Butler Road Corridor Analysis

Location

Butler County, Kansas

Prepared for:

Butler County

City of Andover

City of Rose Hill

Date: May 2009

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May 21, 2009

Daryl C. Lutz, P.E.
Butler County
121 S. Gordy, Ste. 200
El Dorado, KS 67042-2947

Re: Butler Road Corridor Analysis
between 110th Street and 190th Street
Butler County, Kansas

Dear Mr. Lutz:

In response to your request and authorization, TranSystems has completed a corridor analysis for Butler Road between 110th Street (Harry) and 190th Street South located in Butler County, Kansas. The purpose of this study was to assess the impact of future development on the existing transportation system and develop an implementation plan to complement proposed development.

Included in this study is a discussion of the anticipated impact of the proposed development on the roadway network and identified improvements to mitigate deficiencies for the following development conditions:

- Existing conditions.
- Existing conditions with proposed 2030 traffic volume.
- Proposed 2030 improvement conditions.

Also included in the study is a proposed land use plan, access management plan, meeting minutes from meetings with key stakeholders on the project, preliminary environmental assessments as well as preliminary hydrologic and hydraulic recommendations for significant waterways along the corridor.

We trust that the enclosed information proves beneficial to you for implementation. We appreciate the opportunity to be of service to you and we will be available to review this study with you at your convenience.

Sincerely,

By: ______________________
Brett A. Letkowski, P.E.

By: ______________________
Slade G. Engstrom, P.E.

BAL:SGE:P125070016

We would like to take this opportunity to thank the following committee members, staff, stakeholders and representatives for their valuable input and resources. We appreciate their participation throughout the planning process.

1.0 Steering Committee

Darryl Lutz .... Butler County
Mark Detter .... Butler County
Kirk Hayden .... City of Rose Hill
Joel Pile .... City of Rose Hill
Sasha Stiles .... City of Andover
Les Mangus .... City of Andover
Rod Lacy .... KDOT
Derek Clark .... WAMPO

Governing Bodies

Butler County Commission
Andover City Council
Rose Hill City Council

Local Representatives

Len Marotte .... JOEL Assoc. LLC
Tom Mack .... Devlin Enterprises
Paul Kelsey .... Paul Kelsey Development
Clifford Nies .... Clifford Nies Development
Mark Evans .... USD 385
Randall Chickadonz .... USD 349

Consultants

Brett Letkowski .... TranSystems
Steve Lackey .... TranSystems
Jeff McKerrow .... TranSystems
Slade Engstrom .... TranSystems
Tom Powell .... Municipal Lawyer
Ron Schikevitz .... Burns & McDonnell
Graham Smith .... Gould Evans

2.0 Table of Contents

3.0 Executive Summary

Butler County, the City of Andover and the City of Rose Hill contracted with TranSystems in March of 2007 to determine the best configuration of the Butler Road Corridor before development progressed to the point that reasonable options became unavailable. This proactive approach to planning the corridor allows for orderly land development while preserving the opportunity to develop a safe and efficient roadway capable of accommodating ultimate projected traffic volumes.

3.1 Introduction and Background

This segment of Butler Road from US-54 to 190th Street South serves as the main access for the City of Rose Hill to access US-54 (Kellogg Avenue). Kellogg Avenue is Rose Hill's main access to the City of Wichita and other surrounding state highway systems. The absence of access to a state route in Rose Hill places significant importance on Butler Road's use as a "through" route and preserving the capacity and progression of the roadway. Increasing development along the corridor as well as increased interest in developing adjacent properties through the corridor has prompted Butler County, the City of Andover and the City of Rose Hill to develop a corridor plan in order to preserve adequate right-of-way and allow adjacent developments to access Butler Road in a manner that enables the corridor to maintain safe and efficient movement of traffic until it matures to its ultimate build-out.

The study corridor falls under both the jurisdictional planning boundaries of the City of Andover and the City of Rose Hill with the general planning boundary considered to be 135th Street South. The existing roadway configuration is generally two twelve-foot lanes with open ditches and a 55 mph speed limit and could be described as a rural cross section. The existing pavement appears to be in fair condition with striping and wide gravel or earth shoulders adjacent to the pavement.

3.2 Study Purpose

The purpose of this study is to analyze the Butler Road Corridor from Kellogg Avenue to 190th Street (from Andover to Rose Hill). Since the City of Andover has a plan in place for the corridor section from Kellogg Avenue to 110th Street South, a long-range plan will be provided for the Butler Road Corridor from 110th Street South to 190th Street South that defines:

- The number and type of traffic lanes.
- The location and configuration of intersections and driveways.
- The location and use of medians.
- Local streets needed to complement the corridor configuration.

Although the study area was analyzed holistically, the analysis and recommendation section of the report is broken down into two segments:

1. Developing area – US 54 to 170th Street.
2. Rose Hill developed area – 170th Street to 190th Street.

The study involved meeting with corridor stakeholders as well as, gathering utility information, future land use plan, design alternates and assessing the major creek crossings along the corridor (i.e. Eight Mile Creek and Four Mile Creek) as well as an open concrete lined channel along Harris Drive paralleling Butler Road between Ridgeway Drive to Berlin Drive.

3.3 "The Outcome"

For continual development to occur along the corridor and Rose Hill to maintain reasonable access to US-54, a corridor plan is necessary. Through meetings with key stakeholders and meetings with the steering committee, a land use plan was formulated for the corridor and is shown in **Figure 1**. This land use plan provided the basis for traffic projections and ultimate configurations of the roadway network. Butler Road changes in typical section through the corridor to reflect the changing needs and uses of the corridor. **Figure 2** and **Figure 3** show the proposed typical sections through the corridor. A preliminary layout of the corridor was drafted and is included in Appendix A. Preliminary cost estimates for corridor improvements were completed and a corridor improvement plan identified and is shown in Table 5. Preliminary hydraulic, environmental and utility coordination studies were completed to help identify additional project corridor costs that could be associated with the Corridor Improvement Plan to more accurately identify future project costs. Potential financing options as well as grant funding opportunities were identified to provide financing options for the improvements. An access management plan was drafted to allow orderly development to occur along the corridor while preserving the vision for the future roadway and is shown in Appendix E. A public involvement meeting was held and public comments are documented in Appendix D.

4.0 Corridor Stakeholder Involvement

Key aspects to determine the future composition of the corridor involve meeting with the main stakeholders in the long-term development of the corridor. This includes not only city and county representatives who made up the steering committee but also schools and land developers that have future plans for the corridor. It is vital to involve these individuals to ensure the future land use plan and roadway network complements the visions of the members of the community that will be developing the corridor. Meetings with key stakeholders in the corridor took place and a record of the meetings is shown in Appendix C. The general theme prevalent in each stakeholder meeting was the timeline of the improvements. To continue to develop the corridor all of the stakeholders felt that improvements are necessary.

5.0 Proposed Corridor Land Use Plan

5.1 Introduction

The Butler Road Corridor connects the City of Andover, US-54 and the City of Rose Hill. The north boundary of the Butler Road Corridor study area is US-54, also known as Kellogg Avenue. The south boundary is 190th Street, also known as Rosewood Street. East and west corridor planning boundaries were set one mile east and west of the Butler Road centerline. The Future Land Use Map for the corridor was created by using 2006 GIS data from Butler County as well as aerial photography.

5.2 Future Land Use

The Future Land Use chapter includes a graphic representation as shown in Figure 1, as well as a written description of the policies for the future land use along the Butler Road Corridor. The purpose of the Future Land Use Map is to project and guide the growth patterns for developments in the future. It should be recognized that as the communities of Andover and Rose Hill continue to grow and development of the Butler Road Corridor occurs, the Land Use Map should be reviewed and amended as necessary. The Butler Road Corridor Land Use Map is intended to be a living document that is flexible to accommodate changes over time.

The Future Land Use Map was prepared based on the population projections and historic growth patterns of Andover and Rose Hill. The Future Land Use Map was created by studying the *2001 Rose Hill Comprehensive Plan* and the *Comprehensive Development Plan for the Andover Areas, Kansas 2003 – 2013*. The map incorporates the potential improvements for the corridor and the surrounding areas as well as graphically represents the type and locations of different land uses.

The Butler Road Corridor study area is approximately 18 square miles in size. The nine mile long Butler Road Corridor is mainly residential and connects two urban commercial centers at US-54 within the City of Andover and 190th Street south of the City of Rose Hill. In order to protect the Butler Road Corridor from becoming a linear commercial corridor, the urban commercial land uses have been congregated around these two major intersections within the Cities of Andover and Rose Hill. Infill of large-scale retail, mixed-use development and public market places defines these two intersections as community destinations.

To provide support for commercial uses within the Cities of Andover and Rose Hill, the single-family land use development pattern has been expanded around the commercial centers. The further you move away from these two intersections the lower the density, ultimately decreasing into the rural residential land use.

Basic needs and services for residents along the corridor are typically found at several neighborhood commercial nodes located throughout the corridor. Neighborhood commercial nodes are placed approximately 1 to 3 miles apart at the following intersections:

- Butler Road and 110th Street.
- Butler Road and 120th Street.
- Butler Road and 150th Street.

These locations are based on existing development patterns of the area. As development patterns change over time, the locations of the neighborhood commercial may need to change to adequately provide services to new neighborhoods.

Neighborhood commercial development along Butler Road should act as a complement of the urban commercial center at US-54 and Butler Road.

5.3 Land Use Classifications

URBAN COMMERCIAL

Urban commercial land uses are located at major intersections on Butler Road such as US-54 and 170th Street. Urban commercial includes large-scale commercial uses that attract people on a community scale. The urban commercial use incorporates such uses as national and regional chains and franchises.

NEIGHBORHOOD COMMERCIAL

Neighborhood commercial land uses include small-scale neighborhood nodes that are located within or adjacent to neighborhoods for which they provide daily services. The primary uses are neighborhood services including small office, restaurant and retail establishments.

MULTIPLE-FAMILY RESIDENTIAL

Multiple-family residential land uses include land for the development of higher density residential uses. Multiple-family residential can include a variety of different types of residential buildings, such as duplexes, four-plexes and apartments for rental or ownership. Development densities within this land use category are typically seven units per acre or higher. This category also allows two or more dwelling units per residential structure.

NEIGHBORHOOD RESIDENTIAL

Neighborhood residential land uses represent prevailing development standards in housing and neighborhood design. Neighborhood residential development is primarily reserved for single-family homes but may include a mixture of housing types. Neighborhoods are strengthened by the presence of community services (churches, schools and parks) that are permitted in this category. Development densities within this land use category are typically between 1 and 6.99 units per acre.

RURAL RESIDENTIAL

Rural residential land uses provide for large-lot residential development where a full range of municipal services may not be available. This category is intended to allow for flexibility of choice for individuals preferring a larger-lot or estate residential environment. The development densities within this land use category typically include one unit per 2 acres or higher. Ultimately, the development pattern in this area is intended to retain a feeling of rural character feeling.

The rural residential category can accommodate a higher intensity of residential development known as "cluster development." Net densities of 1+ unit(s)/acre can be achieved through clustering residential units on a portion of land and leaving the remaining land undeveloped. Clustering can assist in protecting the natural and rural character of portions of Butler County through environmentally sensitive development.

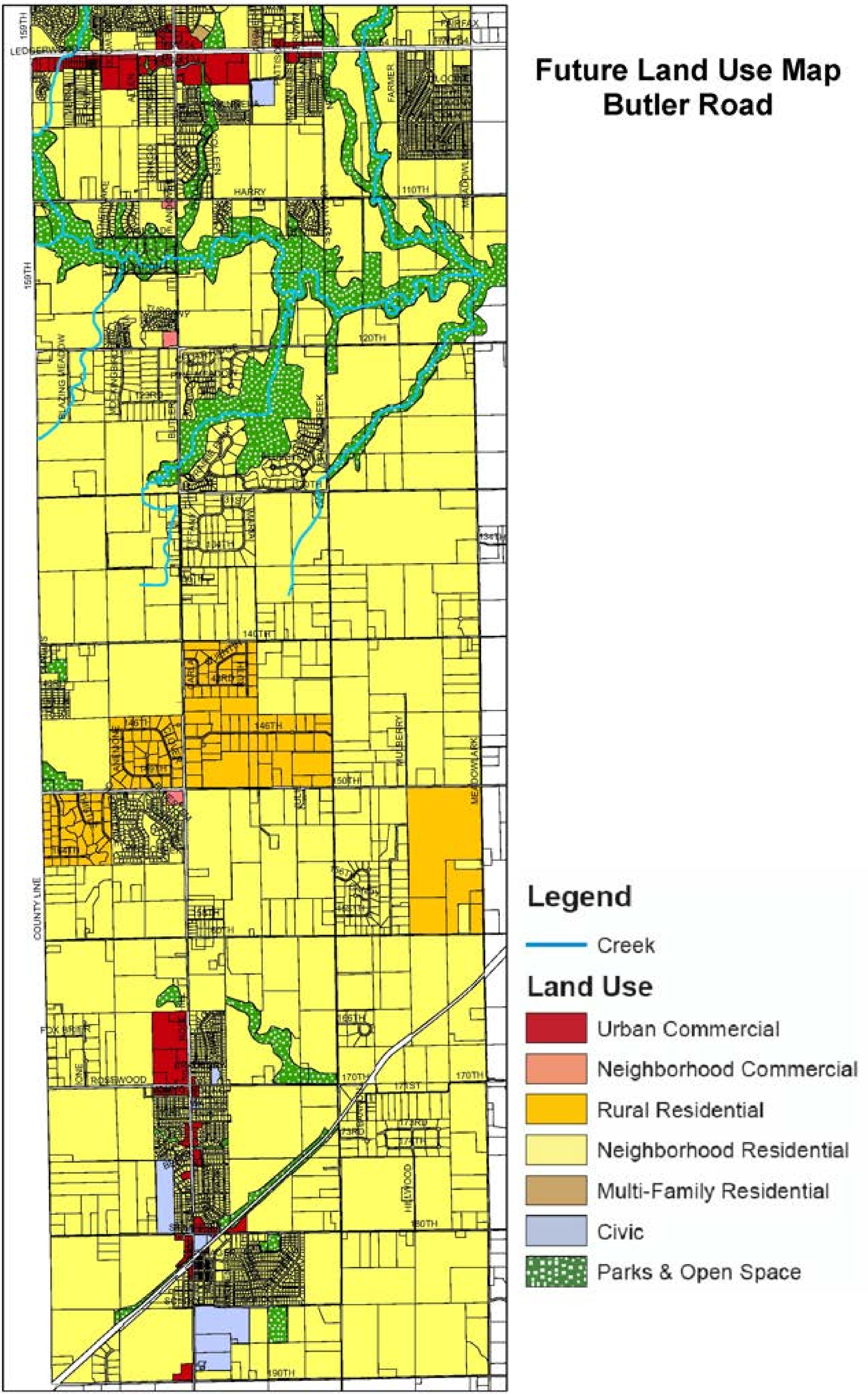
PARKS AND OPEN SPACE

Park and open space land uses include land devoted to parks, open spaces and private and public recreation facilities. Parks and open spaces land uses can occur in other land use categories including single-family residential, rural residential, multiple-family residential and civic.

CIVIC

Civic land use includes land devoted to city buildings, public schools, churches, libraries, hospitals, institutions, nursing homes, service organizations and government uses. Churches, schools and libraries are allowed within all residential land use designations.

Future Land Use Map
Butler Road



TranSystems	FUTURE LAND USE MAP	Butler Road Corridor Study Butler County, Kansas	1 12/9/08 No Scale	Figure 1

6.0 Hydraulic Analysis (110th Street – Rosewood Street)

6.1 Introduction

The waterway opening analysis applies to the Four-Mile Creek and Eight-Mile Creek bridge crossings along the Butler Road Corridor study. The analysis was completed at a planning-level of detail to establish criteria for existing baseline conditions and potential order of magnitude structure sizes to improve flood protection service levels in conjunction with other roadway corridor improvements. Under all scenarios, higher orders of analytical accuracy will be necessary to support final design.

Frequency of rainfall events are generally expressed in terms of the probability of a rainfall event of a specific intensity occurring. For example, a 100-year storm has a 1/100 or 1% probability of occurring in a given year. Care should be taken to remember that these are probabilities and a 100-year storm could occur multiple times in a given year or in consecutive years. For emergency route access during flood events it is usually prudent to design to prevent the 100-year storm from overtopping the roadway.

The waterway opening sizes required to pass the 100-year storm event without over topping the roadway were modeled using HEC-RAS software developed by the US Army Corps of Engineers. Information within the models was taken from multiple sources including survey and existing roadway plan information provided by Butler County, United State Geological Service (USGS) mapping and Federal Emergency Management Agency (FEMA) models when available. Flow values for the 10, 50, 100 and 500-year events were taken from FEMA Flood Insurance Study (FIS) reports while flows for the 25-year event were calculated. Three separate plans were developed at each stream crossing:

1. Effective existing conditions to serve as a basis for comparison.
2. Proposed conditions model scenario one, which maintains the current roadway profile and modifies the waterway opening to provide increased level of flood protection to the roadway.
3. Proposed conditions model scenario two, which raises the roadway profile in addition to modification of the waterway opening to provide an increased level of flood protection to the roadway.

The following modeling results produced required waterway opening sizes that are preliminary in nature only and should be adjusted as more detailed survey information is obtained and detailed design is undertaken. Our concept-level recommendations for bridge openings are based on hydraulic modeling of the bridge structures that yielded 0.1' or less-rise from baseline conditions. While the Kansas Department of Water Resources does not allow a rise in the flood elevation without a map revision, our analysis and recommendations are based on the limited amount of available data relating to prevailing channel and other hydraulic design conditions. The final design will be based on an effective no-rise supported by a detailed analysis including detailed channel characteristics

6.2 Four Mile Creek

Four Mile Creek crosses Butler Road approximately one and a half miles south of the intersection of US-54 and Butler Road and generally runs from northwest to southeast. Currently, Four Mile Creek drainage basin is approximately split between rural agricultural land use and rural residential land use through the drainage basin. The following are the modeling results for the three scenarios for Four Mile Creek:

Effective Existing Conditions

Existing HEC-2 flood models were obtained from FEMA. The existing HEC-2 models were converted to HEC-RAS, and modified to include relevant existing roadway information from plans provided by Butler County. The existing structure is a 44'-55'-44' continuous span bridge with a waterway opening of approximately1910 ft^2. The effective conditions model suggests overtopping of the roadway occurs during the 33-year event. The overtopping location is at the sag point in the roadway profile which is approximately 570 feet north of the existing bridge.

Proposed Conditions Scenario 1

Scenario 1 modeling quickly showed that it is infeasible to build a bridge to pass the 100-year event without overtopping of the roadway while maintaining the existing profile. These conditions would necessitate an extensive amount of channel grading and increase the structure length to more than twice the current length of the existing bridge making it cost prohibitive.

Proposed Conditions Scenario 2

Scenario 2 allows moderate roadway profile changes to occur in conjunction with a new bridge construction. The waterway opening required to prevent the 100-year event from overtopping the roadway after a moderate 3.4' raise in the existing roadway profile is approximately 2860 ft^2. The rise in the profile moved the existing sag point 272 feet closer to the bridge. A 60'-90'-60' span bridge was modeled and resulted in a 0.10-foot rise in the 100-year floodplain upstream of the culvert.

6.3 Eight Mile Creek

Eight Mile Creek crosses Butler Road approximately one-half mile north of the City of Rose Hill and generally runs from northwest to southeast. Currently, Eight Mile Creek drainage basin is predominately of rural agricultural land use with rural residential land use mixed through the drainage basin. The following are the modeling results for the three scenarios for Eight Mile Creek:

Effective Existing Conditions

Existing flood models were requested from FEMA but no existing flood models were available at this crossing location. Butler County surveyed three creek cross sections near the bridge while additional supplemental creek cross sections were obtained from USGS mapping. The existing structure information and roadway profile information were obtained from existing roadway plans that were provided by Butler County. The existing structure is a 3-10'x10'x44' RCB. The effective conditions model suggests that overtopping of the roadway occurs during the 25-year event. The overtopping location is at the sag point in the roadway profile, approximately 960 feet south of the structure.

Proposed Conditions Scenario 1

If you hold the roadway profile constant and enlarge the waterway opening to pass the 100-year event, the waterway opening required without overtopping the roadway is approximately 600 ft^2. This prompted modeling a new 4-15'x10' RCB. The new culvert as modeled resulted in a "no rise" in the 100-year floodplain upstream of the culvert.

Proposed Conditions Scenario 2

Scenario 2 allows moderate roadway profile changes to occur in conjunction with a new bridge construction. Allowing a moderate profile grade raise of approximately two feet, the waterway opening required to pass the 100-year event without overtopping the roadway is approximately 432 ft^2. A 3-12'x12' RCB was modeled which resulted in an approximate 0.10-foot rise in the 100-year floodplain upstream of the culvert.

7.0 Environmental Findings (110th Street – Rosewood Street)

7.1 Introduction

A limited environmental review was performed to determine any significant environmental factors that could be detrimental to proposed improvements. The preliminary environmental review of the site involved:

1. The identification of EPA monitoring wells in the SW quadrant of 130th St. and SW Butler Road as well as possible impacts to the Butler Road Corridor.
2. The identification and inventory of other potential contaminated sites affected by improvements to Butler Road.

3. The identification and inventory of jurisdictional watercourses and wetlands along the corridor that could be affected by roadway improvements that would require a U.S. Army Corps of Engineers 404 permit application.

In addition to TranSystems environmental analysis, a more detailed supplemental environmental analysis was performed by the Kansas Department of Transportation after the concept development stage and is included in Appendix F.

7.2 Environmental Findings

7.2.1 Hazardous Waste/Storage Tanks

Two potential hazardous waste sites were identified within the first section along the Butler Road Corridor. They are as follows:

- A former gas station located southwest of the intersection of 130th and Butler Road, which has two underground storage tanks, and is currently being monitored by KDHE by use of monitoring wells. Since the underground storage tanks are located inside of the new right-of-way and inside the footprint of the roadway project; albeit behind the curb, they should be removed as part of the Butler Road Corridor Improvements. Since the current monitoring wells would probably be destroyed in the removal process, the cost for removal of a typical tank and monitoring well should be budgeted at $25k each or $50k for both tanks.
- A City of Rose Hill water meter vault and valves located approximately a quarter mile south of the intersection of 130th and Butler Road on the west side of the road.

7.2.2 Wetlands Delineation

Our wetlands assessment was based on visual assessment and was not substantiated by National Wetland Inventory maps. Based on the visual assessment of the corridor, no wetlands were observed within the right-of-way.

7.2.3 Jurisdictional Watercourses

Jurisdictional ephemeral drainages, intermittent streams and perennial streams were identified as part of the project. The following watercourses were identified:

- Four Mile Creek – The bridge is a 44'-55'-44' continuous span bridge with about 40 feet from the existing water (at the time of field reconnaissance) to the bridge. The creek is approximately 30 feet wide and 2 feet deep.
- Ephemeral drainage half way between 120th and 130th Street – The ditch is approximately 2-3 feet wide flowing into a Reinforced Concrete Box (RCB) culvert under Butler Road.
- Intermittent stream near Flint Hills Parkway – 2-3 feet wide intermittent stream flowing into a RCB culvert under Butler Road.
- Ephemeral drainage near 146th Street – 1-2 feet wide ephemeral drainage flowing into a RCB culvert under Butler Road.
- Ephemeral drainage north of 150th Street – 2 feet wide ephemeral drainage flowing into a CMP culvert under Butler Road.
- Eight Mile Creek - The bridge is a 3-10'x10' RCB with an 8-12 feet wide intermittent stream 6-12 inches deep (at the time of field reconnaissance) with approximately 10 feet from the bridge to the water.
- Eight Mile Creek Tributary, south of Eight Mile Creek – a 4-7 feet wide intermittent stream flowing into a RCB culvert under Butler Road.

Since the Butler Road study began, some uncertainty in United States Army Corps of Engineers (USACE) permitting has come up. This stems from guidance released in June of 2007 requiring Environmental Protection Agency (EPA) concurrence with USACE determinations on jurisdiction. Since the new guidance has been released, EPA has not opposed USACE jurisdictional determinations. Consequently, the USACE has continued to operate under their interpretation of the guidance; if the EPA were to decide to issue some form of a decision on jurisdictional watercourses, then the USACE interpretation of the guidance may change. If the USACE continues to permit as they have since the new guidance came out, the project should qualify for a nationwide permit. Each crossing would be permitted separately (i.e. no cumulative impacts resulting in an individual permit). The ephemeral drainages identified may or may not be taken as jurisdictional watercourses.

8.0 Corridor Analysis (110th Street – Rosewood Street)

8.1 Introduction

To assess the impact of the proposed corridor development on Butler Road, traffic counts were conducted by Butler County at various locations in the study area along Butler Road. It included manual counts of the existing traffic at the intersections of:

US -54 (Kellogg Avenue)
110th Street (Harry Street)
Tuscany Drive*
120th Street (Pawnee Avenue)
123rd Terrace*
Flint Hills Pkwy.
130th Street
140th Street
146th Street*
150th Street
Sienna Drive*
160th Street
Fox Brier Road*
Osage Street*
170th Street (Rosewood Street)

*Sample counts of 15 to 30 minutes were taken and adjusted to reflect full hour volumes

To supplement the manual peak hour counts, machine counts were also conducted by Butler County at other locations along Butler Road.

8.2 Utility Coordination

Contact was made with known utility companies in the corridor to collect information on existing facilities and identify future expansion plans that might influence development patterns in the area. The following utilities were contacted as part of the project:

- AT&T
- Butler County REC
- Butler County RWD #8
- Sedgwick County RWD #3
- City of Andover – Wastewater Department
- City of Andover – Stormwater Management
- City of Augusta – Water Department
- City of Augusta – Wastewater Department
- City of Rose Hill – Public Works Department
- City of Wichita – Water Utilities
- Coffeyville Resources
- Cox Communications

- Kansas Gas Service
- Oneok Field Services
- Westar Energy
- Southern Star Central Gas Pipeline

From the utility company's responses, no major improvements were planned at the time the utility study information was being gathered (August 2007). While numerous utilities are located in the corridor and much of the proposed corridor improvements will cause utility relocations; it appears relatively few major conflicts are present. From the information made available to us by the above utility companies, only four major utility conflicts were found and will need to be accommodated for during final design. The four locations and utilities are:

- A 6" fuel oil line owned by Coffeyville Resources located 4' – 5' deep at the intersection of 130th Street and Butler Road crossing Butler Road northwest to southeast.
- A 12" gas line owned by Kansas Gas Service located approximately one-half mile south of 140th Street crossing Butler Road northeast to southwest.
- An 8" gas line owned by Southern Star Central Gas Pipeline located approximately one-half mile south of 150th Street crossing Butler Road northwest to southeast.
- An overhead power transmission line owned by Westar located approximately one-half mile south of 160th Street crossing Butler Road east and west.

At this time, it is recommended to attempt to address these utilities during final design without relocation but rather accommodation in the design process to allow them to remain in place.

8.3 Traffic Operation Assessment

An assessment of traffic operations was made for three separate scenarios. These scenarios allowed for comparison of the before and after impacts of the proposed development in the area and include:

- Existing conditions.
- Existing conditions with proposed 2030 traffic volume.
- Proposed 2030 improvement conditions.

The study intersections were evaluated based on the methodologies outlined in the Highway Capacity Manual, 2000 Edition, published by the Transportation Research Board. The operating conditions at an intersection are rated by the "level of service" experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from A to F. LOS A represents the most desirable condition with free-flow movement of traffic with minimal delays. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. Table 1 shows the upper limit of delay associated with each level of service for signalized and unsignalized intersections.

Table 1
Intersection Level of Service Delay Thresholds

Level of Service (LOS)	Signalized	Unsignalized
A	< 10 seconds	< 10 seconds
B	< 20 seconds	< 15 seconds
C	< 35 seconds	< 25 seconds
D	< 55 seconds	< 35 seconds
E	< 80 seconds	< 50 seconds
F	≥ 80 seconds	≥ 50 seconds

The LOS rating deemed acceptable varies by community, facility type and traffic control device. A LOS D is the desirable goal for movements at unsignalized intersections that must yield to other movements; however, a LOS E or F is often accepted for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection or the location is deemed undesirable for signalization for other reasons. Other reasons may include the close proximity of an existing traffic signal or the presence of a convenient alternative path. For signalized intersections, level of service and average delay relate to all vehicles using the intersection. Generally, most cities in Kansas consider LOS D as the minimum desirable standard for a signalized intersection. At unsignalized intersections LOS E and above is often considered a desirable standard. All study intersections were evaluated using the Synchro analysis software package based on Highway Capacity Manual methods.

8.3.1 Existing Conditions

The results for the intersection analyses of existing development conditions in the weekday A.M. and P.M. peak hour are summarized in Table 2. The study intersections were analyzed using the existing lane configurations, existing traffic volumes and traffic controls. Appendix B contains the analysis output files from Synchro.

Table 2
Intersection Level of Service
Existing Development Conditions

Intersection	*Approach/Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS	Delay (s)	LOS	Delay (s)
Kellogg and Butler Road	Signalized (all movements)	C	33.4	C	32.9
110th Street and Butler Road	Eastbound (all movements)	C	19.3	F	52.0
	Westbound (all movements)	B	13.9	C	16.7
Tuscany Street and Butler Road	Eastbound (left)	B	10.9	B	14.7
	Eastbound (right)	A	0.1	A	0.1
120th Street and Butler Road	Eastbound (all movements)	C	17.3	D	34.4
	Westbound (all movements)	C	16.2	C	17.4
123rd Terrace and Butler Road	Eastbound (all movements)	B	11.1	B	13.6
Flint Hills Parkway and Butler Road	Westbound (all movements)	B	11.4	B	13.8
130th Street and Butler Road	Eastbound (all movements)	B	13.3	B	14.5
	Westbound (all movements)	B	12.6	B	12.2
140th Street and Butler Road	Eastbound (all movements)	B	13.1	C	17.0
	Westbound (all movements)	B	11.9	C	15.8
146th Street and Butler Road	Westbound (all movements)	B	11.9	B	11.8
150th Street and Butler Road	Eastbound (left turn)	F	>100	D	29.2
	Eastbound (thru, right turn)	C	16.6	D	33.0
	Westbound (left turn)	D	28.8	F	71.6
	Westbound (thru, right turn)	E	46.5	C	16.9
	Northbound (left turn)	A	8.0	A	8.4
	Southbound (left turn)	A	8.0	A	7.8
Sienna Street and Butler Road	Eastbound (all movements)	B	12.7	B	14.9

Table 2 – Continued Intersection Level of Service Existing Development Conditions					
160th Street and Butler Road	Eastbound (all movements) Westbound (all movements)	B B	13.2 13.9	C C	15.8 15.9
Fox Brier Road and Butler Road	Westbound (all movements)	B	12.9	C	21.7
Osage Street and Butler Road	Westbound (all movements)	B	12.3	C	17.4
Rosewood Street and Butler Road	Signalized (all movements)	A	8.5	A	7.5

LOS – Level of Service
Delay – Delay in seconds per vehicle
*Additional available movements at the intersection but not shown in the chart have delays less than one second and are not shown for clarity.

The overall results indicate that the study intersections currently operate at acceptable levels of service with the exception of the intersections of 110th Street, 120th Street and 150th Street which are experiencing near the highest level of acceptable user delay.

8.3.2 Identification of Current Deficiencies

Due to the current level of service at the intersections of 110th Street, 120th and 150th Street with Butler Road, interim improvements such as a traffic signal using the existing lane configurations might make sense at these locations. Since the data needed for a complete traffic signal warrant analysis is not available as part of this study, only the peak hour warrant was considered at these locations. The following results were obtained using the existing road volumes and lane configurations:

- The intersection of 110th and Butler Road does currently meet the peak hour warrant for a signal.
- The intersection of 120th and Butler Road does currently meet the peak hour warrant for a signal.
- The intersection of 150th and Butler Road does currently meet the peak hour warrant for a signal.

Prior to signal implementation at any of these intersections a complete warrant analysis and engineering study should be completed to ensure that signalization is the <u>best</u> solution for these intersections and/or if additional geometric improvements might be appropriate.

8.3.3 Traffic Volume Projections

Understanding what the eventual development makeup of the adjacent land is the key in determining the nature of the street system necessary to support the future development in a manner consistent with the goals of the community. The land use plan section previously discussed the different uses of the land in the study area but in order to project the street network necessary to complement the future development, certain assumptions as to the intensities of development on specific properties need to made. The future traffic volumes and travel patterns are then determined by means of a traffic model and through an iterative process the specific configuration of streets and intersections that will serve the area when all the assumed development has occurred is determined.

Although the current WAMPO model includes the City of Andover, the City of Rose Hill does not currently fall within the planning boundaries of WAMPO. Thus, the current WAMPO model was extended to include all of the study area. The corridor was then divided into Traffic Analysis Zones (TAZ's) and assuming relevant intensities for the applicable land uses determined previously, a projected 2030 daily traffic volume was formulated for the major intersections along Butler Road. Directional distributions as well as adjustments for peak hours were applied to ultimately determine the future peak hour turning movements at the major intersections of Butler Road.

8.3.4 Existing Conditions with Proposed 2030 Traffic Volume

The projected volumes were analyzed using the existing geometry in the Synchro analysis and simulation software for the 2030 peak hour conditions and are summarized in Table 3. Minor roadway networks are not shown for clarity. Appendix B contains the output files from Synchro.

Table 3
Intersection Level of Service
Existing Plus Proposed Corridor
Development Conditions

Intersection	*Approach/Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS	Delay (s)	LOS	Delay (s)
Kellogg and Butler Road	Signalized (all movements)	F	>100	F	>100
110th Street and Butler Road	Eastbound (all movements)	F	>100	F	>100
	Westbound (all movements)	F	>100	F	>100
	Northbound (left turn)	A	4.3	F	>100
	Southbound (left turn)	F	51.0	F	69.7
120th Street and Butler Road	Eastbound (all movements)	F	>100	F	>100
	Westbound (all movements)	F	>100	F	>100
	Northbound (left turn)	A	3.6	C	18.4
	Southbound (left turn)	A	6.6	C	21.0
130th Street and Butler Road	Eastbound (all movements)	F	>100	F	>100
	Westbound (all movements)	F	>100	F	>100
	Northbound (left turn)	A	2.9	B	11.0
	Southbound (left turn)	A	3.2	A	9.9
140th Street and Butler Road	Eastbound (all movements)	F	>100	F	>100
	Westbound (all movements)	F	>100	F	>100
	Northbound (left turn)	A	2.6	B	10.1
	Southbound (left turn)	A	3.2	A	8.4
150th Street and Butler Road	Eastbound (left turn)	F	>100	F	>100
	Eastbound (thru, right turn)	F	>100	F	>100
	Westbound (left turn)	F	>100	F	>100
	Westbound (thru, right turn)	F	>100	F	>100
	Northbound (left turn)	B	10.1	B	10
	Southbound (left turn)	A	8.9	A	9.4
160th Street and Butler Road	Eastbound (all movements)	F	>100	F	>100
	Westbound (all movements)	F	>100	F	>100
	Northbound (left turn)	A	2.6	A	4.1
	Southbound (left turn)	A	3.2	A	3.7
Rosewood Street and Butler Road	Signalized (all movements)	C	27.1	C	21.9

LOS – Level of Service
Delay – Delay in seconds per vehicle

*Additional available movements at the intersection but not shown in the chart have delays less than one second and are not shown for clarity.

The low LOS values for most of the intersections indicate that the corridor growth will outpace capacity of the existing roadway with the exception of Rosewood Street, which is at LOS C.

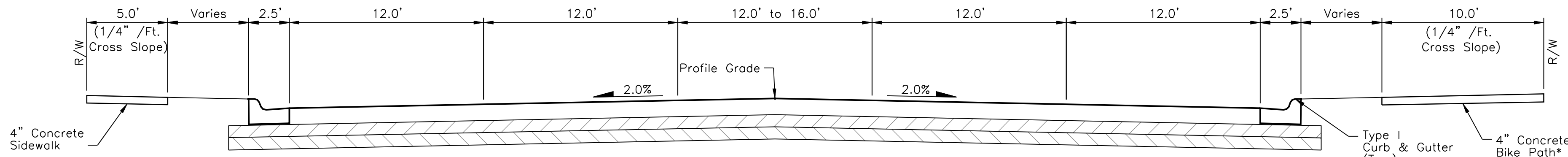
8.3.5 Typical Sections

After the traffic volume projections as well as the existing conditions plus 2030 development traffic scenario were completed, it became apparent that due to the traffic volumes projected for the corridor, an urban typical section appeared to become the more appropriate vision for the corridor. Once the urban typical section was approved by the steering committee, typical sections for Butler Road were developed which account for current and future access management (the Butler Road access Management plan is located in Appendix E) as well as the current and future makeup of the surrounding development. Figure 2 illustrates the typical sections for the different areas of Butler Road.

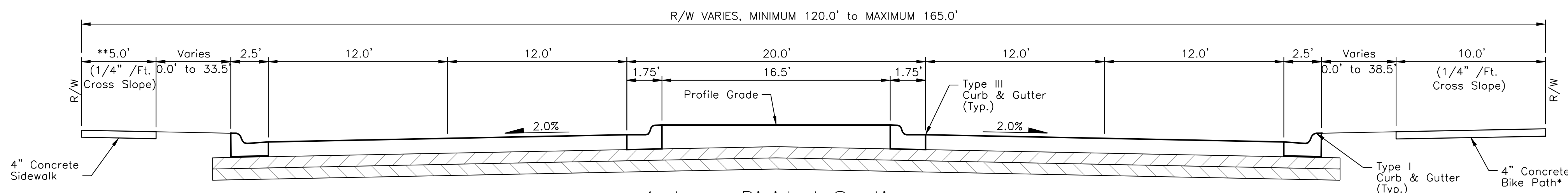
8.3.6 Proposed 2030 Improvement Conditions

The projected volumes were analyzed using the existing geometry for the 2030 peak hour conditions. As deficiencies were identified, improvements were considered and evaluated to achieve acceptable levels of service. Table 4 indicates the LOS and delay for the proposed improvements. Minor roadway networks were omitted for clarity. Appendix A depicts the proposed improvements through the corridor. Appendix B contains the output files from Synchro. Based on the results the following lane arrangements are suggested for the corridor:

- From 110th Street (Harry Street) to 150th Street, a 4-lane divided section with two through lanes in each direction and a 20' median. A 45 mph design speed is recommended.
- From 150th Street to Rosewood Street, a 4-lane undivided section with two through lanes in each direction. A 35 mph design speed is recommended.
- 110th Street intersection should be signalized and have 250-foot dual left turn lanes constructed on the north and west legs, 150-foot dual left lanes constructed on the east and south leg. 150-foot right turn lanes should be constructed on the north, west and south legs. A 200-foot right turn lane should be constructed on the east leg. Two through lanes should be provided on the east and west legs.
- 120th Street intersection should be signalized and have 150-foot dual left turn lanes constructed on all legs except the west leg, which should be 200-foot dual left turn lanes. 150-foot right turn lanes should be constructed on the north, west and south legs and a 200-foot right turn lane shall be constructed on the east leg of the intersection. The east and west legs should have two through traffic lanes in each direction.
- The intersections of 130th, 140th and 160th Streets should be signalized have 150-foot left turn lanes added on all legs of the intersection. The north and south legs shall have 150-foot right turn lanes.
- 150th Street should be signalized and have 250-foot left turn lanes on the east and west legs, 200-foot left turn lane on the south leg and 150-foot left turn lanes on the north leg. A single lane roundabout was also analyzed for an alternative at this intersection, but for the 2030 conditions failed. A multi-lane roundabout was then analyzed and should work under the 2030 conditions. The roundabout could initially be constructed as a single-lane roundabout with the ability to widen (internally) at such a time as the volumes require additional capacity.



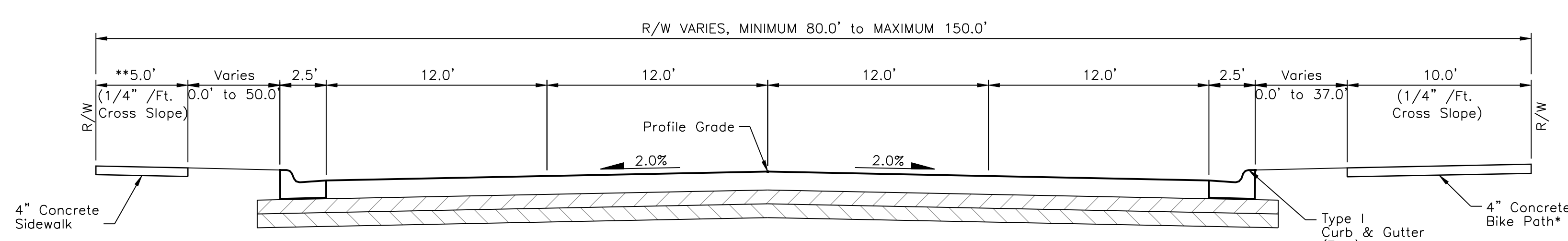
5-Lane Urban Section
110th Street to Kellogg Avenue



4-Lane Divided Section
150th Street to 110th Street

**Alternative: 6.0' Back of Curb Section Can be Used

*In Urban Sections Bike Path May Be Reduced to 8.0' to Facilitate Roadway Signing



4-Lane Urban Section
Rosewood Street to 150th Street

**Alternative: 6.0' Back of Curb Section Can be Used

*In Urban Sections Bike Path May Be Reduced to 8.0' to Facilitate Roadway Signing

Figure 2

December 10, 2008

No Scale

Butler Road Corridor Study
Butler County, Kansas

PROPOSED TYPICAL SECTIONS

TranSystems

Table 4 Intersection Level of Service Proposed Improvements 2030 Corridor Development Conditions					
Intersection	*Approach/Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS	Delay (s)	LOS	Delay (s)
Kellogg and Butler Road	Signalized (all movements)	F	121.4	F	124.9
110th Street and Butler Road	Signalized (all movements)	C	31.4	D	54.7
120th Street and Butler Road	Signalized (all movements)	C	21.9	E	60.7
130th Street and Butler Road	Signalized (all movements)	B	15.2	B	17.5
140th Street and Butler Road	Signalized (all movements)	C	15.2	C	20.8
150th Street and Butler Road	Signalized (all movements)	C	32.7	C	31.2
160th Street and Butler Road	Signalized (all movements)	B	15.0	B	15.7
Rosewood Street and Butler Road	Signalized (all movements)	B	19.3	B	19.6

LOS – Level of Service
Delay – Delay in seconds per vehicle
*Additional available movements at the intersection but not shown in the chart have delays less than one second and are not shown for clarity.

9.0 Corridor Improvement Program (110th Street – Rosewood Street)

Because of the scope and costs of the corridor improvements necessary to maintain reasonable levels of service along the corridor, an improvement program phasing construction for the next 20 years in addition to project costs associated with the improvements was completed and is shown in Table 5. The program was formulated by weighing capacity improvement needs with the associated project costs and a logical construction order.

Table 5 Corridor Improvement Program						
Rose Hill CIP	Year	Cost	Contingency	Engineering and Construction Administration	Total	Total with 4.5% Inflation Factor
190th Street - School Street	0-5	$3,300,000	$660,000	$990,000	$4,950,000	$5,986,007
Drainage Project (Harris Drive)	6-10	$1,212,000	$242,400	$363,600	$1,818,000	$2,740,329
Silknitter Street–Rosewood Street	11-15	$5,200,000	$1,040,000	$1,560,000	$7,800,000	$14,648,379
School Street – Silknitter Street	16-20	$1,226,914	$245,383	$368,074	$1,840,371	$4,307,748
	Subtotal =	$10,938,914			$16,408,371	$27,682,463
Butler Road CIP						
150th Intersection	0-5	$2,216,248	$443,250	$664,874	$3,324,372	$4,017,196

Table 5 – Continued Corridor Improvement Program						
120th Intersection	0-5	$3,964,400	$792,880	$1,189,320	$5,946,600	$7,190,525
4-Mile Creek Bridge	0-5	$3,419,591	$683,918	$1,025,877	$5,129,387	$6,206,119
140th Intersection	6-10	$2,722,080	$544,416	$816,624	$4,083,120	$6,151,601
160th Intersection	6-10	$1,698,120	$339,624	$509,436	$2,547,180	$3,842,852
120th - 110th	6-10	$3,522,380	$704,476	$1,056,714	$5,283,570	$7,960,005
130th Intersection	11-15	$2,849,280	$569,856	$854,784	$4,273,920	$7,858,014
130th - 120th	11-15	$3,704,700	$740,940	$1,111,410	$5,557,050	$11,767,351
140th - 130th	11-15	$3,861,930	$772,386	$1,158,579	$5,792,895	$10,884,966
150th - 140th	11-15	$4,076,420	$815,284	$1,222,926	$6,114,630	$11,489,556
8-Mile Creek Box	16-20	$1,186,720	$237,344	$356,016	$1,780,080	$4,163,324
Rosewood-8 Mile Creek Box	16-20	$3,074,000	$614,800	$922,200	$4,611,000	$10,781,921
8- Mile Creek Box -150th	16-20	$3,463,232	$692,646	$1,038,970	$5,194,848	$12,160,452
	Subtotal =	$39,759,101			$59,638,652	$104,473,882
	Grand Total =	$50,698,015			$76,047,023	$132,156,345

10.0 Funding Opportunities (110th Street – Rosewood Street)

Due to the nature of the costs associated with the corridor improvements, financing alternatives are key to the implementation strategy. A variety of funding sources are available and due to the size and nature of the corridor improvements, it is recommended that a combination of different funding mechanisms be used depending on the improvement type and potential revenue generation associated with each project. In general, the funding sources are as follows:

1. General Obligation Bonds Payable City at Large – Andover and Rose Hill have the authority to declare that streets within each City's jurisdiction, such as the roadway in question are main trafficways under K.S.A. 12-685. Once a street is declared a main trafficway, cities can make improvements to the street and can issue general obligation bonds payable city at large to pay for such improvements. Counties can issue general obligation bonds to pay for proposed improvements by adopting a charter ordinance that opts out from underneath K.S.A. 68-580 *et seq.* (the Arterial Highway Act) which is a non-uniform law.
2. Sales Tax – Cities and counties are authorized by K.S.A. 12-195b to issue general obligation bonds or sales tax revenue bonds that are payable from sales tax revenues to pay for a portion of or all of the cost for public improvements which a city or a county issuing the bonds is otherwise authorized to do pursuant to law. Sales tax bonds could be used to finance the proposed roadway since the cities and counties are authorized to construct and reconstruct the roadway and are authorized to issue General obligations at large bonds to pay for such improvements. (*See* K.S.A. 12-187 *et seq.*)
3. Impact Fees – A part of the cost of constructing the improvements to the roadway could be paid with impact fees that would be assessed to properties determined to be within the roadway corridor area for the proposed roadway. The payment of impact fees would be required at times that owners and developers of property in the roadway corridor area seek building permits and/or plat approval. It would be necessary to conduct a study to justify the creation of an impact district and to establish appropriate fees. Cities and counties have authority to create impact fees under home rule authority. *See McCarthy v. City of Leawood*, 257 Kan. 556, 894 P.2d 836 (1995).

