to their areas of expertise. Table 2.A lists members of the Steering Committee.

CITIZEN'S ADVISORY COMMITTEE MEETING | APRIL 2017

TABLE 2.A | STEERING COMMITTEE MEMBERS

Name	Agency
Rob Ott	City of Manhattan
Brian Johnson	City of Manhattan
Mark Lee	City of Manhattan
Mike Dodson	City of Manhattan
Chad Bunger	City of Manhattan
John Adam	City of Manhattan
Jason Hilgers	City of Manhattan
Kiel Mangus	City of Manhattan
Ron Fehr	City of Manhattan
Leon Hobson	Riley County
Gary Rosewicz	Riley County
Nelda Buckley	KDOT
Mark Karolevitz	KDOT
Stephanie Peterson	Flint Hills MPO
Jared Tremblay	Flint Hills MPO
Anne Smith	Flint Hills ATA

CITIZEN'S ADVISORY COMMITTEE

Citizen's Advisory Committee was assembled with selectively invited members who reflected a broad range of Corridor interests. Member roles were clarified at the outset, with the expectation that selected members would personally attend each and every session. The role of this advisory group was to fully participate in committee meetings and provide meaningful information and advice to the consulting team and decision makers. Members communicated with their constituencies to advance understanding of the Corridor Study, potential alternatives and ultimate recommendations. Membership was broad-based, representing education, business, neighborhood and civic groups. Members served as important links to the community, reflecting the concerns and issues of various stakeholders and the general public. They provided the perspective of citizens who live, work and travel along the Corridor. Table 2.B lists members of the Citizen's Advisory Committee.

TABLE 2.B | CITIZEN'S ADVISORY COMMITTEE MEMBERS

Name	Organization
Andrea Adams	Manhattan-Ogden 383
Brad Kesl	Westar
Brenda Schneider	The Master Teacher
David Adams	Riley County EMS
Deb Nuss	Manhattan Urban Area Planning Board
Ed Klimek	Kansas State Bank
Greg Lund	Riley County Parks
Keith Zachariasen	Manhattan Area Technical College
Mark Samarrai	S&S Development
Marvin Rodriguez	Riley County Commissioner
Megan Rohr	McCullough Dev.
Oscar Ruiz	Kansas State University | KSUPD
Pat Collins	Riley County Fire Department
Rich Seidler	Commercial Real Estate Services
Richard Fink	Riley County Police Department
Ryan Almes	Manhattan Fire Department
Terry Holdren	Kansas Farm Bureau
Tiffani Lara	Redbud Estates
Trent Armbrust	Manhattan Chamber of Commerce
Wes Buckley	Lane4 Property Group

2 | PUBLIC INVOLVEMENT

PROJECT WEBSITE

Public involvement was facilitated by a website—www.SethChildRoad.com—which was developed and maintained during the course of the study. Project information and all public meeting materials were uploaded onto the website. It also served as a mode for gaining public comment with a "Contact Us" page and link to the survey.

SURVEY

A survey was developed to capture a range of perceptions and issues related to the Seth Child Road Corridor. That survey was available electronically at www.SethChildRoad.com and on tablets at the April 2017 Public Open House. Paper copies of the survey were distributed at the Open House in addition to distribution of the link and paper surveys by Committee Members. A total of 150 surveys were completed and returned. Most respondents indicated that they travel on Seth Child Road multiple times each day and live, work or commute along the Corridor. In general, the public values amenities along the Corridor but would like to see more shopping, dining and family-oriented spaces. Other public comments requested enhanced aesthetics along the Corridor, improved signage and lighting and better pedestrian and bicycle connectivity with safer routes to cross Seth Child Road. Drivers also asked for improvements along the Corridor, specifically left-tun movements and safer crossing of Seth Child Road. Exhibits 2.A and 2.B provide a summary of survey quotes and findings. Full survey results and public comments can be found in Appendix K.

EXHIBIT 2.A | SURVEY QUOTES

> "Lack of consistency for out-of-towners. It's difficult to navigate a new place if there's a different kind of intersection at every street."

> "Landscaping. Seth Child Road is ugly, looking at the backs of buildings in many cases. Also, very auto dominated and pedestrian unfriendly."

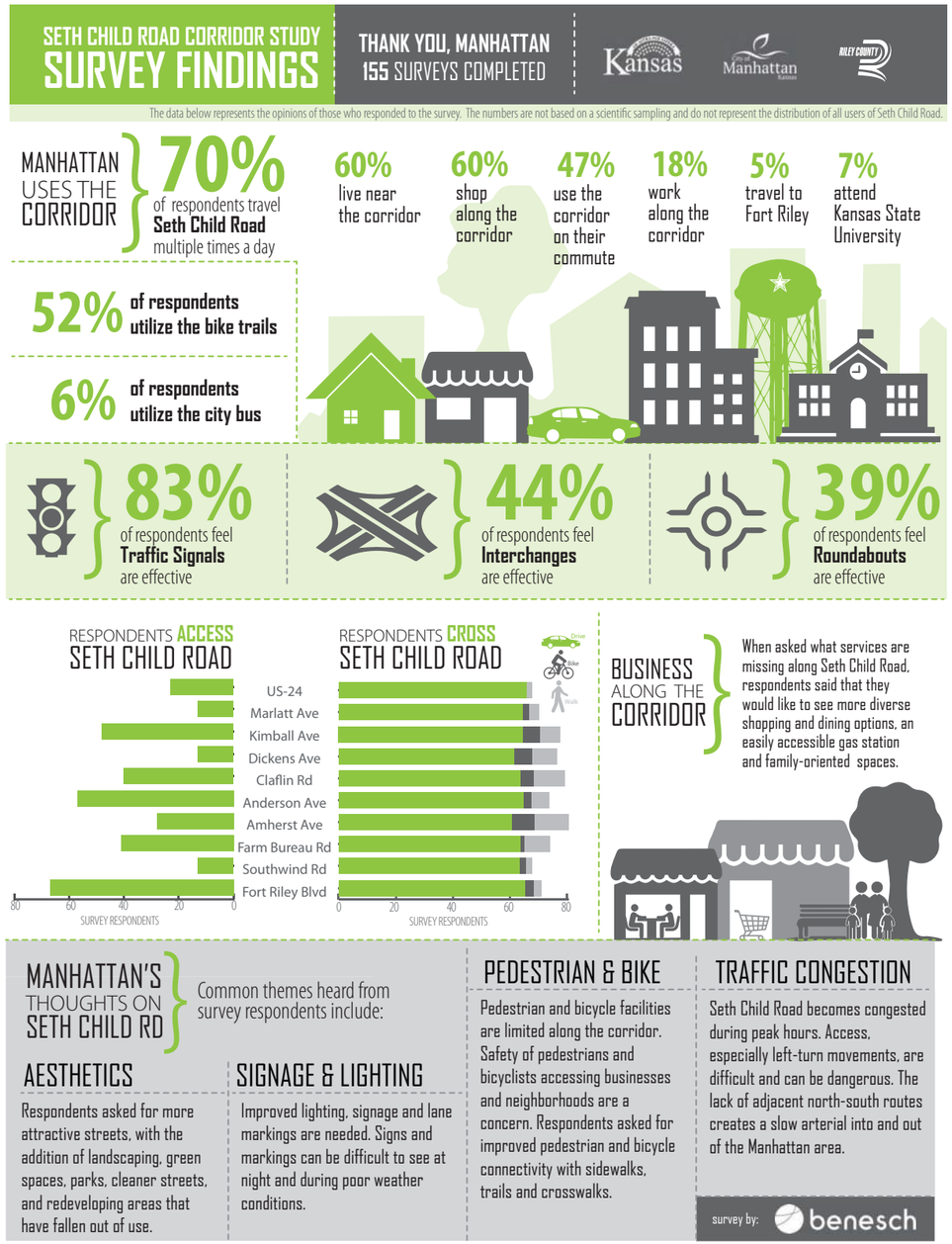
> "If the area to the southwest of Anderson and Seth Child Road was redeveloped, I could see the need for a single controlled access intersection such as a traffic light, maybe at Waters Street."

> "Additional restaurants and grocery options along this Corridor would be beneficial. Redeveloping Anderson from Seth Child Road to Wreath is an opportunity."

> "Intersection at Dickens is heavy and hard to turn across traffic when getting into Seth Child Road turning left from Dickens."

> "There needs to be more bike and pedestrian friendly ways to deal with the Seth Child Road at major intersections, such as the Kimball/Wreath interchange, and the intersections with Claflin and Anderson. In general it would be nice if the west side of town was more bike accessible."

EXHIBIT 2.B | SURVEY FINDINGS



MEETINGS

Three Steering Committee Meetings, including a Value Planning Workshop, were held to report study progress and gather substantive information and advice for making project-level decisions. Throughout the span of the study, members contributed guidance on issues related to their areas of expertise. An agenda created prior to meetings kept each session organized. One of those meetings functioned as a workshop during which the committee helped verify existing conditions and project needs, speculate on solutions, evaluate various alternatives and provide recommendations.

The three Citizen Advisory Committee Meetings were held on the same days as Steering Committee Meetings to facilitate reporting on study progress and exchanging substantive information and advice for the consulting team and decision makers. The group's purpose, composition, leadership, meeting frequency, roles and responsibilities and decision making process were defined in the invitation. Group members brought comments, concerns and ideas heard from the public to each meeting and shared information from the meetings with the public sector they each represented. Committee meetings were held in April, June and September of 2017.

Two Public Meetings were held throughout the course of the study as well. The first, held in April 2017, introduced the project and initiated public input. Large scroll maps were available for to solicit comments as well as map markings to visually indicate areas of importance. The survey, comment forms and engagement with the project team were also part of this meeting. The second Public Meeting was held in January 2018 at which recommended alternatives were presented, followed by an Open House with project team representatives answering questions and receiving input. Most attendees agreed with the need for improvements to Seth Child Road. They were curious about potential modifications and interested in the process to determine recommended alternatives. Once explained, the general response was positive.

Following the January 2018 Public Meeting, the project team presented its findings to the January 2018 City and County Commission meetings.

JUNE 7, 2017

SEPTEMBER 28, 2017

APRIL 13, 2017

JANUARY 10, 2018

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LAND USE PLANNING

The City of Manhattan and Riley County have recently completed Comprehensive Plan updates to guide future development within their communities. At the heart of each plan are identified future needs and desires of their constituents as it pertains to the community vision. The plans have also identified goals and objectives necessary to implement these visions effectively and efficiently. Goals and objectives provide the framework in which decisions about future growth and development are made, including those that could have a bearing on the development and redevelopment of the Seth Child Road Corridor. Below are the relevant documents which were referenced to identify the vision and objectives each community is striving to accomplish. Additional details from each document are available and will influence discussions regarding the future of the Seth Child Road Corridor.

MANHATTAN URBAN AREA COMPREHENSIVE PLAN

The Manhattan Area Comprehensive Plan is organized around its vision and objectives, identifying additional principles, goals and policies for the implementation of each objective topic. Each objective identified will impact the continued development and redevelopment of the Seth Child Road Corridor.

Growth Vision: An economically vital community providing attractive growth opportunities to local, national, and global companies; diverse employment and affordable housing options; and robust quality of life programs to serve the Manhattan Urban Area. A caring community offering quality education; equal opportunities to seek a higher quality of life; and a community which recognizes the importance of conserving and enhancing its natural, historic, and cultural resources.

Plan Objectives:

- A Coordinated and Efficient Pattern of Growth.
- Preserve and Enhance Natural Resources and Promote Resiliency.
- Efficient Use and Expansion of Public Facilities and Services.
- Active Community Involvement and Regional Cooperation.
- A Balanced Multi-Modal Transportation System.
- Healthy, Livable Neighborhoods Offering a Variety of Lifestyle Options.
- An Active Community Recognized for its Quality of Life and Strong Sense of Place.
- A Strong, Diversified Economic Base.

VISION 2025 – A COMPREHENSIVE PLAN FOR RILEY COUNTY

Vision 2025 documents an agreed upon plan for future development within Riley County, including the desired transportation system and public facility enhancements related to public feedback. The County's plan is founded on three fundamental principles: agricultural preservation, resource protection and maintaining the rural character of the community. The vision and goals of the County are different than that of the City of Manhattan, in many respects, as they should be. However, there is alignment in many of the desired development attributes for both, including a desire for efficient growth, quality development and protection of sensitive areas and natural resources.

While the comprehensive plans may not be aligned on all issues affecting growth and development, the coordination of the City and County will be necessary to adequately address future growth and development within the Seth Child Road Corridor.

Vision: In the Year 2025, Riley County is a place where:

- Agricultural land is preserved.
- The rural character and heritage is preserved.
- Development is managed in a way that complements and enhances our County's character.
- Minimal government intervention balances regulation with incentives to direct development.
- A diverse and stable economy provides economic opportunities for all County citizens.
- Conservation of natural resources is valued.
- Downtown and main street revitalization efforts are encouraged.

Goals:

- To preserve and enhance the efficient utilization of rural land for agricultural purposes.
- To promote development that is compatible with the rural character of Riley County.
- To ensure development occurs in a manner which is respectful of the county's environment and natural resources.
- To allow for the development of a diversity of housing types, sizes and price levels to meet the changing needs of all county residents.
- To allow sufficient areas efficiently distributed throughout the county and adequate opportunity for commercial development.
- To allow sufficient opportunities for industrial development at locations with suitable access, adequate community facilities, site - specific resources and without serious environmental or land use limitations.
- To provide for an easy, efficient and safe vehicular flow throughout the county.
- To ensure the efficient provision and utilization of public facilities and services.
- To direct the majority of future residential growth in the unincorporated area of Riley County to the Manhattan urban area and the designated growth areas indicated on the future land use map.

3 | LAND USE ANALYSIS

Land Use

Land use provides the necessary framework for decision making regarding the future development and redevelopment of a community. Where the "current land use" defines those uses found on a property, the future land use plan provides a general recommendation regarding appropriate future uses. This recommendation is based on the context, transportation network, natural features and other criteria specific to a site or location. Land use should focus on property use as well as development scale, its intensity and adjacent development. Appreciating the surrounding context establishes suitable development patterns unique to community subsets. A FLUP typically defines the most appropriate use of the land, for instance agriculture, residential, commercial or industrial. It is important to address the scale and intensity of development by defining the height, bulk and concentration of development. This helps to ensure compatibility and emphasize the relationship between uses within an area while also facilitating transitions between differing land uses. One such example is the transition from a commercial center to an adjacent neighborhood. Land use provides the needed information to assist in making effective decisions regarding future development.

Zoning

Unlike land use, zoning is a regulatory or legal tool that defines what uses may be developed on a particular piece of property. Zoning also defines site planning elements and how the development on a site is arranged. Topics including building orientation, height, setbacks and density of development assist in defining the design of a particular development. Site plan elements such as parking and landscaping also contribute to the layout of a development location.

Kansas Statutes

Chapter 12, Article 7 of the Kansas State Statutes, which is based on the Standard City Planning Enabling Act of 1924, outlines the provisions for planning and zoning of cities and municipalities across the State. Article12-741 of the Statutes is the enabling legislation for the enactment of planning and zoning laws, as well as and regulations by cities and counties, dictating that planning shall be; "for the protection of the public health, safety and welfare ..." In 1992 the State of Kansas updated section 12-741, but the general intent and powers remain the same.

In Kansas, State Statutes give cities and counties the right to determine the proper use of land within their jurisdiction. Chapter 12, Article 741 of the Kansas State Statutes outlines the provisions for planning and zoning of cities and municipalities, which has seven foundational elements that including:

1) The general location, extent, relationship, and use of land for agriculture, residence, business, industry, recreation, education, public buildings and other community facilities, major utilities (both public and private), and any other use deemed necessary;
2) Population and building intensity standards and restrictions and their application
3) Public facilities including transportation facilities of all types (both public and private) which relate to the transportation of persons or goods
4) Capital improvement programming based on a determination of its urgency
5) The funding of long range financial plans for public facilities and capital improvements based on a projection of the public and private fiscal activity of the planning area
6) Utilization and conservation of natural resources
7) Any other element deemed necessary to the proper development / redevelopment of the planning area.

Seth Child Road Corridor

The Corridor, as an asset to the community, provides goods and services, jobs, recreation and amenities for the people of the City, County and region. The Seth Child Road Corridor study area lies between K-18 on the south and US-24 on the north, extending one-half mile on both sides of the roadway. The Seth Child Road Corridor lies primarily within the City of Manhattan; however, the northern portion, north of Marlatt Avenue, is within Riley County. Besides serving as a primary north/south connection, the Corridor also is home to significant commercial centers and jobs, providing goods and services as well as supporting the employment base. Regional providers, like Target and Home Depot, in addition to local shops including a grocery store, restaurants, and other services can be found along the Corridor. The headquarters for Farm Bureau Insurance Company is found near the northern portion of Seth Child Road, and significant natural areas and park assets are situated along the Corridor.

LAND USE & DEVELOPMENT

The Seth Child Road Corridor has long provided connectivity and access as a key north/south roadway servings the community and the region. As such, it has also been a primary development Corridor. Its continuous development provides housing, goods and services, jobs and recreation for the community. As the City of Manhattan has continued to grow westward, Seth Child Road has become a more important transportation connection and service Corridor. To ensure that its transportation network and land use patterns persist in providing adequate service, a plan for its future must be prepared. This planning effort will provide a detailed future land use plan in coordination with the future multi-modal transportation network producing a desirable, usable Seth Child Road Corridor.

Current Land Use

To plan for the future, it is necessary to understand what has shaped the current development environment of the Corridor. Current land uses within the Corridor are defined by the Manhattan Urban Area Comprehensive Plan and the Riley County Vision 2025 Plan. For the purposes of this report, similar land use categories have been combined to create a generalized land use for discussion and evaluation. A detailed breakdown of land uses that define the Seth Child Road Corridor is provided in current land use map Exhibit 3.A. A larger version of the map is located in Appendix A.

Agricultural: Uses focus on the farming, ranching and related uses of large tracts of land. Secondary uses may include rural residential uses that typically would accompany an agricultural use. Areas designated agricultural are not anticipated to develop within the near future. Agricultural land uses comprise 15% of the net land area in the Corridor and are found primarily at the north end of the Corridor in unincorporated Riley County.

Open Space, Parks and Recreation: Land use includes those uses that primarily deal with the publicly accessible parks, natural areas, trails and greenways for use, active or passive, by the community. These areas also define private spaces that have been preserved as natural areas or sensitive natural features and resources. Significant open space, parks and recreation land and facilities are present in the Corridor, representing approximately 17% of the net land area. The open space and park / recreation space within the Corridor is dispersed throughout the Corridor with 5 larger spaces comprising most of the space – Tuttle Creek Reservoir, Washington Marlatt Memorial Park, CiCo Park, Optimist Ball Park and Warner Memorial Park. The presence of Wildcat Creek and the Linear Trail add to the open space and recreation contributes of the southern portion of the Corridor.

Public / Institutional: Use includes those public uses that support residents and the community through specialized services, such as schools, government office, hospitals, airports, libraries, places of worship and other typical public services. Included in this category is the land and facilities that are owned by Kansas State University. These land use categories comprise approximately 12% of the net land area, and represent mostly churches and schools within the study area and a large parcel owned by Kansas State University in the northwest section of the Corridor, comprising 8% of that total.

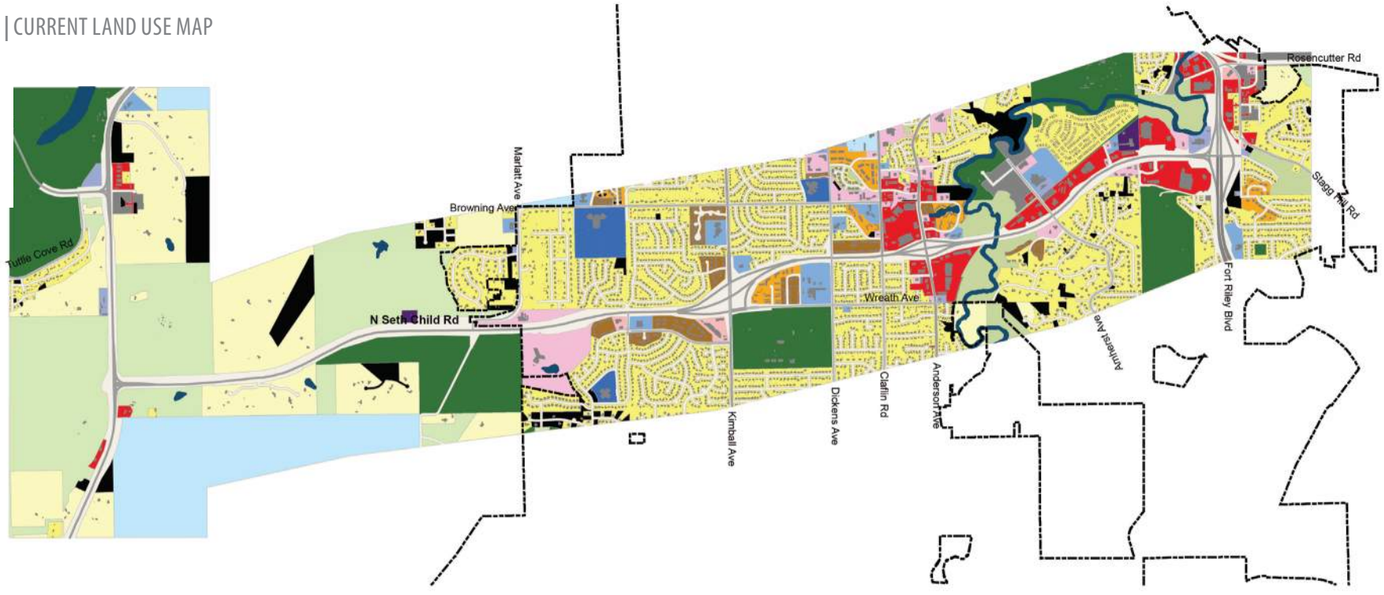
Residential: Uses occupy the greatest amount of net land area within the Corridor at almost 44% or more than 1,900 acres. More than 26% of the total residential area with more than 1,110 acres of the residential development are low-density, typically single-family units. Much of single family residential development is found within neighborhoods along to the Corridor. Conversely much of the higher density residential development adjacent to the Corridor is between Anderson Road and Marlatt Avenue. Some additional residential land use is found at the northern end of the Corridor as "rural residential" in Riley County.

Commercial: Use includes two scales of commercial development, neighborhood and community, within the Seth Child Road (K-113) study area. The community scaled commercial centers include Seth Child Commons and the Home Depot at the south end of the Corridor, as well as the West Loop and Plaza West Shopping Center at the Anderson Avenue interchange. Smaller neighborhood scaled centers like Candlewood at the Kimball Avenue interchange and other individual commercial properties make up the rest of the commercial uses present. The total area dedicated to commercial within the Corridor is just under 200 acres, or approximately 4.5% of the net land area.

Employment: Uses include those that are associated with jobs including industrial and office uses which comprise a little more than 4% of the net land area in the Corridor. Key properties like Kansas Farm Bureau and The Master Teacher campuses, as well as several small office buildings west of the Seth Child Road Corridor along the Anderson and Claflin Corridors comprise the majority of the employment spaces in the study area. Additionally, the utility uses in the Corridor, including a KCPL service yard near the south end of the Corridor and the cellular tower to the north in Riley County, have been included in this Corridor.

Vacant: Parcels are accounted for in the land use calculations and comprise less than 4% of the net land area within the Corridor. The parcels are distributed throughout the Corridor and most are located within platted subdivisions and represent lots not yet developed.

EXHIBIT 3.A | CURRENT LAND USE MAP



Current Land-Use

District	Acres	Percentage
Agriculture	667.964	15%
Open Space	143.35	3%
Parks & Recreation	619.43	14%
Public/Semi-Public	21.4	0%
Institutional	83.75	2%
School	56.25	1%

District	Acres	Percentage
Kansas State University	360	8%
Community Commercial	185.77	4%
Neighborhood Commercial	12.31	0%
Industrial	53.16	1%
Office Research Park	128.67	3%
Rural Residential	644.81	14%

District	Acres	Percentage
Residential Low-Density	1,158.94	26%
Residential Medium-Density	59.74	1%
Residential High-Density	71.57	2%
Utilities	10.75	0%
Vacant	175.91	4%

City Boundary
Water Bodies

Total: 4,454 acres

Note: *The Land Use Calculation Tables are the result of combining the land uses identified by the City of Manhattan and Riley County land use plans, current and future. The zoning calculation remain separate for each jurisdiction.*

3 | LAND USE ANALYSIS

Zoning

Current zoning in the Corridor is defined by the City of Manhattan Zoning Regulations for those properties within the City limits and Riley County Zoning Regulations for those in unincorporated areas of the County—generally the area north of Marlatt Avenue. To provide a consistent look at the zoning within the Corridor, categories of uses have been generalized. A complete breakout and map of each category can be found in the Corridor Zoning and Area Calculation Map, Exhibit 3.B. A larger version of Exhibit 3.B is provided in Appendix A.

Agricultural: Uses left in the Corridor study area are within Riley County. A little more than ¼ of the study area remains in agricultural zoning, primarily used as a holding zoning until the area is ready for development and in areas where the topography may limit development to large lot residential use.

University: Zoned properties consist of a few parcels totaling just under 500 acres or 10% of the land area of the Corridor. Most of the land is held in two large parcels in Riley County that are owned by Kansas State University and a large single parcel at the northwest corner of Dickens Avenue and Seth Child Road that is home to the Manhattan Area Technical College.

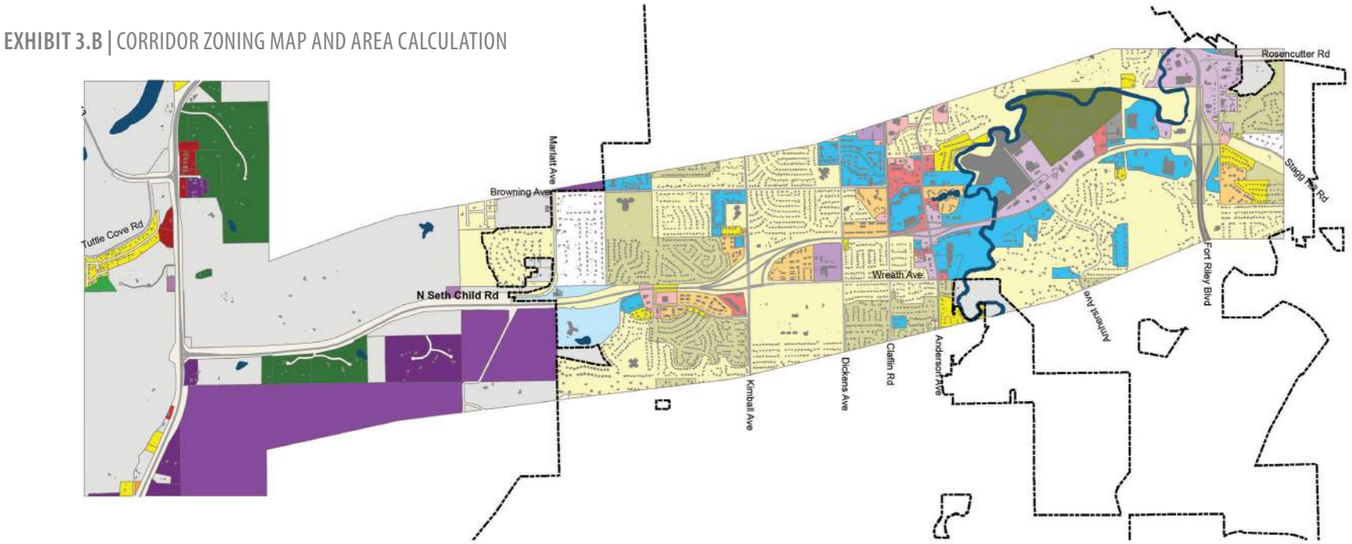
Residential: Uses comprise almost 50% of the Corridor zoning area, including all densities of residential development—single family to the most intense multifamily. Similar to the current and future land use, much of the Corridor, particularly those parts within the Manhattan City limits, is zoned for low-density, single family use. Apartments and multifamily can be found in the middle section of the Corridor, between the Anderson Avenue, Dickens Avenue and Kimball Avenue intersections. It should also be noted that several of the Planned Unit Developments (PUD) that have been approved in the county are developed with residential uses.

Commercial: Uses are found predominately (236 of 258 acres) in the Manhattan City limits, with the remaining commercial zoning found in Riley County along US-24 near Highway K-13 intersection. Similar to the land use patterns most of the commercial development is congregated near the Anderson Avenue and K-18 intersections and the spaces between those intersections. It should also be noted that the City of Manhattan has used the Planned Unit Development zoning tool to enable commercial development in this area, as well as higher intensity residential uses.

Industrial: Zoned properties are found in both the City and in very limited amounts in the County. Zoned industrial properties account for approximately 112 acres or 2% of the total land area, with more than 95% of that area in the City of Manhattan. The zoning for industrial in the city is found east of the Seth Child Road Corridor, near the Amherst Avenue intersection. The limited amount of industrial in the county is along US-24 east of the Seth Child Road (K-113) intersection.

Planned Unit Development (PUD): Can be found in both the city and county and as previously noted, the tool has been used to enable residential, of typically higher densities, and commercial development. Approximately 8%, or 400 acres, of the total land area of the Corridor study area is zoned PUD, with ¾ of this area in the City of Manhattan.

EXHIBIT 3.B | CORRIDOR ZONING MAP AND AREA CALCULATION



Zoning

Manhattan

District	Acres	Percentage
C-1 Restricted Business	34.38	1%
C-2 Neighborhood Shopping	44.57	2%
C-5 Highway Service Commercial	157.06	6%
I-2 Industrial Park	44.24	2%
I-3 Light Industrial	8.93	0%
I-5 Business Park	54.43	2%
PUD Planned Unit Development	298.3	11%
R Single-Family Residential	1,386.67	1%
R-1 Single-Family Residential	385.25	2%
R-2 Single-Family Residential	69.7	6%
R-3 Multi-Family Residential	110.15	2%
R-5 Manufactured Home Park	94.61	0%
R-S Single-Family Residential Suburban	98.3	2%
U University	25.12	11%

Riley County

District	Acres	Percentage
AG Agricultural	1,324.56	60%
C-3 General Business	1.05	0%
C-4 Highway Business	21.25	1%
D-2 Light Industrial	5.06	0%
PUD Planned Unit Development	99.08	4%
Right-of-Way	2.7	0%
SF-1 Single-Family Residential	47.48	2%
SF-2 Single Family Residential	0.93	0%
SF-3 Single Family Residential	32.47	1%
SF-4 Single Family Residential	5.39	0%
SF-5 Single Family Residential	232.14	10%
U University	453.61	20%
City Boundary		
Water Bodies		

Total: 5,038 acres

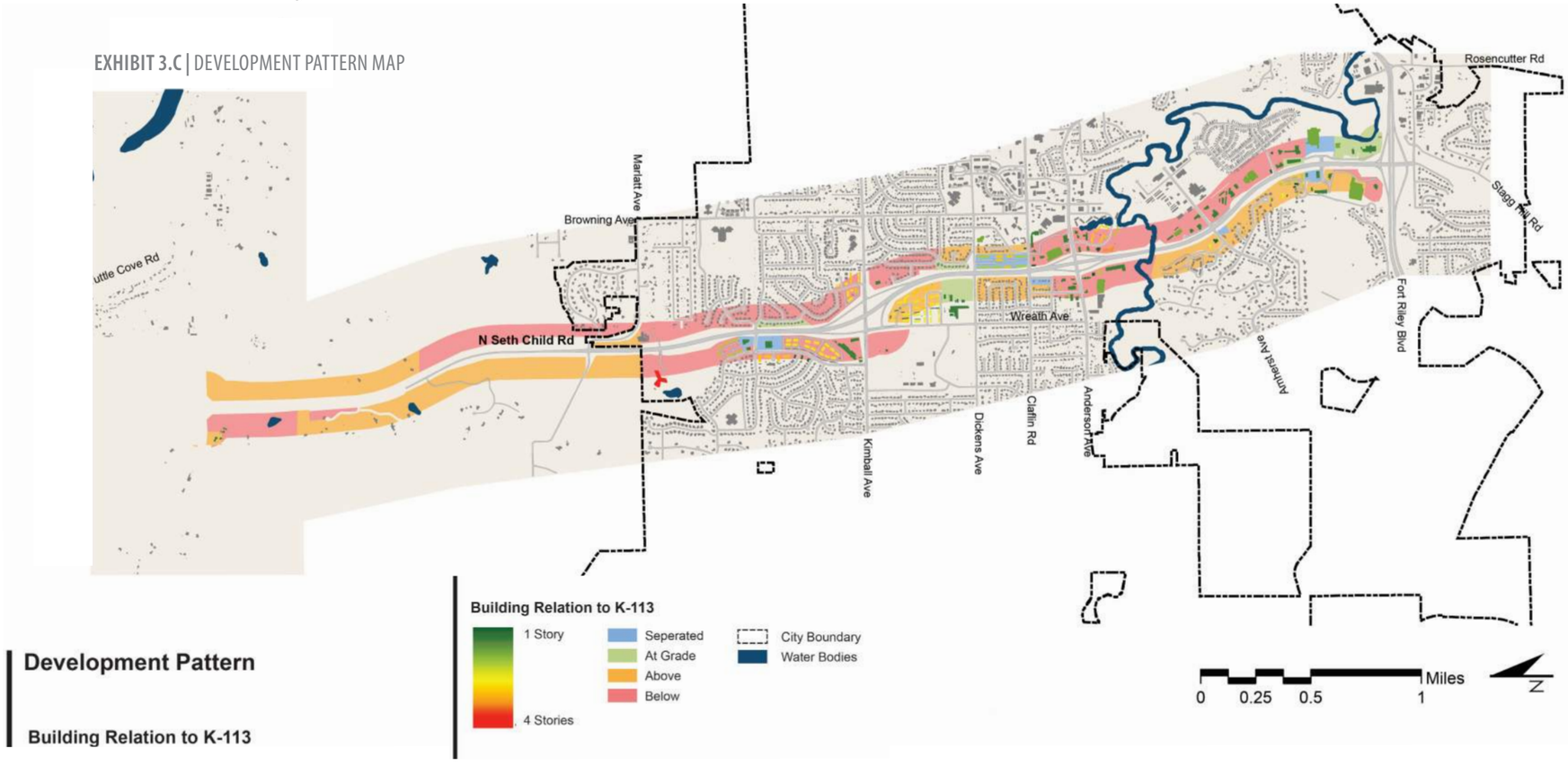
Development Pattern and Form

The pattern and form of development helps create unique places within a community and improve multi-modal accessibility. Development patterns define the relationship of adjacent sites regarding use, arrangement and transition areas. The importance of defining the development patterns lies in the usability of an area and moving between areas. In the Seth Child Road Corridor and surrounding area, the development pattern is suburban in nature—low-density, dispersed, automobile-oriented, served by an arterial/collector street network and curvilinear neighborhood streets. This is the case for both commercial, residential, institutional and industrial development.

The form of development dictates placement of development on the land, its relationship to the street or public realm and the mass of development. Similar to the development pattern, the development form is also suburban in nature. Much of the development within the Corridor and surroundings, both commercial and residential, is setback from the street front with a front yard and driveway access. Parking for commercial development is typically at the front door of the building; site access is auto dominant. Buildings are smaller in mass compared to their site, covering less than 1/3 of the land, with the rest reserved for parking. Typically, the buildings are between one and four stories high.

The existing design and topography of the Seth Child Road Corridor creates a physical separation in many sections along the route that is not ideal for development. In these sections, the relationships between existing or new development and the adjacent roadway is minimal. For example, the relative success or failure of development sites situated considerably by above or below the profile of Seth Child Road is not, and will not, be impacted noticeably by roadway conditions. However, there are sections of the Corridor, primarily near the Claflin Road and Dickens Avenue intersections, where a stronger relationship between the street and development could be established. The development pattern and form in these areas could be used to create a sense of "place" and provide better multi-modal access to the uses adjacent to the Corridor. The same issues of development pattern and form also impact connectivity and access to the east-west roadways that serve the Seth Child Road Corridor. Development pattern map is illustrated in Exhibit 3.C. A larger version is located in Appendix A.

EXHIBIT 3.C | DEVELOPMENT PATTERN MAP



3 | LAND USE ANALYSIS

Future Land Use

The future land use of the Corridor has been defined by the comprehensive plans prepared for Manhattan and Riley County. The maps, definitions and calculations described herein portray a picture of what is desired in the Corridor and therefore may differ from current developments in many locations. The planning process, information analysis and improvement scenarios may cause changes to the applicable land use maps and documents which would impact future land use and development patterns in the Corridor. A detailed breakdown of future land uses which define the Seth Child Road Corridor is provided in the future land use and area calculation map, Exhibit 3.D. A larger version is provided in Appendix A.

Agricultural: Uses will diminish as the region and city continue to grow, with development in the northern end of the Corridor. The future agricultural lands in the Corridor are reduced to less than 75 acres and less than 2% (1.65%) of the total net land area, with no significantly large areas of agricultural land remaining. The Manhattan and Riley County Comprehensive Plan each call for the future potential development of northern section of the Corridor and the intersection of Seth Child Road (K-113) and US 24.

Open Space, Parks and Recreation: Land use area is projected to grow within the Corridor as continued growth and development occurs. Much of this growth is due to the recognition of a desire to protect our environmentally sensitive areas. The Manhattan Comprehensive Plan Future Land Use Map identifies "environmentally-sensitive areas" for protection from development. The environmentally-sensitive areas within the Corridor are associated with Wildcat Creek and its tributaries. The space dedicated to parks and recreation uses decreases slightly, due to increased awareness to preserve open space and the protection of environmentally-sensitive areas within the Corridor. The open spaces offset the loss of park and recreation space.

Public / Institutional: Use area declines to roughly 10% of the land area in the future as some of the current institutional and public uses promote more specific uses in the Corridor when identified on the future land use plan. The public / institutional uses remain spread throughout the Corridor and are largely schools and church facilities, with a few public service facilities. The identification of other uses does not mean that their change is eminent, but that as future redevelopment is considered different uses could be accommodated. The largest contributor to this land use category remains the property that Kansas State University owns toward the north end of the Corridor in Riley County, approximately 355 acres. The open spaces offset the loss in the park and recreation space.

Residential: Land use area increases to more than 50% of the use area within the Corridor. Much of this growth is the development of the areas in the county for low density and rural residential development. The challenging topography in the northern section of the Corridor means that although land is being dedicated to residential development the intensity of the development and the actual number of housing units will be relatively low in comparison to the rest of the Corridor.

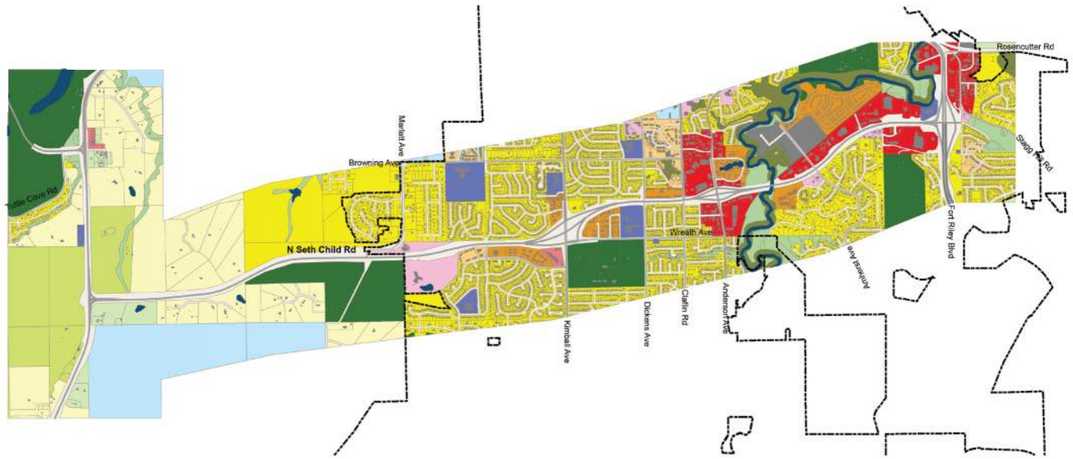
Commercial: Use area is expected to increase in the future, with approximately 50 acres of new commercial development, to serve a growing population. The change is primarily identified in the southern portions of the Corridor, with the expansion of the Anderson Avenue commercial nodes and the far southern sections of the Corridor filling in with commercial uses, expanding the regional services in the Corridor study area.

In addition to the documented changes in land use within the future land use map, see the Potential Growth Area explanation as some of this area would be developed as commercial as growth of the community continues.

Employment: Land use areas are decreasing in the future, due largely to the change in land uses for many of the small office buildings in the Anderson / Claflin Corridors to higher density residential uses. A decrease in the total area of industrial uses is also identified, with a reduction of space south of Fort Riley Boulevard east of the Corridor and some expansion of space east of the Corridor near the Amherst Avenue intersection. In the future, employment uses represent less that 3 percent of the net Corridor land use area. This reduction may also cause a reduction of jobs within the Corridor.

Potential Growth Area: Has been identified at the intersection of Seth Child Road (K-113) and US-24, for future development. The Riley County Comprehensive Plan identifies a significant area, approximately 300+ acres, around the intersection as a "potential long-term growth area". Similarly, the Manhattan Comprehensive Plan identifies the intersection as a "Future Neighborhood Commercial Center." The intersection of two highways provides the opportunity to create a development pattern that can provide goods and services to the surrounding neighborhoods and area development.

EXHIBIT 3.D | FUTURE CORRIDOR ZONING MAP



District	Acres	Percentage
Agriculture	73.3	2%
Environmentally Sensitive Areas	178.21	4%
Preserved Open Space	172.85	4%
Parks & Recreation	568.28	13%
Potential Growth Area	323.29	7%
Public/Semi-Public	94.92	2%

District	Acres	Percentage
Kansas State University	355.52	8%
Community Commercial	230.32	5%
Neighborhood Commercial	12.85	0%
Industrial	45.57	1%
Office Research Park	80.55	2%
Rural Residential	721.51	16%

District	Acres	Percentage
Residential Low/Medium Density	1,364.83	31%
Residential Medium/High Density	70.16	2%
Residential High Density	159.14	4%

City Boundary
Water Bodies

Total: 4,451 acres

Public Realm

The public realm of a community is defined by the public spaces and how they relate to one another and the adjacent development. The public realm typically consists of a community's rights-of-way and public open spaces. The design of the public realm is important to a community and to the Seth Child Road Corridor for many reasons. The public realm frames the development environment and accessibility within a community and in this case the Seth Child Road Corridor. The design of the public realm also helps to define and enhance the connectivity network, in particular the multi-modal aspects of walking and biking. Finally, public realm design allows the public spaces to contribute to the character of the places, corridor and neighborhoods in the community.

Throughout much of the Corridor there is not a clear relationship between the public realm and adjacent development. In some cases, the elevation change between the roadway and development prohibits this, but in some areas including the Southwind, Amherst, Claflin, Dickens and Gary intersections, a better relationship is possible. This disconnect is largely due to the absence of public realm design elements, such as streetscape and landscape, pedestrian facilities and amenities that would make the roadway inviting to front businesses or residences. Additionally, the historic use of this roadway has been to move significant amounts of traffic though the west side of Manhattan.

While moving cars is important, the right-of-way has largely ignored the movement of other modes of transportation, particularly cyclist and pedestrians. Improvements to the Corridor could also improve the connectivity and access within the Corridor and surrounding area. Finally, the lack of design amenities does not allow the Corridor to create an identity nor does it contribute to the character of adjacent development. Specific design elements that relate to the type of place being created, along different sections of the Corridor, could help the Corridor establish an identity as well as support the identity of the specific places in the Corridor. Many of the items identified for the Seth Child Road Corridor public realm also hold true for the arterial and collector street network that serve the Corridor.

PHYSICAL ASSESSMENT

In addition to the land use and future land use plans that identify current and future uses of properties within the Seth Child Road Corridor, the physical setting of the Corridor also has an impact on its development, connectivity and appearance. In many ways the land uses defined respond to the physical setting and as (re)development occurs.

Natural Features

Natural features can have a dramatic impact on development patterns and uses because they shape the land that is used for development. Within the Seth Child Road Corridor, the natural features present—topography and Wildcat Creek—impact portions of the Corridor.

Topography: Within the Seth Child Road Corridor is varied, from steep and rough topography to gentle rolling to almost flat. The center portions of the Corridor generally between Anderson Avenue on the south and Marlatt Avenue on the north are relatively flat and the topography has little impact to development. The same cannot be said for the north and south portions of the Corridor.

The development patterns and uses within the southern portion of the Corridor, south of Anderson Avenue, are impacted by the topography of the area primarily from the presence of Wildcat Creek. The bluffs that form the edge of the creek channel impact the development of the area, separating the channel area and development on the bluffs above. The western side of the Corridor in this area, although challenging topographically, has been developed with low intensity single-family residential development provides access that responds to the topography with a meandering, curvilinear street network.

The northern portion of the Corridor within Riley County jurisdiction also experiences challenging topography. Much of this area is currently natural, agriculture or rural residential development on large lots. The future development potential of this area is limited due to the rugged topography. Future land use plans recognize this challenge and call for rural residential, open space and natural areas with development concentrated at the intersection of Seth Child Road and US-24.

Wildcat Creek

Wildcat Creek helps define development patterns on the southern portion of the Seth Child Road Corridor, running along the east side of the Corridor and crossing the Corridor just south of Anderson Avenue. In addition to the impact of the creek channel and topography, the creek is a primary water course and drainage way in the area which presents flooding potential. Much of the channel area within this reach of the creek lies within the floodway and the 100-year floodplain. Development in much of the area should be prohibited because of flood loss potential.

Conversations during the process made it known that Wildcat Creek impacts the continued use of the Plaza West Shopping Center at the northwest corner of Seth Child Road and the creek crossing. The limited area reserved for the creek and its channel makes it difficult to increase capacity of the creek to accommodate future flooding events. This situation may be further compounded by continued development, creating additional storm water runoff for the creek to accommodate. Redevelopment of this section of the Corridor should address any flooding issues that may be present.

Man-Made Features

A more thorough evaluation of the man-made environment elements are prepared in an accompanying section of this report; however, it is important to recognize the potential impact of these elements and systems on the land use and development patterns in the Seth Child Road Corridor. The land use and development within and surrounding the Corridor are largely shaped and supported by the street network, infrastructure systems and public facilities. Each of these elements contributes to the pattern, form and intensity of development in the Seth Child Road Corridor.

3 | LAND USE ANALYSIS

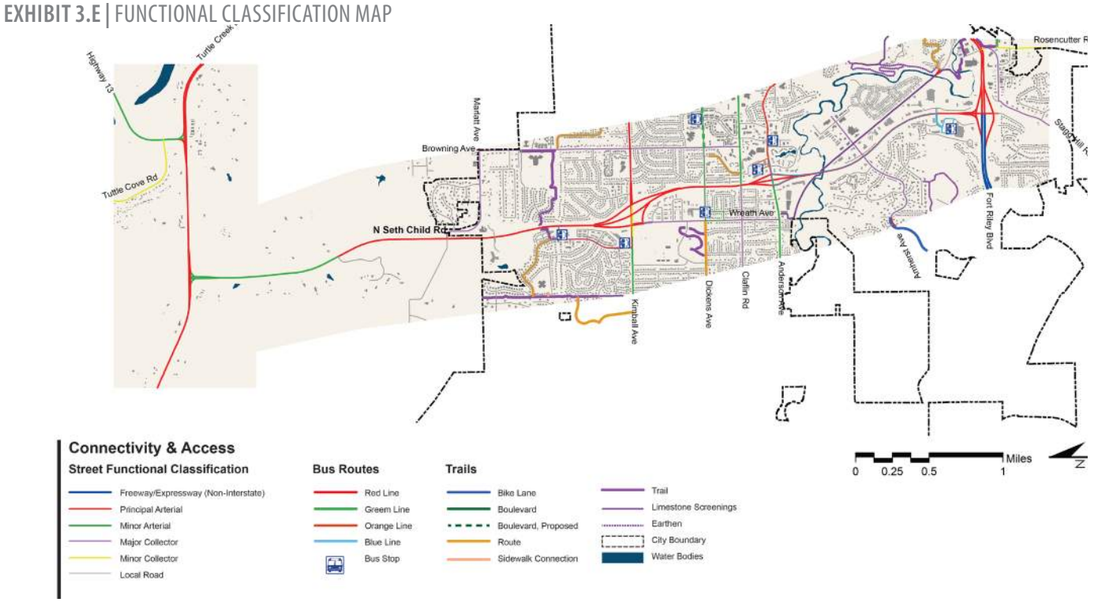
Connectivity & Access (By Modes)

The street network is largely responsible for connecting development within most cities. However, as times change, additional modes of transportation, walking and cycling in particular, are becoming popular methods of connectivity. In addition to the typical automobile use of a corridor, bike lanes, trails, sidewalks and even transit facilities are becoming more prevalent in communities, including Manhattan. The incorporation of all modes within a transportation network increases opportunities for connectivity and accessibility to land uses and development occurring in the Seth Child Road Corridor. Exhibit 3.E illustrates the current functional classification of the street network for the City of Manhattan. A larger version of the Functional Classification Map is located in Appendix A.

Seth Child Road is a primary element of the street network in western Manhattan and serves the automobile traffic of the region. The roadway represents a regional connector from the rural areas of Riley County, through its connection with US-24, and destinations like Tuttle Creek Reservoir, to the City of Manhattan and to points further south via its connection with K-18 (Fort Riley Boulevard). Seth Child Road provides the local connections needed to serve the businesses and neighborhoods of western Manhattan. It is a principal arterial serving the local street network and other arterials and collector streets such as Amherst, Anderson, Dickens, Kimball and Marlatt Avenues. The local arterials and collectors provide direct connections and access to neighborhoods and commercial development and would not operate as effectively without the presence of Seth Child Road. Exhibit 3.E depicts the locations of existing sidewalks, trails and transit route locations.

Sidewalks within the Corridor, adjacent neighborhoods and commercial areas are provided through the arterial and collector street network on one side of the street. Local streets that serve the neighborhoods and residences do not have sidewalks. The sidewalk network provides a basic level of pedestrian connectivity and is supported by a trail network providing an additional layer of connectivity and access. While the trail network is not connected throughout the Corridor, it does provide segments of access within the Corridor and to points east of the Corridor within Manhattan.

EXHIBIT 3.E | FUNCTIONAL CLASSIFICATION MAP



In the northern portion of the Corridor, generally between Kimball Avenue and Marlatt Avenue, a trail with on–street and off-street segments connects Anthony Middle School on the east and the Hudson Nature Trail on the west. The Hudson Nature Trail lies approximately on-half mile to the west of Seth Child Road, from Kimball Avenue on the south, one mile straight north to adjacent neighborhoods. The trail connects to the sidewalk system along Hudson Road providing further connection to the south. The Grand Mere trail is a short distance west of the Hudson Nature Trail and, through a future connection, could provide pedestrian and bicycle access to points west.

The Linear Trail network provides similar connectivity through the southern portion of the Corridor though the use of an abandoned rail line. Starting at the Plaza West Shopping Center and generally following Wildcat Creek to the southeast, the trail connects to Seth Child Road and points further east by a connection to the levee system, stretching to the Kansas River and providing access to eastern Manhattan in Pottawatomie County. The trail system provides good connectivity to the community and the northern and southern portions of the Corridor but lacks connectivity within the Corridor, particularly in a north/south orientation.

Currently, the Seth Child Road Corridor is served by transit, the final layer of connectivity. However, like most of the other connectivity systems, most of the service provides access to and from the Corridor. In general each of the four routes that serve the Corridor connect to the east and destinations in the City of Manhattan, shown in Exhibit 3.E. The Red Line serves the northern section of the Corridor along Kimball Avenue, including the Candlewood Shopping Center and surrounding neighborhoods. The Green Line serves the central portion of the Corridor along Dickens Avenue, connecting to CiCo Park and the Manhattan Area Technical College. The Orange Line also serves the central portion of the Corridor along Anderson Avenue, serving the Westloop Shopping Center. Finally, the Blue Line provides access to the southern portion of the Corridor from Anderson Avenue south to the Seth Child Commons Shopping Center.

The Manhattan Area Transportation Strategy, adopted in 2015, provides the vision and strategies for the future of transportation within Manhattan. The strategy calls for a more robust multi-modal system to connect the City of Manhattan, locally and regionally. The plan identifies improvements to the pedestrian, bicycle and transit systems, as well as the roadway network, to create a complete network of transportation connectivity and access, with improvements identified to better serve the Seth Child Road Corridor. The plan improvements will be considered with the options identified for future transportation modifications during this planning process.