4. Special Assessments – The cost of improving the roadway could be paid in whole or in part by special assessment bonds. Cities have authority to issue special assessment general obligation bonds under authority of the general improvement and assessment law (K.S.A. 12-6a01 *et seq.*). Under this law, cities may issue general obligation bonds payable city at large up to 95% of the total cost of a project. In other words, under the authority of the general improvement and assessment law, cities may pay the cost of a road improvement with special assessments up to 100% and part of the costs from city at large funds up to 95%. Counties have authority under home rule powers to improve roadways with special assessment general obligation financing. Special assessment could be used to finance costs related to construction that is done to benefit a particular area.
5. Special Assessment with Deferral – Cities are authorized to delay the imposition of special assessments under K.S.A. 12-6,110 *et seq.* if the area to be assessed is undeveloped. Undeveloped means the area is in excess of two and a half acres, has not been platted, is used for agricultural purposes and has a population density of less than one family per acre. Counties and cities also have authority to delay imposition under their home rule powers. Cities operating under home rule authority cannot enact an ordinance that would conflict with K.S.A. 12-1,110 *et seq.*
6. Stormwater Utility Fees – Cities and counties using home rule authority have the authority to create citywide and countywide stormwater utilities. The fees produced from the stormwater utility could be used to finance a portion of the cost of the roadway that would be attributable to drainage of stormwater.
7. Self-Improvement Districts – Cities are authorized to create self-improvement districts. Within a self-improvement district, taxes can be assessed for public improvements. At the current time, such districts are limited to central business districts. Some thought might be given to seeking legislation to amend the self-supported improvement district act (K.S.A. 12-1794 *et seq.*) to include roadway corridors such as the proposed roadway and to include joint participants such as more than one city and a county. Under the self-supported improvement district act as it currently is written, cities can issue general obligation bonds to pay for street grading, paving, graveling, curbing, guttering and servicing. The advantage of a self-improvement district is that taxes to pay bonds would be general taxes as opposed to special taxes; i.e., it would not be necessary to establish that property being taxed received a direct benefit before a tax is assessed.
8. Combination – A combination of funding sources suggested above.
9. Inter-local Agreements – The two cities and Butler County will need to enter into an inter-local cooperation agreement with one another that addresses the construction and funding of the roadway project. Under an inter-local cooperation agreement any or all of the above funding sources for payment of improvements could be utilized. Again, legislation would need to be enacted to provide authority to implement a self-improvement district inter-local agreement.
10. Cash – Local government has at its option the use of cash from tax revenues under expenditures or cash reserves. The advantage of using cash is that it is a onetime expense and no debt is incurred and thus no long term commitment to paying for an infrastructure project over an extended period of time. The disadvantage of cash is the availability of cash that is not already earmarked for other expenditures.

Grant opportunities exist through several sources; local planning organizations, state grants and federal earmarks. Listed in the next few paragraphs are the potential grant opportunities and a brief description of the type of projects they will fund:

1. STP/CMAQ funding through WAMPO - Surface Transportation and Congestion Mitigation funding grants are available through the Wichita Area Metropolitan Planning Organization (WAMPO). These funds come from the Federal Highway Administration (FHWA), administered through the Kansas Department of Transportation's (KDOT's) Bureau of Local Projects. The City of Andover is a member of WAMPO and could apply for funding through their Transportation Improvement Plan application process. The portion of the roadway improvements for the Butler Road project that lie inside the planning limits of the City of Andover would be eligible for grant funds through the WAMPO. The grant would pay 80% of the construction costs with the remaining 20% being picked by local government.
2. STP funding through KDOT for Counties - This is a grant program for counties administered through Local Projects at KDOT and has an 80/20 funding split.

3. Bridge Rehab/Replacement funding through KDOT - Funding grants through Local Projects in KDOT can be applied for rehabilitating or replacing bridges that meet certain criteria. The grant is an 80/20 funding split. This program is available for both cities and counties.
4. STP-Safety-City/County - This grant program was formerly called Hazard Elimination Program. The program focuses on creating safer intersections and increasing intersection capacity. The County program is a 90/10 funding split and depending on the size of the city, it is either an 80/20 or a 90/10 funding split. The funds come from the FHWA and are administered by KDOT's Local Projects.
5. STP-Transportation Enhancements (TE) - This grant program is for both cities and counties. It is FHWA funds with an 80/20 funding split. The program provides funds for projects that enhance the environment, trails or historic projects. The program is administered through Program management at KDOT. The City of Andover is also eligible to apply to TE funds through WAMPO. The Butler Road project is planning for a bike path so TE funds could be used for constructing the path adjacent to the paving project.
6. Economic Development (ED) - This grant program is KDOT funds and is distributed based on a KDOT formula for funding splits. It is administered by Program Management and Local Projects at KDOT. The program is available for both city and county government. Currently this program has been suspended due to lack of funds.
7. Demonstration Projects - This grant program is FHWA funded and is provided by the U.S. Congress through special legislation that earmarks funds specifically for certain projects. The projects would be administered through KDOT. The funding splits vary from project to project. These types of projects require local and state political support and the willingness of Kansas Congressmen and Senators to sponsor such legislation at the national level.

While each category of grant opportunities listed above has limited funds, they do provide alternative sources of funding that can be used to offset local participation funds for the Butler Road project. If isolated, projects on Butler Road are chosen by KDOT or WAMPO the scheduling of such improvements may need to be altered to meet funding budget years. The grant information listed above can be found on KDOT's web site.

11.0 Hydraulic Analysis (Rosewood Street -190th Street)

11.1 Introduction

In addition to the creek crossing analysis described previously, a planning level of analysis was done on the Harris Drive ditch in Rose Hill to determine the cost of enclosing the concrete lined ditch adjacent to Butler Road. Although the methods and information used were appropriate for a planning-level assessment of the ditch, higher orders of analytical accuracy will be necessary to support final design. The following modeling results produced required structure sizes that are preliminary in nature only and should be adjusted as more detailed survey information is obtained and detailed design is undertaken.

The ditch was modeled using HEC-RAS software developed by the US Army Corps of Engineers to determine the current capacity of the ditch section. Information within the models was taken from multiple sources including survey and existing roadway plan information provided by Butler County and United State Geological Service (USGS) mapping. Since overtopping of the ditch has occurred in the past the structure was preliminarily sized to match the existing flow plus a 50% increase.

11.2 Harris Drive Ditch – Rose Hill

The Harris Drive ditch is adjacent to both Butler Road and Harris Drive in the City of Rose Hill and in general is located between Ridgway Drive and Berlin Drive. The Harris Drive ditch is concrete lined and in general runs from south to north. According to local residents the ditch has overtopped in the past so capacity improvements, unless cost prohibitive, should be implemented to increase flood protection in the area.

The existing open channel has an approximate capacity of 265 cubic feet per second (cfs) before overtopping occurs. For planning purposes, it was determined to increase the existing channel capacity by 50% to allow for a greater level of flood protection. A design flow of 400 cfs was used to size the replacement system. Due to the geometric constraints on depth, a single 10' x 3' box was chosen to enclose the ditch flow.

12.0 Environmental Findings (Rosewood Street -190th Street)

12.1 Introduction

A limited environmental review was performed to determine any significant environmental factors that could be detrimental to proposed improvements. The preliminary environmental review of the site involved:

1. The identification and inventory of potential contaminated sites affected by improvements to Butler Road.
2. The identification and inventory of jurisdictional watercourses and wetlands along the corridor that could be affected by roadway improvements requiring a U.S. Army Corps of Engineers 404 permit application.

In addition to TranSystems environmental analysis, a more detailed supplemental environmental analysis was performed by the Kansas Department of Transportation after the concept development stage and is included in Appendix F.

12.2 Environmental Findings

12.2.1 Hazardous Waste/Storage Tanks

Five potential hazardous waste sites were identified along this section of Butler Road Corridor. They are as follows:

- A former gas station located in the southeast quadrant of Butler Road and Berry Street in Rose Hill. No underground storage tanks were identified at the site.

- An auto repair shop located in the southeast quadrant of Butler Road and Yeager Street in Rose Hill that appears to have once been a gas station. No underground storage tanks were identified at the site.
- An auto repair shop located in the NW quadrant of Butler Road and the BNSF railroad in Rose Hill that appears to have once been a gas station. No underground storage tanks were identified at the site.
- An active Cenax Gas station located in the southeast quadrant of Butler Road and Rosewood Street in Rose Hill which has two underground storage tanks on the site as well as groundwater monitoring wells.
- A former gas station located in the southwest quadrant of Butler Road and Rosewood Street in Rose Hill which has underground storage tanks on the site.

12.2.2 Wetlands Delineation

Our wetlands assessment was based on visual assessment and was not substantiated by National Wetland Inventory maps. Based on the visual assessment of the corridor, no wetlands were observed within the right-of-way.

12.2.3 Jurisdictional Watercourses

Jurisdictional ephemeral drainages, intermittent streams and perennial streams were identified as part of the project. The following watercourses were identified:

- Ephemeral drainage south of Rosewood Street – 2-3 feet wide concrete lined ephemeral drainage flowing into an elliptical CMP culvert under Butler Road.
- Ephemeral drainage north of 190th Street near the Rose Hill High School – 1-2 feet wide ephemeral drainage flowing to a CMP culvert under Butler Road.

Since the Butler Road study began, some uncertainty in United State Army Corps of Engineers (USACE) permitting has come up. This stems from guidance released in June of 2007 requiring Environmental Protection Agency (EPA) concurrence with USACE determinations on jurisdiction. Since the new guidance has been released EPA has not opposed USACE jurisdictional determinations. Consequently, the USACE has continued to operate under their interpretation of the guidance; if the EPA were to decide to issue some form of a decision on jurisdictional watercourses then the USACE interpretation of the guidance may change. If the USACE continues to permit as they have since the new guidance came out, the project should qualify for a nationwide permit. Each crossing would be permitted separately (i.e. no cumulative impacts resulting in an individual permit). The ephemeral drainages identified may or may not be taken as jurisdictional watercourses.

13.0 Corridor Analysis (Rosewood Street -190th Street)

13.1 Introduction

To assess the impact of the proposed corridor development on Butler Road, traffic counts were conducted by Butler County at various locations in the study area along Butler Road. It included manual counts of the existing traffic at the intersections of:

170th Street (Rosewood Street)	Waitt Street*
Young Street*	Silknitter Street

*Sample counts of 15 to 30 minutes were taken and adjusted to reflect full hour volumes

To supplement the manual peak hour counts, machine counts were also conducted by Butler County at other locations along Butler Road.

13.2 Utility Coordination

Contact was made with known utility companies in the corridor to collect information on existing facilities and identify future expansion plans that might influence development patterns in the area. The following utilities were contacted as part of the project:

- AT&T
- Butler County REC
- Butler County RWD #8
- Sedgwick County RWD #3
- City of Andover – Wastewater Department
- City of Andover – Stormwater Management
- City of Augusta – Water Department
- City of Augusta – Wastewater Department
- City of Rose Hill – Public Works Department
- City of Wichita – Water Utilities
- Coffeyville Resources
- Cox Communications
- Kansas Gas Service
- Oneok Field Services
- Westar Energy
- Southern Star Central Gas Pipeline

From the utility company's responses, no major improvements were planned at the time the utility study information was being gathered (August 2007). While numerous utilities are located in the corridor and much of the proposed corridor improvements will cause utility relocations, it appears no major conflicts are present.

13.3 Traffic Operation Assessment

An assessment of traffic operations was made for three separate scenarios. These scenarios allowed for comparison of the before and after impacts of the proposed development in the area and include:

- Existing conditions.
- Existing conditions with proposed 2030 traffic volume.
- Proposed 2030 improvement conditions.

The study intersections were evaluated based on the methodologies outlined in the Highway Capacity Manual, 2000 Edition, published by the Transportation Research Board. The operating conditions at an intersection are rated by the "level of service" experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from A to F. LOS A represents the most desirable condition with free-flow movement of traffic with minimal delays. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. Table 6 shows the upper limit of delay associated with each level of service for signalized and unsignalized intersections.

Table 6 Intersection Level of Service Delay Thresholds		
Level of Service (LOS)	Signalized	Unsignalized
A	< 10 seconds	< 10 seconds
B	< 20 seconds	< 15 seconds
C	< 35 seconds	< 25 seconds
D	< 55 seconds	< 35 seconds
E	< 80 seconds	< 50 seconds
F	≥ 80 seconds	≥ 50 seconds

The LOS rating deemed acceptable varies by community, facility type and traffic control device. A LOS D is the desirable goal for movements at unsignalized intersections that must yield to other movements; however, a LOS E or F is often accepted for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection or the location is deemed undesirable for signalization for other reasons. Other reasons may include the close proximity of an existing traffic signal or the presence of a convenient alternative path. For signalized intersections, level of service and average delay relate to all vehicles using the intersection. Generally, most cities in Kansas consider LOS D as the minimum desirable standard for a signalized intersection. At unsignalized intersections, LOS E and above is often considered a desirable standard. All study intersections were evaluated using the Synchro analysis software package based on Highway Capacity Manual methods.

13.3.1 Existing Conditions

The results for the intersection analyses of existing development conditions in the weekday A.M. and P.M. peak hour are summarized in Table 7. The study intersections were analyzed using the existing lane configurations, existing traffic volumes and traffic controls. Appendix B contains the analysis output files from Synchro.

Table 7 Intersection Level of Service Existing Development Conditions					
		A.M. Peak Hour		P.M. Peak Hour	
Intersection	*Approach/Movement	LOS	Delay (s)	LOS	Delay (s)
Rosewood Street and Butler Road	Signalized (all movements)	A	8.5	A	7.5
Young Street and Butler Road	Eastbound (all movements) Westbound (all movements)	B B	14.7 12.7	C C	16.8 24.4
Waitt Street and Butler Road	Eastbound (all movements) Westbound (all movements)	B B	14.8 12.7	C C	17.5 17.7
Silknitter Street and Butler Road	Signalized (all movements)	B	12.3	B	13.6
Berry Street and Butler Road	Westbound (all movements)	A	2.3	B	10.5
School Street and Butler Road	Signalized (all movements)	B	13.2	B	11.6
190th Street and Butler Road	Eastbound (all movements) Westbound (all movements)	B A	10.1 9.4	B B	12.0 10.2

LOS – Level of Service
Delay – Delay in seconds per vehicle
*Additional available movements at the intersection but not shown in the chart have delays less than one second and are not shown for clarity.

The overall results indicate that the study intersections currently operate at acceptable levels of service.

13.3.2 Identification of Current Deficiencies

The intersections appear to currently operate within acceptable limits with no interim improvements necessary.

13.3.3 Traffic Volume Projections

Understanding what the eventual development makeup of the adjacent land is the key in determining the nature of the street system necessary to support the future development in a manner consistent with the goals of the community. The land use plan section previously discussed the different uses of the land in the study area but in order to project the street network necessary to complement the future development, certain assumptions as to the intensities of development on specific properties need to made. The future traffic volumes and travel patterns are then determined by means of a traffic model and through an iterative process. The specific configuration of streets and intersections that will serve the area when all the assumed development has occurred is determined.

Although the current WAMPO model includes the City of Andover, the City of Rose Hill does not currently fall within the planning boundaries of WAMPO. Thus, the current WAMPO model was extended to include all of the study area. The corridor was then divided into Traffic Analysis Zones (TAZ's) and assuming relevant intensities for the applicable land uses determined previously, a projected 2030 daily traffic volume was formulated for the major intersections along Butler Road. Directional distributions as well as adjustments for peak hour were applied to ultimately determine the future peak hour turning movements at the major intersections of Butler Road.

13.3.4 Existing Conditions with Proposed 2030 Traffic Volume

The projected volumes were analyzed using the existing geometry in the Synchro analysis and simulation software for the 2030 peak hour conditions and are summarized in Table 8. Minor roadway networks are not shown for clarity. Appendix B contains the output files from Synchro.

Table 8
Intersection Level of Service
Existing Plus Proposed Corridor
Development Conditions

Intersection	*Approach/Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS	Delay (s)	LOS	Delay (s)
Rosewood Street and Butler Road	Signalized (all movements)	C	27.1	C	21.9
Silknitter Street and Butler Road	Signalized (all movements)	D	38.1	D	45.9
School Street and Butler Road	Signalized (all movements)	F	>100	F	>100
190th Street and Butler Road	Eastbound (all movements)	F	>100	F	>100
	Westbound (all movements)	F	>100	F	>100
	Northbound (left turn)	A	3.1	A	3.3
	Southbound (left turn)	A	3.1	A	2.6

LOS – Level of Service
Delay – Delay in seconds per vehicle
*Additional available movements at the intersection but not shown in the chart have delays less than one second and are not shown for clarity.

The low LOS values for most of the intersections indicate that the corridor growth will outpace capacity of the existing roadway with the exception of Rosewood Street and Silknitter Street, which are at LOS D or above.

13.3.5 Typical Sections

After the traffic volume projections, existing conditions plus 2030 development traffic were completed, it became apparent that due to the traffic volumes projected for the corridor, an urban typical section appeared to become the more appropriate vision for the corridor. Once the urban typical section was approved by the steering committee typical sections for Butler Road were developed which account for current and future access management (the Butler Road access management plan is located in Appendix E) as well as the current and future makeup of the surrounding development. Figure 3 illustrates the typical sections for the different areas of Butler Road.

13.3.6 Proposed 2030 Improvement Conditions

The projected volumes were analyzed using the existing geometry for the 2030 peak hour conditions. As deficiencies were identified, improvements were considered and evaluated to achieve acceptable levels of service. Table 9 indicates the LOS and delay for the proposed improvements. Appendix A depicts the proposed improvements through the corridor. Appendix B contains the output files from Synchro. Based on the results the following lane arrangements are suggested for the corridor:

- From Rosewood Street to Silknitter Street, a 4-lane undivided section with two through lanes in each direction. A 35 mph design speed is recommended.
- From Silknitter Street to School Street, a two-lane section with parking is recommended. A 35 mph design speed is recommended.
- From School Street to 190th Street a 3-lane undivided section with one through lane in each direction and one continuous two way left turn lane. A 35 mph design speed is recommended.
- Silknitter should have a left turn lane added on the west leg of the Intersection.
- School Street should be re-aligned and 150 foot left turn lanes provided on all legs of the intersection.
- 190th Street should be signalized and left turn lanes provided on all legs of the intersection.

Table 9
Intersection Level of Service
Proposed Improvements 2030 Corridor
Development Conditions

Intersection	*Approach/Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS	Delay (s)	LOS	Delay (s)
Rosewood Street and Butler Road	Signalized (all movements)	B	19.3	B	19.6
Silknitter Street and Butler Road	Signalized (all movements)	C	24.1	C	30.4
School Street and Butler Road	Signalized (all movements)	C	32.7	C	30.8
190th Street and Butler Road	Eastbound (all movements)	B	14.3	B	16.5

LOS – Level of Service
Delay – Delay in seconds per vehicle
*Additional available movements at the intersection but not shown in the chart have delays less than one second and are not shown for clarity.

14.0 Corridor Improvement Program (Rosewood Street -190th Street)

Because of the scope and costs of the corridor improvements necessary to maintain reasonable levels of service along the corridor, an improvement program phasing construction for the next 20 years in addition to project costs associated

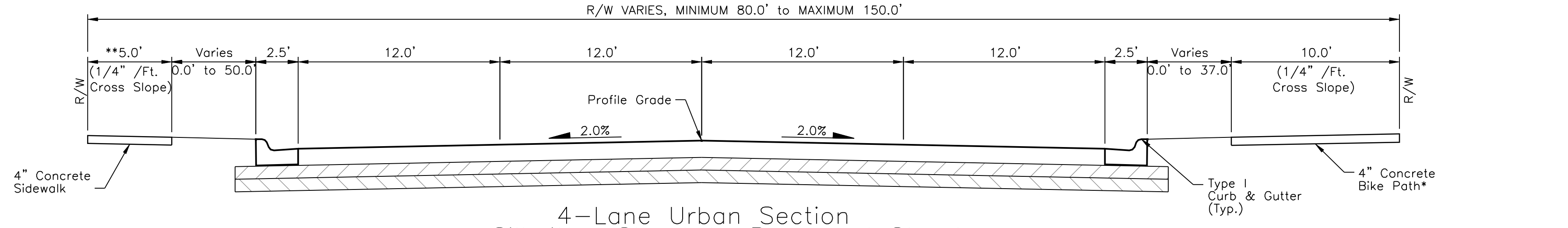
PROPOSED TYPICAL SECTIONS

Butler Road Corridor Study
Butler County, Kansas

December 10, 2008

No Scale

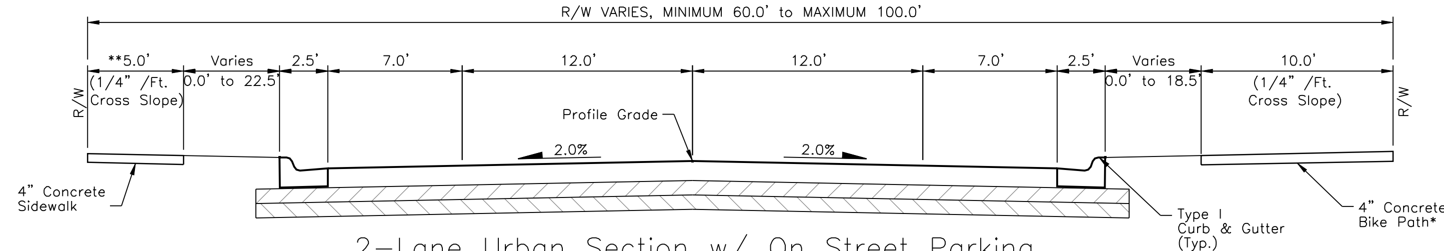
Figure 3



4–Lane Urban Section
Silknitter Street to Rosewood Street

**Alternative: 6.0' Back of Curb Section Can be Used

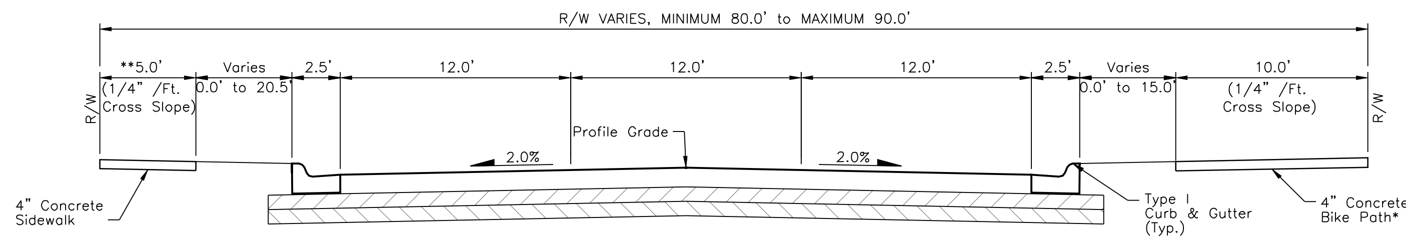
*In Urban Sections Bike Path May Be Reduced to 8.0' to Facilitate Roadway Signing



2–Lane Urban Section w/ On Street Parking
School Street to Silknitter Street

**Alternative: 6.0' Back of Curb Section Can be Used

*In Urban Sections Bike Path May Be Reduced to 8.0' to Facilitate Roadway Signing



3–Lane Urban Section
190th Street to School Street

**Alternative: 6.0' Back of Curb Section Can be Used

*In Urban Sections Bike Path May Be Reduced to 8.0' to Facilitate Roadway Signing

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with the improvements was completed and is shown in Table 10. The program was formulated by weighing capacity improvement needs with the associated project costs and a logical construction order.

Table 5
Corridor Improvement Program

Rose Hill CIP	Year	Cost	Contingency	Engineering and Construction Administration	Total	Total with 4.5% Inflation Factor
190th Street - School Street	0-5	$3,300,000	$660,000	$990,000	$4,950,000	$5,986,007
Drainage Project (Harris Drive)	6-10	$1,212,000	$242,400	$363,600	$1,818,000	$2,740,329
Silknitter Street – Rosewood Street	11-15	$5,200,000	$1,040,000	$1,560,000	$7,800,000	$14,648,379
School Street – Silknitter Street	16-20	$1,226,914	$245,383	$368,074	$1,840,371	$4,307,748
	Subtotal =	$10,938,914			$16,408,371	$27,682,463
Butler Road CIP						
150th Intersection	0-5	$2,216,248	$443,250	$664,874	$3,324,372	$4,017,196
120th Intersection	0-5	$3,964,400	$792,880	$1,189,320	$5,946,600	$7,190,525
4-Mile Creek Bridge	0-5	$3,419,591	$683,918	$1,025,877	$5,129,387	$6,206,119
140th Intersection	6-10	$2,722,080	$544,416	$816,624	$4,083,120	$6,151,601
160th Intersection	6-10	$1,698,120	$339,624	$509,436	$2,547,180	$3,842,852
120th - 110th	6-10	$3,522,380	$704,476	$1,056,714	$5,283,570	$7,960,005
130th Intersection	11-15	$2,849,280	$569,856	$854,784	$4,273,920	$7,858,014
130th - 120th	11-15	$3,704,700	$740,940	$1,111,410	$5,557,050	$11,767,351
140th - 130th	11-15	$3,861,930	$772,386	$1,158,579	$5,792,895	$10,884,966
150th - 140th	11-15	$4,076,420	$815,284	$1,222,926	$6,114,630	$11,489,556
8-Mile Creek Box	16-20	$1,186,720	$237,344	$356,016	$1,780,080	$4,163,324
Rosewood-8 Mile Creek Box	16-20	$3,074,000	$614,800	$922,200	$4,611,000	$10,781,921
8- Mile Creek Box -150th	16-20	$3,463,232	$692,646	$1,038,970	$5,194,848	$12,160,452
	Subtotal =	$39,759,101			$59,638,652	$104,473,882
	Grand Total =	$50,698,015			$76,047,023	$132,156,345

15.0 Funding Opportunities (Rosewood Street -190th Street)

Due to the nature of the costs associated with the corridor improvements financing alternatives are the key to the implementation strategy. A variety of funding sources are available and due to the size and nature of the corridor improvements it is recommended that a combination of different funding mechanisms be used depending on the improvement type and potential revenue generation associated with each project. In general the funding sources are as follows:

1. General Obligation Bonds Payable City at Large - Andover and Rose Hill have the authority to declare that streets within each City's jurisdiction such as the roadway in question are main trafficways under K.S.A. 12-685. Once a street is declared a main trafficway, cities can make improvements to the street and can issue general obligation bonds payable city at large to pay for such improvements. Counties can issue general obligation

bonds to pay for proposed improvements by adopting a charter ordinance that opts out from underneath K.S.A. 68-580 *et seq.* (the Arterial Highway Act) which is a non-uniform law.

2. Sales Tax - Cities and counties are authorized by K.S.A. 12-195b to issue general obligation bonds or sales tax revenue bonds that are payable from sales tax revenues to pay for a portion of or all of the cost for public improvements which a city or a county issuing the bonds is otherwise authorized to do pursuant to law. Sales tax bonds could be used to finance the proposed roadway since the cities and counties are authorized to construct and reconstruct the roadway and are authorized to issue General obligations at large bonds to pay for such improvements. (*See* K.S.A. 12-187 *et seq.*)
3. Impact Fees - A part of the cost of constructing the improvements to the roadway could be paid with impact fees that would be assessed to properties determined to be within the roadway corridor area for the proposed roadway. The payment of impact fees would be required at times that owners and developers of property in the roadway corridor area seek building permits and/or plat approval. It would be necessary to conduct a study to justify the creation of an impact district and to establish appropriate fees. Cities and counties have authority to create impact fees under home rule authority. *See McCarthy v. City of Leawood*, 257 Kan. 556, 894 P.2d 836 (1995).
4. Special Assessments - The cost of improving the roadway could be paid in whole or in part by special assessment bonds. Cities have authority to issue special assessment general obligation bonds under authority of the general improvement and assessment law (K.S.A. 12-6a01 *et seq.*). Under this law, cities may issue general obligation bonds payable city at large up to 95% of the total cost of a project. In other words, under the authority of the general improvement and assessment law, cities may pay the cost of a road improvement with special assessments up to 100% and part of the costs from city at large funds up to 95%. Counties have authority under home rule powers to improve roadways with special assessment general obligation financing. Special assessment could be used to finance costs related to construction that is done to benefit a particular area.
5. Special Assessment with Deferral - Cities are authorized to delay the imposition of special assessments under K.S.A. 12-6,110 *et seq.* if the area to be assessed is undeveloped. Undeveloped means the area is in excess of two and a half acres, has not been platted, is used for agricultural purposes and has a population density of less than one family per acre. Counties and cities also have authority to delay imposition under their home rule powers. Cities operating under home rule authority cannot enact an ordinance that would conflict with K.S.A. 12-1,110 *et seq.*
6. Stormwater Utility Fees - Cities and counties using home rule authority have the authority to create citywide and countywide stormwater utilities. The fees produced from the stormwater utility could be used to finance a portion of the cost of the roadway that would be attributable to drainage of stormwater.
7. Self-Improvement Districts - Cities are authorized to create self-improvement districts. Within a self-improvement district, taxes can be assessed for public improvements. At the current time, such districts are limited to central business districts. Some thought might be given to seeking legislation to amend the self-supported improvement district act (K.S.A. 12-1794 *et seq.*) to include roadway corridors such as the proposed roadway and to include joint participants such as more than one city and a county. Under the self-supported improvement district act as it currently is written, cities can issue general obligation bonds to pay for street grading, paving, graveling, curbing, guttering and servicing. The advantage of a self-improvement district is that taxes to pay bonds would be general taxes as opposed to special taxes; i.e., it would not be necessary to establish that property being taxed received a direct benefit before a tax is assessed.
8. Combination - A combination of funding sources suggested above.
9. Interlocal Agreements - The two cities and Butler County will need to enter into an inter-local cooperation agreement with one another that addresses the construction and funding of the roadway project. Under an interlocal cooperation agreement, any or all of the above funding sources for payment of improvements could be utilized. Again, legislation would need to be enacted to provide authority to implement a self-improvement district inter-local agreement.
10. Cash – Local government has at its option the use of cash from tax revenues, under expenditures, or cash reserves. The advantage of using cash is that it is a onetime expense and no debt is incurred and thus no long term commitment to paying for an infrastructure project over an extended period of time. The disadvantage of cash is the availability of cash that is not already earmarked for other expenditures.

Grant opportunities exist through several sources; local planning organizations, state grants and federal earmarks. Listed in the next few paragraphs are the potential grant opportunities and a brief description of the type of projects they will fund:

1. STP funding through KDOT for Counties - This is a grant program for counties administered through Local Projects at KDOT and has an 80/20 funding split.
2. Bridge Rehab/Replacement funding through KDOT - Funding grants through Local Projects in KDOT can be applied for rehabilitating or replacing bridges that meet certain criteria. The grant is an 80/20 funding split. This program is available for both cities and counties.
3. STP-Safety-City/County - This grant program was formerly called Hazard Elimination Program. The program focuses on creating safer intersections and increasing intersection capacity. The County program is a 90/10 funding split and depending on the size of the city, it is either an 80/20 or a 90/10 funding split. The funds come from the FHWA and are administered by KDOT's Local Projects.
4. STP-Transportation Enhancements (TE) - This grant program is for both cities and counties. It is FHWA funds with an 80/20 funding split. The program provides funds for projects that enhance the environment, trails or historic projects. The program is administered through Program management at KDOT. The City of Andover is also eligible to apply to TE funds through WAMPO. The Butler Road project is planning for a bike path so TE funds could be used for constructing the path adjacent to the paving project.
5. Economic Development (ED) - This grant program is KDOT funds and is distributed based on a KDOT formula for funding splits. It is administered by Program Management and Local projects at KDOT. The program is available for both city and county government. Currently this program has been suspended due to lack of funds.
6. Demonstration Projects - This grant program is FHWA funded and is provided by the U.S. Congress through special legislation that earmarks funds specifically for certain projects. The projects would be administered through KDOT. The funding splits vary from project to project. These types of projects require local and state political support and the willingness of Kansas Congressmen and Senators to sponsor such legislation at the national level.

While each category of grant opportunities listed above has limited funds, they do provide alternative sources of funding that can be used to offset local participation funds for the Butler Road project. If isolated projects on Butler Road are chosen by KDOT or WAMPO the scheduling of such improvements may need to be altered to meet funding budget years. The grant information listed above can be found on KDOT's web site.

16.0 Appendix A - Figures

0 300 600 900

SCALE FEET

1" = 300'

NORTH

A - 1

12/9/2008

1" = 300'

Butler Road Corridor Study

Butler County, Kansas

PROPOSED

2030 CORRIDOR IMPROVEMNETS

TranSystems

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SCALE FEET

1" = 300'

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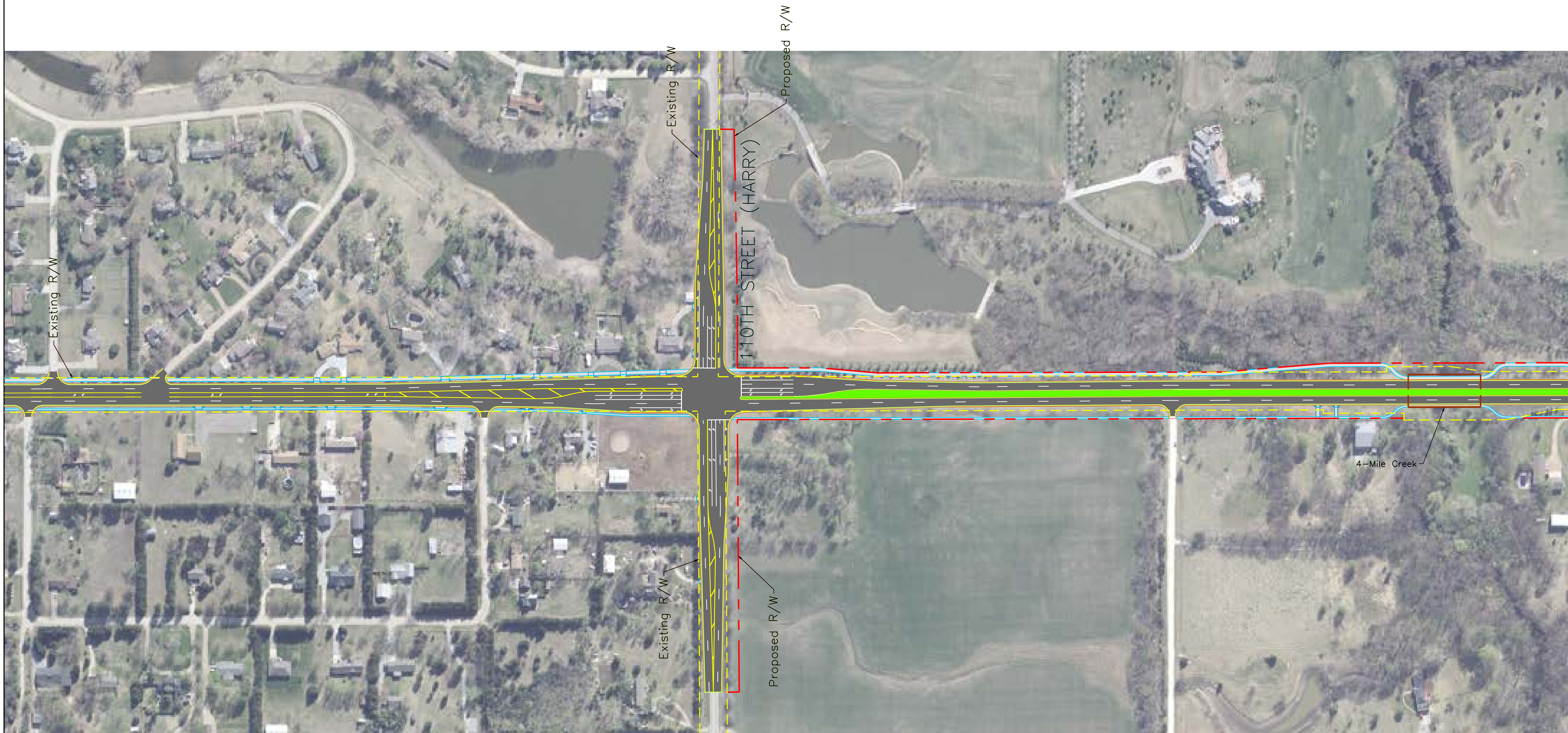

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12/9/2008

1" = 300'

Butler Road Corridor Study
Butler County, Kansas

PROPOSED
2030 CORRIDOR IMPROVEMENTS

TranSystems

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SCALE FEET

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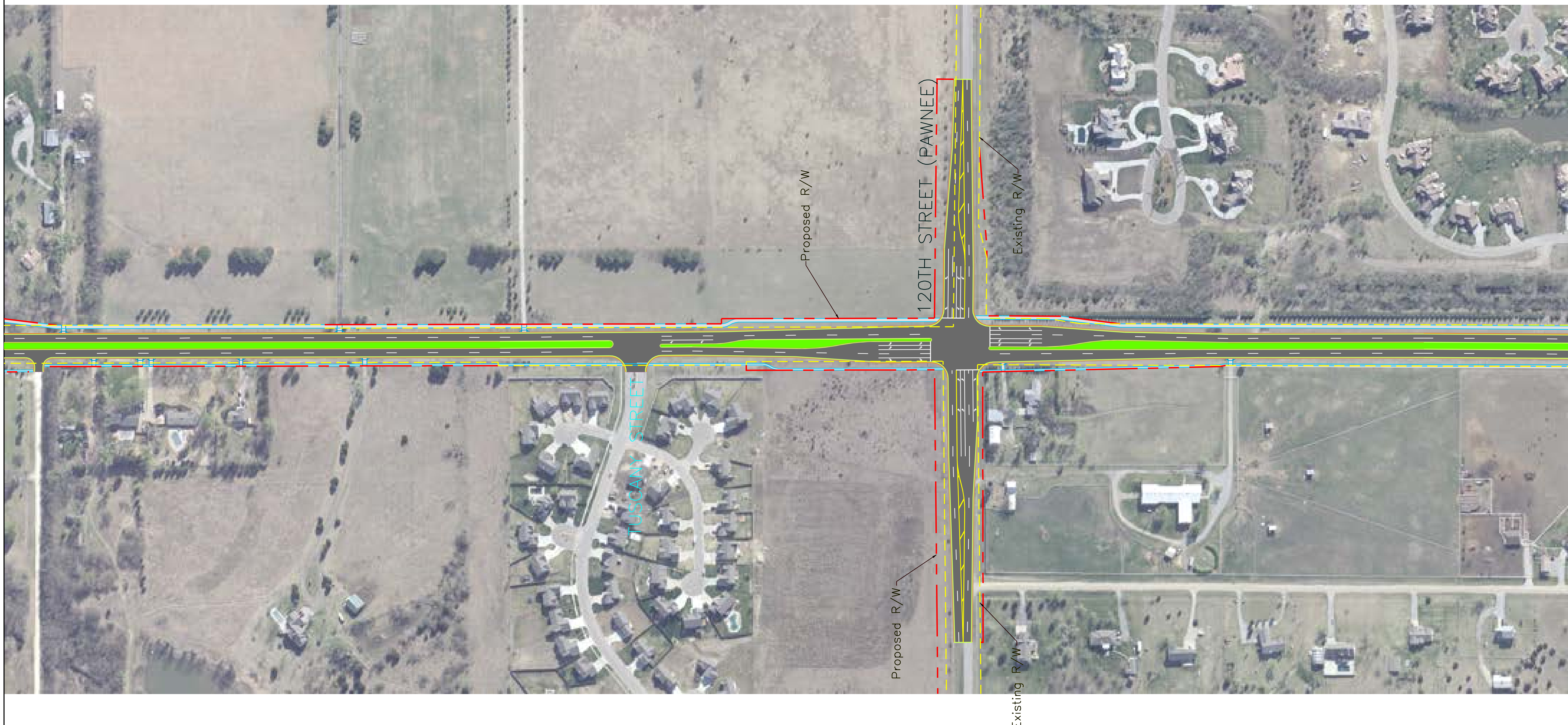

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1" = 300'

Butler Road Corridor Study
Butler County, Kansas

PROPOSED 2030 CORRIDOR IMPROVEMENTS

TranSystems

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SCALE FEET
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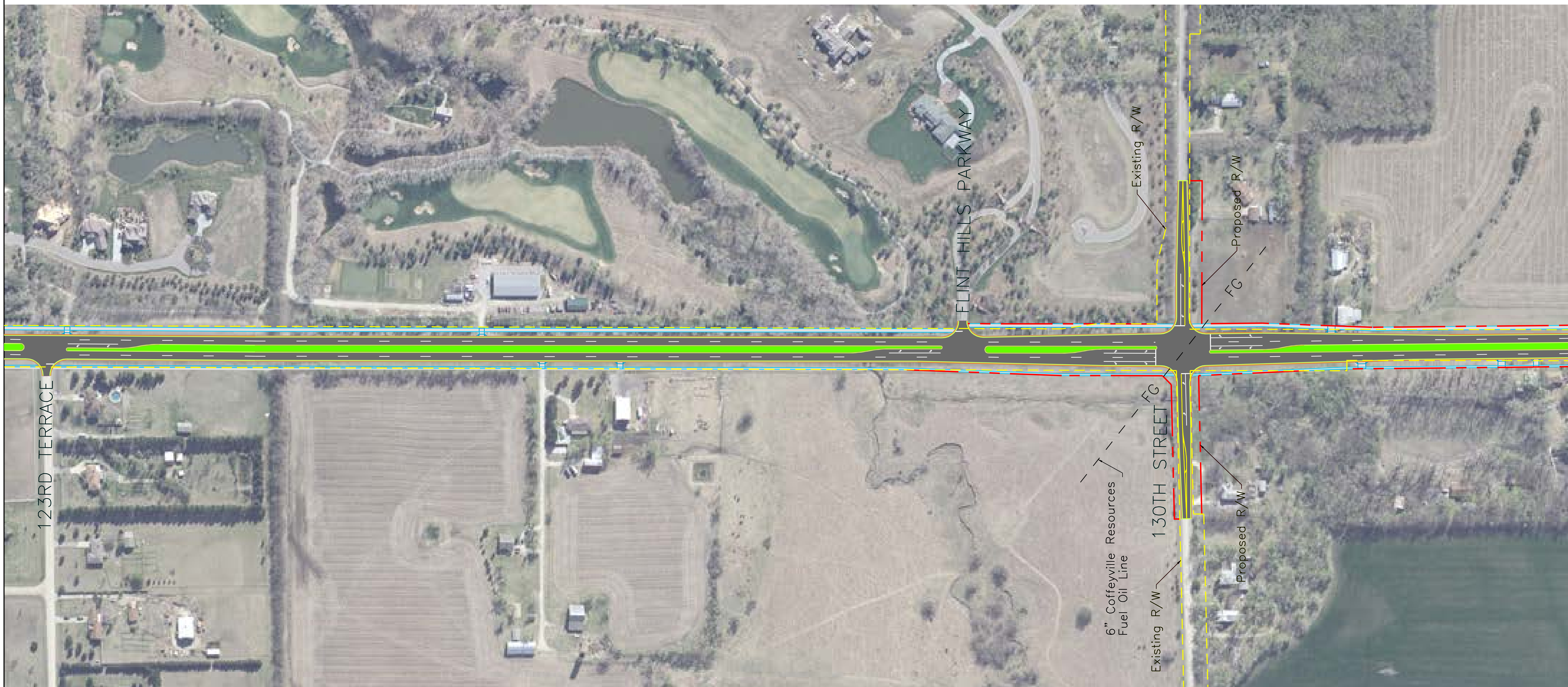

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12/9/2008

1" = 300'

Butler Road Corridor Study
Butler County, Kansas

PROPOSED
2030 CORRIDOR IMPROVEMENTS

TranSystems

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12/9/2008

1" = 300'

Butler Road Corridor Study
Butler County, Kansas

PROPOSED
2030 CORRIDOR IMPROVEMENTS

TranSystems

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SCALE FEET
1" = 300'

NORTH

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12/9/2008

1" = 300'

Butler Road Corridor Study
Butler County, Kansas

PROPOSED
2030 CORRIDOR IMPROVEMENTS

TranSystems

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12/9/2008

1" = 300'

Butler Road Corridor Study
Butler County, Kansas

PROPOSED
2030 CORRIDOR IMPROVEMENTS

TranSystems

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SCALE FEET
1" = 300'

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12/9/2008

1" = 300'

Butler Road Corridor Study
Butler County, Kansas

PROPOSED
2030 CORRIDOR IMPROVEMENTS

TranSystems

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SCALE FEET
1" = 300'

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12/9/2008

1" = 300'

Butler Road Corridor Study
Butler County, Kansas

PROPOSED
2030 CORRIDOR IMPROVEMENTS

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SCALE FEET
1" = 300'

NORTH

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12/9/2008

1" = 300'

Butler Road Corridor Study
Butler County, Kansas

PROPOSED
2030 CORRIDOR IMPROVEMENTS

TranSystems

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SCALE FEET
1" = 300'

NORTH

12/9/2008

1" = 300'

Butler Road Corridor Study
Butler County, Kansas

PROPOSED
2030 CORRIDOR IMPROVEMENTS

TranSystems

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17.0 Appendix B – Synchro Analysis Worksheets

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	8	12	5	363	190	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	13	5	395	207	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		6				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	612	207	215			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	612	207	215			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	98	100			
cM capacity (veh/h)	455	834	1355			

Direction, Lane #	EB 1	NB 1	SB 1	SB 2
Volume Total	22	400	207	9
Volume Left	9	5	0	0
Volume Right	13	0	0	9
cSH	1137	1355	1700	1700
Volume to Capacity	0.02	0.00	0.12	0.01
Queue Length 95th (ft)	1	0	0	0
Control Delay (s)	10.9	0.1	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	10.9	0.1	0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	33.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	5	5	426	130	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	5	463	141	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	618	144	147			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	618	144	147			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	100			
cM capacity (veh/h)	451	903	1435			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	468	147
Volume Left	5	5	0
Volume Right	5	0	5
cSH	602	1435	1700
Volume to Capacity	0.02	0.00	0.09
Queue Length 95th (ft)	1	0	0
Control Delay (s)	11.1	0.1	0.0
Lane LOS	B	A	
Approach Delay (s)	11.1	0.1	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	36.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	1	5	424	2	3	136
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	5	461	2	3	148
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	616	462			463	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	616	462			463	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			100	
cM capacity (veh/h)	453	600			1098	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	7	463	151
Volume Left	1	0	3
Volume Right	5	2	0
cSH	569	1700	1098
Volume to Capacity	0.01	0.27	0.00
Queue Length 95th (ft)	1	0	0
Control Delay (s)	11.4	0.0	0.2
Lane LOS	B		A
Approach Delay (s)	11.4	0.0	0.2
Approach LOS	B		

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	32.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	2	1	5	2	9	3	419	5	7	130	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	2	1	5	2	10	3	455	5	8	141	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	633	625	142	624	623	458	143			461		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	633	625	142	624	623	458	143			461		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	99	100	99	99	98	100			99		
cM capacity (veh/h)	382	398	905	393	398	603	1439			1100		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	17	464	151
Volume Left	2	5	3	8
Volume Right	1	10	5	2
cSH	440	490	1439	1100
Volume to Capacity	0.01	0.04	0.00	0.01
Queue Length 95th (ft)	1	3	0	1
Control Delay (s)	13.3	12.6	0.1	0.5
Lane LOS	B	B	A	A
Approach Delay (s)	13.3	12.6	0.1	0.5
Approach LOS	B	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (veh/h)	1	5	1	3	1	12	1	419	5	1	112	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	5	1	3	1	13	1	455	5	1	122	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	598	588	122	589	585	458	123			461		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	598	588	122	589	585	458	123			461		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	100	99	100	98	100			100		
cM capacity (veh/h)	404	421	929	415	422	603	1464			1100		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	17	462	124
Volume Left	1	3	1	1
Volume Right	1	13	5	1
cSH	453	542	1464	1100
Volume to Capacity	0.02	0.03	0.00	0.00
Queue Length 95th (ft)	1	2	0	0
Control Delay (s)	13.1	11.9	0.0	0.1
Lane LOS	B	B	A	A
Approach Delay (s)	13.1	11.9	0.0	0.1
Approach LOS	B	B		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	33.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	6	408	5	5	139
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	7	443	5	5	151
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	608	446			449	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	608	446			449	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	457	612			1111	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	12	449	157
Volume Left	5	0	5
Volume Right	7	5	0
cSH	530	1700	1111
Volume to Capacity	0.02	0.26	0.00
Queue Length 95th (ft)	2	0	0
Control Delay (s)	11.9	0.0	0.3
Lane LOS	B		A
Approach Delay (s)	11.9	0.0	0.3
Approach LOS	B		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	44	30	45	11	115	58	221	309	12	9	76	68
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	48	33	49	12	125	63	240	336	13	10	83	74
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1081	968	120	990	999	342	157			349		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1081	968	120	990	999	342	157			349		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	39	84	95	93	38	91	83			99		
cM capacity (veh/h)	79	209	932	163	201	700	1423			1210		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	48	82	12	188	240	349	10	157
Volume Left	48	0	12	0	240	0	10	0
Volume Right	0	49	0	63	0	13	0	74
cSH	79	391	163	264	1423	1700	1210	1700
Volume to Capacity	0.61	0.21	0.07	0.71	0.17	0.21	0.01	0.09
Queue Length 95th (ft)	68	19	6	123	15	0	1	0
Control Delay (s)	104.9	16.6	28.8	46.5	8.0	0.0	8.0	0.0
Lane LOS	F	C	D	E	A		A	
Approach Delay (s)	49.2		45.4		3.3		0.5	
Approach LOS	E		E					