Infrastructure

The developed portions of the Corridor, generally between Marlatt Avenue on the north and K-18/Fort Riley Boulevard on the south are well served by the water, sewer and storm water infrastructure systems. The northern section of the Corridor, a mostly undeveloped or sparsely developed area, is served by a county water system, not by sewer. As development and redevelopment occurs, the infrastructure systems should be evaluated for their potential to serve proposed development. This is particularly important in the northern area where facilities are lacking and development will be a challenge. Exhibit 3.F depicts the Infrastructure Map that identifies the locations of existing sanitary sewer. Exhibit 3.G illustrates the locations of water mains. Exhibit 3.H summarizes the locations of the storm water system. Larger versions of Exhibits 3.F, 3.G, and 3.H are provided in Appendix A.

Public Facilities

In addition to the public land uses consisting primarily of educational facilities like Kansas State University land, churches and park land, the Seth Child Road Corridor is also home to other public facilities. The Riley County Law Enforcement Center is located at the far south end of the Corridor at the northeast corner of Seth Child Road and K-18. Additionally, a fire station sits along Anderson Avenue, immediately west of the Plaza West Shopping Center.

EXHIBIT 3.F | INFRASTRUCTURE MAP – SANITARY SEWER

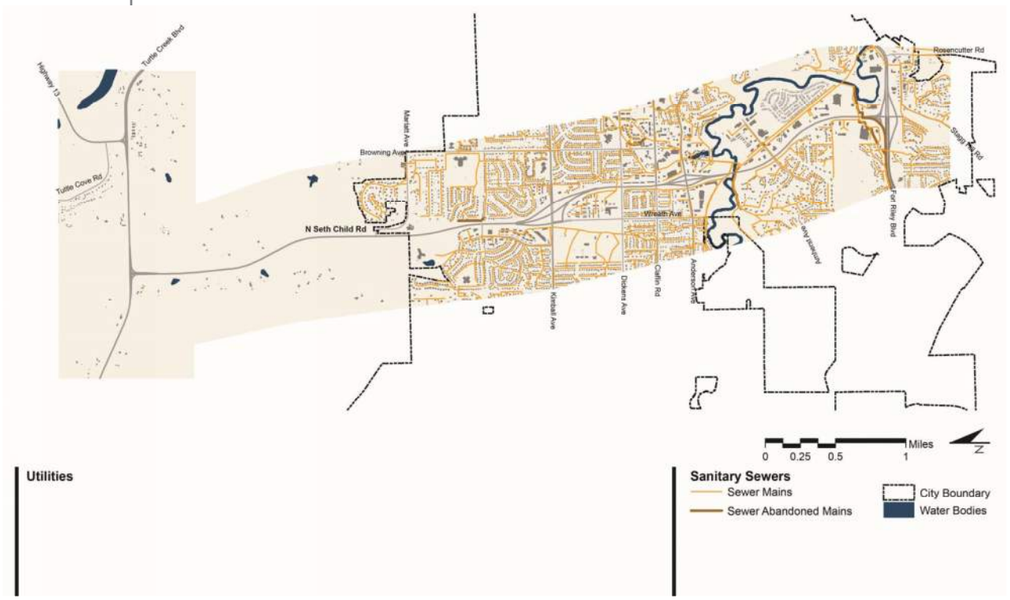


EXHIBIT 3.G | INFRASTRUCTURE MAP – WATER MAINS

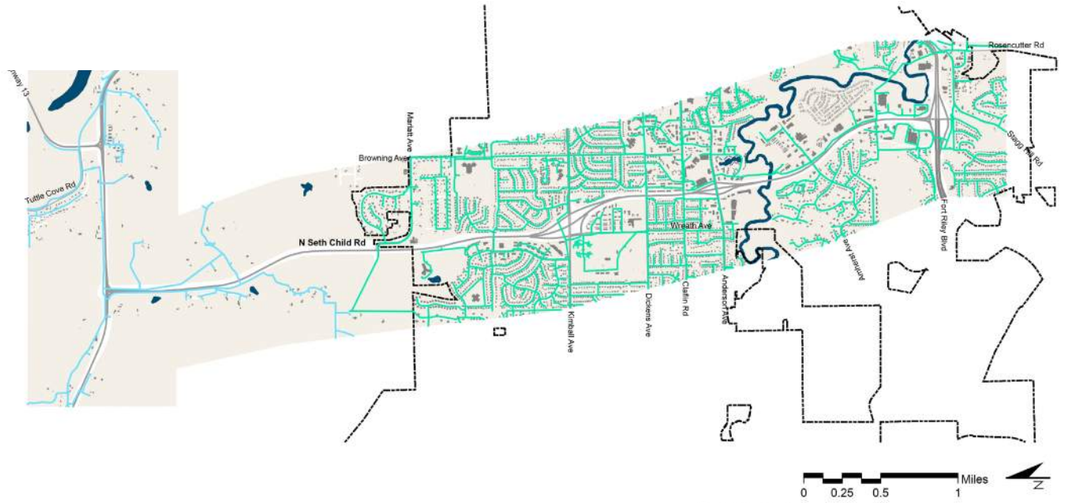
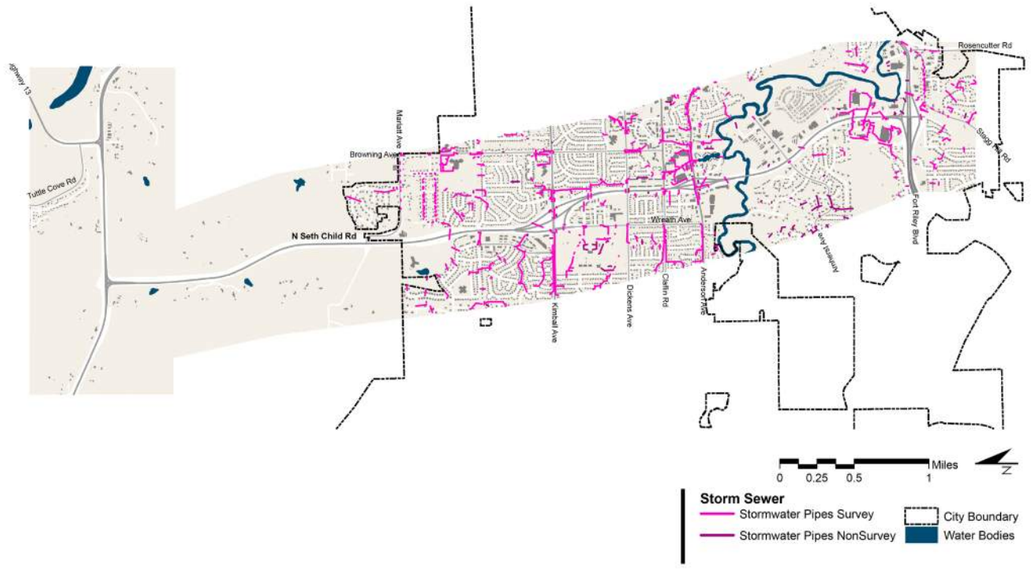


EXHIBIT 3.H | INFRASTRUCTURE MAP – STORMWATER



3 | LAND USE ANALYSIS

OPPORTUNITIES AND CONSTRAINTS

The information analyzed has helped define opportunities and constraints for future development and redevelopment within the Corridor. Existing conditions throughout the Corridor provide the baseline of information from which future improvements can be made. Individually, the topics addressed may not identify some of the true issues present within the Corridor, but the correlation of some of the topics discussed can provide a better picture of the land use and development issues needing to be addressed to create a Corridor for the future. This section is intended to provide the consolidated picture of the Corridor and identify opportunities and constraints to future development and redevelopment within the Seth Child Road (K-113) Corridor. It should be recognized that these issues, opportunities and constraints alone will not guide change in the Corridor, but they must be balanced with necessary transportation and infrastructure changes.

Site Suitability

A site suitability analysis has been prepared to identify those areas most suitable for future development and redevelopment. The information previously discussed makes up a large part of the information used to generate the analysis and associated map. Topics included in this analysis include:

- Property Location – is the property located within the city or the county, which is an indicator of the relationship to existing infrastructure.
- Public Ownership – whether or not a parcel is publicly owned.
- Pedestrian Facility - distance of a parcel from a pedestrian facility, current or planned.
- Bicycle Facilities - distance of a parcel from a bicycle facility, current or planned.
- Transit Facilities - distance of a parcel from a transit stop.
- Future Land Use – location of a parcel within a potential growth area or identified as parks, open space or environmentally sensitive area.
- Flood Potential – relationship of the parcel to the floodway or floodplain.
- Slope – the change in topography across the development site.
- Vacant Parcel – if the parcel is vacant or developed.
- Vacant Tenant Space – if there is space in a development that is vacant.
- Property Value Change – has the property recently increased or decreased in value.

The site suitability map is intended to portray the impact of individual issues when compiled upon a particular area. In areas that have a concentration of issues and a lack of opportunities, it can be assumed that development and redevelopment of those areas will be more difficult or may not need additional improvements to create a positive impact for the Corridor. The map generated (Exhibit 3.I) is intended to provide an additional resource from which decisions can be made. A larger map is provided in Appendix A. Similar to the other information, it should be considered in the context of the Corridor, the vision and goals defined and balanced with the other needs or desires of the community.

Opportunities and Constraints

Based on the review and analysis of information, an initial list of opportunities and constraints to development and redevelopment have been compiled. It is anticipated that this list will be reviewed and refined as it is compared to potential changes to Seth Child Road and its supporting street network. The opportunities and constraints will provide the targets for change within the Corridor for future development and redevelopment to achieve.

Opportunities

- New growth potential to the north along the Seth Child Road (K-113) and US-24 Corridors.
- Infill and redevelopment sites along the Corridor and connecting streets.
- Redevelopment opportunities within existing commercial centers.
- Redevelopment opportunities for higher intensity residential development along the Anderson and Claflin Road Corridor along and near Seth Child Road.
- Improvement to the public realm design to create identity and character for the Corridor and places along the Corridor.
- Improvement to the development pattern and form, in specific parts of the Corridor, to better relate development to the street network.

Constraints

- Limited development capacity at the north end of the Corridor due to topography.
- Limited growth potential at the south end of the Corridor because of environmental features, topography and Wildcat Creek.
- Flooding potential caused by Wildcat Creek and the impact on redevelopment, in particular commercial spaces like the Plaza West Shopping Center and areas east of the Corridor between Anderson and K-18.
- Limited amount of growth area within the city limits of Manhattan.
- Separation of the Seth Child Road and adjacent development, limiting multi-modal access to adjacent uses and neighborhoods.

EXHIBIT 3.I | SITE SUITABILITY MAP

FUTURE LAND USE AND DEVELOPMENT

Continued growth in Manhattan will impact future development of the Seth Child Road Corridor. While this future development only represents a small fraction of anticipated citywide growth, increased development in the Corridor will be necessary with population growth. Despite predictions, levels of future growth will be the result of improvements made to the Corridor and the ability to attract new development. In residential areas, for instance, the provision of goods and services demanded by residents will drive the future construction of new homes. Future changes within the Corridor will take the form of new development, redevelopment and re-tenanting of existing vacant spaces. This section provides an overview of what can be expected regarding the amount, location and type of development in the Seth Child Road Corridor.

Methodology

The Seth Child Road Corridor primarily lies within the City of Manhattan, though the portion north of Marlatt Drive remains within Riley County. The potential of corridor development was examined based on current development patterns, anticipated development market and physical characteristics of the area, as detailed within the land use and market analysis sections of this report. The transportation system was analyzed in segments and the same method applied to the future land use. The land use and development recommendations for the future of Seth Child Road Corridor were broken down into corridor sections – focusing on the North, Central and South sections, with the Anderson Corridor development recommendations embedded within the Central Corridor section.

The developed and rural development environments generally align with the city/county boundary, as well as the North/Central Corridor divide as seen in Exhibit 3.J. The portion of the Corridor within the City of Manhattan is generally developed, while the northern portion in the County remains undeveloped or has been developed in a rural residential (large-lot) pattern. Given the two distinct development environments, proposed development within each area has been approached differently. Development expectations within the north section are limited, given its rural nature, lack of development market and development suitability and challenges within this section of the Corridor. In this section, the primary opportunity remains a continuation of the rural, large-lot residential development pattern that currently exists and is not dependent upon an urban level of infrastructure services.

In contrast, the central and south sections of the Corridor are expected to see the greatest increase of both commercial and residential development. Given the amount of existing, yet underutilized development in these sections, growth will focus on both infill development and renovation of existing spaces in the form of new buildings and tenants, see Exhibit 3.J. Re-tenanting of retail and office space will address the vacancies of both types of spaces within the Corridor. Renovations will vary based on the expected intensity of development, though some renovations will likely occur ahead of new development to absorb a portion of the market capacity within the Corridor.

The market analysis has identified three potential development extents based on the future population growth of the City of Manhattan and the region. The Corridor will develop at a low, a moderate or a high level of development based on the ability of the Seth Child Road Corridor to capture that growth. In each scenario, the amount of growth, and in turn the amount of new development, redevelopment and re-tenanting, varies and the potential impacts will vary as well. The development estimates examine the potential amount of development and type of development for the Corridor as a whole and each of the three sections – north, central and south.

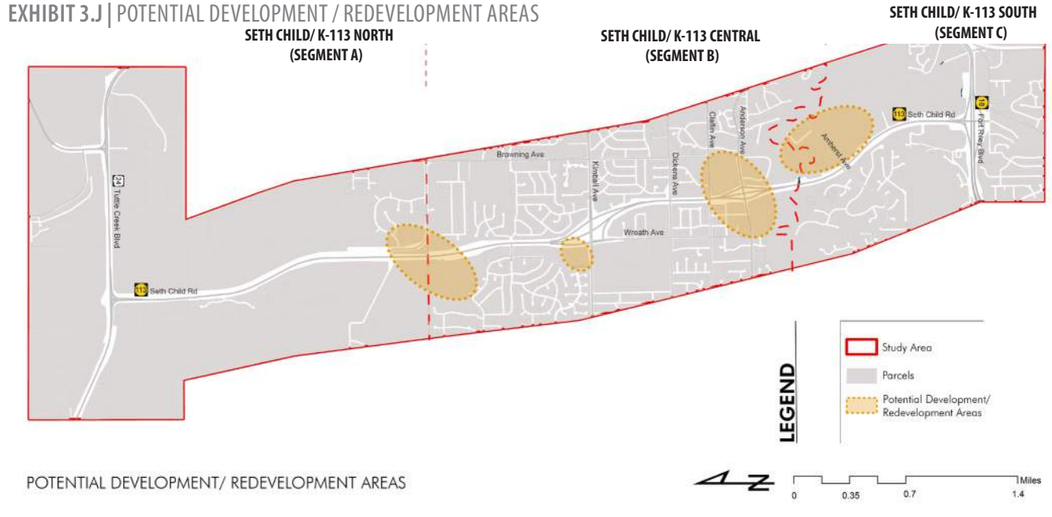
Future Land Use Plan

The land use patterns and types defined by the City of Manhattan and Riley County adequately guide future development of the Seth Child Road Corridor. Therefore, no changes are proposed to the land use plans or patterns for the Corridor.

The recently adopted Comprehensive Plan for Manhattan provides necessary guidance for the continued development and anticipated future development of the Seth Child Road Corridor. The area's focus for future development, infill/redevelopment and new development are appropriately identified on the future land uses proposed by this plan document. It should be noted that the development areas proposed by the Corridor plan primarily include High Density (Residential), Community Commercial (Commercial/Mixed-use), Industrial (Employment) and Office/Research (Employment) categories. The proposed development is supported by the land use policy that mixing uses is appropriate within these categories, particularly the High Density Residential and Community Commercial categories. This policy, established by the future land use plan, should be used to implement future development within the Corridor.

Similarly, the Riley County Comprehensive Plan's future land use plan accommodates the proposed development. The plan identifies Agriculture, Parks and Recreation, Kansas State University and Rural Residential uses as appropriate within the study area. The primary recommendation for development is low-density residential uses. The land use plan also identifies a "future neighborhood commercial center" at the intersection of Seth Child Road and US-24. However, population growth and economic markets are not currently expected to support this level of commercial development for the defined 20-year horizon of this plan document.

EXHIBIT 3.J | POTENTIAL DEVELOPMENT / REDEVELOPMENT AREAS



POTENTIAL DEVELOPMENT/ REDEVELOPMENT AREAS

3 | LAND USE ANALYSIS

Development Estimates

Impending development throughout the Corridor will be residential and commercial (including both office and retail) in nature, shown in Exhibit 3.K. Residential growth is expected to accommodate 10 to 165 new residential units while commercial growth is expected to increase by 74,000 to 176,000 square feet of newly utilized space. Table 3.A provides a list of the estimated Low Growth development scenario. The low, moderate and high growth scenarios were applied to the three segments of the Corridor using the methodology described previously that illustrates and examines anticipated development in the Corridor. In each scenario, the central and south sections of the Corridor are expected to see the greatest amount of future development. Minimal development is anticipated in the northern portion of the Corridor. Targeted areas within the central and south segments are anticipated to best accommodate the amount and type of development proposed.

North Corridor (Segment A)

The North Corridor, which lies primarily within Riley County, is anticipated to have very little growth within this study's projected timeline. As depicted in Exhibit 3.K, the area can expect a small amount of continued residential growth in a rural format. Four new units are projected with the low growth scenario and up to seven new units with the high growth scenario. Most growth in the north section of the Seth Child Road Corridor is expected to be a continuation of existing rural neighborhood developments, as illustrated in Exhibit 3.K. There is opportunity for a small amount of commercial development, as three growth scenarios recognize opportunity for the development of a small office building at the southern end of the section. The congregation of office space near the Kansas Farm Bureau and Master Teacher office facilities begins to create an employment center within the Corridor, despite the area's limited growth potential. Overall, future development in the north section of the Corridor is restricted due to market limitations. A larger version of the exhibit is included in Appendix A.

Central Corridor (Segment B)

The central portion of the Seth Child Road Corridor is expected to change the most and accommodate the greatest amount of future development. High projections can be attributed to the redevelopment potential within the Anderson Corridor, located at the interchange of Anderson and Seth Child Road.

Potential commercial and residential growth in the central section will be primarily achieved through renovation, including the redevelopment of properties and the re-tenanting of vacant commercial space. Residential development is comprised of both single-family (detached, single-unit homes) and multi-family (attached, multi-unit homes) residential units. Single-family residential is limited and should occur within the established neighborhoods adjacent to the Seth Child Road Corridor. The low growth scenario anticipates two additional single family residential units; the moderate growth scenario anticipates four additional units; and the high growth scenario plans for up to six units. Multi-family development is anticipated through the continued development of current multi-family projects and the redevelopment of existing outdated properties suitable for replacement. No multi-family units are supported by the low growth scenario; however, 60 and 120 units are planned with the moderate and high growth scenarios, respectively, shown in Exhibit 3.L (Moderate Growth Scenario) and Exhibit 3.M (High Growth Scenario). Table 3.B (Moderate Growth) and Table 3.C (High Growth) summarize the estimated growth for each section of the Corridor. The Park Place Apartments at the northeast corner of Claflin Road and Seth Child Road could be a target for replacement with new multi-family or mixed-use to support additional redevelopment and commercial growth within the West Loop shopping center.

EXHIBIT 3.K | LOW GROWTH SCENARIO

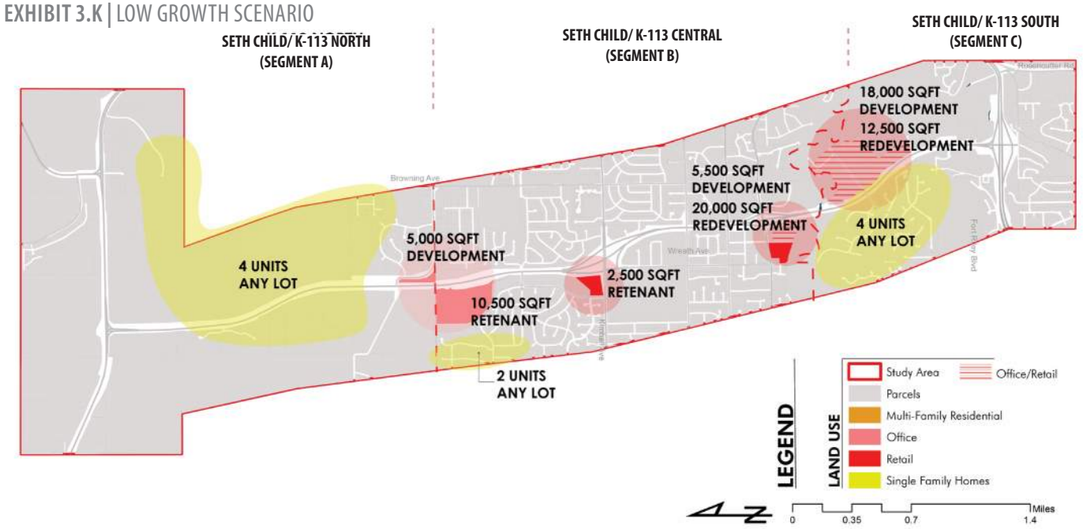


TABLE 3.A | LOW GROWTH SCENARIO

Low Growth	North (A)		Central (B)		South (C)		Corridor	
Residential	# of Units	Acres	# of Units	Acres	# of Units	Acres	# of Units	Acres
Single Family	4	1	2	.5	4	1	10	2.5
Multi-Family	0	-	0	-	0	-	0	0
TOTAL	**4**	**1**	**2**	**.5**	**4**	**1**	**10**	**2.5**
Commercial/Industrial	Sq. Feet	Acres	Sq. Feet	Acres	Sq. Feet	Acres	Sq. Feet	Acres
Retail	0	-	28,000	2.57	24,500	2.25	52,500	4.82
Office	5,000	0.46	10,500	0.96	6,000	0.55	21,500	1.97
Industrial								
TOTAL	**5,000**	**0.46**	**38,500**	**3.53**	**30,500**	**2.80**	**74,000**	**6.79**

*** DEVELOPMENT ASSUMPTIONS:**
Single Family Residential: 4 Units/Acre
Multi-Family Residential: 12 Units/Acre
Retail and Office: 25% ILnd Coverage

Commercial development, both retail and office, is anticipated to occur throughout the Corridor within existing developments and commercial centers. The low growth scenario anticipates approximately 38,500 square feet of development with 28,000 square feet of retail and 10,500 square feet of office use, shown in Table 3.A. The moderate growth scenario forecasts approximately 59,900 square feet of development—49,400 square feet of retail and 10,500 square feet of office, depicted in Table 3.B. The high growth scenario expects approximately 90,800 square feet of commercial development—65,300 square feet of retail and 25,500 square feet of office, detailed in Table 3.C.

Most retail development should occur in the primary commercial centers of the Central Corridor at the Candlewood, West Loop and Plaza West shopping centers. The re-tenanting of space within the Candlewood and West Loop centers will accommodate the low end of retail projects with some new development and redevelopment occurring at the Plaza West center. At the higher end of anticipated growth, significant development and redevelopment at West Loop and Plaza West are needed. Despite development challenges, the Plaza West location provides a significant redevelopment opportunity for the Seth Child Road Corridor and the west side of Manhattan. The redevelopment of the Plaza West shopping center should look to incorporate additional office uses as part of a mixed-use development to address future office development. In addition, office development will also be dispersed throughout the central section of the Seth Child Road Corridor, mostly accommodated by existing vacant office spaces, such as the Kansas Farm Bureau building. There is also a market, within the high growth scenario, for new, small scale office buildings along the Anderson Corridor, east of Seth Child Road.

West Loop: The West Loop shopping center has provided a retail and service destination for the western portion, and all, of Manhattan for decades. Over time, the use and form of the shopping center has changed. The center currently is experiencing vacancies that provide space for future commercial growth. As growth occurs, the redevelopment and re-tenanting of space within West Loop should be prioritized to uphold the center as an active destination within the Seth Child Road Corridor and Manhattan, supported by the proposed Seth Child Road and Anderson Avenue improvements.

Plaza West: The Plaza West commercial center represents an underutilized asset within the Corridor and the community. The center is challenged by physical limitations, including flooding, connectivity, accessibility by automobiles as well as by pedestrians and cyclists. Given its challenges, the Plaza West commercial center still represents a significant redevelopment opportunity worth pursuing. The improvements to the Seth Child Road and Anderson Avenue interchange and the Anderson Corridor will address some of the connectivity and access issues, though redevelopment can further address these issues. Additionally, the presence of the Linear Trail and its connectivity to the southern and eastern parts of Manhattan are an asset to this property. Future development of the Plaza West center should focus on connectivity and accessibility of commercial uses to the trail, including trail-oriented uses and housing. Creating a trail-oriented, mixed-use development would provide a truly unique destination within western Manhattan that is well-connected to the community.

EXHIBIT 3.L | MODERATE GROWTH SCENARIO

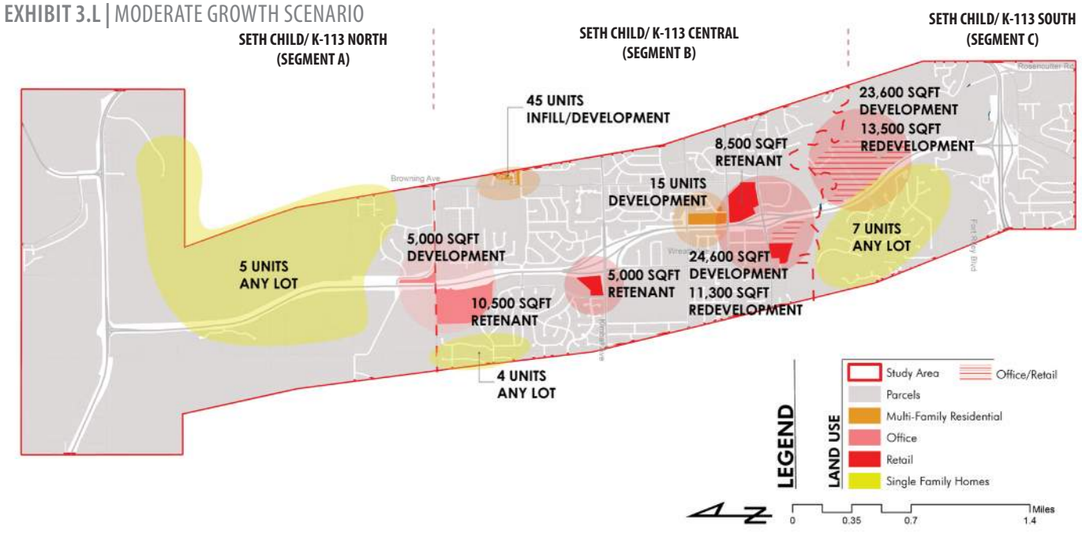


TABLE 3.B | MODERATE GROWTH SCENARIO

Moderate Growth	North (A)		Central (B)		South (C)		Corridor	
Residential	# of Units	Acres	# of Units	Acres	# of Units	Acres	# of Units	Acres
Single Family	5	-	4	1	7	-	16	1
Multi-Family	0	-	60	5	0	-	60	5
TOTAL	**5**	**0**	**64**	**6**	**7**	**0**	**76**	**6**
Commercial/Industrial	Sq. Feet	Acres	Sq. Feet	Acres	Sq. Feet	Acres	Sq. Feet	Acres
Retail	0	-	49,400	4.54	30,100	2.76	79,500	7.30
Office	5,000	0.46	10,500	0.96	7,000	0.64	22,500	2.06
Industrial								
TOTAL	**5,000**	**0.46**	**59,900**	**5.50**	**37,100**	**3.40**	**102,000**	**9.36**

*** DEVELOPMENT ASSUMPTIONS:**
Single Family Residential: 4 Units/Acre
Multi-Family Residential: 12 Units/Acre
Retail and Office: 25% ILnd Coverage

3 | LAND USE ANALYSIS

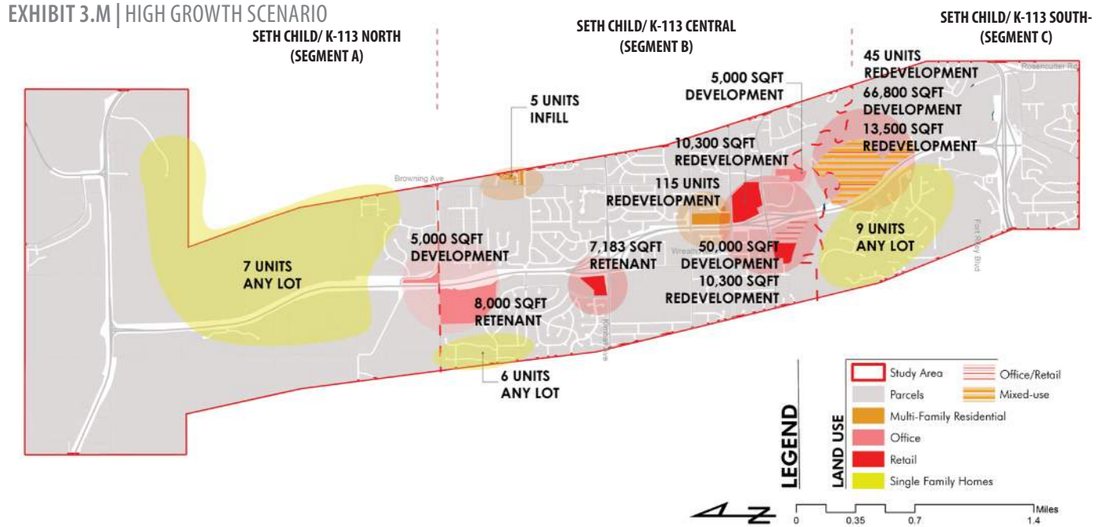
South Corridor (Segment C)

The south portion of the Corridor will also benefit from a significant amount of residential and commercial development in the future. Development in the south portion of the Corridor is targeted toward mixed-use near the Amherst intersection. This area provides opportunities for new development and redevelopment of commercial and light industrial properties. The area may also benefit from its proximity to the Linear Trail to the east. Transportation changes to the intersection at Seth Child Road will provide improved access to the area.

Residential development is comprised of single-family and multi-family units built within existing development areas. The low growth scenario anticipates four units of single-family growth within existing neighborhoods to the east of Seth Child Road and no multi-family units. Likewise, the moderate growth scenario identifies seven single-family units and no multi-family units. The high growth scenario projects nine units of single-family dwellings and 45 multi-family residential units. Like most redevelopment in the Corridor, other than single-family units, the multi-family residential development is anticipated to take place near the Amherst Avenue and Seth Child Road Corridor intersection, depicted in Exhibits 3.K, 3.L and 3.M.

Commercial development potential will likely be in retail, office and residential opportunities. Commercial development within the low-growth scenario is predicted to be 24,500 square feet of retail space and 6,000 square feet for small office space. The moderate growth scenario anticipates 30,100 square feet of retail and 7,000 square feet of office. The high growth scenario tops out the future development at 59,500 square feet of retail and 20,800 square feet of office. Tables 3.A, 3.B and 3.C summarize the estimated land use numbers.

EXHIBIT 3.M | HIGH GROWTH SCENARIO



Zoning Regulations (Segment C)

Current regulations for the City of Manhattan and Riley County adequately address future growth and development of the Seth Child Road Corridor. The City of Manhattan is currently in the process of updating its development code, creating a Unified Development Ordinance (UDO). Upon a review of the initial draft UDO, it is apparent that it will have a positive impact on the continued development of the Seth Child Road Corridor. It is expected to support redevelopment of existing, aged properties to reestablish relationships and connections to surrounding neighborhoods.

In addition to the general development standards established by the new UDO, design standards for residential and non-residential uses have also been prepared. Design standards are intended to ensure that the scale, orientation and character of new development is compatible with the existing context, particularly adjacent neighborhoods. These design standards address site design, building height, parking, street trees and building design. Non-residential design standards include a set of standards for "mixed-use" that will be particularly relevant for redevelopment in the Seth Child Road Corridor as proposed within the West Plaza center and at the Amherst Avenue intersection (east side). New UDO and design standards should serve future development of the Seth Child Road Corridor well.

It is important to note that the UDO is proposed and has not yet been adopted.

TABLE 3.C | HIGH GROWTH SCENARIO

High Growth	North (A)		Central (B)		South (C)		Corridor	
Residential	# of Units	Acres	# of Units	Acres	# of Units	Acres	# of Units	Acres
Single Family	7	-	6	1.50	9	2.25	22	3.75
Multi-Family	0	-	120	10	45	3.75	165	13.75
TOTAL	**7**	**0**	**126**	**11.50**	**54**	**6**	**187**	**17.50**
Commercial/Industrial	Sq. Feet	Acres	Sq. Feet	Acres	Sq. Feet	Acres	Sq. Feet	Acres
Retail	0	-	65,300	6.00	59,500	5.46	124,800	11.46
Office	5,000	0.46	25,500	2.34	20,800	1.91	51,300	4.71
Industrial								
TOTAL	**5,000**	**0.46**	**90,800**	**8.34**	**80,300**	**7.37**	**176,100**	**16.17**

*** DEVELOPMENT ASSUMPTIONS:**
Single Family Residential: 4 Units/Acre
Multi-Family Residential: 12 Units/Acre
Retail and Office: 25% ILnd Coverage

LAND USE ANALYSIS SUMMARY

Future development within the Seth Child Road Corridor will be a combination of residential and commercial development. The amount of development is dependent upon the market in Manhattan that will respond to future growth of the community, both in population and employment. Proposed improvements to the Seth Child Road roadway and adjacent corridors will increase development potential. Future development should occur within the existing context of the corridor development pattern, scale and character. The Unified Development Ordinance under construction by the City of Manhattan will adequately guide Corridor development. Significant opportunities exist to reposition the Corridor within the greater Manhattan context, including redevelopment of the West Plaza and Amherst Avenue areas, as well as continued development and infill of areas like the West Loop and the Kansas Farm Bureau properties. It is understandable that the Seth Child Road Corridor will remain a vital arterial and community destination for the foreseeable future.

EXISTING ECONOMIC CONDITIONS

Prevailing economic conditions along the Seth Child Road Corridor are presented along with economic impacts related to the Corridor's redesign scenarios by comparing the preferred alternative to the "No Build" or do nothing approach.

Existing market conditions and the economic impact of the Corridor are derived from the latest economic data provided by the City of Manhattan, Riley County and the State of Kansas. This data encompasses retail sales, property taxes and employment. Further information was compiled from private sources, including large commercial property owners along the Corridor and published financial sales data from large publicly traded retail corporations.

The Seth Child Road Corridor is an important commercial component of the economies in Manhattan and Riley County. In addition to serving as a major transportation corridor, the businesses and institutions along the Corridor constitute significant portions of the overall taxable revenue sources of the City and County. The evidence is in the following 2017 data and economic conditions:

- There are an estimated 2,085 persons employed along the Seth Child Road Corridor.
- Property values along the Corridor total $147.9 million, which is 88% commercial and 12% residential in total value.
- Based on these values and the 2017 effective property tax rates set by all jurisdictions, these properties contribute a combined total of $4,968,166 in property taxes to the City, USD 383, Riley County and the State of Kansas.
- Retail businesses along the Corridor had combined annual sales of $158,500,000 in 2016, generating $14.1 million in retail sales taxes to the City, County and State for the year.

The "No Build"/do nothing scenario leaves the Corridor under its prevailing road network and traffic patterns. This scenario serves as the basis for measuring the economic impacts of improving the Seth Child Road Corridor. Economic impacts include, but are not limited to, future commercial occupancy rates, assessed values and the level of retail sales activity.

More specifically, the Seth Child Road Corridor was responsible for generating a combined total of $19.1 million in property and sales taxes during 2017 (see Table 4.A), of which $3.9 million was direct revenue for the City. Direct economic impacts for the City, Riley County, USD 383 and the State of Kansas in 2016 are summarized in Table 4.A "Property & Sales Taxes Summary 2016".
Note: All figures represent the latest published data for 2017.

TABLE 4.A | PROPERTY & SALES TAXES SUMMARY 2016

Tax Paid	City of Manhattan	Riley County	USD 383	State of Kansas	TOTAL
Property Taxes	$1,657,680	$1,346,168	$1,912,509	$51,809	**$4,968,166**
Sales Taxes	$2,298,250	$1,580,000	$0	$10,302,500	**$14,180,750**
Total	**$3,955,930**	**$2,926,168**	**$1,912,509**	**$10,354,309**	**$19,148,916**

These amounts do not include state income taxes paid by 2,085 Corridor employees or other state fees, liquor license fees and other taxes. The prevailing economic impacts are detailed as follows.

Existing Corridor Employment

The number of employees who work along the Seth Child Road Corridor impacts on traffic volumes, as well as contributes to sales at local retail establishments, especially fast food restaurants and other dining establishments. Based on the current number of retail stores and offices along the Seth Child Road Corridor, there are an estimated 2,085 persons employed within the Corridor's study area. These workers are categorized as shown in Table 4.B.

TABLE 4.B | EXISTING SETH CHILD ROAD CORRIDOR EMPLOYMENT

Use	Number of Businesses	Estimated Employment
Existing Retail Uses	98 Businesses	1,280
Existing Office Uses		595
Government & Other Institutional Uses	8 Fully or Partially Occupied Buildings	210
Total Employees		**2,085**

The employment data shown in Table 4.B includes three of Manhattan's top 20 private employers, in addition to approximately 205 police officers and civilian employees of the Riley County Police Department headquarters located along the Seth Child Road Corridor. The Corridor's largest private employers include:

Kansas Farm Bureau	225 employees
Dillon's	173 employees
Target	140 employees

Based on the amount of vacant retail and office space in existing buildings in 2017, there is potential to employ up to an additional 200 people to work along the Seth Child Road Corridor, should full occupancy and/or redevelopment of these vacant commercial spaces be achieved in the future.

4 | MARKET ANALYSIS

Existing Property Values and Property Taxes

According to the Riley County Appraiser's Office there was a combined assessed property value of approximately $148 million in 2017 along the Seth Child Road Corridor study area. This is detailed in Table 4.C. The amount includes more than a dozen vacant commercial and agriculturally zoned parcels. The value of these parcels would increase assessed value if future in-fill development occurs.

TABLE 4.C | SETH CHILD ROAD CORRIDOR ASSESSED VALUE BY LAND USE (2017)

Major Land Use		Number of Parcels by Use	2016 Assessed Value	Percent of Total Assessed Value
Commercial:	Retail (98 establishments)	52	$104,323,790	70.5%
	Office	33	$24,981,590	16.9%
	Vacant (zoned commercial)	10	$476,940	0.3%
Residential (includes 1 apartment complex: Park Place)		34	$18,206,100	12.3%
Total (excluding tax exempt public and religious zoned parcels)		**129**	**$147,988,420**	**100%**

Source: Riley County Appraiser's Office.

This $148 million in assessed real estate value includes 34 single family homes and one large multi-family rental project (Park Place Apartments). The combined residential assessed value of $18,206,100 represents 12.3% of the total property value along the Seth Child Road Corridor study area. The three highest assessed commercial properties along the Corridor according to 2016 values are as follows:

West Loop Shopping Center:	$22.5 million
Target:	$9.8 million
Home Depot:	$6.6 million

Following are the three largest retail businesses by square foot (among the 98 businesses along the Corridor) as well as the year each was completed or remodeled and added to the property tax roll:

Target	123,260 Sq. Feet	Built in 2002
Home Depot	94,761 Sq. Feet	Built in 2002
Dillon's	73,843 Sq. Feet	Remodeled in 2011

Property Taxes by Jurisdiction

This amount of assessed value has remained relatively stable over the last three years. However, from 2014 through 2016, there was an annual average of approximately $2.2 million increase in assessed value from the renovation of older buildings or new commercial in-fill construction along the Corridor. These improvements represented average annual increase in total property value of only 0.7 percent.

Based on these values, and the property tax rates set by all jurisdictions, these properties contributed a total $4,968,166 in property taxes in 2017, detailed in Table 6.D.

TABLE 6.D | SETH CHILD ROAD CORRIDOR PROPERTY TAXES BY JURISDICTION (2017)

Jurisdiction	2017 General Mill Rate (a)	Commercial Property Taxes	Residential Property Taxes	TOTAL 2017 Property Taxes
City of Manhattan	48.023 mills	$1,558,134	$100,546	$1,657,680
USD 383	55.372 mills	$1,796,577	$115,932	$1,912,509
Riley County	38.975 mills	$1,264,566	$81,602	$1,346,168
State of Kansas	1.500 mills	$48,668	$3,141	$51,809
Total General Levy	**143.870 mills**	**$4,667,946**	**$301,221**	**$4,968,166**

(a) Does not include miscellaneous special taxing or improvement districts.

Commercial Buildings Overview

Despite the amount and variety of commercial activity along the Corridor, a substantial share of commercial buildings, approximately 661,771 square feet, are located in one of five commercial centers, as shown in Table 4.E. These five commercial centers represent approximately 79% of the Corridor's 835,231 commercial square feet.

TABLE 4.E | SETH CHILD ROAD COMMERCIAL CENTERS (2017)

Major Center Name (Street)	Total Leasable	Existing Businesses	Vacant Spaces	Vacant Square Feet
West Loop Shopping Center (Anderson Avenue)	217,874	39	5	13,358
Kansas Farm Bureau Plaza	215,000	5	7	43,106
Plaza West Center (Anderson Avenue)	111,331	5	5	62,460
Southwind Plaza	59,974	16	2	2,100
Candlewood Shopping Center (Kimball Avenue)	57,592	21	2	7,183
Sub-Total Major Commercial Centers	**661,771 Sq. Feet**	**86**	**21 spaces**	**128,207 Sq. Feet**
Other Free-Standing Commercial Buildings	173,460 Sq. Feet	12	3	Est. 15,500 Sq. Feet
TOTAL CORRIDOR	**835,231 Sq. Feet**	**98**	**24**	**143,707 Sq. Feet**

Source: Riley County Assessor's Office; Richard Caplan & Associates.

Despite this concentration, under each center's existing configuration, there is adequate vacant space for approximately 21 additional businesses in these centers as identified in Table 4.E. Retail real estate experts routinely state that visibility and access are important elements that influence rental rates and the number of customers attracted to commercial users. Access to commercial centers and their visibility directly affect the amount of increase or reduction in the number of businesses and vacancy rate. Therefore, the transportation system has an impact on the vacancy rate for commercial centers along the Corridor.

Sales Taxes by Jurisdiction

As a Corridor dominated by retail development, sales taxes paid by these retail businesses provide a significant economic benefit to the City, County and the State. To assess the current amount of sales taxes generated by businesses along the Seth Child Road Corridor, a variety of financial data from a number of sources were gathered and evaluated. These sources included:

- **An assessment of the City of Manhattan and Riley County sales tax figures for calendar year 2016 by 3-digit Standard Industrial Classification (SIC) code reported for all retail reporting categories provided on a confidential basis from the Kansas Department of Revenue. This data provides the total retail sales by category for all retail businesses in a category so that an average per business within the City or County can be calculated.**
- **Review of the City of Manhattan sales tax revenue trends from 2007 through 2016 which reflect the overall economic health of the City's retail community. Manhattan has experienced an average annual sales tax revenue increase of 2.9% during this 10-year period.**

Based on an analysis of these data sources, 98 retail businesses located along the Corridor had combined annual taxable sales of $158,500,000 in 2016. Using these figures and the sales tax rates of the City, County and State, we can conservatively estimate sales taxes at $16,484,000, shown in Table 4.F. The Corridor represents approximately 14% of the City's total retail sales tax collections.

TABLE 4.F | CORRIDOR ESTIMATED SALES TAX RECEIPTS BY JURISDICTION (2017)

Jurisdiction	Estimated 2016 Taxable Sales	2016 Sales Taxes Rate	2016 Sales Taxes Receipts
<u>City of Manhattan:</u>			
Regular		1.00%	$1,585,000
Quality of Life		0.25%	$396,250
Street Maintenance		0.20%	$317,000
Sub-Total		1.45%	$2,298,250
Riley County		1.00%	$ 1,585,000
State of Kansas		6.50%	$10,302,500
Total	**$158,500,000**	**10.4%**	**$16,484,000**

Source: Kansas Department of Revenue; Multiple public SEC corporate filings of publicly registered businesses (including Target, Home Depot, Papa John's, Dillon/Kroger company.

4 | MARKET ANALYSIS

FUTURE OPPORTUNITIES AND PROJECTED ECONOMIC IMPACT

According to the current Manhattan Urban Area Comprehensive Plan, Manhattan's population is projected to grow by an average 1.19% annually from 54,963 in 2016 to 71,886 in 2035. These additional residents will generate demand for further residential and commercial development. Growth captured along the Seth Child Road Corridor will be directly influenced by the transportation redesign alternatives adopted and implemented.

Road design, sidewalks, trails and related transportation infrastructure have a direct impact on the level of economic activity of most businesses, including those businesses along Seth Child Road. This study section discusses the most significant transportation-related factors considered as a part of the decision making process.

As one might expect, a well-run, sufficiently marketed dining establishment with great food will be successful regardless of the transportation system. Word of mouth and reputation are powerful marketing forces in dining and certain other retail categories. Most office developments, apart from bank branches, are less dependent on vehicle and pedestrian access or visibility. Office buildings are less impacted by the transportation system, other than convenience for their employees. However, given that the current Seth Child Road Corridor commercial inventory is more than 60% retail establishments, it is very important to consider how transportation design-related factors would positively or negatively impact the Seth Child Road Corridor's future economic viability.

Some of the most significant factors that can alter the level of economic activity include:

- **Changes to the Visibility of Businesses from Seth Child Road –** Many businesses, from fast food restaurants to convenience stores to bank branches, benefit from impulse buying. Consequently, awareness of a business to motorists, especially on a major roadway used by persons who may not reside in the immediate area, can be impacted by their visibility. This visibility factor influences the ability of a business to be seen and to attract non-routine customers.
- **Changes to Access to Businesses by Motor Vehicle Drivers –** Even with adequate visibility, customers are also driven to a business or commercial center by parking and/or access convenience. Convenience is routinely cited by customers and business owners as a crucial element to business success.
- **Amount of Pedestrian and Bicyclist Access from Linear Trail, Area Sidewalks and Adjacent Residential Neighborhoods –** As the number of bicyclists and pedestrians grows, it is important to provide and strengthen their access to dining establishments and commercial areas. In a city like Manhattan that has an active population, a more bicycle- and pedestrian-friendly commercial area will draw residents living within or just east or west of the Seth Child Road Corridor and a broader range of clientele who utilize the City's expanding Linear Trail System.
- **Altering the Corridor's Image –** Commercial district success is often influenced by perception or image. In Manhattan for example, Aggieville and Downtown Manhattan present two distinct images that attract local and visiting shoppers and diners. Currently, the Seth Child Road Corridor is not well defined, but could be in the future. Image has the ability to enhance or detract from the economic vitality of an area.

Commercial districts evolve and can be enhanced by or deteriorated through landscaping maintenance, addition or loss of major tenants and care or neglect of streets, building lighting and signage. These and other factors, beyond new competition, can stimulate redevelopment investment and influence a commercial district's and/or a Corridor's image. Therefore, alternative improvement scenarios based on the transportation system can and will contribute to either enhancing or detracting from the economic vitality of the Seth Child Road Corridor.

To perform this analysis, three primary 2040 development growth scenarios were evaluated and are described as follows:

A) The low growth scenario is generally best described as the No Build/"do nothing" scenario. This approach assumes the most limited amount of new commercial and single-family residential investment and redevelopment re-occupying and/or resulting in a net occupancy of an additional 74,000 commercial square feet and an addition of 10 single-family in-fill units. This alternative will raise the annual economic impact of the Corridor from $19.1 million by an additional $15.3 million;

B) The moderate growth scenario, that includes 60 new multi-family units, will provide more market opportunities than the "do nothing", low growth scenario. Enhanced street and business signage and upgraded landscaping can occur with new interchanges constructed to speed motor vehicle traffic while sacrificing motor vehicle, bicyclist and pedestrian access to area businesses. This scenario is projected to increase overall commercial occupancy by 102,000 square feet and 16 single-family in-fill units. It is also projected to increase the Corridor's economic impact by $25.4 million by 2040.

C) The high growth scenario includes 165 new multi-family units in two or three projects and offers the strongest market opportunities. New investment will be generated by at-grade street, sidewalk and trail improvements that increase the Corridor's walkability and attract new mixed-use and multi-family housing developments and redevelopment. This approach is expected to create a stronger sense of place and draw an increased investment, shoppers, employers and residents. A total of 176,000 square feet of new, renovated or re-occupied commercial space is projected for this scenario and would add a projected 475 jobs, increasing the Corridor's economic impact by an additional $40.5 million in 2040.

In addition to the 22 new single-family units in the high growth scenario, two or three new multi-family developments (free-standing or as part of mixed use projects) are also expected to be added along the Corridor as the transportation enhancements result in capturing a higher proportion of the city's projected population. Therefore, alternative transportation scenarios will either enhance or detract from the economic vitality of the Seth Child Road Corridor.

Exhibits 4.A and 4.B along with Table 4.G illustrate the economic impact for these scenarios.

EXHIBIT 4.A | PROJECTED NEW AND RENOVATED CORRIDOR COMMERCIAL DEVELOPMENT 2040

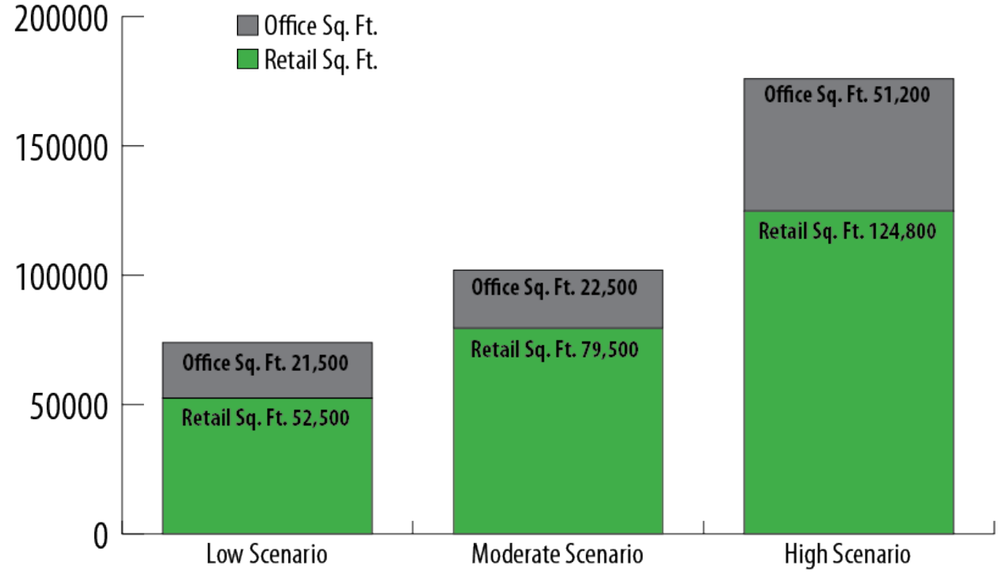
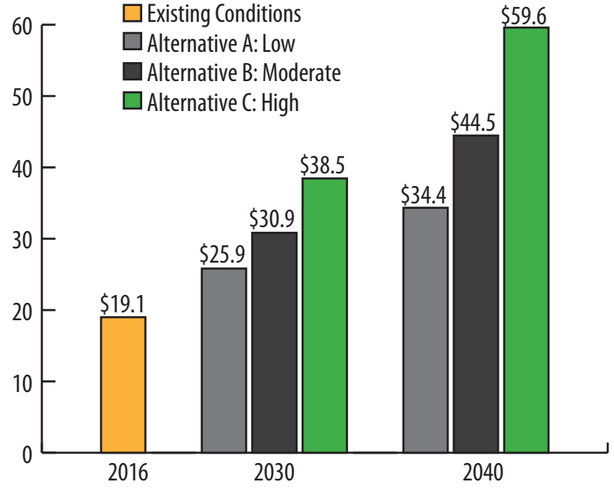


TABLE 4.G | COMBINED ECONOMIC IMPACT OF ALTERNATIVE DESIGN SCENARIOS

Jurisdiction: Revenue Source	ALTERNATIVE A: Low Growth Scenario	ALTERNATIVE B: Moderate Growth with Interchanges	ALTERNATIVE C: High Growth with At-Grade Improvements
CORRIDOR ANNUAL ECONOMIC IMPACT (2016 $) $19,148,916			
City of Manhattan:			
	$ 1,985,775	$ 3,198,881	$ 5,092,545
Property Taxes	$ 1,857,994	$ 3,431,044	$ 5,462,143
City Sub-Total	$ 3,843,769	$ 6,629,925	$ 10,554,688
Riley County:			
County Sales Taxes	$ 1,369,500	$ 2,206,125	$ 3,512,100
Property Taxes	$ 503,339	$ 929,486	$ 1,479,718
County Sub-Total	$ 1,872,839	$ 3,135,611	$ 4,991,818
Riley County USD 383:			
Property Taxes	$ 715,096	$ 1,320,525	$ 2,102,244
State of Kansas:			
State Sales Taxes	$ 8,901,750	$ 14,339,813	$ 22,828,650
Property Taxes	$ 19,371	$ 35,772	$ 56,948
State Sub-Total	$ 8,921,121	$ 14,375,585	$ 22,885,598
2040 NET INCREASE ANNUAL IMPACT	**+ $15,352,825**	**+ $25,461,646**	**+ $40,534,348**
NET INCREMENT over Low/"No Build"	**N / A**	**$10,108,821**	**$25,181,523**
NET NEW JOBS 2040; ANNUAL WAGES	**200 jobs $5.8 million**	**280 jobs $8.2 million**	**475 jobs $13.9 million**

Source: Richard Caplan & Associates 2018.

EXHIBIT 4.B | TOTAL ANNUAL SALES & PROPERTY TAXES ECONOMIC IMPACT (IN $ MILLIONS)

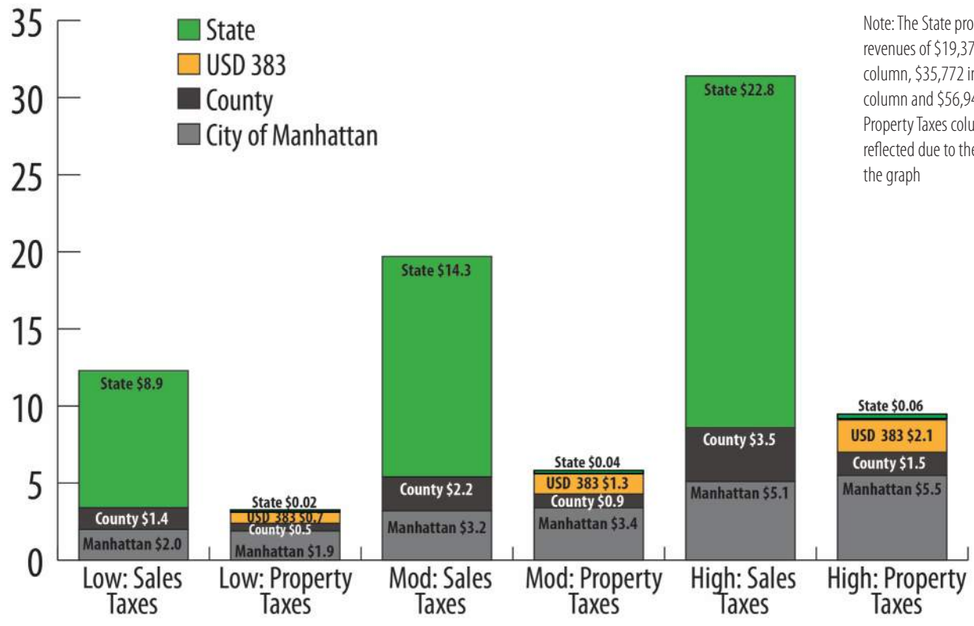


Key assumptions associated with property tax projections are as follows:

1. These projections are based on 2017 effective property tax levies in City of Manhattan, USD 383 and Riley County.
2. The retail component of these commercial projections incorporate the growing retail trend of increased on-line purchasing and therefore the growth rate for new retail development will decline from historical retail construction levels.
3. The average appraised values for the buildings will be the average commercial land and building values assigned by the Riley County Appraiser's Office to two recently constructed commercial developments along the Corridor.
4. The buildings are appraised at an average of $140.00 per square foot and the commercial parcels are appraised at an average of $3.50 per square foot.
5. The combined value of the land and the building at the center will increase by a conservative annual average of 1.0%.

Based on these assumptions and historic trends, Exhibit 6.C illustrates the sales and property taxes accruing to each of the four major government jurisdictions by 2040.

EXHIBIT 4.C | ECONOMIC IMPACT BY SCENARIO AND JURISDICTION 2040 (IN $ MILLIONS)



Note: The State property tax revenues of $19,371 in the Low column, $35,772 in the Moderate column and $56,948 in the High Property Taxes column are not reflected due to their size within the graph

ECONOMIC IMPACT OF SETH CHILD ROAD INVESTMENT

The estimated reconstruction cost of $64.9 million for Seth Child Road (K-113) is projected to yield the following annual economic benefits:

- Generate nearly $320 million in additional economic output
- Grow state sales tax revenues by $2.3 million
- Grow City and County sales tax revenues by $365,000
- Support or create an additional 90 direct jobs throughout the economy. Additional indirect jobs will also be generated.

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TRAFFIC ENGINEERING AND PLANNING BACKGROUND

Seth Child Road Corridor has unique characteristics that transition from south to north. South of Marlatt Avenue, Seth Child Road is primarily four lane divided with a posted speed limit of 45 mph. North of Marlatt Avenue the roadway transitions to two lanes with a 55 mph posted speed limit. The Corridor serves the western edge of Manhattan and is a combination of urban and rural settings.

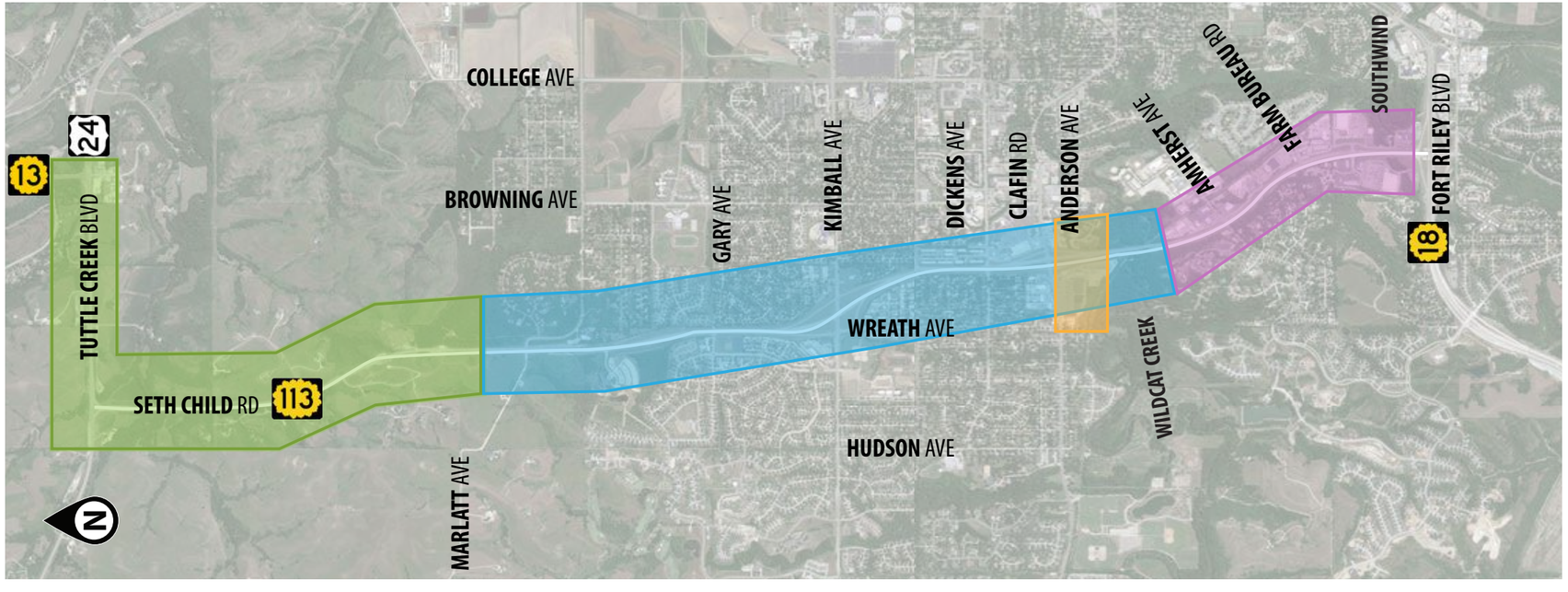
Starting at the southern end of the project the Corridor intersects K-18 (Fort Riley Boulevard) with an interchange. The interchange was recently reconstructed to be modified from a traditional diamond to a diverging diamond configuration. As the Corridor proceeds north, a series of at-grade signalized intersections exist at Southwind Road, Farm Bureau Drive and Amherst Avenue. Anderson Avenue and Kimball Avenue are both grade-separated diamond interchanges with two at-grade intersections between the interchanges. Claflin Road is a signalized intersection, while Dickens Avenue intersects Seth Child Road as an unsignalized, stop-controlled intersection. One unsignalized intersection is located between Kimball Avenue and Marlatt Avenue. Marlatt Avenue is the next east/west corridor that has been identified as a future arterial roadway to serve Manhattan. Currently, Marlatt Avenue joins Seth Child Road as an unsignalized, stop-controlled intersection. The Marlatt Avenue Corridor is located in the area of the City and County with the greatest potential of growth. North of Kimball Avenue, the speed limit increases to 55 mph. North of Marlatt Avenue the Corridor transitions to a rural two-lane highway with a 55 mph posted speed limit.

The Anderson Avenue Corridor is a primary east/west arterial that serves the middle of Manhattan and provides primary access to and from Kansas State University. This segment is a five-lane roadway with a 30 mph posted speed limit. Anderson Avenue currently has several access points that impact the overall flow of traffic.

The Kimball Avenue Corridor is a is four-lane undivided roadway with a 30 mph posted speed limit, and is an east/west arterial that serves the northern section of Manhattan. Kimball Avenue is the main access into Kansas State University Bill Snyder Family Football Stadium.

US-24 is primarily a two-lane rural highway with a 55 mph posted speed limit. The highway widens near Seth Child Road to provide passing lanes and auxiliary turn lanes. Seth Child Road intersects US-24 as an unsignalized intersection with free flow right-turn lanes. Its intersection with K-13 is unsignalized and includes slip lanes for west to northbound and south to westbound.

EXHIBIT 5.A | STUDY SEGMENT MAP



LEGEND

SEGMENT A
US-24 to Marlatt Ave

SEGMENT B
Marlatt Ave to Wildcat Creek

SEGMENT C
Wildcat Creek to K-18

SEGMENT D
Anderson Ave, Wreath to Westloop Entrance

5 | TRAFFIC AND SAFETY ANALYSIS

Data Collection

City of Manhattan staff have completed the daily traffic volume counts at various locations along the Corridor. The machine counts were recorded in February 2017. The average vehicles per day (VPD) are shown in Table 5.A.

TABLE 5.A | 2017 MACHINE COUNTS

Location	2017 City Machine Count (vpd)	Location	2017 City Machine Count (vpd)
Seth Child Road (N of Marlatt Ave)	6,490	NB Seth Child Road (S of Dickens Ave)	8,310
Marlatt Ave (East)	1,530	Seth Child Road (S of Dickens Ave)	14,940
Marlatt Ave (West)	260	Seth Child Road @ Claflin Rd (Southbound)	5,730
Seth Child Road (S of Marlatt Ave)	7,360	Claflin Rd (West)	1,650
Gary Ave (East)	1,200	Claflin Rd (East)	4,730
Gary Ave (West)	1,610	Seth Child Road @ Claflin Rd (North-bound)	7,610
Seth Child Road (S of Gary Ave)	5,250	Seth Child Road (S of Claflin Rd)	13,340
Kimball Ave (NB Seth Child Road On-Ramp)	1,200	Anderson Ave (SB Seth Child Road Off-Ramp)	2,260
Kimball Ave (SB Seth Child Road Off-Ramp)	1,420	Anderson Ave (NB Seth Child Road Off-Ramp)	5,490
Kimball Ave (NB Seth Child Road Off-Ramp)	3,200	Anderson Ave (West)	17,650
Kimball Ave (West)	12,110	Anderson Ave (Westbound @ W Ramp)	9,860
Kimball Ave (Eastbound @ W Ramp)	5,730	Anderson Ave (Eastbound @ W Ramp)	7,790
Kimball Ave (Westbound @ W Ramp)	6,380	Anderson Ave (Westbound @ E Ramp)	9,050
Kimball Ave (Eastbound @ E Ramp)	5,770	Anderson Ave (Eastbound @ E Ramp)	6,740
Kimball Ave (Westbound @ E Ramp)	5,570	Anderson Ave (East)	15,790
Kimball Ave (East)	11,340	Seth Child Road (N of Amherst Ave)	22,850
Kimball Ave (NB Seth Child Road Off-Ramp)	3,200	Seth Child Road @ Amherst Ave (Southbound)	12,140
Seth Child Road (N of Dickens Ave)	14,940	Amherst Ave (West)	2,780
Seth Child Road @ Dickens Ave (Southbound)	6,630	Amherst Ave (East)	2,640
Dickens Ave (West)	830	Seth Child Road @ Amherst Ave (Northbound)	10,710
Dickens Ave (East)	1,460	Seth Child Road (S of Amherst Ave)	22,850

Intersection Turning Movement Counts

Data collection provides the foundation for any traffic study. As part of this study, intersection turning movement counts were recorded at each of the 28 study intersections. The intersection turning movements were recorded using video cameras from 4:00 to 6:00 PM on February 22 and 7:00 to 9:00 AM on February 23, 2017. Peak hours were identified as 7:30 to 8:30 AM and 4:45 to 5:45 PM. Due to the length of the Corridor Study at approximately five miles, the traffic volumes and capacity analysis results were broken into main segments along the Seth Child Road Corridor. The morning and afternoon peak hour intersection turning movement volumes for each segment are illustrated on their own corresponding volume figure in Appendices D through J.

- **Analysis Segment 1: K-18 (Fort Riley Boulevard to Amherst Avenue)**
- **Analysis Segment 2: Anderson Avenue Corridor**
- **Analysis Segment 3: Claflin Road Corridor**
- **Analysis Segment 4: Dickens Avenue Corridor**
- **Analysis Segment 5: Kimball Avenue Corridor**
- **Analysis Segment 6: Gary Avenue Corridor**
- **Analysis Segment 7: Marlatt Avenue Corridor, including the Leadership Lane/Kansas Farm Bureau**
- **Analysis Segment 8: US-24 Corridor, including the K-13 intersection**

Travel Demand Model

Cambridge Systematics reviewed and updated the Travel Demand Model (TDM) for Seth Child Road, as well as reviewed the traffic analysis zones necessary to establish the existing conditions of this Corridor. The following sections document the existing conditions for the travel demand model of the Flint Hills Metropolitan Planning Organization, which was used to examine several 2040 scenarios of the Seth Child Road Corridor.

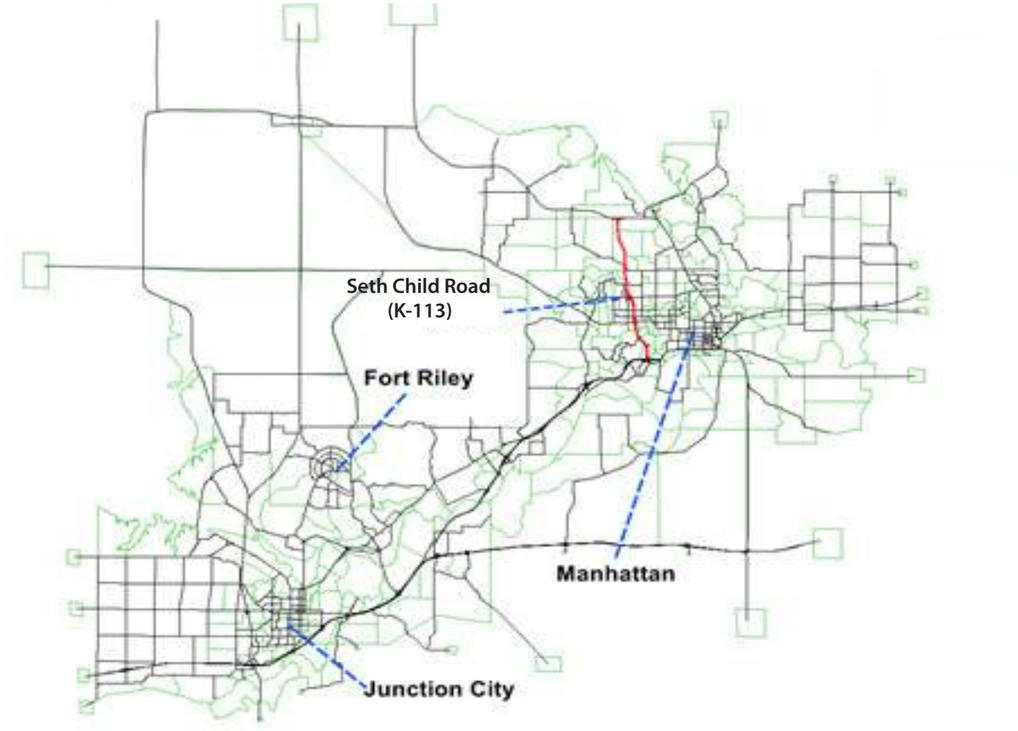
The TDM being used for the Seth Child Road Corridor Study is the Metropolitan Planning Organization (MPO) TDM developed for the Flint Hills Metropolitan Planning Organization (FHMPO). The FHMPO model covers portions of Geary, Riley, and Pottawatomie Counties in Kansas. The two main cities within the model coverage area are Junction City in the southwest area of the model region and Manhattan in the northeast area of the model region. The total population of the region in the model base year of 2012 was about 102,000 living in about 42,000 households. This includes about 3,500 households located on Fort Riley, a military base within the region. In addition to those noted above, approximately 10,000 people lived in group quarter facilities, primarily located in Fort Riley and on the campus of Kansas State University in Manhattan. Total employment in the region in 2012 was about 57,000, which includes about 16,000 employees at Fort Riley.

The TDM also includes a 2040 forecast year. Region wide, the model predicts household growth of about 38 percent, resulting in approximately 58,000 households by 2040. Similar levels of employment growth are predicted at about 37 percent, resulting in roughly 78,000 jobs in 2040. Fort Riley sociodemographics in 2040 are forecast to remain at 2012 levels.

Traffic Analysis Zones

Exhibit 5.B shows a map of the street network and traffic analysis zone (TAZ) structure used in the TDM. The TAZ system includes a total of 630 zones, of which 34 are external to the region and control traffic flows across the boundary of the region. Exhibit 5.B highlights the Seth Child Road Corridor in red.

EXHIBIT 5.B | MAP OF FHMPO TAZ SYSTEM AND STREET NETWORK IN 2012



Along the Seth Child Road Corridor Study area, there are 57 TAZ in the (TDM), shown in Exhibit 5.B. Within this study area, it is possible to generate similar statistics of the 2012 and 2040 land use information noted above for the entire region. For instance, within the study area the TDM forecasts the number of households to increase from 7,800 in 2012 to 10,200 in 2040, an increase of 31 percent, which represents a smaller increase than the regional household growth overall.

Total employment is forecast by the TDM to increase from 7,400 in 2012 to 9,200 in 2040, an increase of 24 percent, which also represents a smaller increase than the regional employment growth overall. With that being said, it is important to note that the 2040 projections developed for the TDM were very general in nature and were not based on detailed analysis at the zone or corridor level. Instead, projections were made at the county level and growth was allocated to zones in a general way, partially on the basis of available developable land.

As part of the Seth Child Road Corridor Study, existing land use information was examined in more detail and a more robust forecast of land use in and around the Corridor is discussed in Section 3. This information was ultimately translated into the TDM, thus updating the current 2040 forecasts.

2012 Base Year Traffic Volumes

The TDM was validated along a number of dimensions for the base year at a system-wide level. For the Seth Child Road Corridor Study, it was important to verify that the TDM matched Corridor traffic volumes reasonably well. To this end, a comparison of 2012 model volumes in the Corridor were compared to traffic counts completed in 2012. 2012 counts from the TDM were used when available, while cases in which the TDM counts were not available were supplemented as applicable. Table 5.B shows the comparisons for the roadways along the Corridor. The roadway traffic volumes shown in Table 5.B are listed from north to south, with Seth Child Road segments and cross streets both presented. For cross streets, roadway volumes on each side of the intersection with Seth Child Road are listed. For the Seth Child Road segments, only a single roadway volume is shown.

Generally, the model matches the counts fairly well, particularly for segments of Seth Child Road itself (as opposed to cross street counts). However, the TDM will not be a perfect match for ground counts as the model is an representation of reality.

TABLE 5.B | MODELED 2012 VOLUMES IN CORRIDOR COMPARED WITH 2012 COUNTS (AADT)

Link Name	West Side			East Side		
	2012	2012 Count	%Diff	2012	2012 Count	%Diff
US-24	6,614	6,718	-2%	5,851	5,968	-2%
Seth Child Road (US-24 to Marlatt Ave)	4,893	4,942	-1%	N/A	N/A	N/A
Marlatt Ave	145	524	-72%	2,216	1,598	39%
Seth Child Road (Marlatt Ave to Gary Ave)	6,486	5,834	11%	N/A	N/A	N/A
Gary Ave	6,089	N/A	N/A	2,742	2,406	14%
Seth Child Road (Gary Ave to Kimball Ave)	9,635	9,742	-1%	N/A	N/A	N/A
Seth Child Road Ramps N of Kimball Ave	772	1,055	-27%	1,089	1,260	-14%
Kimball Ave	18,806	15,282	23%	17,467	11,134	57%
Seth Child Road Ramps S of Kimball Ave	3,368	3,130	8%	3,286	3,240	1%
Seth Child Road (Kimball Ave to Dickens Ave)	14,427	18,776	-23%	N/A	N/A	N/A
Dickens Ave	4,481	2,754	63%	7,374	1,666	343%
Seth Child Road (Dickens Ave to Claflin Rd)	18,487	16,616	11%	N/A	N/A	N/A
Claflin Rd	4,055	3,308	23%	9,246	9,458	-2%
Seth Child Road (Claflin Rd to Anderson Ave)	22,404	19,910	13%	N/A	N/A	N/A
Seth Child Road Ramps N of Anderson Ave	3,341	1,130	196%	4,407	No Count	N/A
Anderson Ave	17,697	15,570	14%	21,484	18,100	19%
Seth Child Road Ramps S of Anderson Ave	4,169	5,790	-28%	4,430	5,785	-23%
Seth Child Road (Anderson Ave to Amherst Ave)	23,255	24,272	-4%	N/A	N/A	N/A
Amherst Ave	5,488	4,186	31%	2,578	2,530	2%
Seth Child Road (Amherst Ave to Farm Bureau Rd)	22,789	21,416	6%	N/A	N/A	N/A
Farm Bureau Rd	N/A	N/A	N/A	7,156	No Count	N/A
Seth Child Road (Farm Bureau Rd to Southwind Rd)	21,472	No Count	N/A	N/A	N/A	N/A
Southwind Rd	14,955	No Count	N/A	3,240	No Count	N/A
Seth Child Road (Southwind Rd to Fort Riley Blvd.)	21,074	18,716	13%	N/A	N/A	N/A
Fort Riley Blvd.	N/A	N/A	N/A	N/A	N/A	N/A

5 | TRAFFIC AND SAFETY ANALYSIS

Annual Average Daily Traffic

Daily traffic volumes shown in Table 5.C represent the 2017 volume condition and the projected Year 2040 volumes. Year 2040 volumes were produced by the FHMPO TDM. Using the TDM, growth rates were derived and applied to the base year volumes to develop the 2017 Annual Average Daily Traffic (AADT) volume. The volumes are shown in vehicles per day (vpd). These same growth rates were applied to the intersection turning movements to develop 2040 "No Build" volumes.

TABLE 5.C | TRAVEL DEMAND MODEL VOLUMES

Location	AADT (2017)	AADT (2040)	Location	AADT (2017)	AADT (2040)
US-24 (West)	6,820	7,890	Anderson Ave (SB Seth Child Road Off-Ramp)	3,450	4,020
US-24 (East)	6,040	6,960	Anderson Ave (NB Seth Child Road Off-Ramp)	4,400	4,240
Seth Child Road (S of US-24)	5,200	6,890	Anderson Ave (West)	17,530	16,810
Seth Child Road (N of Marlatt Ave)	5,610	7,710	Anderson Ave (East)	21,290	20,430
Marlatt Ave (East)	2,640	5,940	Anderson Ave (NB Seth Child Road On-Ramp)	4,560	5,320
Marlatt Ave (West)	280	5,940	Anderson Ave (SB Seth Child Road On-Ramp)	4,180	4,210
Seth Child Road (S of Marlatt Ave)	7,390	13,470	Seth Child Road (N of Amherst Ave)	24,390	30,350
Seth Child Road (N of Gary Ave)	8,410	14,490	Amherst Ave (West)	5,420	5,140
Gary Ave (East)	2,920	3,920	Amherst Ave (East)	2,640	2,980
Gary Ave (West)	6,620	9,710	Seth Child Road (S of Amherst Ave)	23,750	28,750
Seth Child Road (S of Gary Ave)	10,580	16,260	Seth Child Road (N of Farm Bureau Rd)	23,750	28,750
Kimball Ave (NB Seth Child Road On-Ramp)	1,140	1,390	Farm Bureau Rd (East)	3,680	4,020
Kimball Ave (SB Seth Child Road Off-Ramp)	900	1,810	Seth Child Road (S of Farm Bureau Rd)	22,330	26,710
Kimball Ave (NB Seth Child Road Off-Ramp)	3,390	3,930	Seth Child Road (N of Southwind Rd)	22,330	26,710
Kimball Ave (West)	19,380	22,230	Southwind Rd (West)	3,300	3,570
Kimball Ave (East)	17,760	19,150	Southwind Rd (East)	15,060	15,540
Kimball Ave (NB Seth Child Road Off-Ramp)	3,390	3,930	Seth Child Road (S of Southwind Rd)	21,910	26,210
Seth Child Road (N of Dickens Ave)	15,430	21,050	Seth Child Road (N of Fort Riley Blvd)	21,910	26,210
Dickens Ave (West)	4,310	3,610	Fort Riley Blvd (K-18 EB On-Ramp)	4,570	4,460
Dickens Ave (East)	7,730	9,590	Fort Riley Blvd (K-18 WB On-Ramp)	240	330
NB Seth Child Road (S of Dickens Ave)	9,900	13,470	Fort Riley Blvd (WB to SB LT)	1,490	1,030
Seth Child Road (S of Dickens Ave)	19,730	26,630	Fort Riley Blvd (SB to WB K18 RT)	2,700	4,870
Seth Child Road (N of Claflin Rd)	19,730	26,630	Seth Child Road (S of Fort Riley Blvd)	12,310	11,980
Claflin Rd (West)	4,170	4,720			
Claflin Rd (East)	9,590	11,360			
Seth Child Road (S of Claflin Rd)	23,770	31,240			

Existing and 2040 No Build Traffic Operations

Existing 2017 traffic volumes were used to develop baseline traffic operation conditions for the study intersections. 2040 traffic volumes were developed using the growth rates derived from the travel demand volumes. Table 5.D summarizes the growth rates that were applied to the existing turning movements. The existing and 2040 "No Build" traffic volumes are located in Appendices D through J.

TABLE 5.D | GROWTH RATES

Location	Growth Rate	Location	Growth Rate
Amherst Ave (Eastbound)	0.5%	Gary Ave (Eastbound)	0.0%
Amherst Ave (Westbound)	0.5%	Seth Child Road (Northbound)	2.0%
Seth Child Road @ Amherst Ave (Southbound)	1.0%	Gary Ave (Westbound)	0.0%
Seth Child Road @ Amherst Ave (Northbound)	1.0%	Kimball Ave (Eastbound @ East Ramp)	0.5%
Anderson Ave (Eastbound @ East Ramp)	1.0%	Kimball Ave (Westbound @ East Ramp)	0.5%
Anderson Ave (Westbound @ East Ramp)	1.0%	Kimball Ave (Eastbound @ West Ramp)	0.5%
Anderson Ave (Eastbound @ West Ramp)	1.0%	Kimball Ave (Westbound @ West Ramp)	0.5%
Anderson Ave (Westbound @ West Ramp)	1.0%	Kimball Ave (Northbound Off Ramp)	0.5%
Anderson Ave (Northbound Off Ramp)	1.0%	Kimball Ave (Southbound Off Ramp)	2.0%
Anderson Ave (Southbound Off Ramp)	1.0%	Kimball Ave (Northbound @ West Ramp)	1.0%
Claflin Rd (Eastbound)	0.5%	Leadership Ln/KFB Plaza (Westbound)	0.0%
Seth Child Road @ Claflin Rd (Northbound)	1.0%	Leadership Ln/KFB Plaza (Eastbound)	0.0%
Seth Child Road @ Claflin Rd (Southbound)	1.0%	Seth Child Road @ Leadership Ln/KFB (Northbound)	0.0%
Claflin Rd (Westbound)	0.5%	Leadership/KFB (Southbound)	0.0%
Dickens Ave (Eastbound)	0.0%	Marlatt Ave (Eastbound)	14.0%
Seth Child Road @ Dickens Ave (Northbound)	1.0%	Seth Child Rd @ Marlatt Ave (Northbound)	2.0%
Seth Child Road @ Dickens Ave (Southbound)	1.0%	Seth Child Road @ Marlatt Ave (Southbound)	2.0%
Dickens Ave (Westbound)	0.5%	Marlatt Ave (Westbound)	3.0%

Each of the segments identified above were analyzed using existing traffic control and geometrics. Intersection capacity analyses were completed using Synchro and Sim Traffic. The level of service for each intersection was reported using the 2010 Highway Capacity Manual (HCM). Level of service (LOS) is a system of ranking intersection performance using average stop delay per vehicle as the evaluation criteria (expressed as seconds of delay per vehicle, or sec/veh). The HCM LOS rankings are displayed in Table 5.E. For this report, acceptable levels of service were considered LOS D, or better, for the overall intersection and LOS E, or better, for individual movements.

TABLE 5.E | HCM LEVEL OF SERVICE CRITERIA

LOS	Average Delay (s/veh)	
	Signalized	Unsignalized
A	≤10	≤10
B	>10-20	>10-15
C	>20-35	>15-25
D	>35-55	>25-35
E	>55-80	>35-50
F	>80	>50

The HCM reports out of Synchro provide a summary of the independent operation for each intersection. To look at the overall corridor, simulation analysis was completed on multiple runs in Sim Traffic. Sim Traffic evaluates the intersections as a network and the interaction between them. Therefore, the level of service results from Sim Traffic were reported if there was a significant difference between HCM and simulation. In addition to level of service, vehicle queue lengths were developed using Sim Traffic analysis. The 95th percentile queue lengths were rounded to the nearest 5-feet and are included in the level of service figures. Vehicle queue lengths are another metric used to determine the overall traffic operation.

SEGMENT A – US-24 INTERSECTIONS WITH SETH CHILD ROAD & K-13

Existing and 2040 "No Build" traffic volumes are located in Appendix J. Figures J.1 and J.4 represent the volumes used in the capacity analysis for Segment A. Existing geometrics and traffic control were used in the capacity analysis. Figures J.2 and J.3 provide a summary of the individual turning movement level of service for existing conditions and Figures J.5 and J.6 depict 2040 "No Build" conditions.

Seth Child Road & US-24

Unsignalized capacity analysis indicates the northbound approach is currently operating at a LOS C and D during the AM and PM peak periods, respectively. Table 5.F summarizes the level of service for the study intersection located along US-24. Individual turn movements are currently operating at LOS D or better during both the AM and PM peak periods.

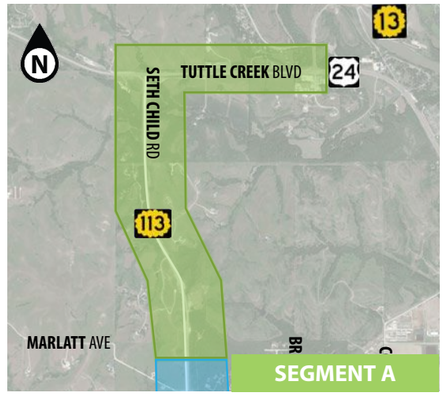
The northbound approach is expected to operate at a LOS E and F during the AM and PM peak periods with 2040 "No Build" traffic volumes.

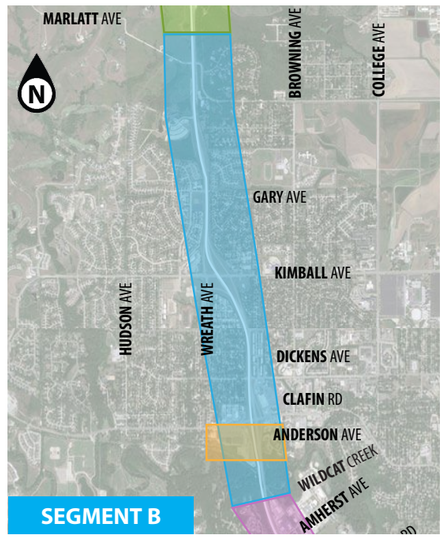
K-13/Dam Rd & US-24

Unsignalized capacity analysis indicates the southbound approach is currently operating at a LOS C during both the AM and PM peak periods, as shown in Table 5.F. Additionally, the northbound approach operates at a LOS C and B, respectively, under existing conditions. During the 2040 No Build traffic volume condition, the southbound approach would be expected to operate at a LOS D during the AM and PM peak periods, while the northbound approach operates at a LOS D and C, respectively.

TABLE 5.F | US-24 LOS SUMMARY

Intersection	EXISTING (2017) AM	EXISTING (2017) PM	2040 NO BUILD AM	2040 NO BUILD PM
Seth Child Road	C	D	E	F
K-13/Dam Rd	C	C	D	D





SEGMENT B – SETH CHILD ROAD FROM MARLATT AVENUE TO WILDCAT CREEK BRIDGE

Marlatt Avenue Corridor: Existing and 2040 "No Build" traffic volumes are located in the Appendix. Figures I.1 and I.4, located in Appendix I represent the volumes used in the capacity analysis for Marlatt Avenue Corridor. The existing geometrics and traffic control were used in the capacity analysis. Figures I.2 and I.3 in Appendix I provide a summary of the individual turning movement level of service for the existing conditions and Figures I5 and I6 depict the 2040 "No Build" conditions.

Seth Child Road & Marlatt Avenue

The unsignalized capacity analysis indicates the westbound approach is currently operating with a LOS C during the AM and PM peak periods, depicted in Table 5.G. During the 2040 "No Build" traffic volume condition, both the eastbound and westbound approaches would be expected to operate at a LOS F during the AM and PM peak periods. MUTCD signal warrant analysis indicate that a traffic signal would be warranted by 2040.

Browning Avenue & Marlatt Avenue

The unsignalized capacity analysis indicate the northbound approach is currently operating with a LOS B during both the AM and PM peak periods. Table 5.G summarizes the level of service for the study intersection located along Marlatt Avenue.

The 2040 "No Build" unsignalized capacity analyses indicate the northbound approach would be expected to downgrade to a LOS D during the AM and PM peak periods for this intersection.

TABLE 5.G | MARLATT AVENUE CORRIDOR LOS SUMMARY

Intersection	EXISTING (2017) AM	EXISTING (2017) PM	2040 NO BUILD AM	2040 NO BUILD PM
Seth Child Road	C	C	F	F
Browning Ave *	B	B	D	D
KFB Plaza/ Leadership Ln *	B	C	B	F

** Unsignalized intersection level of service shown represents the lowest individual turning movement LOS.*

Kansas Farm Bureau (KFB) Plaza/Leadership Lane & Seth Child Road

The unsignalized capacity analysis indicates the eastbound approach is currently operating with a LOS B and C during the AM and PM peak periods, respectively, while the westbound approach is operating with a LOS A and C, respectively. Figures I.2 and I.3 summarize the LOS for each individual turning movement for the existing AM and PM peak periods. During the 2040 "No Build" traffic volume condition, the eastbound approach would be expected to operate during the AM peak period at a LOS B and a LOS E during the PM peak period, detailed in Figures I.5 and I.6. The westbound approach would be expected to operate at a LOS A and F during the AM and PM peak periods, respectively.

5 | TRAFFIC AND SAFETY ANALYSIS

Gary Avenue Corridor: The existing and 2040 "No Build" traffic volumes are located in Appendix H. Figures H.1 and H.4 represent the volumes used in the capacity analysis for Gary Avenue Corridor. The existing geometrics and traffic control were used in the capacity analysis. Figures H.2 and H.3 show a summary of the individual turning movement level of service for the existing conditions, with Figures H.5 and H.6 depicting the 2040 "No Build" conditions. Table 5.H summarizes the level of service for the study intersections located along Gary Avenue.

Candlewood Drive & Gary Avenue

This intersection is currently a single lane roundabout. According to the roundabout capacity analysis, the roundabout currently operates at an overall LOS A for both AM and PM. The 2040 "No Build" analysis indicate that the roundabout will continue to operate at LOS A.

TABLE 5.H | GARY AVENUE CORRIDOR LOS SUMMARY

	EXISTING (2017)		2040 NO BUILD	
Intersection	AM	PM	AM	PM
Candlewood Dr	A	A	A	A
Seth Child Road	F	F	F	F
Meadowood Dr	A	A	A	A
Terry Way	A	A	A	A

Candlewood Drive, Meadowood Drive and Terry Way perform well with LOS A for both AM and PM peak under existing and no build conditions.

Seth Child Road & Gary Avenue

According to the unsignalized capacity analysis, the eastbound and westbound approaches currently operate at LOS F. This intersection operates with two-way stop control and it should be noted that it is not uncommon for an unsignalized side street to experience a poor level of service during peak volume conditions. Due to the poor LOS, a signal warrant analysis was conducted. Based on the Manual on Uniform Traffic Control Devices (MUTCD) traffic signal warrant guidelines, the Peak Hour Warrant (Warrant 3) is currently met for the existing volumes and geometrics. However, none of the other MUTCD signal warrants were met.

The 2040 "No Build" analyses indicate the eastbound and westbound approaches would continue to operate with a LOS F. Due to the poor level of service, signal warrant analyses were completed to determine if a signal should be considered. Similar to existing conditions, Warrant 3 was the only MUTCD signal that would be met by year 2040.

Kimball Avenue Corridor: Figures G.1 and G.4, located in Appendix G, represent the volumes used in the capacity analysis for the Kimball Avenue Corridor. Existing geometrics and traffic control were used in the capacity analysis. Figures G.2 and G.3 summarize the individual turning movement level of service for the existing and 2040 "No Build" conditions. Table 5.I summarizes the level of service for the Kimball Avenue Corridor.

TABLE 5.I | KIMBALL AVENUE CORRIDOR LOS SUMMARY

	EXISTING (2017)		2040 NO BUILD	
Intersection	AM	PM	AM	PM
Candlewood Drive	B	C	B	C
Seth Child Road SB On-Ramp / Wreath Ave.	A	A	A	A
Wreath Ave / Seth Child Road SB Off-Ramp	A	B	B	C
Seth Child Road NB Off-Ramp	C	C	C	C
Seaton Ave	E	F	F	F

Candlewood Drive & Kimball Avenue

Based on the signalized capacity analyses the overall intersection operates at a LOS B and C during the AM and PM peak periods, respectively. The eastbound left turn lane operates at a LOS D during the PM peak hour, shown in Figures G.2 and G.3. All other turning movements operate at LOS C or better during both peak hours. The 2040 "No Build" analyses indicate the overall LOS would not change and would continue to operate at LOS B and C for the AM and PM peak hours, respectively, depicted in Table 5.I.

Seth Child Road SB Off-Ramp / Wreath Avenue & Kimball Avenue

According to the signalized capacity analysis, the intersection of Wreath Ave and Kimball currently operates at an overall LOS A and B during the AM and PM Peak hours, respectively. All individual turning movements operate at LOS D or better during the AM peak hour. During the PM peak hour, all individual turning movements operate at LOS E or better.

The 2040 "No Build" analysis indicates the intersection is expected to operate at LOS B and C, during the AM and PM peak hours, respectively. The individual southbound left turn movement is expected to degrade from LOS D and E in the AM and PM, respectively, to LOS E and F.

Wreath Avenue & Seth Child Road SB On-Ramp

This existing intersection is an unsignalized T-intersection, with the northbound traffic having a stop sign. The unsignalized analyses show all individual movements operating at LOS A for all scenarios.

Seth Child Road NB Off-Ramp & Kimball Avenue

Based on the signalized analysis, the intersection currently operates at LOS C in both the AM and PM peak hours. All individual turning movements operate at LOS D or better. The 2040 "No Build" analysis shows that the overall intersection LOS is expected to remain LOS C for both the AM and PM peak hour and all individual turning movement operate with LOS D or better.

Seaton Avenue & Kimball Avenue

According to the unsignalized capacity analysis, the southbound approach currently operates at LOS E and F during the AM and PM peak hours, respectively. This approach is expected to go to LOS F during both the AM and PM peak hours according to the 2040 "No Build" analysis. The northbound approach, the church driveway, is currently operating with a LOS C and D during the AM and PM peak hours, respectively. The northbound approach would be expected to operate with a LOS C and F during the peak periods for the 2040 volume conditions.

Dickens Avenue Corridor: The existing and 2040 "No Build" traffic volumes are located in Appendix F. Figures F.1 and F.4, located in the Appendix represent the volumes used in the capacity analysis for Dickens Avenue Corridor. The existing geometrics and traffic control were used in the capacity analysis. Figures F.2 and F.3 provide a summary of the individual turning movement level of service for the existing conditions and Figures F.5 and F.6 depict the 2040 "No Build" conditions. Table 5.J summarizes the level of service for the study intersections located along Dickens Avenue.

TABLE 5.J | DICKENS AVENUE CORRIDOR LOS SUMMARY

	EXISTING (2017)		2040 NO BUILD	
Intersection	AM	PM	AM	PM
Wreath Avenue*	C	C	C	C
Seth Child Road	F	F	F	F
Browning Avenue*	D	C	D	C

** Unsignalized intersection level of service shown represents the lowest individual turning movement LOS.*

Wreath Avenue & Dickens Avenue

The unsignalized capacity analysis indicate the intersection turning movements are currently operating with a LOS C or better during both the AM and PM peak periods. The 2040 "No Build" capacity analyses indicate the individual turn movements would be expected to operate with a LOS C or better.

Seth Child Road & Dickens Avenue

Based on unsignalized capacity analyses, the eastbound and westbound approaches are currently operating with a LOS F during both the AM and PM peak periods. The intersection is currently a two-way stop controlled. It is not uncommon for an unsignalized side street to experience poor level service during peak volume conditions. Due to the poor level of service, traffic signal warrant analyses was completed to determine if a signal should be considered. Based on the MUTCD traffic signal warrant guidelines, the Peak Hour Warrant (Warrant 3) is currently met with the existing volumes and geometrics. However, none of the other MUTCD signal warrants were met.

The 2040 "No Build" analyses indicate the eastbound and westbound approaches would continue to operate with a LOS F. Due to the poor level of service, traffic signal warrant analyses was completed to determine if a signal should be considered. Warrant 3 is the only signal warrant expected to be met by year 2040.

Browning Avenue & Dickens Avenue

The unsignalized capacity analyses indicate the eastbound approach on Dickens Avenue is currently operating with a LOS D and C during the AM and PM peak periods, respectively. The westbound approach is currently operating with a LOS C during both the AM and PM peak periods.

Similarly, the 2040 "No Build" capacity analyses indicate the eastbound approach would be expected to operate with a LOS D and C during the AM and PM peak periods, respectively. The westbound approach would be expected to continue to operate with a LOS C during both the AM and PM peak periods.

Claflin Road Corridor: The existing and 2040 "No Build" traffic volumes are located in the Appendix. The existing and 2040 "No Build" volumes are located on the same figures as the Anderson Avenue Corridor, see Appendix E, Figures E.1 and E.4. Figures E.2 and E.3 provide a summary of the individual turning movement level of service for the existing conditions and Figures E.5 and E.6 depict the 2040 "No Build" conditions. Table 5.K summarizes the level of service for the study intersections located along Dickens Avenue.

TABLE 5.K | CLAFLIN ROAD CORRIDOR LOS SUMMARY

	EXISTING (2017)		2040 NO BUILD	
Intersection	AM	PM	AM	PM
Wreath Avenue*	C	C	C	C
Seth Child Road	C	D	D	D
Beachwood Terrace*	C	D	C	D

** Unsignalized intersection level of service shown represents the lowest individual turning movement LOS.*

Wreath Avenue & Claflin Road

The unsignalized capacity analysis indicate the existing intersection turning movements are currently operating with a LOS C or better during both the AM and PM peak periods, as shown in Table 5.K. The 2040 "No Build" capacity analyses indicate that the individual turning movements would be expected to continue to operate with a LOS C or better during both the AM and PM peak hours.

Seth Child Road & Claflin Road

The intersection of Claflin Road with Seth Child Road is currently a signalized intersection and is located about 400 feet north of Seth Child Road and Anderson Avenue interchange gore point. Signalized capacity analyses indicate the overall intersection is currently operating with an overall LOS C and D during the AM and PM peak periods, respectively. The eastbound thru movement is currently operating with a LOS E during the AM peak hour. During the afternoon peak hour, the eastbound left-turn movement currently operates with a LOS E, as shown in Figures E.2 and E.3.

The 2040 "No Build" capacity analyses indicate the overall intersection would be expected to operate with a LOS D during both the AM and PM peak periods. During the AM peak hour, the eastbound thru movement would be expected to operate with a LOS E and the westbound dual left-turn lanes would be expected to operate with a LOS F, as depicted in Figures E.5 and E.6. During the PM peak period, the eastbound left-turn lane would be expected to operate with a LOS E.

Beechwood Terrace & Claflin Avenue

The intersection of Claflin Road with Beechwood Terrace is currently a signalized intersection and is located about 430-feet east of Seth Child Road. The amount of available vehicle storage between intersections is approximately 320-feet. The south leg of the intersection serves the West Loop Shopping Center. Signalized capacity analyses indicate the overall intersection is currently operating with an overall LOS C and D during both the AM and PM peak periods, respectively. The northbound thru/left movement is currently operating with a LOS F during the PM peak hour, as depicted in Figure E.3.

The 2040 No Build capacity analyses indicate the overall intersection would be expected to operate with a LOS C and D during both the AM and PM peak periods, respectively. The northbound thru/left movement is currently operating with a LOS F during the PM peak hour, as depicted in Figure E.6.

Anderson Avenue Corridor: The existing and 2040 "No Build" traffic volumes are located in the Appendix. Figures E.1 and E.4, located in the Appendix E represent the volumes used in the capacity analysis for Anderson Avenue Corridor. The existing geometrics and traffic control were used in the capacity analysis. Figures E.2 and E.3 provide a summary of the individual turning movement level of service for the existing conditions and Figures E.5 and E.6 depict the 2040 "No Build" conditions. Table 5.L summarizes the level of service for the study intersections located along Anderson Avenue.

TABLE 5.L | ANDERSON AVENUE CORRIDOR LOS SUMMARY

	EXISTING (2017)		2040 NO BUILD	
Intersection	AM	PM	AM	PM
Wreath Avenue	C	A	C	A
Waters Street*	B	C	B	C
SB Seth Child Road Ramp	C	D	E	D
NB Seth Child Road Ramp	C	F	C	F
Garden Way*	F	F	F	F
West Loop	C	F	D	F

** Unsignalized intersection level of service shown represents the lowest individual turning movement LOS.*

Wreath Avenue & Anderson Avenue

Signalized capacity analysis indicates the overall intersection is currently operating with a LOS C and A during the AM and PM peak periods, respectively. The individual turn movements are currently operating with a LOS D or better during both the AM and PM peak periods.

The 2040 "No Build" signalized capacity analyses indicate the overall intersection would be expected to operate with a LOS C and A during the AM and PM peak periods. The individual turning movements would be expected to operate with a LOS C or higher.

Waters Street & Anderson Avenue

The unsignalized capacity analysis indicate the southbound approach is currently operating with a LOS B and C during the AM and PM peak periods, respectively. During the 2040 "No Build" traffic condition, the southbound approach would be expected to operate with a LOS B and C during the AM and PM peak periods, respectively.

Southbound Seth Child Road Ramp & Anderson Avenue

Existing capacity analyses indicate the intersection is currently operating with an overall LOS C and D during the AM and PM peak periods, respectively. During the AM peak period, the individual turning movements operate with LOS D or better. However, during the PM peak hour the westbound left-turn lane, southbound movements, and eastbound movements currently experience significant vehicle backup resulting in LOS F for those movements. As part of data collection, the team recorded the vehicle queues during the AM and PM peak periods. Results of vehicle queue data analysis are summarized in Figures E.7 and E.8. During the PM peak hour, the westbound left-turn movement backs up into the westbound thru lane. This vehicle queue interaction then compounds over the peak period. It was observed that the 95th percentile westbound vehicle queue extends back 34 vehicles, approximately 850 feet. This information was used to calibrate the Synchro/Sim Traffic models during the PM peak period. Based on the Sim Traffic model, the westbound vehicle queue was estimated to be 36 vehicles, shown in Exhibit E.10 in Appendix E. The AM peak period was simulated as well but the critical peak period was observed to be the critical peak period. The results are shown in Figure E.9 in Appendix E.

For the 2040 "No Build" traffic condition, the overall intersection would be expected to operate with an overall LOS E and D during the AM and PM peak periods, respectively. During the AM peak hour, the eastbound thru movement would be expected to operate with a LOS F, as shown in Figure E.5. During the PM peak hour, the eastbound thru lanes, westbound left-turn movement, and the southbound approach would be expected to operate with a LOS F. The 95th percentile queue length for the westbound left turn movement would be expected to be about 905 feet during the PM peak period, as depicted in Figure E.6.

Northbound Seth Child Road Ramp & Anderson Avenue

Existing capacity analyses indicate that the overall intersection is currently operating with an overall LOS C and F during the AM and PM peak periods, respectively. The individual intersection turning movements currently operate with LOS D or better during both the AM peak periods. During the PM peak period, all movements, except eastbound thru movement operate with acceptable Level of Service. Currently, the eastbound thru movement would be expected to operate a LOS F which corresponds to the significant vehicle queues that were observed in the field.

Capacity analysis for the 2040 "No Build" traffic conditions revealed the intersection would be expected to operate with a LOS C and F during the AM and PM peak periods, respectively. The individual intersection movements would be expected to operate with a LOS D or better during the AM peak hour. However, during the PM peak hour, the eastbound left-turn movement, the westbound thru movements and the northbound approach would be expected to operate with a LOS F during the PM peak period.

Garden Way & Anderson Avenue

Unsignalized capacity analysis indicate the northbound approach is currently operating with a LOS F during both the AM and PM peak periods. The southbound left-turn lane is currently operating with a LOS E and F during the AM and PM peak periods, respectively. It should be noted that it is not uncommon for an unsigalized side street approach to experience poor level of service during peak volume conditions.

During the 2040 "No Build" traffic volume condition, the northbound approach would be expected to operate with a LOS F during both the AM and PM peak periods. The southbound left-turn movement would be expected to operate with a LOS F during both the AM and PM peak periods.

West Loop Entrance & Anderson Avenue

The West Loop intersection is the first signalized intersection located to the east of Seth Child Road. Signalized capacity analysis indicate the overall intersection is currently operating with a LOS C and F during both the AM and PM peak periods, respectively. Individual turn movements are currently operating with a LOS D or better during both the AM and PM peak periods, except for the westbound thru movement which is currently a LOS F during the PM peak periods, as shown in Figure E.3 in the Appendix.

The 2040 "No Build" signalized capacity analyses indicate that the overall intersection would be expected to operate with a LOS D and F during the AM and PM peak periods, respectively. Individual turning movements would be expected to operate with a LOS D or better during the AM peak hour. During the afternoon peak hour, the westbound thru movement would be expected to operate with a LOS F.

SEGMENT C –SETH CHILD ROAD FROM AMHERST AVENUE TO K-18 (FORT RILEY BOULEVARD) INTERCHANGE

Existing and 2040 "No Build" traffic volumes are located in Appendix D. Figures D.1 and D.4 represent the volumes used in the capacity analysis for Segment C. The existing geometrics and traffic control were used in the capacity analysis unless otherwise noted. Table 5.M below summarizes the level of service for the study intersections located along Segment C.

TABLE 5.M | SEGMENT C CORRIDOR LOS SUMMARY

	EXISTING (2017)		2040 NO BUILD	
Intersection	AM	PM	AM	PM
Amherst Avenue	C	C	C	C
Farm Bureau Road	A	A	A	A
Southwind Road	C	D	C	D
EB K-18 (Fort Riley Blvd) Ramp Crossover	A	B	A	B
WB K-18 (Fort Riley Blvd) Ramp Crossover	B	B	B	B

Seth Child Road & Amherst Avenue

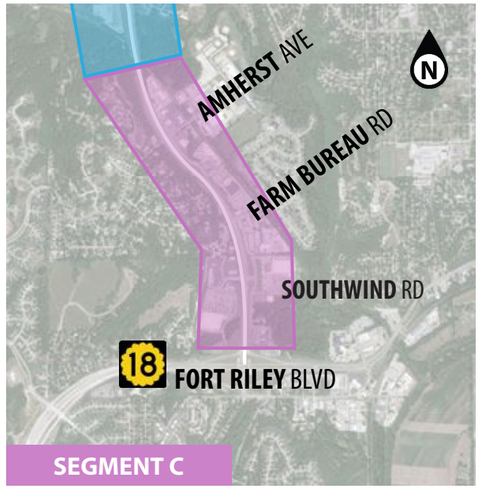
Existing capacity analyses indicated the intersection is currently operating with an overall LOS C during both the AM and PM peak periods. Individual turning movements currently operate with LOS D or better except for the eastbound left-turn movement during the AM peak hour.