Intersection Summary			
Average Delay	16.1		
Intersection Capacity Utilization	46.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	4	2	2	534	137	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	2	2	580	149	2
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	735	150	151			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	735	150	151			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
cM capacity (veh/h)	386	896	1430			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	7	583	151
Volume Left	4	2	0
Volume Right	2	0	2
cSH	477	1430	1700
Volume to Capacity	0.01	0.00	0.09
Queue Length 95th (ft)	1	0	0
Control Delay (s)	12.7	0.0	0.0
Lane LOS	B	A	
Approach Delay (s)	12.7	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	39.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (veh/h)	1	5	4	6	1	11	2	520	2	2	146	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	5	4	7	1	12	2	565	2	2	159	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	747	735	159	741	735	566	160			567		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	747	735	159	741	735	566	160			567		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	98	100	98	100	98	100			100		
cM capacity (veh/h)	320	345	886	325	346	523	1419			1005		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	11	20	570	162
Volume Left	1	7	2	2
Volume Right	4	12	2	1
cSH	452	425	1419	1005
Volume to Capacity	0.02	0.05	0.00	0.00
Queue Length 95th (ft)	2	4	0	0
Control Delay (s)	13.2	13.9	0.0	0.1
Lane LOS	B	B	A	A
Approach Delay (s)	13.2	13.9	0.0	0.1
Approach LOS	B	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	38.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	12	22	479	8	4	140
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	13	24	521	9	4	152
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	686	525			529	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	686	525			529	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	96			100	
cM capacity (veh/h)	412	552			1038	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	37	529	157
Volume Left	13	0	4
Volume Right	24	9	0
cSH	493	1700	1038
Volume to Capacity	0.07	0.31	0.00
Queue Length 95th (ft)	6	0	0
Control Delay (s)	12.9	0.0	0.3
Lane LOS	B		A
Approach Delay (s)	12.9	0.0	0.3
Approach LOS	B		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	35.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	10	477	2	2	150
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	11	518	2	2	163
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			777			
pX, platoon unblocked	0.91	0.91			0.91	
vC, conflicting volume	687	520			521	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	602	417			419	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			100	
cM capacity (veh/h)	418	575			1033	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	16	521	165
Volume Left	5	0	2
Volume Right	11	2	0
cSH	511	1700	1033
Volume to Capacity	0.03	0.31	0.00
Queue Length 95th (ft)	2	0	0
Control Delay (s)	12.3	0.0	0.1
Lane LOS	B		A
Approach Delay (s)	12.3	0.0	0.1
Approach LOS	B		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	12	1	9	10	2	47	6	392	7	9	135	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	0.95	
Frt		1.00	0.85		0.89		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.96	1.00		0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1780	1583		1648		1770	1863	1583	1770	3515	
Flt Permitted		1.00	1.00		0.94		0.65	1.00	1.00	0.49	1.00	
Satd. Flow (perm)		1863	1583		1556		1219	1863	1583	920	3515	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	13	1	10	11	2	51	7	426	8	10	147	7
RTOR Reduction (vph)	0	0	9	0	47	0	0	0	4	0	3	0
Lane Group Flow (vph)	0	14	1	0	17	0	7	426	4	10	151	0
Turn Type	pm+pt		Perm	Perm			pm+pt		Perm	pm+pt		
Protected Phases	5	2			6		3	8		7	4	
Permitted Phases	2		2	6			8		8	4		
Actuated Green, G (s)		3.7	3.7		3.7		24.5	23.8	23.8	24.5	23.8	
Effective Green, g (s)		3.7	3.7		3.7		24.5	23.8	23.8	24.5	23.8	
Actuated g/C Ratio		0.08	0.08		0.08		0.53	0.52	0.52	0.53	0.52	
Clearance Time (s)		6.0	6.0		6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		149	127		125		655	960	815	501	1811	
v/s Ratio Prot							0.00	c0.23		c0.00	0.04	
v/s Ratio Perm		0.01	0.00		c0.01		0.01		0.00	0.01		
v/c Ratio		0.09	0.01		0.14		0.01	0.44	0.01	0.02	0.08	
Uniform Delay, d1		19.7	19.6		19.8		5.1	7.0	5.4	5.1	5.7	
Progression Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3	0.0		0.5		0.0	0.3	0.0	0.0	0.0	
Delay (s)		20.0	19.6		20.3		5.1	7.4	5.4	5.2	5.7	
Level of Service		B	B		C		A	A	A	A	A	
Approach Delay (s)		19.8			20.3			7.3			5.7	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	8.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	46.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	33	5	4	5	5	9	16	363	4	5	142	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	5	4	5	5	10	17	395	4	5	154	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											397	
pX, platoon unblocked												
vC, conflicting volume	609	599	154	604	610	397	167			399		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	609	599	154	604	610	397	167			399		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	99	100	99	99	99	99			100		
cM capacity (veh/h)	392	408	892	399	402	653	1410			1160		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	46	21	416	160	13
Volume Left	36	5	17	5	0
Volume Right	4	10	4	0	13
cSH	416	490	1410	1160	1700
Volume to Capacity	0.11	0.04	0.01	0.00	0.01
Queue Length 95th (ft)	9	3	1	0	0
Control Delay (s)	14.7	12.7	0.4	0.3	0.0
Lane LOS	B	B	A	A	
Approach Delay (s)	14.7	12.7	0.4	0.3	
Approach LOS	B	B			

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	33	5	4	5	5	9	16	363	4	5	142	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	5	4	5	5	10	17	395	4	5	154	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											1218	
pX, platoon unblocked												
vC, conflicting volume	616	605	161	610	610	397	167			399		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	616	605	161	610	610	397	167			399		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	99	100	99	99	99	99			100		
cM capacity (veh/h)	388	405	884	395	402	653	1410			1160		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	46	21	416	173
Volume Left	36	5	17	5
Volume Right	4	10	4	13
cSH	412	489	1410	1160
Volume to Capacity	0.11	0.04	0.01	0.00
Queue Length 95th (ft)	9	3	1	0
Control Delay (s)	14.8	12.7	0.4	0.3
Lane LOS	B	B	A	A
Approach Delay (s)	14.8	12.7	0.4	0.3
Approach LOS	B	B		

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	38.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	10	44	10	33	10	137	28	56	109	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			6.0			6.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.96			0.95			0.98			0.99	
Flt Protected		0.98			0.98			1.00			0.98	
Satd. Flow (prot)		1750			1724			1818			1637	
Flt Permitted		0.98			0.98			0.98			0.85	
Satd. Flow (perm)		1750			1724			1787			1420	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	11	11	48	11	36	11	149	30	61	118	11
RTOR Reduction (vph)	0	11	0	0	28	0	0	9	0	0	3	0
Lane Group Flow (vph)	0	22	0	0	67	0	0	181	0	0	187	0
Parking (#/hr)											0	
Turn Type	Split			Split			Perm			Perm		
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)		0.8			4.4			19.2			19.2	
Effective Green, g (s)		0.8			4.4			19.2			19.2	
Actuated g/C Ratio		0.02			0.10			0.45			0.45	
Clearance Time (s)		6.0			6.0			6.0			6.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		33			179			809			643	
v/s Ratio Prot		c0.01			c0.04							
v/s Ratio Perm								0.10			c0.13	
v/c Ratio		0.67			0.38			0.22			0.29	
Uniform Delay, d1		20.7			17.7			7.1			7.3	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		42.8			1.3			0.1			0.3	
Delay (s)		63.5			19.0			7.2			7.6	
Level of Service		E			B			A			A	
Approach Delay (s)		63.5			19.0			7.2			7.6	
Approach LOS		E			B			A			A	

Intersection Summary			
HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	42.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	4	7	21	8	89	6	213	10	26	124	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.96		1.00	0.86		1.00	0.99		1.00	0.99	
Flt Protected		0.98		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1736		1770	1607		1770	1665		1770	1667	
Flt Permitted		0.79		0.74	1.00		0.67	1.00		0.59	1.00	
Satd. Flow (perm)		1401		1381	1607		1244	1665		1100	1667	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	4	8	23	9	97	7	232	11	28	135	5
RTOR Reduction (vph)	0	7	0	0	89	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	17	0	23	17	0	7	242	0	28	139	0
Parking (#/hr)								0			0	
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		5.7		5.7	5.7		45.3	44.3		47.9	45.6	
Effective Green, g (s)		5.7		5.7	5.7		45.3	44.3		47.9	45.6	
Actuated g/C Ratio		0.08		0.08	0.08		0.64	0.63		0.68	0.65	
Clearance Time (s)		6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		114		112	130		809	1049		771	1081	
v/s Ratio Prot					0.01		0.00	c0.15		c0.00	0.08	
v/s Ratio Perm		0.01		c0.02			0.01			0.02		
v/c Ratio		0.15		0.21	0.13		0.01	0.23		0.04	0.13	
Uniform Delay, d1		30.0		30.2	30.0		4.5	5.6		3.6	4.7	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.6		0.9	0.5		0.0	0.5		0.0	0.2	
Delay (s)		30.6		31.1	30.5		4.5	6.1		3.7	5.0	
Level of Service		C		C	C		A	A		A	A	
Approach Delay (s)		30.6			30.6			6.1			4.8	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.22		
Actuated Cycle Length (s)	70.3	Sum of lost time (s)	18.0
Intersection Capacity Utilization	38.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	61	105	41	18	133
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	66	114	45	20	145
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1247			
pX, platoon unblocked						
vC, conflicting volume	320	136			159	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	320	136			159	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	93			99	
cM capacity (veh/h)	664	912			1421	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	77	159	164
Volume Left	11	0	20
Volume Right	66	45	0
cSH	867	1700	1421
Volume to Capacity	0.09	0.09	0.01
Queue Length 95th (ft)	7	0	1
Control Delay (s)	9.6	0.0	1.0
Lane LOS	A		A
Approach Delay (s)	9.6	0.0	1.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	30.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	51	3	5	1	4	7	10	67	5	2	44	57
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	55	3	5	1	4	8	11	73	5	2	48	62
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	190	183	79	188	211	76	110			78		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	190	183	79	188	211	76	110			78		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	100	99	100	99	99	99			100		
cM capacity (veh/h)	755	705	982	761	680	986	1480			1520		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	64	13	89	112
Volume Left	55	1	11	2
Volume Right	5	8	5	62
cSH	767	839	1480	1520
Volume to Capacity	0.08	0.02	0.01	0.00
Queue Length 95th (ft)	7	1	1	0
Control Delay (s)	10.1	9.4	1.0	0.2
Lane LOS	B	A	A	A
Approach Delay (s)	10.1	9.4	1.0	0.2
Approach LOS	B	A		

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	26.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	17	21	1	18	8	94	323	1	16	126	65
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	29	18	23	1	20	9	102	351	1	17	137	71
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	782	764	172	795	798	352	208			352		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	782	764	172	795	798	352	208			352		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	94	97	100	93	99	93			99		
cM capacity (veh/h)	273	304	871	265	291	692	1363			1207		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	71	29	454	225
Volume Left	29	1	102	17
Volume Right	23	9	1	71
cSH	363	349	1363	1207
Volume to Capacity	0.19	0.08	0.07	0.01
Queue Length 95th (ft)	18	7	6	1
Control Delay (s)	17.3	16.2	2.3	0.7
Lane LOS	C	C	A	A
Approach Delay (s)	17.3	16.2	2.3	0.7
Approach LOS	C	C		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	152	291	65	71	885	126	299	325	48	79	152	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3471		3433	3214	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3471		3433	3214	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	165	316	71	77	962	137	325	353	52	86	165	261
RTOR Reduction (vph)	0	0	30	0	0	36	0	10	0	0	119	0
Lane Group Flow (vph)	165	316	41	77	962	101	325	395	0	86	307	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	9.3	44.0	58.7	4.6	39.3	47.4	14.7	20.9		8.1	14.3	
Effective Green, g (s)	9.3	44.0	58.7	4.6	39.3	47.4	14.7	20.9		8.1	14.3	
Actuated g/C Ratio	0.09	0.43	0.58	0.05	0.39	0.47	0.14	0.21		0.08	0.14	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	314	1533	1008	155	1369	832	497	714		274	452	
v/s Ratio Prot	c0.05	c0.09	0.01	0.02	c0.27	0.01	c0.09	c0.11		0.03	c0.10	
v/s Ratio Perm			0.02			0.05						
v/c Ratio	0.53	0.21	0.04	0.50	0.70	0.12	0.65	0.55		0.31	0.68	
Uniform Delay, d1	44.0	17.9	9.3	47.4	26.2	15.3	41.0	36.2		44.1	41.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	0.1	0.0	2.5	1.7	0.1	3.1	0.9		0.7	4.0	
Delay (s)	45.6	18.0	9.3	49.9	27.9	15.4	44.1	37.1		44.8	45.5	
Level of Service	D	B	A	D	C	B	D	D		D	D	
Approach Delay (s)		25.1			27.9			40.2			45.4	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	33.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	101.6	Sum of lost time (s)	36.0
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (veh/h)	61	2	15	5	17	26	23	346	11	28	178	36
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	66	2	16	5	18	28	25	376	12	30	193	39
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	743	712	213	723	726	382	233			388		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	743	712	213	723	726	382	233			388		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	77	99	98	98	94	96	98			97		
cM capacity (veh/h)	293	342	827	322	336	665	1335			1170		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	85	52	413	263
Volume Left	66	5	25	30
Volume Right	16	28	12	39
cSH	336	456	1335	1170
Volume to Capacity	0.25	0.11	0.02	0.03
Queue Length 95th (ft)	25	10	1	2
Control Delay (s)	19.3	13.9	0.6	1.2
Lane LOS	C	B	A	A
Approach Delay (s)	19.3	13.9	0.6	1.2
Approach LOS	C	B		

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	0	672	0	0	288
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	730	0	0	313
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			Raised			Raised
Median storage veh)			1			1
Upstream signal (ft)						1176
pX, platoon unblocked	0.97					
vC, conflicting volume	1043	730			730	
vC1, stage 1 conf vol	730					
vC2, stage 2 conf vol	313					
vCu, unblocked vol	1029	730			730	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	371	422			874	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	0	730	0	313
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	1700	1700	1700
Volume to Capacity	0.00	0.43	0.00	0.18
Queue Length 95th (ft)	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	0.0	0.0	0.0	
Approach LOS	A			

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	38.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	8	5	2	350	460	26
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	5	2	380	500	28
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		6				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	885	500	528			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	885	500	528			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	99	100			
cM capacity (veh/h)	315	571	1039			

Direction, Lane #	EB 1	NB 1	SB 1	SB 2
Volume Total	14	383	500	28
Volume Left	9	2	0	0
Volume Right	5	0	0	28
cSH	512	1039	1700	1700
Volume to Capacity	0.03	0.00	0.29	0.02
Queue Length 95th (ft)	2	0	0	0
Control Delay (s)	14.7	0.1	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	14.7	0.1	0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	4	6	2	249	512	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	7	2	271	557	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	835	560	563			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	835	560	563			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	100			
cM capacity (veh/h)	337	528	1008			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	273	563
Volume Left	4	2	0
Volume Right	7	0	7
cSH	430	1008	1700
Volume to Capacity	0.03	0.00	0.33
Queue Length 95th (ft)	2	0	0
Control Delay (s)	13.6	0.1	0.0
Lane LOS	B	A	
Approach Delay (s)	13.6	0.1	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	37.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	2	1	250	2	2	516
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	1	272	2	2	561
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	838	273			274	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	838	273			274	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	100			100	
cM capacity (veh/h)	336	766			1289	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	3	274	563
Volume Left	2	0	2
Volume Right	1	2	0
cSH	413	1700	1289
Volume to Capacity	0.01	0.16	0.00
Queue Length 95th (ft)	1	0	0
Control Delay (s)	13.8	0.0	0.0
Lane LOS	B		A
Approach Delay (s)	13.8	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	38.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	2	10	1	5	14	3	233	3	16	493	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	2	11	1	5	15	3	253	3	17	536	9
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	854	838	540	848	841	255	545			257		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	854	838	540	848	841	255	545			257		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	99	98	100	98	98	100			99		
cM capacity (veh/h)	266	297	542	271	296	784	1024			1308		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	17	22	260	562
Volume Left	4	1	3	17
Volume Right	11	15	3	9
cSH	398	520	1024	1308
Volume to Capacity	0.04	0.04	0.00	0.01
Queue Length 95th (ft)	3	3	0	1
Control Delay (s)	14.5	12.2	0.1	0.4
Lane LOS	B	B	A	A
Approach Delay (s)	14.5	12.2	0.1	0.4
Approach LOS	B	B		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	45.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	1	1	7	5	4	1	234	6	11	492	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	1	1	8	5	4	1	254	7	12	535	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	828	824	538	823	824	258	540			261		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	828	824	538	823	824	258	540			261		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	100	97	98	99	100			99		
cM capacity (veh/h)	282	305	544	289	305	781	1028			1304		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	17	262	552
Volume Left	5	8	1	12
Volume Right	1	4	7	5
cSH	307	350	1028	1304
Volume to Capacity	0.02	0.05	0.00	0.01
Queue Length 95th (ft)	2	4	0	1
Control Delay (s)	17.0	15.8	0.0	0.3
Lane LOS	C	C	A	A
Approach Delay (s)	17.0	15.8	0.0	0.3
Approach LOS	C	C		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	1	2	261	8	4	489
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	2	284	9	4	532
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	828	288			292	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	828	288			292	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	340	751			1269	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	3	292	536
Volume Left	1	0	4
Volume Right	2	9	0
cSH	535	1700	1269
Volume to Capacity	0.01	0.17	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	11.8	0.0	0.1
Lane LOS	B		A
Approach Delay (s)	11.8	0.0	0.1
Approach LOS	B		

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	50	90	197	22	29	24	70	164	26	62	354	42
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	98	214	24	32	26	76	178	28	67	385	46
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	915	901	408	1127	910	192	430			207		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	915	901	408	1127	910	192	430			207		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	73	60	67	69	87	97	93			95		
cM capacity (veh/h)	203	246	644	77	243	849	1129			1365		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	54	312	24	58	76	207	67	430
Volume Left	54	0	24	0	76	0	67	0
Volume Right	0	214	0	26	0	28	0	46
cSH	203	427	77	360	1129	1700	1365	1700
Volume to Capacity	0.27	0.73	0.31	0.16	0.07	0.12	0.05	0.25
Queue Length 95th (ft)	26	145	29	14	5	0	4	0
Control Delay (s)	29.2	33.0	71.6	16.9	8.4	0.0	7.8	0.0
Lane LOS	D	D	F	C	A		A	
Approach Delay (s)	32.5		33.0		2.3		1.1	
Approach LOS	D		D					

Intersection Summary			
Average Delay	12.8		
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	8	10	5	248	568	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	11	5	270	617	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	906	626	634			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	906	626	634			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	98	99			
cM capacity (veh/h)	305	484	949			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	20	275	634
Volume Left	9	5	0
Volume Right	11	0	16
cSH	384	949	1700
Volume to Capacity	0.05	0.01	0.37
Queue Length 95th (ft)	4	0	0
Control Delay (s)	14.9	0.2	0.0
Lane LOS	B	A	
Approach Delay (s)	14.9	0.2	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	40.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	3	7	4	1	4	4	261	7	10	575	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	3	8	4	1	4	4	284	8	11	625	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	949	948	627	954	946	288	628			291		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	949	948	627	954	946	288	628			291		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	99	98	98	100	99	100			99		
cM capacity (veh/h)	236	257	484	230	258	752	954			1270		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	13	10	296	639
Volume Left	2	4	4	11
Volume Right	8	4	8	3
cSH	347	339	954	1270
Volume to Capacity	0.04	0.03	0.00	0.01
Queue Length 95th (ft)	3	2	0	1
Control Delay (s)	15.8	15.9	0.2	0.2
Lane LOS	C	C	A	A
Approach Delay (s)	15.8	15.9	0.2	0.2
Approach LOS	C	C		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	72	12	258	20	32	546
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	78	13	280	22	35	593
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	954	291			302	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	954	291			302	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	72	98			97	
cM capacity (veh/h)	279	748			1259	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	91	302	628
Volume Left	78	0	35
Volume Right	13	22	0
cSH	306	1700	1259
Volume to Capacity	0.30	0.18	0.03
Queue Length 95th (ft)	30	0	2
Control Delay (s)	21.7	0.0	0.8
Lane LOS	C		A
Approach Delay (s)	21.7	0.0	0.8
Approach LOS	C		

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	30	12	266	16	8	610
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	13	289	17	9	663
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			777			
pX, platoon unblocked						
vC, conflicting volume	978	298			307	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	978	298			307	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	88	98			99	
cM capacity (veh/h)	276	742			1254	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	46	307	672
Volume Left	33	0	9
Volume Right	13	17	0
cSH	336	1700	1254
Volume to Capacity	0.14	0.18	0.01
Queue Length 95th (ft)	12	0	1
Control Delay (s)	17.4	0.0	0.2
Lane LOS	C		A
Approach Delay (s)	17.4	0.0	0.2
Approach LOS	C		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	4	21	20	6	20	26	256	17	29	397	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	0.95	
Frt		1.00	0.85		0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.97	1.00		0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1805	1583		1717		1770	1863	1583	1770	3521	
Flt Permitted		1.00	1.00		1.00		0.49	1.00	1.00	0.59	1.00	
Satd. Flow (perm)		1863	1583		1754		919	1863	1583	1097	3521	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	4	23	22	7	22	28	278	18	32	432	15
RTOR Reduction (vph)	0	0	22	0	21	0	0	0	9	0	2	0
Lane Group Flow (vph)	0	11	1	0	30	0	28	278	9	32	445	0
Turn Type	pm+pt		Perm	Perm			pm+pt		Perm	pm+pt		
Protected Phases	5	2			6		3	8		7	4	
Permitted Phases	2		2	6			8		8	4		
Actuated Green, G (s)		2.5	2.5		2.5		21.8	21.1	21.1	21.8	21.1	
Effective Green, g (s)		2.5	2.5		2.5		21.8	21.1	21.1	21.8	21.1	
Actuated g/C Ratio		0.06	0.06		0.06		0.52	0.50	0.50	0.52	0.50	
Clearance Time (s)		6.0	6.0		6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		110	94		104		488	929	790	576	1756	
v/s Ratio Prot							c0.00	c0.15		0.00	0.13	
v/s Ratio Perm		0.01	0.00		c0.02		0.03		0.01	0.03		
v/c Ratio		0.10	0.01		0.29		0.06	0.30	0.01	0.06	0.25	
Uniform Delay, d1		18.8	18.7		19.1		5.0	6.2	5.3	5.1	6.1	
Progression Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.4	0.1		1.6		0.0	0.2	0.0	0.0	0.1	
Delay (s)		19.2	18.8		20.6		5.1	6.4	5.3	5.1	6.2	
Level of Service		B	B		C		A	A	A	A	A	
Approach Delay (s)		18.9			20.6			6.3			6.1	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	7.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	42.3	Sum of lost time (s)	18.0
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	5	14	20	5	2	12	293	12	3	588	45
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	5	15	22	5	2	13	318	13	3	639	49
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											397	
pX, platoon unblocked	0.88	0.88	0.88	0.88	0.88		0.88					
vC, conflicting volume	1002	1003	639	1015	1046	325	688			332		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	936	938	526	951	986	325	581			332		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	98	97	89	97	100	99			100		
cM capacity (veh/h)	209	230	488	199	215	716	877			1228		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	25	29	345	642	49
Volume Left	4	22	13	3	0
Volume Right	15	2	13	0	49
cSH	330	213	877	1228	1700
Volume to Capacity	0.08	0.14	0.01	0.00	0.03
Queue Length 95th (ft)	6	12	1	0	0
Control Delay (s)	16.8	24.6	0.5	0.1	0.0
Lane LOS	C	C	A	A	
Approach Delay (s)	16.8	24.6	0.5	0.1	
Approach LOS	C	C			

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	43.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	5	10	18	2	32	12	282	14	49	552	21
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	5	11	20	2	35	13	307	15	53	600	23
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											1218	
pX, platoon unblocked												
vC, conflicting volume	1094	1066	611	1072	1070	314	623			322		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1094	1066	611	1072	1070	314	623			322		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	97	98	89	99	95	99			96		
cM capacity (veh/h)	173	210	493	182	209	726	958			1238		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	18	57	335	676
Volume Left	2	20	13	53
Volume Right	11	35	15	23
cSH	306	341	958	1238
Volume to Capacity	0.06	0.17	0.01	0.04
Queue Length 95th (ft)	5	15	1	3
Control Delay (s)	17.5	17.7	0.5	1.1
Lane LOS	C	C	A	A
Approach Delay (s)	17.5	17.7	0.5	1.1
Approach LOS	C	C		

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	10	41	10	64	10	280	100	67	179	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			6.0			6.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.96			0.92			0.97			0.99	
Flt Protected		0.98			0.98			1.00			0.99	
Satd. Flow (prot)		1750			1693			1796			1646	
Flt Permitted		0.98			0.98			0.99			0.81	
Satd. Flow (perm)		1750			1693			1779			1348	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	11	11	45	11	70	11	304	109	73	195	11
RTOR Reduction (vph)	0	11	0	0	55	0	0	15	0	0	2	0
Lane Group Flow (vph)	0	22	0	0	71	0	0	409	0	0	277	0
Parking (#/hr)											0	
Turn Type	Split			Split			Perm			Perm		
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)		1.9			6.1			22.8			22.8	
Effective Green, g (s)		1.9			6.1			22.8			22.8	
Actuated g/C Ratio		0.04			0.12			0.47			0.47	
Clearance Time (s)		6.0			6.0			6.0			6.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		68			212			831			630	
v/s Ratio Prot		c0.01			c0.04							
v/s Ratio Perm								c0.23			0.21	
v/c Ratio		0.33			0.33			0.49			0.44	
Uniform Delay, d1		22.8			19.5			9.0			8.7	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		2.8			0.9			0.5			0.5	
Delay (s)		25.7			20.4			9.5			9.2	
Level of Service		C			C			A			A	
Approach Delay (s)		25.7			20.4			9.5			9.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	48.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	23	24	16	8	87	14	205	30	150	335	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.96		1.00	0.86		1.00	0.98		1.00	1.00	
Flt Protected		0.98		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1751		1770	1608		1770	1644		1770	1669	
Flt Permitted		0.82		0.74	1.00		0.54	1.00		0.55	1.00	
Satd. Flow (perm)		1467		1384	1608		1003	1644		1025	1669	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	25	26	17	9	95	15	223	33	163	364	11
RTOR Reduction (vph)	0	15	0	0	86	0	0	3	0	0	1	0
Lane Group Flow (vph)	0	71	0	17	18	0	15	253	0	163	374	0
Parking (#/hr)								0			0	
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		9.7		9.7	9.7		64.1	62.0		75.5	67.7	
Effective Green, g (s)		9.7		9.7	9.7		64.1	62.0		75.5	67.7	
Actuated g/C Ratio		0.10		0.10	0.10		0.66	0.64		0.77	0.69	
Clearance Time (s)		6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		146		138	160		676	1045		853	1159	
v/s Ratio Prot					0.01		0.00	0.15		c0.02	c0.22	
v/s Ratio Perm		c0.05		0.01			0.01			0.13		
v/c Ratio		0.48		0.12	0.12		0.02	0.24		0.19	0.32	
Uniform Delay, d1		41.5		40.0	40.0		5.8	7.6		2.9	5.9	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.5		0.4	0.3		0.0	0.5		0.1	0.7	
Delay (s)		44.1		40.4	40.3		5.8	8.2		3.0	6.6	
Level of Service		D		D	D		A	A		A	A	
Approach Delay (s)		44.1			40.3			8.1			5.5	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	97.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	6	42	202	10	98	273
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	46	220	11	107	297
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1247			
pX, platoon unblocked						
vC, conflicting volume	735	225			230	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	735	225			230	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	94			92	
cM capacity (veh/h)	356	814			1337	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	52	230	403
Volume Left	7	0	107
Volume Right	46	11	0
cSH	702	1700	1337
Volume to Capacity	0.07	0.14	0.08
Queue Length 95th (ft)	6	0	6
Control Delay (s)	10.5	0.0	2.7
Lane LOS	B		A
Approach Delay (s)	10.5	0.0	2.7
Approach LOS	B		

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	44.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	99	12	31	5	2	6	10	66	5	6	134	82
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	108	13	34	5	2	7	11	72	5	7	146	89
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	307	302	190	340	344	74	235			77		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	307	302	190	340	344	74	235			77		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	83	98	96	99	100	99	99			100		
cM capacity (veh/h)	633	603	852	575	571	987	1333			1521		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	154	14	88	241
Volume Left	108	5	11	7
Volume Right	34	7	5	89
cSH	668	711	1333	1521
Volume to Capacity	0.23	0.02	0.01	0.00
Queue Length 95th (ft)	22	2	1	0
Control Delay (s)	12.0	10.2	1.0	0.2
Lane LOS	B	B	A	A
Approach Delay (s)	12.0	10.2	1.0	0.2
Approach LOS	B	B		

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	79	25	119	5	16	17	36	256	8	20	410	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	86	27	129	5	17	18	39	278	9	22	446	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	893	871	462	1009	883	283	478			287		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	893	871	462	1009	883	283	478			287		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	63	90	78	96	94	98	96			98		
cM capacity (veh/h)	233	274	600	152	270	756	1084			1275		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	242	41	326	500
Volume Left	86	5	39	22
Volume Right	129	18	9	33
cSH	355	332	1084	1275
Volume to Capacity	0.68	0.12	0.04	0.02
Queue Length 95th (ft)	120	11	3	1
Control Delay (s)	34.4	17.4	1.3	0.5
Lane LOS	D	C	A	A
Approach Delay (s)	34.4	17.4	1.3	0.5
Approach LOS	D	C		

Intersection Summary			
Average Delay	8.8		
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	332	787	243	88	422	111	156	269	103	238	277	229
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3392		3433	3299	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3392		3433	3299	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	361	855	264	96	459	121	170	292	112	259	301	249
RTOR Reduction (vph)	0	0	40	0	0	45	0	33	0	0	117	0
Lane Group Flow (vph)	361	855	224	96	459	76	170	371	0	259	433	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.4	33.4	44.0	4.5	27.5	39.9	10.6	15.8		12.4	17.6	
Effective Green, g (s)	10.4	33.4	44.0	4.5	27.5	39.9	10.6	15.8		12.4	17.6	
Actuated g/C Ratio	0.12	0.37	0.49	0.05	0.31	0.44	0.12	0.18		0.14	0.20	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	396	1312	878	171	1080	806	404	595		472	644	
v/s Ratio Prot	c0.11	c0.24	0.03	0.03	0.13	0.01	0.05	0.11		c0.08	c0.13	
v/s Ratio Perm			0.11			0.03						
v/c Ratio	0.91	0.65	0.26	0.56	0.42	0.09	0.42	0.62		0.55	0.67	
Uniform Delay, d1	39.4	23.5	13.5	41.8	25.0	14.6	36.9	34.4		36.2	33.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	24.7	1.2	0.2	4.2	0.3	0.1	0.7	2.0		1.3	2.8	
Delay (s)	64.1	24.7	13.6	46.0	25.3	14.6	37.6	36.4		37.5	36.3	
Level of Service	E	C	B	D	C	B	D	D		D	D	
Approach Delay (s)		32.3			26.3			36.8			36.7	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	32.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.1	Sum of lost time (s)	18.0
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	96	18	29	6	10	25	22	332	4	28	451	72
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	104	20	32	7	11	27	24	361	4	30	490	78
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1034	1003	529	1042	1040	363	568			365		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1034	1003	529	1042	1040	363	568			365		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	44	92	94	96	95	96	98			97		
cM capacity (veh/h)	187	230	549	176	219	682	1004			1193		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	155	45	389	599
Volume Left	104	7	24	30
Volume Right	32	27	4	78
cSH	222	352	1004	1193
Volume to Capacity	0.70	0.13	0.02	0.03
Queue Length 95th (ft)	113	11	2	2
Control Delay (s)	52.0	16.7	0.8	0.7
Lane LOS	F	C	A	A
Approach Delay (s)	52.0	16.7	0.8	0.7
Approach LOS	F	C		

Intersection Summary			
Average Delay	8.0		
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	0	528	0	0	608
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	574	0	0	661
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			Raised			Raised
Median storage veh)			1			1
Upstream signal (ft)						1176
pX, platoon unblocked	0.86					
vC, conflicting volume	1235	574			574	
vC1, stage 1 conf vol	574					
vC2, stage 2 conf vol	661					
vCu, unblocked vol	1190	574			574	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	325	518			999	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	0	574	0	661
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	1700	1700	1700
Volume to Capacity	0.00	0.34	0.00	0.39
Queue Length 95th (ft)	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	0.0	0.0	0.0	
Approach LOS	A			

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	35.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	100	100	100	100	100	100	600	100	100	500	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	652	109	109	543	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1902	1793	598	1902	1793	707	652			761		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1902	1793	598	1902	1793	707	652			761		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	78	0	0	75	88			87		
cM capacity (veh/h)	0	62	502	0	62	436	934			851		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	326	326	870	761
Volume Left	109	109	109	109
Volume Right	109	109	109	109
cSH	0	0	934	851
Volume to Capacity	Err	Err	0.12	0.13
Queue Length 95th (ft)	Err	Err	10	11
Control Delay (s)	Err	Err	2.9	3.2
Lane LOS	F	F	A	A
Approach Delay (s)	Err	Err	2.9	3.2
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	100	100	100	100	100	100	600	100	100	400	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	652	109	109	435	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1793	1685	489	1793	1685	707	543			761		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1793	1685	489	1793	1685	707	543			761		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	81	0	0	75	89			87		
cM capacity (veh/h)	0	73	579	0	73	436	1025			851		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	326	326	870	652
Volume Left	109	109	109	109
Volume Right	109	109	109	109
cSH	0	0	1025	851
Volume to Capacity	Err	Err	0.11	0.13
Queue Length 95th (ft)	Err	Err	9	11
Control Delay (s)	Err	Err	2.6	3.2
Lane LOS	F	F	A	A
Approach Delay (s)	Err	Err	2.6	3.2
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	200	100	100	100	300	200	300	400	100	100	300	200
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	217	109	109	109	326	217	326	435	109	109	326	217
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2120	1848	435	1848	1902	489	543			543		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2120	1848	435	1848	1902	489	543			543		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	83	0	0	62	68			89		
cM capacity (veh/h)	0	45	621	0	42	579	1025			1025		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	217	217	109	543	326	543	109	543
Volume Left	217	0	109	0	326	0	109	0
Volume Right	0	109	0	217	0	109	0	217
cSH	0	85	0	67	1025	1700	1025	1700
Volume to Capacity	Err	2.57	Err	8.13	0.32	0.32	0.11	0.32
Queue Length 95th (ft)	Err	514	Err	Err	34	0	9	0
Control Delay (s)	Err	816.6	Err	Err	10.1	0.0	8.9	0.0
Lane LOS	F	F	F	F	B		A	
Approach Delay (s)	Err		Err		3.8		1.5	
Approach LOS	F		F					

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	97.0%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	100	100	100	100	100	100	600	100	100	400	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	652	109	109	435	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1793	1685	489	1793	1685	707	543			761		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1793	1685	489	1793	1685	707	543			761		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	81	0	0	75	89			87		
cM capacity (veh/h)	0	73	579	0	73	436	1025			851		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	326	326	870	652
Volume Left	109	109	109	109
Volume Right	109	109	109	109
cSH	0	0	1025	851
Volume to Capacity	Err	Err	0.11	0.13
Queue Length 95th (ft)	Err	Err	9	11
Control Delay (s)	Err	Err	2.6	3.2
Lane LOS	F	F	A	A
Approach Delay (s)	Err	Err	2.6	3.2
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	200	100	100	100	500	100	100	400	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	0.95	
Frt		1.00	0.85		0.97		1.00	1.00	0.85	1.00	0.97	
Flt Protected		0.98	1.00		0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1817	1583		1756		1770	1863	1583	1770	3433	
Flt Permitted		0.66	1.00		0.71		0.38	1.00	1.00	0.20	1.00	
Satd. Flow (perm)		1223	1583		1278		700	1863	1583	382	3433	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	217	109	109	109	543	109	109	435	109
RTOR Reduction (vph)	0	0	69	0	11	0	0	0	70	0	20	0
Lane Group Flow (vph)	0	218	40	0	424	0	109	543	39	109	524	0
Turn Type	pm+pt		Perm	Perm			pm+pt		Perm	pm+pt		
Protected Phases	5	2			6		3	8		7	4	
Permitted Phases	2		2	6			8		8	4		
Actuated Green, G (s)		29.0	29.0		29.0		33.0	28.2	28.2	31.4	27.4	
Effective Green, g (s)		29.0	29.0		29.0		33.0	28.2	28.2	31.4	27.4	
Actuated g/C Ratio		0.37	0.37		0.37		0.42	0.36	0.36	0.40	0.35	
Clearance Time (s)		6.0	6.0		6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		448	580		468		357	663	564	222	1188	
v/s Ratio Prot							0.02	c0.29		c0.02	0.15	
v/s Ratio Perm		0.18	0.03		c0.33		0.11		0.02	0.17		
v/c Ratio		0.49	0.07		0.91		0.31	0.82	0.07	0.49	0.44	
Uniform Delay, d1		19.4	16.3		23.8		14.5	23.2	16.8	17.0	20.0	
Progression Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.8	0.1		20.9		0.5	7.8	0.1	1.7	0.3	
Delay (s)		20.2	16.4		44.7		15.0	31.0	16.9	18.8	20.3	
Level of Service		C	B		D		B	C	B	B	C	
Approach Delay (s)		18.9			44.7			26.7			20.0	
Approach LOS		B			D			C			C	

Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	79.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	100	100	100	100	100	100	400	100	100	400	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	435	109	109	435	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											397	
pX, platoon unblocked	0.87	0.87	0.87	0.87	0.87		0.87					
vC, conflicting volume	1522	1413	435	1522	1467	489	543			543		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1525	1400	279	1525	1463	489	404			543		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	84	0	0	81	89			89		
cM capacity (veh/h)	0	98	663	0	89	579	1008			1025		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	326	326	652	543	109
Volume Left	109	109	109	109	0
Volume Right	109	109	109	0	109
cSH	0	0	1008	1025	1700
Volume to Capacity	Err	Err	0.11	0.11	0.06
Queue Length 95th (ft)	Err	Err	9	9	0
Control Delay (s)	Err	Err	2.7	2.8	0.0
Lane LOS	F	F	A	A	
Approach Delay (s)	Err	Err	2.7	2.3	
Approach LOS	F	F			

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	91.4%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	300	100	400	100	200	100	200	300	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			6.0			6.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.96			0.93			0.97			0.98	
Flt Protected		0.98			0.98			0.99			0.98	
Satd. Flow (prot)		1750			1705			1777			1612	
Flt Permitted		0.98			0.98			0.70			0.67	
Satd. Flow (perm)		1750			1705			1256			1096	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	326	109	435	109	217	109	217	326	109
RTOR Reduction (vph)	0	20	0	0	40	0	0	13	0	0	8	0
Lane Group Flow (vph)	0	307	0	0	830	0	0	422	0	0	644	0
Parking (#/hr)											0	
Turn Type	Split			Split			Perm			Perm		
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)		10.0			27.0			35.0			35.0	
Effective Green, g (s)		10.0			27.0			35.0			35.0	
Actuated g/C Ratio		0.11			0.30			0.39			0.39	
Clearance Time (s)		6.0			6.0			6.0			6.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		194			512			488			426	
v/s Ratio Prot		c0.18			c0.49							
v/s Ratio Perm								0.34			c0.59	
v/c Ratio		1.58			1.62			0.86			1.51	
Uniform Delay, d1		40.0			31.5			25.3			27.5	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		286.3			288.5			14.7			242.2	
Delay (s)		326.3			320.0			40.0			269.7	
Level of Service		F			F			D			F	
Approach Delay (s)		326.3			320.0			40.0			269.7	
Approach LOS		F			F			D			F	

Intersection Summary			
HCM Average Control Delay	253.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.56		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	123.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	200	100	300	100	100	400	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.96		1.00	0.90		1.00	0.96		1.00	0.97	
Flt Protected		0.98		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1750		1770	1677		1770	1613		1770	1626	
Flt Permitted		0.53		0.49	1.00		0.29	1.00		0.37	1.00	
Satd. Flow (perm)		951		908	1677		531	1613		687	1626	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	217	109	326	109	109	435	109
RTOR Reduction (vph)	0	17	0	0	68	0	0	9	0	0	7	0
Lane Group Flow (vph)	0	310	0	109	258	0	109	426	0	109	537	0
Parking (#/hr)								0			0	
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		33.5		33.5	33.5		53.7	47.6		55.3	48.4	
Effective Green, g (s)		33.5		33.5	33.5		53.7	47.6		55.3	48.4	
Actuated g/C Ratio		0.32		0.32	0.32		0.51	0.45		0.52	0.46	
Clearance Time (s)		6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		301		287	530		340	724		429	742	
v/s Ratio Prot					0.15		c0.02	0.26		0.02	c0.33	
v/s Ratio Perm		c0.33		0.12			0.14			0.12		
v/c Ratio		1.03		0.38	0.49		0.32	0.59		0.25	0.72	
Uniform Delay, d1		36.2		28.2	29.3		15.5	21.9		13.9	23.4	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		59.7		0.8	0.7		0.5	3.5		0.3	6.1	
Delay (s)		96.0		29.0	30.0		16.1	25.4		14.2	29.4	
Level of Service		F		C	C		B	C		B	C	
Approach Delay (s)		96.0			29.8			23.5			26.9	
Approach LOS		F			C			C			C	

Intersection Summary			
HCM Average Control Delay	38.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	106.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (veh/h)	100	100	100	100	100	100	100	100	100	100	100	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	109	109	109	109	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	924	815	163	924	815	163	217			217		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	924	815	163	924	815	163	217			217		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	18	59	88	18	59	88	92			92		
cM capacity (veh/h)	132	264	882	132	264	882	1352			1352		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	326	326	326	326
Volume Left	109	109	109	109
Volume Right	109	109	109	109
cSH	240	240	1352	1352
Volume to Capacity	1.36	1.36	0.08	0.08
Queue Length 95th (ft)	441	441	7	7
Control Delay (s)	225.2	225.2	3.1	3.1
Lane LOS	F	F	A	A
Approach Delay (s)	225.2	225.2	3.1	3.1
Approach LOS	F	F		

Intersection Summary			
Average Delay	114.2		
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (veh/h)	100	100	100	100	100	100	100	600	100	200	500	300
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	652	109	217	543	326
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2228	2120	707	2228	2228	707	870			761		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2228	2120	707	2228	2228	707	870			761		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	75	0	0	75	86			74		
cM capacity (veh/h)	0	32	436	0	27	436	775			851		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	326	326	870	1087
Volume Left	109	109	109	217
Volume Right	109	109	109	326
cSH	0	0	775	851
Volume to Capacity	Err	Err	0.14	0.26
Queue Length 95th (ft)	Err	Err	12	25
Control Delay (s)	Err	Err	3.6	6.6
Lane LOS	F	F	A	A
Approach Delay (s)	Err	Err	3.6	6.6
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	117.1%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	700	600	200	200	2000	600	400	800	300	200	400	500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3395		3433	3244	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3395		3433	3244	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	761	652	217	217	2174	652	435	870	326	217	435	543
RTOR Reduction (vph)	0	0	7	0	0	0	0	32	0	0	81	0
Lane Group Flow (vph)	761	652	210	217	2174	652	435	1164	0	217	897	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.0	54.0	71.5	6.0	50.0	64.5	17.5	21.1		14.5	18.1	
Effective Green, g (s)	10.0	54.0	71.5	6.0	50.0	64.5	17.5	21.1		14.5	18.1	
Actuated g/C Ratio	0.08	0.45	0.60	0.05	0.42	0.54	0.15	0.18		0.12	0.15	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	287	1598	1026	172	1480	933	502	599		416	491	
v/s Ratio Prot	c0.22	c0.18	0.03	0.06	c0.61	0.08	c0.13	c0.34		0.06	0.28	
v/s Ratio Perm			0.10			0.33						
v/c Ratio	2.65	0.41	0.20	1.26	1.47	0.70	0.87	1.94		0.52	1.83	
Uniform Delay, d1	54.8	22.1	11.0	56.8	34.8	20.4	49.9	49.2		49.3	50.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	753.1	0.2	0.1	155.9	214.8	2.3	14.5	430.5		1.2	379.6	
Delay (s)	807.9	22.2	11.1	212.7	249.6	22.7	64.5	479.7		50.5	430.4	
Level of Service	F	C	B	F	F	C	E	F		D	F	
Approach Delay (s)		387.6			198.3			369.0			361.4	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	302.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.73		
Actuated Cycle Length (s)	119.6	Sum of lost time (s)	30.0
Intersection Capacity Utilization	133.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	300	100	100	100	100	200	100	700	100	700	700	200
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	326	109	109	109	109	217	109	761	109	761	761	217
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	3696	3478	870	3587	3533	815	978			870		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	3696	3478	870	3587	3533	815	978			870		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	69	0	0	42	85			2		
cM capacity (veh/h)	0	0	351	0	0	377	705			775		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	543	435	978	1739
Volume Left	326	109	109	761
Volume Right	109	217	109	217
cSH	0	0	705	775
Volume to Capacity	Err	Err	0.15	0.98
Queue Length 95th (ft)	Err	Err	14	401
Control Delay (s)	Err	Err	4.3	51.0
Lane LOS	F	F	A	F
Approach Delay (s)	Err	Err	4.3	51.0
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	200.5%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	0	1500	0	0	800
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	1630	0	0	870
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			Raised			Raised
Median storage veh)			1			1
Upstream signal (ft)						1176
pX, platoon unblocked	0.82					
vC, conflicting volume	2500	1630			1630	
vC1, stage 1 conf vol	1630					
vC2, stage 2 conf vol	870					
vCu, unblocked vol	2723	1630			1630	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	118	125			398	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	0	1630	0	870
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	1700	1700	1700
Volume to Capacity	0.00	0.96	0.00	0.51
Queue Length 95th (ft)	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	0.0	0.0	0.0	
Approach LOS	A			

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	100	100	100	100	100	100	1300	100	100	800	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	1413	109	109	870	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2989	2880	924	2989	2880	1467	978			1522		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2989	2880	924	2989	2880	1467	978			1522		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	67	0	0	31	85			75		
cM capacity (veh/h)	0	10	327	0	10	157	705			438		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	326	326	1630	1087
Volume Left	109	109	109	109
Volume Right	109	109	109	109
cSH	0	0	705	438
Volume to Capacity	Err	Err	0.15	0.25
Queue Length 95th (ft)	Err	Err	14	24
Control Delay (s)	Err	Err	11.0	9.9
Lane LOS	F	F	B	A
Approach Delay (s)	Err	Err	11.0	9.9
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	125.3%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (veh/h)	200	100	100	100	100	100	100	1200	100	100	700	200
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	217	109	109	109	109	109	109	1304	109	109	761	217
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2826	2717	870	2826	2772	1359	978			1413		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2826	2717	870	2826	2772	1359	978			1413		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	69	0	0	40	85			77		
cM capacity (veh/h)	0	14	351	0	13	182	705			482		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	435	326	1522	1087
Volume Left	217	109	109	109
Volume Right	109	109	109	217
cSH	0	0	705	482
Volume to Capacity	Err	Err	0.15	0.23
Queue Length 95th (ft)	Err	Err	14	21
Control Delay (s)	Err	Err	10.1	8.4
Lane LOS	F	F	B	A
Approach Delay (s)	Err	Err	10.1	8.4
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	133.3%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	200	200	400	100	200	100	200	500	100	100	500	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	217	217	435	109	217	109	217	543	109	109	543	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2011	1902	598	2337	1902	598	652			652		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2011	1902	598	2337	1902	598	652			652		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	13	0	0	78	77			88		
cM capacity (veh/h)	0	47	502	0	47	502	934			934		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	217	652	109	326	217	652	109	652
Volume Left	217	0	109	0	217	0	109	0
Volume Right	0	435	0	109	0	109	0	109
cSH	0	118	0	67	934	1700	934	1700
Volume to Capacity	Err	5.52	Err	4.87	0.23	0.38	0.12	0.38
Queue Length 95th (ft)	Err	Err	Err	Err	23	0	10	0
Control Delay (s)	Err	Err	Err	Err	10.0	0.0	9.4	0.0
Lane LOS	F	F	F	F	B		A	
Approach Delay (s)	Err		Err		2.5		1.3	
Approach LOS	F		F					