For the 2040 "No Build" traffic condition, the overall intersection would be expected to continue to operate with a LOS C for both the AM and PM peak periods. Individual intersection turning movements would expected to operate with a LOS D or better except the eastbound left-turn movement would expected to operate with a LOS E during the AM peak period.

Seth Child Road & Farm Bureau Road

As shown in Table 5.M, the intersection is currently operating with an overall LOS A during both the AM and PM peak periods and the individual intersection turning movement currently operate with LOS D or better.

The 2040 "No Build" capacity analyses indicate the overall intersection would be expected to continue to operate with a LOS A during both the AM and PM peak periods. Individual intersection turning movements would operate with LOS D or better.



Seth Child Road & Southwind Road

Existing capacity analyses indicated the overall intersection is currently operating with an overall LOS C and D during the AM and PM peak periods, respectively, as summarized in Table 5.M. Individual intersection turning movements currently operate with LOS D or better except for the eastbound right-turn movement and the westbound left-turn movement. The eastbound right-turn movement currently operates with a LOS F during the PM peak period and the westbound left-turn movement currently operates with a LOS E during the AM peak hour.

For the 2040 "No Build" traffic condition, the overall intersection would be expected to continue to operate with a LOS C and D during the AM and PM peak periods, respectively. The eastbound right-turn would be expected to continue to operate with a LOS F and the eastbound left-turn lane would be expected to operate with a LOS E during the PM peak hour. The westbound left-turn movement would be expected to operate with a LOS E during both the AM and PM peak periods.

K-18 (Fort Riley Boulevard) & Seth Child Road Interchange

The interchange of K-18 (Fort Riley Road) with Seth Child Road was analyzed as a diverging diamond interchange (DDI). The interchange recently was converted from the traditional diamond interchange to the DDI configuration. Capacity analyses indicate the south crossover traffic signal and the eastbound K-18 ramps are expected to operate with an overall intersection LOS A and B during the AM and PM peak periods for both the existing and 2040 "No Build" traffic volume conditions. Figures D.2 and D.3 in Appendix D provide a summary of the individual turning movement level of service for the existing conditions. Exhibits D.5 and D.6 in Appendix D depict the 2040 "No Build" conditions. As noted in the exhibits, the individual turning movements would be expected to operate with a LOS B or better for each of the peak periods.

Similarly, for existing and future 2040 "No Build" conditions, the north crossover is expected to operate with an overall intersection LOS B during both the AM and PM peak periods and the individual turning movements are expected to operate with LOS B or better, as shown in Exhibits D.2, D.3, D.5 and D.6 in Appendix D.

SAFETY ANALYSIS OF EXISTING ROADWAYS AND INTERSECTIONS ON SETH CHILD ROAD CORRIDOR

Traffic safety analyses were completed for this project using primarily the procedures presented in the AASHTO Highway Safety Manual (HSM). In the HSM, guidance is provided to analyze intersections and roadway sections that are reasonably homogeneous with respect to key variables such as traffic volume, highway cross-section, highway classification and surrounding land use. For the Study Corridor, the roadway sections used for analysis consisted of sections from one public road intersection to the next. For safety analysis purposes, the Corridor was divided into 53 roadway segments, 45 at-grade intersections, 8 ramps, and 5 at-grade ramp terminals. Each of these facility types are discussed in the following sections. The safety analysis information located in Appendix B provides more detail relating to the available crash data and analysis summary. Additionally, the existing conditions analysis information was provided within the June 2017 Existing Conditions Memo.

5 | TRAFFIC AND SAFETY ANALYSIS

Roadway Segments

The Study Corridor includes 53 roadway segments, 16 segments on Seth Child Road and 37 segments on side streets that intersect Seth Child Road. The Study Corridor includes:

- 8 urban four-lane divided (U4D) roadway segments on Seth Child Road
- 4 urban four-lane undivided (U4U) roadway segments on Seth Child Road
- 4 rural two-lane undivided (R2U) roadway segments on Seth Child Road (north of Marlatt Avenue)
- 3 urban four-lane divided (U4D) roadway segments on side streets near Seth Child Road
- 13 urban four-lane undivided (U4U) roadway segments on side streets near Seth Child Road
- 21 urban two-lane undivided (U2U) roadway segments on side streets near Seth Child Road

The four-lane divided sections on Seth Child Road have a flush median ranging in width from 11.6 to 14.6 ft. For substantial parts of intersection approaches in this flush median section, the flush median is reconfigured as exclusive left-turn lanes in each direction of travel. There is also a 36-ft depressed median between the opposing directions of travel on Seth Child Road for approximately 750 ft on the approach to US 24. The four-lane divided roadway sections on side streets have raised medians ranging in width from 6.5 to 19 ft.

Table B.1, located in the Existing Conditions Memo and Appendix B, provides a summary of Segment lengths analyzed as part of this study. A total of 9.76 miles was analyzed, including 5.39 miles along Seth Child Road and 4.37 miles on side streets. The shortest segment, on Amherst Avenue from Seth Child Road to the adjacent frontage road is 0.02 miles in length. The longest roadway segment, on Seth Child Road from Marlatt Avenue to Top of the World Drive is 0.76 miles in length. The current (2017) Average Annual Daily Traffic Volumes (AADT) range from 5,200 to 24,390 (VPD) on Seth Child Road and from 280 to 19,380 (VPD) along the side streets. Where no traffic counts or estimates were available, AADT were estimated based on land use, development density, and comparison to other streets in the Study Corridor where traffic counts were available. Table B.1 in Appendix B also presents estimates of previous (2013) traffic volumes and forecast future (2020 and 2040) traffic volumes.

Intersection

The Study Corridor includes 45 at-grade intersections; including 12 intersections along Seth Child Road, 32 intersections on side street corridors; and the intersection of US-24 and K-13. The Study Corridor includes:

- 3 urban four-leg signalized (U/4SG) intersections on Seth Child Road
- 1 urban three-leg signalized (U/3SG) intersection on Seth Child Road
- 4 urban four-leg intersections with minor-road stop control (U/4ST) on Seth Child Road
- 4 rural three-leg intersections with minor-road stop control (R2U/3ST) on Seth Child Road
- 1 rural four-leg intersection with minor-road stop control (R4D/4ST) at US 24 and K-13
- 3 urban four-leg signalized (U/4SG) intersections on side streets near Seth Child Road
- 1 urban three-leg signalized (U/3SG) intersection on a side street near Seth Child Road
- 1 urban four-leg roundabout on a side street near Seth Child Road
- 5 urban four-leg intersections with minor-road stop control (U/4ST) on side streets near Seth Child Road
- 22 urban three-leg intersections with minor-road stop control (U/3ST) on side streets near Seth Child Road

In addition to these 45 at-grade intersections, there are 5 at-grade crossroad ramp terminals located within the study Corridor. One intersection that currently does not exist will be added in the future at the connection from the Grand Mere development with Marlatt Avenue. This will make Marlatt Avenue west of Seth Child Road a much higher traffic volume street. The Grand Mere development will also have a substantial impact on the intersection of Seth Child Road and Marlatt Avenue.

Table B.2 in Existing Conditions Memo and Appendix B presents the location, intersection type, and major- and minor-road traffic volumes for each intersection. The table not only presents the current (2017) major- and minor road traffic volumes for each intersection, but also presents estimates of previous (2013) traffic volumes and forecast future (2020 and 2040) traffic volumes.

Ramps

The Seth Child Road Corridor includes two existing diamond interchanges, one at Anderson Avenue and the other at Kimball Avenue. Each interchange has four ramps: a northbound off-ramp, a northbound on-ramp, a southbound off-ramp and a southbound on-ramp. All of the ramps are diamond ramps that intersect the arterial crossroad (Anderson Avenue or Kimball Avenue) directly, with the exception of the southbound on-ramp at the Kimball Avenue interchange which is a button hook ramp that begins from Wreath Avenue 0.1 mile south of its intersection with Kimball Avenue.

Table B.3 in the Existing Conditions Memo and Appendix B presents the location, ramp type, ramp length, and traffic volumes for each individual ramp. The ramp lengths range from 0.13 to 0.27 mile, not including the mainline speed-change lanes on Seth Child Road. The current (2017) traffic volumes for the ramps range from 900 to 4,560 VPD. Table B.3 summarizes the previous (2013) traffic volumes and forecast future (2020 and 2040) traffic volumes for each ramp. The five at-grade crossroad ramp terminals at the two interchanges are addressed in the next section.

Ramp Terminals

The two interchanges in the Seth Child Road Corridor contain five at-grade crossroad ramp terminals, as follows:

- The west ramp terminal at the interchange of Seth Child Road and Anderson Avenue; this ramp terminal is located on Anderson Avenue and provides access to and from the southbound off- and on-ramps.
- The east ramp terminal at the interchange of Seth Child Road and Anderson Avenue; this ramp terminal is located on Anderson Avenue and provides access to and from the northbound off- and on-ramps.
- The west ramp terminal at the interchange of Seth Child Road and Kimball Avenue; this ramp terminal is located on Kimball Avenue and provides access to and from Wreath Avenue and the southbound off-ramp.
- The east ramp terminal at the interchange of Seth Child Road and Kimball Avenue; this ramp terminal is located on Kimball Avenue and provides access to and from the northbound off- and on-ramps.
- The southbound on-ramp ramp terminal at the interchange of Seth Child Road and Kimball Avenue; this ramp terminal is located on Wreath Avenue 0.076 mi south of Kimball Avenue and provides access to the southbound on-ramp.

Table B.4 in the Existing Conditions Memo and Appendix B presents the location and traffic volumes for the five at-grade crossroad ramp terminals.

Crash History Data

Crash history data for the roadway segments, intersections, ramps, and ramp terminals within the Seth Child Road Corridor are present in this section. Crashes have been assigned to a particular intersection or ramp terminal if the crash occurred at the intersection or ramp terminal, or if the occurrence of the crash was related to the presence or operation of the intersection or ramp terminal. All of the crashes were assigned to the roadway segment or ramp within which they occurred.

Available crash history data were obtained from three sources: Riley County, KDOT and the City of Manhattan. KDOT data included the complete years 2011 through 2015. The 2016 KDOT data was potentially incomplete. The City data included the complete years 2012 through 2016. Given that the periods of data availability from the two sources were not identical but overlapped, the four-year period common to both data sets (2012 to 2015) was used as the study period for crash history. Most crashes on Seth Child Road were included in both the KDOT and City data sets, with some crashes included in either the KDOT data or the City data, but not both. The data set was adjusted so that crashes found in both data sets were counted only once. Crashes on the side streets near Seth Child Road were available from the City data set only.

Table 5.N presents the distribution of crashes by location type (roadway segment, intersection, ramp, or ramp terminal, and by most severe injury level (fatal, injury, or property damage only) for the Study Corridor as a whole. The ramp terminal crashes are limited to those that occurred at or were related to an at-grade crossroad ramp terminal; crashes at or associated with a mainline speed-change lane on Seth Child Road are included with the ramp crashes. Of the 403 crashes that occurred in the Study Corridor during the period from 2012 and 2015, 109 crashes (27.1%) were attributed to roadway segments, 224 crashes (55.6%) were attributed to intersections, 3 crashes (just under 1%) were attributed to ramps, and 67 crashes (16.6%) were attributed to ramp terminals. In the Study Corridor during the four-year study period, there were a total of 2 fatal crashes (0.5% of total crashes), 115 injury crashes (28.5%), and 286 property-damage-only crashes (71%). Appendix B provides a summary of the distribution of crash types by location type.

TABLE 5.N | SUMMARY OF CRASHES IN STUDY CORRIDOR BY LOCATION TYPE AND CRASH SEVERITY LEVEL

	Crash Frequency by Crash Severity Level (2012-2015)				
Location Type	Fatal	Injury	Property-Damage Only	Total	Location Types %
Roadway Segment	0	19	90	109	27.1%
Intersection	2	77	145	224	55.6%
Ramp	0	1	2	3	0.7%
Ramp Terminal	0	18	49	67	16.6%
Total	**2**	**115**	**286**	**403**	**100%**

HIGHWAY SAFETY MANUAL ANALYSIS

This section presents the safety analysis performed with the crash prediction procedures of the AASHTO Highway Safety Manual (HSM) using the Interactive Highway Safety Design Model (IHSDM) and ISATE software. The HSM procedures are being used to guide safety decision making for the Study Corridor because the raw or observed crash history data alone are random in nature and potentially biased because they can be observed for only a relatively short period. In this case, that time period spans four years. For any study period as short as three to five years, a high observed crash count will likely decrease in future years even if no improvement is made. Such decreases in crash count, known as regression to the mean, can bias any safety effectiveness evaluation based solely on observed crash data. If one were to try to observe crash data for a longer period, changed conditions such as traffic volume growth, vehicle design improvements and weather events, would likely make the subsequent period different from the first. The HSM provides a tool to estimate the expected long-term average crash frequency, a value which is more stable and less subject to random variation than observed crash data.

The HSM uses an approach called the Empirical Bayes (EB) method to compensate for the potential bias due to regression to the mean. The EB method combines the predicted and observed crash frequencies to obtain the expected crash frequency, an unbiased estimate of the long-term average crash frequency that would result if a site could be observed for a very long period without any changes in traffic volume or other conditions. For most of the roadway types present in the Study Corridor, the EB method is applied separately for five specific crash type categories (multiple-vehicle non-driveway crashes, single-vehicle crashes, multiple-vehicle driveway-related crashes, pedestrian and bicycle crashes) in each of two specific crash severity categories (fatal-and-injury crashes and property-damage-only crashes). The EB method computations follow the HSM procedures, but full details of these computations are not shown in the accompanying tables provided in Appendix B.

Once the expected crash frequency is determined, HSM procedures can be used to adjust that estimate to forecast the expected long-term average crash frequency for any future time period of interest, assuming that traffic volumes increase as forecast and no other conditions in the Study Corridor change; i.e., the no-build alternative. The future period of interest in this study is the 20-year period from January 1, 2020, to December 31, 2039.

The HSM models have not yet been calibrated for Kansas conditions for most roadway and intersection types present in the Study Corridor. Therefore, the models have, of necessity been used without calibration. Even without calibration, the HSM models provide results that accurately represent the differences in safety performance between specific roadway segment or intersection types.

5 | TRAFFIC AND SAFETY ANALYSIS

HSM - Crash Frequency Forecast for Entire Study Corridor

Table 5.O summarizes the current and forecast crash frequencies by crash severity level for the entire Study Corridor. The table shows that 2,414 crashes (including 773 fatal-and-injury crashes and 1,641 property-damage-only crashes are expected to occur in the Study Corridor during the 20-year period from 2020 to 2039, inclusive, if no improvements are made. Appendix B provides additional information regarding the development of the crash frequencies.

TABLE 5.O | CURRENT AND FORECAST CRASH FREQUENCIES BY CRASH SEVERITY LEVEL

	Observed Crash History (2012-2015)			Forecast 20-Year Crash Frequency (2020-2039)		
Location Type	Fatal & Injury	Property Damage Only	Total	Fatal & Injury	Property Damage Only	Total
Roadway Segment	19	90	109	138	553	691
Intersection	79	145	224	454	806	1,260
Ramp	1	2	3	15	19	34
Ramp Terminal	18	49	67	166	263	429
Total	**117**	**286**	**403**	**773**	**1,641**	**2,414**

IDENTIFIED LOCATIONS FOR FUTURE EVALUATION

Based on the safety analysis discussed in the previous section and Existing Conditions Memo, there appear to be 10 locations that may warrant improvements: 2 roadway segments, 7 intersections, and 1 ramp terminal. Table 5.P identifies locations within the Study Corridor that should be evaluated further. Evaluation was taken into account during the alternative development phase discussed in Section 6. Appendix B provides detailed information regarding the safety analysis for the existing and 20-year no-build conditions along with preferred alternative.

The key focus areas for intersections include:

- **The signalized intersections along Seth Child Road with Southwind Road, Amherst Avenue and Claflin Road are among the highest volume intersections in the Study Corridor and have relatively high number of crashes. In particular, Seth Child Road and Southwind Road has the most crashes of any intersection in the Study Corridor.**
- **The stop-controlled intersection at US 24 and K-13 immediately south of the Tuttle Creek Dam had two reported fatal crashes in the study period and was studied by KDOT in 2016. KDOT concluded that no traffic control change was identified, but offsetting the opposing left-turn lanes on US-24 , was one option that would improve the sight lines for the opposing left-turn vehicles.**
- **Two side street intersections–the stop-controlled intersections at Claflin Road with Wreath Avenue and the signalized intersection at Claflin Road with Browning Avenue have sufficient crash frequencies and higher crash rates.**
- **The intersection of Seth Child Road and Marlatt Avenue will likely need improvement and, perhaps, signalization or other alternatives once the connection from the Grand Mere development is completed to Marlatt Avenue.**
- **The signalized intersection of northbound Seth Child Road ramp with Anderson Avenue has experienced a sufficient number of crashes.**
- **The crash data indicate that northbound Seth Child Road and Kimball Avenue intersection should be considered for improvement. However, this ramp intersection was recently signalized after data was collected, which should reduce the number of critical crashes that were present. Therefore, the northbound Seth Child Road ramp terminal with Kimball Avenue was not included on the list of areas for further evaluation.**

TABLE 5.P | LOCATIONS IDENTIFIED FOR FURTHER EVALUATION

ROADWAY SEGMENTS
Anderson Avenue from Wreath Avenue to Waters Street
Anderson Avenue from Waters Street to Seth Child Road
INTERSECTIONS
Seth Child Road and Southwind Road
Seth Child Road and Amherst Avenue
Seth Child Road and Claflin Avenue
Seth Child Road and Marlatt Avenue
US-24 and K-13
Claflin Road and Wreath Avenue
Claflin Road and Browning Avenue
RAMP TERMINALS
Seth Child Road and Anderson Avenue East Ramp Terminal

VALUE METHODOLOGY

Subsequent to the team's collection of existing conditions, stakeholder expectations, and performance data, Value Planning methodology was utilized to assess alternatives and make recommendations. This process engaged people with varying perspectives to help determine what the Corridor truly needs to be. Public input through meetings, surveys and web-based comments were sought. Both the Project Advisory Committee and the Steering Committee were engaged in more detail on community expectations and vision for the corridor. With information that defined the corridor vision, the design team, working with the owners, were able to speculate on ideas and evaluate them, ultimately leading to an array of recommendations for improvements.

The use of Value Planning (VP) achieves four goals:

- Fully documents the data collection and decision making process in a transparent manner, allowing stakeholders to see how recommendations were made.
- Accounts for the expectations of stakeholders in the decision making process.
- Maximizes creativity.
- Facilitates a selection process to rate alternatives and recommendations that perform well, meet stakeholder expectations and have the most reasonable cost.

Value Planning encompasses six phases:

- Information Phase
- Function Analysis Phase
- Speculation Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

Information Phase

The purpose of the information phase is to define what the project is and what it is supposed to do. For the Seth Child Road Corridor, the idea was to explore what the transportation issues were from an engineering and public works perspective, identify Corridor issues from stakeholders perception, and develop a vision for the future. This phase can be broken into a two-step approach, with the first step involving data and information collection. The second step is organizing the information. This information helps facilitate the identification of the corridor functions. Information was gathered from a number of sources and are discussed in more detail in other sections of this report. However, defining the project's stakeholders and their expectations are crucial to the process. Table 6.A identifies the team's list of identified project stakeholders. Understanding and documenting the stakeholders assures that the team is considering the various perspectives for the Corridor. The table is broken into owners, users and stakeholders.

VALUE PLANNING WORKSHOP
JUNE 2017

TABLE 6.A | PROJECT STAKEHOLDERS

OWNERS	USERS	STAKEHOLDERS
Kansas Department of Transportation	Flint Hills Area Transportation Agency (aTa) Bus	Flint Hills Metropolitan Planning Organization
City of Manhattan	School Bus	Flint Hills Area Transportation Agency
Riley County	Adjacent Residents	Businesses
Federal Highway Administration	Drivers	School District
	Bicyclists	Kansas State University (KSU)
	Pedestrians	KSU Athletics
	Truck Operators	KSU Students
	Transit Users	KSU Faculty
	Emergency Responders	Manhattan Area Technical College
	Commuters (Thru North/South Traffic)	Manhattan Parks & Recreation
	Local Traffic	US Army Corps of Engineers
	Cross Traffic (East/West Traffic)	Institutions
	Para Transit	Tax Payers
	Utility Companies	Fort Riley
	Manhattan Public Works	Fort Riley Commuters
	Riley County Public Works	Flint Hills Regional Council
	KDOT Maintenance	Volunteer Organizations
	Game Day Traffic	Social Service Organizations
	Regional Traffic	Insurance Companies
	Cross-Country Traffic	Chamber of Commerce
		West Loop Business Association
		Candlewood Businesses
		Developers
		Adjacent Home Owner Associations
		Green Apple Bikes
		Bicycle/Pedestrian Advisory Committee
		Environmental Groups and Organizations
		Kansas Department of Health and Environment
		Riley County Police Department
		Kansas State Patrol
		Riley County Parks & Recreation
		Adjacent Property Owners
		Riley County Fair
		Federal Emergency Management Agency
		Visitors to the Community

Who are the Owners, Users and Stakeholders?

Owners are those individuals or groups that are financially responsible for funding the project, or shares in funding of the project or represent the owner's interests. This category includes the study's sponsors which include the City of Manhattan, Riley County and KDOT.

Users are those that actively use or maintain the project. This category includes various transportation mode users and types of traffic. Any entity that has a use for the Seth Child Road Right-of-Way, such as utility companies or roadway maintenance crews, were included in this category.

Stakeholders are those that are impacted by the project in other ways. They are financially affected by the project, environmentally concerned about the project or disturbed by a required change in habit or recreation. This includes various regulators, business owners and a variety of other entities. Certain agencies like the Metropolitan Planning Organization (MPO) and the Flint Hills Regional Council were identified because of the planning mission or their advocacy for the community. The US Army's Fort Riley and Kansas State University, located in the community, have a number of stakeholder groups within each entity identified.

For the remainder of the report these three groups will be collectively referred to as stakeholders.

6 | ALTERNATIVE DEVELOPMENT

Once the stakeholders have been identified, the next step in defining the project vision is determining the constraints, needs and desires. From these parameters, the team was able to define the important functions and graphically present the project. Table 6.B summarizes the stakeholder's constraints, needs and desires for the Seth Child Road Corridor created by the team and based on stakeholder input.

TABLE 6.B | STAKEHOLDER CONSTRAINTS

CONSTRAINTS	NEEDS	DESIRES
Definition: Legal Requirement. Standards of the Owner. Physical conditions of the site. Commitments to Stakeholders	Definition: Expectations that must be fulfilled by the project if constraints are not violated. Limitations or restrictions that are imposed by Stakeholders but which can be violated.	Definition: Expectations that should be fulfilled if cost is not a factor.
Maintain Environmental Constraints	Minimize Right-of-Way (ROW) Acquisitions	No ROW Acquisitions
	Minimal Zoning Changes	No Zoning Changes
No Negative Flood Way Impacts	Minimize Park Impacts	No Park Ground Impacts
	Minimize Flood Plain Impacts	No Flood Plain Impacts
Minimum Design Criteria	Maintain East/West Connectivity (All Modes)	Maintain All Existing Access Points
Maintain Seth Child Road North/South Access and Connectivity	Enhance Safety (All Modes)	No New Direct Property Access (Seth Child Road)
	Define Access Criteria (Corridor Management)	New Use Agreement to Use Bus Stops
Maintain Anderson / Kimball / Marlatt / K-18 / US-24 Connections	Improve Traffic Flow	Bicycle/Pedestrian Along Corridor
	Bicycle / Pedestrian North/South Facilities	Enhance Bicycle/Pedestrian East/West Connectivity
Overall Intersection Level of Service (LOS) E	Bicycle/Pedestrian Connecting Destination and Origin	Overall Intersection LOS C or Better
Comply with NEPA Requirements	Complete Linear Trail Loop	Signalized Individual Turn Movement LOS D or Better
	Overall Intersection LOS D or Better	Maintain Business Access Movements
	Signalized Individual Turn Movement LOS E or Better	Wayfinding Signage for Destinations
	Maintain Viability to Businesses	Improve Drainage / Flooding (Wildcat Creek)
	Integration of ITS	Maximize Property Values
	Accommodate Utility Infrastructure Improvements and Development	Facilitate Development/Redevelopment
		Minimize Construction Impacts
	Improve Lighting	Highest and Best Land Use
	Phased/Prioritized Improvements	Create a Sense of Place
	Enhance Aesthetics Along Corridor	
	Manage Budget	
	Positive Cost/Benefit Ratio	

What are Constraints, Needs and Desires?

Constraints are requirements that cannot be violated without significant reason. The stakeholders clearly identified that maintaining the north/south connectivity and the major east / west connections to the corridor were required for any alternatives. Compliance with environmental requirements including the avoidance or aggravating of flooding along Wildcat Creek were considered constraints.

Needs are the things stakeholders expect to be accomplished provided they do not violate the constraints. Maintaining east/west connectivity was defined as a need for the corridor and was to be applied to not only motorized vehicles but also pedestrians, bicyclists, and transit. Seth Child Road was described by stakeholders as a barrier to east/west movement for all modes. In some case, it was considered to divide the City. It was within this category that the importance of benefiting businesses and multi-modal users (bicycle, buses, and pedestrians) began to emerge. Aesthetics was also identified as a need.

Desires are expectations of stakeholders that should be pursued if cost is not a factor. Business and multi-modal components were again emphasized as well as creating a sense of place for the corridor.

For all three classification of stakeholder expectations, efficient vehicular movement and alleviating congestion were identified in varying degrees and levels. This is expressed in the Levels of Service (LOS), which is sometimes defined as the degree of driver frustration in navigating the corridor and its intersections. Constraints identified a minimum threshold of acceptable LOS which is a point above failure of the roadway system. Needs and desires identified higher expectations for LOS for the corridor. Clearly, the exercise identified that connectivity, capacity, relief of congestion, accommodating business, and accommodating multi-modal were all requirements of any proposed improvements.

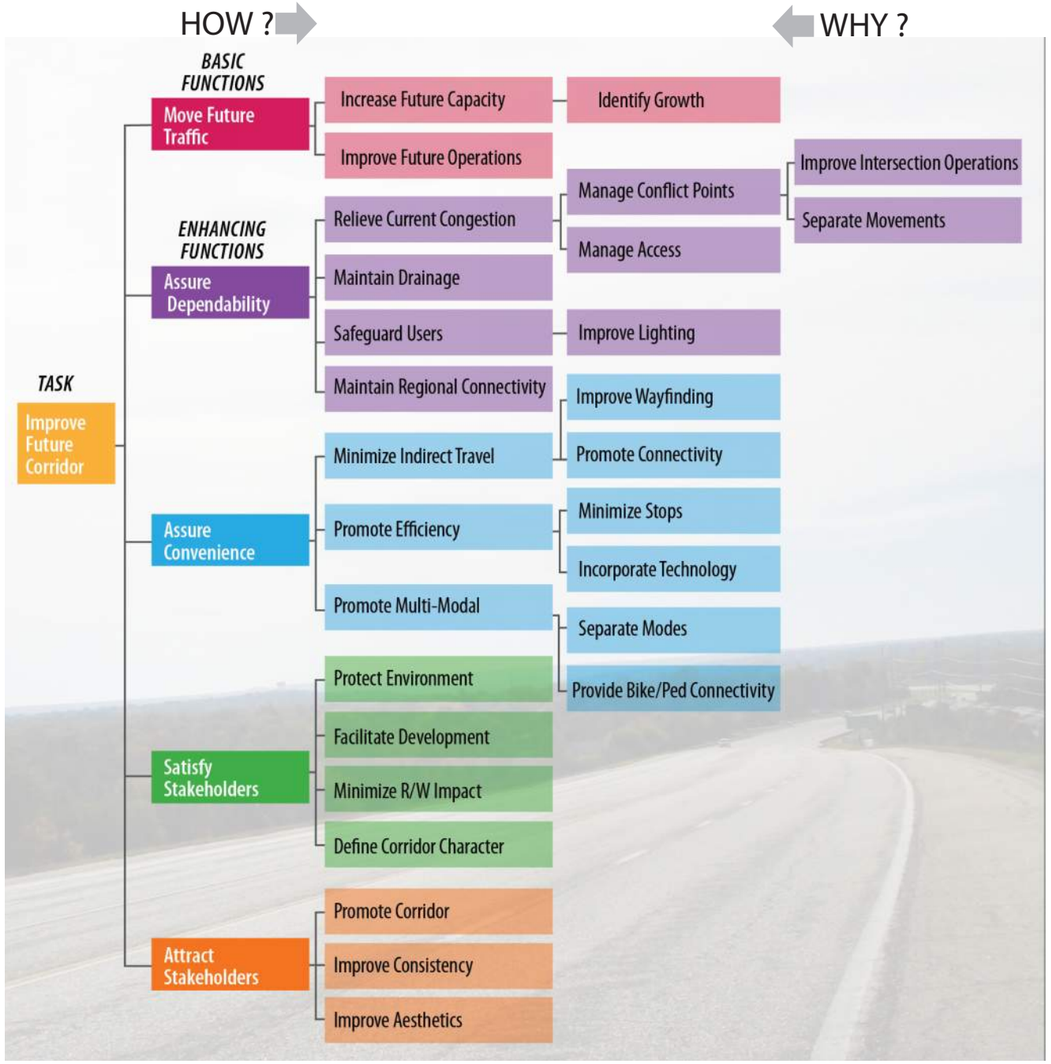
SETH CHILD ROAD & FARM BUREAU ROAD

Function Analysis Phase

With input from both the Steering Committee and the Citizen Advisory Committee, functions for the Corridor were defined and subsequently organized into a graphical representation called a Customer Function Model. Functions are essentially two-word representations defining goals and expectations for the project. This helps to answer the questions: What is it? What does it do? What should it do? One overarching function, called the Task, is determined by the team to define the purpose of the overall project. Other function categories support the task. Basic Functions define the very minimum needed to fulfill the Task. Enhancing Functions make the Task better and include the categories Dependability, Convenience, Satisfy Stakeholders, and Attract Stakeholders. Basic and Dependability functions tend to be data driven and measurable. Functions that make the project convenient can also be measurable but they can also be subjective in meeting stakeholder expectations. It is important that the project not only perform well through basic, dependable and convenience functions but it should also appeal to stakeholders in a more subjective manner. These types of functions satisfy stakeholders and attract stakeholders and are captured under those classifications. Exhibit 6.A illustrates the Customer Function Model for the Seth Child Road Corridor.

SETH CHILD ROAD, BETWEEN DICKENS AVE AND CLAFLIN RD

EXHIBIT 6.A | CUSTOMER FUNCTION MODEL



For this study, the Task was determined to be Improve Future Corridor. It was understood by the team that there are issues that need to be addressed today including congestion and accommodating multi-modal, but the study was defined as positioning the corridor so that future improvements could be implemented as the community grows and future funding becomes available.

The Basic Function for fulfilling the Task is to Move Future Traffic. This is further defined by the functions Increase Future Capacity and Improve Future Operations. Again, it is generally understood that the plan for the corridor is to accommodate an increase in traffic while mitigating the traffic operation issues resulting from growth in the community.

6 | ALTERNATIVE DEVELOPMENT

A number of things can be done to fulfill the Basic Function. However, providing enhancing functions help to define an even better project and eliminate unsatisfactory alternatives. It was agreed that dependability could be achieved if relieving current congestion, maintaining drainage, safeguarding users, and maintaining regional connectivity were accomplished. These were also reflected in public comments and committee input. Congestion can be addressed by managing the number of conflict points and access locations.

The enhancing functions for convenience include minimizing indirect travel, promoting efficiency and promoting multi-modal. It was clear throughout the information phase that stakeholders expect improved infrastructure for bicycles and pedestrians while reducing Seth Child Road as an obstacle for east-west movements. Promoting connectivity, utilizing technology and minimizing stops all further supported the convenience functions.

Satisfying stakeholders fell into the realm of environmental and regulatory concerns as well as the development growth, minimizing impact to adjacent property and creating a sense of place. The functions Protect Environment, Facilitate Development, Minimize Right-of-Way Impacts and Define Corridor Character were all used to capture the expectations of stakeholders.

Finally, attracting stakeholder functions were defined to make the corridor attractive to stakeholders. These functions further defined a future vision for the corridor. Improving the look and feel of the corridor were captured in the functions Promote Corridor and Improve Aesthetics while Improve Consistency was to make travel more efficient by improving driver expectancy.

Developing the functions and organizing them into the Customer Function Model helps the team to clearly communicate with each other and stakeholders where the project is going and what is important to the project. In addition, it aides in promoting creativity for ideas and helps keep team focused on what the stakeholders expect. As will be seen later, criteria used for evaluating alternatives were derived from the functions within the Customer Function Model.

Speculation Phase

Following the identification of functions and assembling them into the Customer Function Model, the next step in the process was to answer the question, "What else will do the job?" This is the key question in the speculation phase. The team which included members of the consultant team and the project sponsors brainstormed ideas for addressing the project and its functions. Criticism was not allowed. Creativity and quantity was encouraged. Table 6.C documents the ideas that were generated by the team.

156 ideas were generated and varied from larger macro solutions like braided ramps or single point urban interchanges to micro solutions like right-in/right-out access at specific intersection along Anderson Avenue. Some ideas pushed the bounds of reasonable as with an overpass at Dickens or a light rail system. Regardless, creativity was encouraged so that new reasonable ideas could spring from perceived absurd ideas.

TABLE 6.C | IDEA GENERATION

No.	Item Descriptions
1	Add Lighting US-24
2	Modernize US-24 Intersection
3	Remove Free Flow Right Turn (RT) Lanes
4	Roundabouts
5	Align K-113 to K-13
6	Decrease Turn Radius
7	Decrease Turn Bay Storage US-24
8	Improve Signage
9	Signalize Intersection
10	Increase Accel/Decel length
11	Create Interchange
12	Improve Offset Left Turn (LT) Lane Alignment
13	Improve Channelization
14	Flashing Warning Beacons
15	Add Seth Child Road Bike Lanes (North of Marlatt)
16	Provide Separated Bike Facility
17	Widen Shoulders
18	Add Access Control along Seth Child Road (North)
19	Frontage Roads (US-24)
20	Frontage Roads (Seth Child Road)
21	Combine Drive
22	Create Median/Parkway Strip
23	Eliminate Access Low Volume Cross Access (Driveways)
24	Restrict Movement at Low Volume Intersections
25	Development Node at US-24 and Seth Child Road
26	No Build
27	Convert to Urban Arterial
28	Add N/S Thru Lanes (2 to 4-Lane) (N of Marlatt)
29	Align Marlatt East/West Legs
30	Add interchange at Marlatt
31	Completion of Linear Trail
32	Add Grade Separated Sidewalk Crossing
33	At Grade Pedestrian Crossing
34	RIRO Intersections (Dickens, Gary, Farm Bureau)
35	3/4 Access Intersections
36	RCUT
37	Close Farm Bureau Place (North) Add Frontage Road
38	Restrict Dickens to Vehicular & Provide Bike/Ped Across Other Location
39	Add Sidewalks along Seth Child Road
40	Add Multi Use Path along Seth Child Road
41	Coordination of Signals
42	All At-Grade Intersections (Seth Child Road)
43	All Grade-Separation interchanges (Seth Child Road)
44	Roundabouts on Seth Child Road
45	Single-Point Urban Interchange (SPUI) on Anderson
46	Develop Farm Bureau Property
47	SPUI on Kimball
48	Redevelop Plaza West
49	Consolidate Driveways along Anderson
50	Raised Median Anderson
51	Address Wildcat Creek Flooding
52	Manage Points of Access
53	Lengthen Seth Child Road bridges over Anderson
54	DDI at Anderson
55	Restrict Gary Access/ Add Ped Crossing
56	Improve Parallel Routes to Seth Child Road (Browning & Wreath)
57	Change Character of Seth Child Road to Urban Section
58	Extend Browning (Claflin to Anderson)
59	Extension Wreath (Miller Parkway to Anderson)
60	Better Access Management from Seth Child Road (Corner Clearance)
61	Tight Urban Diamond Interchange (Anderson)
62	Higher Density Development
63	Improve Streetscape
64	Roundabout Interchange at Anderson
65	Improve West Leg of Kimball Interchange
66	Seth Child Road off State System (City Owned)
67	Combine Claflin and Anderson C/D Road
68	Frontage Road (Anderson South to K-18)
69	Multi Directional Boulevard (Kimball to Anderson)
70	Anderson At-Grade Intersection
71	Widen Wildcat Creek Bridges for Pedestrians
72	Pedestrian Bridge over Wildcat Creek
73	Bus-on Shoulders (Peak Periods)
74	Integrate Transit Stops with Future Developments
75	ITS Improvements
76	Improve Wayfinding Signs
77	Real Time Travel Information
78	DMS boards

EXHIBIT 6. C | IDEA GENERATION (CONT.)

No.	Item Descriptions
79	Bluetooth along Corridor
80	Frontage Rd - Amherst to Southwind
81	Consolidate Intersection South of Anderson
82	RT Out on Seth Child Road at Plaza West
83	Dickens Overpass
84	6 Lanes on Anderson
85	Double Lefts at Interchange
86	Manage WB to SB Claflin LT
87	Remove Access to Pizza Hut & Gas Station
88	RIRO Access to Pizza Hut & Gas Station
89	Bicycle Access to Neighborhoods along Seth Child Road
90	Reverse Frontage Road from Amherst to Southwind
91	Auxiliary Lane Seth Child Road Kimball to Anderson
92	Green Infrastructure
93	Movie Theater Redevelopment
94	Raised Landscape Median along Seth Child Road
95	Seth Child Road Street Lighting (North End)
96	Master Development and Access Plan (Redbud & Amherst Intersection)
97	Continuous Lane Ft Riley to Southwind (Northbound)
98	Rumblestrips
99	Centerline Rumble Strips
100	Call Boxes on Trails
101	Collector Road to East Side of Wildcat
102	Turn Lanes on Seth Child Road (Marlatt)
103	Turn Lanes on Seth Child Road (Gary Ave)
104	Turn Lanes on Seth Child Road North Section
105	Close East Leg of Southwind
106	Advance Signal Ahead Signs (Activated Red Signal Signs)
107	Add Accel SB Lane South of Southwind
108	Add Pedestrian Connection from Target to Shuiss Rd
109	Close E/W Thru Traffic at Southwind
110	Evaluate Pavement Marking Options at Southwind
111	Park and Ride Facilities
112	Connect Garden Way to Linear Trail
113	Dickens Pedestrian Overpass
114	Claflin Pedestrian Overpass
115	Traffic Signal Waters and Anderson
116	Split Diamond (Claflin and Anderson)
117	Claflin Underpass
118	Convert Wreath Ave and SB Seth Child Intersection to a Roundabout

No.	Item Descriptions
119	Extend Wreath South, Construct Median East
120	Add Thru lanes on Anderson Ave behind Existing Concrete Piers
121	Marlatt Interchange - Roundabout Terminals
122	Marlatt Interchange - DDI
123	Marlatt Interchange - Tight Diamond
124	Marlatt Three Lane Arterial
125	Marlatt Four Lane Arterial
126	Marlatt Five Lane Arterial
127	Reroute Master Teacher Access to Marlatt as part of Interchange
128	Bike Lanes along Marlatt
129	Separated Bike/Ped Trail along Marlatt
130	Bike/Ped Crossing on Marlatt
131	Cloverleaf Interchange at Anderson Ave
132	Cloverleaf Interchange at Kimball Ave
133	Cloverleaf Interchange at Marlatt
134	Partial Cloverleaf interchange at Marlatt
135	Partial Cloverleaf Interchange at Anderson (South Side)
136	Partial Cloverleaf Interchange at Kimball Ave (North)
137	Anderson Seth Child Road NB On-Ramp Underneath Claflin Intersection
138	Anderson Seth Child Road SB Off-Ramp Underneath Claflin Intersection
139	Elevated Roundabout at Amherst
140	DDI at Kimball Avenue
141	Roundabout Interchange at Kimball
142	Separate NB Seth Child Road LT Movement at US 24
143	Seth Child Road Elevated Expressway (Kellogg Scenario)
144	Gary Avenue Underpass
145	Gary Avenue Overpass
146	Dickens Avenue Underpass
147	Elevate Seth Child Road Thru Southwind
148	Split Diamond Interchange/frontage (Amherst to Southwind)
149	RCUT Southwind
150	NB Jug Handle at Southwind
151	SB Continuous Flow Intersection at Southwind
152	Reversible Lanes on Seth Child Road
153	Light Rail
154	N/S HOV Lane (Thru Traffic)
155	N/S Cycle Track
156	Separate Local Traffic from Thru Traffic via Urban Section

Evaluation Phase

With 156 ideas, clearly an initial screening had to take place so that a reasonable number of alternatives could be evaluated. The team reviewed each idea and either selected (S) for further consideration or rejected (R). In addition, ideas that violated the project constraints were eliminated. A list of reasons for rejection during the initial screening were developed and are shown in Table 6.D.

TABLE 6.D | REJECTION REASONING

	REJECTION REASONING
	R1 Violates Constraint
	R2 Not Feasible
	R3 Too Expensive
	R4 Low Public Acceptance
	R5 Combine with Other Options
	R6 Duplicate Idea
	R7 High Cost/Low Benefit
	R8 Outside Scope/Beyond Study Area
	R9 Low Agency Acceptance
	R10 Lack of Detailed Information
	R11 Environmental Complications
	R12 High Risk Solution
	S = Selected for further consideration0
	AG = As Given ("No Build")
	F1 - Future Land Use
	DS = Design Suggestion

6 | ALTERNATIVE DEVELOPMENT

TABLE 6.E | ELIMINATION REASONING

No.	Item Descriptions	
1	Add Lighting US-24	S
2	Modernize US-24 Intersection	S
3	Remove Free Flow Right Turn (RT) Lanes	S
4	Roundabouts	S
5	Align K-113 to K-13	R7
6	Decrease Turn Radius	S
7	Decrease Turn Bay Storage US-24	S
8	Improve Signage	S
9	Signalize Intersection	S
10	Increase Accel/Decel Length	S
11	Create Interchange	S
12	Improve Offset Left Turn (LT) Lane Alignment	S
13	Improve Channelization	S
14	Flashing Warning Beacons	S
15	Add Seth Child Road Bike Lanes (North of Marlatt)	R12
16	Provide Separated Bike Facility	S
17	Widen Shoulders	S
18	Add Access Control along Seth Child Road (North)	S
19	Frontage Roads (US-24)	F1
20	Frontage Roads (Seth Child Road)	S
21	Combine Drive	S
22	Create Median/Parkway Strip	s
23	Eliminate Access Low Volume Cross Access (Driveways)	R4
24	Restrict Movement at Low Volume intersections	S
25	Development Node at US-24 and Seth Child Road	F1
26	No Build	S
27	Convert to Urban Arterial	S
28	Add N/S thru lanes (2 to 4-Lane) (N of Marlatt)	S
29	Align Marlatt East/West Legs	S
30	Add Interchange at Marlatt Ave	S
31	Completion of Linear Trail	S
32	Add Grade Separated Sidewalk Crossing	S
33	At Grade Pedestrian Crossing	S
34	RIRO Intersections (Dickens, Gary, Farm Bureau)	S
35	3/4 Access Intersections	S
36	RCUT	S
37	Close Farm Bureau Place (North) Add Frontage Road	R5
38	Restrict Dickens to Vehicular & Provide Bike/Ped Across Other Location	S
39	Add Sidewalks along Seth Child Road	R5
40	Add Multi Use Path along Seth Child Road	S
41	Coordination of Signals	S
42	All At-Grade Intersections (Seth Child Road)	S
43	All Grade-Separation Interchanges (Seth Child Road)	S
44	Roundabouts on Seth Child Road	S
45	SPUI on Anderson	S
46	Develop Farm Bureau Property	S
47	SPUI on Kimball	S
48	Redevelop Plaza West	F1
49	Consolidate Driveways along Anderson	S
50	Raised Median Anderson	S
51	Address Wildcat Creek Flooding	R8
52	Manage Points of Access	S
53	Lengthen Seth Child Road Bridges over Anderson	S
54	DDI at Anderson	S
55	Restrict Gary Access/ Add Ped Crossing	S
56	Improve Parallel Routes to Seth Child Road (Browning & Wreath)	S
57	Change Character of Seth Child Road to Urban Section	S
58	Extend Browning (Claflin to Anderson)	R7
59	Extension Wreath (Miller Parkway to Anderson)	R7
60	Better Access Management from Seth Child Road (Corner Clearance)	S
61	Tight Urban Diamond Interchange (Anderson)	S
62	Higher Density Development	F1
63	Improve Streetscape	S
64	Roundabout Interchange at Anderson	S
65	Improve West Leg of Kimball Interchange	S
66	Seth Child Road off State System (City Owned)	R9
67	Combine Claflin and Anderson C/D Road	S
68	Frontage Road (Anderson South to K-18	R5
69	Multi Directional Boulevard (Kimball to Anderson)	S
70	Anderson At-Grade Intersection	S
71	Widen Wildcat Creek Bridges for Pedestrians	S
72	Pedestrian Bridge over Wildcat Creek	R6
73	Bus-on Shoulders (Peak Periods)	R7
74	Integrate Transit Stops with Future Developments	S
75	ITS Improvements	S
76	Improve Wayfinding Signs	S
77	Real Time Travel Information	S
78	DMS Boards	S
79	Bluetooth Along Corridor	S
80	Frontage Road - Amherst to Southwind	S
81	Consolidate Intersection South of Anderson	F1
82	RT Out on Seth Child Road at Plaza West	F1
83	Dickens Overpass	S
84	6 lanes on Anderson	S
85	Double Lefts at Interchange	S
86	Manage WB to SB Claflin LT	S
87	Remove Access to Pizza Hut & Gas Station	R2
88	RIRO Access to Pizza Hut and Gas Station	S
89	Bicycle Access to Neighborhoods along Seth Child Road	S
90	Reverse Frontage Road from Amherst to Southwind	S
91	Auxiliary Lane Seth Child Road Kimball to Anderson	S
92	Green Infrastructure	S
93	Movie Theater Redevelopment	F1
94	Raised Landscape Median along Seth Child Road	S
95	Seth Child Road Street Lighting (North End)	S
96	Master Development and Access Plan (Redbud & Amherst Intersection)	F1
97	Continuous Lane Ft Riley to Southwind (Northbound)	S
98	Rumblestrips	S
99	Centerline Rumble Strips	S
100	Call Boxes on Trails	S
101	Collector Road to East side of Wildcat	R7
102	Turn lanes on Seth Child Road (Marlatt)	S
103	Turn lanes on Seth Child Road (Gary Ave)	S
104	Turn lanes on Seth Child Road North Section	S
105	Close East Leg of Southwind	R2
106	Advance Signal Ahead Signs (Activated Red Signal Signs)	S
107	Add Accel SB Lane South of Southwind	S
108	Add Pedestrian Connection from Target to Shuiss Rd	S
109	Close E/W Thru Traffic at Southwind	R2
110	Evaluate Pavement Marking Options at Southwind	S
111	Park and Ride Facilities	S
112	Connect Garden Way to Linear Trail	S
113	Dickens Pedestrian Overpass	S
114	Claflin Pedestrian Overpass	S
115	Traffic Signal Waters and Anderson	S
116	Split Diamond (Claflin and Anderson)	S
117	Claflin Underpass	S
118	Convert Wreath Ave and SB Seth Child Intersection to a Roundabout	S
119	Extend Wreath South, Construct Median East	S
120	Add Thru Lanes on Anderson Ave Behind Existing Concrete Piers	S
121	Marlatt Interchange - Roundabout Terminals	S
122	Marlatt Interchange - DDI	S
123	Marlatt Interchange - Tight Diamond	S
124	Marlatt Three Lane Arterial	R5
125	Marlatt Four Lane Arterial	R5
126	Marlatt Five Lane Arterial	R5
127	Reroute Master Teacher Access to Marlatt as Part of Interchange	R5
128	Bike Lanes along Marlatt	R5
129	Separated Bike/Ped Trail along Marlatt	R5
130	Bike/Ped Crossing on Marlatt	R5
131	Cloverleaf Interchange at Anderson Ave	R2
132	Cloverleaf Interchange at Kimball Ave	R2
133	Cloverleaf Interchange at Marlatt	R2
134	Partial Cloverleaf Interchange at Marlatt	R2
135	Partial Cloverleaf Interchange at Anderson (South Side)	R2
136	Partial Cloverleaf Interchange at Kimball Ave (North)	R2
137	Anderson Seth Child NB On-ramp Underneath Claflin Intersection	R3
138	Anderson Seth Child SB Off-ramp Underneath Claflin intersection	R3
139	Elevated Roundabout at Amherst	R3
140	DDI at Kimball Avenue	S
141	Roundabout Interchange at Kimball	S
142	Separate NB Seth Child Road LT Movement at US-24	S
143	Seth Child Road Elevated Expressway (Kellogg Scenario)	R3
144	Gary Avenue Underpass	R7
145	Gary Avenue Overpass	R7
146	Dickens Avenue Underpass	R2
147	Elevate Seth Child Road thru Southwind	R2
148	Split Diamond Interchange/Frontage (Amherst to Southwind)	R2
149	RCUT Southwind	R4
150	NB Jug Handle at Southwind	R4
151	SB Continuous Flow Intersection (CFI) at Southwind	S
152	Reversible Lanes on Seth Child Road	R9
153	Light Rail	R2
154	N/S HOV Lane (thru traffic)	R2
155	N/S Cycle Track	S
156	Separate Local Traffic from Thru Traffic via Urban Section	S

LEGEND	
	IDEA ELIMINATION

Table 6.E shows the initial screening of the ideas along with their reasons for being eliminated using the rejection criteria defined in Table 6.D.

The ideas were further evaluated and assembled into a series of alternatives for each node along the corridor (i.e. Southwind Road, Anderson Avenue, US-24, etc.). Multiple alternatives were developed for evaluation based on their technical performance, stakeholder acceptance and cost. Clearly, each of the alternative provide benefits and impacts to the corridor.

Based on the functions developed earlier, criteria for evaluating each concept were developed. For evaluating Performance, criteria were selected from the Basic, Dependability and Convenience Functions. Performance evaluations are more technical in nature and can be evaluated based on data, traffic analysis results, and engineering judgment. Their criteria descriptions follow.

Performance Criteria

Accommodate Future Capacity - In keeping with the basic functions and task of the study, being able to accommodate the future Year 2040 traffic volumes based on the growth of the community is necessary.

Relieve Congestion - This criteria was selected based on existing conditions and future 2040 traffic projections. As an example, the interchange with Anderson Avenue experiences congestion issues today and will continue to decline as volumes continue to increase. The Travel Demand Model for the community shows capacity issues which will translate to congestion issues for the design horizon of 2040. Alternatives need to address how to manage more traffic with acceptable Levels of Service, LOS D or better for overall intersection and LOS E for individual turn movements.

Safeguard Users – Opportunities for improving safety were considered for each alternative. This can be encompassed with geometric modifications, lighting, traffic control devices, roadside conditions, reduction of conflict points, and interactions with different movements and modes of travel.

Efficient Bike and Pedestrian Movement – An emphasis on improving bike and pedestrian movements and making the corridor friendlier for those modes of travel. This issue was expressed by several stakeholders. How an alternative incorporates pedestrian facilities and movements was used in the performance evaluation.

Efficient Vehicular Movement – The alternatives were evaluated based on moving motorized vehicles through the system. It entails reasonable driver expectation, level of service, and access points along the corridor. Evaluation considered both the east/west movements as well as the north/south movements.

The team evaluated these five categories and ranked them in order of importance. It should be noted that all of them are important but weighting their relative importance was helpful in the matrix analysis. Based on a scale of 1 to 10, with 10 being most important, weights were then assigned to each criteria as shown in the Table 6.F.

TABLE 6.F | PERFORMANCE RANK AND WEIGHTS

Criteria	Rank	Weight
Accommodate Future Capacity	3	8
Relieve Congestion	2	9
Safeguard Users	1	10
Efficient Bike/Ped Movement	5	7
Efficient Vehicular Movement	4	8

Considering the overall vision for the corridor and meeting stakeholder expectations is addressed in the more subjective categories for Acceptance. These criteria are drawn from the function classifications Assure Convenience, Satisfy Stakeholders, and Attract Stakeholders. The team selected the following for evaluating the alternatives.

Acceptance Criteria

Promote Corridor – Committee members were clear that the Seth Child Road Corridor should be attractive, comfortable to all users and create a sense of place. This criteria was used to evaluate the effectiveness of each alternative in accomplishing those goals.

Promote Multi-Modal – Input from the public and the committee members, as well as field observations, showed that there is a present need and desire to improve bicycle and pedestrian facilities along the Corridor, as well as crossing Seth Child Road. In addition, public transit is a growing mode within community. Accommodating and planning for all these modes were considered with this criterion.

Facilitate Development – The Corridor has a varied land use and is an important economic center for the community. Stakeholders felt that creating opportunities for development and business growth were an important consideration for each alternative.

Minimize Right-of-Way Impacts – As a state highway, Seth Child Road has significant right-of-way. Effectively using the existing right-of-way and minimizing the impacts to adjacent properties were important considerations in the evaluation of the concepts.

Improve Aesthetics – From grade-separated interchanges to at-grade stop-controlled intersections, Seth Child Road varies in feel from a rural highway to an urban roadway. The ability to make the roadway consistent, attractive for users, and have the potential for beautification and were considered in the evaluation.

Similar to the performance criteria, the acceptance criteria were ranked and weighted as shown Table 6.G.

TABLE 6.G | ACCEPTANCE RANK AND WEIGHTS

Criteria	Rank	Weight
Promote Corridor	5	8
Promote Multi-Modal	1	10
Facilitate Development	3	9
Minimize ROW Impacts	2	9
Improve Aesthetics	4	8

Matrix Analysis

Each alternative was evaluated for Performance and Acceptance based on a scale of zero to five. Five is considered excellent and zero is unacceptable. Alternatives for each node location were entered into matrices and evaluated by the team. It should be noted that 'No Build' was always an option to measure against and evaluated alongside the other alternatives. The weighting factor was used in calculating a weighted average rating for each alternative, giving them a way to compare numerically.

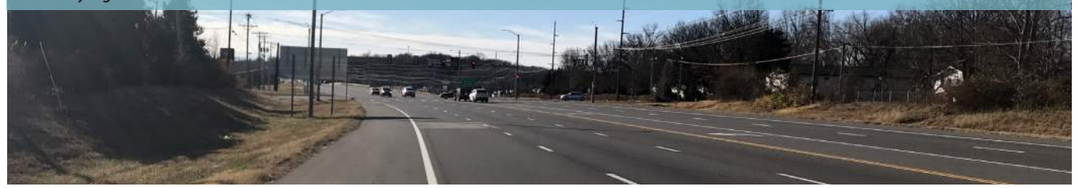
Finally, cost was also considered for each alternative. Cost rating is done in two steps. Step one is to establish the upper and lower limits of the cost rating scale. The lower limit and upper limit are established to bracket the range of costs for the alternatives considered while taking into consideration the project budget or what the owner considers a reasonable amount to spend. Continuing with the rating scale of zero to five, the lowest limit is assigned a five and the highest limit is assigned a zero. A straight line interpolation is selected to aid in establishing intermediate points. The second step is to plot alternative costs on the cost graph to determine respective ratings on a zero-to-five scale.

Cost estimating for each alternative was performed using recent (2016) KDOT bid tabulations and representative construction costs. A contingency of 30 percent was added to the costs. Concept/planning level costs were estimated to focus on relative comparison between alternatives. Further development of the project costs and adjustment for inflation is necessary as the projects move forward into preliminary design phase.

6 | ALTERNATIVE DEVELOPMENT

SEGMENT A – Segment A includes US-24 from Seth Child Road intersection to the K-13 intersection and runs south to just north of Marlatt Avenue. This segment of the corridor study is primarily rural two-lane highway roadway section with ditch section.

SEGMENT B – Segment B runs from Marlatt Avenue to the Wildcat Creek bridges located just south of Anderson Avenue. This segment is comprised of two grade-separated highway interchanges, one signalized intersection and four unsignalized intersections. Seth Child Road is primarily a five-lane undivided section with 10-foot paved shoulders and ditch section. The intersections have some auxiliary right-turn lanes.



SEGMENT C – Segment C begins at the Wildcat Creek bridges and continues south to Southwind Road. Seth Child Road within this segment is primarily a five-lane undivided section with 10-foot paved shoulders and ditch section. Each of the intersections have exclusive right-turn lanes.

SEGMENT D – Segment D is Anderson Avenue from Wreath Avenue to the West Loop Shopping Center entrance. This is a five-lane urban curb and gutter section with 26 access points. There are ramp terminals for the K-113 interchange and a number of local driveways. Seth Child Road intersects with Anderson Avenue as a standard diamond interchange with traffic signals at each ramp terminal. Both Wreath Avenue and West Loop Shopping Center entrance are signalized.

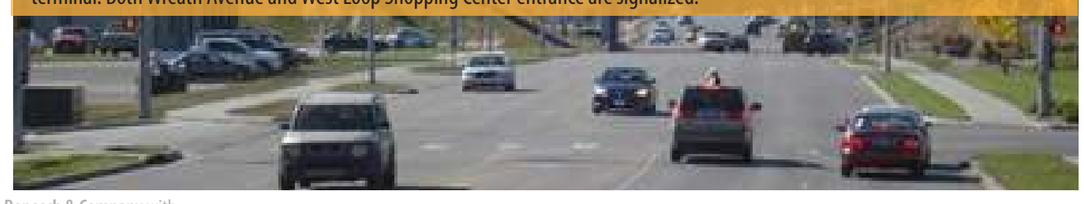
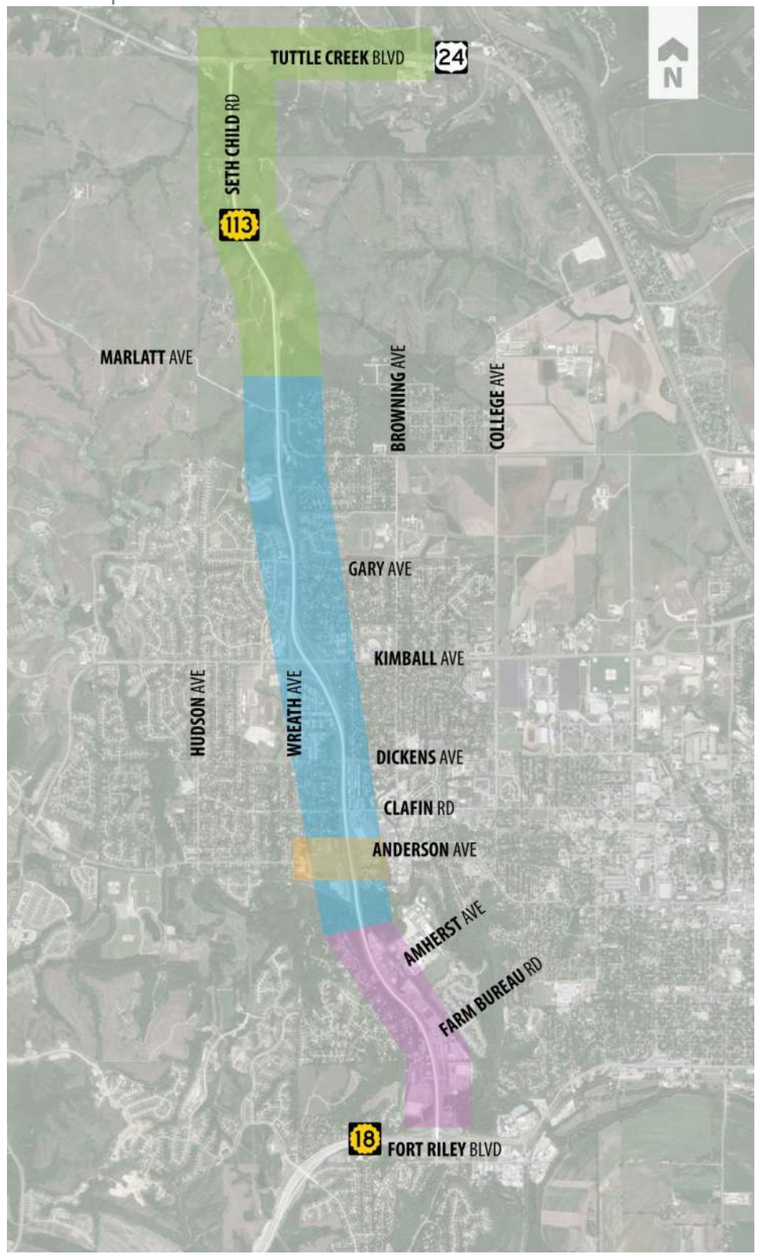


EXHIBIT 6.B | SEGMENT DISPLAY



LEGEND

SEGMENT A
US-24 to Marlatt Ave

SEGMENT B
Marlatt Ave to Wildcat Creek

SEGMENT C
Wildcat Creek to K-18

SEGMENT D
Anderson Ave, Wreath to West Loop Shopping Center

SEGMENT A – US-24 INTERSECTIONS WITH SETH CHILD ROAD AND K-13

Year 2040 traffic volumes are located in the Appendix J. Figure J.4, located in the appendix represents the volumes used in the capacity analysis for Segment A.

US-24 & K-13

IDENTIFIED ISSUES: The following observations were identified through the team's field visits or were mentioned in the public involvement process.

- Lack of street lighting at the intersection of US-24 and Seth Child Road (K-113).
- Variable speeds exist due to turning movements mixed with the posted 55 mph speed limit.
- 12 reported crashes during the study period including two fatal and six injury crashes.

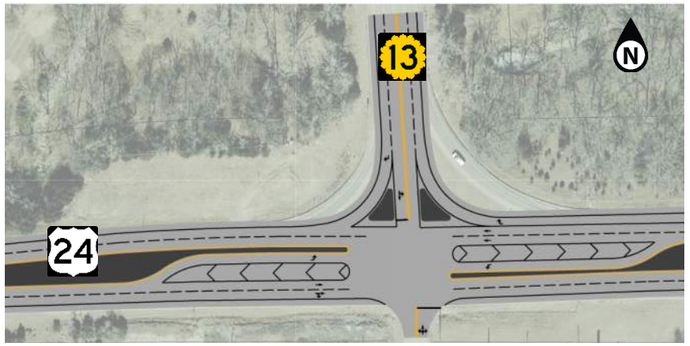
The safety analysis revealed that there have been 12 crashes during the study period (Year 2012 to 2015). Four property damage only crashes (PDO), six injury crashes and two fatalities. The intersection currently has a crash rate of 97.6 crashes per 100 million entering vehicles (100 MEV), almost twice the statewide average of 50 crashes per 100 MEV.

ALTERNATIVE DEVELOPMENT: The alternatives listed in Table 6.H1 were developed through the speculation phase and identified for further evaluation. Three alternatives evaluated include No Build, traffic signalization, offset left-turn lanes, and a roundabout.

Traffic Signal: The MUTCD signal warrant analysis identified no traffic signal warrants would be expected to be met by Year 2040. Table L.1 located in Appendix L provides a LOS summary of individual movement LOS for each alternative. Exhibit 6.C illustrates the offset left-turn alternative.

Offset Left-Turn Lanes: The offset left-turn alternative would be expected to operate with LOS D in 2040 traffic conditions, shown in Table 6.H1. This alternative improves the sight distance lines for the eastbound and westbound left-turn vehicles. Additional improvements would be to tighten the intersection footprint with raised medians. Table L1 summarizes the individual turning movements levels of service. Exhibit 6.C illustrates the offset left-turn alternative.

EXHIBIT 6.C | K-13 OFFSET LEFT-TURN ALTERNATIVE



Roundabout: A single-lane roundabout would be expected to operate with an overall LOS A, as depicted in Table 6.H1. Individual turn movement levels of service are summarized in Table L1 (Appendix L). A roundabout would be expected to reduce the number crashes by 44 percent.

EXHIBIT 6.D | K-13 ROUNDABOUT ALTERNATIVE

MATRIX ANALYSIS:

For this intersection and all subsequent sites, the design team rated each alternative based on performance and acceptance criteria previously discussed. Using a scale of one to five with one being poor and five excellent, a weight average rating for each alternative.

TABLE 6.H1 | K-13 & US-24 LOS SUMMARY

Option	Overall LOS
2040 No Build	D
EB/WB Offset Left-Turn Lanes	D
Roundabout (HCS)	A

Note: Unsignalized intersection level of service shown represents the lowest individual turning movement LOS

In performance, the roundabout was rated the highest alternative because of its ability to handle 2040 traffic volumes, relieve congestion, crash reduction, and reduce number of conflict points.

TABLE 6.H2 PERFORMANCE RATING

		Weight of Importance	No Build		Roundabout		Offset LT	
Excellent = 5 Very Good = 4 Good = 3 Satisfactory = 2 Poor = 1 Unacceptable = 0			Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating
	Criteria	(1-10)						
1	Accommodate Future Capacity	8	3	24	4	32	4	32
2	Relieve Congestion	9	3	27	4	36	3	27
3	Safeguard Users	10	1	10	4	40	3	30
4	Efficient Bike/Ped Movement	7	1	7	3	21	2	14
5	Efficient Vehicular Movement	8	2	16	3	24	3	24
	Total Weighted Rating	42	84.00		153.00		127.00	
	Average Weighted Rating		2.00		3.64		3.02	

For stakeholder acceptance, the roundabout was the preferred option. While it did have more right-of-way impacts than the other two options, its ability to promote multi-modal, facilitate development and improve aesthetics made it the more acceptable choice.

TABLE 6.H3 ACCEPTANCE RATING

		Weight of Importance	No Build		Roundabout		Offset LT	
Excellent = 5 Very Good = 4 Good = 3 Satisfactory = 2 Poor = 1 Unacceptable = 0								
	Criteria	(1-10)						
1	Promote Corridor	8	1	8	2	16	2	16
2	Promote Multi-Modal	10	1	10	3	30	2	20
3	Facilitate Development	9	1	9	3	27	2	18
4	Minimize ROW impacts	9	5	45	3	27	5	45
5	Improve Aesthetics	8	1	8	4	32	2	16
	Total Weighted Rating	44	80.00		132.00		115.00	
	Average Weighted Rating		1.82		3.00		2.61	

The costs and ratings for the alternatives are shown in the following table. As expected, the "No Build" scenario has the best cost rating because of no initial cost.

TABLE 6.H4| K-13 COST SUMMARY

	No Build	Roundabout	Offset Left
Cost	$0	$1.5 million	$1.5 million
Rating	5	2	2

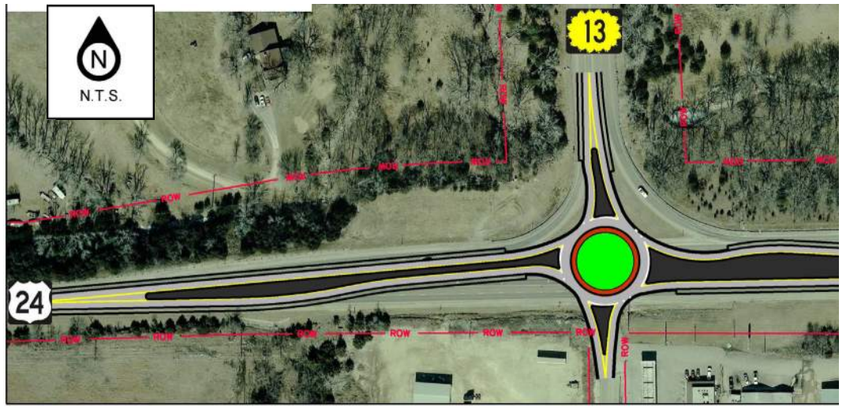
6 | ALTERNATIVE DEVELOPMENT

The alternatives were averaged together as shown below.

TABLE 6.H5 **RATING SUMMARY**

				No Build	Round-about	Offset LT
Ratings			Performance (P)	2.0	3.6	3.0
			Acceptance (A)	1.8	3.0	2.6
			Cost (C)	5.0	2.0	2.0
	P	A	C			
Value Indicator	1	1	1	2.9	2.9	2.5
	2	1	1	2.7	3.1	2.7
	1	2	1	2.7	2.9	2.6
	1	1	2	3.5	2.7	2.4

EXHIBIT 6.D | K-13 ROUNDABOUT ALTERNATIVE



SUMMARY: The Roundabout and No Build alternatives tie for the number of highest average ratings. However, the No Build alternative has several poor (1) ratings, therefore eliminating that alternative. In addition, with a zero initial cost, the No Build cost rating is skewed relative to the other alternatives. When an emphasis is placed on performance, the roundabout received an average rating of 3.1, making it the preferred alternative. Likewise, if acceptance is emphasized, the roundabout received average rating of 2.9, making it the preferred. **For these reasons, the roundabout was selected as the preferred alternative at the K-13/ US-24 intersection.**

US-24 & SETH CHILD ROAD (K-113)

IDENTIFIED ISSUES: The following observations were identified through the team's field visits or were mentioned during the public involvement process.

- Lack of street lighting at the intersection of US-24 and Seth Child Road (K-113).
- Variable speeds exist due to turning movements mixed with the posted 55 mph speed limit.
- Three reported crashes during the study period.
- Northbound left-turn movement would be expected to operate with a LOS F in Year 2040.

As part of the safety analysis, this intersection has experienced three crashes within the study period (Year 2012 to 2015). One property damage only crash (PDO), one injury crash and one fatality crash. The intersection currently has a crash rate of 11.8 crashes per 100 million entering vehicles (100 MEV).

ALTERNATIVE DEVELOPMENT: Through the speculation phase of the value planning process, the alternatives listed in Table 6.I1 were evaluated further to determine how they would perform. Four alternatives were evaluated including No Build, traffic signalization, northbound flyover ramp lanes, and a roundabout.

Redefined Intersection with Traffic Signal: The MUTCD warrant analysis determined a traffic signal would be expected to be met by year 2040. Signalized capacity analyses indicate that the overall intersection would be expected to operate with LOS B, as shown in Table 6.I1. Table L.1(Appendix L), provides a LOS summary for the individual movements for each alternative.

EXHIBIT 6.E | US-24 & SETH CHILD ROAD SIGNAL ALTERNATIVE

Northbound Left-turn Flyover Ramp: This was an alternative that was developed through the speculation phase to eliminate the northbound left-turn conflict with US-24 traffic. However, the conceptual cost for alternative received a poor rating, eliminating the alternative from further consideration. A conceptual drawing for this alternative was not developed.

Roundabout: A single-lane roundabout was proposed to reduce the number of conflicts within the intersection. Roundabout capacity analyses indicate that the overall intersection would be expected to operate with an overall LOS C during the PM peak period for the 2040 volume conditions. The proposed roundabout would be expected to reduce the number crashes by 44 percent. Since the intersection is a T-type intersection, the westbound thru traffic could bypass the roundabout, removing one of the higher traffic volumes and a conflict point. With bypass lanes, the overall intersection would be expected to operate with an overall LOS A in Year 2040. Exhibit 6.F below illustrates the single-lane roundabout alternative.

EXHIBIT 6.F | US-24 & SETH CHILD ROAD ROUNDABOUT ALTERNATIVE

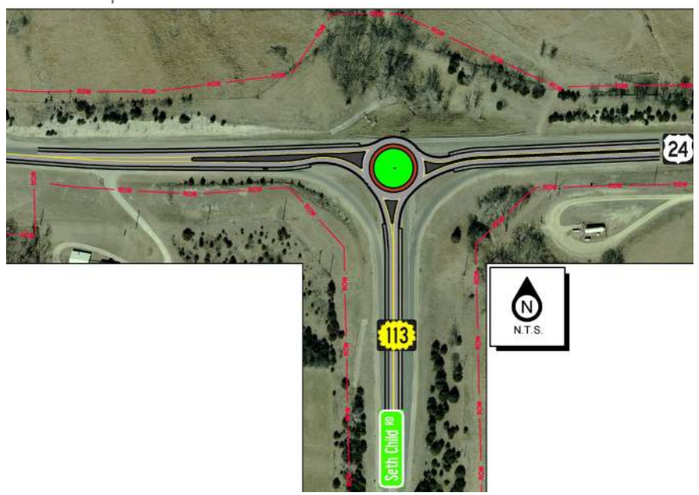


TABLE 6.I1 | SETH CHILD ROAD & US-24 LOS SUMMARY

Option	Overall LOS
2040 No Build	F
Redefined Intersection with Signal	B
Roundabout (HCS)	C
Roundabout w/Bypass (HCS)	A
NB Flyover	A

Note: Unsignalized intersection level of service shown represents the lowest individual turning movement LOS.

MATRIX ANALYSIS: Based on the performance rating, the roundabout with the westbound bypass lane was rated the highest rated alternative with a 3.83 rating. The proposed roundabout had the best overall LOS, can handle higher capacities, and reduced the number of conflict points and crashes.

TABLE 6.12 PERFORMANCE RATING

	Excellent = 5, Very Good = 4, Good = 3, Satisfactory = 2, Poor = 1, Unacceptable = 0	Weight of Importance	No Build		NB LT Flyover		Roundabout		Signalized	
			Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating
	Criteria	(1-10)								
1	Accommodate Future Capacity	8	1	8	4	32	4	32	3	24
2	Relieve Congestion	9	1	9	4	36	4	36	3	27
3	Safeguard Users	10	1	10	5	50	4	40	3	30
4	Efficient Bike/Ped Movement	7	1	7	1	7	3	21	3	21
5	Efficient Vehicular Movement	8	2	16	4	32	4	32	3	24
	Total Weighted Rating	42	50.00		157.00		161.00		126.00	
	Average Weighted Rating		1.19		3.74		3.83		3.00	

For stakeholder acceptance, the roundabout was again the preferred option. Its ratings were overall higher than the other alternatives.

TABLE 6.13 ACCEPTANCE RATING

	Excellent = 5, Very Good = 4, Good = 3, Satisfactory = 2, Poor = 1, Unacceptable = 0	Weight of Importance	No Build		NB LT Flyover		Roundabout		Signalized	
			Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating
	Criteria	(1-10)								
1	Promote Corridor	8	1	8	3	24	3	24	2	16
2	Promote Multi-Modal	10	1	9	2	20	3	30	3	30
3	Facilitate Development	9	2	20	1	9	3	27	3	27
4	Minimize R/W Impacts	9	5	35	2	18	3	27	4	36
5	Improve Aesthetics	8	2	16	2	16	4	32	2	16
	Total Weighted Rating	44	88.00		87.00		140.00		125.00	
	Average Weighted Rating		2.00		1.98		3.18		2.84	

The costs and ratings for the alternatives are shown in the following table. As expected the "No Build" scenario has the best cost rating because of no initial cost.

TABLE 6.14 | US-24 SETH CHILD ROAD COST SUMMARY

	No Build	Northbound Left Turn Flyover	Roundabout	Signalized
Cost	$0	$8.7 million	$1.7 million	$2.5 million
Rating	5	1	4.2	3.9

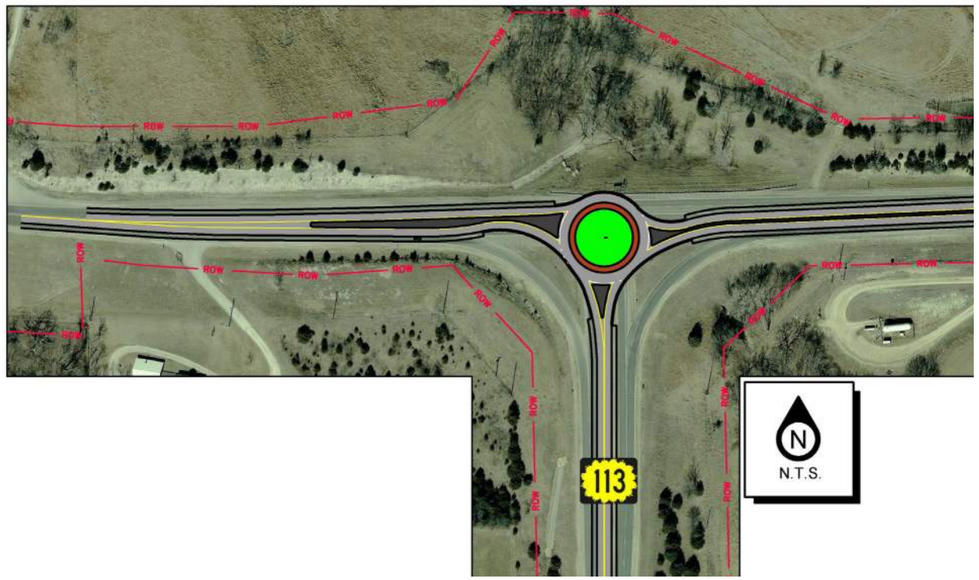
The alternatives were averaged together as shown below.

TABLE 6.15 RATING SUMMARY

				No Build	NB LT Flyover	Roundabout	Signalized
Ratings			Performance (P)	1.2	3.7	3.8	3.0
			Acceptance (A)	2.0	2.0	3.2	2.8
			Cost (C	5.0	1.0	4.2	3.9
	P	A	C				
Value Indicator	1	1	1	2.7	2.2	3.7	3.2
	2	1	1	2.3	2.6	3.8	3.2
	1	2	1	2.5	2.2	3.6	3.1
	1	1	2	3.3	1.9	3.9	3.4

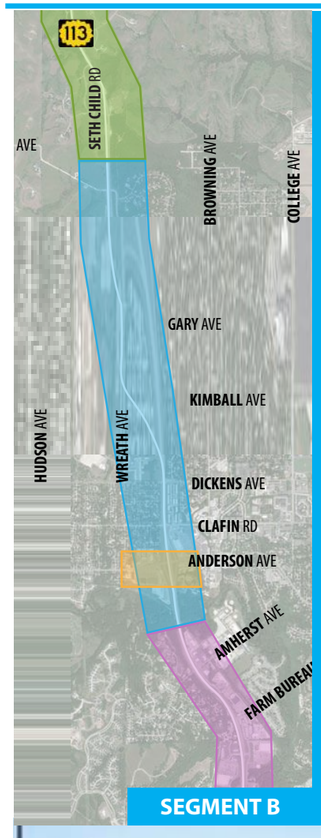
SUMMARY: The preferred alternative was identified as the roundabout with westbound bypass lane based on equal emphasis on the three categories. When an emphasis is placed on performance, the roundabout has an average rating of 3.8 and is still the preferred alternative. Likewise, if acceptance is emphasized, the roundabout received an average rating of 3.6, making it the preferred. **The matrix analysis identified the roundabout alternative as the preferred alternative.**

EXHIBIT 6.F | US-24 & SETH CHILD ROAD ROUNDABOUT ALTERNATIVE



6 | ALTERNATIVE DEVELOPMENT

SEGMENT B – SETH CHILD ROAD (K-113)FROM MARLATT AVENUE TO WILDCAT CREEK BRIDGE



Segment B is the section of the corridor that has the greatest variety of the intersection types (i.e. interchanges, unsignalized intersections, and signalized at-grade intersections). Anderson Avenue was identified as the critical node within the Corridor due to the amount side street traffic volume, significant traffic congestion, and proximity to Claflin Road. All of these factors identified Anderson Avenue as the critical node within Segment B and Seth Child Road. Alternatives considered at this location would help define the overall corridor. The 2040 traffic volumes shown in Figure E.4 illustrate the 2040 No-Build traffic volume scenario for the Anderson Avenue corridor and Claflin Road intersection. Figure E.6 illustrates the overall intersection and individual turning movement LOS for the 2040 "No Build" traffic volume condition (PM Peak Hour). Each of these exhibits are included in Appendix E.

SETH CHILD ROAD & ANDERSON AVENUE

IDENTIFIED ISSUES: The following observations were identified through the team's field visits and observations or were mentioned through the public involvement process.

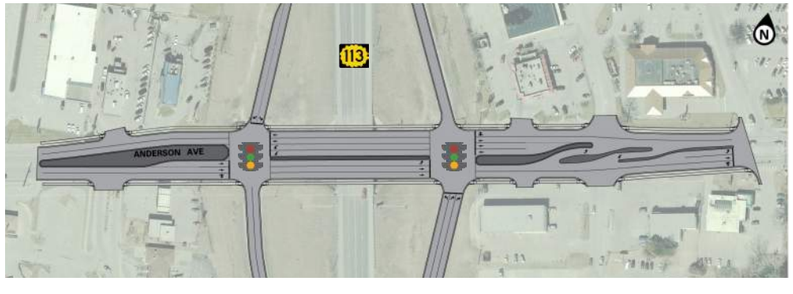
- Significant vehicle queuing currently exists during the afternoon commuter peak period. Figure E.3 in Appendix E summarizes the 95th percentile vehicle queue lengths.
- Anderson Avenue interchange ramp intersections currently to operate with a LOS D and LOS F during PM peak periods for the southbound and northbound Seth Child Road ramps, respectively.
- Vehicles block the adjacent driveways resulting in additional congestion to the Corridor.
- 15 reported crashes during the study period at the southbound Seth Child Road ramp intersection and 22 reported crashes at the northbound ramp intersection.

The safety analysis revealed that the interchange ramp intersections at Anderson Avenue have experienced 37 crashes during the study period (Year 2012 to 2015). 24 property damage only crashes (PDO), 13 injury crashes and no fatalities. The intersection crash rates were reported to be 48.8 crashes per 100 million entering vehicles (100 MEV) for the southbound ramp and 58.1 crashes 100 MEV for the northbound ramp. The estimated number of crashes for 2040 No Build is 302 total crashes.

ALTERNATIVE DEVELOPMENT: Several alternatives were identified through the speculation phase of the value planning process. The alternatives that were carried forward for further evaluation are summarized in Table 6.J1. The table summarizes the overall intersection levels of service based on the 2040 capacity analysis.

Modified Diamond Interchange: To improve the overall traffic operation and increase the westbound left-turn capacity, the roadway section on Anderson Avenue would need to be expanded to accommodate a minimum of seven lanes – two westbound left-turn lanes, two westbound thru lanes, a single eastbound left-turn lane, and two eastbound thru lanes. With the additional lanes along Anderson Avenue, the ramp terminals would be expected to operate with a LOS C during the PM peak period. However, the westbound left-turn movement, eastbound left-turn movement, and northbound left-turn movement would be expected to operate with LOS E during the PM peak period, shown in Table L.2 in the (Appendix L).

EXHIBIT 6.G | ANDERSON AVENUE MODIFIED DIAMOND ALTERNATIVE



Elliptical Roundabout Interchange: An elliptical roundabout was analyzed as part of the alternative development. Table L.2, (Appendix L) provides a summary of the traffic analysis. The overall interchange would be expected to operate with a LOS C during the PM peak period, but a couple of the individual turn movements would be expected to operate with a LOS E. To construct an elliptical roundabout, the Seth Child Road bridge would need to be lengthened to accommodate the additional width for the interchange. A conceptual drawing was not developed for this concept.

Roundabout Terminals: Multi-lane roundabouts were evaluated at both ramp terminals. This concept would not require the Seth Child Road bridge to be lengthened. Based on the 2040 capacity analysis, the northbound and southbound ramps would be expected to operate with a LOS D and C, respectively, and several of the individual turn movements would operate with a LOS E or F, as depicted in Table L.2.

EXHIBIT 6.H | ANDERSON AVENUE ROUNDABOUT INTERCHANGE

TABLE 6.J1 | SETH CHILD ROAD & ANDERSON AVENUE LOS SUMMARY

Option	Part of Interchange	Overall LOS
2040 No Build	SB Ramp	D
	NB Ramp	F
Modified Diamond	SB Ramp	C
	NB Ramp	C
Roundabout (Elliptical)	-	C
Roundabout	SB Ramp	C
	NB Ramp	D
DDI	SB Ramp	C
	NB Ramp	C
SPUI	-	C
At-Grade Signal		D

SETH CHILD ROAD & ANDERSON AVENUE

Diverging Diamond Interchange: A diverging diamond interchange (DDI) was analyzed and evaluated. Based on the capacity analyses, the DDI would be expected to operate with LOS C ramp terminals. However, the existing ramp terminals are separated by approximately 390 feet. Based on DDI design criteria, crossovers located shorter than 700 feet tend to not perform well. Therefore, the DDI crossovers should be separated a minimum of 700 feet, resulting in ROW impacts to adjacent properties. Exhibit 6.I illustrates a potential diverging diamond interchange.

EXHIBIT 6. I | ANDERSON AVENUE DIVERGING DIAMOND INTERCHANGE

Single Point Urban Interchange (SPUI): A single point urban interchange (SPUI) was analyzed and evaluated. Based on the capacity analyses, the SPUI would be expected to operate with LOS C with the individual turning movements operating with a LOS D or better, depicted in Table L.2 (Appendix L). To construct a SPUI, the Seth Child Road bridge would need to be replaced and lengthened to accommodate the additional width for the interchange ramps due to the large turn radii. The SPUI alternative is displayed in Exhibit 6.J.

EXHIBIT 6. J | ANDERSON AVENUE SPUI

At-Grade Signalized Intersection: Through the speculation phase, the idea to convert the interchange into an at-grade signalized intersection was presented. Based on the capacity analysis, the overall at-grade intersection would be expected to operate with a LOS D during the PM peak period and the individual turn movements would operate with a LOS D or better, as shown in Table L.2 in Appendix L. The at-grade intersection would require three northbound and southbound thru lanes and dual left-turn lanes for the eastbound and westbound approaches.

Additional investigation was completed to evaluate lowering Seth Child Road to Anderson Avenue ground level. Exhibit 6.K illustrates how the proposed Seth Child Road vertical profile can be accomplished with acceptable profile grades The proposed profile grades are shown as 1.41% and 2.14%. American Public Works Association (APWA) street standards recommends a maximum 6% grade for an urban arterial. The profile developed is well below that level. Exhibit 6.L illustrates the proposed at-grade alternative.

EXHIBIT 6.K | SETH CHILD ROAD PROPOSED PROFILE AT ANDERSON AVENUE

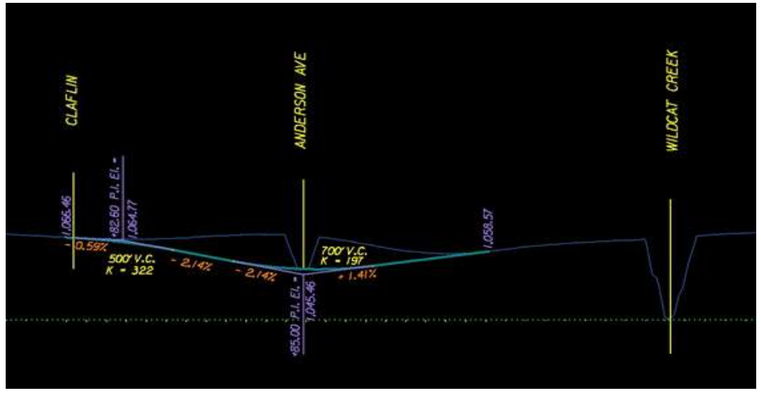
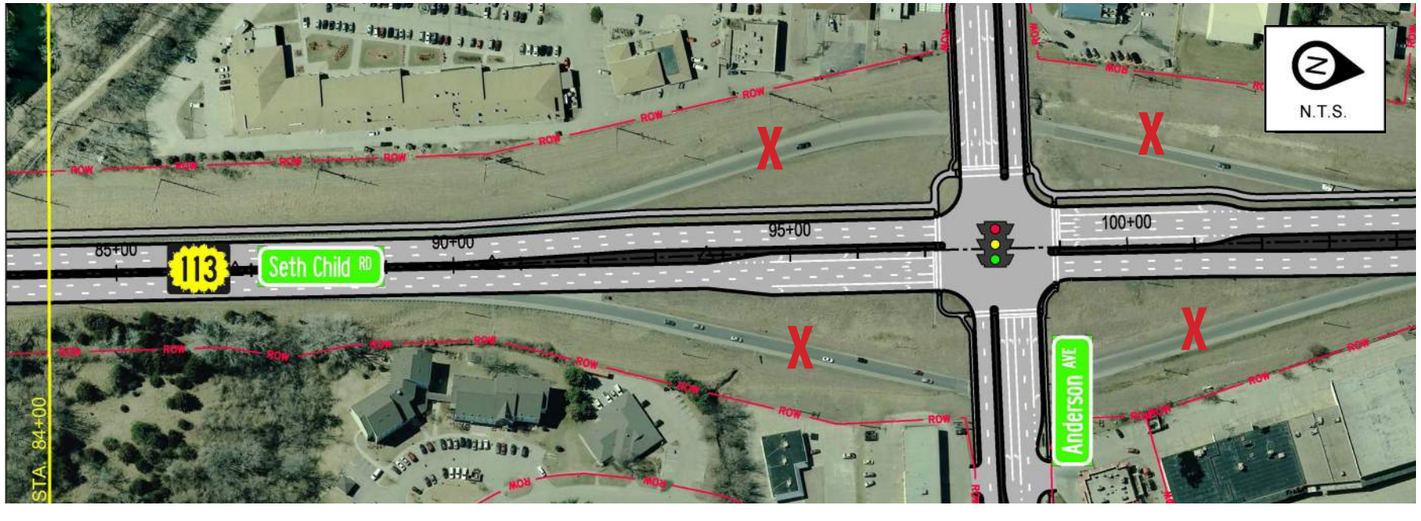


EXHIBIT 6.L | ANDERSON AVENUE AT-GRADE SIGNAL ALTERNATIVE



6 | ALTERNATIVE DEVELOPMENT

MATRIX ANALYSIS: The Value Planning process looked at additional criteria to evaluate the alternatives to identify the one that will provide the best performance, with the greatest acceptance, and a reasonable price.

Based on the performance rating, the Diverging Diamond Interchange (DDI) alternative was identified as the preferred alternative because of its capability to relieve congestion and reduce the number of conflict points. It also excelled at more efficient vehicular movement.

TABLE 6.J2 PERFORMANCE RATING

Excellent = 5, Very Good = 4, Good = 3, Satisfactory = 2, Poor = 1, Unacceptable = 0

	Criteria	Weight of Importance (1-10)	Do Nothing Rating	Do Nothing Weighted Rating	At-Grade Signal Rating	At-Grade Signal Weighted Rating	Modified Diamond Rating	Modified Diamond Weighted Rating	DDI Rating	DDI Weighted Rating	SPUI Rating	SPUI Weighted Rating	Roundabout Interchange Rating	Roundabout Interchange Weighted Rating
1	Accommodate Future Capacity	8	1	8	3	24	3	24	4	32	3	24	2	16
2	Relieve Congestion	9	1	9	3	27	3	27	4	36	3	27	2	18
3	Safeguard Users	10	2	20	3	30	3	30	4	40	3	30	4	40
4	Efficient Bike/Ped Movement	7	2	14	4	28	3	21	3	21	2	14	3	21
5	Efficient Vehicular Movement	8	1	8	3	24	3	24	4	32	3	24	2	16
	Total Weighted Rating	42		59.00		133.00		126.00		161.00		119.00		111.00
	Average Weighted Rating			1.40		3.17		3.00		3.83		2.83		2.64

Based on the acceptance rating, the at-grade signalized intersection was identified as the preferred alternative. The at-grade intersection provides a better opportunity to add north/south pedestrian facilities, minimizing ROW impacts to adjacent properties, and improves driveway spacing from Seth Child Road to help facilitate development.

TABLE 6.J3 ACCEPTANCE RATING

Excellent = 5, Very Good = 4, Good = 3, Satisfactory = 2, Poor = 1, Unacceptable = 0

	Criteria	Weight of Importance (1-10)	Do Nothing Rating	Do Nothing Weighted Rating	At-Grade Signal Rating	At-Grade Signal Weighted Rating	Modified Diamond Rating	Modified Diamond Weighted Rating	DDI Rating	DDI Weighted Rating	SPUI Rating	SPUI Weighted Rating	Roundabout Interchange Rating	Roundabout Interchange Weighted Rating
1	Promote Corridor	8	1	8	4	32	2	16	3	24	2	16	4	32
2	Promote Multi-Modal	10	1	10	4	40	2	20	3	30	2	20	3	30
3	Facilitate Development	9	1	9	4	36	2	18	3	27	3	27	3	27
4	Minimize R/W Impacts	9	5	45	4	36	3	27	1	9	2	18	2	18
5	Improve Aesthetics	8	1	8	3	24	2	16	3	24	2	16	4	32
	Total Weighted Rating	44		80.00		168.00		97.00		114.00		97.00		139.00
	Average Weighted Rating			1.82		3.82		2.20		2.59		2.20		3.16

The costs and ratings for the alternatives are shown in the following table. As expected the No Build scenario has the best cost rating because of no initial cost. The roundabout interchange was the next best alternative based on cost. Project costs were developed for each alternative to provide a representative comparison.

TABLE 6.J4 | ANDERSON AVENUE COST SUMMARY

	No Build	At-Grade Signal	Modified Diamond	DDI	SPUI	Roundabout Interchange
Cost	$0	$8.75 million	$8.1 million	$7.60 million	$11.0 million	$5.5 million
Rating	5	2.6	2.8	2.9	2	3.5

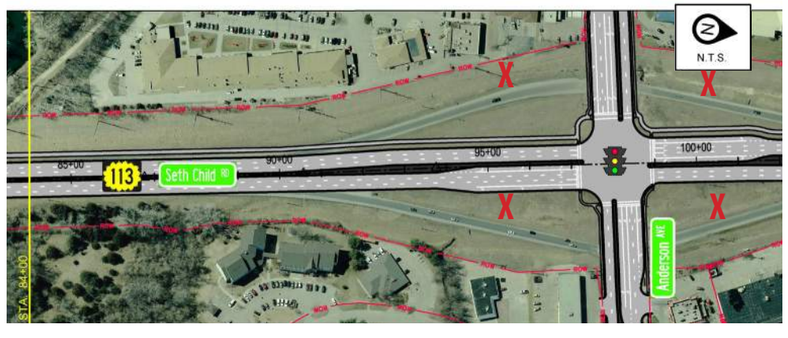
The alternatives were averaged together as shown below.

TABLE 6.J5 RATING SUMMARY

		No Build	At-Grade Signal	Modified Diamond	DDI	SPUI	Roundabout Interchange
Ratings	Performance (P)	1.4	3.2	3.0	3.8	2.8	2.6
	Acceptance (A)	1.8	3.8	2.2	2.6	2.2	3.2
	Cost (C	5.0	2.6	2.8	2.9	2.0	3.5
	P A C						
Value Indicator	1 1 1	2.7	3.2	2.7	3.1	2.3	3.1
	2 1 1	2.4	3.2	2.8	3.3	2.5	3.0
	1 2 1	2.5	3.4	2.6	3.0	2.3	3.1
	1 1 2	3.3	3.0	2.7	3.1	2.3	3.2

SUMMARY: The preferred alternative is identified as the at-grade signalized intersection when all criteria have equal emphasis with a 3.2 average rating. When an emphasis is placed on performance, the DDI received the highest rating with an average of 3.3. When acceptance is emphasized, the at-grade signalized intersection received a 3.4 rating. The "No Build" rated higher when cost was emphasized, however the "No-Build" rated poorly in many other categories. The roundabout interchange had the next highest average rating when cost was emphasized. The at-grade signalized intersection received the highest rating when everything was equal and for acceptance rating. Therefore, the at-grade signalized intersection was identified as the preferred alternative. The at-grade signalized intersection alternative is shown below in Exhibit 6.L.

EXHIBIT 6.L | ANDERSON AVENUE AT-GRADE SIGNAL ALTERNATIVE



SETH CHILD ROAD (K-113) & CLAFLIN ROAD

IDENTIFIED ISSUES: The existing Claflin Road intersection is currently a signalized at-grade intersection that would be expected to operate with an overall intersection LOS D during the 2040 traffic conditions. However, the intersection currently is about 335 feet north of the Anderson Avenue gore point. The northbound on-ramp and southbound off-ramp are located within the influence area of the Claflin Road intersection. Unfortunately the intersection would be required to be closed with any of the Anderson Avenue interchange alternatives because the intersection would not meet access management guidelines. Suggested spacing for a signalized intersection to an interchange ramp is 2,640 feet, per KDOT's Access Management Policy.

The safety analysis revealed that the Claflin Road intersection experienced 26 crashes during the study period (Year 2012 to 2015); 18 property damage only crashes (PDO), eight injury crashes and no fatalities. The intersection crash rate was calculated to be 55.4 crashes per 100 million entering vehicles (100 MEV), approximately one-half of the state wide average of 100 crashes per 100 MEV for urban intersection. The estimated 20-Year No Build crash frequency is 146.6 total crashes.

ALTERNATIVE DEVELOPMENT: The only alternatives considered at this intersection were a signalized intersection or closing the intersection. Table 6.K depicts the overall intersection levels of service for the 2040 volume condition. The signal alternative is the proposed six-lane urban roadway section. Table L.2, located in Appendix L, provides a LOS summary for individual movements for the 2040 signal alternatives.

TABLE 6.K | SETH CHILD ROAD & CLAFLIN ROAD LOS SUMMARY

Option	Overall LOS
2040 No Build	D
Signal	C

SETH CHILD ROAD (K-113) & KIMBALL AVENUE

IDENTIFIED ISSUES: The following observations were identified through the team's field visits and observations or were mentioned through the public involvement process. The 2040 "No Build" traffic volumes are summarized in Exhibit G.4, included in Appendix G.

- Southbound left-turn movement would be expected to operate with a LOS F in 2040 "No Build" traffic volume conditions, shown in Exhibit G.6 in the Appendix.
- The Seth Child Road southbound on-ramp is served by a T-intersection on Wreath Ave.
- Nine crashes were reported during the study period at the southbound Seth Child Road ramp intersection with Wreath Avenue and 19 reported crashes at the northbound ramp intersection.
- 20-Year No Build crash frequency is 92.1 total crashes

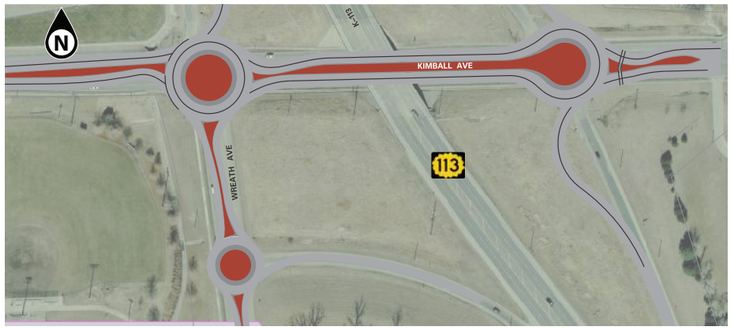
The safety analysis revealed that the interchange ramp intersections at Kimball Avenue have experienced 28 crashes during the study period (Year 2012 to 2015) with 24 property damage only crashes (PDO), four injury crashes and no fatalities. The intersection crash rates were reported to be 24.0 crashes per 100 million entering vehicles (100 MEV) for the southbound ramp and 64.4 crashes per 100 MEV for the NB ramp. It should be noted that traffic signals were installed during the safety review period.

ALTERNATIVE DEVELOPMENT: Similar to Anderson Avenue, several alternatives were suggested through the speculation phase. The following alternatives were analyzed and evaluated on a nodal basis for Kimball Avenue. Table 6.L1 summarizes the capacity analyses for each of the alternatives being considered.

Modified Diamond Interchange: To improve the overall traffic operation, the westbound approach would need to be expanded to accommodate dual left-turns and two thru lanes at the southbound ramp/Wreath Avenue intersection. The eastbound approach would be served with two thru lanes; northbound approach would have a single left and right-turn lanes; and the southbound approach would have a single left-turn lane and a shared thru/right-turn lanes. These geometrics are expected to operate with an overall LOS C during the PM peak period in 2040. Table L.2, in Appendix L, summarizes the individual turning movement and overall intersection levels of service. The northbound ramp would have a single eastbound left-turn lane and two thru lanes; westbound approach would have two thru lanes; and the northbound approach would have a single left-turn lane and a free flow right-turn lane. The northbound ramp would be expected to operate with a LOS C during the PM peak period. A conceptual layout of the modified diamond interchange was not created. Costs were estimated from Anderson Avenue improvement costs.

Roundabout Terminals: Multi-lane roundabouts were evaluated at both ramp terminals and a single-lane roundabout was proposed at the southbound Seth Child Road ramp/Wreath Avenue intersection. Based on the 2040 capacity analysis, the northbound and southbound ramps are both expected to operate with a LOS C. The eastbound and westbound thru movements would be expected to operate with a LOS E, as depicted in Table L.2 in the Appendix. The southbound Seth Child Ramp and Wreath Avenue intersection would be expected to operate with a LOS B as a single-lane roundabout. Exhibit 6.M below illustrates the roundabout interchange alternative.

EXHIBIT 6.M | KIMBALL AVENUE ROUNDABOUT INTERCHANGE



Diverging Diamond Interchange: A diverging diamond interchange (DDI) was analyzed and based on the capacity analyses, the DDI would be expected to operate with LOS B at both ramp terminals/crossovers. However, access to Wreath Avenue would need to be closed because access could not be provided at the west crossover. Cico Park is located west of Wreath Avenue, limiting the opportunity to shift the alignment west to maintain access to Kimball Avenue. A conceptual layout was not prepared for this alternative.

Single Point Urban Interchange (SPUI): A single point urban interchange (SPUI) was analyzed and evaluated. Based on the capacity analyses, the SPUI would be expected to operate with LOS B with the individual turning movements operating with a LOS C or better. To construct a SPUI, the Seth Child Road bridge would need to be replaced and lengthened to accommodate the additional width for the interchange ramps due to the large turn radii. Like the DDI option, access to Wreath Avenue would need to be closed. A conceptual layout was not prepared for this alternative.

At-Grade Signalized Intersection: Similar to Anderson Avenue, an at-grade signalized intersection was analyzed. Based on the capacity analysis, the overall at-grade intersection would be expected to operate with a LOS C during the PM peak period and the individual turn movements would operate with a LOS D or better, as shown in Table L.2 in the appendix. The at-grade intersection would require three thru lanes and dual left-turn lanes for the northbound and southbound approaches, shown in Exhibit 6.N below. The eastbound and westbound approaches would require dual left-turn lanes and two thru lanes with an eastbound right-turn lane.

EXHIBIT 6.N | KIMBALL AVENUE AT-GRADE SIGNALIZED INTERSECTION

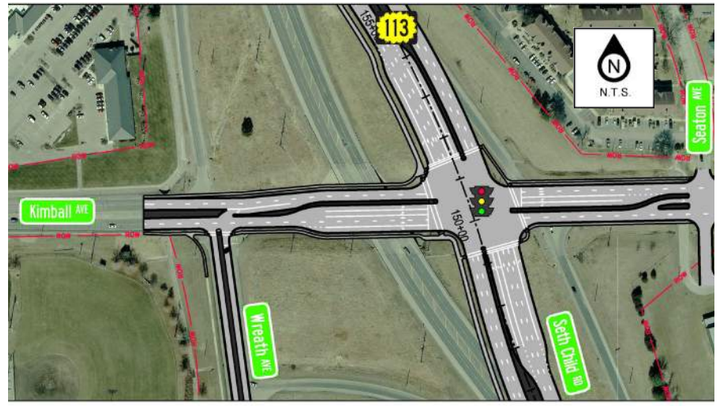


TABLE 6.L1 | SETH CHILD ROAD & KIMBALL AVENUE LOS SUMMARY

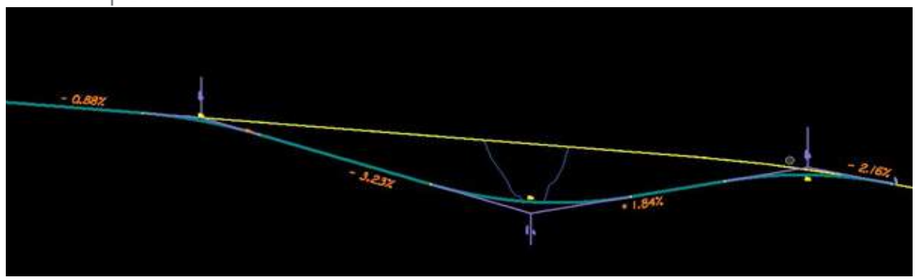
Option	Part of Interchange	Overall LOS
2040 No Build	SB Ramp	C
	NB Ramp	C
Modified Diamond	SB Ramp	C
	NB Ramp	C
Roundabouts (HCS)	SB Ramp	C
	NB Ramp	C
DDI	SB Ramp	B
	NB Ramp	B
SPUI	-	B
At-Grade Signal	-	C

6 | ALTERNATIVE DEVELOPMENT

Anderson Avenue was identified as the critical node for Segment B when defining the overall Seth Child Road Corridor. Should Anderson Avenue remain a grade-separated interchange, then the best performing alternative at other locations like the Kimball Avenue interchange would intuitively be grade separated also. Likewise, should the recommendation state that Anderson Avenue become an at-grade signalized intersection, other locations like Kimball Avenue would likely be considered as an at-grade signalized intersection.

For the at-grade option, evaluation of the vertical profile was required. Exhibit 6.O illustrates how the vertical profile would need to change to accommodate an at-grade intersection. The profile can be adjusted to tie into Kimball Avenue. The proposed profile grades are shown as 1.84% and 3.23%. As stated in the Anderson Avenue section, APWA street standards recommends a maximum 6% grade for an urban arterial. The profile developed is well below that level.

EXHIBIT 6.0 | SETH CHILD ROAD PROPOSED PROFILE AT KIMBALL AVENUE



MATRIX ANALYSIS: The matrix analysis completed as part of the Value Planning process compares each alternative using the performance and acceptance evaluation criteria to identify the alternative that will provide the best performance, with the greatest acceptance at a reasonable cost.

Based on the performance criteria, the DDI alternative received the highest rating because of its ability to perform with the best level of service and reducing the number or conflicts.