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	97.4%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	100	100	100	100	100	100	600	100	100	800	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	652	109	109	870	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2228	2120	924	2228	2120	707	978			761		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2228	2120	924	2228	2120	707	978			761		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	67	0	0	75	85			87		
cM capacity (veh/h)	0	37	327	0	37	436	705			851		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	326	326	870	1087
Volume Left	109	109	109	109
Volume Right	109	109	109	109
cSH	0	0	705	851
Volume to Capacity	Err	Err	0.15	0.13
Queue Length 95th (ft)	Err	Err	14	11
Control Delay (s)	Err	Err	4.1	3.7
Lane LOS	F	F	A	A
Approach Delay (s)	Err	Err	4.1	3.7
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	96.4%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	200	100	100	100	100	500	100	100	800	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	0.95	
Frt		1.00	0.85		0.96		1.00	1.00	0.85	1.00	0.98	
Flt Protected		0.98	1.00		0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1817	1583		1750		1770	1863	1583	1770	3480	
Flt Permitted		0.65	1.00		0.77		0.17	1.00	1.00	0.24	1.00	
Satd. Flow (perm)		1209	1583		1376		309	1863	1583	444	3480	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	217	109	109	109	109	543	109	109	870	109
RTOR Reduction (vph)	0	0	100	0	16	0	0	0	67	0	9	0
Lane Group Flow (vph)	0	218	117	0	311	0	109	543	42	109	970	0
Turn Type	pm+pt		Perm	Perm			pm+pt		Perm	pm+pt		
Protected Phases	5	2			6		3	8		7	4	
Permitted Phases	2		2	6			8		8	4		
Actuated Green, G (s)		22.9	22.9		22.9		31.9	27.8	27.8	31.9	27.8	
Effective Green, g (s)		22.9	22.9		22.9		31.9	27.8	27.8	31.9	27.8	
Actuated g/C Ratio		0.31	0.31		0.31		0.44	0.38	0.38	0.44	0.38	
Clearance Time (s)		6.0	6.0		6.0		6.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		380	498		433		218	711	604	269	1329	
v/s Ratio Prot							c0.03	c0.29		0.02	0.28	
v/s Ratio Perm		0.18	0.07		c0.23		0.19		0.03	0.15		
v/c Ratio		0.57	0.23		0.72		0.50	0.76	0.07	0.41	0.73	
Uniform Delay, d1		20.9	18.5		22.1		13.5	19.6	14.3	13.7	19.3	
Progression Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.1	0.2		5.6		1.8	4.9	0.0	1.0	2.1	
Delay (s)		23.0	18.7		27.7		15.3	24.5	14.3	14.7	21.4	
Level of Service		C	B		C		B	C	B	B	C	
Approach Delay (s)		20.8			27.7			21.7			20.7	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	72.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	100	100	100	100	100	100	500	100	100	800	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	543	109	109	870	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											397	
pX, platoon unblocked	0.70	0.70	0.70	0.70	0.70		0.70					
vC, conflicting volume	2065	1957	870	2065	2011	598	978			652		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2308	2153	598	2308	2231	598	754			652		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	69	0	0	78	82			88		
cM capacity (veh/h)	0	24	351	0	22	502	599			934		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	326	326	761	978	109
Volume Left	109	109	109	109	0
Volume Right	109	109	109	0	109
cSH	0	0	599	934	1700
Volume to Capacity	Err	Err	0.18	0.12	0.06
Queue Length 95th (ft)	Err	Err	16	10	0
Control Delay (s)	Err	Err	4.9	3.0	0.0
Lane LOS	F	F	A	A	
Approach Delay (s)	Err	Err	4.9	2.7	
Approach LOS	F	F			

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	117.8%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	300	100	400	100	300	100	100	300	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			6.0			6.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.96			0.93			0.97			0.97	
Flt Protected		0.98			0.98			0.99			0.99	
Satd. Flow (prot)		1750			1705			1794			1615	
Flt Permitted		0.98			0.98			0.69			0.69	
Satd. Flow (perm)		1750			1705			1245			1120	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	326	109	435	109	326	109	109	326	109
RTOR Reduction (vph)	0	20	0	0	40	0	0	10	0	0	10	0
Lane Group Flow (vph)	0	307	0	0	830	0	0	534	0	0	534	0
Parking (#/hr)											0	
Turn Type	Split			Split			Perm			Perm		
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)		11.0			30.0			31.0			31.0	
Effective Green, g (s)		11.0			30.0			31.0			31.0	
Actuated g/C Ratio		0.12			0.33			0.34			0.34	
Clearance Time (s)		6.0			6.0			6.0			6.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		214			568			429			386	
v/s Ratio Prot		c0.18			c0.49							
v/s Ratio Perm								0.43			c0.48	
v/c Ratio		1.43			1.46			1.25			1.38	
Uniform Delay, d1		39.5			30.0			29.5			29.5	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		219.8			217.2			128.6			188.2	
Delay (s)		259.3			247.2			158.1			217.7	
Level of Service		F			F			F			F	
Approach Delay (s)		259.3			247.2			158.1			217.7	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	220.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.42		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	110.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	100	100	400	100	100	700	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.96		1.00	0.92		1.00	0.97		1.00	0.98	
Flt Protected		0.98		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1750		1770	1723		1770	1626		1770	1645	
Flt Permitted		0.66		0.46	1.00		0.09	1.00		0.33	1.00	
Satd. Flow (perm)		1176		860	1723		169	1626		611	1645	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	109	109	435	109	109	761	109
RTOR Reduction (vph)	0	15	0	0	30	0	0	8	0	0	4	0
Lane Group Flow (vph)	0	312	0	109	188	0	109	536	0	109	866	0
Parking (#/hr)								0			0	
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)		32.8		32.8	32.8		68.0	63.0		68.0	63.0	
Effective Green, g (s)		32.8		32.8	32.8		68.0	63.0		68.0	63.0	
Actuated g/C Ratio		0.28		0.28	0.28		0.57	0.53		0.57	0.53	
Clearance Time (s)		6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		325		237	476		164	862		399	872	
v/s Ratio Prot					0.11		c0.03	0.33		0.01	c0.53	
v/s Ratio Perm		c0.27		0.13			0.35			0.15		
v/c Ratio		0.96		0.46	0.39		0.66	0.62		0.27	0.99	
Uniform Delay, d1		42.3		35.7	34.9		22.4	19.6		13.2	27.7	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		38.6		1.4	0.5		9.7	3.4		0.4	28.8	
Delay (s)		81.0		37.1	35.5		32.1	22.9		13.5	56.5	
Level of Service		F		D	D		C	C		B	E	
Approach Delay (s)		81.0			36.0			24.5			51.7	
Approach LOS		F			D			C			D	

Intersection Summary			
HCM Average Control Delay	45.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	118.8	Sum of lost time (s)	18.0
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	200	100	100	100	100	100	100	100	100	100	100	200
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	217	109	109	109	109	109	109	109	109	109	109	217
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	978	870	217	978	924	163	326			217		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	978	870	217	978	924	163	326			217		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	55	87	5	52	88	91			92		
cM capacity (veh/h)	111	243	822	115	226	882	1234			1352		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	435	326	326	435
Volume Left	217	109	109	109
Volume Right	109	109	109	217
cSH	171	210	1234	1352
Volume to Capacity	2.54	1.55	0.09	0.08
Queue Length 95th (ft)	932	512	7	7
Control Delay (s)	750.4	311.7	3.3	2.6
Lane LOS	F	F	A	A
Approach Delay (s)	750.4	311.7	3.3	2.6
Approach LOS	F	F		

Intersection Summary			
Average Delay	282.6		
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	700	900	200	100	300	200	200	1300	100	200	1100	200
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	761	978	217	109	326	217	217	1413	109	217	1196	217
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	4022	3696	1304	4348	3750	1467	1413			1522		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	4022	3696	1304	4348	3750	1467	1413			1522		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	0	0	0	0	55			50		
cM capacity (veh/h)	0	1	196	0	1	157	482			438		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	1957	652	1739	1630
Volume Left	761	109	217	217
Volume Right	217	217	109	217
cSH	0	0	482	438
Volume to Capacity	Err	Err	0.45	0.50
Queue Length 95th (ft)	Err	Err	58	67
Control Delay (s)	Err	Err	18.4	21.0
Lane LOS	F	F	C	C
Approach Delay (s)	Err	Err	18.4	21.0
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	253.9%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	700	1600	700	300	1200	200	600	1000	400	600	900	700
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3387		3433	3307	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3387		3433	3307	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	761	1739	761	326	1304	217	652	1087	435	652	978	761
RTOR Reduction (vph)	0	0	0	0	0	0	0	36	0	0	87	0
Lane Group Flow (vph)	761	1739	761	326	1304	217	652	1486	0	652	1652	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.0	54.0	72.0	6.0	50.0	66.0	18.0	20.0		16.0	18.0	
Effective Green, g (s)	10.0	54.0	72.0	6.0	50.0	66.0	18.0	20.0		16.0	18.0	
Actuated g/C Ratio	0.08	0.45	0.60	0.05	0.42	0.55	0.15	0.17		0.13	0.15	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	286	1593	1029	172	1475	950	515	565		458	496	
v/s Ratio Prot	c0.22	c0.49	0.11	0.09	0.37	0.03	c0.19	0.44		0.19	c0.50	
v/s Ratio Perm			0.37			0.11						
v/c Ratio	2.66	1.09	0.74	1.90	0.88	0.23	1.27	2.63		1.42	3.33	
Uniform Delay, d1	55.0	33.0	17.3	57.0	32.3	13.9	51.0	50.0		52.0	51.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	757.3	51.9	2.8	424.0	6.7	0.1	134.5	738.8		203.0	1054.2	
Delay (s)	812.3	84.9	20.1	481.0	39.0	14.0	185.5	788.8		255.0	1105.2	
Level of Service	F	F	C	F	D	B	F	F		F	F	
Approach Delay (s)		239.5			114.1			607.9			873.4	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	455.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.74		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	137.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	700	1600	700	300	1200	200	700	1000	400	600	900	700
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	761	1739	761	326	1304	217	761	1087	435	652	978	761
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	6359	5707	1359	7120	5870	1304	1739			1522		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	6359	5707	1359	7120	5870	1304	1739			1522		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	0	0	0	0	0			0		
cM capacity (veh/h)	0	0	182	0	0	196	361			438		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	3261	1848	2283	2391
Volume Left	761	326	761	652
Volume Right	761	217	435	761
cSH	0	0	361	438
Volume to Capacity	Err	Err	2.11	1.49
Queue Length 95th (ft)	Err	Err	1378	848
Control Delay (s)	Err	Err	530.5	69.7
Lane LOS	F	F	F	F
Approach Delay (s)	Err	Err	530.5	69.7
Approach LOS	F	F		

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	418.9%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	0	2100	0	0	1900
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	2283	0	0	2065
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			Raised			Raised
Median storage veh)			1			1
Upstream signal (ft)						1176
pX, platoon unblocked	0.81					
vC, conflicting volume	4348	2283			2283	
vC1, stage 1 conf vol	2283					
vC2, stage 2 conf vol	2065					
vCu, unblocked vol	5028	2283			2283	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	36	50			222	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	0	2283	0	2065
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	1700	1700	1700
Volume to Capacity	0.00	1.34	0.00	1.21
Queue Length 95th (ft)	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	0.0	0.0	0.0	
Approach LOS	A			

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	113.9%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	100	100	600	100	100	500	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.92		1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1723		1770	1723		1770	3539	1583	1770	3539	1583
Flt Permitted	0.62	1.00		0.62	1.00		0.45	1.00	1.00	0.33	1.00	1.00
Satd. Flow (perm)	1158	1723		1158	1723		832	3539	1583	624	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	109	109	652	109	109	543	109
RTOR Reduction (vph)	0	45	0	0	45	0	0	0	75	0	0	74
Lane Group Flow (vph)	109	173	0	109	173	0	109	652	34	109	543	35
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		Perm
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	11.6	11.6		11.6	11.6		21.6	16.2	16.2	22.6	16.7	16.7
Effective Green, g (s)	11.6	11.6		11.6	11.6		21.6	16.2	16.2	22.6	16.7	16.7
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.42	0.31	0.31	0.44	0.32	0.32
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	260	387		260	387		446	1109	496	404	1143	511
v/s Ratio Prot		c0.10			0.10		0.03	c0.18		c0.03	0.15	
v/s Ratio Perm	0.09			0.09			0.08		0.02	0.09		0.02
v/c Ratio	0.42	0.45		0.42	0.45		0.24	0.59	0.07	0.27	0.48	0.07
Uniform Delay, d1	17.2	17.3		17.2	17.3		9.3	14.9	12.5	8.8	14.0	12.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.8		1.1	0.8		0.3	0.8	0.1	0.4	0.3	0.1
Delay (s)	18.3	18.1		18.3	18.1		9.6	15.7	12.5	9.2	14.3	12.2
Level of Service	B	B		B	B		A	B	B	A	B	B
Approach Delay (s)		18.2			18.2			14.6			13.3	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	51.7	Sum of lost time (s)	18.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	100	100	600	100	100	400	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.92		1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1723		1770	1723		1770	3539	1583	1770	3539	1583
Flt Permitted	0.62	1.00		0.62	1.00		0.50	1.00	1.00	0.33	1.00	1.00
Satd. Flow (perm)	1158	1723		1158	1723		930	3539	1583	614	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	109	109	652	109	109	435	109
RTOR Reduction (vph)	0	45	0	0	45	0	0	0	75	0	0	74
Lane Group Flow (vph)	109	173	0	109	173	0	109	652	34	109	435	35
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		Perm
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	11.6	11.6		11.6	11.6		21.6	16.2	16.2	23.0	16.9	16.9
Effective Green, g (s)	11.6	11.6		11.6	11.6		21.6	16.2	16.2	23.0	16.9	16.9
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.42	0.31	0.31	0.44	0.33	0.33
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	259	385		259	385		474	1105	494	408	1152	515
v/s Ratio Prot		c0.10			0.10		0.02	c0.18		c0.03	0.12	
v/s Ratio Perm	0.09			0.09			0.07		0.02	0.09		0.02
v/c Ratio	0.42	0.45		0.42	0.45		0.23	0.59	0.07	0.27	0.38	0.07
Uniform Delay, d1	17.3	17.4		17.3	17.4		9.4	15.1	12.5	8.7	13.5	12.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.8		1.1	0.8		0.2	0.8	0.1	0.4	0.2	0.1
Delay (s)	18.4	18.2		18.4	18.2		9.7	15.9	12.6	9.0	13.7	12.1
Level of Service	B	B		B	B		A	B	B	A	B	B
Approach Delay (s)		18.3			18.3			14.7			12.6	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	51.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	100	100	100	300	200	300	400	100	100	300	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.92		1.00	0.94		1.00	0.97		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1723		1770	1751		1770	3433		1770	3327	
Flt Permitted	0.27	1.00		0.60	1.00		0.18	1.00		0.45	1.00	
Satd. Flow (perm)	501	1723		1120	1751		335	3433		836	3327	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	109	109	109	326	217	326	435	109	109	326	217
RTOR Reduction (vph)	0	36	0	0	24	0	0	20	0	0	100	0
Lane Group Flow (vph)	217	182	0	109	519	0	326	524	0	109	443	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	40.9	40.9		40.9	40.9		41.4	32.4		21.0	18.0	
Effective Green, g (s)	40.9	40.9		40.9	40.9		41.4	32.4		21.0	18.0	
Actuated g/C Ratio	0.43	0.43		0.43	0.43		0.44	0.34		0.22	0.19	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	217	747		486	759		412	1180		216	635	
v/s Ratio Prot		0.11			0.30		c0.15	0.15		0.02	0.13	
v/s Ratio Perm	c0.43			0.10			c0.20			0.10		
v/c Ratio	1.00	0.24		0.22	0.68		0.79	0.44		0.50	0.70	
Uniform Delay, d1	26.7	16.9		16.7	21.5		20.0	24.0		30.7	35.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	61.1	0.2		0.2	2.6		10.0	0.3		1.9	3.4	
Delay (s)	87.8	17.1		17.0	24.1		30.0	24.2		32.6	39.0	
Level of Service	F	B		B	C		C	C		C	D	
Approach Delay (s)		52.4			22.9			26.4			37.9	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM Average Control Delay	32.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	94.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	100	100	600	100	100	400	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.92		1.00	0.92		1.00	0.98		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1723		1770	1723		1770	3463		1770	3433	
Flt Permitted	0.62	1.00		0.62	1.00		0.45	1.00		0.27	1.00	
Satd. Flow (perm)	1158	1723		1158	1723		836	3463		494	3433	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	109	109	652	109	109	435	109
RTOR Reduction (vph)	0	35	0	0	35	0	0	19	0	0	32	0
Lane Group Flow (vph)	109	183	0	109	183	0	109	742	0	109	512	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	12.3	12.3		12.3	12.3		21.6	18.7		24.6	20.2	
Effective Green, g (s)	12.3	12.3		12.3	12.3		21.6	18.7		24.6	20.2	
Actuated g/C Ratio	0.23	0.23		0.23	0.23		0.40	0.35		0.46	0.38	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	267	397		267	397		389	1213		333	1299	
v/s Ratio Prot		c0.11			0.11		0.02	c0.21		c0.03	0.15	
v/s Ratio Perm	0.09			0.09			0.10			0.12		
v/c Ratio	0.41	0.46		0.41	0.46		0.28	0.61		0.33	0.39	
Uniform Delay, d1	17.5	17.7		17.5	17.7		10.1	14.3		8.6	12.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.8		1.0	0.8		0.4	0.9		0.6	0.2	
Delay (s)	18.5	18.5		18.5	18.5		10.5	15.3		9.2	12.3	
Level of Service	B	B		B	B		B	B		A	B	
Approach Delay (s)		18.5			18.5			14.7			11.8	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	53.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	200	100	500	100	100	400	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	0.95	
Frt		1.00	0.85		0.93		1.00	0.97		1.00	0.97	
Flt Protected		0.98	1.00		0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1817	1583		1716		1770	3450		1770	3433	
Flt Permitted		0.63	1.00		0.85		0.38	1.00		0.29	1.00	
Satd. Flow (perm)		1165	1583		1477		711	3450		548	3433	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	217	109	543	109	109	435	109
RTOR Reduction (vph)	0	0	67	0	31	0	0	20	0	0	25	0
Lane Group Flow (vph)	0	218	42	0	404	0	109	632	0	109	519	0
Turn Type	pm+pt		Perm	Perm			pm+pt			pm+pt		
Protected Phases	5	2			6		3	8		7	4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)		24.3	24.3		24.3		20.2	17.2		20.2	17.2	
Effective Green, g (s)		24.3	24.3		24.3		20.2	17.2		20.2	17.2	
Actuated g/C Ratio		0.39	0.39		0.39		0.32	0.28		0.32	0.28	
Clearance Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		453	615		574		281	949		236	945	
v/s Ratio Prot							0.02	c0.18		c0.02	0.15	
v/s Ratio Perm		0.19	0.03		c0.27		0.11			0.13		
v/c Ratio		0.48	0.07		0.70		0.39	0.67		0.46	0.55	
Uniform Delay, d1		14.4	12.0		16.1		15.3	20.1		15.5	19.3	
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.8	0.0		3.9		0.9	1.8		1.4	0.7	
Delay (s)		15.2	12.0		20.0		16.2	21.9		16.9	20.0	
Level of Service		B	B		C		B	C		B	B	
Approach Delay (s)		14.1			20.0			21.1			19.5	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	62.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	100	100	100	100	100	100	400	100	100	400	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	435	109	109	435	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											397	
pX, platoon unblocked	0.91	0.91	0.91	0.91	0.91		0.91					
vC, conflicting volume	1304	1467	272	1304	1467	272	543			543		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1140	1319	7	1140	1319	272	305			543		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	5	89	0	5	85	90			89		
cM capacity (veh/h)	17	115	978	18	115	726	1142			1022		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	326	326	326	326	326	326
Volume Left	109	109	109	0	109	0
Volume Right	109	109	0	109	0	109
cSH	43	45	1142	1700	1022	1700
Volume to Capacity	7.51	7.27	0.10	0.19	0.11	0.19
Queue Length 95th (ft)	Err	Err	8	0	9	0
Control Delay (s)	Err	Err	3.4	0.0	3.7	0.0
Lane LOS	F	F	A		A	
Approach Delay (s)	Err	Err	1.7		1.9	
Approach LOS	F	F				

Intersection Summary			
Average Delay	3334.2		
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	400	100	300	100	200	100	200	300	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.92		1.00	0.89		1.00	0.95		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1723		1770	1653		1770	1769		1770	1613	
Flt Permitted	0.43	1.00		0.34	1.00		0.29	1.00		0.39	1.00	
Satd. Flow (perm)	804	1723		637	1653		534	1769		733	1613	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	435	109	326	109	217	109	217	326	109
RTOR Reduction (vph)	0	45	0	0	128	0	0	23	0	0	15	0
Lane Group Flow (vph)	109	173	0	435	307	0	109	303	0	217	420	0
Parking (#/hr)											0	
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	17.5	13.7		32.9	23.1		26.0	23.0		28.2	24.1	
Effective Green, g (s)	17.5	13.7		32.9	23.1		26.0	23.0		28.2	24.1	
Actuated g/C Ratio	0.22	0.18		0.42	0.30		0.33	0.29		0.36	0.31	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	227	303		460	490		226	522		320	498	
v/s Ratio Prot	0.02	0.10		c0.16	0.19		0.02	0.17		c0.04	c0.26	
v/s Ratio Perm	0.08			c0.24			0.14			0.21		
v/c Ratio	0.48	0.57		0.95	0.63		0.48	0.58		0.68	0.84	
Uniform Delay, d1	25.1	29.5		19.0	23.7		20.1	23.4		21.3	25.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	2.6		28.5	2.5		1.6	1.7		5.6	12.4	
Delay (s)	26.7	32.1		47.4	26.2		21.8	25.1		26.9	37.6	
Level of Service	C	C		D	C		C	C		C	D	
Approach Delay (s)		30.3			36.8			24.2			34.0	
Approach LOS		C			D			C			C	

Intersection Summary			
HCM Average Control Delay	32.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	78.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	200	100	400	100	100	400	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.92		1.00	0.90		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1723		1770	1677		1770	1626		1770	1676	1583
Flt Permitted	0.30	1.00		0.53	1.00		0.47	1.00		0.30	1.00	1.00
Satd. Flow (perm)	562	1723		992	1677		870	1626		558	1676	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	217	109	435	109	109	435	109
RTOR Reduction (vph)	0	48	0	0	94	0	0	8	0	0	0	53
Lane Group Flow (vph)	109	170	0	109	232	0	109	536	0	109	435	56
Parking (#/hr)								0			0	
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)	15.5	15.5		15.5	15.5		39.1	36.1		44.3	38.7	38.7
Effective Green, g (s)	15.5	15.5		15.5	15.5		39.1	36.1		44.3	38.7	38.7
Actuated g/C Ratio	0.21	0.21		0.21	0.21		0.52	0.48		0.59	0.51	0.51
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	116	355		204	346		488	781		419	863	815
v/s Ratio Prot		0.10			0.14		0.01	c0.33		c0.02	c0.26	
v/s Ratio Perm	c0.19			0.11			0.11			0.13		0.04
v/c Ratio	0.94	0.48		0.53	0.67		0.22	0.69		0.26	0.50	0.07
Uniform Delay, d1	29.4	26.3		26.6	27.5		9.3	15.2		8.2	12.0	9.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	64.0	1.0		2.7	4.9		0.2	4.9		0.3	2.1	0.2
Delay (s)	93.3	27.3		29.3	32.3		9.5	20.0		8.5	14.1	9.3
Level of Service	F	C		C	C		A	C		A	B	A
Approach Delay (s)		49.3			31.6			18.3			12.3	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM Average Control Delay	24.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	75.2	Sum of lost time (s)	24.0
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	100	100	100	100	100	100	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.92		1.00	0.92		1.00	0.92		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1723		1770	1723		1770	1723		1770	1723	
Flt Permitted	0.62	1.00		0.62	1.00		0.62	1.00		0.62	1.00	
Satd. Flow (perm)	1158	1723		1158	1723		1158	1723		1147	1723	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	109	109	109	109	109	109	109
RTOR Reduction (vph)	0	47	0	0	47	0	0	41	0	0	40	0
Lane Group Flow (vph)	109	171	0	109	171	0	109	177	0	109	178	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	10.4	10.4		10.4	10.4		15.7	10.4		15.9	10.5	
Effective Green, g (s)	10.4	10.4		10.4	10.4		15.7	10.4		15.9	10.5	
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.36	0.24		0.36	0.24	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	272	405		272	405		485	405		489	409	
v/s Ratio Prot		c0.10			0.10		0.03	0.10		c0.03	c0.10	
v/s Ratio Perm	0.09			0.09			0.05			0.05		
v/c Ratio	0.40	0.42		0.40	0.42		0.22	0.44		0.22	0.43	
Uniform Delay, d1	14.3	14.4		14.3	14.4		9.8	14.4		9.7	14.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.7		1.0	0.7		0.2	0.8		0.2	0.7	
Delay (s)	15.2	15.1		15.2	15.1		10.0	15.2		9.9	15.1	
Level of Service	B	B		B	B		B	B		A	B	
Approach Delay (s)		15.1			15.1			13.4			13.3	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	44.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	100	100	600	100	200	500	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	109	109	652	109	217	543	326
RTOR Reduction (vph)	0	0	84	0	0	81	0	0	67	0	0	187
Lane Group Flow (vph)	109	109	25	109	109	28	109	652	42	217	543	139
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Actuated Green, G (s)	7.8	7.7	15.5	7.8	7.7	17.7	7.8	18.7	26.5	10.0	20.9	28.7
Effective Green, g (s)	7.8	7.7	15.5	7.8	7.7	17.7	7.8	18.7	26.5	10.0	20.9	28.7
Actuated g/C Ratio	0.11	0.11	0.23	0.11	0.11	0.26	0.11	0.27	0.39	0.15	0.31	0.42
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	393	400	499	393	400	550	393	970	754	503	1085	805
v/s Ratio Prot	c0.03	c0.03	0.01	0.03	0.03	0.01	0.03	c0.18	0.01	c0.06	0.15	0.02
v/s Ratio Perm			0.01			0.01			0.02			0.07
v/c Ratio	0.28	0.27	0.05	0.28	0.27	0.05	0.28	0.67	0.06	0.43	0.50	0.17
Uniform Delay, d1	27.6	27.7	20.6	27.6	27.7	18.9	27.6	22.0	13.0	26.5	19.4	12.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.4	0.0	0.4	0.4	0.0	0.4	1.8	0.0	0.6	0.4	0.1
Delay (s)	28.0	28.1	20.6	28.0	28.1	19.0	28.0	23.9	13.1	27.1	19.7	12.4
Level of Service	C	C	C	C	C	B	C	C	B	C	B	B
Approach Delay (s)		25.6			25.0			23.0			19.0	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	68.2	Sum of lost time (s)	24.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	700	600	200	200	2000	600	400	800	300	200	400	500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	3539	1583	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	761	652	217	217	2174	652	435	870	326	217	435	543
RTOR Reduction (vph)	0	0	35	0	0	1	0	0	71	0	0	4
Lane Group Flow (vph)	761	652	182	217	2174	651	435	870	255	217	435	539
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Actuated Green, G (s)	20.0	44.4	61.9	13.6	38.0	52.4	17.5	22.1	35.7	14.4	19.0	39.0
Effective Green, g (s)	20.0	44.4	61.9	13.6	38.0	52.4	17.5	22.1	35.7	14.4	19.0	39.0
Actuated g/C Ratio	0.17	0.37	0.52	0.11	0.32	0.44	0.15	0.19	0.30	0.12	0.16	0.33
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	579	1905	907	394	1631	780	507	660	557	417	567	601
v/s Ratio Prot	c0.22	0.13	0.03	0.06	c0.43	0.10	c0.13	c0.25	0.05	0.06	0.12	0.15
v/s Ratio Perm			0.09			0.31			0.11			0.19
v/c Ratio	1.31	0.34	0.20	0.55	1.33	0.83	0.86	1.32	0.46	0.52	0.77	0.90
Uniform Delay, d1	49.3	26.6	15.1	49.6	40.2	29.2	49.3	48.2	33.5	48.8	47.6	37.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	153.4	0.1	0.1	1.7	154.1	7.7	13.5	153.7	0.6	1.2	6.2	16.0
Delay (s)	202.7	26.7	15.2	51.2	194.4	36.9	62.8	201.9	34.1	50.0	53.8	53.8
Level of Service	F	C	B	D	F	D	E	F	C	D	D	D
Approach Delay (s)		107.3			150.4			131.3			53.1	
Approach LOS		F			F			F			D	

Intersection Summary			
HCM Average Control Delay	121.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	118.5	Sum of lost time (s)	24.0
Intersection Capacity Utilization	106.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	300	100	100	100	100	200	100	700	100	700	700	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	326	109	109	109	109	217	109	761	109	761	761	217
RTOR Reduction (vph)	0	0	95	0	0	25	0	0	71	0	0	37
Lane Group Flow (vph)	326	109	14	109	109	192	109	761	38	761	761	180
Turn Type	Prot		Perm	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4		3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	13.5	12.7	12.7	6.9	6.1	32.7	6.9	27.0	33.9	26.6	46.7	60.2
Effective Green, g (s)	13.5	12.7	12.7	6.9	6.1	32.7	6.9	27.0	33.9	26.6	46.7	60.2
Actuated g/C Ratio	0.14	0.13	0.13	0.07	0.06	0.34	0.07	0.28	0.35	0.27	0.48	0.62
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	477	462	207	244	222	630	244	983	650	939	1700	1078
v/s Ratio Prot	c0.09	0.03		0.03	c0.03	0.08	0.03	c0.22	0.00	c0.22	0.22	0.02
v/s Ratio Perm			0.01			0.04			0.02			0.09
v/c Ratio	0.68	0.24	0.07	0.45	0.49	0.31	0.45	0.77	0.06	0.81	0.45	0.17
Uniform Delay, d1	39.8	37.9	37.1	43.3	44.0	23.9	43.3	32.3	21.0	32.9	16.7	7.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.0	0.3	0.1	1.3	1.7	0.3	1.3	3.9	0.0	5.4	0.2	0.1
Delay (s)	43.8	38.2	37.2	44.6	45.8	24.1	44.6	36.2	21.1	38.3	16.9	7.9
Level of Service	D	D	D	D	D	C	D	D	C	D	B	A
Approach Delay (s)		41.4			34.7			35.4			25.2	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	31.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	97.2	Sum of lost time (s)	24.0
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	100	100	1300	100	100	800	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.92		1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1723		1770	1723		1770	3539	1583	1770	3539	1583
Flt Permitted	0.53	1.00		0.53	1.00		0.27	1.00	1.00	0.11	1.00	1.00
Satd. Flow (perm)	995	1723		995	1723		499	3539	1583	210	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	109	109	1413	109	109	870	109
RTOR Reduction (vph)	0	43	0	0	43	0	0	0	52	0	0	55
Lane Group Flow (vph)	109	175	0	109	175	0	109	1413	57	109	870	54
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		Perm
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	13.9	13.9		13.9	13.9		39.8	35.5	35.5	39.8	35.5	35.5
Effective Green, g (s)	13.9	13.9		13.9	13.9		39.8	35.5	35.5	39.8	35.5	35.5
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.56	0.50	0.50	0.56	0.50	0.50
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	193	334		193	334		353	1752	784	210	1752	784
v/s Ratio Prot		0.10			0.10		0.02	c0.40		c0.03	0.25	
v/s Ratio Perm	c0.11			0.11			0.15		0.04	0.26		0.03
v/c Ratio	0.56	0.52		0.56	0.52		0.31	0.81	0.07	0.52	0.50	0.07
Uniform Delay, d1	26.2	25.9		26.2	25.9		7.9	15.2	9.5	11.0	12.1	9.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.8	1.5		3.8	1.5		0.5	2.8	0.0	2.2	0.2	0.0
Delay (s)	29.9	27.4		29.9	27.4		8.4	18.0	9.5	13.2	12.3	9.5
Level of Service	C	C		C	C		A	B	A	B	B	A
Approach Delay (s)		28.3			28.3			16.8			12.1	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	71.7	Sum of lost time (s)	18.0
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	100	100	100	100	100	100	1200	100	100	700	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.92		1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1723		1770	1723		1770	3539	1583	1770	3539	1583
Flt Permitted	0.57	1.00		0.57	1.00		0.30	1.00	1.00	0.12	1.00	1.00
Satd. Flow (perm)	1060	1723		1060	1723		550	3539	1583	219	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	109	109	109	109	109	109	1304	109	109	761	217
RTOR Reduction (vph)	0	42	0	0	42	0	0	0	56	0	0	121
Lane Group Flow (vph)	217	176	0	109	176	0	109	1304	53	109	761	96
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		Perm
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	20.9	20.9		20.9	20.9		38.4	34.1	34.1	38.4	34.1	34.1
Effective Green, g (s)	20.9	20.9		20.9	20.9		38.4	34.1	34.1	38.4	34.1	34.1
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.50	0.44	0.44	0.50	0.44	0.44
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	287	466		287	466		341	1561	698	195	1561	698
v/s Ratio Prot		0.10			0.10		0.02	c0.37		c0.03	0.22	
v/s Ratio Perm	c0.20			0.10			0.14		0.03	0.25		0.06
v/c Ratio	0.76	0.38		0.38	0.38		0.32	0.84	0.08	0.56	0.49	0.14
Uniform Delay, d1	25.9	22.9		22.9	22.9		10.7	19.1	12.5	13.9	15.4	12.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.8	0.5		0.8	0.5		0.5	4.0	0.0	3.4	0.2	0.1
Delay (s)	36.7	23.4		23.8	23.4		11.3	23.2	12.5	17.3	15.6	12.9
Level of Service	D	C		C	C		B	C	B	B	B	B
Approach Delay (s)		30.0			23.5			21.5			15.3	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	20.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	77.3	Sum of lost time (s)	18.0
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	200	400	100	200	100	200	500	100	100	500	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.90		1.00	0.95		1.00	0.97		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1676		1770	1769		1770	3450		1770	3450	
Flt Permitted	0.51	1.00		0.22	1.00		0.23	1.00		0.26	1.00	
Satd. Flow (perm)	953	1676		415	1769		436	3450		491	3450	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	217	435	109	217	109	217	543	109	109	543	109
RTOR Reduction (vph)	0	54	0	0	13	0	0	20	0	0	20	0
Lane Group Flow (vph)	217	598	0	109	313	0	217	632	0	109	632	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	41.1	41.1		41.1	41.1		27.2	23.2		25.4	22.3	
Effective Green, g (s)	41.1	41.1		41.1	41.1		27.2	23.2		25.4	22.3	
Actuated g/C Ratio	0.48	0.48		0.48	0.48		0.32	0.27		0.30	0.26	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	459	807		200	851		201	937		192	901	
v/s Ratio Prot		c0.36			0.18		c0.05	0.18		0.02	0.18	
v/s Ratio Perm	0.23			0.26			c0.29			0.15		
v/c Ratio	0.47	0.74		0.55	0.37		1.08	0.67		0.57	0.70	
Uniform Delay, d1	14.9	17.9		15.6	14.0		28.4	27.7		24.3	28.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	3.7		3.0	0.3		86.3	1.9		3.8	2.5	
Delay (s)	15.6	21.5		18.6	14.2		114.6	29.7		28.1	31.0	
Level of Service	B	C		B	B		F	C		C	C	
Approach Delay (s)		20.1			15.3			50.9			30.6	
Approach LOS		C			B			D			C	

Intersection Summary			
HCM Average Control Delay	31.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	85.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	100	100	100	100	600	100	100	800	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.92		1.00	0.92		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1723		1770	1723		1770	3463		1770	3480	
Flt Permitted	0.61	1.00		0.61	1.00		0.21	1.00		0.28	1.00	
Satd. Flow (perm)	1140	1723		1140	1723		398	3463		518	3480	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	109	109	109	109	652	109	109	870	109
RTOR Reduction (vph)	0	36	0	0	36	0	0	18	0	0	13	0
Lane Group Flow (vph)	109	182	0	109	182	0	109	743	0	109	966	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	12.8	12.8		12.8	12.8		25.5	22.5		28.5	24.0	
Effective Green, g (s)	12.8	12.8		12.8	12.8		25.5	22.5		28.5	24.0	
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.44	0.39		0.49	0.42	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	252	382		252	382		247	1348		353	1445	
v/s Ratio Prot		c0.11			0.11		0.02	0.21		c0.02	c0.28	
v/s Ratio Perm	0.10			0.10			0.17			0.13		
v/c Ratio	0.43	0.48		0.43	0.48		0.44	0.55		0.31	0.67	
Uniform Delay, d1	19.4	19.6		19.4	19.6		10.0	13.7		8.2	13.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	0.9		1.2	0.9		1.3	0.5		0.5	1.2	
Delay (s)	20.6	20.5		20.6	20.5		11.3	14.2		8.7	14.9	
Level of Service	C	C		C	C		B	B		A	B	
Approach Delay (s)		20.5			20.5			13.8			14.3	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	15.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	57.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	200	100	100	100	100	500	100	100	800	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	0.95	
Frt		1.00	0.85		0.96		1.00	0.97		1.00	0.98	
Flt Protected		0.98	1.00		0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1817	1583		1750		1770	3450		1770	3480	
Flt Permitted		0.66	1.00		0.79		0.17	1.00		0.34	1.00	
Satd. Flow (perm)		1222	1583		1403		309	3450		634	3480	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	217	109	109	109	109	543	109	109	870	109
RTOR Reduction (vph)	0	0	109	0	17	0	0	17	0	0	9	0
Lane Group Flow (vph)	0	218	108	0	310	0	109	635	0	109	970	0
Turn Type	pm+pt		Perm	Perm			pm+pt			pm+pt		
Protected Phases	5	2			6		3	8		7	4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)		21.6	21.6		21.6		28.6	25.6		28.6	25.6	
Effective Green, g (s)		21.6	21.6		21.6		28.6	25.6		28.6	25.6	
Actuated g/C Ratio		0.32	0.32		0.32		0.42	0.38		0.42	0.38	
Clearance Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		387	501		444		194	1295		316	1306	
v/s Ratio Prot							c0.02	0.18		0.02	c0.28	
v/s Ratio Perm		0.18	0.07		c0.22		0.21			0.13		
v/c Ratio		0.56	0.22		0.70		0.56	0.49		0.34	0.74	
Uniform Delay, d1		19.4	17.1		20.4		13.4	16.3		12.4	18.4	
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.9	0.2		4.7		3.7	0.3		0.7	2.3	
Delay (s)		21.3	17.3		25.2		17.1	16.6		13.0	20.8	
Level of Service		C	B		C		B	B		B	C	
Approach Delay (s)		19.3			25.2			16.7			20.0	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	68.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	100	100	100	100	100	100	500	100	100	800	100
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	109	109	109	109	109	109	543	109	109	870	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											397	
pX, platoon unblocked	0.79	0.79	0.79	0.79	0.79		0.79					
vC, conflicting volume	1793	2011	489	1630	2011	326	978			652		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1469	1745	0	1262	1745	326	435			652		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	87	0	0	84	88			88		
cM capacity (veh/h)	0	52	855	0	52	670	884			930		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	326	326	380	380	543	543
Volume Left	109	109	109	0	109	0
Volume Right	109	109	0	109	0	109
cSH	0	0	884	1700	930	1700
Volume to Capacity	Err	Err	0.12	0.22	0.12	0.32
Queue Length 95th (ft)	Err	Err	10	0	10	0
Control Delay (s)	Err	Err	3.8	0.0	3.1	0.0
Lane LOS	F	F	A		A	
Approach Delay (s)	Err	Err	1.9		1.5	
Approach LOS	F	F				

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	100	100	300	100	400	100	300	100	100	300	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.92		1.00	0.88		1.00	0.96		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1723		1770	1639		1770	1793		1770	1613	
Flt Permitted	0.27	1.00		0.37	1.00		0.26	1.00		0.26	1.00	
Satd. Flow (perm)	507	1723		683	1639		481	1793		481	1613	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	109	109	326	109	435	109	326	109	109	326	109
RTOR Reduction (vph)	0	44	0	0	170	0	0	15	0	0	15	0
Lane Group Flow (vph)	109	174	0	326	374	0	109	420	0	109	420	0
Parking (#/hr)											0	
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	18.4	14.7		32.9	23.2		25.5	22.6		25.5	22.6	
Effective Green, g (s)	18.4	14.7		32.9	23.2		25.5	22.6		25.5	22.6	
Actuated g/C Ratio	0.24	0.19		0.43	0.30		0.33	0.30		0.33	0.30	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	183	332		468	498		209	530		209	477	
v/s Ratio Prot	0.03	0.10		c0.11	c0.23		c0.02	0.23		0.02	c0.26	
v/s Ratio Perm	0.11			0.19			0.15			0.15		
v/c Ratio	0.60	0.53		0.70	0.75		0.52	0.79		0.52	0.88	
Uniform Delay, d1	24.2	27.7		15.8	24.0		20.1	24.7		20.1	25.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.1	1.5		4.5	6.3		2.3	8.0		2.3	17.1	
Delay (s)	29.3	29.2		20.3	30.3		22.5	32.7		22.5	42.7	
Level of Service	C	C		C	C		C	C		C	D	
Approach Delay (s)		29.2			26.6			30.7			38.7	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	30.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	76.4	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	100	100	100	100	200	100	400	100	200	500	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.92		1.00	0.90		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1723		1770	1677		1770	1626		1770	1676	1583
Flt Permitted	0.40	1.00		0.56	1.00		0.34	1.00		0.21	1.00	1.00
Satd. Flow (perm)	747	1723		1050	1677		627	1626		400	1676	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	109	109	109	109	217	109	435	109	217	543	109
RTOR Reduction (vph)	0	42	0	0	83	0	0	10	0	0	0	59
Lane Group Flow (vph)	217	176	0	109	243	0	109	534	0	217	543	50
Parking (#/hr)								0			0	
Turn Type	Perm			Perm			pm+pt			pm+pt		Perm
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		4
Actuated Green, G (s)	26.4	26.4		26.4	26.4		38.6	35.5		48.4	40.4	40.4
Effective Green, g (s)	26.4	26.4		26.4	26.4		38.6	35.5		48.4	40.4	40.4
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.44	0.40		0.55	0.46	0.46
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	224	517		315	504		316	657		345	770	728
v/s Ratio Prot		0.10			0.14		0.01	c0.33		c0.06	c0.32	
v/s Ratio Perm	c0.29			0.10			0.14			0.29		0.03
v/c Ratio	0.97	0.34		0.35	0.48		0.34	0.81		0.63	0.71	0.07
Uniform Delay, d1	30.3	24.0		24.0	25.2		15.6	23.3		13.7	19.0	13.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	50.7	0.4		0.7	0.7		0.7	10.6		3.6	5.4	0.2
Delay (s)	81.0	24.4		24.7	25.9		16.3	33.9		17.2	24.4	13.4
Level of Service	F	C		C	C		B	C		B	C	B
Approach Delay (s)		52.6			25.6			30.9			21.2	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	30.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	87.9	Sum of lost time (s)	24.0
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	100	100	100	100	100	100	100	100	100	100	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.92		1.00	0.92		1.00	0.92		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1723		1770	1723		1770	1723		1770	1677	
Flt Permitted	0.62	1.00		0.62	1.00		0.44	1.00		0.62	1.00	
Satd. Flow (perm)	1158	1723		1158	1723		812	1723		1158	1677	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	109	109	109	109	109	109	109	109	109	109	217
RTOR Reduction (vph)	0	42	0	0	42	0	0	40	0	0	78	0
Lane Group Flow (vph)	217	176	0	109	176	0	109	178	0	109	248	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		2			6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	17.7	17.7		17.7	17.7		20.1	14.4		19.9	14.3	
Effective Green, g (s)	17.7	17.7		17.7	17.7		20.1	14.4		19.9	14.3	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.36	0.26		0.36	0.26	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	368	548		368	548		391	445		475	431	
v/s Ratio Prot		0.10			0.10		c0.03	0.10		0.02	c0.15	
v/s Ratio Perm	c0.19			0.09			0.07			0.06		
v/c Ratio	0.59	0.32		0.30	0.32		0.28	0.40		0.23	0.58	
Uniform Delay, d1	16.0	14.4		14.3	14.4		12.2	17.1		12.3	18.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.4	0.3		0.5	0.3		0.4	0.6		0.2	1.9	
Delay (s)	18.4	14.8		14.8	14.8		12.6	17.7		12.5	19.9	
Level of Service	B	B		B	B		B	B		B	B	
Approach Delay (s)		16.6			14.8			16.0			18.1	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	16.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	55.7	Sum of lost time (s)	18.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	700	900	200	100	300	200	200	1300	100	200	1100	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	761	978	217	109	326	217	217	1413	109	217	1196	217
RTOR Reduction (vph)	0	0	11	0	0	6	0	0	5	0	0	4
Lane Group Flow (vph)	761	978	206	109	326	211	217	1413	104	217	1196	213
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Actuated Green, G (s)	22.0	27.0	34.0	4.0	9.0	16.0	7.0	38.0	42.0	7.0	38.0	60.0
Effective Green, g (s)	22.0	27.0	34.0	4.0	9.0	16.0	7.0	38.0	42.0	7.0	38.0	60.0
Actuated g/C Ratio	0.22	0.27	0.34	0.04	0.09	0.16	0.07	0.38	0.42	0.07	0.38	0.60
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	755	956	633	137	319	348	240	1345	760	240	1345	1045
v/s Ratio Prot	c0.22	c0.28	0.02	0.03	0.09	0.04	c0.06	c0.40	0.01	0.06	0.34	0.04
v/s Ratio Perm			0.11			0.09			0.06			0.09
v/c Ratio	1.01	1.02	0.33	0.80	1.02	0.61	0.90	1.05	0.14	0.90	0.89	0.20
Uniform Delay, d1	39.0	36.5	24.5	47.6	45.5	39.1	46.2	31.0	17.8	46.2	29.0	9.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	34.7	35.1	0.3	26.5	56.1	3.0	33.5	39.0	0.1	33.5	7.5	0.1
Delay (s)	73.7	71.6	24.8	74.0	101.6	42.1	79.6	70.0	17.9	79.6	36.6	9.2
Level of Service	E	E	C	E	F	D	E	E	B	E	D	A
Approach Delay (s)		67.2			77.2			67.9			38.7	
Approach LOS		E			E			E			D	

Intersection Summary			
HCM Average Control Delay	60.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	89.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	700	1600	700	300	1200	200	700	1000	400	600	900	700
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	3539	1583	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	761	1739	761	326	1304	217	761	1087	435	652	978	761
RTOR Reduction (vph)	0	0	1	0	0	1	0	0	1	0	0	1
Lane Group Flow (vph)	761	1739	760	326	1304	216	761	1087	434	652	978	760
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	5	2	3	1	6	7	3	8	1	7	4	5
Permitted Phases			2			6			8			4
Actuated Green, G (s)	21.0	39.0	62.0	9.0	27.0	46.0	23.0	29.0	38.0	19.0	25.0	46.0
Effective Green, g (s)	21.0	39.0	62.0	9.0	27.0	46.0	23.0	29.0	38.0	19.0	25.0	46.0
Actuated g/C Ratio	0.18	0.32	0.52	0.08	0.22	0.38	0.19	0.24	0.32	0.16	0.21	0.38
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	601	1653	897	257	1144	686	658	855	580	544	737	686
v/s Ratio Prot	c0.22	c0.34	0.16	0.09	0.26	0.05	c0.22	c0.31	0.06	0.19	0.28	c0.19
v/s Ratio Perm			0.32			0.09			0.22			0.29
v/c Ratio	1.27	1.05	0.85	1.27	1.14	0.31	1.16	1.27	0.75	1.20	1.33	1.11
Uniform Delay, d1	49.5	40.5	24.9	55.5	46.5	25.9	48.5	45.5	36.7	50.5	47.5	37.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	132.7	37.3	7.5	147.9	73.9	0.3	86.8	131.3	5.2	106.2	156.5	67.7
Delay (s)	182.2	77.8	32.4	203.4	120.4	26.2	135.3	176.8	41.9	156.7	204.0	104.7
Level of Service	F	E	C	F	F	C	F	F	D	F	F	F
Approach Delay (s)		91.5			124.0			137.3			159.5	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	124.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	108.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	300	100	100	100	100	300	100	1900	100	300	1600	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	326	109	109	109	109	326	109	2065	109	326	1739	326
RTOR Reduction (vph)	0	0	88	0	0	5	0	0	34	0	0	19
Lane Group Flow (vph)	326	109	21	109	109	321	109	2065	75	326	1739	307
Turn Type	Prot		Perm	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4		3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	10.0	11.0	11.0	5.0	6.0	16.0	5.0	60.0	65.0	10.0	65.0	75.0
Effective Green, g (s)	10.0	11.0	11.0	5.0	6.0	16.0	5.0	60.0	65.0	10.0	65.0	75.0
Actuated g/C Ratio	0.09	0.10	0.10	0.05	0.05	0.15	0.05	0.55	0.59	0.09	0.59	0.68
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	312	354	158	156	193	317	156	1930	1022	312	2091	1166
v/s Ratio Prot	c0.09	c0.03		0.03	0.03	c0.09	0.03	c0.58	0.00	0.09	c0.49	0.02
v/s Ratio Perm			0.01			0.11			0.04			0.17
v/c Ratio	1.04	0.31	0.13	0.70	0.56	1.01	0.70	1.07	0.07	1.04	0.83	0.26
Uniform Delay, d1	50.0	46.0	45.1	51.8	50.7	47.0	51.8	25.0	9.6	50.0	18.1	6.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	63.1	0.5	0.4	12.8	3.8	53.7	12.8	42.1	0.0	63.1	3.0	0.1
Delay (s)	113.1	46.5	45.5	64.6	54.5	100.7	64.6	67.1	9.7	113.1	21.1	6.9
Level of Service	F	D	D	E	D	F	E	E	A	F	C	A
Approach Delay (s)		86.2			84.2			64.3			31.7	
Approach LOS		F			F			E			C	

Intersection Summary			
HCM Average Control Delay	54.7	HCM Level of Service	D
HCM Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	30.0
Intersection Capacity Utilization	94.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

18.0 Appendix C – Stakeholder Meeting Minutes

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 13, 2007
Time:
Location: JOEL Assoc., LLC. - 1999 Amidon, Suite 375, Wichita, KS

Attendees: Len Marotte, JOEL Assoc., LLC.
Steve Lackey, TranSystems

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:

Mr. Len Marotte is the developer of what was called in 2000, Tuscany Addition at the northwest corner of Butler Road and 120th Street. Since that point in time he has sold off Parcel 4 and 5 to Devlin Properties and Parcel 3 to Bill Blair of Blair Construction. Parcels 1 and 2 are now called Winchester Addition.

It is Mr. Marotte's desire to develop Parcels 1 and 2 over the next 4-5 years. He indicated that Parcels 3 and 4 will be re-platted into estate lots. Parcel 5 is zoned light commercial and will probably remain light commercial.

POE and Associates is his platting engineer and he works with Kenny Hill to facilitate platting and development issues with Andover.

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 17, 2007
Time:
Location: Devlin Enterprises – 1313 N. Webb Rd., Suite 100, Wichita, KS

Attendees: Tom Mack, Devlin Enterprises
Steve Lackey, TranSystems

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:

Mr. Mack indicated he will re-plat that northeast portion of the Flint Hill plat into smaller lots, but there will still be lots to support high end housing. Devlin Enterprises and Clifford Nies are joint venturing a 150 acre residential development at the southeast corner of 130th Street and Butler Road. He indicated he was working with Andover to use either special assessment bounds or Industrial Revenue Bonds which are allowed under a new State law. Details have not been worked out. Mr. Mack indicated they would be financing the streets privately, but the water and sewer would be special assessments. He hoped they could begin development in 2008 or 2009, with phases being accomplished in thirds over a 6 to 9 year period. There is a major crude line running through the development which is tied into the Coffeeville Refinery.

Mr. Mack said they own commercially zoned property at the northwest corner of 120th Street and Butler Road and had plans to develop it in the next 5 years. He said that if they had major events at the golf course, the major services such as lodging and restaurants would be provided either in Andover or Wichita. The previously mentioned commercial property could be the site of a Holiday Inn Express type of use, but that has not been decided. Mr. Mack indicated that he does not anticipate holding golf events that would create a high demand for spectators (PGA type events), due to the limitations of providing space on the course. Smaller events such as the U.S. Senior Amateur or Lady Amateur events could be held.

Mr. Mack also mentioned that debt limitations in Andover factors into his business plan.

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 17, 2007
Time:
Location: Paul Kelsey Development - 716 N. 119th St. W., Wichita, KS

Attendees: Paul Kelsey, Paul Kelsey Development
Steve Lackey, TranSystems
Tim Aziere, Baughman Co.
Kris Rose, Baughman Co.

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:

Mr. Paul Kelsey is currently developing the plat Ami Lane which has approximately 289 lots. It is his intent to develop this plat, but he'll have to "see how the market goes". He's hopeful that he will be able to develop 100 lots in 2008 or 2009. He is also planning to develop 80 acres for resident use within the Rose Hill city limits west of Butler Road and north of Silknetter Street. No time table for this development has been established. Mr. Kelsey has several developments or plans for developments in the general area, with some outside of the study area that will develop as the market dictates. He also stated that he knew of a pending development near 63rd Street and 159th Street, but he didn't know who owned, or the use of the property. Baughman indicated they thought there was now potential for development to occur south of the Rose Hill School since the "trust" issues had been eliminated. They acknowledged that getting infrastructure into the area would be difficult and expensive.

Mr. Kelsey feels that commercial operations are necessary within the corridor so property owners do not have to drive into the cities for all services. Commercial operations such as gas stations, convenience stores or laundry facilities were a few uses he mentioned.

Mr. Kelsey pointed out that the railroad tracks in Rose Hill were a "problem" to travel within Rose Hill and it severed residents north of the tracks from the school south of the tracks.

Mr. Kelsey brought up that due to the amount of debt Andover could levy, he was restrained from developing as fast as he would like using special assessment bonds; but acknowledged he has adjusted his planning efforts to accommodate the financing arrangements with Andover. He had not had any experience with Rose Hill so he really had no comments about how they planned or operated. He said he thought Rose Hill had a 1% sales tax in place to be used for road construction.

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 17, 2007
Time:
Location: Clifford Nies Construction – 10330 E. 21st St. N., #303, Wichita, KS

Attendees: Clifford Nies, Clifford Nies Construction
Steve Lackey, TranSystems

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:

Mr. Nies has numerous ownerships within the project corridor, including his own residence and residential properties of his immediate family. The ownerships are too numerous to list here. He is very interested in seeing this corridor develop and to have the roadway upgraded to four lanes. He is currently developing the Sienna subdivision at the southwest corner of 150th Street and Butler Road. He indicated he plans to develop the land east of the Sienna subdivision, but does not have a time table. He acknowledged he is involved in a joint venture with Devlin Enterprises at 130th Street and Butler Road.

He felt that the majority of the commercial land uses should be provided by Andover or Rose Hill. He said that 150th and Butler Road was a high traffic intersection and during the AM and PM peaks along the roadway it "was impossible" to get out of adjacent properties. He is all in favor of building a four lane roadway as soon as possible. He would support a roadway with ditches if possible, as long as it allowed four to five lanes. He was unsure if extra right of way could be made available for the roadway and ditches if necessary. He thought storm sewers would be too expensive, but he was still open to alternatives. He thought the possibility of making the roadway a toll road would help pay the roadway and should be considered.

Mr. Nies indicated that the old filling station south of 130th Street, on the west side of the road, was going to be auctioned off August 22, 2007. He indicated the site is polluted. There is a propane site south of the gas station site. He didn't know if it was polluted.

Finally, Mr. Nies said he didn't feel there were flooding problems within the corridor. There could be a small amount of ponding that takes place, but it doesn't flood the Butler Road to his knowledge.

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 17, 2007
Time:
Location: USD 385 (Andover School District) – 1432 N. Andover Road, Andover, KS

Attendees: Mark Evans, USD 385
Steve Lackey, TranSystems

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:

Mr. Evans spent much of his time explaining how they are currently building a new elementary school south of Kellogg and east of Andover Road. This new school will be adjacent to a new YMCA, retail center, a residential development and a new Dillon's site with a potential "big box" development near. The results of this site will be added traffic to Kellogg and to Andover Road, south of Kellogg. He indicated that due to potential development south of Kellogg, they are searching for more land to buy in order to facilitate more school building needs. He said they would like to buy another 60 acres for expansion purposes.

Mr. Evans said currently they operate two buses on Andover Road, south of Kellogg and have plans to expand to three. The district buses everybody that wants to ride with no restrictions.

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 22, 2007
Time:
Location: USD 349 (Rose Hill School District) – 104 N. Main, Rose Hill Road, Rose Hill, KS

Attendees: Randall Chickadonz, USD 349
Steve Lackey, TranSystems

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:

Mr. Chickadonz said that USD 394 has had a decrease in enrollment in recent years, but this year enrollment increased 20-30 students. He anticipates that enrollment will increase due to anticipated new development within the school district; however they will remain a class 4A school in all likelihood. The current campus site is located south of School Street and east of Rose Hill Road.

Currently, the district is expanding the existing middle school at School Street and Rose Hill Road for an academic center use. He does not anticipate moving or relocating School Street on their north edge of the campus due to building constraints. He anticipates expansion to the high school and adding softball fields in the future on the current site. The new elementary school on the northeast portion of the school campus created another need for accessing the campus site from Rose Hill Road; however, the access to the site has been facilitated by using residential streets in the area rather than accessing the site from Rose Hill Road, west of the school site. Mr. Chickadonz indicated that using Rose Hill Road is avoided as much as possible due to the traffic congestion during AM and PM peaks. The current roadway is congested due to ingress or egress to the school site, the railroad tracks being in use, and the pedestrian signal being used at the north end of the school site on Rose Hill Road.

Mr. Chickadonz spent a great deal of time explaining the difficulty in the lack of east/west egress into Rose Hill Road and that Rose Hill Road is extremely congested due to the lack of alternative routes in the area. This congestion impacts his patrons and his bus routing for picking up students in the morning and taking them home in the afternoon. If any construction is taking place in the area, it severely impacts the districts ability to meet busing schedules. Further, if there were alternative routes to avoid the rail crossing on Rose Hill Road he would be supportive of such an option.

The current bus system picks up students that live at least 2 ½ miles from the school; however, provisions are made for students that live within the 2 ½ mile perimeter for service as well. In the case of students that live within 2 ½ miles of their school, there is the option to ride the school bus by paying a fee. There are 13 buses that operate daily picking up students and all of the buses utilize Rose Hill Road in their routes.

Mr. Chickadonz indicated that when a train is crossing the Rose Hill Road during peak times, “it is not a pleasant experience” waiting for the train to clear. He said that long backups result even though the trains move at a high rate of speed. He indicated that a solution to the grade crossing would be beneficial both from a vehicular and pedestrian standpoint. He said that some students still elect to walk back and forth from school and he fears for their safety. He requested that any proposal for Rose Hill Road should plan for improvements to accommodate both vehicular traffic and pedestrian traffic.

TranSystems

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 13, 2007
Time:
Location: JOEL Assoc., LLC. - 1999 Amidon, Suite 375, Wichita, KS

Attendees: Len Marotte, JOEL Assoc., LLC.
Steve Lackey, TranSystems

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:

Mr. Len Marotte is the developer of what was called in 2000, Tuscany Addition at the northwest corner of Butler Road and 120th Street. Since that point in time he has sold off Parcel 4 and 5 to Devlin Properties and Parcel 3 to Bill Blair of Blair Construction. Parcels 1 and 2 are now called Winchester Addition.

It is Mr. Marotte's desire to develop Parcels 1 and 2 over the next 4-5 years. He indicated that Parcels 3 and 4 will be re-platted into estate lots. Parcel 5 is zoned light commercial and will probably remain light commercial.

POE and Associates is his platting engineer and he works with Kenny Hill to facilitate platting and development issues with Andover.

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 17, 2007
Time:
Location: Clifford Nies Construction – 10330 E. 21st St. N., #303, Wichita, KS

Attendees: Clifford Nies, Clifford Nies Construction
Steve Lackey, TranSystems

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:
Mr. Nies has numerous ownerships within the project corridor, including his own residence and residential properties of his immediate family. The ownerships are too numerous to list here. He is very interested in seeing this corridor develop and to have the roadway upgraded to four lanes. He is currently developing the Sienna subdivision at the southwest corner of 150th Street and Butler Road. He indicated he plans to develop the land east of the Sienna subdivision, but does not have a time table. He acknowledged he is involved in a joint venture with Devlin Enterprises at 130th Street and Butler Road.

He felt that the majority of the commercial land uses should be provided by Andover or Rose Hill. He said that 150th and Butler Road was a high traffic intersection and during the AM and PM peaks along the roadway it "was impossible" to get out of adjacent properties. He is all in favor of building a four lane roadway as soon as possible. He would support a roadway with ditches if possible, as long as it allowed four to five lanes. He was unsure if extra right of way could be made available for the roadway and ditches if necessary. He thought storm sewers would be too expensive, but he was still open to alternatives. He thought the possibility of making the roadway a toll road would help pay the roadway and should be considered.

Mr. Nies indicated that the old filling station south of 130th Street, on the west side of the road, was going to be auctioned off August 22, 2007. He indicated the site is polluted. There is a propane site south of the gas station site. He didn't know if it was polluted.

Finally, Mr. Nies said he didn't feel there were flooding problems within the corridor. There could be a small amount of ponding that takes place, but it doesn't flood the Butler Road to his knowledge.

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 17, 2007
Time:
Location: Paul Kelsey Development - 716 N. 119th St. W., Wichita, KS

Attendees: Paul Kelsey, Paul Kelsey Development
Steve Lackey, TranSystems
Tim Aziere, Baughman Co.
Kris Rose, Baughman Co.

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:

Mr. Paul Kelsey is currently developing the plat Ami Lane which has approximately 289 lots. It is his intent to develop this plat, but he'll have to "see how the market goes". He's hopeful that he will be able to develop 100 lots in 2008 or 2009. He is also planning to develop 80 acres for resident use within the Rose Hill city limits west of Butler Road and north of Silknetter Street. No time table for this development has been established. Mr. Kelsey has several developments or plans for developments in the general area, with some outside of the study area that will develop as the market dictates. He also stated that he knew of a pending development near 63rd Street and 159th Street, but he didn't know who owned, or the use of the property. Baughman indicated they thought there was now potential for development to occur south of the Rose Hill School since the "trust" issues had been eliminated. They acknowledged that getting infrastructure into the area would be difficult and expensive.

Mr. Kelsey feels that commercial operations are necessary within the corridor so property owners do not have to drive into the cities for all services. Commercial operations such as gas stations, convenience stores or laundry facilities were a few uses he mentioned.

Mr. Kelsey pointed out that the railroad tracks in Rose Hill were a "problem" to travel within Rose Hill and it severed residents north of the tracks from the school south of the tracks.

Mr. Kelsey brought up that due to the amount of debt Andover could levy, he was restrained from developing as fast as he would like using special assessment bonds; but acknowledged he has adjusted his planning efforts to accommodate the financing arrangements with Andover. He had not had any experience with Rose Hill so he really had no comments about how they planned or operated. He said he thought Rose Hill had a 1% sales tax in place to be used for road construction.

TranSystems

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 17, 2007
Time:
Location: Devlin Enterprises – 1313 N. Webb Rd., Suite 100, Wichita, KS

Attendees: Tom Mack, Devlin Enterprises
Steve Lackey, TranSystems

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:
Mr. Mack indicated he will re-plat that northeast portion of the Flint Hill plat into smaller lots, but there will still be lots to support high end housing. Devlin Enterprises and Clifford Nies are joint venturing a 150 acre residential development at the southeast corner of 130th Street and Butler Road. He indicated he was working with Andover to use either special assessment bounds or Industrial Revenue Bonds which are allowed under a new State law. Details have not been worked out. Mr. Mack indicated they would be financing the streets privately, but the water and sewer would be special assessments. He hoped they could begin development in 2008 or 2009, with phases being accomplished in thirds over a 6 to 9 year period. There is a major crude line running through the development which is tied into the Coffeeville Refinery.

Mr. Mack said they own commercially zoned property at the northwest corner of 120th Street and Butler Road and had plans to develop it in the next 5 years. He said that if they had major events at the golf course, the major services such as lodging and restaurants would be provided either in Andover or Wichita. The previously mentioned commercial property could be the site of a Holiday Inn Express type of use, but that has not been decided. Mr. Mack indicated that he does not anticipate holding golf events that would create a high demand for spectators (PGA type events), due to the limitations of providing space on the course. Smaller events such as the U.S. Senior Amateur or Lady Amateur events could be held.

Mr. Mack also mentioned that debt limitations in Andover factors into his business plan.

TranSystems

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 17, 2007
Time:
Location: USD 385 (Andover School District) – 1432 N. Andover Road, Andover, KS

Attendees: Mark Evans, USD 385
Steve Lackey, TranSystems

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:

Mr. Evans spent much of his time explaining how they are currently building a new elementary school south of Kellogg and east of Andover Road. This new school will be adjacent to a new YMCA, retail center, a residential development and a new Dillon's site with a potential "big box" development near. The results of this site will be added traffic to Kellogg and to Andover Road, south of Kellogg. He indicated that due to potential development south of Kellogg, they are searching for more land to buy in order to facilitate more school building needs. He said they would like to buy another 60 acres for expansion purposes.

Mr. Evans said currently they operate two buses on Andover Road, south of Kellogg and have plans to expand to three. The district buses everybody that wants to ride with no restrictions.

TranSystems

SW Butler Road Corridor Study

Key Stakeholder Meeting Minutes

Date: August 22, 2007
Time:
Location: USD 349 (Rose Hill School District) – 104 N. Main, Rose Hill Road, Rose Hill, KS

Attendees: Randall Chickadonz, USD 349
Steve Lackey, TranSystems

Handouts: None, did have an aerial of the project limits with known developments and property owners

Discussion:

Mr. Chickadonz said that USD 394 has had a decrease in enrollment in recent years, but this year enrollment increased 20-30 students. He anticipates that enrollment will increase due to anticipated new development within the school district; however they will remain a class 4A school in all likelihood. The current campus site is located south of School Street and east of Rose Hill Road.

Currently, the district is expanding the existing middle school at School Street and Rose Hill Road for an academic center use. He does not anticipate moving or relocating School Street on their north edge of the campus due to building constraints. He anticipates expansion to the high school and adding softball fields in the future on the current site. The new elementary school on the northeast portion of the school campus created another need for accessing the campus site from Rose Hill Road; however, the access to the site has been facilitated by using residential streets in the area rather than accessing the site from Rose Hill Road, west of the school site. Mr. Chickadonz indicated that using Rose Hill Road is avoided as much as possible due to the traffic congestion during AM and PM peaks. The current roadway is congested due to ingress or egress to the school site, the railroad tracks being in use, and the pedestrian signal being used at the north end of the school site on Rose Hill Road.

Mr. Chickadonz spent a great deal of time explaining the difficulty in the lack of east/west egress into Rose Hill Road and that Rose Hill Road is extremely congested due to the lack of alternative routes in the area. This congestion impacts his patrons and his bus routing for picking up students in the morning and taking them home in the afternoon. If any construction is taking place in the area, it severely impacts the districts ability to meet busing schedules. Further, if there were alternative routes to avoid the rail crossing on Rose Hill Road he would be supportive of such an option.

The current bus system picks up students that live at least 2 ½ miles from the school; however, provisions are made for students that live within the 2 ½ mile perimeter for service as well. In the case of students that live within 2 ½ miles of their school, there is the option to ride the school bus by paying a fee. There are 13 buses that operate daily picking up students and all of the buses utilize Rose Hill Road in their routes.

Mr. Chickadonz indicated that when a train is crossing the Rose Hill Road during peak times, "it is not a pleasant experience" waiting for the train to clear. He said that long backups result even though the trains move at a high rate of speed. He indicated that a solution to the grade crossing would be beneficial both from a vehicular and pedestrian standpoint. He said that some students still elect to walk back and forth from school and he fears for their safety. He requested that any proposal for Rose Hill Road should plan for improvements to accommodate both vehicular traffic and pedestrian traffic.

19.0 Appendix D – Public Comments

Let us know your thoughts on the SW Butler Road Project.

TranSystems

EXPERIENCE | Transportation

Clifford Nies
Name

15565 S.W Butler Rd
Street Address

Rose Hill 67133
City, State, ZIP

316-776-2453
Phone Number

Cliff@NiesHomes.com
Email Address

If you want growth at Rose Hill we need this Road project.

Drop this card in the comment box or mail before October 25, 2008. Your comments will be reviewed by the project team and incorporated into the project record.

Let us know your thoughts on the SW Butler Road Project.

TranSystems

EXPERIENCE | Transportation

Bob Grelinger
Name

15630 E. 47th So.
Street Address

Derby, KS 67037
City, State, ZIP

733-0918
Phone Number

Email Address

Need Stop Light at Butler Road and 150th

Drop this card in the comment box or mail before October 25, 2008. Your comments will be reviewed by the project team and incorporated into the project record.

Let us know your thoughts on the SW Butler Road Project.

TranSystems

EXPERIENCE | Transportation

Greg + Sandra Rau
Name

13901 E 47th St S
Street Address

Derby KS 67037
City, State, ZIP

733-1454
Phone Number

Email Address

We see a great need for a stop lite at the corner of 150th + Butler Road. We constantly see people using the turn lane on Butler Road to pass. It is very difficult to cross Butler Road with a grain truck, tractor or pickup pulling a trailer. The traffic does not slow down to the posted 45 MPH at the intersection and the average speed on Butler Road well exceeds 55 MPH. We feel this is a safety issue.

Drop this card in the comment box or mail before October 25, 2008. Your comments will be reviewed by the project team and incorporated into the project record.

Let us know your thoughts on the SW Butler Road Project.

TranSystems

EXPERIENCE | Transportation

Richard Hittle
Name

118 Citation
Street Address

Andover KS 67002
City, State, ZIP

733-2936
Phone Number

Email Address

The plan as proposed would destroy trees and driveway south of 4 mile creek. Rerouting or removing the west sidewalk could avoid costly litigation. Worst of all the rigid median from Harry to 47th will inconvenience homeowners and impact emergency services and future road maintenance. At 45 mph the U-turn hazard will be far greater than allowing left turns. Limiting access to Butler Rd needs to be done by planning and zoning not a physical barrier.

Drop this card in the comment box or mail before October 25, 2008. Your comments will be reviewed by the project team and incorporated into the project record.

From: JAY BRADLEY [mailto:n5ber@yahoo.com]
Sent: Monday, October 20, 2008 10:47 PM
To: WI-Brett Letkowski
Cc: dlutz@BUCOKS.com
Subject: Re: Butler Road Comments

Brett
Thanks for the opportunity to follow up. My original comments are:

+ As a daily driver of Butler Road from 200 to 54, I look forward to the end result but not the process.
+ I feel the project needs to be expedited with <u>all</u> intersections as the first order of business.
+ Costs should not be placed on adjacent land owners. Funding should come from city/county/state/federal coffers.
+ Make the PowerPoint available if possible. Stats & $ were good info.

---end of card

But since I've got the chance to elaborate...
Butler Road is how I get to work everyday: north to 54 and west to Oliver. Imagining this project proceed over 10/15/20 years is de ja vu of Kellogg construction. Not a pleasant thought.
But it needs to be done. As quickly and as painlessly as possible. I believe getting the intersections done first should be a priority. Both for safety and project progress. I always have someone pull out in front of me at intersections. I just expect it and deal with it.
I drive 55/60 and still get passed. Usually by the same 2 or 3 cars. That second lane would be great. I don't look forward to the stoplights or the speed limit dropping to 45, but that's the trade-off.
There should be NO assessments placed on the owners of adjacent land. They're going to get hurt in this deal bad enough. (I've got frontage property on the 200 to 210 mile. I'm preparing to lose that land when it's my turn, but I'd rather not take any more beating than necessary.) The funding for this project should come from other sources.
And I really hope you make that PowerPoint available soon. Even with the rough, estimated numbers. The traffic stats, costs per mile, revenue resource list: all good information that needs to be discussed and re-discussed. Please distribute it.

I actually look forward to the time when the 200 to 210 mile gets widened. Yes, I'll lose 30 or more feet from my yard and a row of hundred year old trees lining the road. But it's dangerous entering and exiting my driveway. Idiots will pass as we try to turn left into the driveway. (There's no vaccine for idiocy.) But that's at least 10 years down the road.

Thanks for listening.

Let us know your thoughts on the SW Butler Road Project.

RECEIVED
OCT 20 2008
TranSystems

TranSystems
EXPERIENCE | Transportation

STEVE RUTZ
Name

2006 SOUTH ANDOVER RD.
Street Address

ANDOVER, KS 67002
City, State, ZIP

316-733-1615
Phone Number

STEVER@TRAMCOINC.COM
Email Address

WHAT ARE THE PLANS FOR CURRENT UTILITIES, LANDSCAPING, LIGHTING, ETC... IF ANY? ESPECIALLY CONCERNING THE MEDIAN, OF WHICH I STRONGLY OBJECT NO LEFT TURN INTO OUR PROPERTY. WHAT IS THE PLAN FOR THE AGRICULTURAL EQUIPMENT THAT TRAVELS THIS ROAD? U-TURNS ARE NOT ACCEPTABLE IN THIS SITUATON. YOUR DRAINAGE PLAN NEEDS INTENSE ATTENTION TO DETAIL. 4 MILE CREEK CAN BE EXTREMELY UNPREDICTABLE DEPENDING ON RAINFALL LOCATION. DO YOUR PLANNING BASED ON ALL INDIVIDUALS AFFECTED, NOT JUST THE MAJOR PLAYERS.

Drop this card in the comment box or mail before October 25, 2008. Your comments will be reviewed by the project team and incorporated into the project record.

RECEIVED

OCT 21 2008

TranSystems

Paul & Dixie Fogle
15950 SW 160th St.
Rose Hill, Kansas 67133
(316) 776-9209

Oct. 19, 2008

Mr. Letkowski,

We reside on the NE corner of 160th St. and Rose Hill Rd.

We are very concerned about storm water drainage. Last year, on the advice of our attorney, we constructed a flood water diversion wall that runs the length of our property on the North and East sides. The north wall extends to the ditch on the east side of Rose Hill Rd. If your proposed design is implemented, water that is currently diverted to the ditch will flood our house. The water that we are diverting is the runoff from approximately four acres. This flood water diversion wall is necessary because my neighbors will not properly drain their lots. Our attorney advised us to construct this flood water diversion wall at our expense, nearly $8000, because it would be less expensive than taking legal action against our neighbor to fix this problem.

We are also concerned about the large expansion of the easement on the west side of our property.

Why is such a large easement necessary? Why does the bike path need to veer so far from the highway at this point? Who will be responsible for the up keep of this large easement? We can't even get the County to keep the culvert open to help get rid of the runoff water.

We do not want to give up that much of our property for a bike path.

We realize that your proposal is a 'long view', but we need these questions/concerns addressed at some point.

Thank you for this opportunity to voice our concerns.

Paul & Dixie Fogle

Paul L. Fogle
Dixie Fogle

Let us know your thoughts on the SW Butler Road Project.

TranSystems

EXPERIENCE | Transportation

MIKE KROEKER
Name

2004 S. ANDOVER RD
Street Address

ANDOVER, KS 67002
City, State, ZIP

316-682-7884
Phone Number

mkroeker@swbell.net
Email Address

THIS PROJECT, THOUGH FAR-REACHING OFFERS VERY LITTLE IN THE WAY OF ADVANTAGES TO ME AND MY SISTER/BROTHER-IN-LAW AS PROPERTY OWNERS ALONG THE CORRIDOR BETWEEN HARRY & PAWNEE. ON THE CONTRARY, WE WILL BE FORCED TO DRIVE AN EXTRA 1/4 MILE TO ENTER OUR PROPERTY AFTER MAKING A U-TURN SOUTH OF OUR DRIVEWAY.

Drop this card in the comment box or mail before October 25, 2008.
Your comments will be reviewed by the project team and incorporated into the project record.

20.0 Appendix E – Draft Access Management Plan

Butler Road
Access Management Policy

DRAFT

December 1, 2008

Prepared by:

TranSystems Corporation
245 N. Waco, Suite 222
Wichita, Kansas 67202

Table of Contents

1 - Introductory Information

Introduction

Problems on our street system such as delays to through traffic caused by turning vehicles and some midblock accidents can be traced to the access provided to abutting properties via side streets and driveways. Historically, most decisions to allow access were made relative to individual properties and not the function of the street to which access was allowed. This approach to access planning has frequently resulted in illogical access points, which have led to increased congestion and accidents. The ultimate configuration of a street and its function are typically the result of land use planning, transportation planning and traffic engineering. The concept of access management integrates these activities in order to optimize the safety and performance of the public street network.

Access management takes a comprehensive view of property access relative to the function of the streets from which it is provided. The objective of access management is to find the right balance between property access and traffic safety and efficiency. Access should be viewed in the context of the street system instead of individual properties and in relation to ultimate traffic volumes and future street functions. What is acceptable one day may be perceived differently when viewed from a long-term perspective.

Access management is the control of the location, design and operation of driveways, median openings, intersections and street connections to a roadway. It also involves the application of median treatments and turning lanes, and the appropriate separation of traffic signals. These limitations are imposed to maintain the ability of a roadway to safely and efficiently accommodate traffic volumes commensurate with their function.

Access management requires that all properties have reasonable access to the public roadway system. Due to existing constraints, some existing access will be allowed to continue, and areas may never adhere to the access management contained herein. The objective of this access management policy is to prevent the creation of access problems in the future as well as avoid further degradation of access problems in already developed areas. The effect of access management along arterial streets is that the supporting networks of collector and local streets and inter-parcel connectivity become critical to effective property access and circulation.

Every community has experienced safety and traffic operational problems associated with poorly planned access to abutting properties. It has been discovered that managing access to major roadways has significant positive effects, including accident reduction, congestion alleviation, enhancing community character, and improving air quality. The impact of access management will vary based on the specific circumstances of any street segment, but experience has provided valuable insight into the factors that have a negative influence on traffic safety and efficiency. Some of these factors include:

- Driveways or side streets in close proximity to major intersections;
- Driveways or side streets spaced too close together;
- Lack of left-turn lanes to store turning vehicles;
- Deceleration of turning traffic in through lanes;
- Traffic signals too close together;

Sometimes these problems on major streets have unintended and undesirable consequences such as encouraging drivers to find alternate routes on collector and local streets.

Requirements for well-designed road and access systems further the orderly layout and use of land and help improve the design of residential subdivisions and commercial circulation systems. The change to shared or unified access to properties along major roadway sometimes causes concern among property owners or business operators, due to the perception that loss of individual driveway access could adversely affect property values or income.

The appearance of corridors and gateways is also critical to the image of a community and its overall attractiveness to investors. Minimizing the number of curb cuts, consolidating access drives, constructing landscaped medians, and buffering parking lots from adjacent thoroughfares results in a visually pleasing and efficient corridor that, in turn, can help attract new investment. Effective management of roadway corridors will also protect property values over time.

Butler Road

Butler Road functions as the only North/South corridor connecting Rose Hill to Andover and ultimately the City of Wichita via US-54. Butler Road is known by other names as well; in Andover, it is named as Andover Road and in Rose Hill, it is named Rose Hill Road. For continuity, it will be referred to as Butler Road throughout the document but will include sections of Andover/Rose Hill Road in the study area. This Access Management Policy was written for the study segment bounded by US-54 on the north and 190th Street on the south, as well as major intersecting roads for a mile each direction east and west. Butler Road will ultimately become a suburban section with the ultimate build-out of the corridor shown in the Butler Road Corridor study document, which will act as a companion to the access management policy.

2 - Glossary

AASHTO – The American Association of State Highway and Transportation Officials.

Access – Any way or means of approach to provide vehicular or pedestrian entrance to a property.

Access Management – Measures to assure the appropriate location, design and operation of driveways, median openings, interchanges and street connections to a roadway, as well as the application of median treatments and turning lanes in roadway design, and the appropriate separation of traffic signals for the purpose of maintaining the safety and operational performance of roadways.

Access Management Program – The whole of all actions taken by a governing council, board or agency to maintain the safety and traffic carrying capacity of its roadways.

Annual Average Daily Traffic (AADT) – The annual average two-way daily traffic volume on a route. AADT represents the total traffic on a road per year, divided by 365.

At Grade – When two or more facilities that meet in the same plane of elevation.

Auxiliary Lane – A lane adjoining a roadway that is used for acceleration, deceleration or storage of turning vehicles.

Reverse Frontage Road – A local road that is used to provide alternative access to a road with higher functional classification; backage roads typically run parallel with the main route and provide access at the back of a line of adjacent properties. Also known as a “Backage Road” or “Parallel Access Road”.

Change in Use - A change in use may include, but is not limited to, structural modifications, remodeling, a change in the type of business conducted, expansion of an existing business, a change in zoning, or a division of property creating new parcels, but does not include modifications in advertising, landscaping, general maintenance or aesthetics that do not affect internal or external traffic flow or safety.

Commercial – Property developed for the purpose of retail, wholesale, or industrial activities, and which typically generate higher numbers of trips and traffic volumes than residential properties.

Conflict – A traffic-related event that causes evasive action by a driver to avoid a collision.

Conflict Point – Any point where the paths of two through or turning vehicles diverge, merge, or cross and create the potential for conflicts.

Congestion – A condition resulting from more vehicles trying to use a given road during a specific period of time than the road is designed to handle with what are considered acceptable levels of delay or inconvenience.

Connection - Any driveway, street, turnout or other means of providing for the movement of vehicles to or from the public roadway system.

Connection Spacing - The distance between connections, measured from centerline to centerline (center of right-of-way for public streets) along the edge of the traveled way.

Cross Access – A service drive that provides vehicular access between two or more abutting sites so that the driver need not enter the public street system to move between them.

Deceleration Lane – A speed-change lane that enables a vehicle to leave the through traffic lane and decelerate to stop or make a slow-speed turn.

Directional Median Opening – An opening in a raised median that provides for specific traffic movements and physically restricts other movements. For example, a directional median opening may allow only right turns at a particular location.

Divided Driveway – Driveway which has a separate one-way entrance and one-way exit. Typically placed on opposite ends of the property.

Driveway – A (typically) private roadway or entrance used to access residential, commercial or other property from an abutting public roadway.

Design Traffic Volume – The traffic volume that a roadway or driveway was designed to accommodate, and against which its performance is evaluated.

Downstream – The next feature (e.g. a driveway) in the same direction as the traffic flow.

Driveway Density – The number of driveways divided by the length of a particular roadway.

Driveway Spacing - (see Connection Spacing)

Driveway Width – The width of a driveway measured from one side to the other at the point of tangency.

Easement – A public dedication or private grant by a property owner of the specific use of a strip of land or portion of land by others.

Entering Sight Distance – The distance of minimum visibility needed for a passenger vehicle to safely enter a roadway and accelerate without unduly slowing through traffic.

Facility – A transportation asset designed to facilitate the movement of traffic, including roadways, intersections, auxiliary lanes, frontage roads, backage roads, bike paths, etc.

FHWA – The Federal Highway Administration of the U.S. Department of Transportation.

Flag Lot – A lot, tract or parcel of land that provides minimum frontage to a road or street by a narrow strip of land for a driveway and whose main body of land lies to the rear of the property that is adjacent to the road or street. When such lots are permitted, a building setback line must be shown on the recorded plat, which is not less than that required by applicable zoning regulations.

Frontage – The property on one side of a street between two intersecting streets (crossing or terminating) measured along the line of the street; or with a dead-end street, all property abutting one side of the street measured from the nearest intersecting street and the end of the dead-end street.

Frontage Road – A local road that is used to provide alternative access to property from a road with higher functional classification; frontage roads typically run parallel to the mainline road and provide access at the front of a line of adjacent properties.

Functional Area – The area surrounding an interchange or intersection that includes the space needed for drivers to make decisions, accelerate, decelerate, weave, maneuver and queue for turns and stop situations.

Functional Classification System – A system used to categorize the design and operational standards of roadways according to their purpose in moving vehicles; higher functional classification implies higher traffic capacity and speeds, and typically longer traveling distances.

Functional Integrity – Incorporating appropriate access management standards and controls that allow a roadway to maintain its classified purpose.

Geometric Design Standards – The acceptable physical measurements that allow a facility to maintain functional integrity.

Grade Separated - Two or more facilities that intersect in separate planes of elevation.

Highway System – All public highways and roads, including controlled access highways, freeways, expressways, other arterials, collectors and local streets.

Interchange – A grade-separated facility that provides for movement between two or more roadways.

Internal Circulation – Traffic flow that occurs inside a private property.

Internal Site Design – The layout of a private property, including building placement, parking lots, service drives and driveways.

Intersection – An at-grade facility that provides mobility between two or more roadways.

Interstate – A Federally-designated roadway system for relatively uninterrupted, high-volume mobility between states.

Joint (or Shared) Access – A private access facility used by two or more adjacent sites.

Lane – The portion of a roadway used in the movement of a single line of vehicles.

Left-Turn Lane – A lane used for acceleration, deceleration and/or storage of vehicles conducting left-turning maneuvers.

Level of Service – The factor that rates the performance of a roadway by comparing operating conditions to ideal conditions; “A,” is the best, “F,” which is worst.

Planning Commission – Andover-Rose Hill or Butler County Planning Commission.

Planning and Zoning Department – Andover-Rose Hill or Butler County Planning and Zoning Department.

WAMPO –Wichita Area Metropolitan Planning Organization

Median – A barrier that separates opposing flows of traffic. Raised medians (with curbs and a paved or landscaped area in the center) are generally used in urban areas. Raised medians should not be confused with more obtrusive Jersey Barriers. Flush median (with no curbs and a grass-covered area in the center) are generally used in rural areas. Medians can be both functional and attractive.

Median Width – The distance between the near edge of the through travel lanes in each direction when separated by a median.

Mid-Block Crossing – A crossing that is provided so that pedestrians can conveniently and safely cross a roadway in the middle of a block or segment of roadway.

NCHRP – The National Cooperative Highway Research Program, a program that sponsors research on highway safety, operations, standards and other topics.

Peak Hour Traffic – The number of vehicles passing over a section of roadway during its most active 60-minute period each day.

Police Power – The general power vested in the legislature to make reasonable laws, statutes and ordinances where not in conflict with the Constitution that secure or promote the health, safety, welfare and prosperity of the public.

Public Road – A highway, street or road, open for use by the general public and which is under the jurisdiction or control of a public body.

Queue Storage – That portion of a traffic lane that is used to temporarily hold traffic that is waiting to make a turn or proceed through a traffic control device such as a stop sign or traffic signal.

Raised Median – The elevated section of a divided road that separates opposing traffic flows.

Residential - Property developed for the purpose of single family, multi-unit or other housing quarters.

Reviewing Engineer – An individual or individuals designated by the City or County Public Works Department to review development projects and make decisions as outlined in this Policy. The review should include input from the Public Works Departments, Planning and Zoning Departments and other appropriate departments (fire, police, etc.).

Right-In, Right-Out – A driveway where left turns are prohibited either by physical or regulatory means.

Right-of-Way – Land reserved, used or slated for use for a highway, street, alley, walkway, drainage facility, or other public purpose related to transportation or utilities.

Roadway Classification System – See “Functional Classification System”

Rural – A geographic area that is not in an urbanized area, municipality or similarly densely-developed area. Defined as the area beyond the 30-year development boundary for this policy.

Service Road – A local road that is used to provide alternative access to a road with higher functional classification; service roads may include internal circulation systems, frontage roads, or backage roads.

Shared Driveway – A single, private driveway serving two or more lots.

Side Friction – Driver delays and conflicts caused by vehicles entering and exiting driveways.

Sight Distance – The distance visible to the driver of a passenger vehicle measured along the normal travel path of a roadway to a specified height above the roadway when the view is unobstructed to oncoming traffic.

Spacing – For purposes of this policy, the distance between two roadways and or drives measured from the center of one roadway to the center of the next roadway, unless otherwise defined for a specific application.

Speed Differential – The difference in travel speed between through traffic, and traffic entering or exiting a roadway.

Stopping Sight Distance – The minimum distance required for a vehicle traveling on a roadway to come to a complete stop upon the driver seeing a potential conflict; it includes driver reaction and braking time and is based on a wet pavement.

Storage Length – see Queue Length.

Strip Development – A linear pattern of roadside commercial development, typically with relatively shallow lots and frequent drives. Also typically lacks a network of side streets permitting efficient traffic circulation between adjacent developments.

Taper – The transitional area of a roadway where lanes are added or dropped.

Throat Length –The distance parallel to the centerline of a driveway to the first on-site location at which a driver can make a right-turn or a left turn. On roadways with curb and gutter, the throat length shall be measured from the face of the curb. On roadways without a curb and gutter, the throat length shall be measured from the edge of the shoulder.

Traffic Flow – The actual amount of traffic movement.

Transportation Impact Study – A report that compares relative roadway conditions with and without a proposed development; typically including an analysis of mitigation measures.

Trip Generation – The estimated volume of entering and exiting traffic caused by a particular development.

Turning Radius – The radius of an arc that approximates the turning path of a vehicle.

Two-Way Left-Turn Lane (TWLTL) – A lane located between opposing traffic flows which provides a transition area for left-turning vehicles.

Uncontrolled Access – A situation that results in the incremental development of an uncontrolled number, spacing and/or design of access facilities.

Upstream – Against (behind) the direction of the traffic flow.

Vehicle Trip – A vehicle moving from a point of origin to a point of destination.

Warrant – The standardized condition under which traffic management techniques are justified.

Weaving – Crossing of traffic streams moving in the same general direction through merging and diverging, for instance near an interchange or intersection.

3 - Roadway Classification System

Introduction

The roadway access classification system forms the basis of access management. Safe and efficient operation of streets and highways requires that these facilities be classified and designed for the functions that they will perform. The entire road system is traditionally classified by relating the portion of through movement to the proportion of access such as shown in *Figure 3-1*. Freeways, which have full control of access and serve only the through movement function are at one end of the scale; local streets, which predominately provide for land access, are at the other end of the scale because they have little or no through movement. Collector and arterial streets normally must provide a balance between movement and access functions; it is along these streets that access management actions become important.

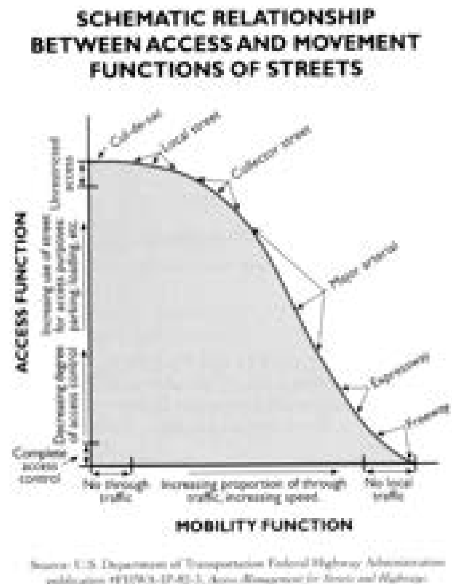


Figure 3-1 - Functional Classification

The cities of Andover-Rose-Hill have an existing functional classification system in place in the subdivision regulations, defining roadways based on the traditional hierarchy: freeway, arterial, collector, etc. While this system can be used for access management purposes, it is often tied to other regulations already in place and would require a thorough review of all current city regulations as well as combining specific descriptions of roadways between cities to ensure continuity of the document. Therefore, a separate, but parallel system has been developed using a numbering system of Access Class 1 through Access Class 5. Using this system will provide additional flexibility in that, where necessary, various access classifications can be assigned to sections of a roadway with the same functional classification.

In addition to the functional classification of a roadway, the level of existing development also influences access management. Therefore, connection spacing standards have been categorized by area types: urban and suburban. The ultimate configuration of Butler Road being urban negates the necessity of including a third type of area, rural. In urban areas, there is a higher level of expectation from motorists for more frequent cross streets and driveways and therefore drivers tend to drive with more awareness, or caution, in these areas. Conversely, in suburban areas, drivers have a higher expectation for free-flow traffic conditions and more defined access points. This also has practical influence on access management, as existing development in urban areas generally provides little opportunity to achieve the levels of access management desired in suburban areas.

Roadway classification should be assigned based on ultimate (30-year) development conditions, not existing conditions.

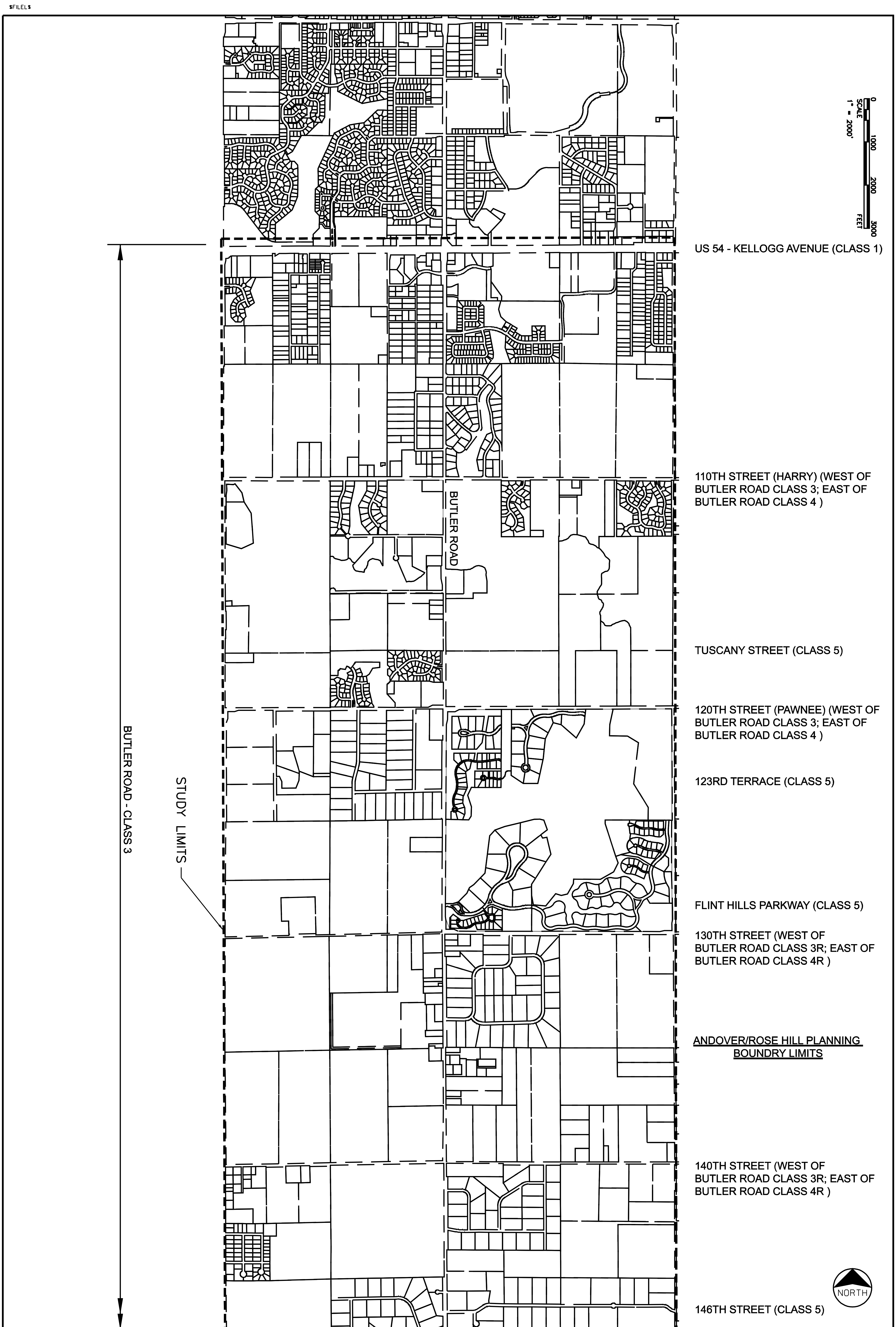
Access Classes and Area Types

The Access Management Area types and roadway Access Classification Types are described in the following tables. General definitions of the area types are shown on *Table 3-1*; the access classification type and descriptions are shown in *Table 3-2* . The official assigned classifications and area boundaries are illustrated on *Figure 3-2.*

Table 3-1 Access Management Area Types	
Area Type	Description
Urban	Older, fully developed areas. Generally developed more than 30 years ago. Typically smaller lot and development sizes.
Suburban	Newer areas, fully or partially developed or undeveloped. For access management purposes, area extends to forecast 30-year development boundary.