TABLE 6.L2 PERFORMANCE RATING

Excellent = 5, Very Good = 4, Good = 3, Satisfactory = 2, Poor = 1, Unacceptable = 0		Weight of Importance	Do Nothing		At-Grade Signal		Roundabout Interchange		DDI		SPUI		Modified Diamond	
			Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating
	Criteria	(1-10)												
1	Accommodate Future Capacity	8	1	8	2	16	2	16	3	24	3	24	3	24
2	Relieve Congestion	9	1	9	2	18	2	18	4	36	4	36	3	27
3	Safeguard Users	10	2	20	3	30	4	40	4	40	3	30	3	30
4	Efficient Bike/Ped Movement	7	2	14	4	28	3	21	3	21	2	14	2	14
5	Efficient Vehicular Movement	8	1	8	3	24	3	24	2	16	2	16	3	24
	Total Weighted Rating	**42**	**59.00**		**116.00**		**119.00**		**137.00**		**120.00**		**119.00**	
	Average Weighted Rating		**1.40**		**2.76**		**2.83**		**3.26**		**2.86**		**2.83**	

The stakeholder acceptance criteria identified the at-grade traffic signal as the preferred alternative. The at-grade traffic signal is able to accommodate multi-modal users and promote the corridor with a sense of place contributed to its high rating.

TABLE 6.L3 ACCEPTANCE RATING

Excellent = 5, Very Good = 4, Good = 3, Satisfactory = 2, Poor = 1, Unacceptable = 0		Weight of Importance	Do Nothing		At-Grade Signal		Roundabout Interchange		DDI		SPUI		Modified Diamond	
			Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating
	Criteria	(1-10)												
1	Promote Corridor	8	2	16	4	32	3	24	3	24	3	24	3	24
2	Promote Multi-Modal	10	2	20	4	40	3	30	3	30	2	20	2	20
3	Facilitate Development	9	1	9	3	27	4	36	3	27	3	27	3	27
4	Minimize R/W Impacts	9	5	45	3	27	3	27	3	27	4	36	2	18
5	Improve Aesthetics	8	1	8	3	24	4	32	3	24	2	16	2	16
	Total Weighted Rating	**44**	**98.00**		**150.00**		**149.00**		**132.00**		**123.00**		**105.00**	
	Average Weighted Rating		**2.23**		**3.41**		**3.39**		**3.00**		**2.80**		**2.39**	

The costs and ratings for the alternatives are shown in the following table. As expected the "No Build" scenario received the best cost rating because of no initial cost. The roundabout interchange was the next best alternative based on cost.

TABLE 6.L4 | KIMBALL AVENUE COST SUMMARY

	No Build	At-Grade Signal	Roundabout Interchange	DDI	SPUI	Modified Diamond
Cost	$0	$8 million	$4.0 million	$6.5 million	$11.0 million	$7.0 million
Rating	5	2.8	3.9	3.2	2.0	3.1

The alternatives were averaged together as shown below.

TABLE 6.L5 RATING SUMMARY

				No Build	At-Grade Signal	Roundabout Interchange	DDI	SPUI	Modified Diamond
Ratings			Performance (P)	1.4	2.8	2.8	3.3	2.9	2.8
			Acceptance (A)	2.2	3.4	3.4	3.0	2.8	2.4
			Cost (C)	5.0	2.8	3.9	3.2	2.0	3.1
	P	A	C						
Value Indicator	1	1	1	2.9	3.0	3.4	3.2	2.6	2.8
	2	1	1	2.5	2.9	3.2	3.2	2.6	2.8
	1	2	1	2.7	3.1	3.4	3.1	2.6	2.7
	1	1	2	3.4	2.9	3.5	3.2	2.4	2.9

Looking at Kimball Avenue independently, the preferred alternative is identified as the roundabout interchange when all criteria have equal emphasis. When an emphasis is placed on performance, the roundabout and DDI have an average rating of 3.2. If acceptance is emphasized, the roundabout received an average rating of 3.4. The roundabout also excelled in the cost category with a 3.5 rating.

SETH CHILD ROAD (K-113)& MARLATT AVENUE

Marlatt Avenue currently intersects Seth Child Road as an at-grade unsignalized intersection. Marlatt Avenue is a future east/west arterial for Manhattan. Currently, Marlatt Avenue is a two-lane paved roadway east of Seth Child Road and a rural rock roadway west of Seth Child Road. Marlatt Avenue has recently been widened to a four-lane urban roadway section from Tuttle Creek Boulevard (US-24) to Denison Avenue. The west leg of the intersection of Marlatt Avenue was identified to experience the highest growth rate in the next twenty plus years. The travel demand model estimates the 2040 volumes along the west leg of the corridor would grow at 14% per year over the next 22 years. This area of Manhattan has the greatest potential for development growth.

IDENTIFIED ISSUES: The following observations were identified through the team's field visits and observations or were mentioned through the public involvement process. The 2040 "No Build" traffic volumes are summarized in Exhibit I.4, included in Appendix I.

- Marlatt Avenue is expected to be the east/west corridor that will experience the highest traffic volume growth (14% west leg and 3% east leg).
- The intersection is currently two-way stop controlled intersection.
- The east leg of Marlatt Ave has two 90 degree curves within the first 1,500 feet.
- The west leg of Marlatt Avenue is currently unpaved.

ALTERNATIVE DEVELOPMENT: The following alternatives were analyzed and evaluated on a nodal basis for Kimball Avenue. Table 6.M1 summarizes the capacity analyses for each of the alternatives being considered.

At-Grade Signalized Intersection: The traffic growth along Marlatt Avenue has been identified as the corridor that will experience the highest growth over the next 20 plus years. MUTCD signal warrant analyses indicate that a traffic signal would be expected to be met by the Year 2040. The capacity analyses indicate that the overall at-grade intersection would be expected to operate with a LOS C during the PM peak period. Individual turn movements would be expected to operate with a LOS E or better, as shown in Table L.2 located in Appendix L. The northbound approach would have a single left-turn lane, two thru lanes and a right-turn lane. The southbound approach would have a single left-turn "lane," a thru lane and a thru/right-turn lane. The eastbound approach would have a single left-turn lane, one thru lane and one right-turn lane. The westbound approach would have dual left-turn lanes and a thru/right-turn lane. Exhibit 6.P represents the at-grade signalized intersection.

EXHIBIT 6.P | MARLATT AVENUE AT-GRADE SIGNALIZED INTERSECTION

At-Grade Roundabout Intersection: A multi-lane roundabout was evaluated, and the capacity analyses indicate that the overall at-grade roundabout would be expected to operate with a LOS C during the PM peak period. Individual turn movements would be expected to operate with a LOS D or better, as shown in Table L.2 in the Appendix. The northbound and southbound approaches would have two entering lanes. The eastbound and westbound approaches would have single-lane entries, shown in Exhibit 6.Q.

EXHIBIT 6.Q | MARLATT AVENUE AT-GRADE ROUNDABOUT

Roundabout Interchange: Single-lane roundabouts were evaluated at both ramp terminals. Based on the 2040 capacity analysis, the northbound and southbound ramps are both expected to operate with a LOS B. A conceptual layout was not completed for this alternative.

Diamond Interchange: A diamond interchange was evaluated as a possible alternative. It was assumed the ramp terminals would be signalized. The capacity analyses indicate that the northbound and southbound ramp terminals would operate with an overall LOS C and D, respectively. The individual turn movements would be expected to operate with a LOS D or better, except for the westbound left-turn movement, which would operate with LOS E. Exhibit 6.R below illustrates diamond interchange alternative.

EXHIBIT 6.R | MARLATT AVENUE DIAMOND INTERCHANGE

Diverging Diamond Interchange: A diverging diamond interchange (DDI) was analyzed as an interchange alternative. The capacity analyses indicate that the DDI crossovers would operate with a LOS B and A for the northbound and southbound ramps respectively. Table L.2 in the Appendix provides a summary of the individual turn movement LOS. A conceptual layout was not prepared for this alternative.

Single Point Urban Interchange (SPUI): A single point urban interchange (SPUI) was analyzed and evaluated. Based on the capacity analyses, the SPUI would be expected to operate with LOS B with the individual turning movements operating with a LOS C or better, as shown in Table L.2 in the Appendix. A conceptual layout was not prepared for this alternative.

6 | ALTERNATIVE DEVELOPMENT

MATRIX ANALYSIS: As part of the Value Planning process, each alternative using the performance and acceptance evaluation criteria to identify the alternative that will provide the best performance, with the greatest acceptance at a reasonable cost.

TABLE 6.M1 | SETH CHILD ROAD & MARLATT AVENUE LOS SUMMARY

Option	Part of Interchange	Overall LOS
At-Grade Signal	-	C
At-Grade Roundabout (HCS)	-	C
Roundabout Interchange (HCS)	SB Ramp	B
	NB Ramp	B
Diamond	SB Ramp	D
	NB Ramp	C
DDI	SB Ramp	A
	NB Ramp	B
SPUI		B

Based on the performance criteria, the roundabout interchange and the DDI received the highest ratings due to their ability to provide good level of service and safeguard users more effortlessly.

TABLE 6.M2 PERFORMANCE RATING

Excellent = 5, Very Good = 4, Good = 3, Satisfactory = 2, Poor = 1, Unacceptable = 0

	Criteria	Weight of Importance (1-10)	Do Nothing Rating	Do Nothing Weighted Rating	At-Grade Signal Rating	At-Grade Signal Weighted Rating	Diamond Rating	Diamond Weighted Rating	DDI Rating	DDI Weighted Rating	SPUI Rating	SPUI Weighted Rating	At-Grade Roundabout Rating	At-Grade Roundabout Weighted Rating	Roundabout Interchange Rating	Roundabout Interchange Weighted Rating
1	Accommodate Future Capacity	8	1	8	2	16	3	24	4	32	4	32	2	16	4	32
2	Relieve Congestion	9	1	9	3	27	3	27	4	36	4	36	2	18	4	36
3	Safeguard Users	10	1	10	3	30	4	40	5	50	3	30	4	40	5	50
4	Efficient Bike/Ped Movement	7	1	7	3	21	3	21	3	21	2	14	4	28	3	21
5	Efficient Vehicular Movement	8	1	8	3	24	3	24	4	32	3	24	3	24	4	32
	Total Weighted Rating	42		42.00		118.00		136.00		171.00		136.00		126.00		171.00
	Average Weighted Rating			1.00		2.81		3.24		4.07		3.24		3.00		4.07

For stakeholder acceptance criteria, the at-grade roundabout was the preferred option. Its ability to accommodate multi-modal uses and promote the corridor with a sense of place contributed to the roundabout receiving a high rating.

TABLE 6.M3 ACCEPTANCE RATING

Excellent = 5, Very Good = 4, Good = 3, Satisfactory = 2, Poor = 1, Unacceptable = 0

	Criteria	Weight of Importance (1-10)	Do Nothing Rating	Do Nothing Weighted Rating	At-Grade Signal Rating	At-Grade Signal Weighted Rating	Diamond Rating	Diamond Weighted Rating	DDI Rating	DDI Weighted Rating	SPUI Rating	SPUI Weighted Rating	At-Grade Roundabout Rating	At-Grade Roundabout Weighted Rating	Roundabout Interchange Rating	Roundabout Interchange Weighted Rating
1	Promote Corridor	8	1	8	4	32	4	32	4	32	4	32	4	32	4	32
2	Promote Multi-Modal	10	1	10	4	40	3	30	3	30	2	20	4	40	3	30
3	Facilitate Development	9	1	9	3	27	4	36	4	36	4	36	3	27	4	36
4	Minimize R/W Impacts	9	5	45	4	36	2	18	2	18	1	9	3	27	2	18
5	Improve Aesthetics	8	1	8	2	16	3	24	3	24	2	16	4	32	4	32
	Total Weighted Rating	44		80.00		151.00		140.00		140.00		113.00		158.00		148.00
	Average Weighted Rating			1.82		3.43		3.18		3.18		2.57		3.59		3.36

The costs and ratings for the alternatives are shown in the following table. As expected the "No Build" scenario has the best cost rating because of no initial cost.

TABLE 6.M4 | MARLATT AVENUE COST SUMMARY

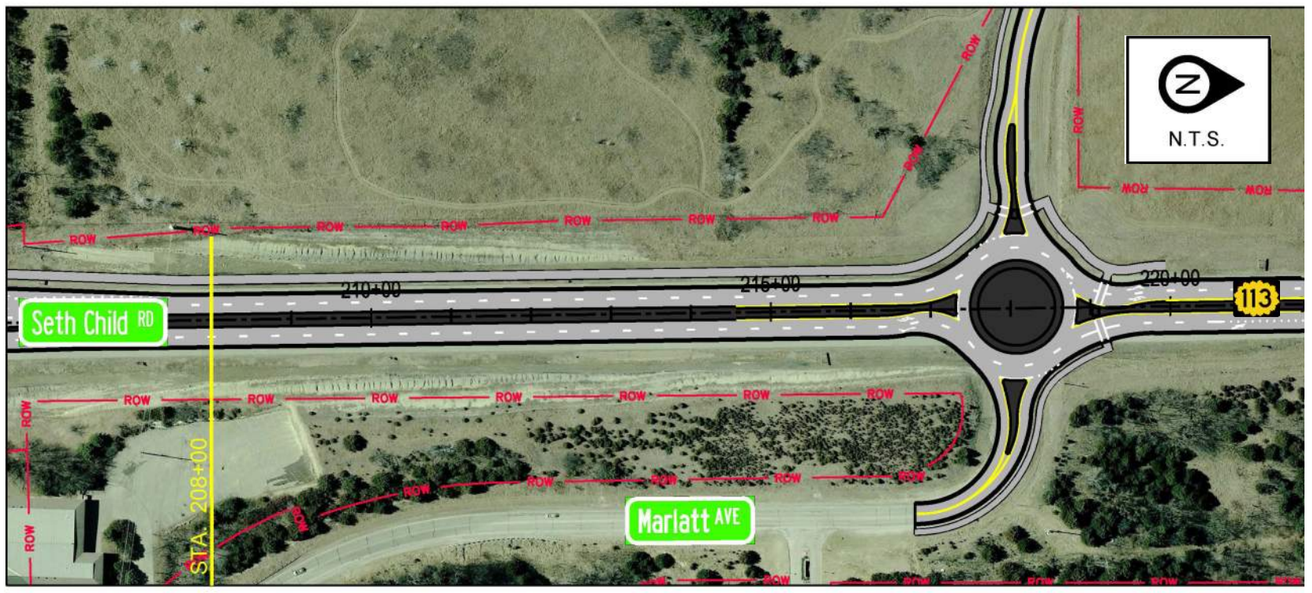
	No Build	At-Grade Signal	Diamond	DDI	SPUI	At-Grade Roundabout	Roundabout Interchange
Cost	$0	$4 million	$11.3 million	$10.8 million	$11.9 million	$3.6 million	$11.4 million
Rating	5	4	2.2	2.3	2	4.1	2.1

TABLE 6.M5 RATING SUMMARY

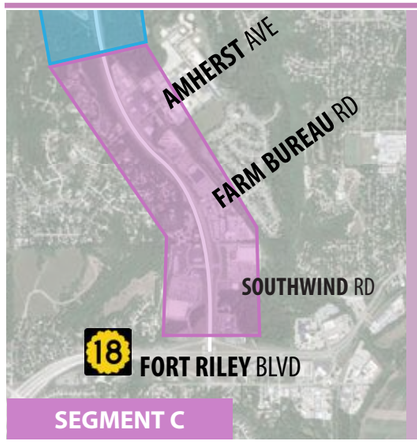
				No Build	At-Grade Signal	Diamond	DDI	SPUI	At-Grade Roundabout	Roundabout Interchange
Ratings			Performance (P)	1.0	2.8	3.2	4.1	3.2	3.0	4.1
			Acceptance (A)	1.8	3.4	3.2	3.2	2.6	3.6	3.4
			Cost (C)	5.0	4.0	2.2	2.3	2.0	4.1	2.1
	P	A	C							
Value Indicator	1	1	1	2.6	3.4	2.9	3.2	2.6	3.6	3.2
	2	1	1	2.2	3.3	3.0	3.4	2.8	3.4	3.4
	1	2	1	2.4	3.4	3.0	3.2	2.6	3.6	3.2
	1	1	2	3.2	3.6	2.7	3.0	2.5	3.7	2.9

The preferred alternative is the at-grade roundabout when all criteria have equal emphasis. When an emphasis is placed on performance, the at-grade roundabout received an average rating of 3.4. If acceptance is emphasized, the at-grade roundabout received an average rating of 3.6. With an emphasis on cost, the roundabout remains the highest rated alternative with a 3.7 rating.

EXHIBIT 6.S | MARLATT AVENUE AT-GRADE ROUNDABOUT



SEGMENT C – SETH CHILD ROAD (K-113) FROM AMHERST AVENUE TO K-18 (FORT RILEY BOULEVARD) INTERCHANGE



The intersections along the Segment C area of the Corridor are currently signalized at-grade intersections. As part of the speculation phase, additional alternatives were developed and evaluated at a high level. For example, an interchange at Amherst Avenue was evaluated. The west side of Seth Child Road has higher ground/ bluffs and the existing ground along the east side is lower than Seth Child Road. In order to have Amherst Avenue cross above Seth Child Road, the roadway profile would touch down at the existing ground approximately at Linear Trail. Impact to the existing businesses was considered to be too extreme to be carried forward as an alternative.

IDENTIFIED ISSUES: The following observations were identified through field visits and observations or were mentioned through the public involvement process. The 2040 No Build traffic volumes are summarized in Figure D.4, included in Appendix D. The summary of the traffic operations for the 2040 No Build traffic volumes are shown in Figure D.6 in Appendix D.

- The Southwind Road intersection would be expected to operate with an overall LOS D, but the east and westbound left-turn movements would be expected to operate with LOS E and a LOS F for the eastbound right-turn movement.
- Concerns with the northbound weave from the westbound K-18 interchange ramp to go west on Southwind Road.
- There were 37 reported crashes at the intersection with Southwind Road during the study period with 12 injury crashes. The intersection has a crash rate of 69.0 crashes per 100 million entering vehicles (MEV).
- Farm Bureau Road had 13 reported crashes with four injury crashes during the study period and a 33.3 crashes per 100 MEV.
- There were 31 reported crashes with 11 injury crashes at the intersection with Amherst Avenue. The crash rate was calculated to be 72.9 crashes per 100 MEV.

ALTERNATIVE DEVELOPMENT: Based on the existing topography along Seth Child Road, the amount of alternatives were limited to variations of an at-grade intersection. Table 6.N provides a summary of the traffic operation for the preferred alternatives identified though the Value Planning process. A brief discussion for each intersection is described to identify if additional improvements were recommended on top of the three north/south thru lanes. Table L.3, provided in Appendix L, summarizes the individual movements for each alternative.

TABLE 6.N | SEGMENT C LOS SUMMARY (K-18 TO AMHERST AVENUE)

Intersection	Overall LOS
Southwind Rd	C
Farm Bureau Rd	A
Amherst Avenue	B

SOUTHWIND & SETH CHILD ROAD

The intersection was analyzed with the addition of a thru lane for the north and southbound approaches. The intersection approaches were analyzed as urban arterial roadway section. A second northbound left-turn lane was added to accommodate the significant left-turn volume. The level of service shown in Table 6.N reflects this intersection geometry. The overall intersection would be expected to operate LOS C. The individual turn movements would be expected to operate with LOS D or better, as shown in Table L.3 in Appendix L. Exhibit 6.T depicts the Southwind Road intersection modifications.

FARM BUREAU ROAD & SETH CHILD ROAD

There were a few alternatives identified through the Value Planning process. The first alternative was to add the additional thru lane and convert to an urban arterial roadway section. The next alternative was to modify the intersection into a ¾-access intersection. The westbound left-turn movement would be restricted by a raised median. This alternative would need to be completed as part of any redevelopment along the east side of Seth Child Road because a collector road or backage road would be required to accommodate the westbound left-turn movement. Currently, a roadway does not exist to connect to Amherst Avenue or Southwind Road. Motorists would need to travel through parking lots to access southbound Seth Child Road. Exhibit 6.U illustrates the full access intersection improvements.

AMHERST AVENUE & SETH CHILD ROAD

Amherst Avenue would remain with similar geometry as it exists today for the side road but with the addition of the north and southbound thru lanes. With converting to an urban roadway section, the overall intersection would be expected to operate with LOS C. The existing Frontage Road does not have adequate separation from Seth Child Road. Consideration should be given to developing backage roads or creating better separation. However, because this solution would entail redevelopment and the purchase of more right-of-way, discussions with the property owners are recommended but were beyond the scope of this study. Access control should be established along the east leg of Amherst Avenue to help manage the number of access points, as shown in Exhibit 6.V.

EXHIBIT 6.T | SOUTHWIND ROAD INTERSECTION

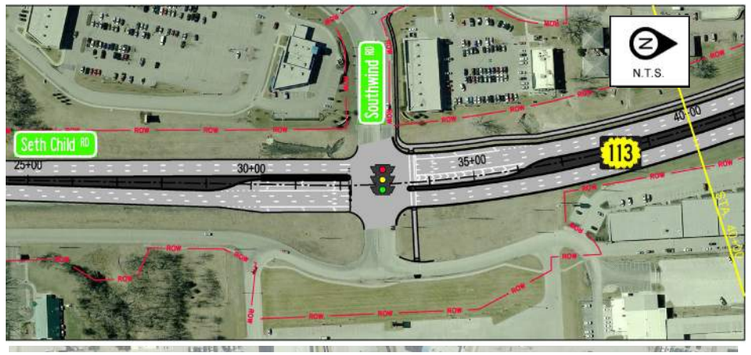


EXHIBIT 6.U | FARM BUREAU ROAD INTERSECTION

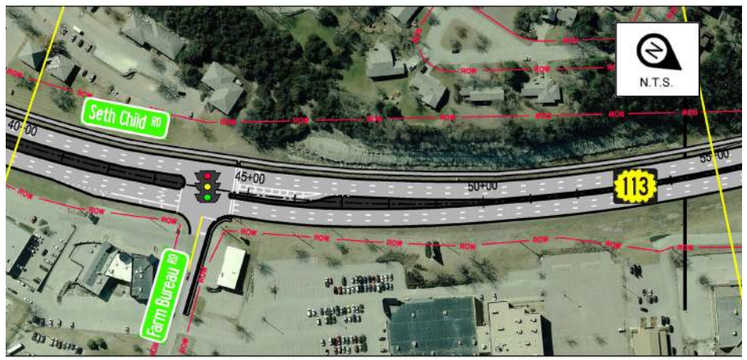


EXHIBIT 6.V | AMHERST AVENUE INTERSECTION

6 | ALTERNATIVE DEVELOPMENT

SEGMENT D –ANDERSON AVENUE CORRIDOR (WREATH AVENUE TO WEST LOOP INTERSECTION)

Segment D is comprised of the Anderson Avenue corridor from Wreath Avenue to the West Loop Shopping Center intersection. Traffic operation of this segment of the corridor is in direct relation with the Seth Child Road (K-113) interchange traffic operation.

IDENTIFIED ISSUES: The following observations were identified through field visits and observations or were mentioned through the public involvement process. The 2040 No Build traffic volumes are summarized in Figure E.4, included in the Appendix E. The summary of the traffic operations for the 2040 "No Build" traffic volumes are shown in Figure E.6.

- Twenty Six Access Points from Wreath Avenue to West Loop Signal.
- Vehicle queues blocking driveways.
- Identified within Manhattan Area Transportation Strategy (MATS) for Access Control.
- No Build Expected 20-Year Crash Frequency - 256.6 Crashes (Corridor).

ALTERNATIVE DEVELOPMENT: Exhibit 6.W represents establishing access control along Anderson Avenue Corridor. Any roadway modifications to Anderson Avenue should include evaluating the access points to manage the number of conflict points along the corridor. Redevelopment opportunities that may occur along the corridor, between Wreath Avenue and West Loop Signal, provide a great time to reduce the number of access points using the available access management tools.

Wreath Avenue Traffic Signal: Two alternatives were developed and evaluated to incorporate into any Anderson Avenue modifications. Alternative One would provide exclusive eastbound and westbound left-turn lanes and a potential south leg. The south leg would be tied to any redevelopment opportunities that could occur along the southern edge of Anderson Avenue. The proposed traffic signal would be expected to operate with an overall intersection LOS B. Exhibit 6.W shows the signalized intersection alternative.

Wreath Avenue Roundabout: Alternative Two would convert the intersection to a multi-lane roundabout. Again, the south leg would be tied to any redevelopment opportunities. The proposed roundabout would be expected to operate with an overall intersection LOS B. The overall intersection LOS for each alternative are summarized in Table 6.O. Exhibit 6.X illustrates a multi-lane roundabout at Wreath Avenue.

TABLE 6.0 | SEGMENT D LOS SUMMARY (ANDERSON AVENUE, WREATH AVE TO WEST LOOP INTERSECTION)

Intersection	Option	Overall LOS
Wreath Ave	2040 No Build	A
	Roundabout	B
West Loop	2040 No Build	B

EXHIBIT 6.X | WREATH AVENUE ROUNDABOUT

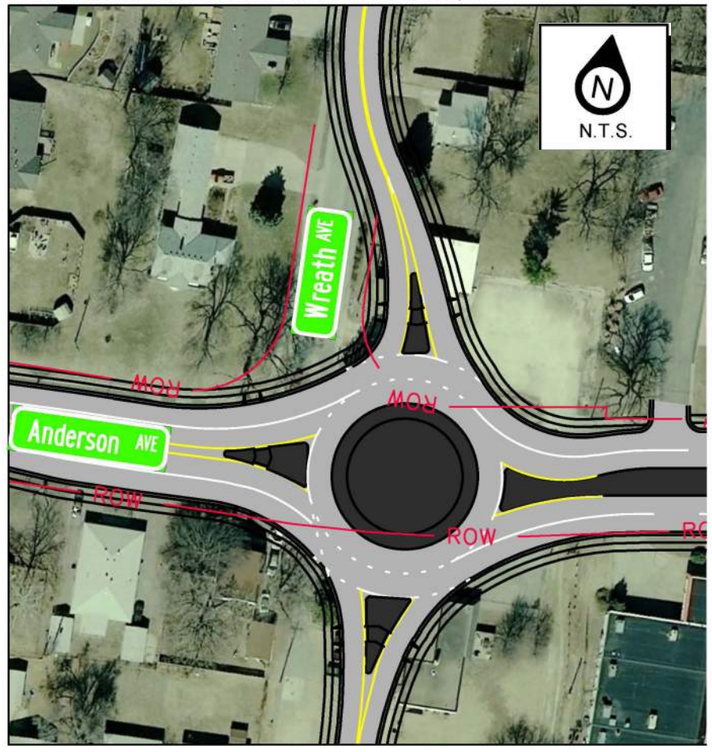
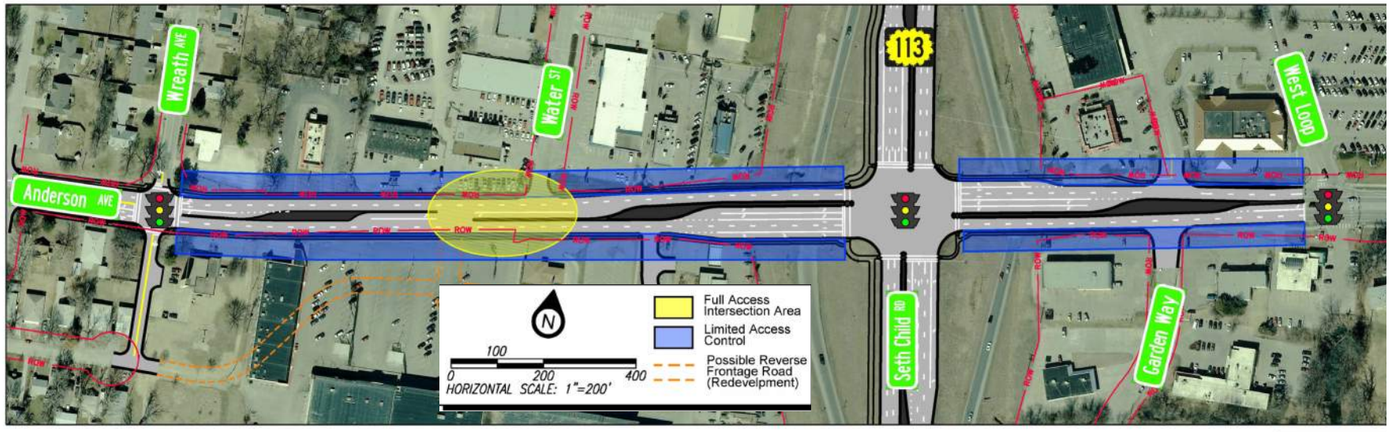


EXHIBIT 6.W | ANDERSON AVENUE ACCESS CONTROL



GRADE SEPARATED VERSUS URBAN ARTERIAL CORRIDOR

Once each node along the corridor was evaluated independently to determine the alternative that would be best suited for each location, the Value Planning Team completed an evaluation of the overall corridor as a system. Currently, the existing corridor is a mixture of traffic controls, at-grade intersections, and grade-separated interchanges. In general, the corridor was evaluated as two cases: a free-flowing roadway with grade-separated interchanges versus an urban roadway with at-grade intersections. The section evaluated was the section located primarily within the city limits (Marlatt Avenue to K-18).

IDENTIFIED ISSUES: The following observations were identified through the team's field visits and observations or were mentioned through the public involvement process.

- Lack of pedestrian access for north/south pedestrian flow.
- Bicyclists have to use the existing shoulder to travel north and south along the corridor. Approximately 1,500 feet north of Marlatt Avenue, the paved shoulder reduces to a three-foot paved shoulder, which is unusable by a bicyclist.
- Mixture of intersection types throughout the corridor.
  - Four signalized intersections
  - Two grade-separated interchanges
  - Five unsignalized intersections
- 122 reported crashes have occurred at the intersections located along Seth Child Road (US-24 to Southwind Road) during the study period. Table 6.P provides a summary of the crashes reported at each intersection.

TABLE 6.P | SETH CHILD ROAD CRASH SUMMARY

Major Road	Minor Road	Number of Crashes (2012-2015)			
		Fatal	Injury	PDO	Total
Seth Child Road	Southwind Rd	0	12	25	37
Seth Child Road	Farm Bureau Rd	0	4	9	13
Seth Child Road	Amherst Ave	0	11	20	31
Seth Child Road	Claflin Rd	0	8	18	26
Seth Child Road	Dickens Ave	0	4	1	5
Seth Child Road	Gary Ave	0	4	2	6
Seth Child Road	Leadership Ln	0	0	0	0
Seth Child Road	Marlatt Ave	0	0	1	1
Seth Child Road	Top of the World Dr	0	0	1	1
Seth Child Road	High Plains Ranch	0	0	0	0
Seth Child Road	Eagle Ridge Rd	0	0	0	0
US -24	Seth Child Road	0	1	1	2
	Total	**0**	**44**	**78**	**122**

Pedestrian and Bike Access

The urban section provides for more opportunity to develop a multi-use path. Based on the pedestrian connectivity analysis and pedestrian street audit (see appendix), the addition of a multi-use path parallel to the corridor and setback from the traveled way has a positive impact to the overall corridor. The grade-separated alternative would not improve the north / south pedestrian connectivity due to free flowing speeds and lack of pedestrian facilities.

Safety Analysis

MRI Global completed the safety analysis of the corridor. Based on the analysis, the proposed urban arterial roadway section would provide a crash reduction ranging from 24.7% to 26.6%. More detailed safety analysis information is provided in the appendix. Table 6.Q provides a summary of 20-Year Crash Frequency for the No-Build facility versus the urban arterial alternatives, and represents the amount of crash reduction for the different urban arterial concepts. For example, the urban arterial with a roundabout at Marlatt Avenue and Wreath Avenue would be expected to have 26.6% crash reduction over the next 20 years.

TABLE 6.Q | EXPECTED CRASH FREQUENCY TOTALS

Alternative	PROJECT TOTALS: NO-BUILD ALTERNATIVE Expected 20-yr Total Crash Frequency (2020 through 2039)			URBAN ARTERIAL ALTERNATIVE Expected 20-yr Total Crash Frequency (2020 through 2039)			NUMBER OF CRASHES REDUCED Expected 20-yr Total Crash Frequency Reduction (2020 through 2039)			PERCENTAGE OF CRASH REDUCTION Expected 20-yr Total Crash Frequency Reduction (2020 through 2039)		
	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total
Urban Arterial with Marlatt Signal and Wreath Signal	661	1349	2010	470.2	1044	1514	190	304	495	28.9	22.6	24.7
Urban Arterial with Marlatt Roundabout and Wreath Signal	661	1349	2010	457.9	1045	1513	193	303	496	29.2	22.5	24.7
Urban Arterial with Marlatt Signal and Wreath Roundabout	661	1349	2010	455.4	1020	1475	205	328	534	31.1	24.4	26.6
Urban Arterial with Marlatt Roundabout and Wreath Roundabout	661	1349	2010	453.1	1201	1475	207	327	535	31.5	24.3	26.6

6 | ALTERNATIVE DEVELOPMENT

SETH CHILD ROAD ACCESS

The two alternatives - free-flow grade separation versus urban arterial roadway section will impact several intersections differently due to access management guidelines. With a free-flow section, the intersections listed in Table 6.R1 may have no access to Seth Child Road or would be limited to a ¾ access. A ¾ access would remove the side road left-turn onto Seth Child Road. While the urban arterial roadway section would allow all of the existing intersections to remain open.

TABLE 6.R1 SETH CHILD ROAD ACCESS

Seth Child Road Access	Alternative	
	Urban Arterial	Freeway Section
Marlatt Avenue	Open	Open
Leadership Lane/ KFB Plaza	Open	Closed
Gary Avenue	Full or 3/4	Closed or 3/4
Kimball Avenue	Open	Open
Dickens Avenue	Full or 3/4	Closed or 3/4
Claflin Avenue	Open	Closed
Anderson Avenue	Open	Open
Amherst Avenue	Open	Open
Farm Bureau Drive	Open	Open
Southwind Road	Open	Open

For performance the urban section was rated highest because of its ability to accommodate bikes and pedestrians and efficiently move vehicles.

TABLE 6.R2 PERFORMANCE RATING

Excellent = 5, Very Good = 4, Good = 3, Satisfactory = 2, Poor = 1, Unacceptable = 0		Weight of Importance	Do Nothing		Urban Section		Grade Separated	
			Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating
	Criteria	(1-10)						
1	Accommodate Future Capacity	8	1	8	4	32	4	32
2	Relieve Congestion	9	1	9	3	27	4	36
3	Safeguard Users	10	2	20	3	30	3	30
4	Efficient Bike/Ped Movement	7	1	7	4	28	3	21
5	Efficient Vehicular Movement	8	3	24	3	24	2	16
	Total Weighted Rating	42	68.00		141.00		135.00	
	Average Weighted Rating		1.62		3.36		3.21	

For stakeholder acceptance the urban corridor was rated highest because of the opportunities to promote the corridor, accommodate multi-modal users and help facilitate development.

TABLE 6.R3 ACCEPTANCE RATING

Excellent = 5, Very Good = 4, Good = 3, Satisfactory = 2, Poor = 1, Unacceptable = 0		Weight of Importance	Do Nothing		Urban Section		Grade Separated	
			Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating
	Criteria	(1-10)						
1	Promote Corridor	8	1	8	4	32	3	24
2	Promote Multi-Modal	10	2	20	4	40	3	30
3	Facilitate Development	9	2	18	4	36	3	27
4	Minimize R/W Impacts	9	5	45	3	27	3	27
5	Improve Aesthetics	8	2	16	4	32	3	24
	Total Weighted Rating	44	107.00		167.00		132.00	
	Average Weighted Rating		2.43		3.80		3.00	

The costs and ratings for the alternatives are shown in the following table. As expected the "No Build" scenario has the best cost rating because of no initial cost. However, for the two improvement scenarios, grade-separated free-flow has the lowest cost. It should be noted that south of Wildcat Creek in Segment C, the intersection would remain at-grade because topography limits the ability to develop interchanges.

TABLE 6.R4 | SETH CHILD ROAD COST SUMMARY

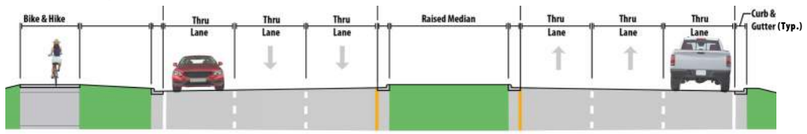
	No Build	Urban Section	Grade Separated
Cost	$0	$64 million	$42.4 million
Rating	5	3	3.6

TABLE 6.R5 RATING SUMMARY

				No Build	Urban Section	Grade Separated
Ratings			Performance (P)	1.6	3.4	3.2
			Acceptance (A)	2.4	3.8	3.0
			Cost (C)	5.0	3.0	3.6
	P	A	C			
Value Indicator	1	1	1	3.0	3.4	3.3
	2	1	1	2.7	3.4	3.3
	1	2	1	2.9	3.5	3.2
	1	1	2	3.5	3.3	3.4

The urban section was identified as the preferred alternative for all the scenarios except where cost was emphasized over performance and acceptance. Even though the urban section has a higher cost than the grade-separated corridor, its better performance and ability to facilitate the vision for the corridor resulted in a higher stakeholder acceptance leading to the recommendation of the urban section with at-grade intersections for the Seth Child Road Corridor.

EXHIBIT 6.Y | 6-LANE URBAN TYPICAL SECTION



IMPLEMENTATION PLAN

As discussed in Section 6 (Alternative Development), recommendations for the long-term vision of the Seth Child Road Corridor involve reconstructing the roadway as an urbanized typical section with at-grade intersections. The typical section would include three thru lanes in northbound and southbound directions for a total cross section of six thru lanes. A proposed median would separate the northbound and southbound thru lanes to promote safety and create a more pleasant boulevard feel. Each intersection along the Corridor would either be maintained or converted, as appropriate, to at-grade intersections as a means of improving traffic operations and safety. Auxiliary turn lanes would be incorporated at each intersection as discussed in the Alternative Development section. Drainage associated with the roadway would be addressed with a curb and gutter enclosed drainage system designed to the latest standards of either KDOT or the City of Manhattan, whichever is more conservative. Because portions of the Corridor are located within the Wildcat Creek Basin, roadway modifications within this area meet FEMA flood plain guidelines and receive a "No Rise" certificate. Finally, a bike and hike trail is recommended within the Corridor right-of-way to promote multi-use and improve connectivity to the various land uses along the Corridor. It is recommended that the trail connect with the major cross street multi-use systems in compliance with the Manhattan Area Transportation Strategy (MATS) Bike and Hike Master Plan. Exhibit 7.A illustrates the existing roadway section. The proposed six-lane urban roadway section is illustrated in Exhibit 7.B. Exhibit 7.C provides a rendering of the urban roadway section. The recommended urban road section addresses the following expectations for the project:

- Accommodate future vehicle volumes
- Improve Level of Service for drivers on the Corridor
- Reduce congestion
- Minimize impacts to adjacent properties
- Accommodate future development
- Accommodate facilities for multi-use
- Create opportunities for aesthetic improvements
- Create a sense of place
- Remove perceived barrier that the Corridor represents to bicycles and pedestrians
- Promote economic development
- Maintain regional connectivity

EXHIBIT 7.A | TYPICAL CROSS SECTION - EXISTING

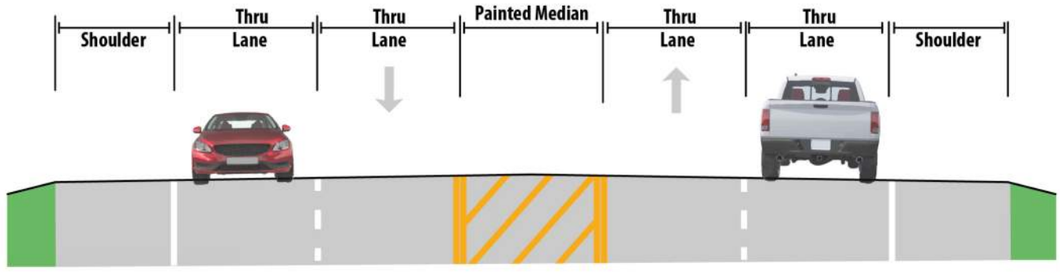
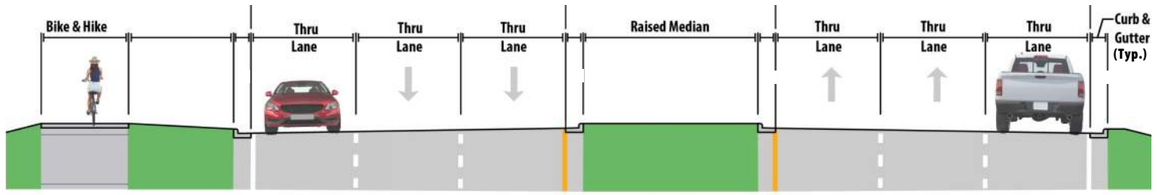


EXHIBIT 7.B | TYPICAL CROSS SECTION - PROPOSED



7 | SUMMARY & IMPLEMENTATION

The alternatives described in the previous section were identified as providing the best performance with greatest acceptance at a reasonable cost. As noted in the previous section, these alternatives were established using a matrix analysis of the overall Corridor and each individual node. The phases described below define a potential plan to implement the Seth Child Road Corridor modifications which will ultimately be finalized as funding becomes available.

PHASE 1.

A roundabout was identified as the preferred alternative at the intersection of Seth Child Road (K-113) with US-24 as a way to improve the overall traffic operation and reduce the number of crashes. Exhibit 7.D provides a conceptual layout of the single-lane roundabout. The proposed intersection modification is estimated to cost $1.7 million in 2017 dollars. Page 89 provides additional information on the proposed alternative.

Estimated construction costs for projects are expressed as 2017 dollars and were calculated based on 2016 KDOT bid tabulations for unit prices with an assumed inflation to 2017 dollars using a four percent growth rate. Costs are for construction alone and include thirty percent contingency. Right-of-way, utility relocations, preliminary engineering or construction engineering are not included in the project costs shown in this report. Paving is assumed asphalt. The project costs are planning level estimates and should not be considered absolute costs but should be utilized as order of magnitude for planning and budgeting. Costs should be reviewed and updated as projects are programmed and submitted for funding.

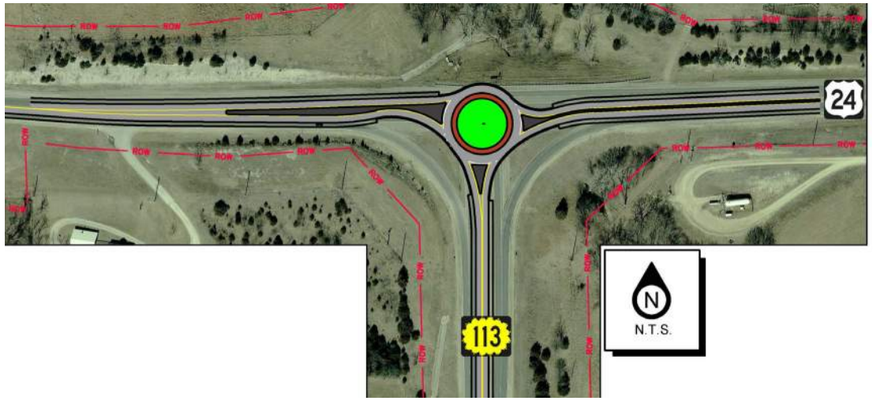


EXHIBIT 7.D| US-24 & SETH CHILD ROAD ROUNDABOUT (PHASE 1)

PHASE 2.

Similar to the US-24 intersection with Seth Child Road, the intersection of K-13 with US-24 has a history of severe crashes. Based on the study, a roundabout will provide the best performance for the intersection while providing the greatest safety benefit. Exhibit 7.E illustrates the roundabout concept and its potential layout in the intersection. Coordination with existing businesses on the south side of US-24 will be an important aspect of the roundabout design. Estimated intersection construction costs are $1.5 million in 2017 dollars. Additional information for the proposal alternative is included on Page 90.

Construction costs were not included for the segment of US-24 between K-13 and Seth Child Road (K-113). It is assumed the roundabouts would tie into the existing roadway section as soon as possible per design standards. Actual construction limits should be evaluated more closely when the projects are in the design phase.

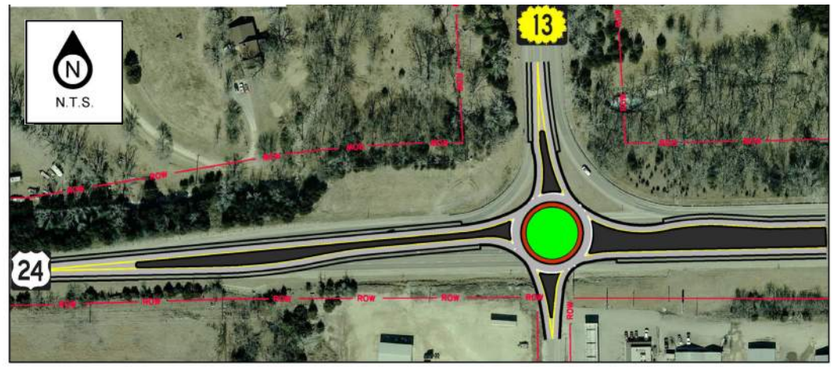


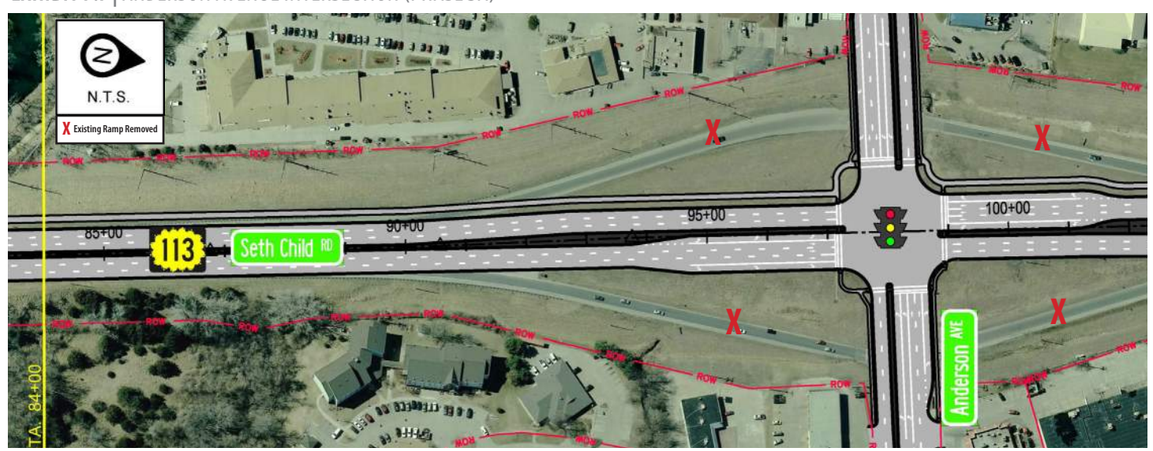
EXHIBIT 7. E | US-24 & K-13 ROUNDABOUT (PHASE 2)

PHASE 3.

The Anderson Avenue Corridor is currently experiencing significant traffic congestion during the peak commuter periods. The present Anderson Avenue intersection with Seth Child Road is a traditional diamond interchange. Development has encroached on the ramp terminals limiting options to minimize right-of-way impacts. Through the Alternative Development phase, the study team identified the Anderson Avenue intersection for conversion to an at-grade urban intersection. As a critical node for the entire Seth Child Road Corridor, the Anderson Avenue node will determine the ultimate roadway section for the remaining segments of Seth Child Road. Page 79 provides additional information about the Anderson Avenue at-grade traffic signal alternative.

The at-grade intersection would require three northbound/southbound thru lanes on Seth Child Road with a left and right-turn lane for each approach. Exhibit 7.F illustrates the signalized at-grade option. The eastbound/westbound approaches would have two thru lanes, dual-left turn lanes and dedicated right-turn lanes. In addition to intersection geometrics, a bike and hike trail would be incorporated for the northbound/southbound directions. At this time it was assumed the trail would be located along one side of the roadway.

EXHIBIT 7.F | ANDERSON AVENUE INTERSECTION (PHASE 3A)



The construction cost of converting to an at-grade intersection is estimated to be about $8.6 million (2017 dollars). That estimate does not include any right-of-way, engineering or utility relocation costs.

Claffin Road is located approximately 1,000 feet from Anderson Avenue. Ramps from the existing Anderson Avenue interchange are approximately 335 feet from Claflin Road. All interchange alternatives evaluated at Anderson Avenue assumed that Claflin Road would be impacted and be modified with the Anderson Avenue intersection. If an interchange were to remain at Anderson Avenue, Claflin Road would need to be closed to maintain adequate spacing from the proposed ramps.

With the at-grade Anderson Avenue alternative, the Seth Child Road section would extend through the Claflin Road intersection. Therefore, three northbound and southbound thru lanes would be required along with left-turn and right-turn lanes for both approaches, as shown in Exhibit 7.H. The eastbound and westbound approaches would be modified to include dual left-turn lanes and a westbound right-turn lane. As noted above, the bike and hike trail would extend through this intersection. The Claflin Road intersection project is estimated to be about $4.5 million. Page 82 provides more information regarding Claflin Road modifications.

Traffic operation for the Anderson Avenue Corridor is influenced by the number of access points from Wreath Avenue to West Loop Shopping Center Entrance. There are currently 26 access points along Anderson Avenue from Wreath Avenue to West Loop signal. If funding is available, the number of access points along the Anderson Avenue Corridor should be reduced with access management modifications from Wreath Avenue to West Loop signal. Exhibit 7.G illustrates a potential access management plan. The Anderson Avenue improvements include adding eastbound and westbound left-turn lanes at Wreath Avenue or a roundabout as shown in Exhibits 7.G or 7.I. Construction costs for widening Anderson Avenue are estimated to be $1.9 million. Additional information regarding Access Management Plan for Anderson Avenue is shown on Page 80.

EXHIBIT 7.G | ANDERSON AVENUE ACCESS MANAGEMENT (PHASE 3A)

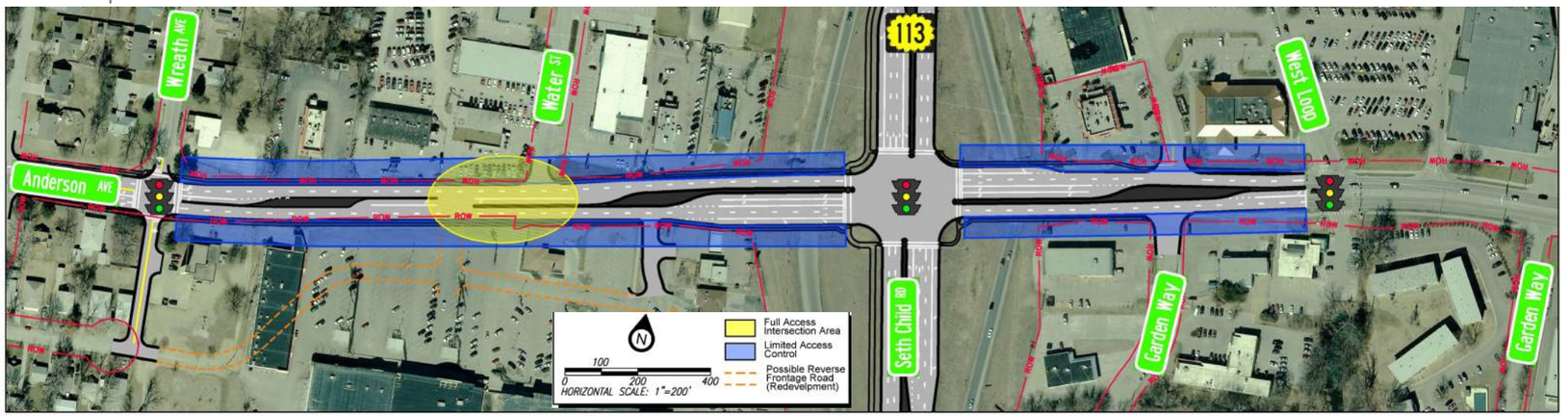


EXHIBIT 7.H | - CLAFLIN ROAD INTERSECTION (PHASE 3B)

EXHIBIT 7.I | - WREATH AVENUE ROUNDABOUT (PHASE 3C)

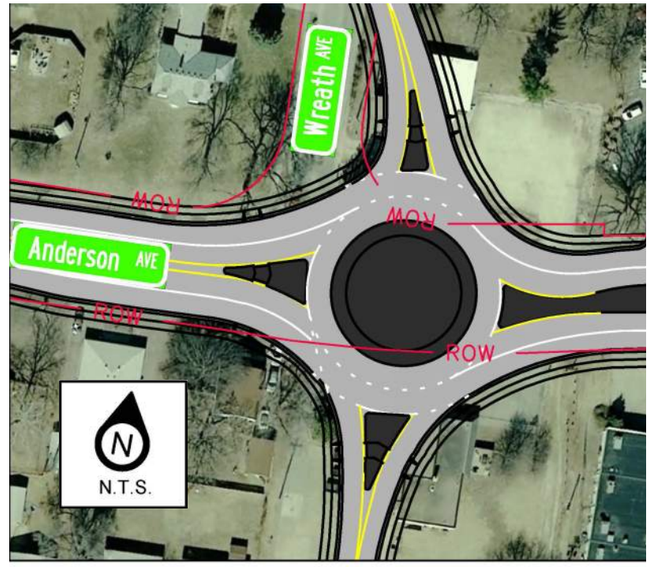


TABLE 7.A | TOTAL ESTIMATED ANDERSON AVENUE CONSTRUCTION COST

3A. Anderson Ave At-Grade Intersection	$8,600,000
3B. Claflin Road	$4,500,000
3C. Anderson Ave (Wreath Ave Signal)	$1,900,000
Total Estimated Construction Cost (Phase 3)	$15,000,000

The total Anderson Avenue at-grade signal alternative, including Claflin Road and the Anderson Avenue Corridor modification from Wreath Avenue to West Loop Shopping Center, is estimated to be approximately $15.0 million (2017 dollars). Table 7.A summarizes the total estimated construction costs.