Table 3-2 Access Classification Types	
Access Class	Description
1	*Interstates and Freeways.* Limited access highways designed for high-speed, high-volume traffic movements. Access is permitted only via interchanges. Access requirements per KDOT standards.
2	*Expressways.* Highly controlled access facilities distinguished by their ability to carry high-speed, high-volume traffic over long distances in a safe and efficient manner. These highways are distinguished by a highly controlled limited number of connections, median openings and infrequent traffic signals. Access requirements per KDOT standards.
3	Typically ***principal arterial*** type roadways. Controlled access facilities where direct access to abutting land will be controlled to maximize the through movement of traffic. Roadways of regional importance intended to serve moderate to high volumes of traffic traveling relatively long distances. These roadways are intended to serve through traffic and are distinguished by existing or planned restrictive medians and maximum distance between signals and driveway connections. Land use planning, zoning and subdivision regulations should be such to support the restrictive spacing of this designation.
3R	Rural, multi-lane (two or more through lanes in each direction) roadways designated as "Corridor Protection" routes.
4	Typically ***minor arterial*** or ***major collector*** type roadways. Roadways that operate under lower traffic volumes, over shorter distances, and provide a higher degree of property access than major arterials.
4R	Rural, single-lane (one through lane in each direction) roadways designated as "Corridor Protection" routes.
5	Typically ***collector*** type roadways. Provides for traffic movement between arterials and local streets. Carries moderate traffic volumes over moderate distances. *This classification shall not be used on Arterial roadways.*
5R	Rural roadways located on section lines, extensions of these roadways (where they do not follow the section lines) and other rural routes that carry through traffic over distances in excess of one mile.

In suburban areas where there is minimal development and the primary roadways have not been improved, small developments may not necessitate improvements to the major roadway in order to provide sufficient capacity other than perhaps the construction of turn lanes. *These developments and temporary improvements should be planned in a way that accommodates these standards when the roadway is ultimately improved.*



TranSystems

ACCESS CLASSIFICATION

Butler Road Corridor Study

Butler County, Kansas

12/1/2008

1" = 2000'

Figure 3-2A

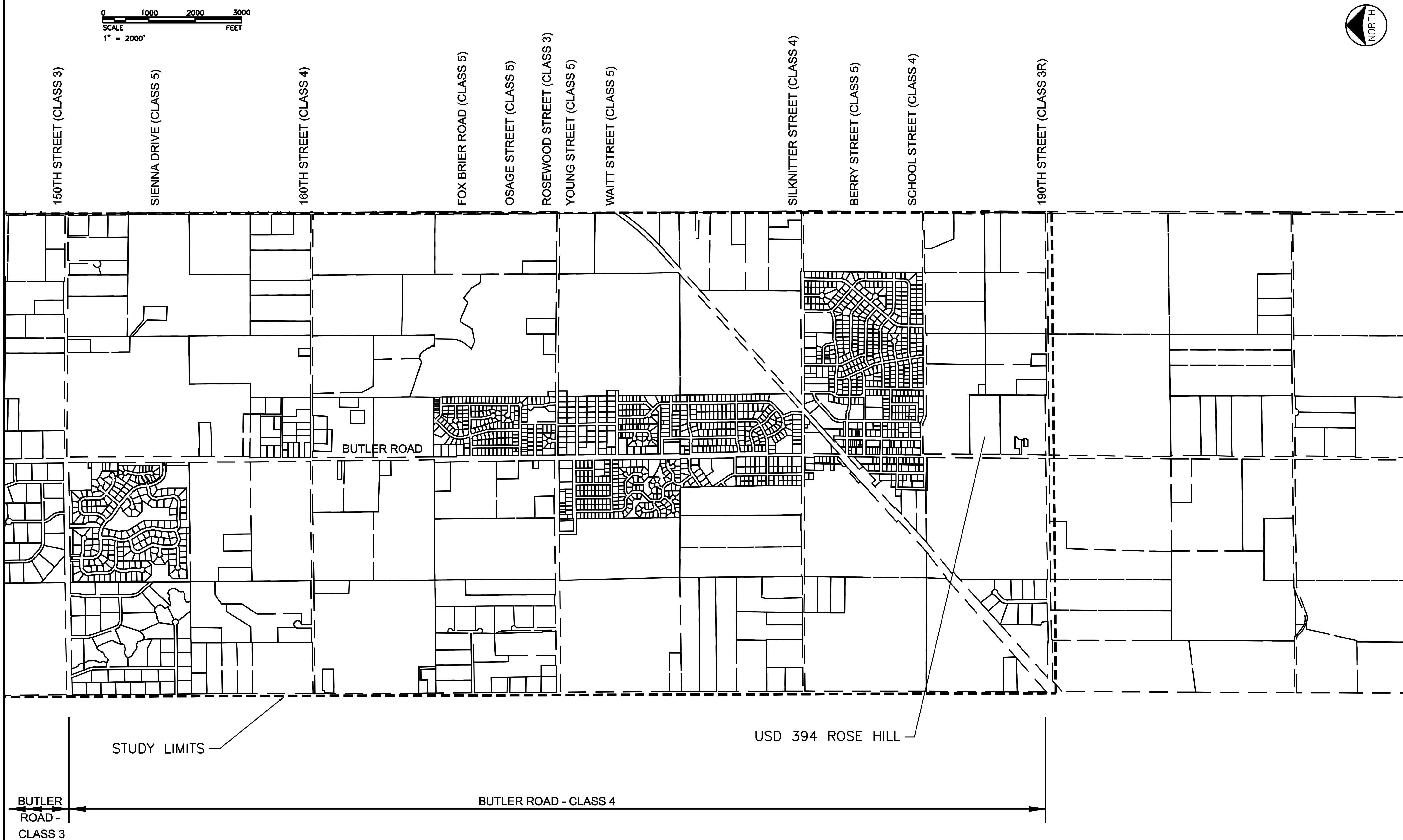


Figure 3-2B

12/1/2008

1" = 2000'

Butler Road Corridor Study

Butler County, Kansas

ACCESS CLASSIFICATION

TranSystems

4 - Right-of-Way and Typical Sections

Introduction

Providing sufficient right-of-way to meet the long-term growth potential of a roadway is one of the most important elements of the transportation network. Once development occurs adjacent to the roadway, additional expansion of the road may become very expensive or impractical if sufficient right-of-way is not available. This may in turn limit development if additional capacity cannot be accommodated.

Proposed Butler Road right-of-way is shown in the companion Butler Road Corridor Study document. Any additional access point not shown in ***Figure 3-2*** connecting onto Butler Road should have enough Right of Way to accommodate the lane arrangements of the ultimate build-out.

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5 - Collector Street Planning

Introduction

Collector streets both those classified as collector streets and those within or adjacent to developments that serve in this capacity, allow many developments to be efficiently served from a limited number of connections to the major (arterial) street system.

Planning Requirements

The following requirements shall be applied in the development of the collector street system.

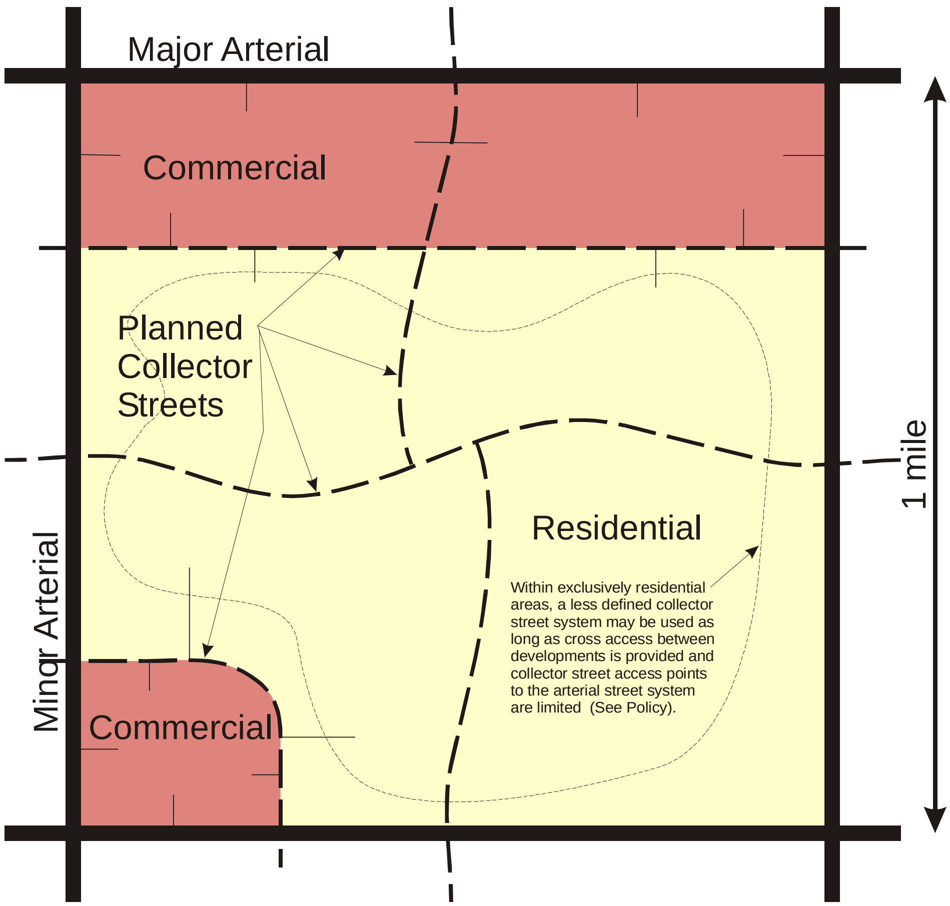

Figure 5-1- Collector Street Planning

Requirements:

- Prior to the approval of any new development in suburban areas, the Planning Commission shall develop a conceptual collector street system for the area bounded by the section line roads containing the development based on zoned and master planned land uses within the area. Consideration must also be given to existing or planned connections and collector streets in adjacent sections, existing property lines and topographic features.
- The proposed development plan may propose an alternative collector street system as long as the principals described above are followed. The alternative collector street system must be approved along with the development plan. Within exclusively residential areas, continuous collector streets are desirable, but not essential. In these areas, a less defined collector system may be utilized, but should provide connectivity between developments and relatively direct access to the designated collector street connections to the

arterial street system (Note that access at other connections to the arterial street system may be restricted per this Policy).

- Collector roads shall be public streets.
- A collector street may serve both residential and commercial development, but should be planned to discourage use by commercial traffic into residential areas.
- Major collector streets should connect to arterial streets at full median opening locations in accordance with the standards in this policy. Where feasible, the connection should also be made at a location suitable for traffic signal installation.

Example

An example of a collector street network is shown on ***Figure 5-1***.

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6 - Review/Exceptions Process

Introduction

Flexibility is essential when administering access spacing requirements to balance access management objectives with the needs and constraints of a development site. The following policies are intended to establish a permit requirement and to provide flexibility, while maintaining a fair, equitable and consistent process for access management decisions. The exception/waiver process described below applies to all of the standards in this policy.

Permit Required

- No person shall construct or modify any access connection to Butler Road or a Class 3-5 roadway intersecting (within a mile in each direction) Butler Road without a connection permit. All requests for connections to a roadway within the Butler Road study area shall be reviewed for conformance with this access management policy.
- Access connections that do not conform to this policy and were constructed before the effective date of this policy, shall be considered legal nonconforming connections and may continue without a permit until a change in use occurs as provided in Section 9. Access connections granted a temporary permit are legal nonconforming connections until the temporary permit expires.
- Any access connection constructed without a permit after the adoption of this policy shall be considered an illegal nonconforming connection and shall be issued a violation notice and may be closed until the property owner applies for and receives a connection permit.

Requests for Deviation

- Access connections deemed in conformance with this policy may be authorized by the reviewing engineer. Any requests for deviation shall require approval by the reviewing engineer (in consultation with Planning and Zoning and other appropriate City and County departments). Any appeal of the decision of the reviewing engineer shall be to the Planning Commission, which has final decision authority.
- Deviations of greater than 10% of the allowable spacing standard or 100 feet, whichever is less, shall also submit documentation justifying the need for the deviation and an access management plan for the site that includes site frontage plus the distance of connection spacing standards from either side of the property lines. The analysis shall address existing and future access for study area properties, evaluate impacts of the proposed plan versus impacts of adherence to standards and include improvements and recommendations necessary to implement the proposed plan.

Waiver for Nonconforming Situations

Where the existing configuration of properties and driveways in the Butler Road influence area precludes spacing of access points in accordance with the spacing standards of this policy, the reviewing engineer (in consultation with Planning and Zoning and other appropriate City and County departments) shall be authorized to waive the spacing requirement if all of the following conditions have been met:

- No other reasonable access to the property is available. Joint access should be considered with an adjacent property farthest from the nearest intersection. In these cases:
- A joint use driveway with cross access easements will be established to serve two or more abutting building sites;
- The building sites will be designed to provide cross access and unified circulation with provisions to include other adjacent properties not yet developed if applicable;
- The property owner shall agree to close any pre-existing curb cuts after the construction of the joint use driveway has been completed.

- The connection does not create a potential safety or operational problem as determined by the city/county engineer based on a review of a transportation impact study prepared by the applicant's professional engineer.
- If the first two bullet points are met, an access connection along the property line farthest from the nearest adjacent intersection may be allowed. If the property abuts Butler Road and an intersecting roadway of Class 3-5, the access point shall be on the intersecting roadway. The construction of a median may be required on the roadway to restrict movements to right-in/right-out and only one drive shall be permitted.

Temporary Access

A development that cannot meet the connection spacing standards of this policy and has no reasonable alternative means of access to the public road system, but will once future development occurs shall be issued a temporary connection permit. The temporary driveway access permit will be recorded in the property deed and filed with the Butler County Register of Deeds. When adjoining parcels develop which can provide joint or cross access, the temporary permit shall be rescinded and the property owner must apply for a connection permit.

Conditions shall be included in the temporary permit including, but not limited to the following:

- Applicants must sign an agreement to participate in any future project to consolidate access points.
- Applicants must sign an agreement to abandon the interim access when alternative access becomes available.
- The transportation impact study should consider both the temporary and final access/circulation plan.
- A limit may be placed on the development intensity of properties issued temporary permits, until alternative access becomes available.

7 - Access Management and Subdivision Practices

Introduction

The design of property access is established when land is subdivided for commercial or residential development. All new lot splits and commercial and residential plats will be reviewed to assure that property access is designed in accordance with the access management guidelines of this plan. The following policies shall also apply.

Creation of New Lots

- New lots shall not be created on any arterial or collector roadway unless they comply with the access spacing standards of this plan.

Subdivision Access

- When a subdivision is proposed that would abut or contain a roadway with an access classification, it shall be designed to provide lots abutting the classified roadway with access from an interior local street. On Access Class 3 or 4 roadways, appropriate measures may be required to buffer residential properties from the noise and traffic of the through street.
- Direct residential driveway access to individual one-family and two-family dwellings should be avoided from any roadway with a designated access class.
- Corner lots shall obtain access from the street with the lowest functional classification, and access shall be placed as far from the intersection as possible to achieve the maximum available corner clearance.
- Access locations to subdivisions shall provide appropriate sight distance, driveway spacing, and include a review of related considerations.

Connectivity of Supporting Streets

As the Butler Road area continues to grow and land is subdivided for development, it will be essential to provide for a balanced network of local and collector streets to avoid traffic congestion on major arterial roadways. Without a supporting street system, all local trips are forced onto a few major roads resulting in significant traffic delays and driver frustration. Reasonable connectivity of the local street network is also important. Fragmented street systems impede emergency access and increase the number and length of individual trips. Residential street systems should be designed in a manner that discourages through traffic, without eliminating connectivity.

To accomplish these objectives, the following policies shall apply:

- New residential subdivisions shall be designed to coordinate with existing and proposed streets.
- All new developments shall be designed to discourage the use of local and residential collector streets by cut-through traffic while maintaining the overall connectivity with the surrounding system of roadways. This may be accomplished using modified grid systems, T-intersections, roadway jogs, or other appropriate traffic calming or street design measures within the development.
- Proposed streets should be extended to the boundary lines of the proposed development where such an extension would connect with streets in another existing, platted or planned development. The extension or connection should be based upon traffic circulation or public safety issues and compatibility of adjacent land uses.

When a proposed development abuts un-platted land or a future development phase of the same development, stub streets should be provided to provide access to abutting properties or to logically extend the street system into the surrounding areas. All street stubs should be provided with a temporary turn-around or cul-de-sac, and the restoration and extension of the street would be the responsibility of any future developer of the abutting land.

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8 - Unified Access and Circulation

Introduction

Internal connections between neighboring properties and shared driveways allow vehicles to circulate from one businesses or development to the next without having to reenter a major roadway. Unified access and circulation improves the overall ease of access to development and reduces the need for individual driveways. The purpose of this section is to accomplish unified access and circulation systems for commercial development.

Outparcels and Shopping Center Access

Outparcels are lots on the perimeter of a larger parcel that break its frontage along a roadway. They are often created along thoroughfare frontage of shopping center sites, and leased or sold separately to businesses that desire the visibility of thoroughfare locations. Outparcel access policies foster unified access and circulation systems that serve outparcels as well as interior development, thereby reducing the need for driveways on an arterial.

In the interest of promoting unified access and circulation systems, development sites under the same ownership or consolidated for the purposes of development and comprised of more than one building site shall prepare a unified access and circulation plan. In addition, the following shall apply:

- The number of connections shall be the minimum number necessary to provide reasonable access to the overall development site and not the maximum available for that frontage under the connection spacing requirements in this policy.
- Access to outparcels shall be internalized using the shared circulation system of the principal development.
- All necessary easements and agreements shall be recorded in an instrument that runs with the deed to the property.

Unified access for abutting properties under different ownership and not part of an overall development plan shall be addressed through the Joint and Cross Access provisions below.

Joint and Cross Access

Joint and cross access policies promote connections between major developments, as well as between smaller businesses along a corridor. These policies help to achieve unified access and circulation systems for individual developments under separate ownership that could not otherwise meet access spacing standards or that would benefit from interconnection (i.e., adjacent shopping centers or office parks that abut shopping centers and restaurants).

- Adjacent commercial or office properties and major traffic generators (i.e. shopping plazas, office parks) shall provide a cross access drive and pedestrian access way to allow circulation between adjacent properties. This requirement shall also apply to a building site that abuts an existing developed property unless the reviewing engineer finds that this would be impractical.
- To promote efficient circulation between smaller development sites, the reviewing engineer may require dedication of a 30-50 ft easement that extends to the edges of the property lines of the development site under consideration to provide for the development of a service road system. The service road shall be of sufficient width to accommodate two-way travel aisles and incorporate stub-outs and other design features that make it visually obvious that abutting properties may be tied in to it. Abutting properties shall be required to continue the service road as they develop or redevelop in accordance with the requirements of this policy. The easement may be provided to the front or rear of the site or across the site where it connects to a public roadway.
- Property owners shall record all necessary easements and agreements, including an easement allowing cross access to and from the adjacent properties, an agreement to close driveways provided for access in the interim after construction of the joint use driveway(s) or service road system, and a joint maintenance

agreement defining maintenance responsibilities of property owners that share the joint use driveway and cross access system.

- Joint and cross access requirements may be waived by the reviewing engineer for special circumstances such as incompatible uses (e.g. a gas station next to a child care center) or major physical constraints (e.g. change in grade between properties makes connection impractical).

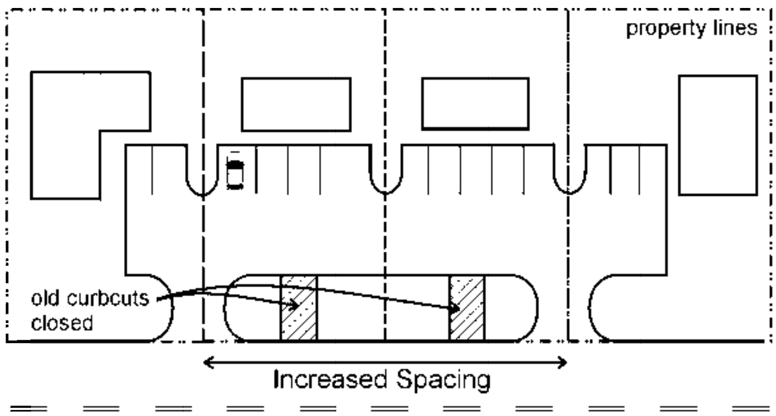

Figure 8-1 - Joint/Cross Access Example

9 - Redevelopment Requirements

Introduction

Access management policies are not retroactive. Existing nonconforming properties may continue in the same manner as they existed before the policies were adopted. This allowance, commonly known as "grandfathering", protects the substantial investment of property owners and recognizes the expense of bringing nonconforming properties into conformance.

Yet nonconforming access situations may pose safety hazards, contribute to traffic congestion, deter economic development or undermine community character. To address the public interest in these matters, without posing an undue burden on property owners, access to nonconforming properties is best addressed when a change in use occurs so applicants can finance access improvements as part of the overall property improvement. In some instances, opportunities to improve the location or design of property access can also occur during the roadway improvement process. This plan includes the following conditions or circumstances where property owners may be required to relocate or reconstruct nonconforming access features and/or pursue alternative access measures.

Requirements

Properties with nonconforming access connections shall be allowed to continue, but must be brought into compliance with this access management policy to the maximum extent possible when modifications to the roadway are made or when a change in use results in one or more of the following conditions:

- When a new connection permit is required.
- When site plan review is required.
- When a site experiences an increase of ten percent (10%) or greater in peak hour trips or 100 vehicles per hour in the peak hour, whichever is less, as determined by one of the following methods:
    a. An estimation based on the ITE Trip Generation Manual (latest edition) for typical land uses, or
    b. Traffic counts made at similar traffic generators in the Butler Road area, or
    c. Actual traffic monitoring conducted during the peak hour of the adjacent roadway traffic for the property.
- If the principal activity on a property is discontinued for a period of one year or more, or construction has not been initiated for a previously approved plat within a period of one year or more, then that property must thereafter be brought into conformance with all applicable access management requirements of this policy, unless otherwise exempted by the permitting authority. This shall include the need to update any previously approved transportation impact study, where new traffic projections are available. For uses or approved plats in existence upon adoption of this policy, the one-year period for the purposes of this section begins upon the effective date of these requirements.

Access to all change in use activities shall be approved by the reviewing engineer regardless of whether a driveway permit is required. All relevant requirements of this policy shall apply.

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10 - Transportation Impact Study Requirements

Warrants for Transportation Impact Studies

The necessity to review all land development applications from a transportation perspective as well as the wide variety of land use types and intensities suggest that multiple thresholds or triggers be established to warrant a transportation impact study. The reviewing engineer (in consultation with Planning and Zoning) shall have the discretion to waive or reduce the requirements for a transportation impact study to be prepared for any development application. The following triggers are recommended:

Table 10-1

Transportation Impact Study Warrants

Development Triggers	Minimum Study Requirements
All Applications[1,2]	Conduct Transportation Impact Study tasks 1-7 listed below.
Development Plan Generates 100 to 499 Trips in a Peak Hour	Conduct Transportation Impact Study tasks 1-14
Development Plan Generates 500 or More Trips in a Peak Hour	Conduct Transportation Impact Study tasks 1-14 plus extend the study in each direction along arterial streets (Access Class 2, 3, 3R, 4, 4R) serving the development site to at least the next intersecting major street (Access Class 1-5, 3R-5R) beyond those immediately adjacent to the site.

[1]Individual single-family residential properties do not require a study.
[2]A full Transportation Impact Study is not required for residential developments generating fewer than 100 trips if the proposed development meets the criteria of this policy (e.g. connection spacing, turn lanes, sight distances, etc.). The applicant shall complete Task 1 below. Tasks 2-6 will be evaluated by the reviewing engineer.

Transportation Impact Analysis Study Tasks

The following tasks represent the minimum recommended thresholds for a transportation impact study when such a study is deemed appropriate. The purpose of such a study is to assess the impact of new development or redevelopment on the public street system and to evaluate access and circulation for automobile and truck traffic, pedestrians, bicyclists, and transit.

There shall be a pre-application meeting with representatives of the applicant, City/County Public Works and Planning and Zoning to discuss the need for and the nature of the Transportation Impact Study and content of the report. This will include, but not be limited to, such things as use of secondary and primary data, analysis procedures, and so on. The reviewing jurisdiction will prepare a specific scope of services for the transportation impact study identifying intersections to be studied, scenarios to be developed and any deleted or additional tasks from the items listed below.

1. Prepare a conceptual layout of the proposed development depicting land use types and intensities and the arrangement of buildings, parking and access. Identify any existing development on and/or approved plans for the site and identify land uses (including types and the arrangement of buildings, parking and access) on property abutting the proposed development site, including property across public streets. The layout should be approximately to scale.

2. Identify the land uses shown in the Comprehensive Plan for the proposed development site under study, as well as the ultimate arterial and collector street network in the vicinity of the site (at least the first arterial or collector street (Access Class 1-5, 3R-5R) beyond those immediately adjacent to the site in each direction).

3. Identify the Access Class of the public street(s) bordering the site and those streets on which access for the development is proposed. The Access Class is shown on
4.
5.
6. Figure 3-2.

7. Identify allowable access to the development site as defined by criteria included in this Access Management Policy.

8. Document current public street characteristics adjacent to the site, including the nearest arterial and collector streets (Access Class 1-5, 3R-5R), including number and types of lanes, speed limits or 85th percentile speeds, and sight distances along the public street(s) from proposed access.

9. Compare proposed access with established design criteria (driveway spacing, alignment with other streets and driveways, width of driveway, and minimum sight distances). If appropriate, assess the feasibility of access connections to abutting properties, including shared access with the public street system, in order to comply with access standards in this Access Management Policy.

10. Estimate the number of trips generated by existing and proposed development on the site for a typical weekday and weekday peak hours (Saturday peak hours should also be considered in commercial areas) using the latest edition of Trip Generation published by the Institute of Transportation Engineers. Local trip generation characteristics may be used if deemed to be properly collected and consistent with the subject development application as determined by the reviewing jurisdiction staff. The analysis may also include these factors only after approval from staff: a) Pass-by capture rate (commercial land uses only), b) internal capture rate (mixed-use developments only), c) diverted trips. Calculate the net difference in trips between existing and proposed uses. If the development site already has an approved plan, also estimate the number of trips that would be generated by the approved land uses.

11. Document current peak hour traffic volumes on a typical weekday (Tuesday, Wednesday and/or Thursday) and Saturday (in commercial areas where Saturday traffic volumes may be the appropriate design condition). Traffic volumes should be measured at any existing site driveway(s) and on the adjacent collector streets, including the nearest collector/arterial street intersection in each direction along streets bordering the development site. The time periods in which existing traffic is counted should generally coincide with the highest combination of existing traffic plus traffic expected to be generated by the proposed development. Traffic volume counts at intersections shall document left-turn, through and right-turn movements on all approaches and shall be tabulated in no greater than 15-minute increments. The reviewing jurisdiction staff shall determine, based on the nature of the development, additional time periods during the day in which current traffic volumes shall be documented (e.g. school dismissal, factory shift change, etc.).

12. Estimate future weekday P.M. peak hour (and Saturday, where appropriate) traffic volumes for the intersections included in the study area. Future traffic growth projections will be provided by the reviewing jurisdiction.

13. Develop trip distribution estimates. Submit trip generation and distribution estimates to reviewing jurisdiction for approval prior to proceeding. Distribute and assign the net development trips through the site driveway(s) plus the nearest collector/arterial street (Access Class 1-5, 3R-5R) intersections in each direction along streets beyond those bordering the development site. If applicable, this and subsequent tasks shall be repeated based on approved land uses.

14. Conduct volume/capacity analyses for the peak hours at site driveway(s) and other intersections using methodologies outlined in the latest edition of the Highway Capacity Manual published by the Transportation Research Board (using software approved by reviewing jurisdiction). The analyses should be conducted for

1) existing conditions, 2) existing plus development conditions and 3) future conditions. The analysis of future conditions shall be based initially on the street network characteristics included in the traffic model. Where traffic queues extend out of turn bays or through adjacent signalized intersections, additional analysis may be required to determine the impact on intersection operation (methodologies or modeling used for such analysis must be approved by the Public Works Director).

15. Compare existing plus development conditions and future conditions with established City/County guidelines/policies for acceptable levels of service (level-of-service "D" or better at intersection on suburban and urban arterial streets (Access Class 1-4) and level of service "C" on suburban and urban collector streets (Access Class 5) and all rural streets (Access Class 3R, 4R and 5R)) and the turn lane requirements in this Policy.

16. Identify geometric and traffic control improvements needed to mitigate deficiencies and/or comply with established guidelines/policies.

17. Prepare a typewritten report outlining the findings and conclusions of the study, including exhibits illustrating the site plan, traffic volumes (current and projected), and existing street conditions. Any deviation from established guidelines/policies shall be clearly identified and justification provided as to the basis for such a condition and its potential ramifications on the public street system.

Possible Additional Requirements

1. Extend the study to additional street segments and/or intersections on the public street system. Public Works staff shall make this determination based on the scale, location and/or nature of the proposed development and the condition or state of development of the street network near the site.

Submit five copies of the study to City/County Public Works Department at the time of application. The study will be reviewed by the reviewing engineer. Approval of the study by the reviewing engineer, in consultation with Planning and Zoning, will be required before a permit can be issued or application for change in zoning or platting can be accepted.

Other Transportation Issues Associated With Site Planning

While transportation impact studies primarily address automobile traffic, recognition of other vehicle types and travel modes is appropriate, particularly in a community that strives for multi-modal choice. The following text by no means, however, represents a comprehensive list of site planning elements.

Trucks

Site driveways and internal circulation must be designed to accommodate the largest truck anticipated to serve the development. Vehicle turning paths need to be provided such that trucks do not encroach over curbs and medians. Encroachment into opposing turning lanes should be minimized but can be consistent with the scale of the development and the frequency and timing of truck movements. Truck circulation through a development site should minimize conflicts with customer traffic and loading docks should be configured such that parked trucks do not impede normal traffic flow.

Pedestrians

The investment in sidewalks along public streets or off-street paths is diminished if pedestrians cannot readily travel between public sidewalk facilities and adjacent land uses. All development plans should provide this connectivity whether it is made via proposed parking lot facilities and/or additional sidewalks or paths.

Bicycles

Similar to pedestrians, development plans should provide reasonable opportunities to travel between adjacent public streets or bicycle trails and the land use. This does not imply that separate facilities are needed; rather, the conditions within a development site should be comparable to conditions adjacent to and near the site. Adequate and properly placed parking facilities for bicycles are a key component to encouraging bicycle travel.

Public Transportation

Site development should account for both current and potential bus services. Some of these considerations are similar to trucks due to the relatively large size of buses; however, the primary difference is that buses need to circulate with customer traffic flow. One other consideration is that large parking lots can potentially be used as park-and-ride facilities in conjunction with bus transit service.

Qualifications to Conduct a Transportation Impact Study

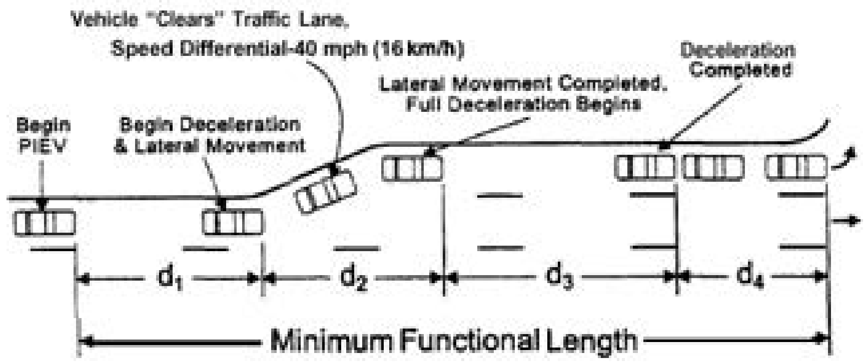
The recommended elements of a transportation impact study require skills found only in a professional engineer with specific experience in the field of transportation planning.

For this reason, the person conducting and the person reviewing the study must be a registered professional engineers with experience in the preparation or review of transportation impact studies for land development.

11 - Intersection Functional Area

Introduction

The functional area of an intersection consists of more than the area bounded by the stop lines or crosswalks; it also includes the area upstream of the intersection where vehicles have to react to slowing traffic in front of them, decelerate and wait in queues ***(Figure 11-1)***. The downstream functional area includes the area where through traffic merges with traffic turning from the cross street. It also includes the distance required to accelerate back to driving speeds.



d_1 = distance traveled during perception-reaction time

d_2 = distance traveled while driver decelerates and maneuvers laterally

d_3 = distance traveled during full deceleration and coming to a stop or to a speed at which the turn can be comfortably executed

d_4 = storage length

Figure 11-1 - Upstream Intersection Functional Area Components

Calculating Intersection Functional Area

The upstream intersection functional area can be determined by summing two primary components:

Reaction/Deceleration Time ($d_1+d_2+d_3$)

This is the distance traveled while the driver recognizes that action is required (e.g. sees vehicles stopping ahead), reacts (e.g. presses brake pedal) and decelerates (e.g. slows to a stop). These values can be calculated from ***Table 11-1***. The following rules can be applied:

- Access Class 2,3R, 4R and 5R roadways shall use "desirable conditions" in all cases
- Access Class 3, 4 and 5 roadways may use limiting conditions.
- On Access Class 3, 4 and 5 roadways with posted speeds below 45 MPH, $d_1+d_2+d_3$ may be reduced to 100'.

Table 11-1 Upstream Intersection Area Excluding Storage (ft)[1]				
Speed (MPH)	Desirable Conditions[2] Deceleration[4]	Desirable Conditions[2] PIEV Plus Deceleration[5]	Limiting Conditions[3] Deceleration[4]	Limiting Conditions[3] PIEV Plus Deceleration
30	225	315	170	215
35	295	370	220	270
40	375	490	275	335
45	465	595	340	405
50	565	710	410	485
55	675	835	485	565
60	785	960	565	605

[1]all distances rounded to 5ft
[2]2.0 second perception-reaction time; 3.5 fps^2 average deceleration while moving laterally into turn lane, 6.0 fps^2 average deceleration thereafter; speed differential < 10 mph
[3]1.0 second perception-reaction time; 4.5 fps^2 average deceleration while moving laterally into turn lane, 9.0 fps^{2}average deceleration thereafter; speed differential <10 mph
[4]distance to decelerate from through traffic speed to a stop while moving laterally into a left-turn or right-turn lane
[5]distance traveled during perception-reaction time plus deceleration distance

Queue Storage Length (d_4)

Queue lengths should be calculated based on existing (or existing plus development for new development projects) and future (30-year) traffic conditions. For development projects, turn lane storage improvements may be based on existing plus development, however site access and right of way should be planned to accommodate future conditions.

Queue lengths should be calculated for left-turn, through and right-turn lanes. Queue lengths should consider 95th percentile queues and should be calculated using established procedures or software that reports 95th percentile or maximum back of queue. As traffic signals on most arterial corridors have the potential to be coordinated, it is recommended that a cycle length of at least 120 seconds be used. Analysis should conform to Highway Capacity Manual methods. In areas with closely spaced or coordinated signals, software that analyzes coordinated signal timings (e.g. SYNCHRO, CORSIM, etc.) may be needed to supplement the analysis. In these cases, queue lengths should be evaluated for both coordinated arrival and random vehicle arrival and the larger of the two values used, as future changes in coordination, timings can significantly change queue patterns.

Downstream Functional Area

The functional area of an intersection extends some distance downstream from the crosswalk location because of the need to establish guidance and tracking after having passed through the area in which there are no lane lines. This is especially true following a left turn. A vehicle should clear a major intersection before the driver is required to respond to vehicles entering, leaving or crossing the major roadway. The logic of this criterion is to simplify the driving task and thus minimize the chances of driver mistakes and collisions. Stopping sight distance is one criterion, which would allow the driver to clear the intersection before having to rapidly decelerate in response to a maneuver at a downstream intersection. Downstream functional areas based on AASHTO stopping sight distances are given on Table 11-2.

Table 11-2 Downstream Intersection Area (ft)	
Speed	AASHTO Stopping Distance[1]
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
[1]Source: Table 3-1, page 112, 2004 AASHTO "Green Book"	

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12 - Medians and Continuous Center Turn Lanes

Introduction

Restrictive ("raised" or "non-traversable") medians and well designed median openings are known to be some of the most important features in a safe and efficient highway system. The design and placement of these medians and openings is an integral part of the Access Management practice. Medians are used because of:

- Vehicular Safety — to prevent accidents caused by crossover traffic, headlight glare distraction and traffic turning left from through lanes.
- Pedestrian Safety — to provide a refuge for pedestrians crossing the highway.
- Vehicular Efficiency — to remove turning traffic from through lanes thereby maintaining/increasing highway operating speed. This reduces fuel consumption and emissions, which is an environmental benefit.
- Improved Aesthetics – Landscaped and grass medians offer aesthetic benefits over paved turn lanes or undivided roadways.

Properly implemented median management will result in improvements to traffic operations, minimize adverse environmental impacts and increase highway safety. As traffic flow is improved, delay is reduced, as are vehicle emissions. In addition, roadway capacity and fuel economy are increased, and most importantly, accidents are less numerous and/or less severe.[1]

Continuous two-way center turn lanes ("two-way left-turn lanes" or "TWLTL" or "traversable" medians) do not provide all of the safety benefits of restrictive medians, but do offer substantial safety improvements over roadways where no left-turn lanes are provided, particularly in areas with frequent driveways. These facilities provide more flexibility than restrictive medians and operate safely and efficiently under appropriate circumstances. However, once the driveway density and left-turning traffic volumes reach a certain point, the safety benefits diminish rapidly. At that point, restrictive medians are the more effective alternative with regard to safety and operations. Similarly, once through

[1] *Median Handbook,* Florida Department of Transportation, Jan. 1997

traffic volumes on a roadway reach certain levels, adequate gaps for traffic to turn left onto or off a roadway become infrequent and accident rates begin to climb.

Median Standards

Restrictive medians shall prohibit vehicles from crossing the median except at designated median openings using a barrier curb or wide landscaped median treatment. Restrictive medians shall be required under the following conditions:

Requirements:

- On all Access Class 1 or 2 roadways.
- On all new or reconstructed Access Class 3 and 3R roadways.
- On Access Class 4 roadways where existing daily traffic volumes are in excess of 24,000 (or where traffic volumes are projected to exceed 24,000 in the future the roadway and access should be designed to accommodate the future installation of a raised median, e.g. identify potential median opening locations, use 16-foot center turn lane).

Recommended:

- Speeds are posted at 40 MPH or above.
- Adjacent to left-turn lanes at signalized intersections (existing or planned signal locations) where drives are present within the intersection functional area.
- Adjacent to all dual left-turn lanes.
- On roadways with three or more through lanes in each direction.

Continuous Two-Way Center Turn Lanes

Continuous two-way center turn lanes shall be considered under the following conditions (except where restrictive medians are required as described above):

Requirements:

- On all Access Class 4 or 5 roadways adjacent to property that is developed as or planned for commercial development or in areas where there is a need for frequent left-turn lanes.

13 - Median Openings

Introduction

Openings in raised medians should only be provided to accommodate turning traffic in locations where this can be safely done. Where openings are provided, an adequate spacing between them is required to allow for weaving of traffic to preserve traffic flow and provide for safe lane changes and turns.

A full opening allows turns to be made in both directions; a directional opening allows turns to be made in only one direction. An example of a directional median would be one that allows left turns into a driveway, but does not allow left turns to be made out.[2]

Examples of these median opening types are shown on Figure 13-1 and Figure 13-2[3].

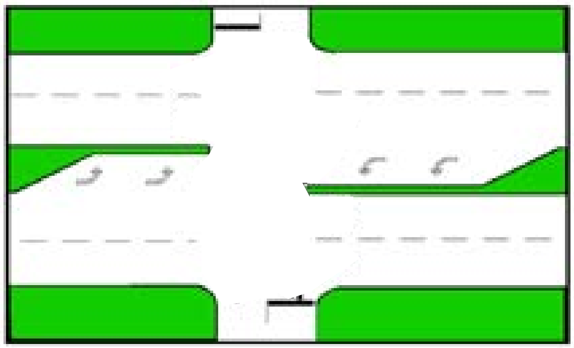

Figure 13-1 - Full Median Opening

[2] Missouri Department of Transportation Access Management Manual, Sept. 2000
[3] *Median Handbook,* Florida Department of Transportation, Jan. 1997

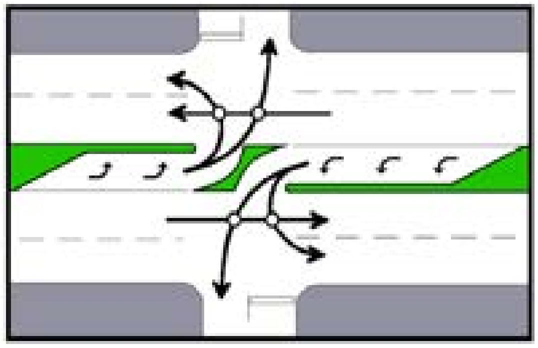

Figure 13-2 - Directional Median Opening

Median Opening Standards

Requirements:

- The minimum spacing standards for full median openings are summarized on ***Table 13-1*** subject to the limitations listed below.
- No median openings shall be permitted on Access Class 1 roadways.
- Median opening dimensions shall not exceed the deviation requirements in *Section 6* without going through the review/exceptions process.
- Median openings shall not be permitted where an opening would be unsafe due to inadequate sight distance.
- Full median openings must meet the requirements of both *Table 13-1* and the minimum connection spacing as defined in *Section 15*. Directional median openings may be provided at any connection that meets the connection spacing requirements in *Section 15* and is found to be an acceptable location based on a transportation impact study.
- Left-turn lanes shall be required at all median openings. Median openings shall not be permitted where adequate queue storage cannot be provided for the left-turn lane.

Table 13-1

Minimum Full Median Opening Standards
(Centerline to Centerline)

Access Class (of Primary Road)	Rural	Suburban	Urban
2	1 mile	1 mile	1 mile
3 and 3R	½ mile (2,640')	½ mile (2,640')	¼ mile (1,320')
4	--	¼ mile[1] (1,320')	725'

[1]On Class 4 Roadways with medians where future daily traffic volume projections are below 24,000, 725' feet may be used.

U-Turns

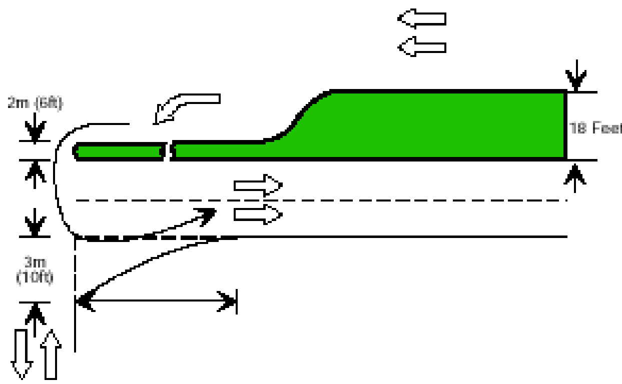

Figure 13-3 - Accommodating U-Turns by Flaring Intersection

A standard passenger vehicle cannot make a u-turn from a left-turn lane with minimal median width (e.g. 4 feet) and only two lanes in the opposing direction. In order to accommodate u-turn movements at median openings on a four-lane roadway widening of the downstream approach near the u-turn location should be provided. Downstream widening can be accommodated by allowing vehicles to turn on the shoulder or by flaring the pavement width at the u-turn locations. Ultimately, the width between the left edge of the left turn lane and the right edge of the downstream travel lane need to be at least 44 feet apart for a typical automobile to make a u-turn. An example of this technique is illustrated on *Figure 13-3*[4].

[4] *Median Handbook,* Florida Department of Transportation, Jan. 1997

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14 - Traffic Signals

Introduction

This standard governs the distance between signalized at-grade intersections on public roadways. Minimum spacing is intended to preserve efficient traffic flow and progression on urban arterial roadways; for instance, a quarter or half-mile spacing allows traffic signals to be effectively interconnected and synchronized. Effective signal coordination will also tend to reduce rear-end collisions and stop and go driving that increases congestion, delay, and air pollution.

Traffic Signal Standards

An intersection should meet the following requirements to be considered for installation of a traffic signal.

Requirements:

- The intersection shall meet warrants in the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD). Installation of a traffic signal based on the peak hour or four-hour warrant will only be considered at the intersection of two roadways which both are Access Class 4 or higher (2, 3, 3R, 4, 4R).
- For intersections where one or more of the roadways has an Access Class of 5 or 5R or is unclassified, existing traffic volumes shall be utilized in evaluating the signal warrants (installation of a traffic signal based on existing plus proposed development traffic volumes may be approved based on traffic volume increases projected to occur within the next 12 months).
- The location of the traffic signal shall conform to the spacing standards shown *Table 14-1*.
- Traffic signal interconnect (conduit and cable) shall be installed between traffic signals within 3000 feet of the proposed location.

Table 14-1

Minimum Traffic Signal Spacing Standards
(Centerline to Centerline)

Access Class (of Primary Road)	Rural	Suburban	Urban
2	1 mile	1 mile	1 mile
3, 3R, 4R	1 mile	½ mile (2,640’)	¼ mile (1,320’)
4, 5R	½ mile (2,640’)	¼ mile (1,320’)	¼ mile* (1,320’)

*Traffic signal spacing of 660’ may be considered in retrofit applications where there is an opportunity to combine and reduce the number existing connections when a transportation impact study indicates that queues will not extend between signals and signal progression can be maintained.

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15 - Connection Spacing

Introduction

This standard governs the minimum allowable spacing between connections (side streets and private driveways) on various classes of roadways. Access points introduce conflicts and friction into the traffic stream. Vehicles entering and leaving the main roadway often slow the through traffic, and the difference in speeds between through and turning traffic increases accident potential. As stated in the 2004 AASHTO A Policy on Geometric Design of Highways and Streets, "As the number of business and access points increases along a roadway, there is a corresponding increase in crash rates…..each additional access point per mile increases the crash rate about three percent"

The consensus is that increasing the spacing between access points improves arterial flow and safety by reducing the number of conflicts per mile, by providing greater distance to anticipate and recover from turning maneuvers, and by providing opportunities for use of turn lanes.

Connection Spacing Standards

Connections to major streets shall conform to the following requirements.

Requirements:

- To determine the minimum connection spacing, the following procedure shall be used:
- On approaches to (upstream of) the intersection of two roadways with an assigned Access Class or at any connection that is controlled by a traffic signal (or is likely to be controlled by a signal in the future):
- Determine the through traffic queue length from Table 15-2
- Add the deceleration distance from *Table 15-3*.
- Compare to the distances on *Table 15-1*. Use the larger of the two values.
- For spacing between other connections, select the distance on *Table 15-1*.
- Exceptions may be permitted to these distances as provided in *Section 6.*
- Connections that permit left-turn in or out movements shall be aligned with existing or currently planned connections on the opposite side of the roadway or be offset by the following minimum distances:
- Access Class 2 roadways, all roads with speed limits of 45 MPH or greater - 660'
- Access Class 3, 3R and 4R roadways - 300'
- Access Class 4, 5 and 5R roadways - 200'
- Additional distance may be required to accommodate left turn queues between the two connections
- Left-in only movements must be controlled using a restrictive median (See *Figure 13-2*).

Table 15-1 Minimum Connection Spacing Standards (Centerline to Centerline)						
Access Class (of Primary Road)	Rural		Suburban		Urban	
	TWLTL or Un-divided[1]	Restrictive Median[2]	TWLTL or Un-divided[1]	Restrictive Median[2]	TWLTL or Un-divided[1]	Restrictive Median[2]
2	--	¼ mile (1,320’)	--	¼ mile (1,320’)	--	¼ mile (1,320’)
3, 3R, 4R	¼ mile (1,320’)	725’	¼ mile (1,320’)	725’	725’	375’
4	725’	725’	725’	375’	375’	300’
5	375’	--	300’	--	225’	--
5R	600’	600’	--	--	--	--

[1]Roadways with traversable medians (e.g. two-way left-turn lanes) or no medians.
[2]Roadways where non-traversable (raised) medians are in place, restricting movements at access locations to right-in/right-out except where median openings are permitted by this policy.