PHASE 4.

Segment C, K-18 to Anderson Avenue, would be the next Seth Child Road segment to upgrade to a six-lane urban roadway section. Based on the planning level cost estimates, this segment is estimated at $20.2 million dollars. This section incluces approximately 6,000 linear feet of urban roadway and a new bridge over Wildcat Creek. The capacity analyses indicate that northbound approach at Southwind Road should have dual left-turn lanes and an exclusive right-turn lane, as shown in Exhibit 7.J. The Farm Bureau intersection modifications include a southbound left-turn lane and a northbound right-turn lane, as shown in Exhibit 7.K.

The Amherst Avenue intersection was determined to need northbound and southbound left- and right-turn lanes, illustrated in Exhibit 7.L. Additional information is provided on Pages 75-77 for each intersection and the Wildcat Creek Bridge. These projects could be separated into individual projects or combined into one project for all of Segment C. Table 7.B provides a summary of the estimated construction costs.

PHASE 5.

The Marlatt Avenue intersection could be elevated to a higher priority as development continues west of the Seth Child Road Corridor.

EXHIBIT 7.J | SOUTHWIND ROAD INTERSECTION (PHASE 4A)

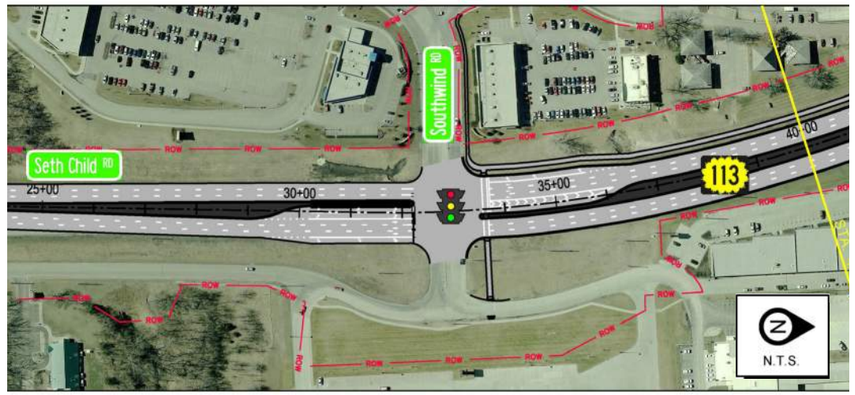


EXHIBIT 7.K | FARM BUREAU ROAD INTERSECTION (PHASE 4B)

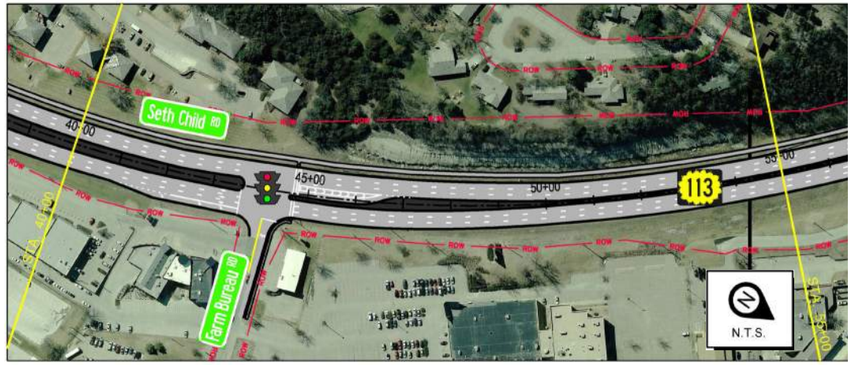


EXHIBIT 7.L | AMHERST AVENUE INTERSECTION (PHASE 4C)

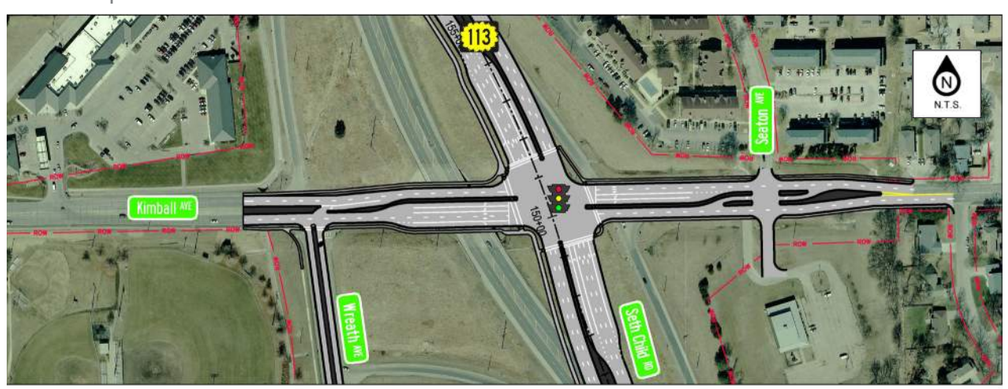
The west leg is anticipated to have the highest growth rate (approximately 14% per year) over the next twenty years. The preferred alternative is an at-grade multi-lane roundabout. An at-grade roundabout at this location provides a transition to the new urban roadway section, plus it ties into the proposed roundabout at US-24. The appropriate location for the at-grade roundabout should be evaluated further during project design as the existing east and west legs of Marlatt do not align well in addition to the fact that development has encroached along the east side of Seth Child Road. Further, the topography provides an additional challenge to this intersection. Construction costs of $4.5 million (2017 dollars) are estimated assuming the location remains at the current Marlatt intersection. The at-grade roundabout alternative is displayed in Exhibit 7.M. Page 86 provides additional information regarding intersection modifications.

EXHIBIT 7.M | MARLATT AVENUE INTERSECTION (PHASE 5)

PHASE 6.

A roundabout interchange is the alternative suggested for the Kimball Avenue interchange. However, the at-grade signalized intersection received a very similar overall rating. The at-grade intersection provides a better opportunity to incorporate other modes of travel with a north/south bike and hike trail while also helping to maintain consistency within the Seth Child Road Corridor. Exhibit 7.N illustrates the at-grade intersection concept. Construction costs are estimated to be approximately $8.0 million (2017 dollar). Additional information regarding the Kimball Avenue interchange is provided on Page 84.

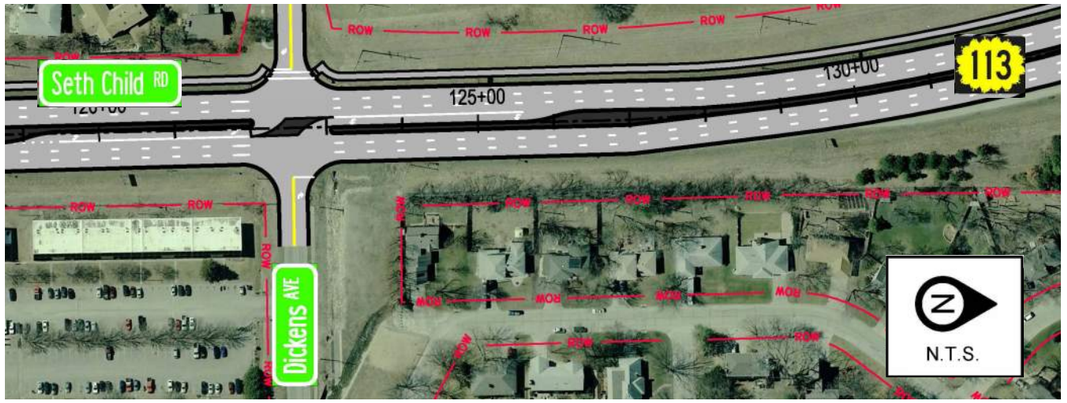
EXHIBIT 7.N | KIMBALL AVENUE INTERSECTION (PHASE 6)



PHASE 7.

The segment from Claflin Road to Kimball Avenue should be upgraded to an urban roadway section. Dickens Avenue intersection is located within this segment of the Corridor. Dickens Avenue provides access to Manhattan Area Technical College. Page 83 provides additional information regarding the Dickens Avenue intersection. The current recommendation is to modify the intersection into a 3/4 access intersection which would eliminate the side street left-turn movement onto Seth Child Road. Final determination of intersection geometrics should be evaluated during the project design phase. Estimated construction costs are estimated to be $3.3 million in 2017 dollars.

EXHIBIT 7.O | DICKENS AVENUE INTERSECTION (PHASE 7)

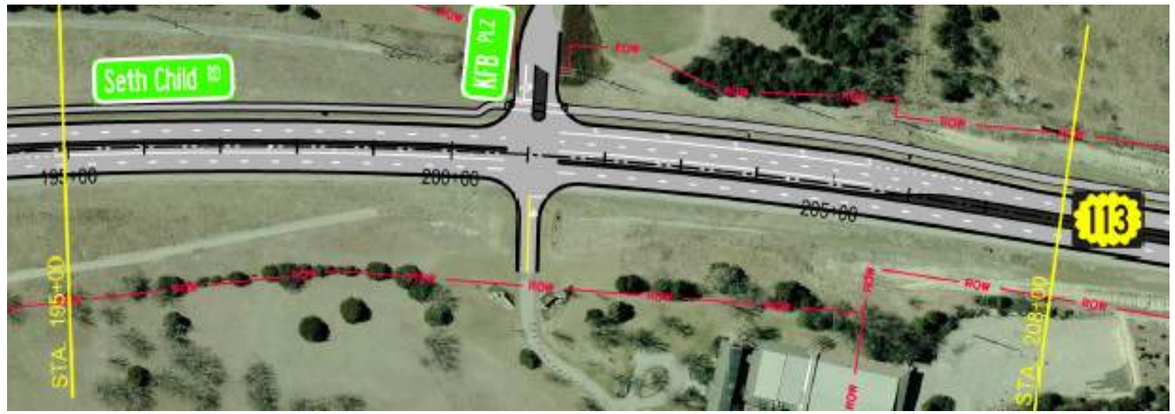


PHASE 8.

The segment from Kimball Avenue to Marlatt Avenue should be upgraded to the urban roadway section. The northbound three thru lanes would end at the intersection of Gary Avenue. The three southbound thru lanes would begin prior to Kimball Avenue. Two unsignalized intersections are located within this segment of the Corridor – Gary Avenue and KFB Plaza /Leadership Lane. Page 85 provides additional information regarding this segment of the Corridor. The current recommendation is to modify Gary Avenue into a 3/4 access intersection which would eliminate the side street left-turn movement onto Seth Child Road. The KFB Plaza/Leadership Lane intersection would remain a full-access unsignalized intersection. Final determination of the final geometrics should be evaluated during the project design phase. Estimated construction costs are estimated to be $7.8 million in 2017 dollars.

EXHIBIT 7. P | GARY AVENUE INTERSECTION (PHASE 8)

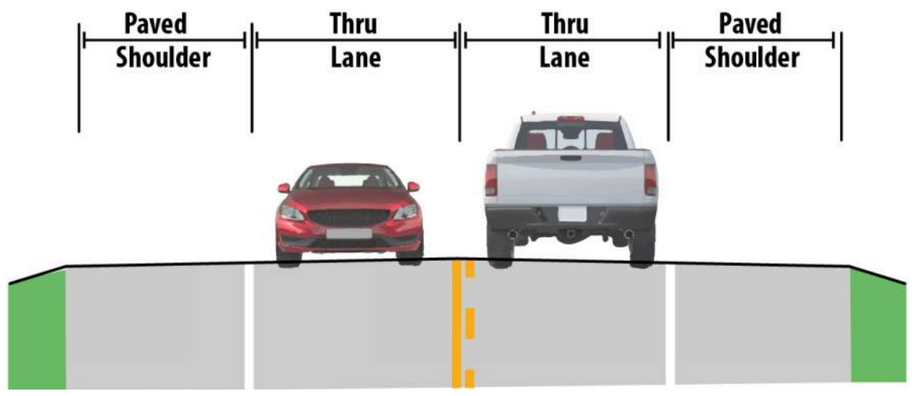
EXHIBIT 7.Q | KFB PLAZA / LEADERSHIP LANE INTERSECTION (PHASE 8)



PHASE 9.

The remaining section of the Seth Child Road Corridor is located north of Marlatt Avenue to US-24. This section of Seth Child Road would remain as a two-lane rural roadway section, as shown in Exhibit 7.R. Access control should still be managed by City of Manhattan and KDOT Access Management Policies. Any alterations to the access within this segment of Seth Child Road should be approved by the Riley County and KDOT prior to implementing. Estimated construction costs were calculated to be approximately $2.7 million (2017 dollars). This alternative assumes reconstruction to a rural section with asphalt shoulders. Pages 87 and 88 provide additional information regarding this corridor segment.

EXHIBIT 7.R | PROPOSED TWO-LANE RURAL SECTION (PHASE 9)



7 | SUMMARY & IMPLEMENTATION

Overall performance benefits for the Corridor are addressed by additional recommendations. At this time, access to the Corridor is well maintained with driveway access significantly limited. This is due to it being a state highway in addition to its construction and development. For continued efficiency, it is recommended that KDOT and City of Manhattan Corridor Management Policies be maintained, encouraging access to adjacent land from existing side roads to prohibit future driveway construction.

Because the major intersections within the Corridor are planned to be signalized, it is recommended that signals be interconnected. In addition, cameras and intelligent transportation system elements should also be incorporated to help local traffic managers adapt to significant changes in traffic patterns, such as those seen at the conclusion of Kansas State University sporting events. Proposed medians, roundabouts and multi-use facilities provide opportunities for aesthetic enhancements to the Corridor. Lighting is one such enhancement which would add to the aesthetics and contribute to driver comfort and safety. These items, along with maintaining adjacent business viability, contribute to the desired sense of place and economic development identified by stakeholders. Estimated construction costs for the development of the entire Corridor Management Plan is estimated to be about $64.9 million in 2017 dollars.

TABLE 7.B -SETH CHILD ROAD IMPLEMENTATION PLAN

Implementation Priority	Location	Segment	Corridor Recommendation	Cost
1	US-24 and Seth Child Road (K-113)	Segment A	Single Lane Roundabout	$1.9 Million
2	US-24 and K-13	Segment A	Single Lane Roundabout	$1.5 Million
3A	Anderson Ave & Seth Child Rd (K-113)	Segment B	At-Grade Signalized Intersection	$8.6 Million
3B	Claflin Rd and Seth Child Rd (K-113)	Segment B	Incorporate with Seth Child and Anderson Improvements. Maintain Traffic Signal	$4.5 Million
3C	Anderson Ave (Wreath to Seth Child Rd)	Segment B	Access Management, Maintain Signal and EB/WB Left-turn Lanes at Wreath	$1.9 Million
4A	Southwind Rd and Seth Child Rd (K-113)	Segment C	Maintain At-Grade Traffic Signal, Add NB Dual Left-turn Lanes, Six-Lane Urban Roadway Section	$4.8 Million
4B	Farm Bureau Rd and Seth Child Rd (K-113)	Segment C	Maintain At-Grade Traffic Signal, Six-Lane Urban Roadway Section	$3.5 Million
4C	Amherst Ave and Seth Child Rd (K-113)	Segment C	Maintain At-Grade Traffic Signal, Six-Lane Urban Roadway Section	$5.9 Million
4D	Wild Cat Creek Bridge on Seth Child Rd (K-113)	Segment C	Wildcat Creek Bridge for Six-Lane Urban Roadway Section	$6.0 Million
5	Marlatt Ave and Seth Child Rd (K-113)	Segment B	At Grade Roundabout	$4.5 Million
6	Kimball Ave and Seth Child Rd (K-113)	Segment B	At Grade Signal	$8.0 Million
7	Seth Child Rd (K-113) Claflin to Kimball	Segment B	At Grade Intersections with Six-Lane Urban Roadway Section, Gary Ave & Leadership Lane	$3.3 Million
8	Seth Child Rd (K-113) Kimball to Marlatt	Segment B	At Grade Intersections with Right In/Right Out or 3/4 Access at Gary Ave. and Leadership Lane	$7.8 Million
9	Seth Child Rd (K-113) Marlatt to US-24	Segment A	Two-Lane Rural Section, Turn Lanes As Warranted	$2.7 Million
Total Corridor Improvement Cost (2017 Dollars)				$64.9 Million

INTERSECTION MODIFICATIONS

Issues Identified

a. 2040 No Build traffic operation
- Overall intersection LOS D
- Eastbound and westbound left-turn movements LOS E
- Eastbound right-turn movements LOS F
- Northbound weave between K-18 and Southwind is a concern during peak commuter periods

b. Crash rate
- Existing crash rate - 69.0 crashes per 100 MEV
- Statewide average - 100 crashes per 100 MEV
- No Build expected 20-year crash rate - 166.8 Crashes

Recommended Improvement

a. Urban roadway section with raised median

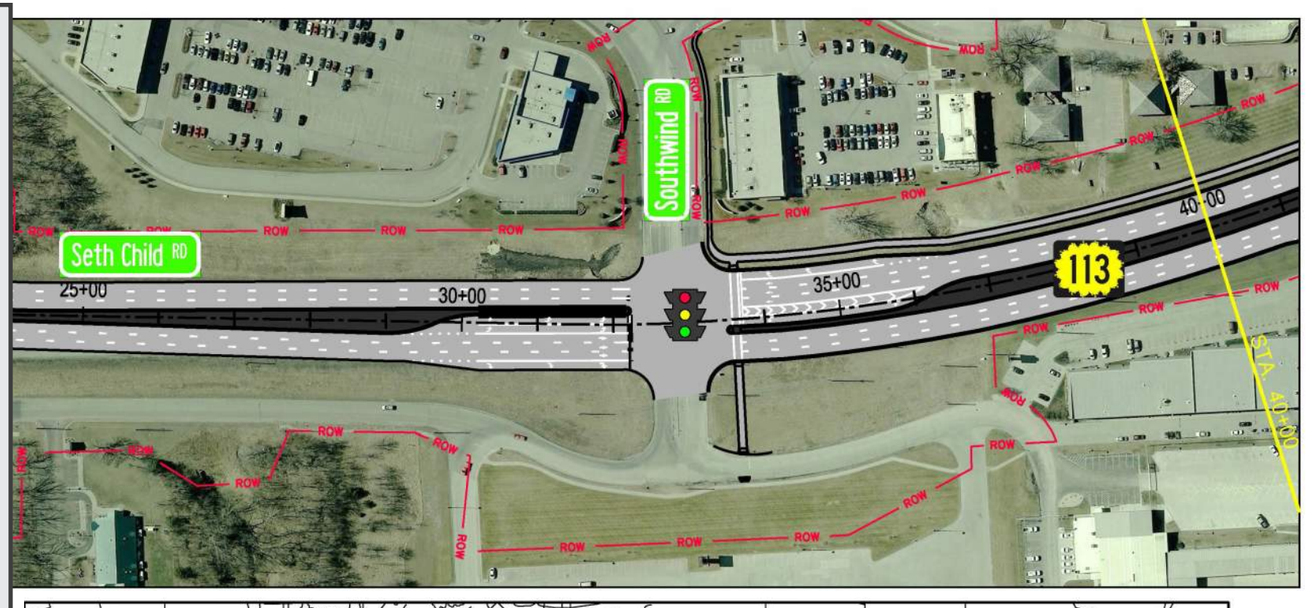
b. Proposed intersection geometrics
- Northbound approach:
  Two left-turn lanes, three thru lanes, one right-turn lane
- Southbound Approach:
  One left-turn lane, three thru lanes, one right-turn lane
- Eastbound Approach:
  Two left-turn lanes, one thru lane, one right-turn lane
- Westbound Approach:
  One left-turn lane, one thru lane,
  One thru/right-turn lane

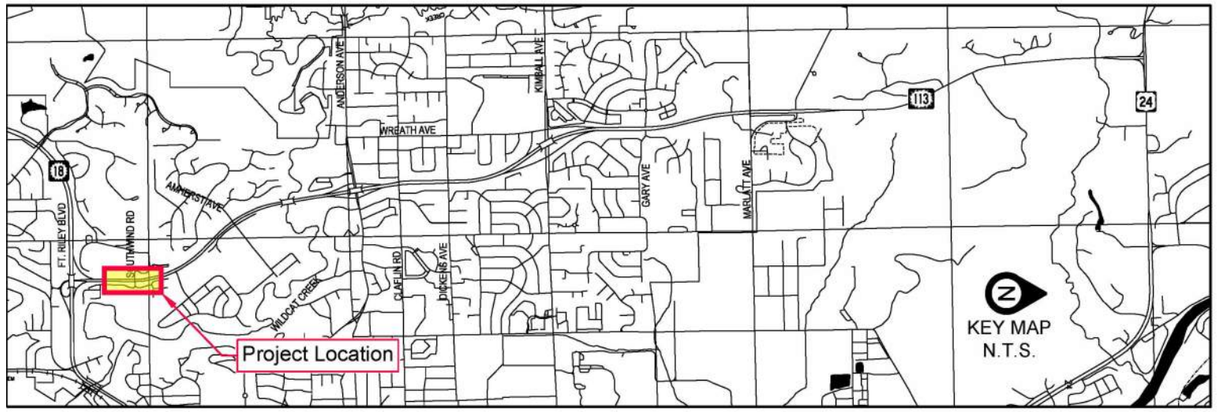
c. Provide protected northbound / southbound left-turn signal phasing

d. Evaluate activated 'Be Prepared to Stop' signs to notify drivers of upcoming red signal

e. Expected 20-year crash rate
- Preferred Alternative - 150.4 crashes
- 16.3% crash reduction

Estimated Construction Cost (2017 Dollars) - $4.8 Million





BENEFITS

1. Improve 2040 traffic operation
   - Overall intersection LOS C
   - Individual turning movements LOS D or better
2. Improve north/south thru lane capacity
3. Provides opportunity for north/south pedestrian connectivity
4. Opportunity for improved aesthetics along roadway

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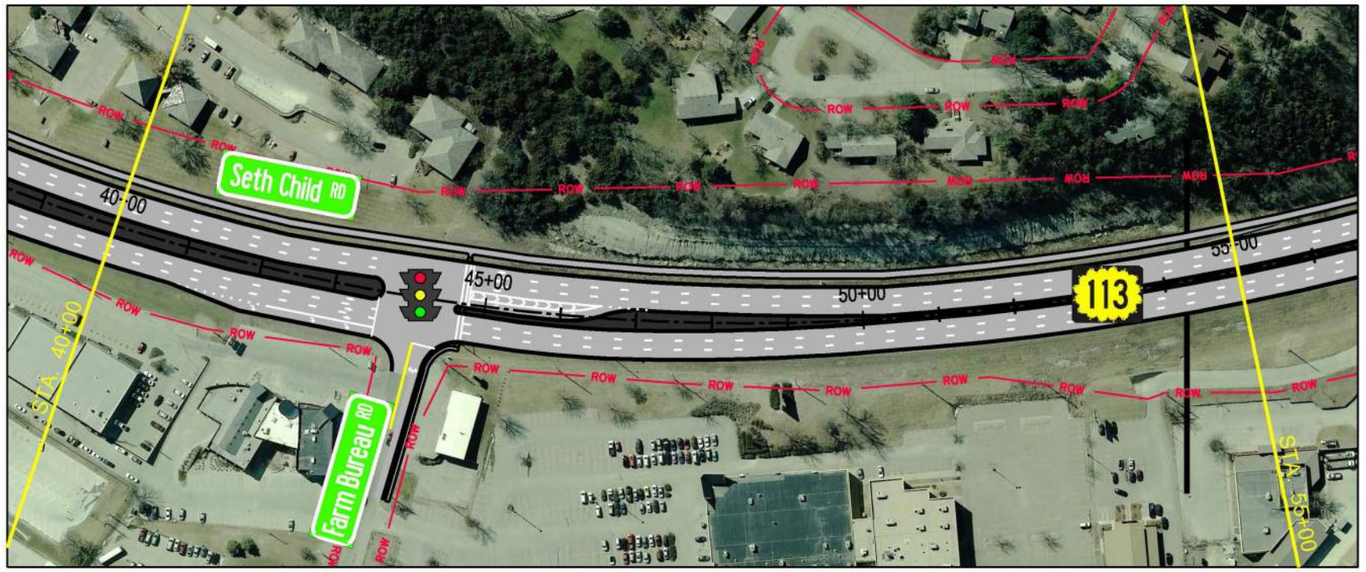
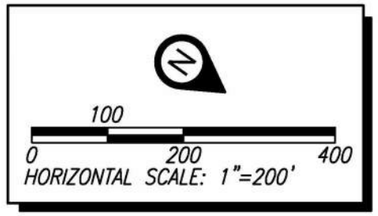
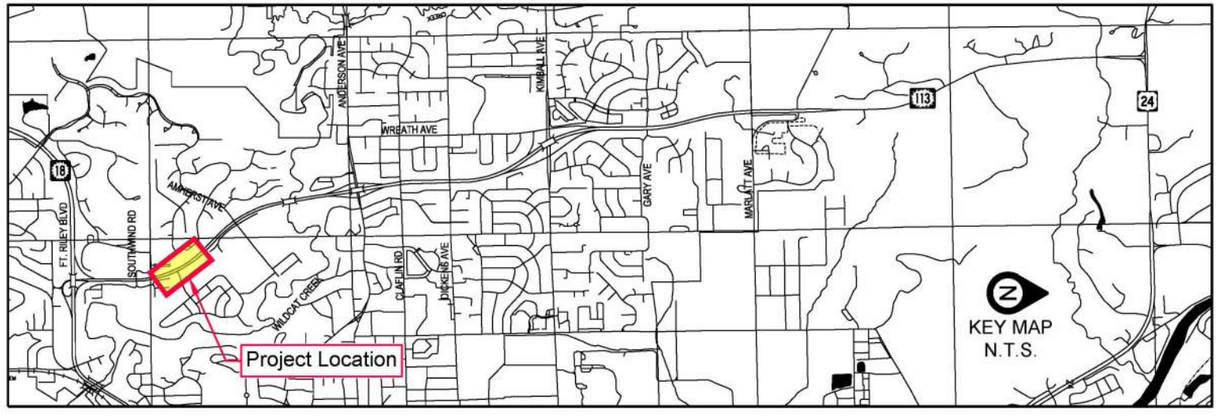
Phase 4A | Southwind Road Intersection

7 | SUMMARY & IMPLEMENTATION







INTERSECTION MODIFICATIONS

Issues Identified

a. Crash rate
- Existing crash rate 33.3 crashes per 100 MEV
- Statewide average - 100 crashes per 100 MEV
- No Build expected 20-year crash rate - 67.3 crashes

b. Five driveways located with 230 feet from Seth Child Road Corridor

Recommended Improvement

a. Urban roadway section with raised median

b. Proposed intersection geometrics
- Northbound Approach: three thru lanes, one right-turn lane
- Southbound Approach: one left-turn lane, three thru lanes
- Westbound Approach: one shared left / thru / right-turn lane

c. Provide protected southbound left-turn signal phasing

d. Evaluate access management along Farm Bureau Road (Minor collector 1 per 330 feet)

e. Expected 20-year crash rate
- Preferred alternative 60.7 crashes
- 6.6% crash reduction

Estimated Construction Cost (2017) - $3.5 Million

BENEFIT

1. 2040 traffic operation
   - Overall intersection LOS A
   - Individual turning movements LOS D or better
2. Improve north / south thru lane capacity
3. Provides opportunity for north / south pedestrian connectivity
4. Opportunity for improved aesthetics along roadway

LIMITATIONS

1. Potential retaining wall needed along west side of corridor to accommodate multi-use path

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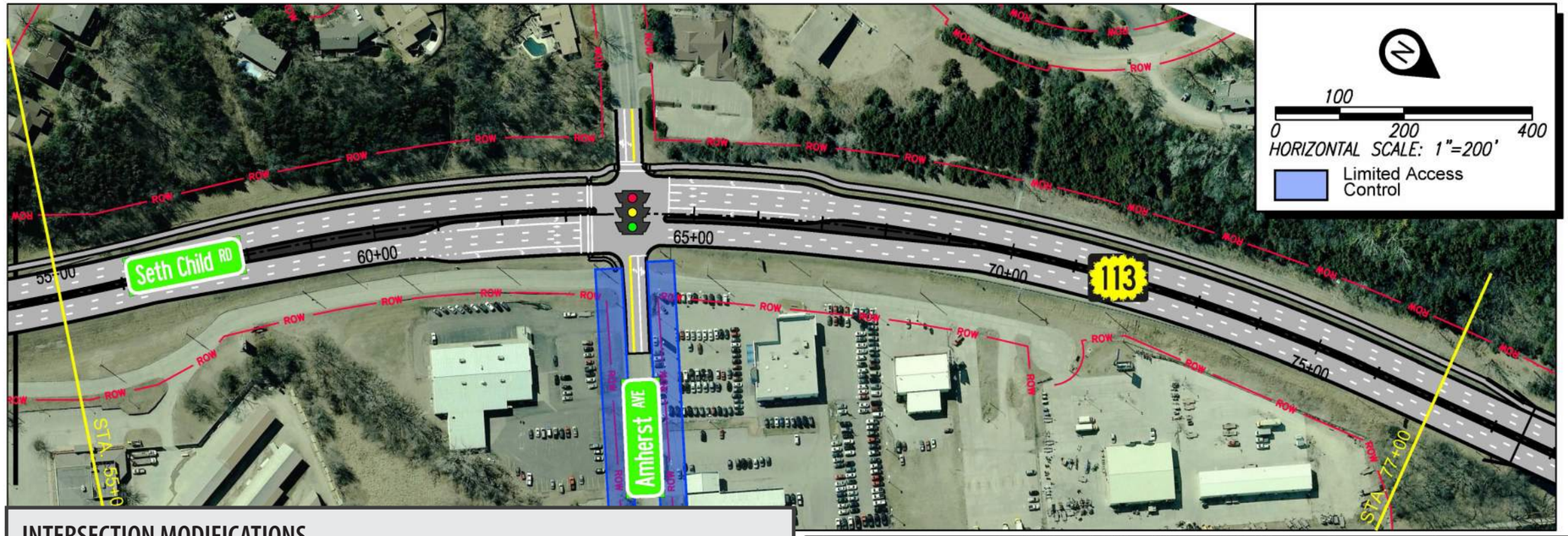

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INTERSECTION MODIFICATIONS

Issues Identified

a. 2040 No Build traffic operation
- Overall intersection LOS C

b. Crash rate
- Existing crash rate - 72.9 crashes
- Statewide average - 100 crashes per 100 MEV
- No Build expected 20-year crash rate - 153.8 crashes

c. Nine driveways located within 480 feet from Seth Child Road Corridor (east)

Recommended Improvement

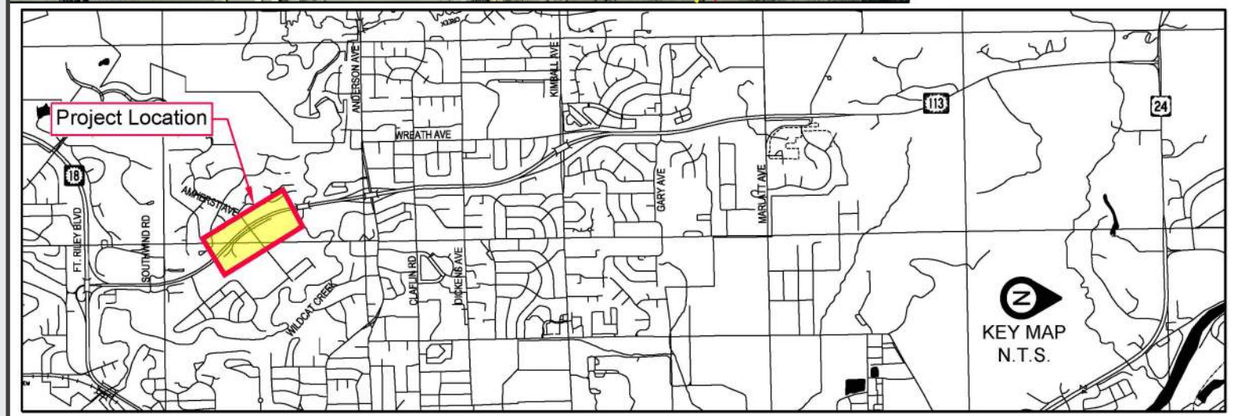
a. Urban roadway section with raised median

b. Proposed intersection geometrics
- Northbound Approach: one left-turn lane, three thru lanes, one right-turn lane
- Southbound Approach: one left-turn lane, three thru lanes, one right-turn lane
- Eastbound Approach: one left-turn lane, one shared thru / right-turn lane
- Westbound Approach: one left-turn lane, one shared thru / right-turn lane

c. Evaluate access management on Amherst Avenue

d. Expected 20-year crash rate
- Preferred alternative - 138.7 crashes
- 15.1% crash reduction

Estimated Construction Cost (2017 Dollars) - $5.9 Million



BENEFIT

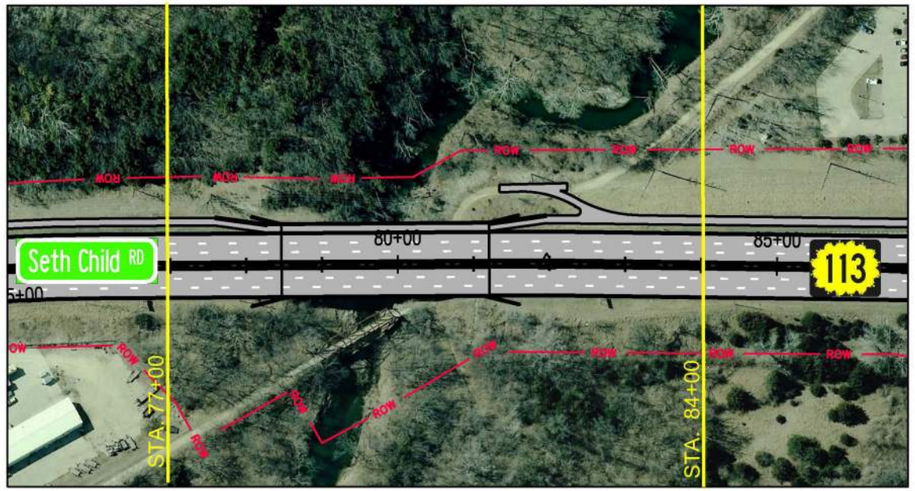
1. Improve 2040 traffic operation
   - Overall intersection LOS C
   - Individual turning movements LOS E or better
2. Improve north / south thru lane capacity
3. Provides opportunity for north / south pedestrian connectivity
4. Opportunity for improved aesthetics along roadway

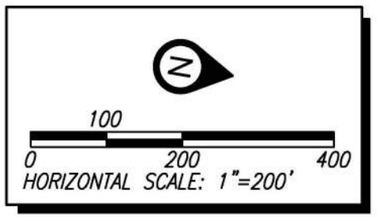
LIMITATIONS

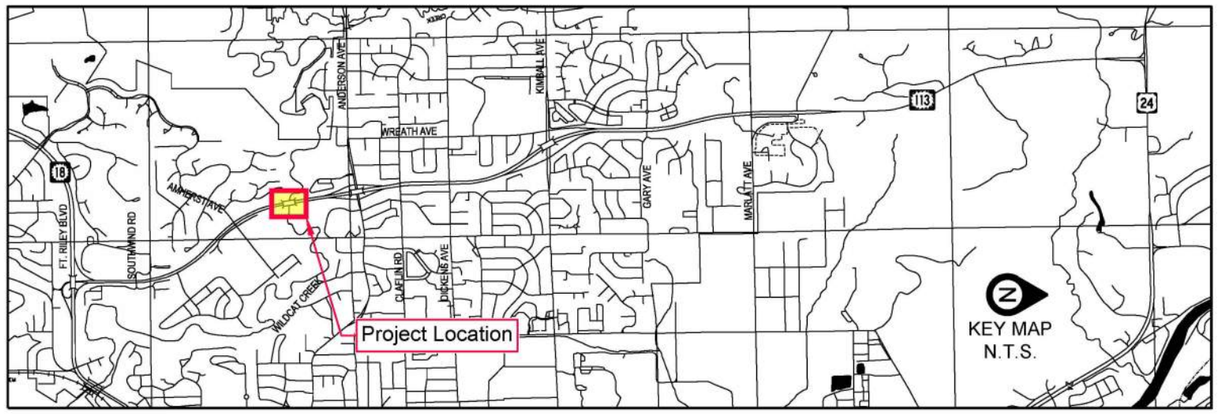
1. Frontage Road located 30 feet from existing Seth Child Road shoulder

Phase 4C | Amherst Avenue Intersection

7 | SUMMARY & IMPLEMENTATION







INTERSECTION MODIFICATIONS

Issues Identified

a. No pedestrian facilities

Recommended Improvement

a. Urban roadway section with raised median and third north/south thru lane
b. Provide raised median across bridge for urban roadway section
c. Accommodate pedestrian facilities across bridge

Estimated Construction Cost (2017 Dollar) - $6.0 Million

BENEFIT

1. Provide opportunity for north / south pedestrian connectivity
2. Opportunity for improved aesthetics along roadway
3. Urban roadway section with raised median and connectivity to Linear Trail
4. Improve north / south lane capacity

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INTERSECTION MODIFICATIONS

Issues Identified

a. Traffic congestion PM peak hour
- Existing traffic operation (PM peak hour)
  - Overall intersection LOS F (northbound ramp)
  - Several individual turn movements LOS F
  - Westbound left-turn vehicle queue 900 feet+
- 2040 No Build traffic operation
  - Overall intersection LOS E (Southbound ramp)(AM peak hour)
  - Overall intersection LOS F (Northbound ramp) (PM peak hour)

b. Crash rate
- Southbound ramp - 48.8 crashes per 100 MEV
- Northbound ramp - 58.1 crashes per 100 MEV
- Statewide average -100 crashes per 100 MEV
- No Build expected 20-year crash rate - 302.0 total crashes for interchange

c. Driveways located within 150 feet of interchange ramps

b. Northbound and southbound Seth Child Road interchange ramps located within 335 feet of Claflin Road intersection

e. Seth Child Road ramp terminals separated by only 390 feet

f. Westbound left-turn lane storage only 100 feet.
- Observed existing vehicle queue - 34 vehicles

g. Eastbound left-turn lane storage only 100 feet

Recommended Improvement

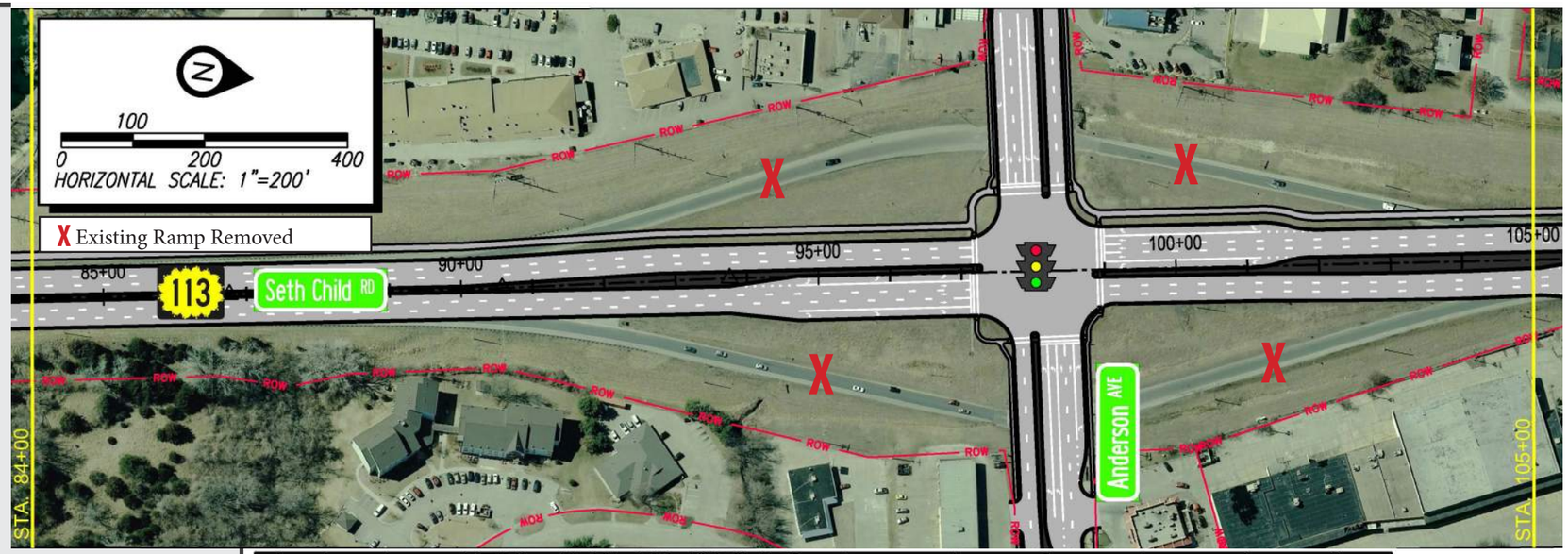
a. Urban roadway section with raised median

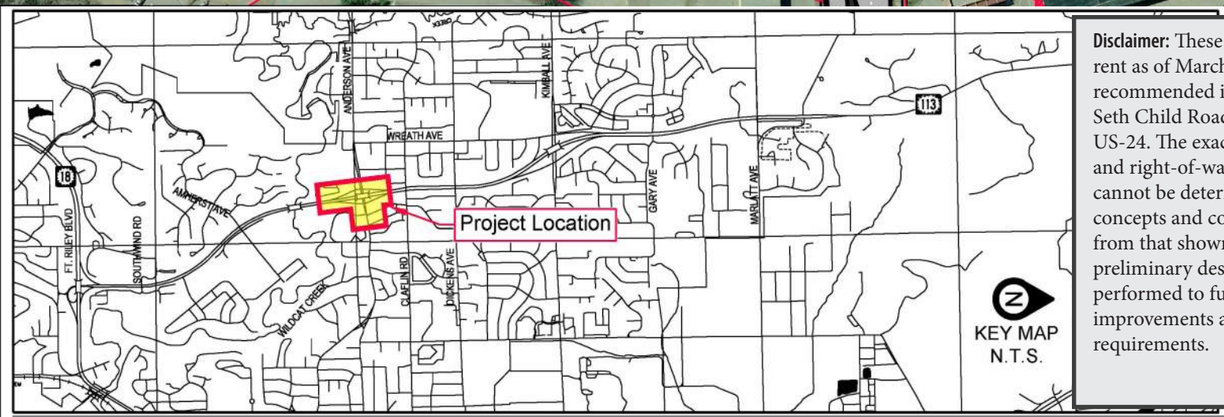
b. Construct at-grade signalized intersection

c. Proposed intersection geometrics
- Northbound Approach: One left-turn lane, three thru lanes, one right-turn lane
- Southbound Approach: One left-turn lane, three thru lanes, one right-turn lane
- Eastbound Approach: Two left-turn lanes, two thru lanes, one right-turn lane
- Westbound Approach: Two left-turn lanes, two thru lanes, one right-turn lane

d. Preferred alternative expected 20-year crash rate
- Intersection 113.6 total crashes
- 62.4% crash reduction

Estimated Construction Cost (2017) $8.6 Million (At-Grade Intersection Only)





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BENEFITS

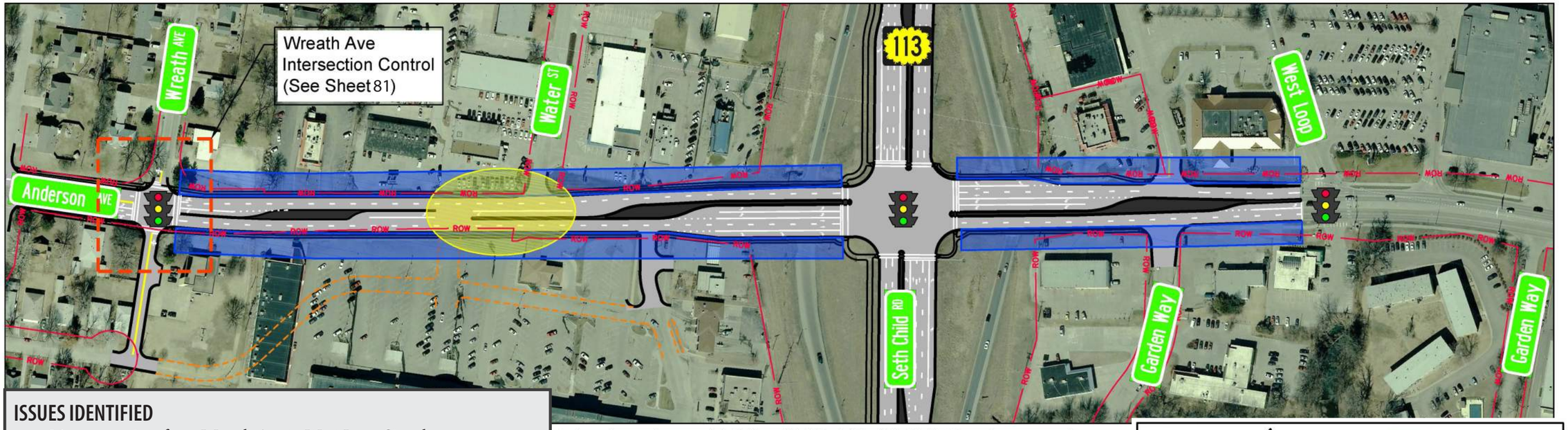
1. Improve 2040 traffic operation
   - Overall intersection LOS D
   - Individual turning movements LOS D or better
2. Allows Claflin Road intersection to remain open
3. Consistent intersection traffic control along the Corridor (at-grade signals)
4. Provides opportunity for north / south pedestrian connectivity
5. Opportunity for improved aesthetics along roadway
6. Increases driveway distance from Seth Child Road stop bar locations
7. Opportunity for access management

LIMITATIONS

1. Removing existing interchange
2. Significant traffic control and construction sequencing
3. Removing free flow north / south Seth Child Road traffic

Phase 3A | Anderson Avenue Intersection

7 | SUMMARY & IMPLEMENTATION



ISSUES IDENTIFIED

a. 26 access points from Wreath Ave to West Loop Signal
b. Vehicle queues blocking driveways
c. Identified within MATS for access control
d. No Build expected 20-year crash rate - 256.6 crashes (Corridor)

Existing Access Points (Anderson Ave West) - (1,400 Feet)

- North Side: Nine driveways/streets
- South Side: Nine driveways

Existing Access Points (Anderson Ave East) - (800 Feet)

- North Side: Three driveways/streets
- South Side: Five driveways/streets

RECOMMENDED IMPROVEMENTS

Anderson Ave (West)

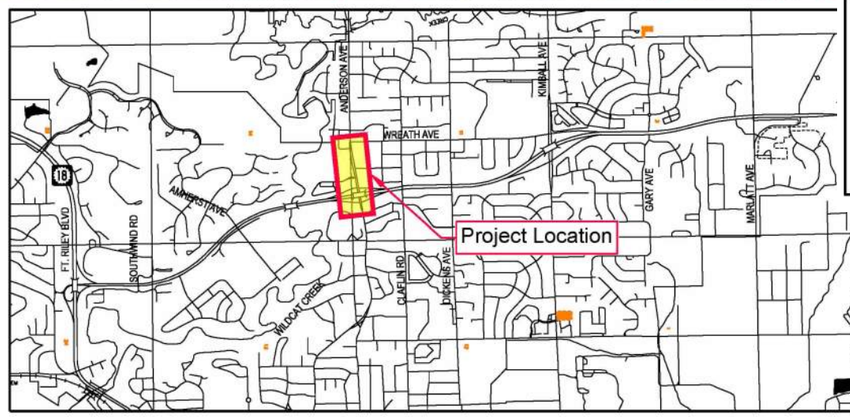
a. Reduce the number of full-access intersections to one
b. Limited access (440-foot spacing)
c. Follow MATS Appendix A for access management

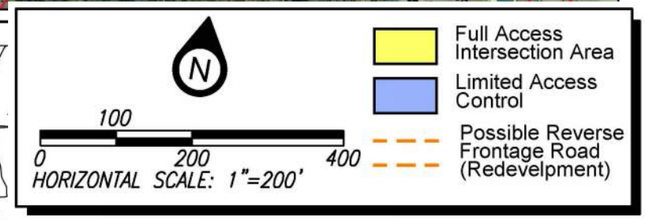
Anderson Ave (East)

a. Full access intersection (West Loop Traffic Signal)
b. Utilize Garden Way loop for access to Anderson Ave (South Side)
c. Utilize internal roadways to access West Loop Signal (North side)

See Sheet 68 for Estimated Construction Costs

Per Manhattan Access Management Guidelines, Table A-1





BENEFITS

1. Conflict points reduced along corridor
2. Preferred alternative expected 20-year crash rate
   - Intersection 151.6 total crashes
   - 40.9% crash reduction
3. Improve Anderson Ave traffic flow

LIMITATIONS

1. Direct access is reduced
2. Some indirect travel

ACCESS MANAGEMENT TOOLS

1. Raised median
   a. Right-in/Right-out access
   b. ¾ access
2. Consolidate driveways
3. Remove driveways
4. Cross access agreements
5. Reverse frontage roads

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WREATH AVENUE TRAFFIC CONTROL

Issues Identified

a. No eastbound/westbound left-turn lanes
b. Crash rate
   - 50.6 crashes per 100 MEV
   - No Build expected 20-year crash rate -38.9 total crashes (intersection)

TRAFFIC SIGNAL CONCEPT

a. Add eastbound/westbound left-turn lanes
b. Upgrade traffic signal
c. Interconnect traffic signal with Seth Child Road
d. Future south leg (Redevelopment opportunity)
e. Traffic signal expected 20-year crash rate
   - Intersection 32.3 "severe" crashes
   - 17.0% crash reduction

Benefits

1. Consistent traffic control with Seth Child signal
2. Improved eastbound/westbound operation

Limitations

1. Right-angle crash potential

ROUNDABOUT CONCEPT

a. Construct multi-lane roundabout
b. Future southern leg (Redevelopment opportunity)
c. Roundabout expected 20-year crash rate
   - Intersection 0.0 "severe" crashes
   - 100.0% crash reduction

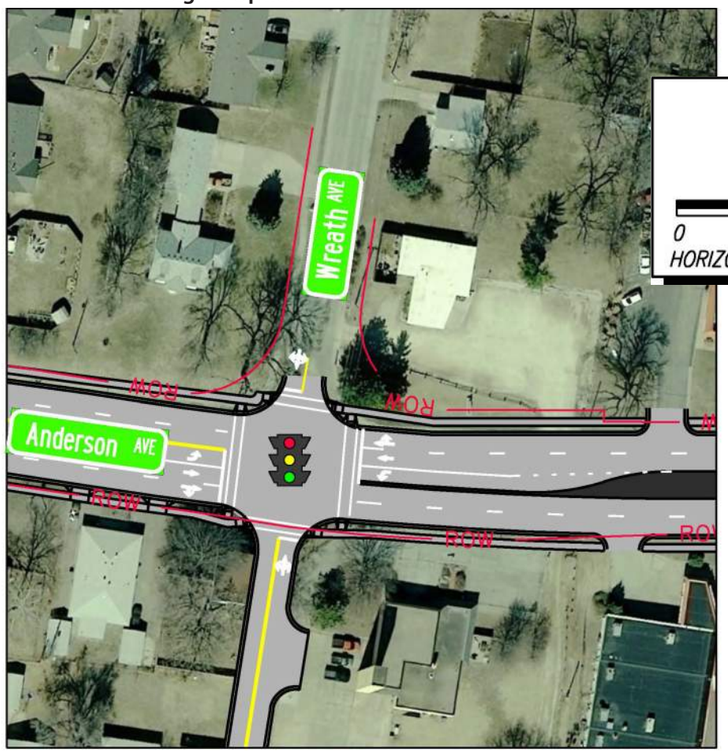
Benefits

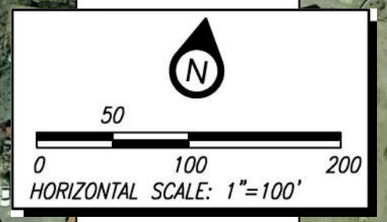
1. Reduction of conflict points
2. "Severe" crash reduction
3. Accommodates Anderson Ave U-turns

Limitations

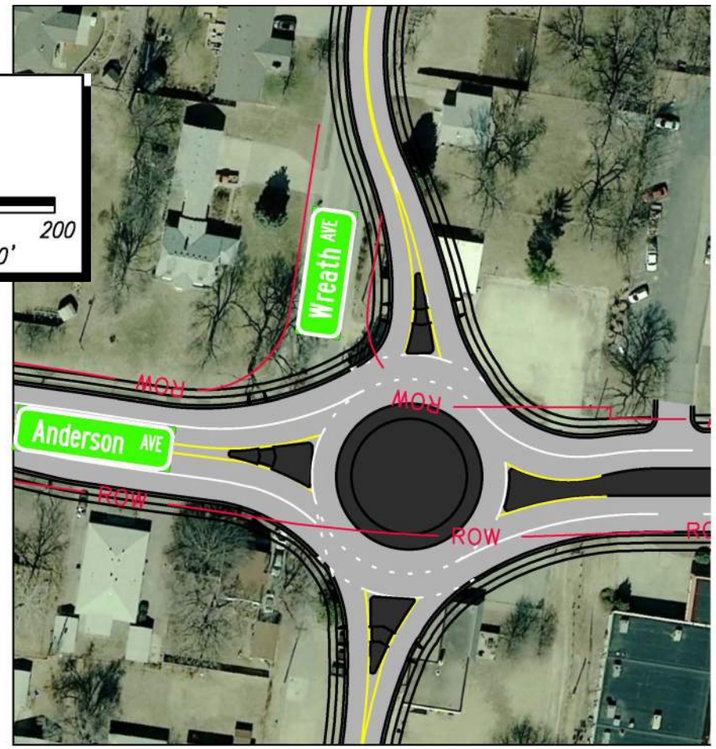
1. Right-of-Way Impact
2. Public Perception

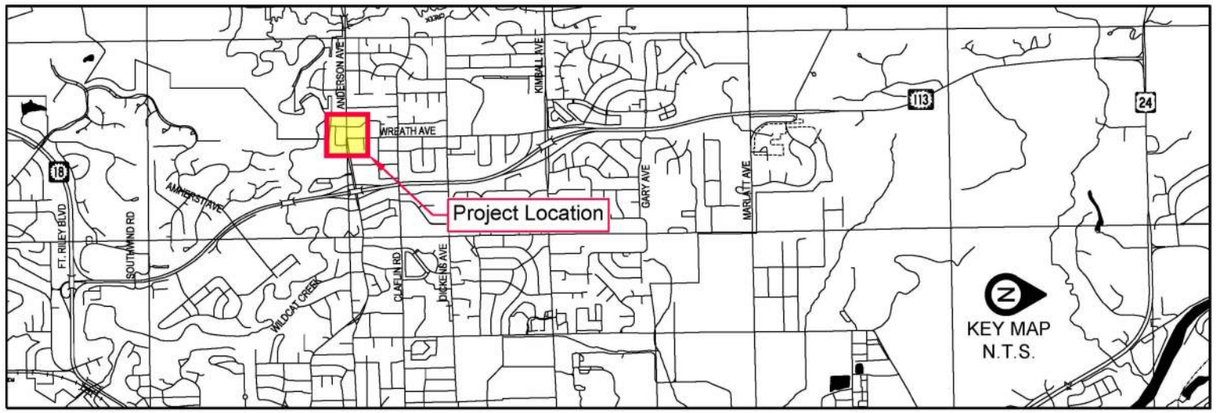
Wreath Avenue Signal Option





Wreath Avenue Roundabout Option





ESTIMATE CONSTRUCTION COST

Anderson Ave with Signal = $1.9 Million
Anderson Ave with Roundabout = $2.3 Million

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Phase 3C | Wreath Avenue Intersection

7 | SUMMARY & IMPLEMENTATION

INTERSECTION MODIFICATION

Issues Identified

a. Traffic Operation
- Existing traffic operation (PM peak hour)
  - Overall intersection LOS D
  - Eastbound left-turn movement LOS E
  - Westbound left-turn vehicle queue 300 feet
- 2040 No Build Traffic Operation
  - Overall intersection LOS D (AM and PM peak hour)
  - Westbound left-turn movement LOS F (AM peak hour)

b. Crash Rate
- 55.4 crashes per 100 MEV
- Statewide average - 100 crashes per 100 MEV
- No Build expected 20-year crash rate - 146.6 crashes

c. Existing Access Points (Claflin Road East)
- Two access points located between Seth Child Road and Beechwood Terrace (315 feet of available storage)

d. Existing Access Points (Clafin Road West)
- Six access points located between Seth Child Road and Waters Street (460 feet of available storage)

e. Proximity to Anderson Avenue Interchange, Seth Child Road access would need to be removed
- Claflin Road stop bar located 335 feet north of Anderson Avenue Ramp Gore Point
- Nearest Signal per KDOT Access Management 2,640 ft.