Table 15-2 Typical Vehicle Queue Length On Approaches to Signalized Intersections					
Access Class (of Street Being Evaluated)	Future ADT	Access Class (of Cross Street)			
		3	4	5	Other
3	>20,000	650’	650’	650’	650’
3	<20,000	500’	500’	500’	400’
4	>20,000	650’	650’	650’	650’
4	<20,000	500’	500’	400’	400’
5	>5,000	300’	200’	200’	200’
5	<5,000	300’	300’	300’	200’
Other		300’	200’	200’	n/a

Table 15-3 Intersection Width[1] Reaction and Deceleration Distance On Approaches to Signalized Intersections		
Speed (MPH)	Access Class 2, 3R, 4R, 5R	Access Class 3, 4, 5
30	375’	245’
35	430’	300’
40	550’	355’
45	655’	465’
50	770’	545’
55	895’	625’
60	1030’	665’
[1]Includes an additional 60 feet to account for ½ of intersection width at upstream and downstream intersections for use in determining centerline to centerline distances.		

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16 - Turn Lanes

Introduction

Left turns may pose problems at driveways and street intersections. They may increase conflicts, delays and accidents and often complicate traffic signal timing. These problems are especially prevalent at major suburban highway intersections where heavy left-turn movements take place, but occur also where left turns enter or leave driveways serving adjacent land development.

Vehicles slowing to turn onto cross streets or into drives cause disruptions to through street traffic flow and increase accidents along a corridor. Thus, the treatment of turning vehicles has an important bearing on the safety and movement along arterial roadways.

Left-Turn Lane Standards

Requirements:

- Left-turn lanes shall be provided on all approaches to intersections controlled by, or planned to be controlled by, traffic signals.
- Left-turn lanes shall be provided at the intersections of two roadways where both have any assigned Access Class (see *Figure 3-2*).
- Left-turn lanes shall be provided at all median openings on roadways with medians.
- Left-turn lanes shall be provided at all connections with Access Class 3 roadways, if the required medians are not yet in place.
- Continuous two-way left turn lanes may be used in lieu of individual left-turn lanes where permitted.
- Left-turn lanes shall be provided at intersections where the peak hour left-turn volume exceeds the levels identified on *Figure 16-1*. The directional volume is the total volume (left turns, through and right turns) approaching the intersection in the direction of the potential left-turn lane.
- To determine the left-turn lane length requirements at signalized intersections (existing or future signal locations), the following procedure shall be used:
- For most locations, the left-turn lane length can be calculated by adding the appropriate distances from *Table 16-1* and *Table 16-2*. (These distances do not include the taper, turn lane lengths are measured from the stop line, end of median or corner radius point as appropriate to the end of the full-width turn lane)
- Where left-turn volumes from a Class 2 or 3 roadway exceed 300 vehicles per hour in the peak hour or 200 for other roadways, at exits from commercial developments or for situations where unusual traffic patterns exist, left-turn lanes shall provide queue storage and deceleration length as described in *Section 11*. Use d_4 for queue storage, d_2+d_3 for deceleration length on *Table 11-1* (100 feet on Access Class 3, 4 and 5 roadways with posted speeds below 45 MPH). However, the turn lane length on streets with any assigned Access Class shall not be less than indicated in part (a) above without approval from the reviewing engineer.
- At unsignalized intersections, the left-turn lane length shall be the distance shown on *Table 16-2*, plus 50 feet, plus the taper length.
- At intersections of two Access Class 3 or 4 roadways, plan for dual left-turn lanes.

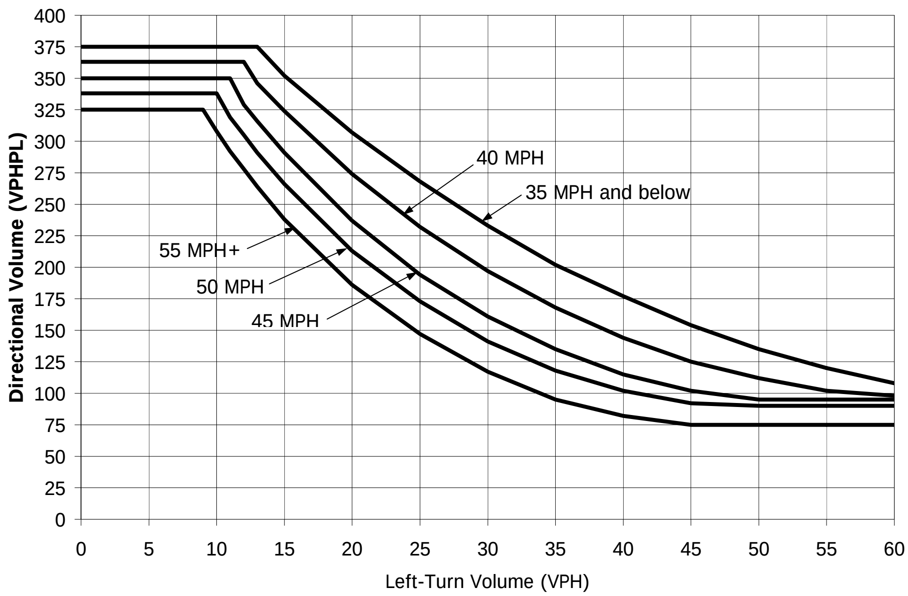


Figure 16-1 - Left-Turn Lane Warrants at Unsignalized Intersections[5]

[5] P.E. Hawley and V.G. Stover, *Guidelines for Left-Turn Bays at Unsignalized Access Locations on Arterial Roadways,* 2nd National Conference on Access Management, Aug. 1996

Table 16-1 Standard Left-Turn Lane Queue Storage Requirements									
Access Class (of Street Being Evaluated)		Access Class (of Cross Street)							
		3	3	4	4	5	5	Other	Other
	Future ADT	>20,000	<20,000	>20,000	<20,000	>5,000	<5,000	>3,000	<3,000
3	all	2@300'	2@300'	2@300'	2@300'	300'	300'	300'	300'
4	all	2@300'	2@300'	2@300'	2@300'	300'	200'	300'	200'
5	all	300'	200'	200'	150'	300'	150'	300'	150'
Other	>5,000	2@300'	2@200'	2@200'	2@150'	2@200'	2@200'	n/a	n/a
Other	<5,000	200'	200'	150'	150'	150'	150'	n/a	n/a

Dual left turn lanes are identified by "2@". At these locations, where dual left turn lanes cannot be practically provided due to existing constraints, the left-turn lane length shall be 1.5 times the distance shown.

Table 16-2 Deceleration Distance for Turn Lanes			
Speed (MPH)	Access Class 2, 3R, 4R, 5R	Access Class 3	Access Class 4, 5
30	100'	100'	0'[1]
35	100'	100'	0'[1]
40	100'	100'	0'[1]
45	465'	340'	340'
50	565'	410'	410'
55	675'	485'	485'
60	785'	565'	565'

[1]For unsignalized intersections, use 100'.

Right-Turn Lane Standards

Requirements

- Right-turn lanes shall be required when the peak hour right-turn volume exceeds the thresholds shown on *Table 16-3.*
- Right-turn lanes will not be required if the posted speed is at or below 30 M.P.H. or the total traffic volume on the roadway (existing and 30-year projection) is below 10,000 vehicles per day
- Separate right turn lanes and tapers should be provided for each connection where warranted. The use of continuous right-turn lanes is strongly discouraged.
- Right-turn lane lengths shall be as follows:
- For typical applications, the turn lane length shall be 150' on streets with posted speeds of 40 M.P.H. or below and 300' for streets with posted speeds of 45 M.P.H or more, plus taper length.
- When the right-turn lane is required for capacity reasons (in order to maintain acceptable levels of service) at an existing or future signalized intersection, the turn lane length shall meet or exceed the through traffic queue length (using *Table 15-2* plus *Table 15-3* plus taper or, alternatively, as described in Section 11).

Table 16-3

Right-Turn Lane Warrants

Roadway Class	Rural	Suburban	Urban
2	>10 VPH	>10 VPH	>10 VPH
3, 3R, 4R	>25 VPH	>25 VPH	>25 VPH
4, 5R	>25 VPH (45 MPH+) >50 VPH (<45 MPH)	>25 VPH (45 MPH+) >50 VPH (<45 MPH)	>25 VPH (45 MPH+) >100 VPH (<45 MPH)
5	>50 VPH (45 MPH+) >100 VPH (<45 MPH)	>50 VPH (45 MPH+) >100 VPH (<45 MPH)	>50 VPH (45 MPH+) >100 VPH (<45 MPH)

VPH – Right-turn volumes in vehicles per hour

17 - Sight Distance

Introduction

Sight distance for driveway construction should be considered essential in the design and issuance of permits for all classes of driveways. If there is a request to construct a driveway at a questionable location, the transportation impact study must include an on-site inspection to evaluate the sight distance. Sight distance is always the most important consideration in the decision making process when placing driveways. Both vertical and horizontal alignment can limit sight distance. Special consideration is required for skewed intersections.

The sight distance standards should be based on criteria included in the 2004 AASHTO "A Policy on Geometric Design of Highways and Streets" (Greenbook). Six cases are provided:

- Case A – Intersections with no control
- Case B – Intersections with stop control on the minor road
- Case C – Intersections with yield control on minor road
- Case D – Intersections with traffic signal control
- Case E – Intersections with all-way stop control
- Case F – Left-Turns from the major road

For additional information and application, consult the 2004 AASHTO "A Policy on Geometric Design of Highways and Streets" (Greenbook).

Exceptions to Sight Distance Requirements

Sight distance should be considered a key element in the location of all driveways with particular emphasis placed upon public street approaches, high volume commercial and industrial driveways, and all driveways on Principal Arterial routes. All driveway locations shall meet or exceed the requirements listed above.

If no location on the applicant's frontage meets or exceeds the sight distance requirements, but a location does meet or exceed the distances shown in the *Minimum Stopping Sight Distance* column on *Table 17-1*, a driveway may be located with the City Engineer's approval, in accordance with the following criteria:

1. The proposed driveway location has the maximum sight distance available on the entire property frontage.

2. The Access Classification for the route is not 2 or 3.

3. The proposed location is not for a public street approach or a high-volume commercial driveway (more than 50 trips (in plus out) existing or projected during the peak hour).

4. There is no other available access, having equal or greater sight distance.

5. The Applicant will submit a letter to the reviewing engineer stating the following: "Applicant is aware that the sight distance of this driveway is severely restricted. The sight distance is the minimum necessary for a vehicle traveling at the posted speed to come to a complete stop prior to the driveway." The permit may also be issued with conditions limiting the number and types of vehicles using the driveway.

If these conditions are not met, the permit shall not be issued for the driveway. The applicant should be advised of work that could improve sight distance for the location, such as minor grading or brush removal.

Table 17-1 Minimum Stopping Sight Distance (ft)									
Speed[1]	30	35	40	45	50	55	60	65	70
Distance	200	250	305	360	425	495	570	645	730

[1]Greater of design speed or 85th percentile speed.
Source: Reference Table 3-1, page 112, 2004 AASHTO "Green Book"

18 - Driveway/Connection Geometrics

Introduction

The design of driveways is critical in access management in that it affects the speed of traffic turning into and out of driveways. This in turn affects the speed differential between through traffic and turning traffic. Large speed differentials are created when driveways are inadequately designed. The large speed differentials are associated with higher crash rates and diminished traffic operations. Driveway designs should be based on the results of a study of the traffic likely to use them; these standards are presented to illustrate good practices for driveway design.[6]

Driveway/Connection Standards

Lining Up Driveways across Roadways

Driveways shall align with driveways across the roadway on roadways without non-traversable medians or shall be offset as described in the connection spacing standards ***(Section 15)***.

Angle of Intersection to the Public Roadway

- Driveways that serve two-way traffic should have angles of intersection with the public road of 90 degrees or very near 90 degrees. The minimum acceptable angle for driveways that serve two-way traffic is 70 degrees.
- Driveways that serve one-way traffic may have an acute angular placement of from 60 to 90 degrees.

[6] Missouri Department of Transportation Access Management Manual, Sept. 2000

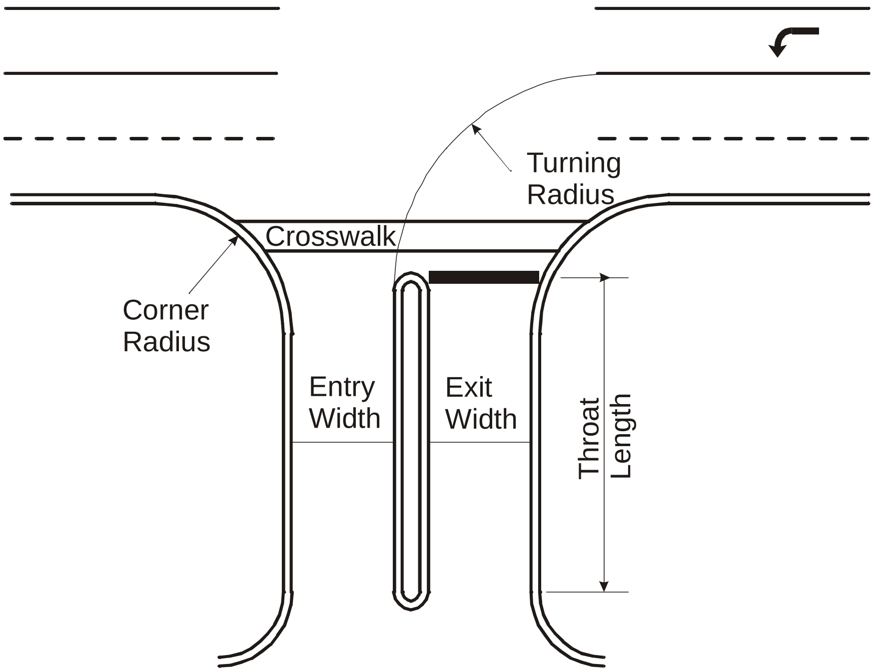


Figure 18-1 - Driveway Features

Corner Radius

The corner radius at intersections should be large enough to allow entering vehicles to do so at a reasonable rate of speed. *Table 18-1* shows minimum approach radii, measured from the edge of the driving surface of the roadway. Larger approach radii are allowable for driveways; however, the impact on lane definition, the view angle of right-turning traffic to see cross traffic, and the impact on pedestrian crossing times should all be considered. Corner radii of greater than 75 feet should not be used.

Table 18-1

Minimum Driveway Corner Radius

Minimum Right-Turn Radius for Driveways	Urban Areas (Or at or below 45 MPH posted speed)	Rural Areas (Or greater than 45 MPH posted speed)
Residential Driveways	10 feet	25 feet
[1]Commercial Driveways	50 feet	50 feet
Industrial Driveways/ Commercial Service Drives	Design to handle typical large truck that uses the driveway	Design to handle typical large truck that uses the driveway
[1]For divided commercial driveways Corner Radius can be reduced to 25 feet.		

Driveway Width

No two-way, non-residential driveway should have a width less than 24 feet. Driveway widths should be measured from the face of curb to the face of curb at the point of tangency. Minimum acceptable and maximum acceptable widths for various levels of traffic and directions of access are shown on *Table 18-2*. Where driveway medians are proposed, the median width should be added to the minimum widths shown in the table.

- All driveways with four or more lanes shall have a raised, landscaped median at least 8 feet in width. On industrial drives with primarily heavy truck traffic medians may be omitted, or mountable type median may be used but should be constructed with a pavement surface of a contrasting color.
- Single inbound or outbound lanes on driveways with a median shall be 16-18 feet in width.

Table 18-2

Driveway Widths
(Back of Curb to Back of Curb)

Driveway Traffic Category	Average Daily Traffic Using Driveway	Peak Hour Traffic Using Driveway	With Two-Way Access		With One-Way Access	
			Min. Width	Max. Width	Min. Width	Max. Width
Residential	0 - 100	0 - 10	20 feet	30 feet	NA	NA
Low Volume Commercial/Industrial	< 1500	< 150	28 feet[2]	42 feet[3]	13 feet[1]	20 feet[1]
Medium Volume Commercial/Industrial	1500-4000	150-400	42 feet[3]	54 feet[4]	20 feet[1]	30 feet[2]
High Volume Commercial/Industrial	>4000	>400	42 feet[3]	To Be Determined Through a Traffic Study	Generally Not Applicable	Generally Not Applicable

[1]One-lane driveways.
[2]Driveway striped for two-lanes.
[3]Driveway striped for three lanes.
[4]Driveway striped for four lanes.

Driveways and Accommodation of Pedestrians

In urban areas, all driveways must adequately accommodate pedestrians using sidewalks or paths. The crosswalk location should be placed to balance the pedestrian crossing distance and the width of the intersection for vehicular traffic (typically, this is at about the center point of the corner radius). Crosswalks should not be placed where pedestrians would likely have to cross behind or between stopped vehicles. Where four or more driveway lanes are created, they should be designed so that the pedestrians have a refuge from entering and exiting traffic. A safe boundary should always be created between pedestrian and motor vehicle traffic.

Driveways and Accommodation of Bicycles

Where a new driveway crosses a bicycle facility (such as a dedicated bike path or an on-street bike lane), the driveway should be designed to accommodate the safe crossing of bicyclists. Likewise, when a new bicycle facility is built that crosses existing driveways, the bicycle facility should be designed with safe crossings in mind.

Driveway Throat Length

The driveway throat length should minimize or eliminate the condition where inbound traffic queues back onto a public street. The throat length also provides for a place for exiting vehicles to queue, better definition of the driving lanes, and separation between the parking area and the adjacent street. Driveway throat lengths shall meet the following requirements:

- All driveways shall provide at least 20 feet of throat length.

- For driveways, serving between 100 and 400 vehicles in the peak hour (two-way traffic volumes) the driveways shall provide at least 80 feet of throat length.
- For driveways serving over 400 vehicles per hour (two-way traffic volume) and for all driveways controlled by a traffic signal, adequate throat length shall be determined by the transportation impact study.

Turning Radius

The path that a vehicle follows when turning left to or from a cross street or drive is defined as the turning radius *(Figure 18-1)*. This path should be a continuous, smooth curve from the stopping point (e.g. the stop line, the end of the median nose, or the location the vehicle typically waits to make a left turn) to beyond the farthest conflicting travel lane. Left-turning drivers should not have to pull out straight into the intersection and then begin the turn maneuver. The minimum turning radii are as follows:

- For low volume drives or streets (less than 100 vehicles in the peak hour) serving primarily passenger cars, 40 feet minimum.
- For dual left-turn movements, 75 feet minimum (for the inner left-turn movement).
- For all other situations, 60 feet minimum.

Opposing left-turn movements (e.g. eastbound left turns and westbound left turns) at the same intersections shall provide at least 10 feet separation between the outside edges of the two turning paths.

Vertical Geometrics

Access driveways on arterial roadways should always be designed to allow vehicles to proceed into or out of the driveway at a speed that will prevent large speed differentials between turning and through traffic. Required apron lengths, desirable grade changes and maximum allowable grade changes are shown on *Table 18-3*. The apron is a relatively flat area where the driveway meets the public roadway. These standards apply to all types of driveways, including those for residential, commercial and industrial uses. Driveways should always have a minimum grade change between ½ to 1 percent to provide for adequate drainage. Either an upgrade or downgrade is permissible.

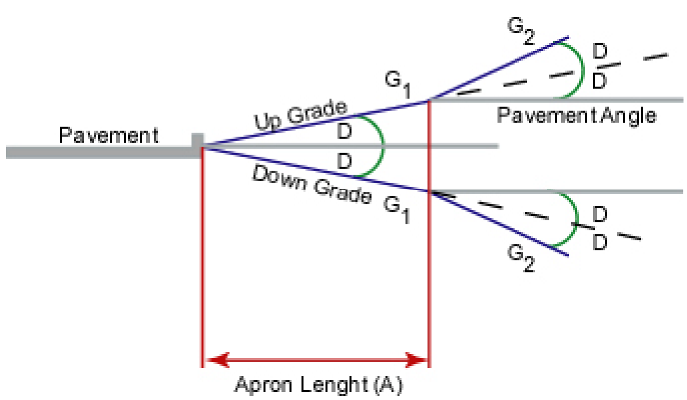


Figure 18-2 - Driveway Grades

Table 18-3

Driveway Grade Requirements

Access Class	Required Minimum Apron Length (“A” In the Diagram)	Desirable Grade Change, Urban	Maximum Grade Change Allowed, Urban	Desirable Grade Change, Rural	Maximum Grade Change Allowed, Rural
2	≥ 30 feet	≤ 2%	≤ 3 %	≤ 1%	≤ 2%
3, 3R, 4R	≥ 25 feet	≤ 3%	≤ 4%	≤ 2%	≤ 3%
4, 5R	≥ 20 feet	≤ 4%	≤ 5%	≤ 3%	≤ 4%
5	≥ 15 feet	≤ 5%	≤ 6%	≤ 4%	≤ 5%

The Apron Length is shown as “A” and grade change as “D” on the diagram.
The grade may change along the course of the driveway, as indicated by G_1 and G_2. In such cases, it is very important to ensure that the minimum apron length is maintained.

21.0 Appendix F – KDOT Preliminary Environmental Review

Kansas Department of Transportation

MEMO TO: Ron Seitz, Chief
Bureau of Local Project

FROM: Scott Vogel, Chief
Environmental Services Section

DATE: November 10, 2008

SUBJECT: Preliminary Environmental Review
Butler Road (BLP-BUTLERD)
Butler County

A Preliminary Environmental Review for the Butler Road project was initiated based on a study area map and description received August 13, 2008. The following is a summary of each environmental task evaluated.

NOISE – NOISE STUDY REQUIRED: The project meets Type I criteria. A noise study would be needed and, if impacts are identified, noise abatement analysis would be required.

ARCHEOLOGY – PHASE II RECOMMENDED: A Phase I archeological investigation was initiated based on the referenced study area map. Background research concluded that the areas near the Four Mile and Eight Mile Creek valleys have a moderate to high potential for archeological sites. Phase II pedestrian surveys and geomorphological testing is recommended within approximately one-half mile of each creek as shown on the attached maps (Recommend Archeological Surveys). Geomorphologicial testing consists of cutbank inspection and limited backhoe trenching and/or mechanical soil coring.

CULTURAL & HISTORICAL – PROJECT CLEARED: An Activity I field investigation was conducted on September 8, 2008 and submitted to the State Historic Preservation Officer (SHPO) for review. The SHPO determined there are no structures listed on the National Register of Historic Places within the project study area and the project may proceed.

WETLANDS – POTENTIAL MITIGATION REQUIRED: The attached National Wetlands Inventory (NWI) maps show potential emergent and forested wetlands within or adjacent to the project. A field verification visit was conducted on November 3, 2008 by Environmental Services staff. As wetland delineations were not performed, the NWI mapped wetlands are referred to as potential wetlands based on visual sightings of wetland plant species and hydrology indicators.

The NWI map shows a potential PABFh (Palustrine aquatic bed semi-permanently flooded diked/impounded) wetland located just west of Butler Road in the SE ¼ SE ¼ NE ¼ Sec. 31-T27S-R3E. This NWI wetland was not field verified. It is thought this mapped wetland may have been a pond that has since been filled in. The NWI map shows a potential PFOA (Palustrine forested temporarily flooded) wetland along the Fourmile Creek channel in Sec. 31 and 32-T27S-R3E. The site visit verified this as a potential forested wetland. The NWI map indicates a potential PFOAh (Palustrine forested temporarily flooded diked/impounded) wetland in the SE ¼ Sec. 6-T28S-R3E and SW ¼ Sec. 5-T28S-R3E where Butler Road crosses a tributary to Fourmile Creek. This was confirmed as a potential wetland. In the SE ¼ SE ¼ SE ¼ Sec. 6-T28S-R3E the drainage/slough to the west of Butler Road and crossed by 130th Rd. appeared to be a potential emergent wetland. This potential wetland is not shown on the NWI map. The drainage below the pond located in the SE ¼ SE ¼ NE ¼ Sec.19-T28S-R3E appears to be another potential emergent wetland not shown on the NWI map. National Wetlands Inventory mapped wetlands may or may not qualify as Corps of Engineers jurisdictional wetlands when wetland delineations are performed according to the 1987 Corps of Engineers Wetlands Delineation Manual. Fill or excavation in Corps of Engineers jurisdictional wetlands requires Section 404 permits from the Corps of Engineers.

STREAMS AND PONDS – SPECIAL CONDITIONS REQUIRED: The Kansas Department of Health & Environment, December, 2007 Surface Water Register classifies Fourmile Creek and Eightmile Creek as Expected aquatic Life Use (E) waters. Corps of Engineers Regional Special Conditions requires any box culverts with three or more cells on E streams to have the center cell lowered to concentrate low flows. Fill or excavation in Corps of Engineers jurisdictional streams requires Section 404 permits from the Corps of Engineers.

WILDLIFE – NO MITIGATION REQUIRED:
Federal: In Butler County the US Fish & Wildlife Service lists the endangered Topeka Shiner. The Topeka Shiner may occur in the headwaters of the South Fork Cottonwood River located in the northeast part of Butler County. Topeka Shiner habitat will not be impacted by this project.

State: In Butler County the Kansas Department of Wildlife & Parks has designated critical habitat (DCH) for the state threatened Bald Eagle, and state threatened Topeka Shiner. Designated critical habitat for the Bald Eagle is described as, "All lands and waters that lie within 5 air miles of public lands on El Dorado Reservoir." Designated critical habitat for the Topeka Shiner is described as, "The South Fork Cottonwood River and its tributaries in Butler County from the Butler/Chase County line upstream to its headwaters." Both of these DCH areas are well outside of the project area and will not be impacted.

FLOODPLAINS – FLOODPLAINS AND FLOODWAYS PRESENT: The attached Federal Emergency Management Agency (FEMA), Flood Insurance Rate Maps, panels 2003830165D, 2003830230D, 2000370240C, and 2000370305B show mapped 100-year floodplains at Fourmile Creek and an un-named tributary to Fourmile Creek, both in the NW ¼ Sec. 32-T27S-R3E, an un-named tributary to Fourmile Creek in the SW ¼ Sec. 5-T28S-R3E, and at Eightmile Creek in the NW ¼ Sec. 29-T28S-R3E. Within these floodplains areas of fill that average over 1 ft. in height would require Division of Water Resources (DWR) Floodplain Fill permits.

The attached FEMA Flood Boundary and Floodway maps (panels 2000370230, and 2000370240) indicate a floodway at Fourmile Creek. Just north of this stream crossing in Sec.

32-T27S-R3E on the east side of Butler Road a tributary floodway is located very close to the existing road. Following this same Fourmile Creek tributary north, the tributary floodway extends to Harry Street (110th St. on August 13, 2008 maps). The DWR does not allow a rise in a floodway (see K.A.R. 5-45-13).

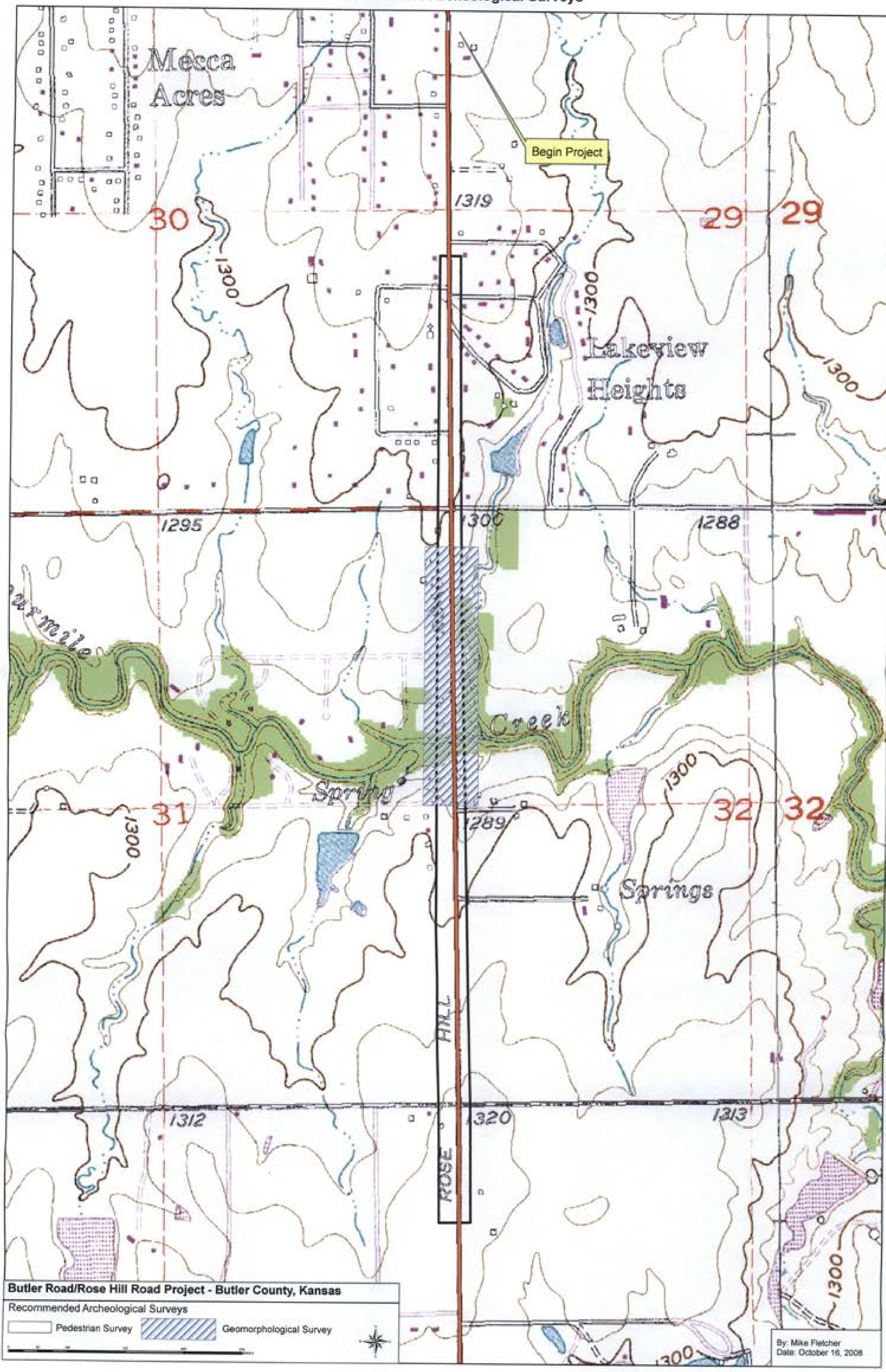
HAZARDOUS WASTE – POTENTIAL HAZARDOUS WASTE: A database search for state landfills and identified sites, CERCLIS, and National Priorities List sites was conducted. No sites were identified within the study area. A field survey was conducted on September 25th to identify sites posing potential hazardous waste impacts. Seven potential sites were identified as shown on the attached map (Potential Hazardous Waste). Listed below is a summary of these sites.

1. In the SE quadrant of Butler Rd. and Berry Street in Rose Hill. A former gas station. No UST's identified.
2. In the SE quadrant of Butler Rd. and Yeager St. in Rose Hill. An auto repair shop that appears to have once been a gas station. No UST's identified.
3. In the NW quadrant of Butler Rd. and BNSF Railroad in Rose Hill. An auto repair shop that appears to have once been a gas station. No UST's identified.
4. In the SE quad of Butler Rd. and Rosewood Street (170th) in Rose Hill. An active Cenex Gas Station. UST's located 10 ft. south of Rosewood curb line and 40 ft. east of Butler Road curb line. Groundwater monitoring wells are also located at this site.
5. In the SW quad of Butler Rd. and Rosewood Street (170th) in Rose Hill. A closed Conoco gas station. UST's located 30 ft. south of Rosewood curb line and 20 ft. west of Butler Rd. curb line.
6. Approx. 1550 ft. south of 130th St., on the west side of Butler Rd. An 8' x 14' concrete pad housing City of Rose Hill water meter vault and valves. This pad is located about 15 ft. west of the Butler Rd. ROW.
7. ¼ mile south of 130th St., on the west side of Butler Road. A former gas station (Allstop/Rathburn Enterprise). Two UST's, fill ports located 40 ft. west of existing Butler Road Centerline. Two pump islands located 35 ft. west of Centerline. The UST's could be within 15 to 20 ft. of existing Butler Road ROW. Also two groundwater monitoring wells, one 35 ft. west of Butler Road centerline and one 40 ft. west of centerline. This site is in the KDHE Storage Tank Section under the Time & Materials contract which means it is being monitored but no remedial action has been ordered. The KDHE project code is U2-008-12612. The KDHE project manager is Matt Lawhon.

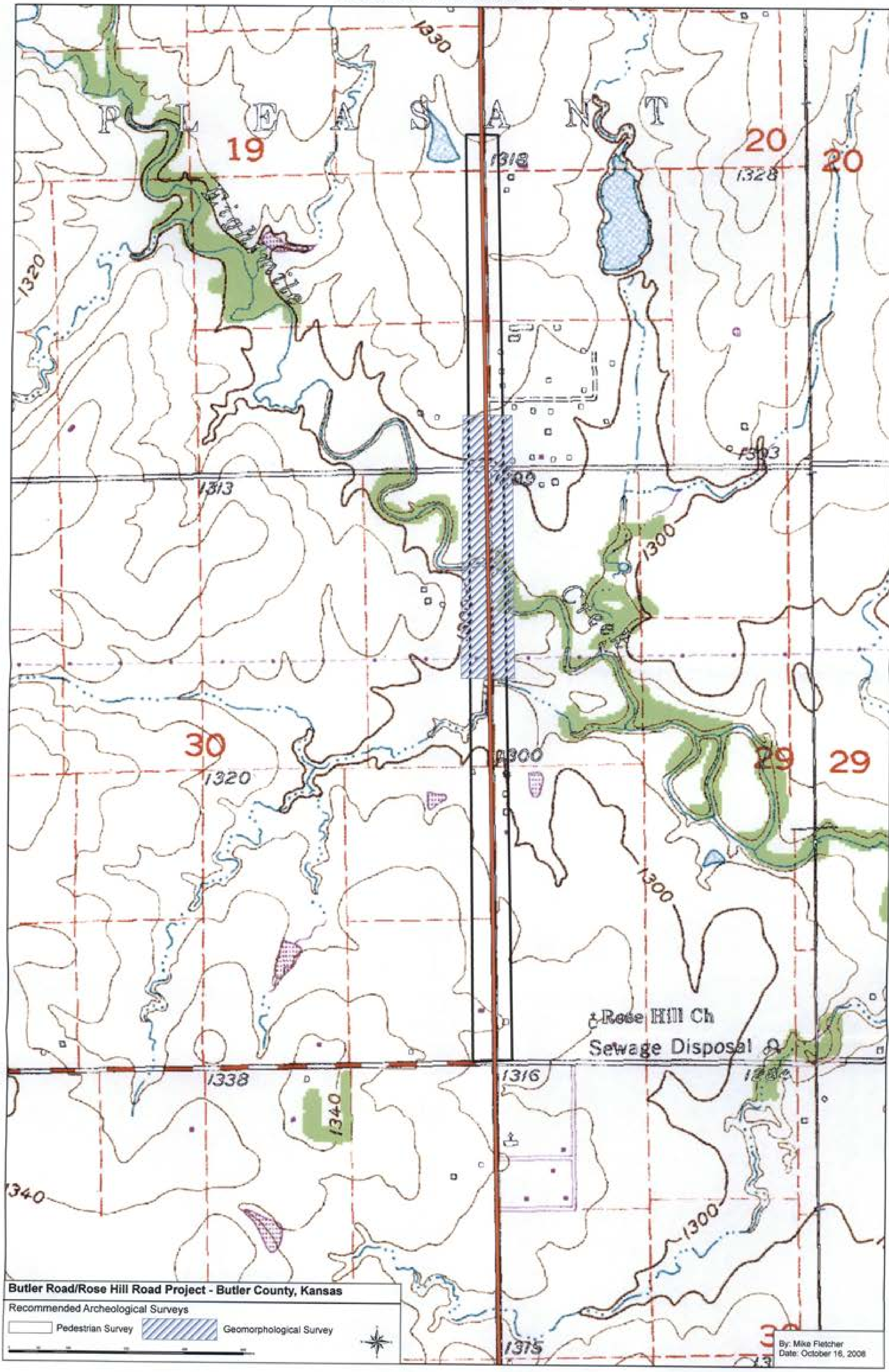
If you have any questions contact this office at (785) 296-0853.

SPV:MPF
Attachments

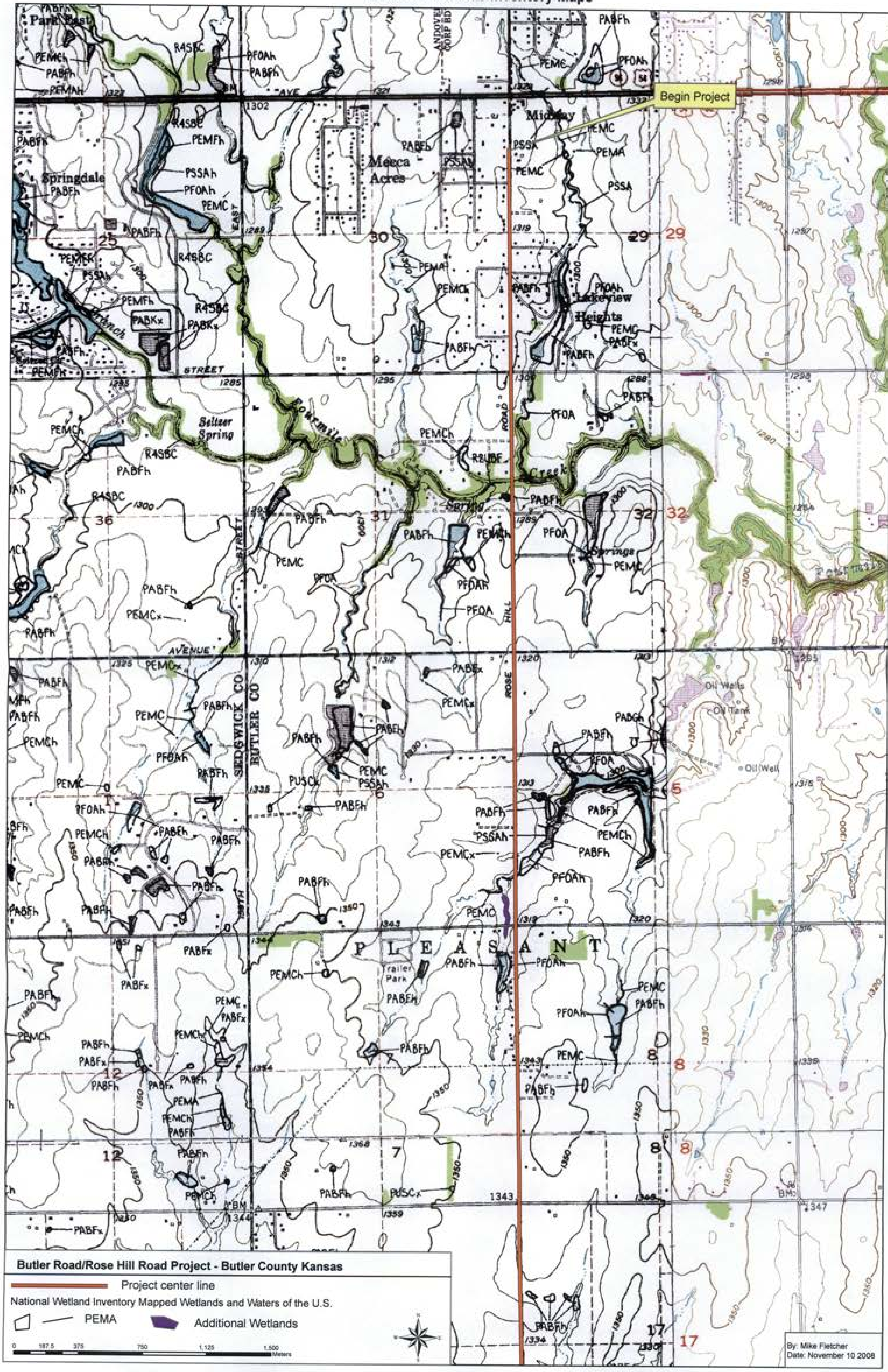
Butler Road Project
Recommend Archeological Surveys



Butler Road Project
Recommend Archeological Surveys



Butler Road Project
National Wetlands Inventory Maps



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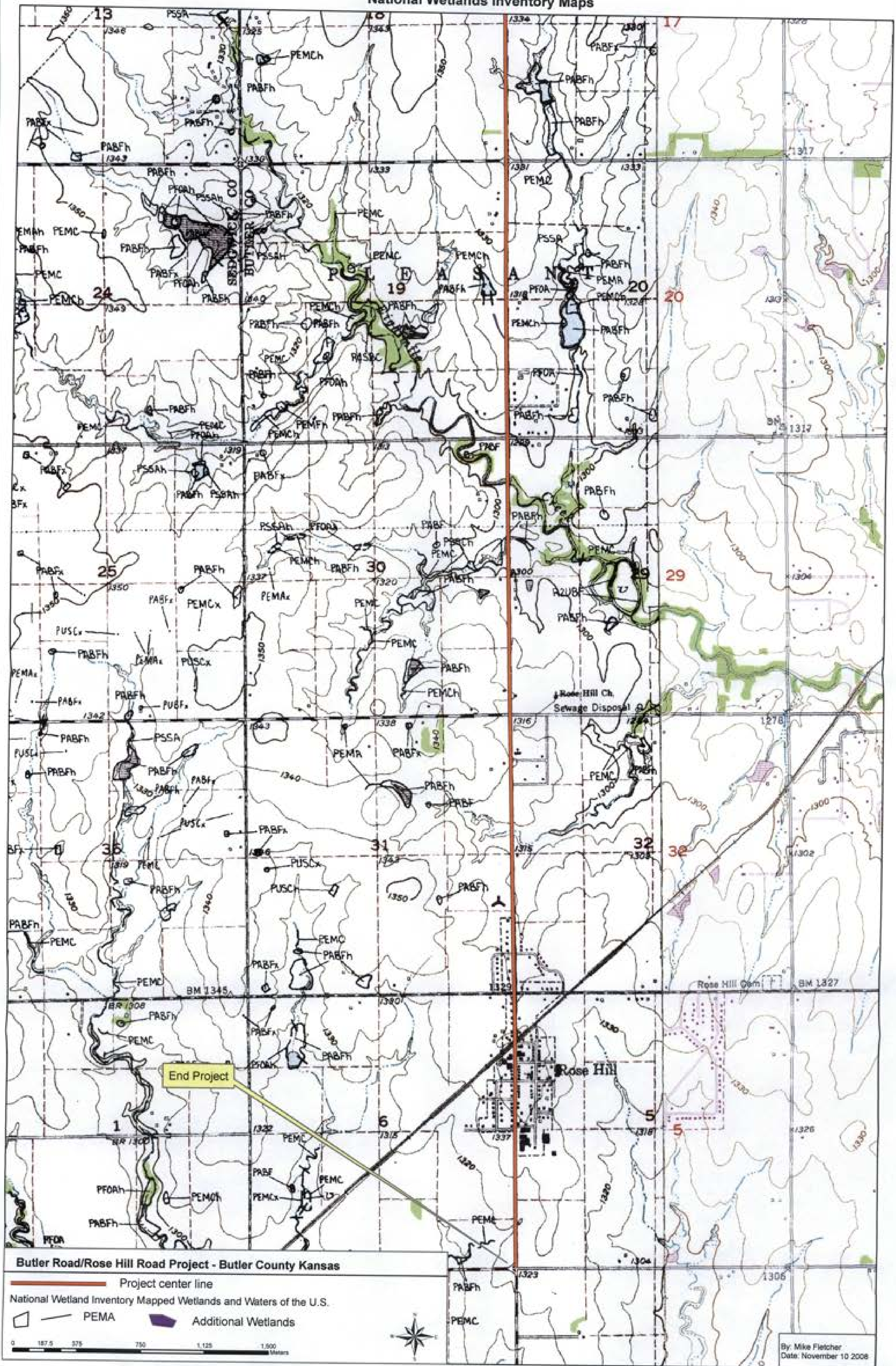