Recommended Improvement

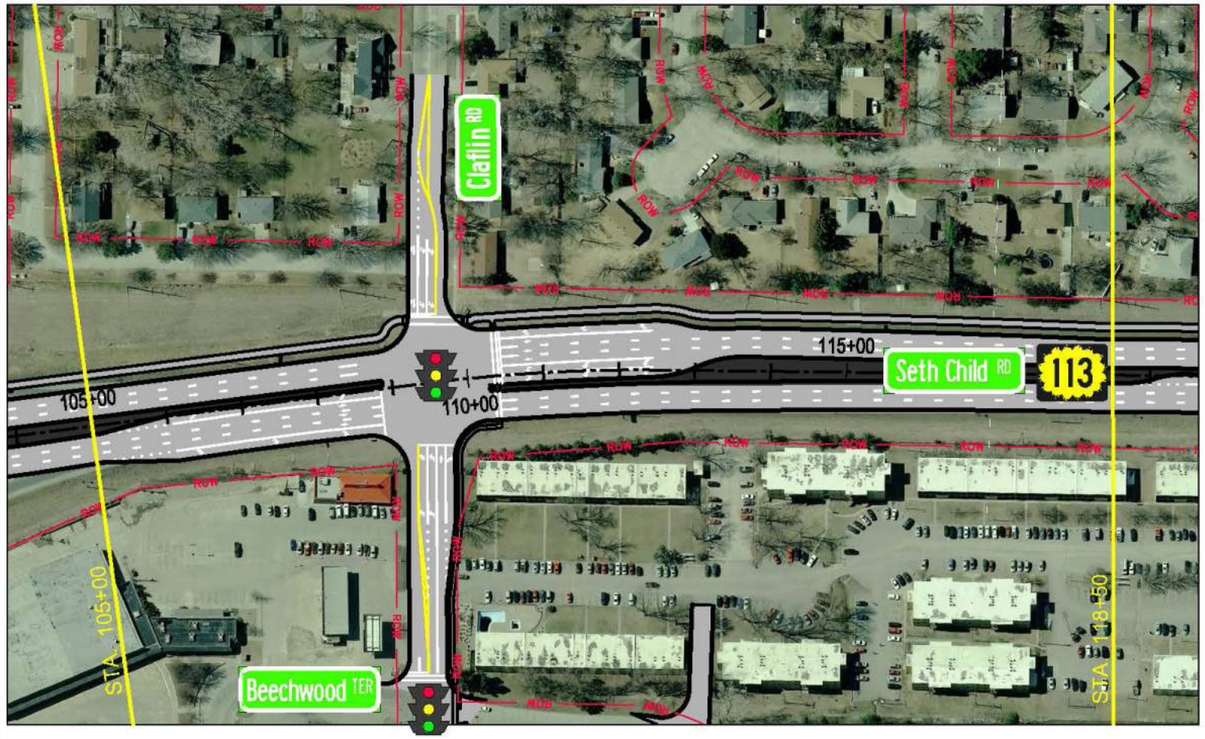
a. Urban roadway section with raised median

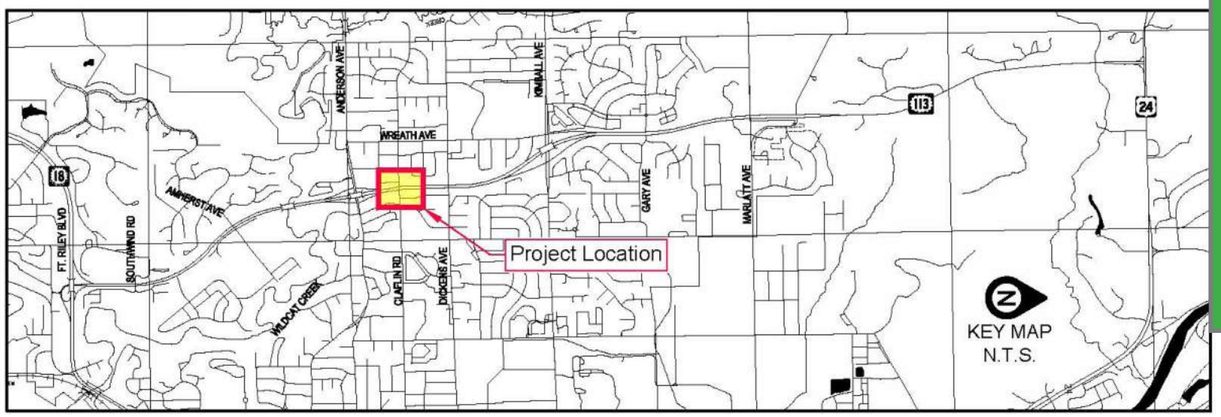
b. Proposed intersection geometrics
- Northbound Approach: One left-turn lane, three thru lanes, one right-turn lane
- Southbound Approach: Two left-turn lanes, three thru lanes, one right-turn lane
- Eastbound Approach: Two left-turn lanes, one shared thru/right-turn lane
- Westbound Approach: Two left-turn lanes, one thru lane, one right-turn lane

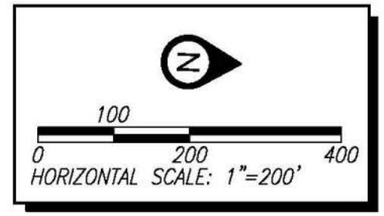
c. Manage access points between Seth Child Road and Beechwood Terrace

d. Preferred alternative expected 20-year crash rate
- Intersection 142.9 total crashes
- 2.5% crash reduction

Estimated Construction Cost (2017 Dollars) $4.5 Million







BENEFITS

1. Maintain signalized full access to Seth Child Road
2. Improve intersection spacing (Corridor)
   - Existing 335 feet
   - Proposed 1,000 feet (stop bar to stop bar)
3. Consistent intersection traffic control along the Corridor (urban roadway section)
4. Improve north / south lane capacity
5. Driver expectancy improved
6. Provides opportunity for north/south pedestrian connectivity
7. Opportunity for improve aesthetics along roadway
8. Opportunity for access management along Claflin Road

LIMITATIONS

1. Impact to existing Access Points on Claflin Road
2. Claflin Road ROW

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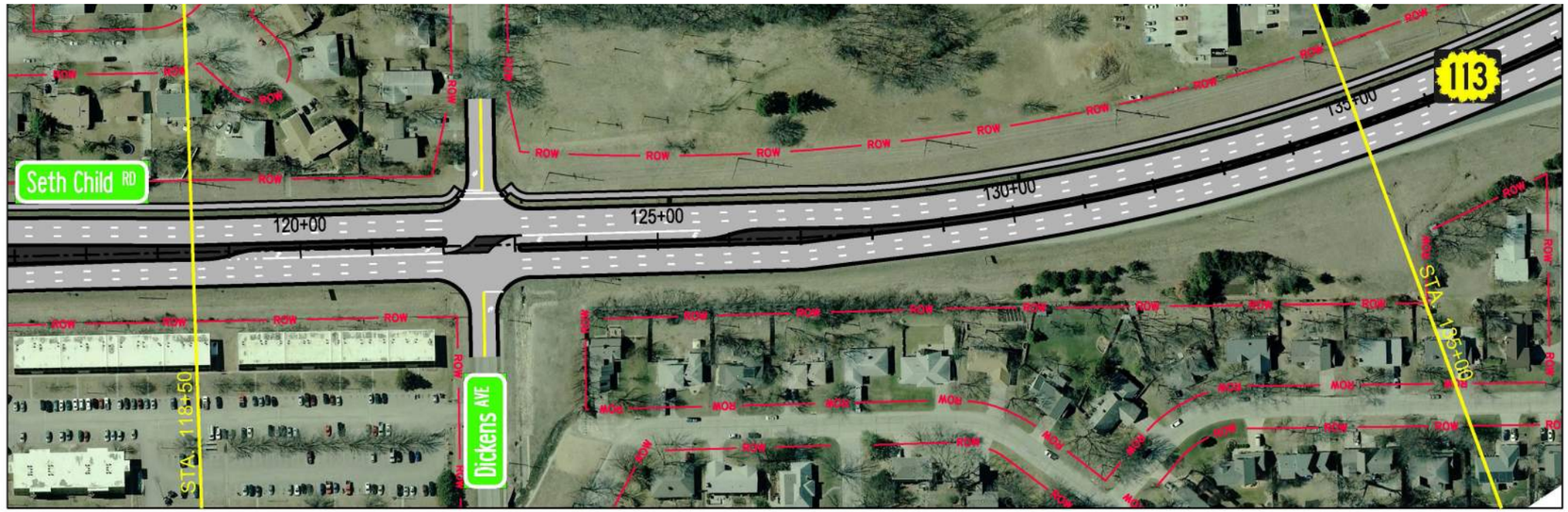

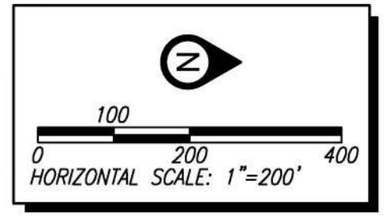

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INTERSECTION MODIFICATIONS

Issues Identified

a. Unsignalized intersection between Anderson Avenue and Kimball Avenue interchanges

b. 2040 No Build traffic operation
- Unsignalized intersection
- Eastbound and westbound approaches LOS F

c. Crash Rate
- Dickens Ave - 13.0 crashes per 100 MEV
- Statewide Average - 100 crashes per 100 MEV
- No build expected 20-year crash rate (Claflin to Kimball) - 45.9 crashes

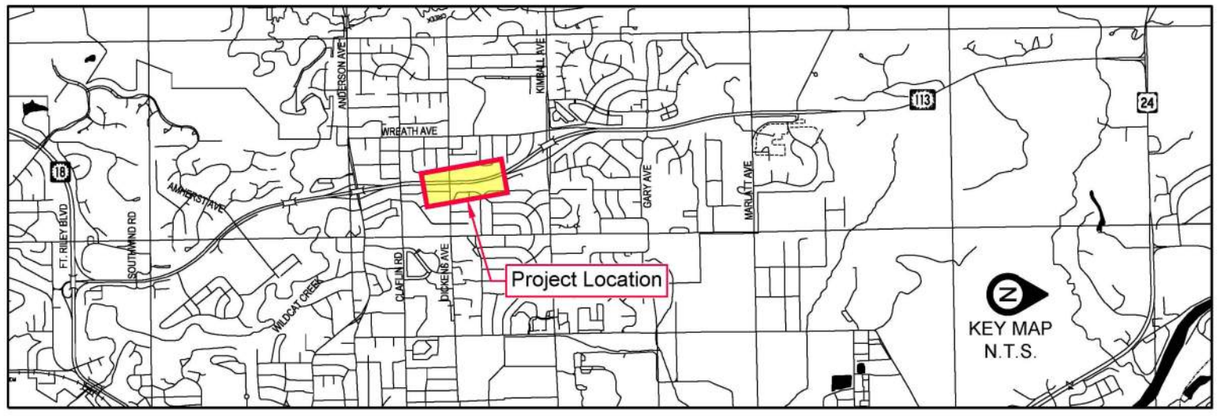
Recommended Improvement

a. Urban roadway section with raised median

b. Dickens Avenue 3/4-access intersection
- Northbound approach: one left-turn lane, three thru lanes, one right-turn lane
- Southbound approach: one left-turn lane, three thru lanes, one right-turn lane
- Eastbound Approach: one left-turn lane
- Westbound Approach: one left-turn lane

c. Expected 20-year crash rate
- Preferred Alternative - 40.7 crashes
- 11.3% crash reduction

Estimated Construction Cost (2017 Dollars) - $3.3 Million



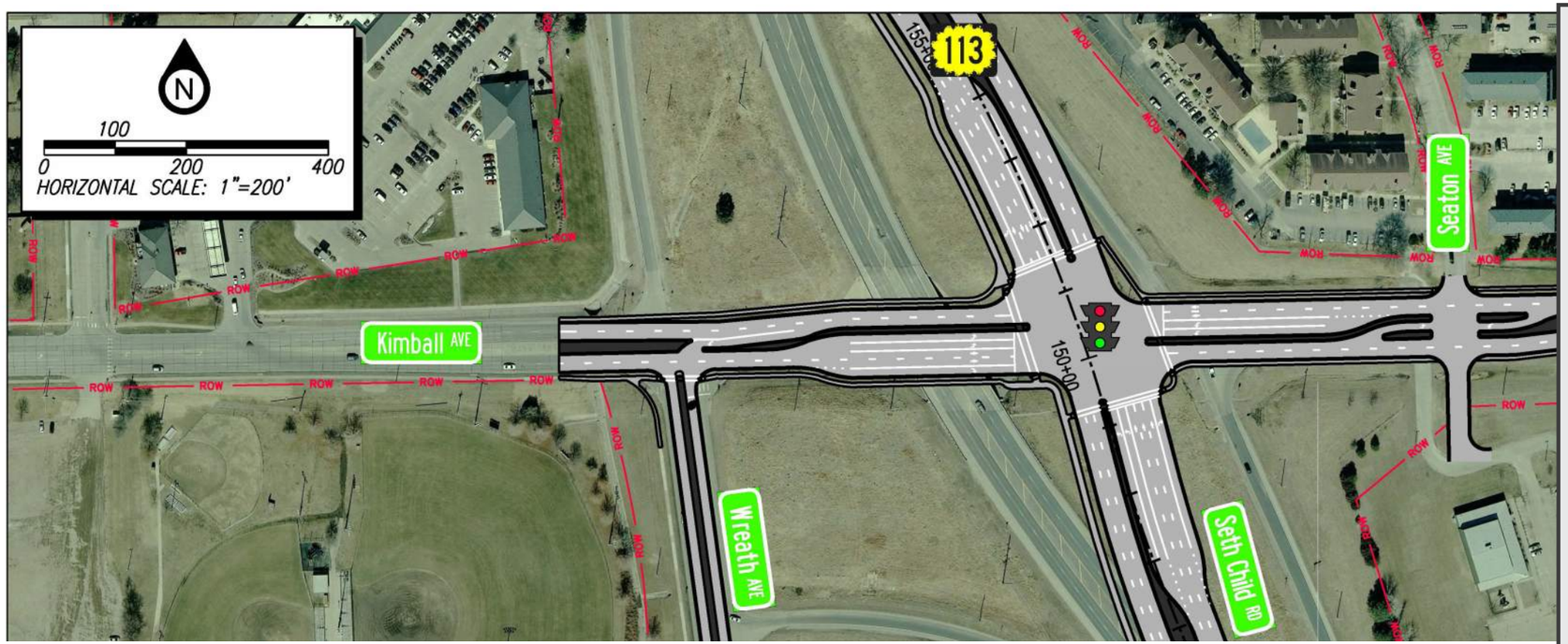
BENEFIT

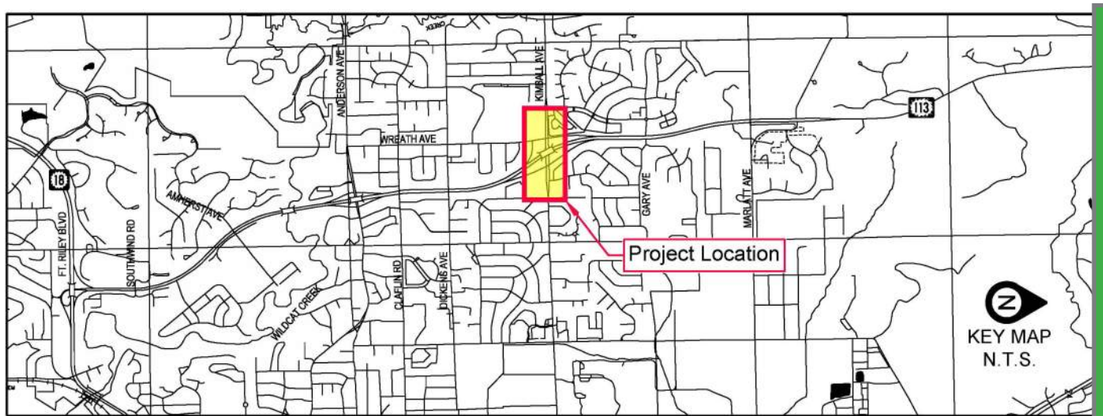
1. Improve north / south lane capacity
2. Remove side street left-turn conflict
3. Provides opportunity for north / south pedestrian connectivity
4. Opportunity for improved aesthetics along roadway

LIMITATIONS

1. Dickens Avenue restricted to 3/4 access versus full access

7 | SUMMARY & IMPLEMENTATION





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BENEFIT

1. Improve 2040 traffic operation
   - Overall intersection LOS C
   - Individual turning movements LOS D or better
2. Allows partial access to Wreath Avenue
3. Consistent intersection traffic control along the Corridor (at-grade signals)
4. Provides opportunity for north / south pedestrian connectivity
5. Opportunity for improved aesthetics along roadway
6. Development opportunity for excess ROW

LIMITATIONS

1. Removing existing interchange
2. Significant traffic control and construction sequencing
3. Removes free-flow north / south Seth Child Road traffic
4. Eliminates northbound / left-turn from Wreath Avenue to Kimball Avenue

INTERSECTION MODIFICATIONS

Issues Identified

a. Traffic congestion PM peak hour
   - 2040 No Build traffic operation
     - Overall intersection LOS C (southbound ramp)
     - Overall intersection LOS C (northbound ramp)
     - Southbound left-turn movement LOS F

b. Crash rate
   - Southbound off-ramp / Wreath Ave - 24.0 crashes per 100 MEV
   - Northbound ramp - 64.4 crashes per 100 MEV
   - Wreath Ave / southbound on-ramp - 13.7 crashes per 100 MEV
   - 20-year No Build crash rate
     - Overall interchange total - 192.1 crashes
     - Southbound ramp - 70.7 crashes
     - Northbound ramp - 75.7 crashes
     - Wreath Avenue - 19.5 crashes

c. Wreath Avenue two-way street and serves as southbound on-ramp

d. Seth Child Road ramp terminals separate by 710 feet

Recommended Improvement

a. Urban roadway section with raised median

b. Construct at-grade signalized intersection

c. Proposed intersection geometrics
   - Northbound Approach: Two left-turn lanes, three thru lanes, one right-turn lane
   - Southbound Approach: Two left-turn lanes, three thru lanes, one right-turn lane
   - Eastbound Approach: Two left-turn lanes, two thru lanes, one right-turn lane
   - Westbound Approach: Two left-turn lanes, one thru lane, one shared thru / right-turn lane

d. Expected 20-year crash rate
   - Preferred alternative expected 20-year crash rate - 91.2 crashes
   - 2.5% crash reduction

Estimated Construction Cost (2017 Dollars) - $8.0 Million
(At-Grade Intersection Only)

Phase 6 | Kimball Avenue Intersection

INTERSECTION MODIFICATIONS

Issues Identified

a. Two unsignalized intersection between Kimball Avenue and Marlatt Avenue

b. 2040 No Build Traffic Operation
- Gary Avenue - 24.8 crashes per 100 MEV
- KFB Drive / Leadership Lane - eastbound left-turn LOS E, Eastbound right-turn LOS B, westbound approach LOS F

c. Crash Rate
- Gary Avenue - 24.8 crashes per 100 MEV
- KFB Drive / Leadership Lane - 0.0 crashes per 100 MEV
- No Build expected 20-year crash rate (Kimball to Marlatt) - 90.1 crashes

Recommended Improvement

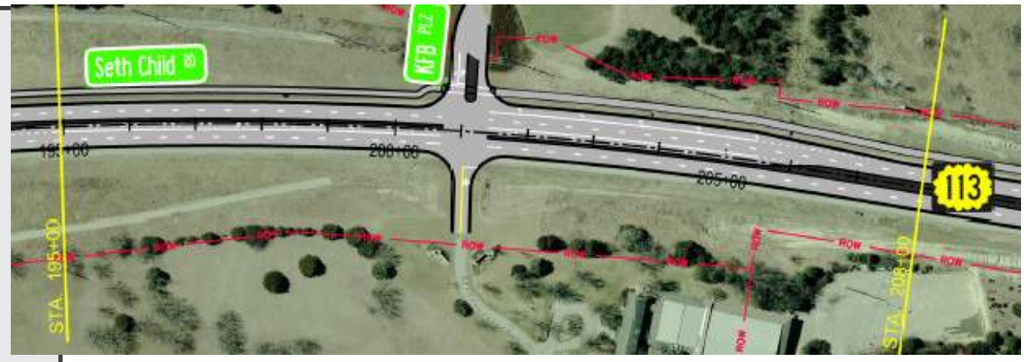
a. Urban roadway section with raised median

b. Gary Avenue 3/4 access intersection
- Northbound Approach: One left-turn lane, two thru lanes, one right-turn lane
- Southbound Approach: One left-turn lane, one thru lane, one thru/right-turn lane
- Eastbound Approach: One right-turn lane
- Westbound Approach: One right-turn lane

c. KFB Drive / Leadership Lane
- Northbound Approach: One left-turn lane, one thru lane, one thru/right-turn lane
- Southbound Approach: One left-turn lane, two thru lanes, one right-turn lane
- Eastbound Approach: One left-turn/thru lane, one right-turn lane
- Westbound Approach: One shared left / thru / right-turn lane

d. Expected 20-year crash rate
- Preferred alternative - 90.1 crashes
- 0% crash reduction

Estimated Construction Cost (2017 Dollars) - $7.8 Million



BENEFIT
1. Remove side street Left-Turn conflict at Gary Avenue
2. Provides opportunity for north / south pedestrian connectivity
3. Opportunity to provide aesthetics along roadway

LIMITATIONS
1. Gary Avenue restricted to 3/4 Access versus Full Access

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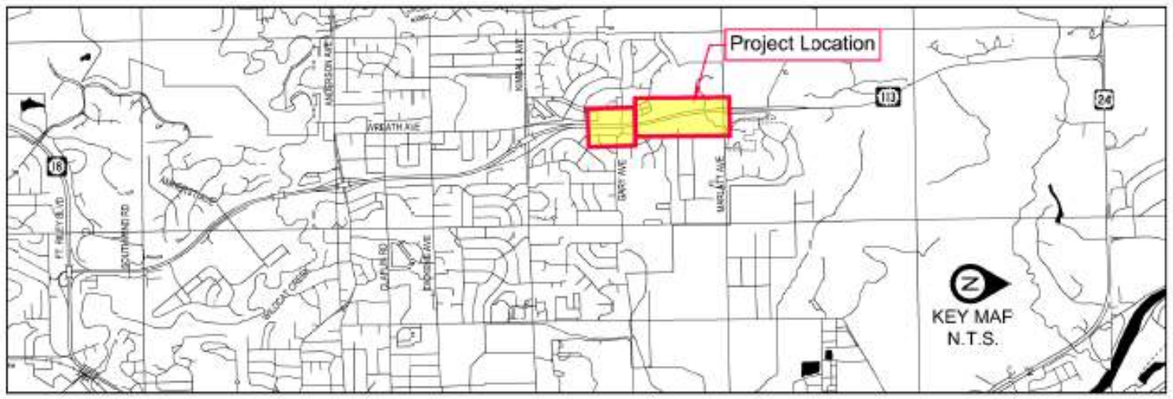
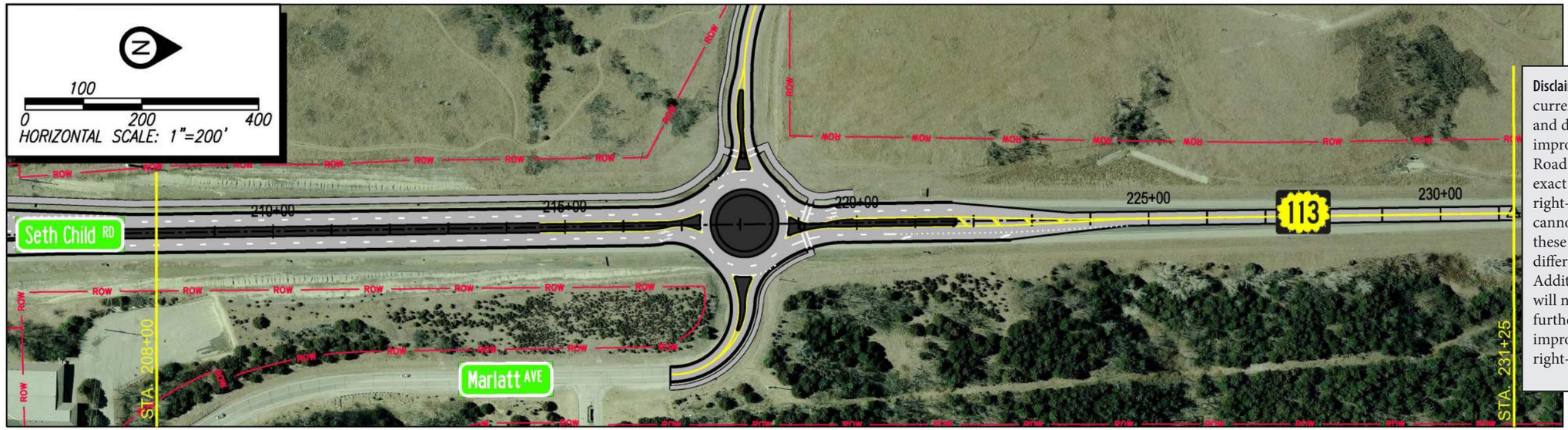


Phase 8 | Seth Child Segment Road - Kimball to Marlatt



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INTERSECTION MODIFICATIONS

Issues Identified

a. 2040 No Build traffic operation
- Unsignalized intersection
- Eastbound and westbound approaches LOS F

b. 20-Year growth along west leg of Marlatt Avenue is estimated to be 14.0% per year
- Identified as the highest growth along the Seth Child Road Corridor

c. Crash rate
- 7.5 crashes per 100 MEV
- Statewide average - 100 crashes per 100 MEV
- No Build expected 20-year crash rate - 15.4 crashes

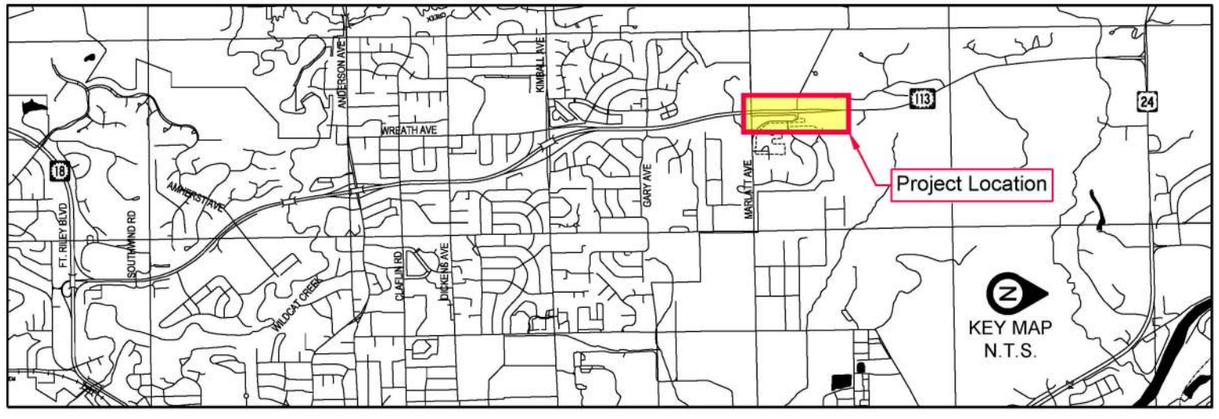
Recommended Improvement

a. Urban roadway section with raised median

b. Proposed intersection geometrics
- Multi-lane roundabout
- Northbound/southbound approaches: Two-lane entry
- Eastbound/westbound approaches: Single-lane entry

c. Expected 20-year crash rate
- Preferred Alternative - 8.6 crashes
- 44.1% crash reduction

Estimated Construction Cost (2017 Dollars) - $4.5 Million



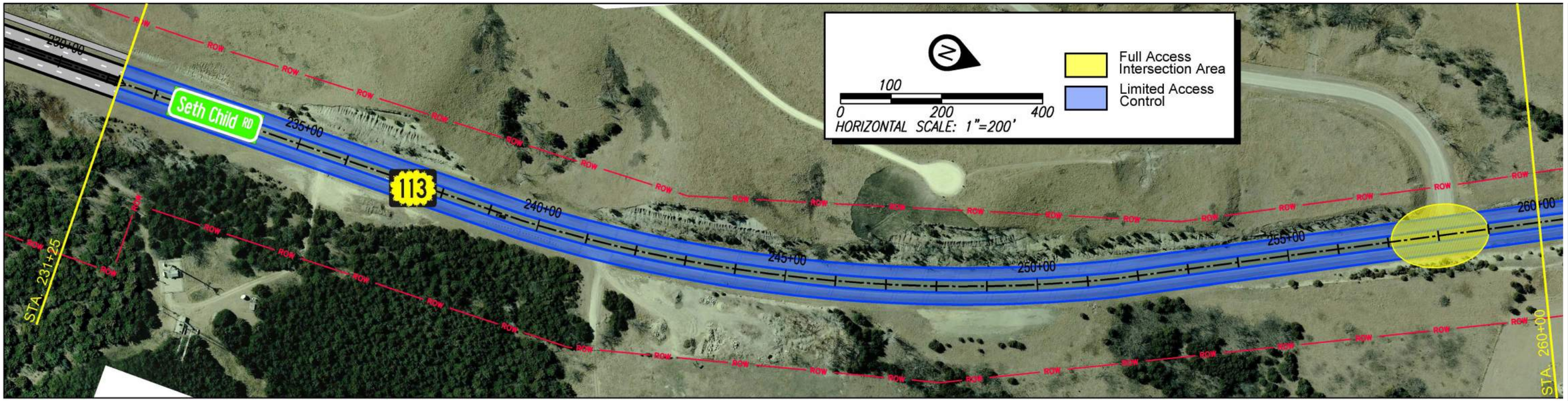
BENEFIT

1. Improve 2040 traffic operation
   - Overall intersection LOS C
   - Individual turning movements LOS C or better
2. Provides opportunity for north / south pedestrian connectivity
3. Roundabout coordinates well with proposed US-24 roundabout
4. Opportunity for improve aesthetics along roadway

LIMITATIONS

1. Location of roundabout to be identified as part of an alignment study for Marlatt Avenue
2. ROW impacts unknown
3. Public perception of roundabouts

Phase 5 | Marlatt Avenue Intersection


Seth Child RD
113
230+00
235+00
240+00
245+00
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255+00
260+00
STA. 231+25
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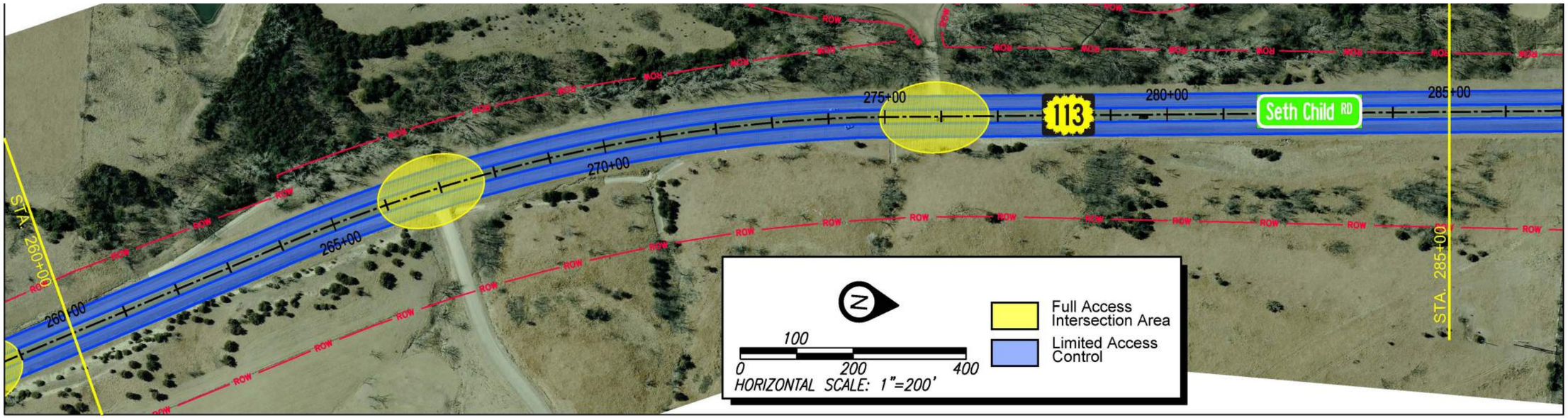
HORIZONTAL SCALE: 1"=200'
Full Access Intersection Area
Limited Access Control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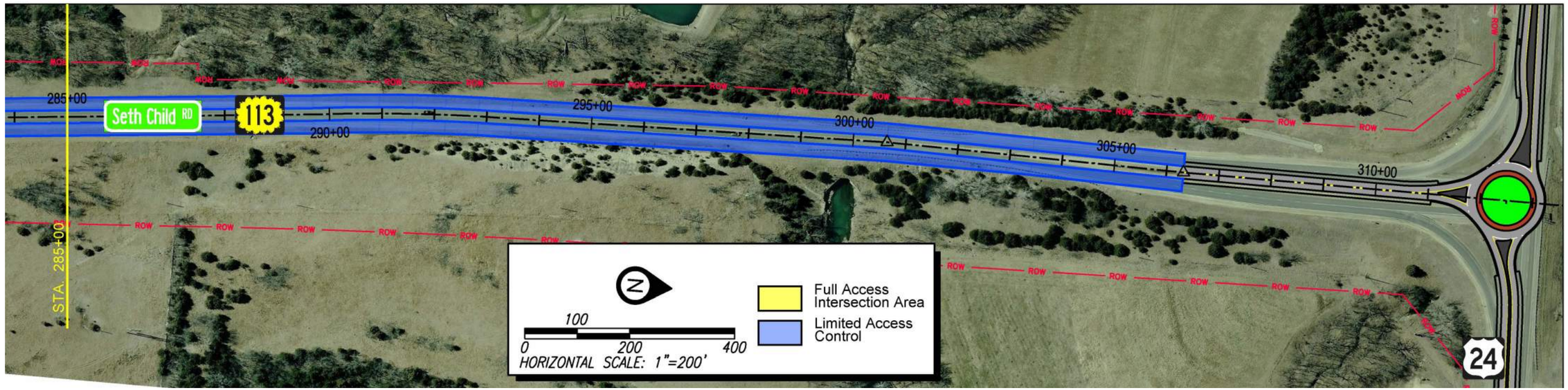
Limited Access Control



INTERSECTION MODIFICATIONS

Issues Identified

a. No traffic operation issues identified
b. Crash history - 12 Total Crashes with two injury crashes (2012 to 2015)

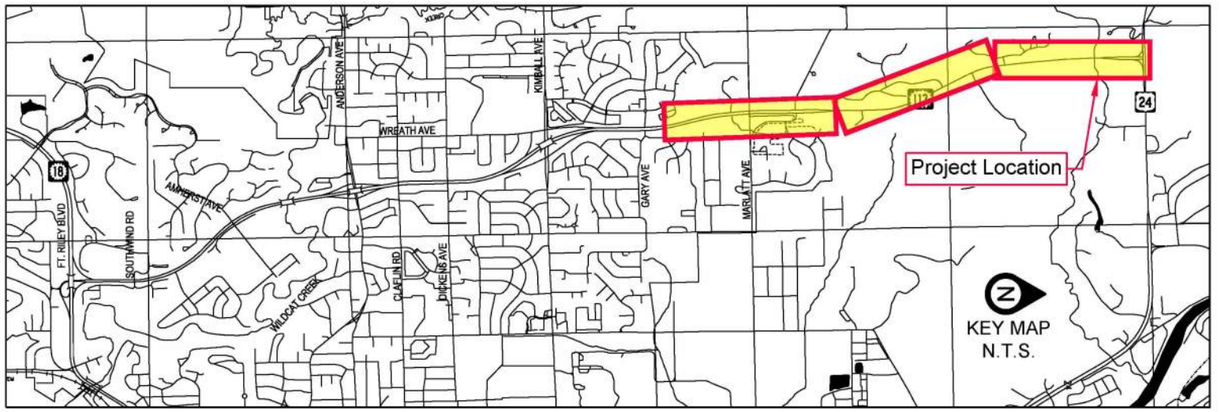
Recommended Improvement

a. Establish access control
b. Expected 20-year crash rate
- Preferred alternative - 92.5 crashes
- 0% crash reduction

Estimated Construction Cost (2017 Dollars) - $2.7 Million (2-lane reconstruction)

BENEFIT

1. Manage access points along the Corridor with established access control
2. Follow City of Manhattan and KDOT Access Management Policies



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INTERSECTION MODIFICATIONS

Issues Identified

a. Severe injury crashes reported during study period

b. Crash Rate
- 11.8 crashes per 100 million entering vehicles MEV
- Statewide average - (rural) 50 crashes per 100 MEV
- No Build expected 20-year crash rate - 27.1 crashes

c. Speed Differential

d. Poor Intersection Lighting

Recommended Improvement

a. Construct single-lane roundabout

b. Evaluate bypass lanes at time of design

c. Design roundabout to accommodate WB-67 trucks

d. Speed management should be checked through fastest path design and horizontal radii for westbound bypass lane

e. Expected 20-year crash rate
- Preferred alternative - 15.2 crashes
- 44.0% crash reduction

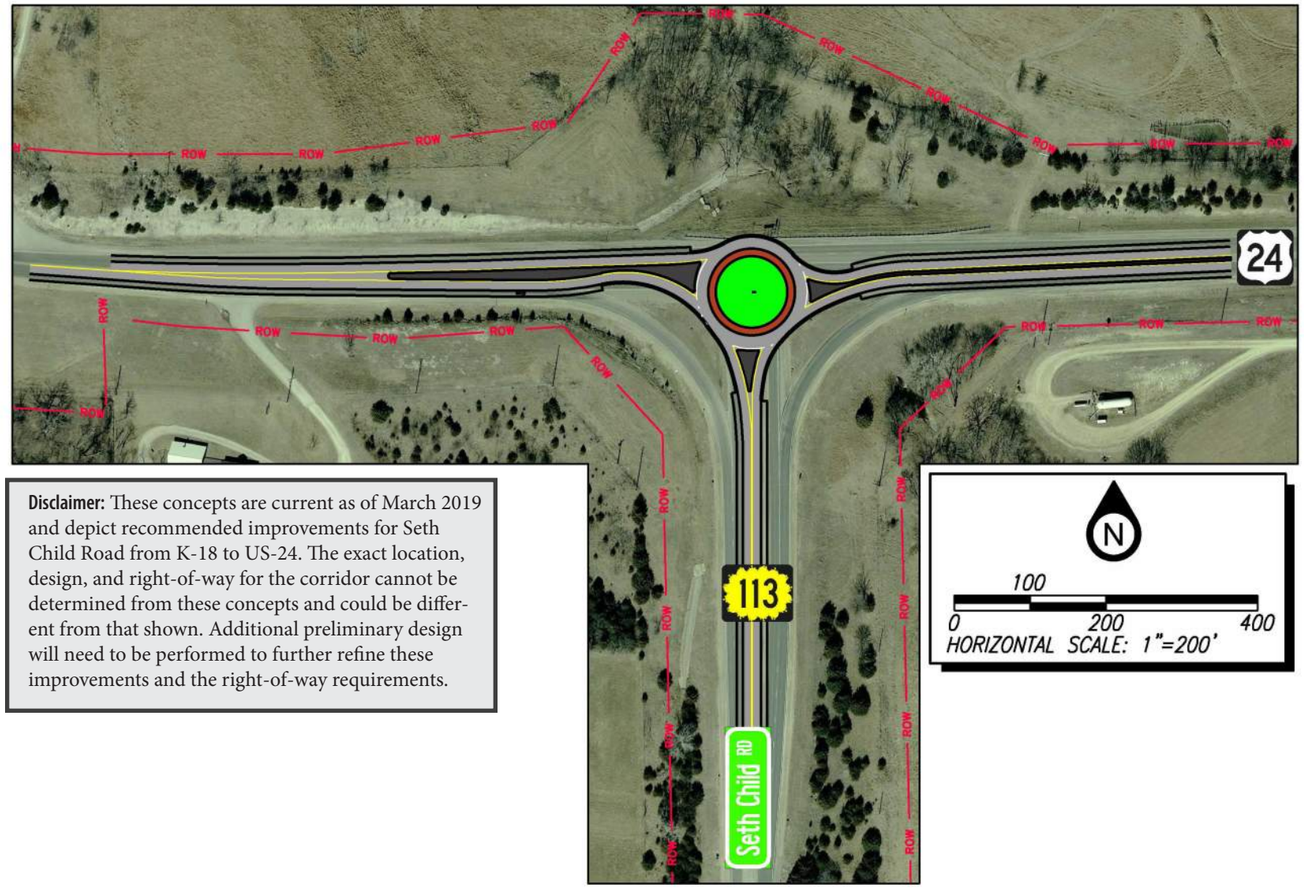
Estimated Construction Cost (2017 Dollar) $1.9 Million

BENEFITS

1. Reduction of injury related crashes
2. Manage US-24 speeds at Seth Child Road (K-113)
3. Reduce number of conflict points at intersection
4. Accommodates trucks
5. Promote Seth Child Road Corridor
6. Intersection Lighting
7. Compliment roundabout recommendation at US-24 intersection with K-13
8. Improved Year 2040 Level of Service

LIMITATIONS

1. Roundabout on high speed facility
2. New intersection type to US-24 Corridor
3. Public perception of roundabouts
4. Perceived longer travel times



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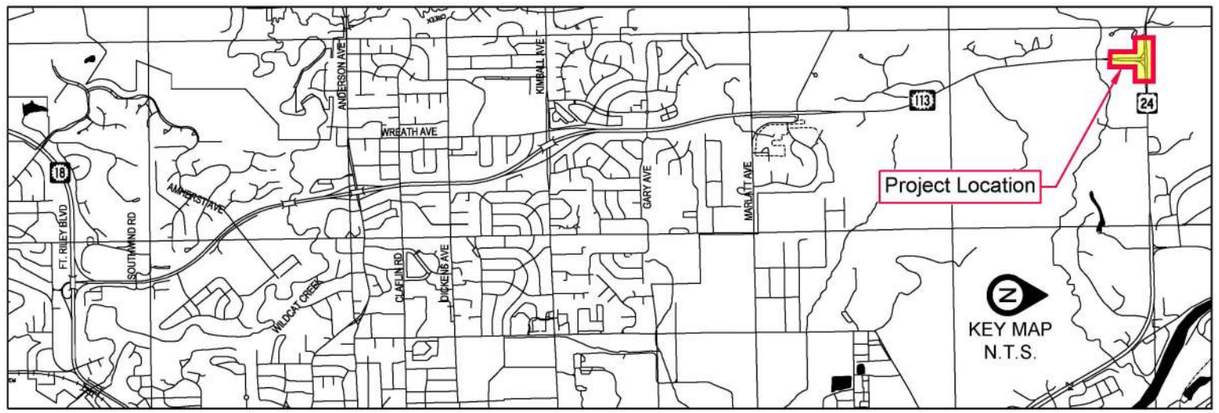

PHASE 1 | Seth Child Road and US-24 Intersection

7 | SUMMARY & IMPLEMENTATION

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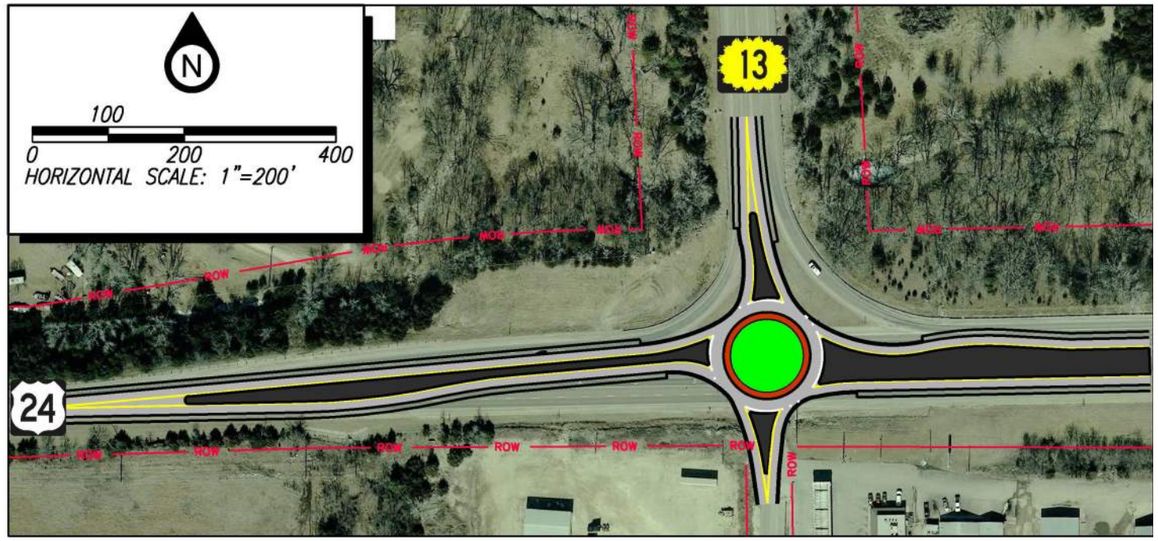

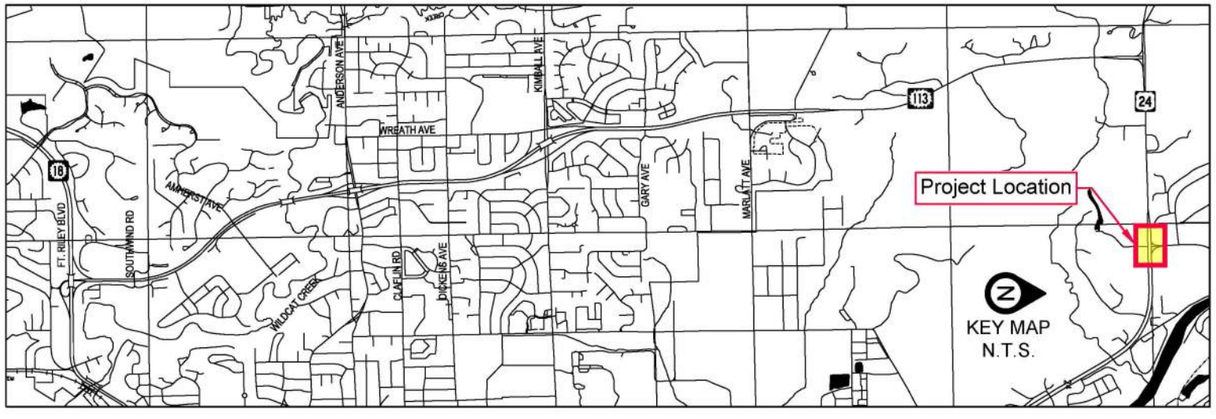

INTERSECTION MODIFICATIONS

Issues Identified

a. Six injury and two fatality crashes reported during study period 97.6 crashes per 100 MEV
b. Statewide average crash rate - 50 crashes per 100 MEV
c. No Build expected 20-year crash rate - 37.1 crashes
d. Speed differential
e. Poor intersection lighting

Recommended Improvement

a. Construct single-lane roundabout
b. Design to accommodate westbound-67 trucks
c. Evaluate bypass lanes at time of design
d. Speed management checked through fastest path design
e. Expected 20-year crash rate
   - Preferred alternative 20.8 crashes
   - 44.0% crash reduction

Estimated Construction Cost (2017) $1.5 Million

BENEFITS

1. Reduction of injury related crashes
2. Reduce number of conflict points
3. Intersection lighting
4. Complement roundabout recommendation at US-24 intersection with Seth Child Road (K-113)
5. Improved Level of Service

LIMITATIONS

1. Roundabout on high speed facility
2. New intersection type at US-24 Corridor
3. Public perception of roundabouts
4. Perceived longer travel times

Phase 2 | US-24 and K-13 Intersection