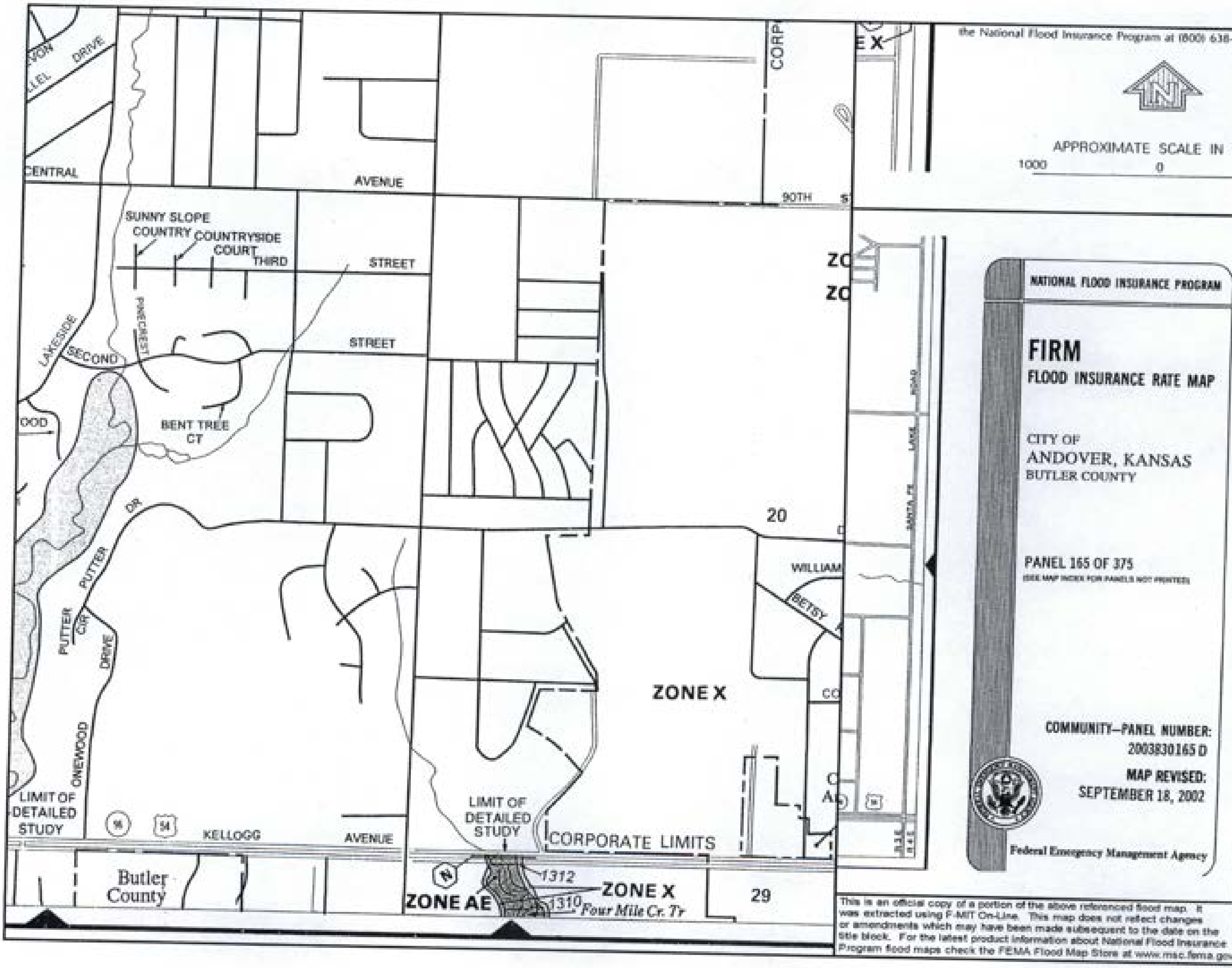

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ANDOVER, KANSAS
BUTLER COUNTY
PANEL 165 OF 375
(SEE MAP INDEX FOR PANELS NOT PRINTED)
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2003830165 D
MAP REVISED:
SEPTEMBER 18, 2002
Federal Emergency Management Agency
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CENTRAL
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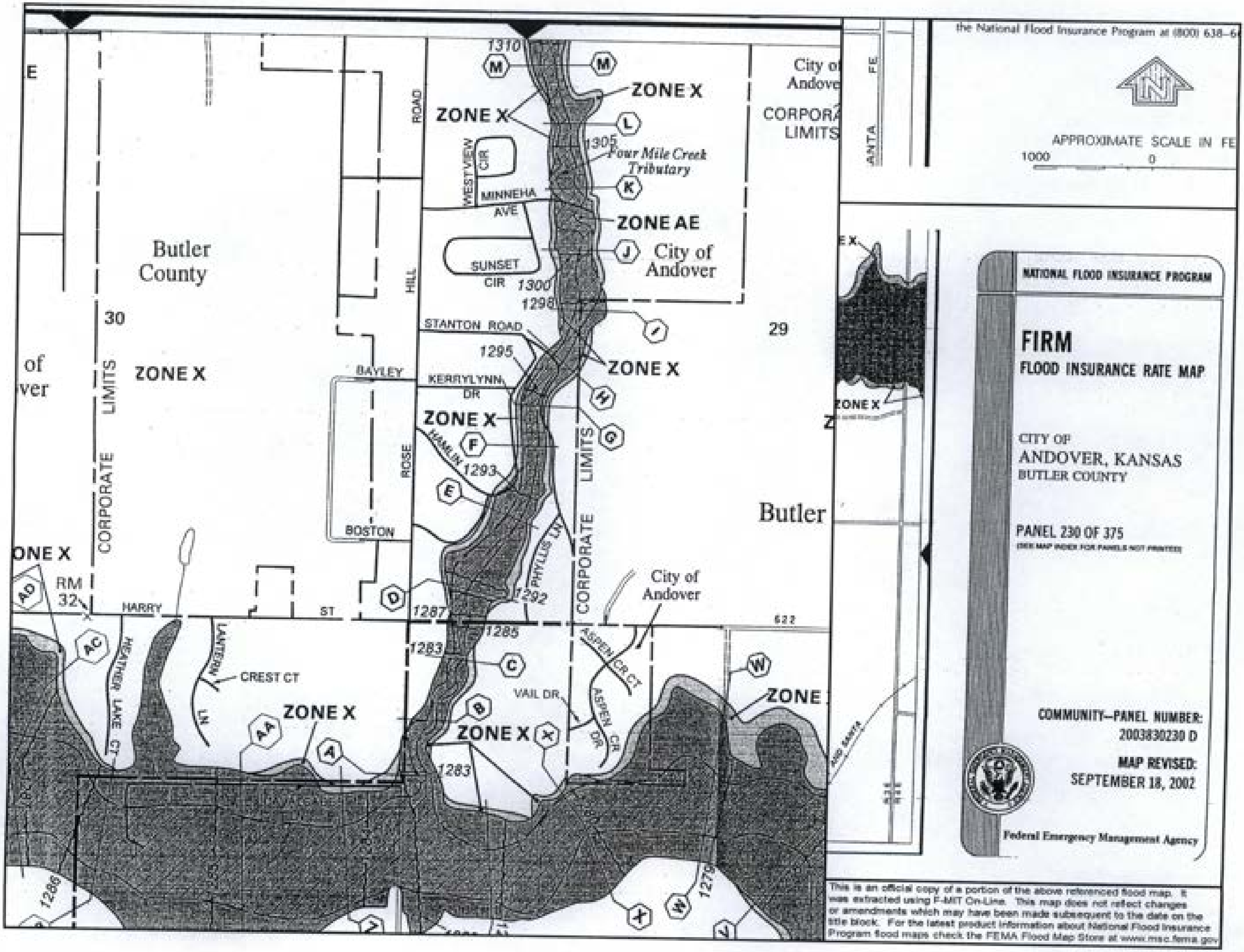
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NATIONAL FLOOD INSURANCE PROGRAM
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BUTLER COUNTY
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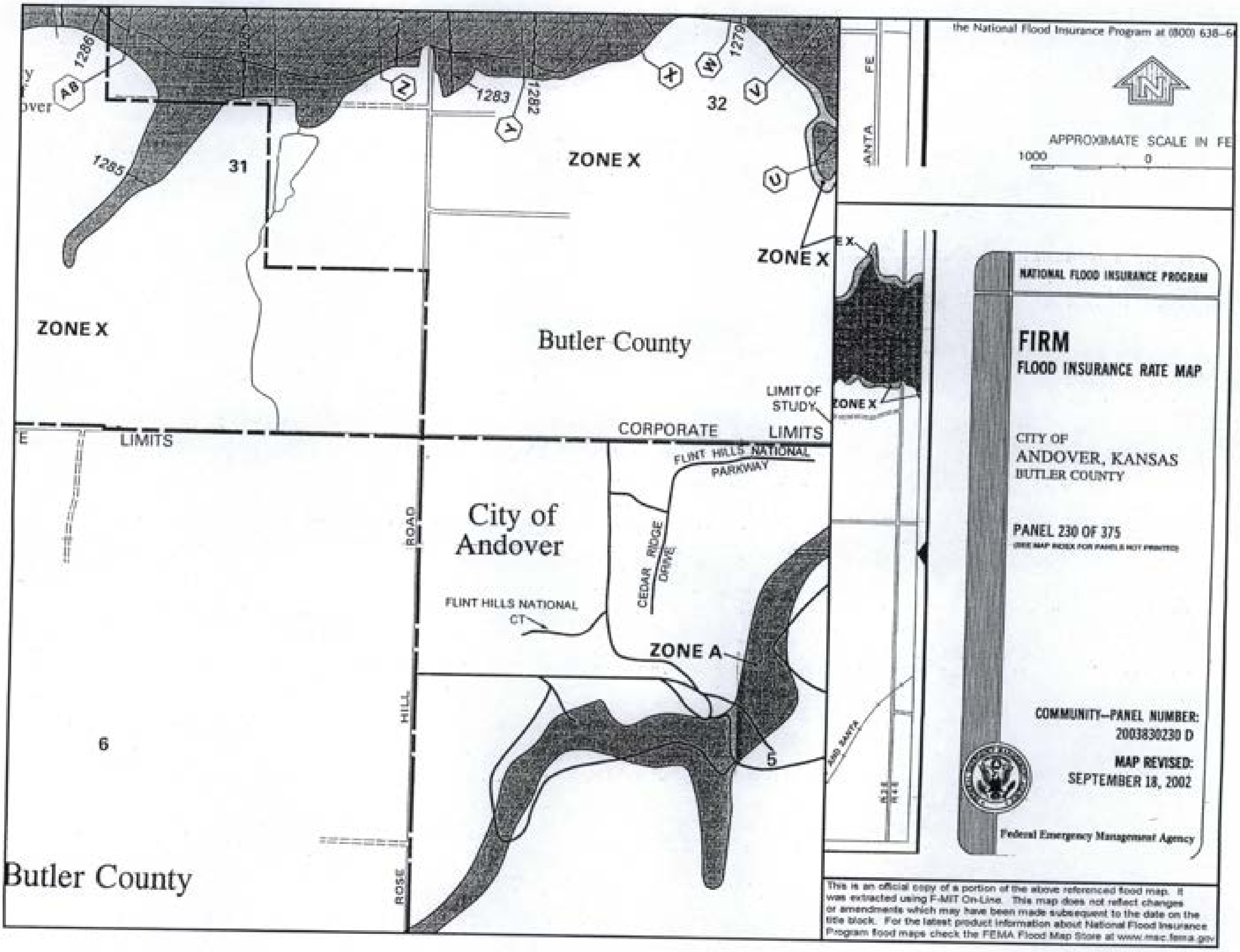

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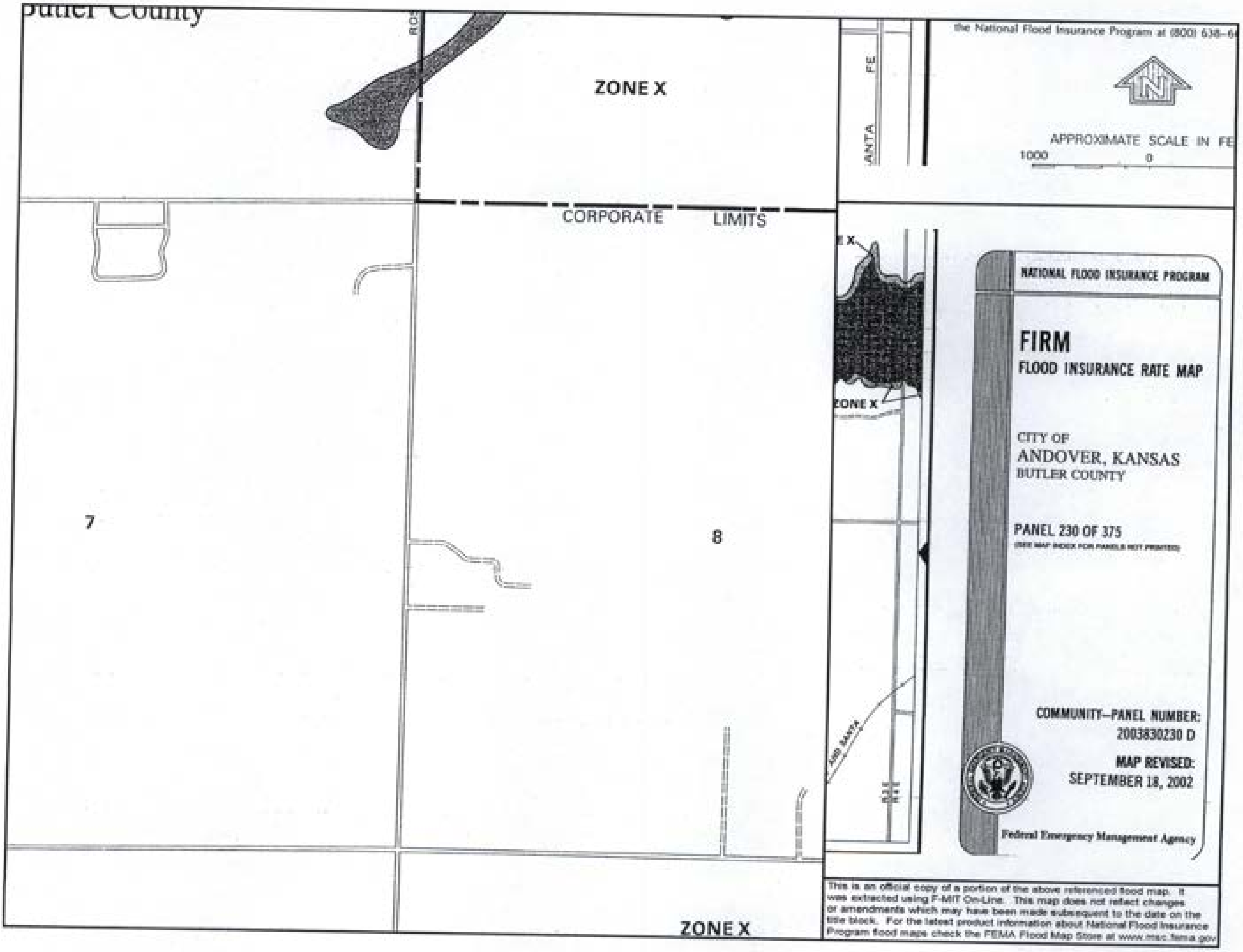
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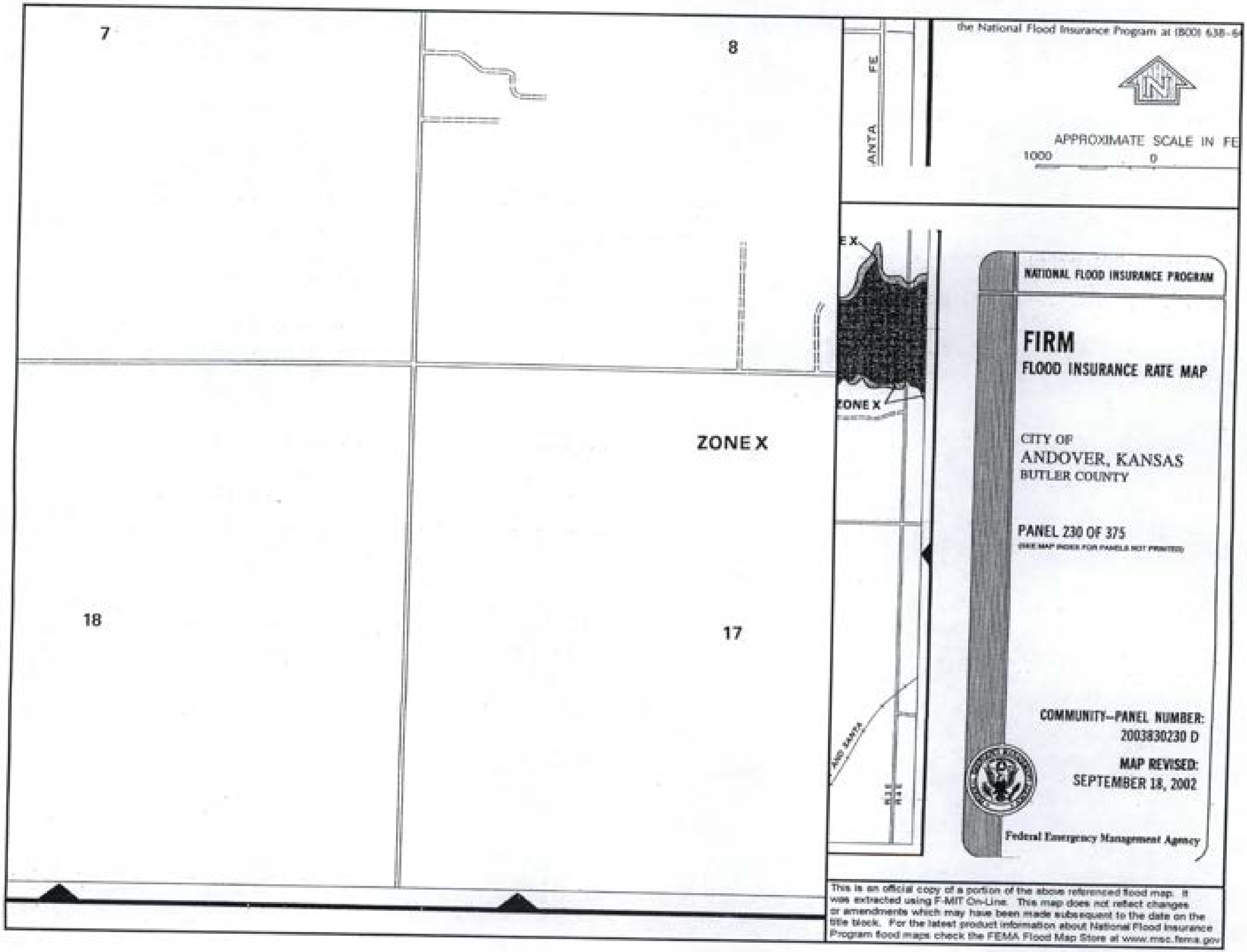
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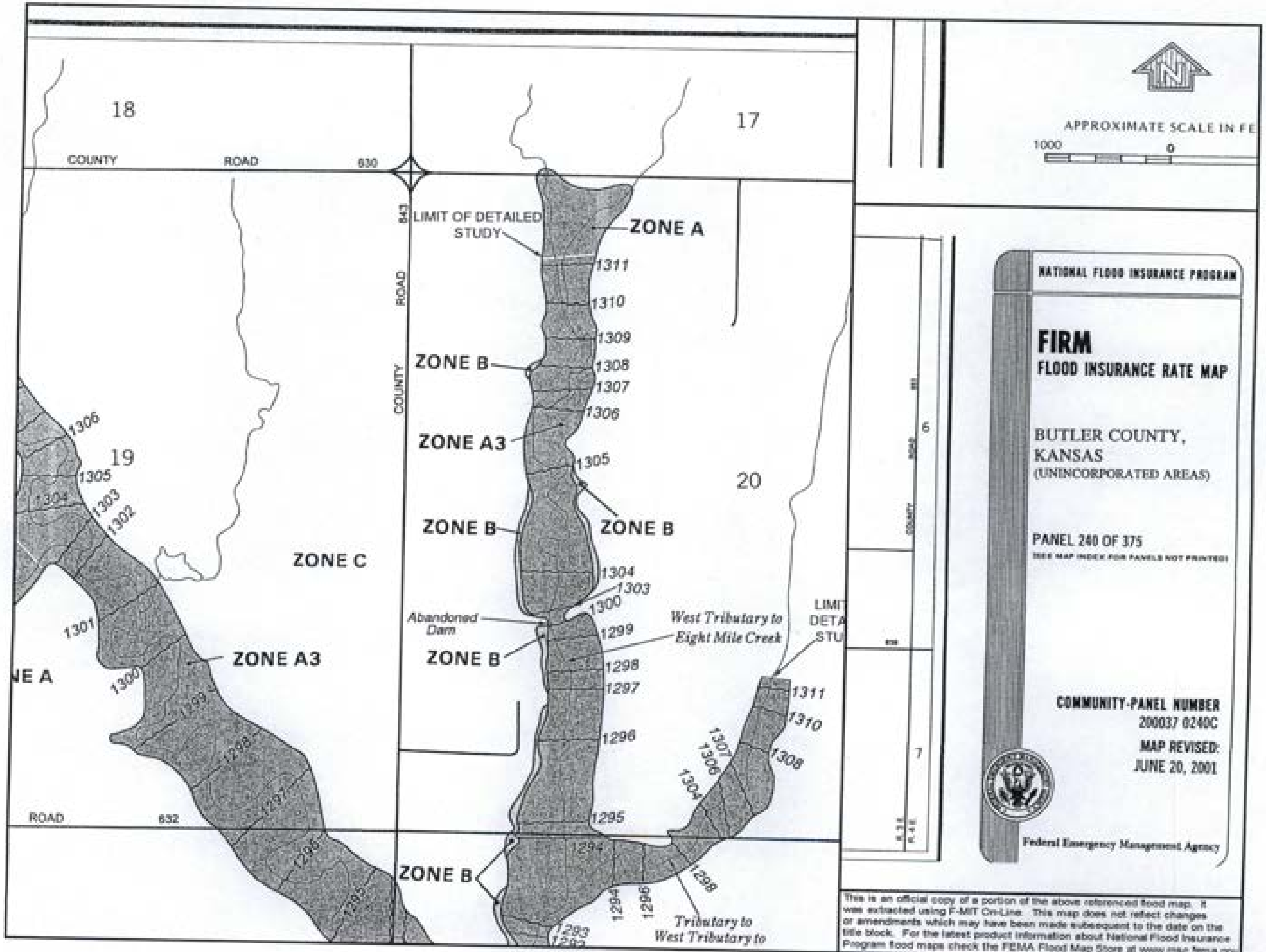

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ZONE C
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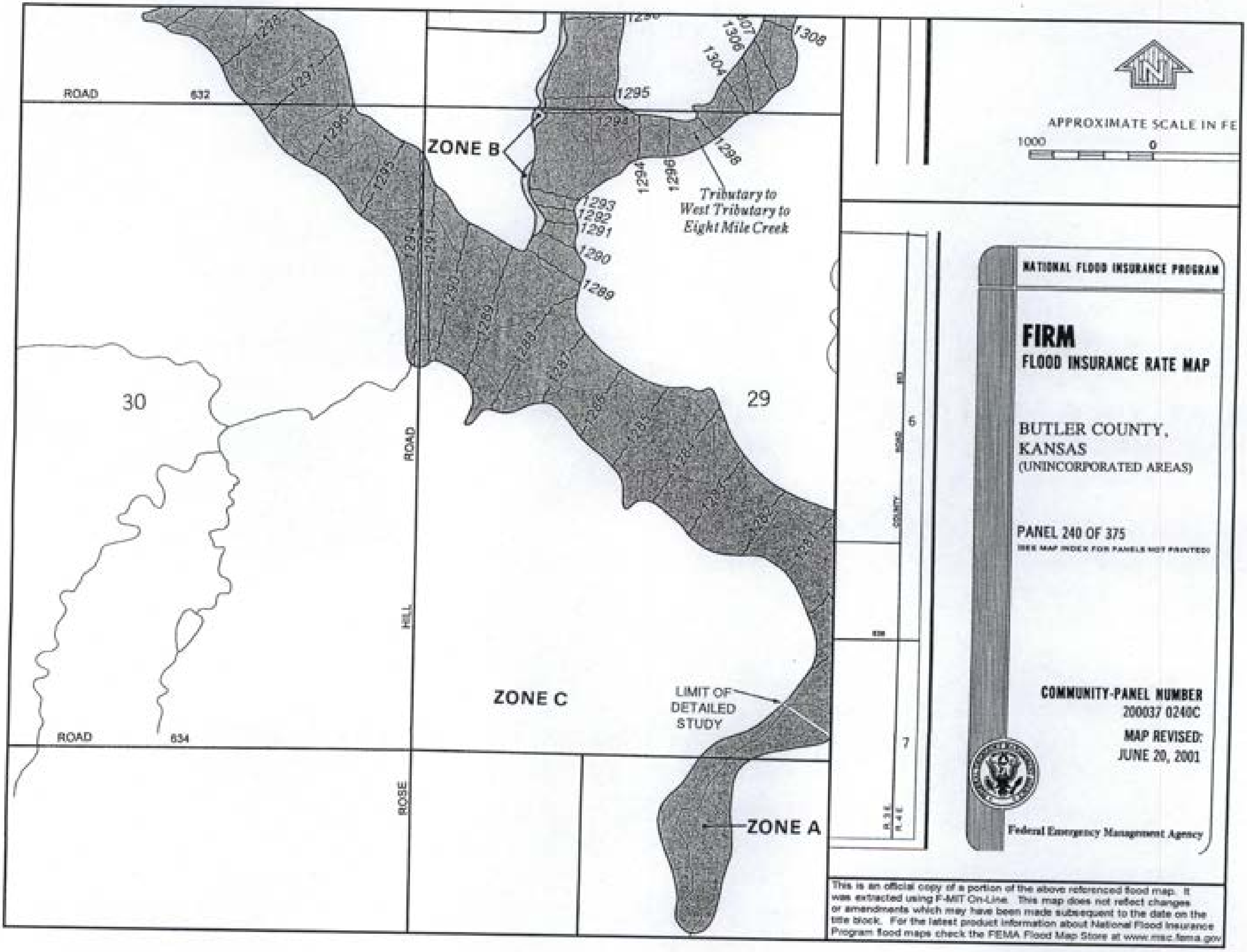
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Tributary to
West Tributary to
Eight Mile Creek
1293
1292
1291
1290
1289
1308
1306
1304
30
29
ROSE HILL ROAD
ZONE C
LIMIT OF DETAILED STUDY
ROAD 634
ZONE A
COUNTY ROAD
6
7
APPROXIMATE SCALE IN FE
1000
0
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
BUTLER COUNTY,
KANSAS
(UNINCORPORATED AREAS)
PANEL 240 OF 375
(SEE MAP INDEX FOR PANELS NOT PRINTED)
COMMUNITY-PANEL NUMBER
200037 0240C
MAP REVISED:
JUNE 20, 2001
Federal Emergency Management Agency
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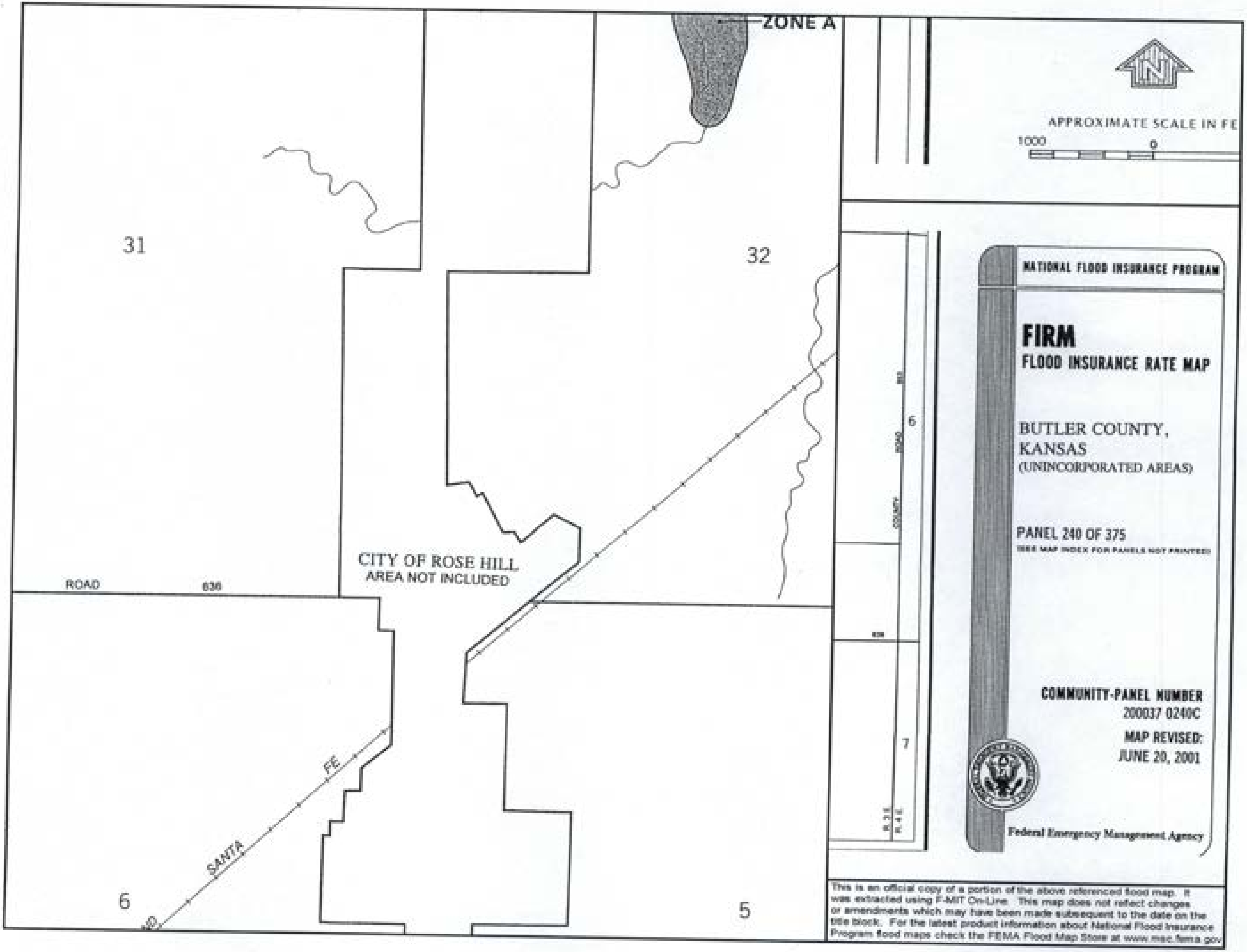
ZONE A
APPROXIMATE SCALE IN FE
1000
0
31
32
CITY OF ROSE HILL
AREA NOT INCLUDED
ROAD
636
SANTA
FE
6
5
7
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
BUTLER COUNTY,
KANSAS
(UNINCORPORATED AREAS)
PANEL 240 OF 375
(SEE MAP INDEX FOR PANELS NOT PRINTED)
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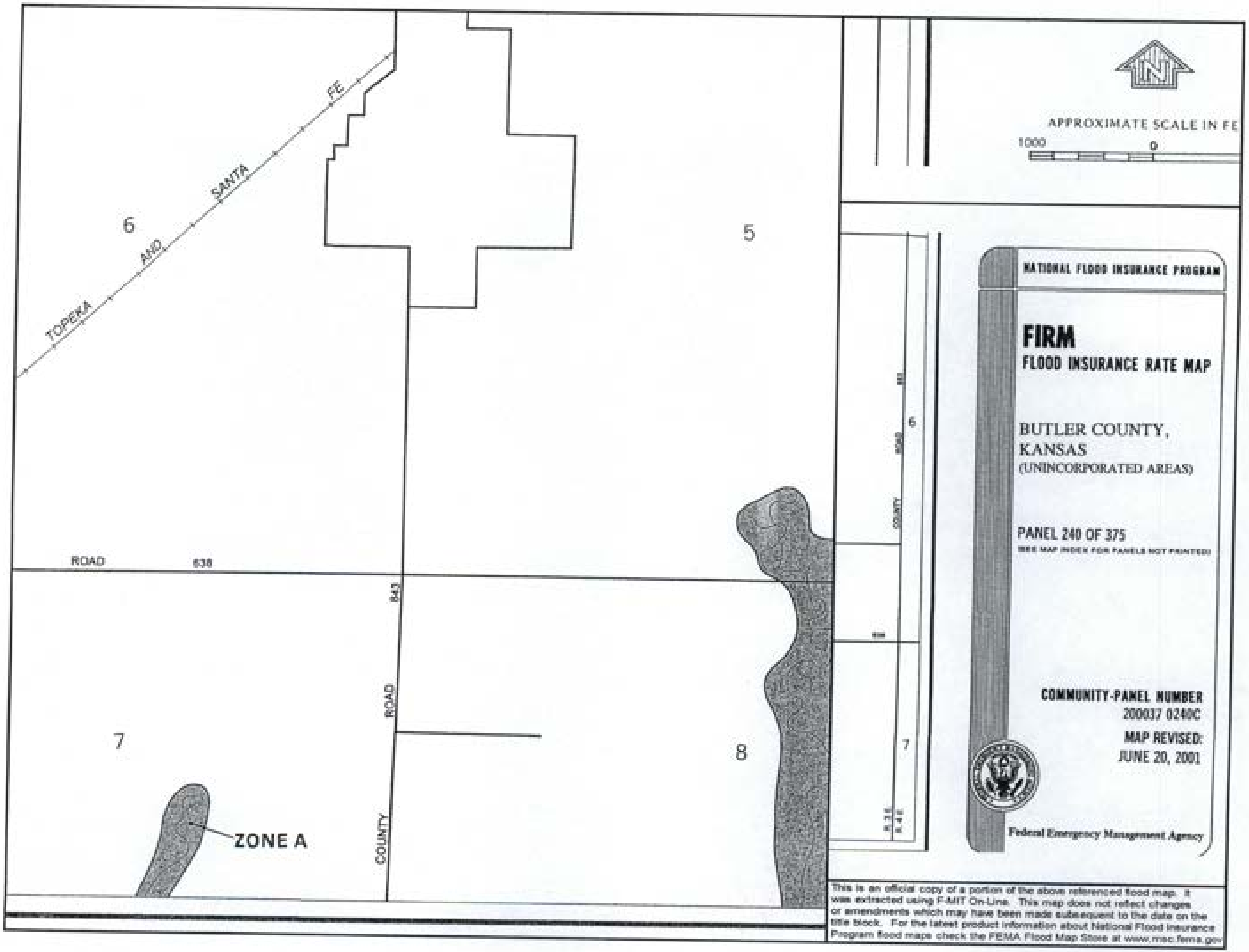
APPROXIMATE SCALE IN FE
1000
0
TOPEKA
AND
SANTA
FE
6
5
ROAD
638
843
ROAD
COUNTY
7
8
ZONE A
6
COUNTY
ROAD
7
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
BUTLER COUNTY,
KANSAS
(UNINCORPORATED AREAS)
PANEL 240 OF 375
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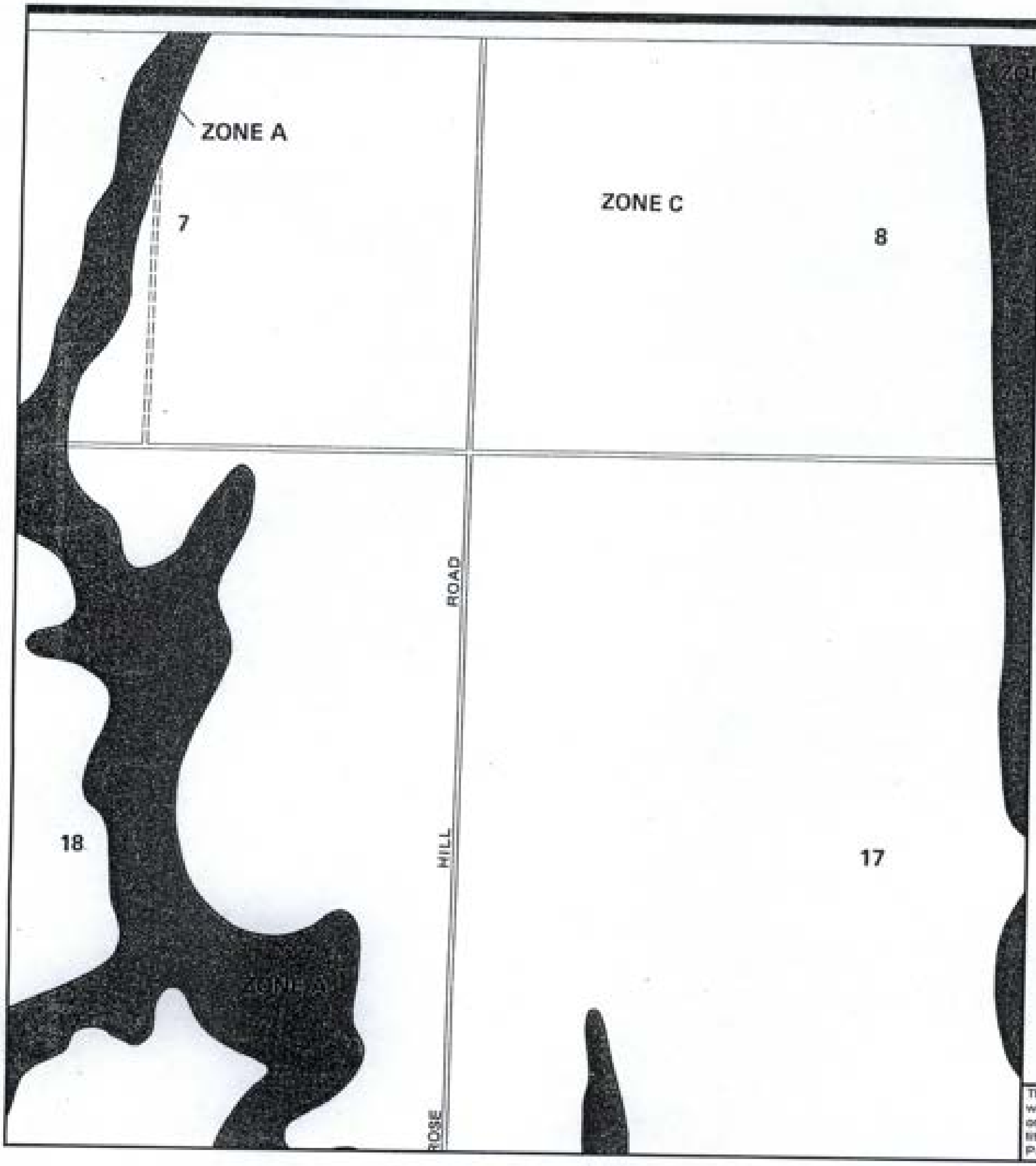

APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

COUNTY OF
BUTLER,
KANSAS
(UNINCORPORATED AREAS)

PANEL 305 OF 375

COMMUNITY-PANEL NUMBER
200037 0305 B

EFFECTIVE DATE:
MARCH 2, 1981

federal emergency management agency
federal insurance administration

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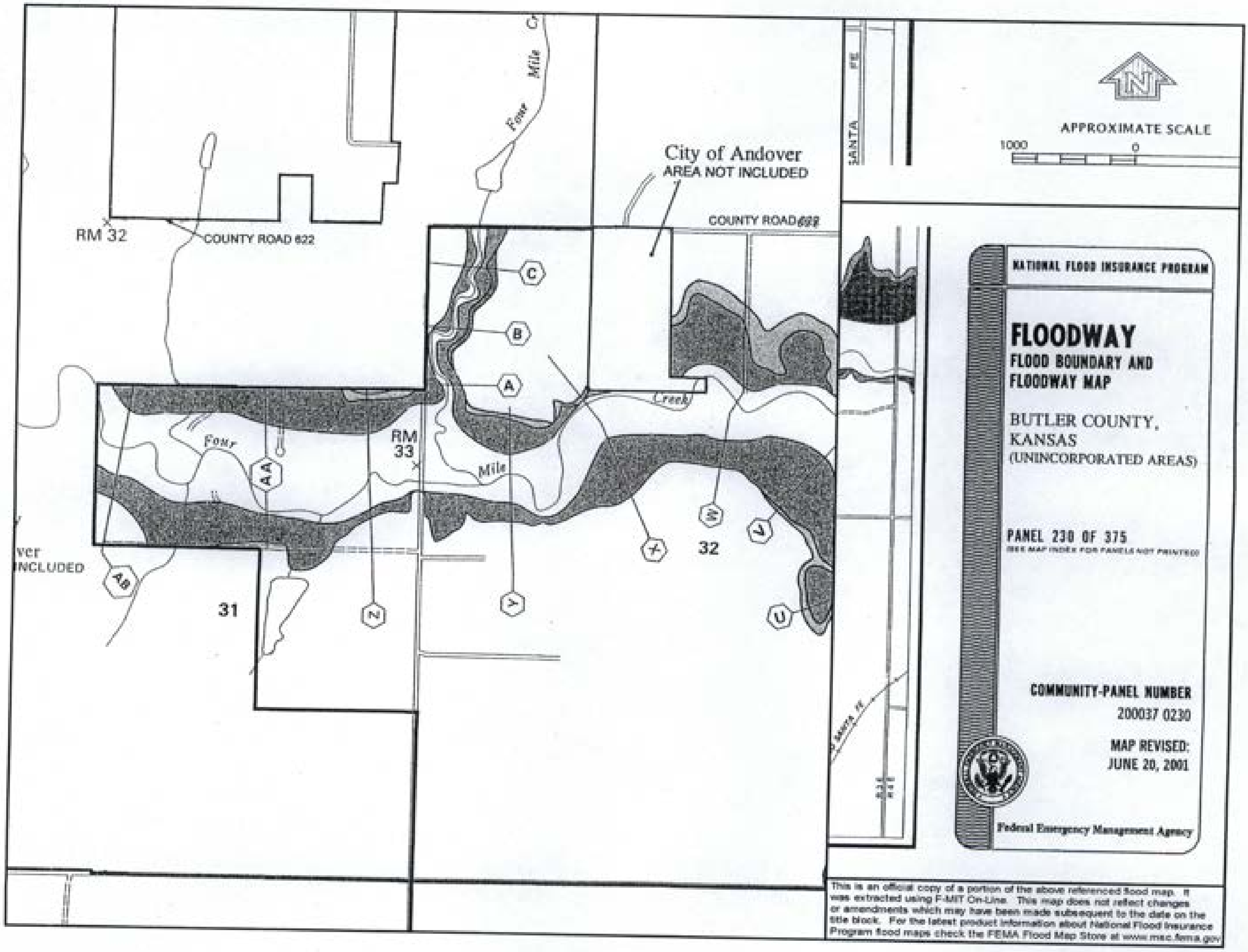
City of Andover
AREA NOT INCLUDED
COUNTY ROAD 622
RM 32
COUNTY ROAD 622
RM 33
Four Mile Creek
31
32
INCLUDED
SANTA FE
APPROXIMATE SCALE
1000
0
NATIONAL FLOOD INSURANCE PROGRAM
FLOODWAY
FLOOD BOUNDARY AND
FLOODWAY MAP
BUTLER COUNTY,
KANSAS
(UNINCORPORATED AREAS)
PANEL 230 OF 375
(SEE MAP INDEX FOR PANELS NOT PRINTED)
COMMUNITY-PANEL NUMBER
200037 0230
MAP REVISED:
JUNE 20, 2001
Federal Emergency Management Agency
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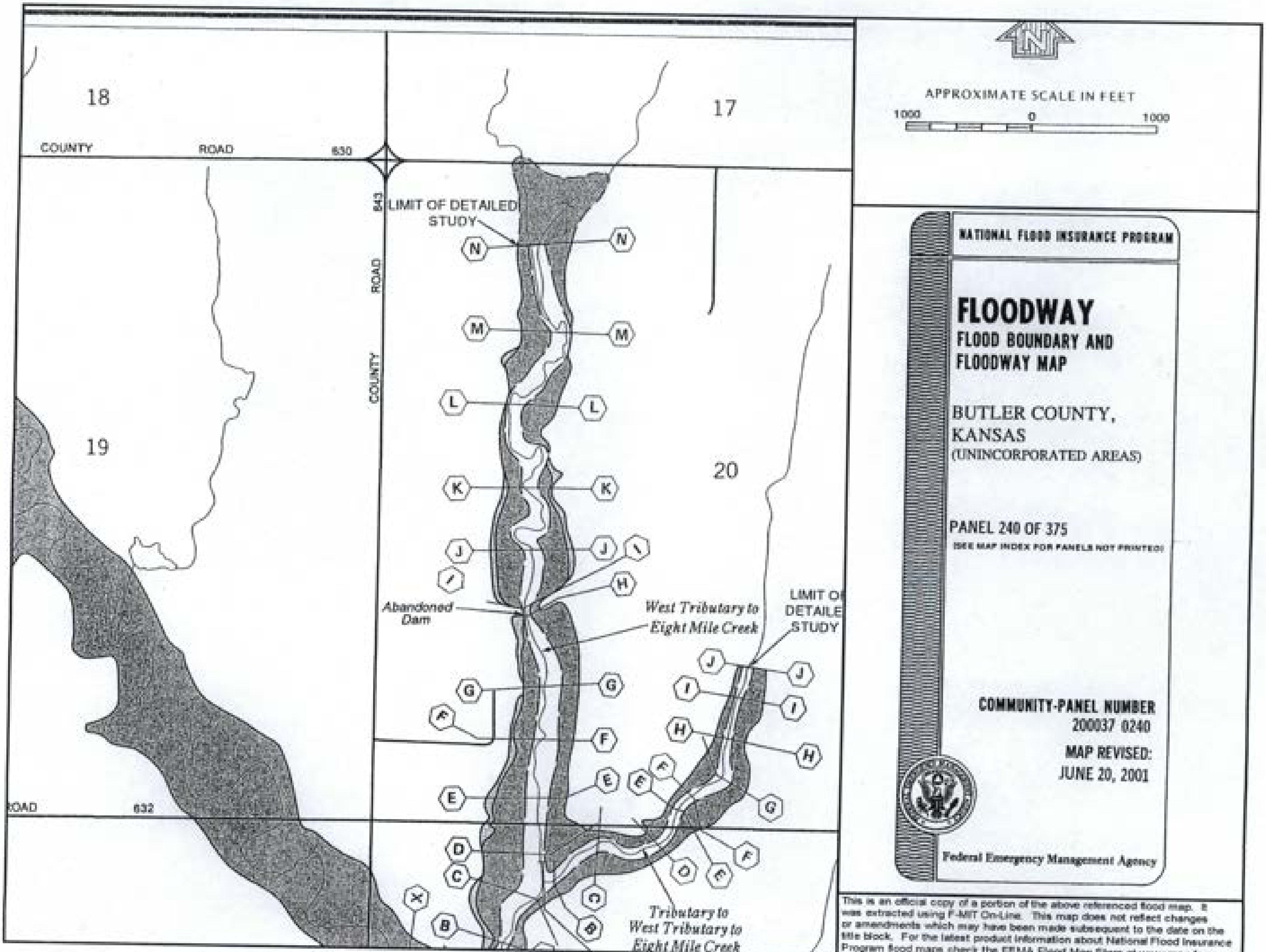


NATIONAL FLOOD INSURANCE PROGRAM

FLOODWAY

FLOOD BOUNDARY AND FLOODWAY MAP

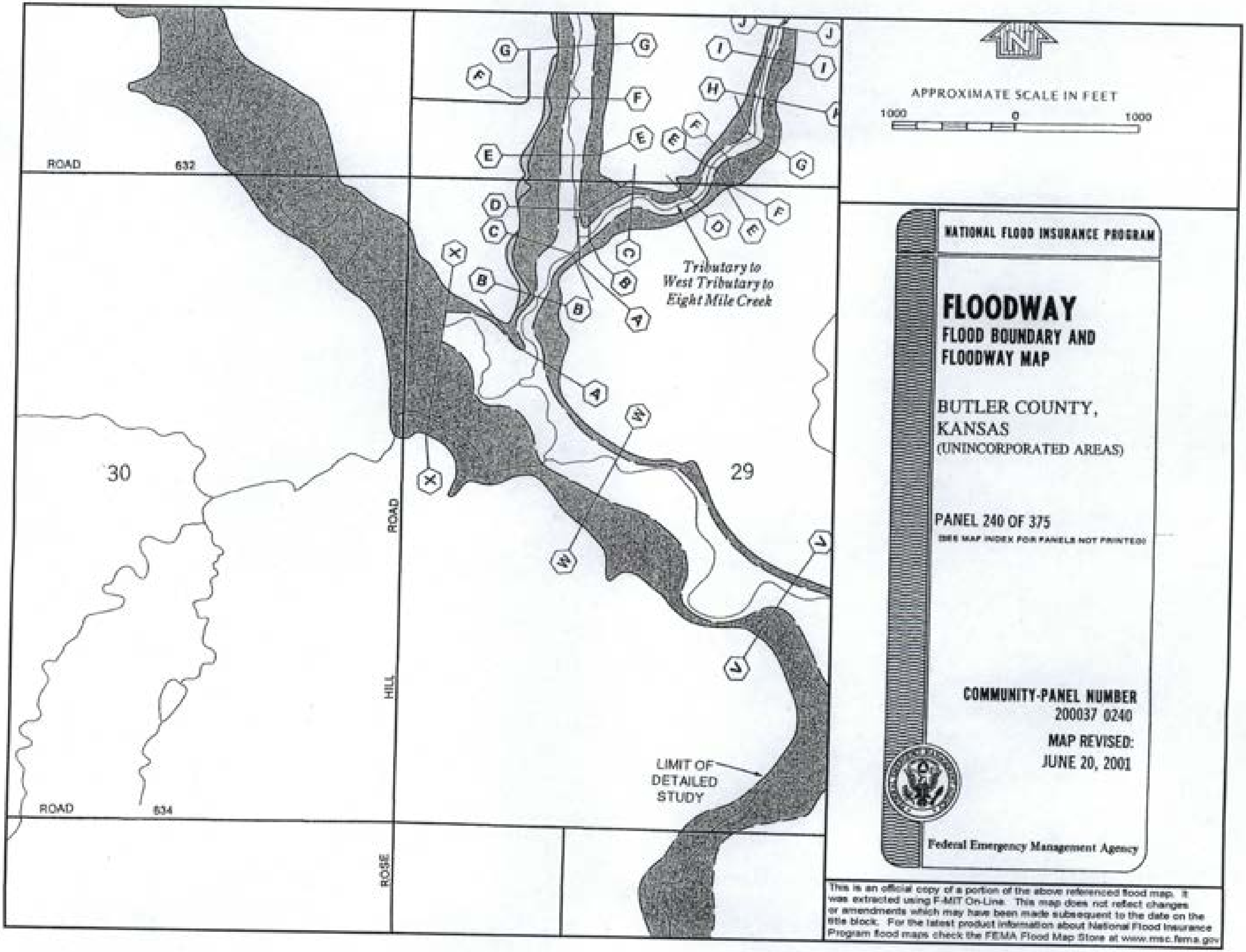
BUTLER COUNTY,
KANSAS
(UNINCORPORATED AREAS)

PANEL 240 OF 375
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
200037 0240

MAP REVISED:
JUNE 20, 2001

Federal Emergency Management Agency


APPROXIMATE SCALE IN FEET
1000
0
1000
ROAD
632
ROAD
634
ROSE
HILL
ROAD
30
29
Tributary to
West Tributary to
Eight Mile Creek
LIMIT OF
DETAILED
STUDY
A
B
C
D
E
F
G
H
I
J
V
W
X
NATIONAL FLOOD INSURANCE PROGRAM
FLOODWAY
FLOOD BOUNDARY AND
FLOODWAY MAP
BUTLER COUNTY,
KANSAS
(UNINCORPORATED AREAS)
PANEL 240 OF 375
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Butler Road Project
Potential Hazardous Waste

Butler Road Project
Potential Hazardous Waste